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(54) FILLING MACHINE AND METHOD FOR FILLING CONTAINERS WITH A POURABLE PRODUCT

(57) There is described a filling machine (1) for filling containers (2) with a pourable product at a pressure higher than the atmospheric pressure, the filling machine (1) comprises: a filling valve (5) having an outlet opening configured to be connected in a fluid-tight manner with one container (2) to be filled at a time and selectively movable between an open configuration, in which the filling valve (5) feeds said pourable product to the container (2) through the outlet opening, and a closed configuration, in which the filling valve (5) interrupts the flow of the pourable product towards the container (2); a de-

compression circuit (8) configured to relieve a pressure present within the filled container (2) by venting an aerosol, comprising at least pourable product particles and a gas, outside the filled container (2); an isolation chamber (20) containing, in use, an atmosphere controlled in sterile and/or aseptic conditions and housing at least the outlet opening; and a drain circuit (24) configured to drain a cleaning fluid from the isolation chamber (20) during a cleaning process of the latter; the decompression circuit (8) is fluidly connectable to the drain circuit (24) for venting the aerosol to the drain circuit (24).

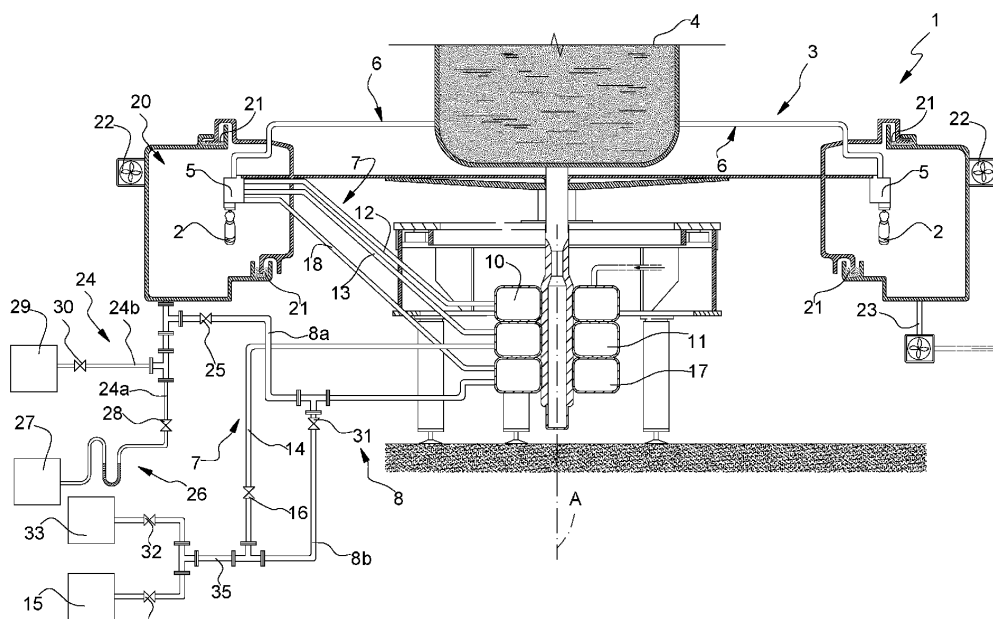


FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a filling machine for filling containers with a pourable product at a pressure higher than the atmospheric pressure, preferably with a pourable food product such as a carbonated food product like sparkling water or soft drinks, etc.

[0002] The present invention also relates to a method for filling containers with a pourable product at a pressure higher than the atmospheric pressure, preferably with a pourable food product such as a carbonated food product like sparkling water or soft drinks, etc.

BACKGROUND ART

[0003] Filling machines typically used for filling containers, such as plastic or glass bottles, with a pourable product at a pressure higher than the atmospheric pressure are known. Such filling machines essentially comprise a conveyor device, usually a rotatable conveyor device such as a carousel rotatable about a vertical axis, a reservoir containing the pourable product and a plurality of filling devices peripherally carried by the carousel, fluidly connected to the reservoir by respective ducts and conveyed by the carousel along a circular transfer path.

[0004] In particular, the carousel receives, in use, a succession of empty containers from an inlet conveyor, e.g. an inlet star wheel, and feeds the filled containers to an outlet conveyor, e.g. an outlet star wheel.

[0005] Each filling device essentially comprises a support element configured to receive and hold a respective container in a vertical position, and a filling valve configured to feed a predetermined amount of pourable product into such container, while the filling device advances along the transfer path due to the rotary motion imparted thereto by the carousel.

[0006] Typically, a filling valve of the known type essentially comprises:

- a tubular body fixed to a peripheral portion of the carousel and defining a flow channel for feeding the pourable product into a respective container to be filled, which is arranged under the tubular body;
- a shutter which engages the tubular body in a sliding manner and is movable inside the channel so that it can allow or prevent the flow of the pourable product towards the respective container; and
- an actuator configured for moving the shutter inside the channel defined by the tubular body.

[0007] In particular, the tubular body has a longitudinal axis, normally parallel to the carousel axis, and terminates at a lower end with an axial discharge opening configured to come into contact with a top end mouth of the respective container to be filled.

[0008] Thus, the filling operation is of the so-called

"contact-filling" type; the fluid-tight contact between the discharge opening and the top end mouth of the container to be filled is necessary to carry out the filling operation at a pressure higher than the atmospheric pressure.

[0009] The filling machine further comprises two circuits formed at least partially inside the tubular body of each filling valve:

- a pressurization-exhaust circuit configured both to pressurize each container up to a predetermined pressure value higher than the atmospheric pressure value, before starting the actual filling of the container itself, and to exhaust the gas contained in the container, during the filling of the container with the pourable product; and
- a decompression circuit configured to perform a decompression step of each container at the end of the filling.

[0010] In certain embodiments, the pressurization circuit and the exhaust circuit are two separate and independent circuits.

[0011] With reference to each filling device, the decompression circuit has a first end opening fluidly communicating, in use, with the container arranged in contact with the respective filling valve, and a second end opening opposite the first end opening and connected by means of a valve, to an annular decompression chamber, a single one for the entire filling machine. The annular decompression chamber is fluidly connected to the external environment and is thus kept at atmospheric pressure or at a pressure lower than the pressure inside the container at the end of filling.

[0012] The decompression step of each container is carried out by opening, for one or more pre-set time intervals, the respective valve that controls the connection of the decompression circuit, and thus the internal environment of the respective filled container, with the decompression chamber. Such decompression step is necessary to relieve the excess pressure present within each container after filling in order to prevent foaming of the pourable product.

[0013] Especially in the case in which pourable food products are envisaged, it is known in the art the need for ensuring a suitable aseptic condition of the containers during the filling process, in order to guarantee the quality and safety standards provided for the consumers.

[0014] Consequently, filling machines of the above-mentioned type further comprise an isolation chamber positioned peripherally around the carousel, housing, at least partially, the filling devices, in particular housing at least the discharge opening of each filling valve, and configured to internally delimit, in a fluid-tight manner, a controlled atmosphere, so that the filling valves can operate in sterile and/or aseptic conditions.

[0015] The isolation chamber therefore defines a sterile and/or aseptic environment of the filling machine, required to guarantee the above-mentioned operating con-

ditions.

[0016] It is known in the field the need for ensuring aseptic conditions in filling machines operating at a pressure higher than the atmospheric pressure, and in particular wherein a decompression step of the filled containers has to be carried out after filling.

[0017] Usually, the decompression circuit has an end mouth opening, through which the product aerosol in excess is discharged in the external environment. Since the mouth opening is directly connected with the external environment, germination can occur therein, which especially during long production cycles can spread along the decompression circuit and, in the worst cases, reach the isolation chamber.

[0018] EP-B-302067 describes a filling machine having an isolation chamber internally delimiting, in use, a controlled atmosphere and housing at least the discharge opening of each filling valve.

[0019] The document describes one embodiment, in which the mouth opening of the decompression circuit opens directly into the isolation chamber. However, such configuration has the drawback that the whole aerosol in excess (containing product particles and gas) is vented into the isolation chamber; such aerosol can therefore spread all over the isolation chamber and contaminate the controlled atmosphere.

[0020] EP-B-302067 describes another embodiment, according to which the mouth opening opens into an exhaust duct of the venting system of the isolation chamber.

[0021] However, such configuration has the drawback that the exhaust duct is, in turn, directly connected with the external environment, and therefore a contamination can still occur therein.

[0022] Furthermore, both embodiments present the drawback that the cleaning process of the decompression circuit, during which the circuit is flushed with cleaning fluid, is very complicated, due to the above-mentioned positioning of the mouth opening of the circuit itself.

[0023] Therefore, a need is felt in the industry to improve the aseptic conditions of the known filling machines for filling containers at a pressure higher than the atmospheric pressure and, at the same time, ensuring an easy and simple cleaning process of the circuits of the known filling machines.

DISCLOSURE OF INVENTION

[0024] It is therefore an object of the present invention to provide a filling machine for filling containers at a pressure higher than the atmospheric pressure which is designed to overcome at least one of the above-mentioned drawbacks in a straightforward and low-cost manner.

[0025] This object is achieved by a filling machine for filling containers at a pressure higher than the atmospheric pressure as claimed in claim 1.

[0026] It is a further object of the present invention to provide a method for filling containers at a pressure higher than the atmospheric pressure which allows to over-

come at least one of the above-mentioned drawbacks in a straightforward and low-cost manner.

[0027] This object is achieved by a method for filling containers at a pressure higher than the atmospheric pressure as claimed in claim 8.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic side view, with parts removed for clarity, of a filling machine according to the present invention; and

Figures 2a-2c are larger-scale schematic views of a detail of the filling machine of Figure 1, during different operating conditions.

BEST MODE FOR CARRYING OUT THE INVENTION

[0029] With reference to Figure 1, number 1 indicates as a whole a filling machine for filling containers 2 with a pourable product at a pressure higher than the atmospheric pressure, preferably a pourable food product such as a carbonated food product like sparkling water or soft drinks, etc.

[0030] In particular, containers 2 may be plastic bottles and the pourable product is a liquid with the addition of a gas under pressure, for example CO₂.

[0031] Filling machine 1 is adapted to be fed with empty containers 2 and is configured to fill these latter with the pourable product.

[0032] To this end, filling machine 1 comprises a rotary conveyor, preferably a carousel 3 rotatable about a vertical axis A, and a reservoir 4 arranged peripherally with respect to carousel 3 and containing, in use, the pourable product under pressure to be fed to the carousel 3 itself.

[0033] Filling machine 1 further comprises a plurality of filling valves 5, peripherally carried by carousel 3 and each one configured to feed a predetermined amount of pourable product to a relative container 2 during the rotation of carousel 3 about axis A.

[0034] Therefore, filling valves 5 are conveyed by carousel 3 along an arc-shaped transfer path in respective positions radially spaced from axis A.

[0035] In detail, each filling valve 5 is fluidly connected to reservoir 4 by means of a circuit 6 adapted to convey the pourable product from reservoir 4 to the filling valve 5 itself.

[0036] For the sake of brevity, reference will be made in the following to a single filling valve 5 and to a single container 2 to be filled. However, the features described hereinafter and related to such filling valve 5 and container 2 are applicable to each filling valve 5 of carousel 3 and to each container 2 to be filled.

[0037] According to a manner known and not described in detail, filling valve 5 comprises valve means

configured to control the flow of the pourable product towards the container 2 to be filled and support means apt to support such container 2 in a position, preferably vertical, below filling valve 5.

[0038] More precisely, filling valve 5 includes a flow channel (not shown) comprising an outlet end opening (not shown) through which the pourable product is dosed, in use, and a known shutter (also not shown) movable within the flow channel to selectively allow or prevent the flow of the pourable product through the outlet opening.

[0039] The container 2 is supported by the above-mentioned support means, so that the top end mouth of container 2 is coupled in a fluid-tight manner with the outlet opening of filling valve 5.

[0040] In other words, filling valve 5 is configured to carry out a so-called "contact filling operation" on container 2.

[0041] Filling valve 5 further comprises a known actuator (not shown) operatively coupled with the shutter and configured to control the movement of this latter within the flow channel.

[0042] In particular, the shutter, and therefore filling valve 5, is controllable, i.e. movable, between an open configuration, in which filling valve 5 feeds pourable product to container 2 through the outlet opening, and a closed configuration, in which filling valve 5 interrupts the flow of pourable product towards container 2.

[0043] As schematically shown in Figure 1, filling machine 1 further comprises:

- a pressurization-exhaust circuit 7 configured both to pressurize container 2 up to a predetermined pressure value higher than the atmospheric pressure value, before starting the actual filling of the container 2 itself, and to exhaust the gas contained in container 2, during the filling of container 2 with the pourable product; and
- a decompression circuit 8 configured to perform a decompression step of container 2 at the end of the filling.

[0044] In detail, pressurization-exhaust circuit 7 comprises a first annular chamber 10 and a second annular chamber 11, preferably both carried by carousel 3, and, for each filling valve 5, a duct 12 fluidly connecting the inner environment of the relative container 2 to annular chamber 10, and a duct 13 fluidly connecting the inner environment of the relative container 2 to annular chamber 11.

[0045] In use, pressurized gas, for example CO₂, is fed from annular chamber 10 to container 2 through duct 12, to build up a pressure higher than the atmospheric pressure inside the container 2 itself before filling.

[0046] Then, during filling, the gas in excess is exhausted from container 2 to annular chamber 11 through duct 13.

[0047] Annular chamber 10 is fluidly connectable to annular chamber 11, in a manner known and not shown

in detail.

[0048] According to an alternative embodiment not shown, pressurization circuit and exhaust circuit may be two separate and fluidly independent circuits, according to a configuration known in the art and not described in detail herein.

[0049] Pressurization-exhaust circuit 7 further comprises an exhaust duct 14 for venting the exhaust gas into an atmospheric drain 15.

[0050] Conveniently, exhaust duct 14 is connectable to atmospheric drain 15 by means of a valve 16.

[0051] Decompression circuit 8 is configured to relieve a pressure present within the filled container 2 by venting an aerosol outside the filled container 2.

[0052] In greater detail, such aerosol comprises at least pourable product particles and a gas. In one embodiment, the aerosol is formed by pourable product particles suspended in a gas containing mostly CO₂.

[0053] Hence, such aerosol contains a gaseous part and a liquid part suspended in the gaseous part.

[0054] Decompression circuit 8 comprises an annular chamber 17 preferably carried by carousel 3 and, for each filling valve 5, a duct 18 fluidly connecting the inner environment of the relative container 2 to annular chamber 17.

[0055] Accordingly, annular chamber 17 is maintained at a pressure lower than the pressure present within container 2 at the end of the filling.

[0056] Pressurization and decompression are knowingly used for controlling the amount of foam within container 2 at the end of the filling and to reduce product spills from the top end mouth when container 2 is detached from filling valve 5.

[0057] As visible in Figure 1, filling machine 1 further comprises an isolation chamber 20 positioned peripherally around carousel 3, coaxially to axis A, housing, at least partially, filling valves 5, in particular housing at least the outlet opening of each filling valve 5, and configured to internally delimit, in a fluid-tight manner, an atmosphere controlled in sterile and/or aseptic conditions, so that the filling operation can occur in sterile and/or aseptic conditions.

[0058] Therefore, isolation chamber 20 defines, in use, a sterile and/or aseptic environment of filling machine 1, required to guarantee the above-mentioned operating conditions.

[0059] Isolation chamber 20 comprises known labyrinth-type seals 21 configured to isolate the controlled atmosphere from the external environment.

[0060] The controlled atmosphere is formed in a known manner by venting treated and/or filtered air inside isolation chamber 20 by means of suitable air supply and filtration units 22, only schematically shown in the appended Figures.

[0061] Filling machine 1 further comprises an extraction duct 23 fluidly connected to isolation chamber 20 and apt to vent the atmosphere in excess outside from isolation chamber 20 and into the external environment,

so that a periodic air exchange is guaranteed within the controlled atmosphere.

[0062] Filling machine 1 also comprises a drain circuit 24 fluidly connected to isolation chamber 20 and configured to drain a cleaning fluid from isolation chamber 20 during a cleaning process of isolation chamber 20, preferably a periodic cleaning process.

[0063] According to the present invention, decompression circuit 8 is fluidly connectable with drain circuit 24 for venting the above-mentioned aerosol to drain circuit 24, in particular into drain circuit 24.

[0064] In particular, decompression circuit 8 is selectively connectable to drain circuit 24 by means of a valve 25, which is fluidly interposed between drain circuit 24 and decompression circuit 8.

[0065] More in particular, decompression circuit 8 comprises a first branch 8a fluidly connectable with drain circuit 24 through valve 25; accordingly, valve 25 is arranged upstream of the intersection between decompression circuit 8 and drain circuit 24.

[0066] According to a further aspect of the present invention, drain circuit 24 comprises a siphon portion 26 housing, at least in use, a gas-blocking means, preferably a gas-blocking liquid.

[0067] Siphon portion 26 is configured to collect the pourable product particles, i.e. the liquid part, of the vented aerosol and to block the gas, i.e. the gaseous part, of the aerosol during venting of the aerosol itself from the first branch 8a to drain circuit 24.

[0068] In practice, the vented moist aerosol flows through the opened valve 25 and into drain circuit 24, until it reaches siphon portion 26. At this point, the gas-blocking liquid housed therein collects the liquid particles, which become part of the gas-blocking liquid itself, and blocks the gas part of the aerosol.

[0069] According to this preferred embodiment, drain circuit 24 comprises an atmospheric drain 27 arranged downstream of siphon portion 26 and through which the liquid in excess present within siphon portion 26 periodically outflows.

[0070] Conveniently, drain circuit 24 is further configured to feed the gas of the aerosol, which has been blocked in use by the gas-blocking liquid, from siphon portion 26 into isolation chamber 20.

[0071] Opportunely, valve 25 is closed during this latter operation, in order to prevent the gas of the aerosol to flow back to decompression circuit 8.

[0072] In light of the above, the liquid part is collected within siphon portion 26 and then periodically expelled through atmospheric drain 27, whereas the gas part is conveyed into isolation chamber 20.

[0073] Conveniently, extraction duct 23 is further configured to vent such gas part of the aerosol, which has been previously conveyed into isolation chamber 20, outside from the isolation chamber 20 itself.

[0074] Thanks to the above configuration, the decompression circuit 8, and therefore the inner environment of container 2 and, hence, the pourable product to be

bottled, is never in fluid contact with the external environment, thereby significantly reducing the risk of contamination.

[0075] In order to perform the above-mentioned cleaning process of isolation chamber 20, drain circuit 24 further comprises:

- a first branch 24a including siphon portion 26 and terminating with atmospheric drain 27 and further including a valve 28 arranged upstream of siphon portion 26; and
- a second branch 24b branching upstream of valve 28 and fluidly connectable, by means of a valve 30, to a recirculation circuit 29 configured to recirculate the cleaning fluid into isolation chamber 20 during the cleaning process.

[0076] It is known in the field the need for performing a cleaning process also for decompression circuit 8 and for pressurization-exhaust circuit 7.

[0077] To this end, decompression circuit 8 comprises a second branch 8b, branching upstream of valve 25 and configured to drain a cleaning fluid during the cleaning process of decompression circuit 8.

[0078] In detail, second branch 8b comprises a valve 31, arranged downstream of the branching, which is controllable to selectively allow the flow of the cleaning fluid along second branch 8b or to prevent the flow of the aerosol along second branch 8b.

[0079] Furthermore, both second branch 8b and exhaust duct 14 of pressurization-exhaust circuit 7 are fluidly connectable with one another through valve 16. Moreover, the resulting branch 35 downstream of the intersection between second branch 8b and exhaust duct 14 is connectable, through a valve 32, to a recirculation circuit 33 adapted to recirculate, during the relative cleaning process, the cleaning fluid into the pressurization-exhaust circuit 7 and into the decompression circuit 8.

[0080] Conveniently, the fluid connection between the resulting branch 35 and atmospheric drain 15 is selectively closable by means of a valve 34 arranged upstream of the atmospheric drain 15 itself.

[0081] In light of the above, valve 32 and valve 34 are arranged fluidly in parallel with one another.

[0082] The operation of filling machine 1 is described hereinafter with reference to Figures 2a-2c and starting from a condition in which container 2 is filled and the decompression step is to be carried out.

[0083] In this condition, i.e. during the decompression step (Figure 2a), valve 25 is open and valve 31 is closed, so that the aerosol can flow through first branch 8a and not through second branch 8b. Moreover, valve 30 is closed and valve 28 is open, so that the aerosol can reach siphon portion 26 through first branch 24a, while being prevented to flow through second branch 24b and towards recirculation circuit 29.

[0084] As soon as the venting of the aerosol is completed, valve 25 closes off. In this condition, the liquid

part is collected into siphon portion 26 and the gaseous part, blocked by the gas-blocking liquid of siphon portion 26 and by the closed valve 25, is fed into isolation chamber 20.

[0085] Preferably, valve 16 and valve 34 are open, whereas valve 32 is closed.

[0086] Figure 2b shows a condition during which the cleaning process of isolation chamber 20 is carried out.

[0087] In this condition, valve 25 is closed, so that the cleaning fluid is prevented to flow into decompression circuit 8, valve 28 is closed and valve 30 is open, so that the cleaning fluid can undergo recirculation through recirculation circuit 29.

[0088] Preferably, valve 31 and valve 16 are also closed.

[0089] Figure 2c shows a condition during which the cleaning process of decompression circuit 8 and pressurization-exhaust circuit 7 is carried out.

[0090] In this condition, valve 25 is closed, so that the cleaning fluid is prevented to flow towards drain circuit 24, and valves 16 and 31 are open, so that the cleaning fluid can flow through second branch 8b and exhaust duct 14. Moreover, valve 32 is open, so that the cleaning fluid can recirculate through recirculation circuit 33, and valve 34 is closed, so that the cleaning fluid is prevented to flow towards atmospheric drain 15.

[0091] The advantages of filling machine 1 according to the present invention will be clear from the foregoing description.

[0092] In particular, thanks to the above configuration, the decompression circuit 8, and therefore the inner environment of container 2 and, hence, the pourable product to be bottled, is never in fluid contact with the external environment, thereby significantly reducing the risk of contamination.

[0093] In addition, the above configuration allows for a more efficient cleaning and sterilization of decompression circuit 8 compared to the filling machines known from the prior art, thereby further improving the aseptic conditions of the filling machine 1 itself.

[0094] Clearly, changes may be made to filling machine 1 as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. A filling machine (1) for filling containers (2) with a pourable product at a pressure higher than the atmospheric pressure, said filling machine (1) comprising:
 - at least one filling valve (5) having an outlet opening configured to be connected in a fluid-tight manner with one container (2) to be filled at a time and selectively movable between an open configuration, in which said filling valve (5)

feeds said pourable product to the container (2) through the outlet opening, and a closed configuration, in which said filling valve (5) interrupts the flow of said pourable product towards the container (2);

- a decompression circuit (8) configured to relieve a pressure present within the filled container (2) by venting an aerosol, comprising at least pourable product particles and a gas, outside the filled container (2);

- an isolation chamber (20) containing, in use, an atmosphere controlled in sterile and/or aseptic conditions and housing at least said outlet opening; and

- a drain circuit (24) configured to drain a cleaning fluid from said isolation chamber (20) during a cleaning process of said isolation chamber (20);

characterized in that said decompression circuit (8) is fluidly connectable to said drain circuit (24) for venting said aerosol to the drain circuit (24).

2. The filling machine as claimed in claim 1, wherein said drain circuit (24) comprises a siphon portion (26) housing a gas-blocking means and configured to collect the pourable product particles of said aerosol and to block the gas of said aerosol during venting of said aerosol.
3. The filling machine as claimed in claim 2, wherein said drain circuit (24) is fluidly connected to the isolation chamber (20) and is further configured to feed the gas of said aerosol, blocked in use from said gas-blocking means, from the siphon portion (26) into the isolation chamber (20).
4. The filling machine as claimed in claim 3, wherein said decompression circuit (8) is selectively connectable to said drain circuit (24) by means of a first valve element (25) fluidly interposed between said decompression circuit (8) and said drain circuit (24); said first valve element (25) being closed when said drain circuit (24) feeds, in use, said gas of said aerosol into the isolation chamber (20).
5. The filling machine as claimed in claim 3 or 4, further comprising an extraction duct (23) fluidly connected to said isolation chamber (20) and apt to vent the atmosphere in excess outside from the isolation chamber (20); wherein said extraction duct (23) is further configured to vent said gas of said aerosol, previously fed into the isolation chamber (20), outside from the isolation chamber (20).
6. The filling machine as claimed in claim 4 or 5, wherein said decompression circuit (8) has a first branch

- (8a) including said first valve element (25) and fluidly connectable, through said first valve element (25), to said drain circuit (24); said decompression circuit (8) further comprising a second branch (8b), branching upstream of said first valve element (25) and configured to drain a cleaning fluid during a cleaning process of said decompression circuit (8); said first valve element (25) being closed during said cleaning process of said decompression circuit (8).
7. The filling machine as claimed in claim 6, wherein said second branch (8b) has a second valve element (31) configured to selectively allow or prevent the flow of said cleaning fluid into said second branch (8b); said second valve element (31) being closed during the venting of said aerosol into the drain circuit (24).
8. A method for filling containers (2) with a pourable product at a pressure higher than the atmospheric pressure, the method comprising the steps of:
- a) filling one container (2) at a time at a pressure higher than the atmospheric pressure through an outlet opening of at least one filling valve (5);
 - b) providing an isolation chamber (20) containing an atmosphere controlled in sterile and/or aseptic conditions and housing at least said outlet opening;
 - c) providing a drain circuit (24) configured to drain a cleaning fluid from said isolation chamber (20) during a cleaning process of said isolation chamber (20); and
 - d) carrying out a decompression step of the container (2) after filling, by venting an aerosol, formed by at least pourable product particles and a gas, outside the filled container (2);
- characterized in that** the decompression step d) comprises the step of:
- e) venting said aerosol into said drain circuit (24).
9. The method as claimed in claim 8, wherein said drain circuit (24) comprises a siphon portion (26) housing a gas-blocking means;
- the method further comprising the step of:
- f) collecting the pourable product particles of said aerosol into said siphon portion (26).
10. The method as claimed in claim 9, further comprising the steps of:
- g) blocking said gas of said aerosol by means of said gas-blocking means;
 - h) feeding the blocked gas of said aerosol into said isolation chamber (20) by means of said drain circuit (24).
11. The method as claimed in claim 10, further comprising the step of:
- i) venting said gas, previously fed at step h), outside from said isolation chamber (20) through an extraction duct (23) fluidly connected to the isolation chamber (20) and apt to vent the atmosphere in excess from the isolation chamber (20).
12. The method as claimed in any one of the claims 8 to 11, wherein the decompression step c) is carried out by means of a decompression circuit (8) having a first branch (8a) and a second branch (b); wherein the step e) of venting said aerosol is carried out through said first branch (a); the method further comprising the steps of:
- l) draining a cleaning fluid during a cleaning process of said decompression circuit (8) through said second branch (b); and
 - m) interrupting the fluid connection between said first branch (8a) and said drain circuit (24) during the step 1) of draining.
13. The method as claimed in claim 12, further comprising the step of:
- n) interrupting the fluid connection between said second branch (8b) and said drain circuit (24) during the step e) of venting.

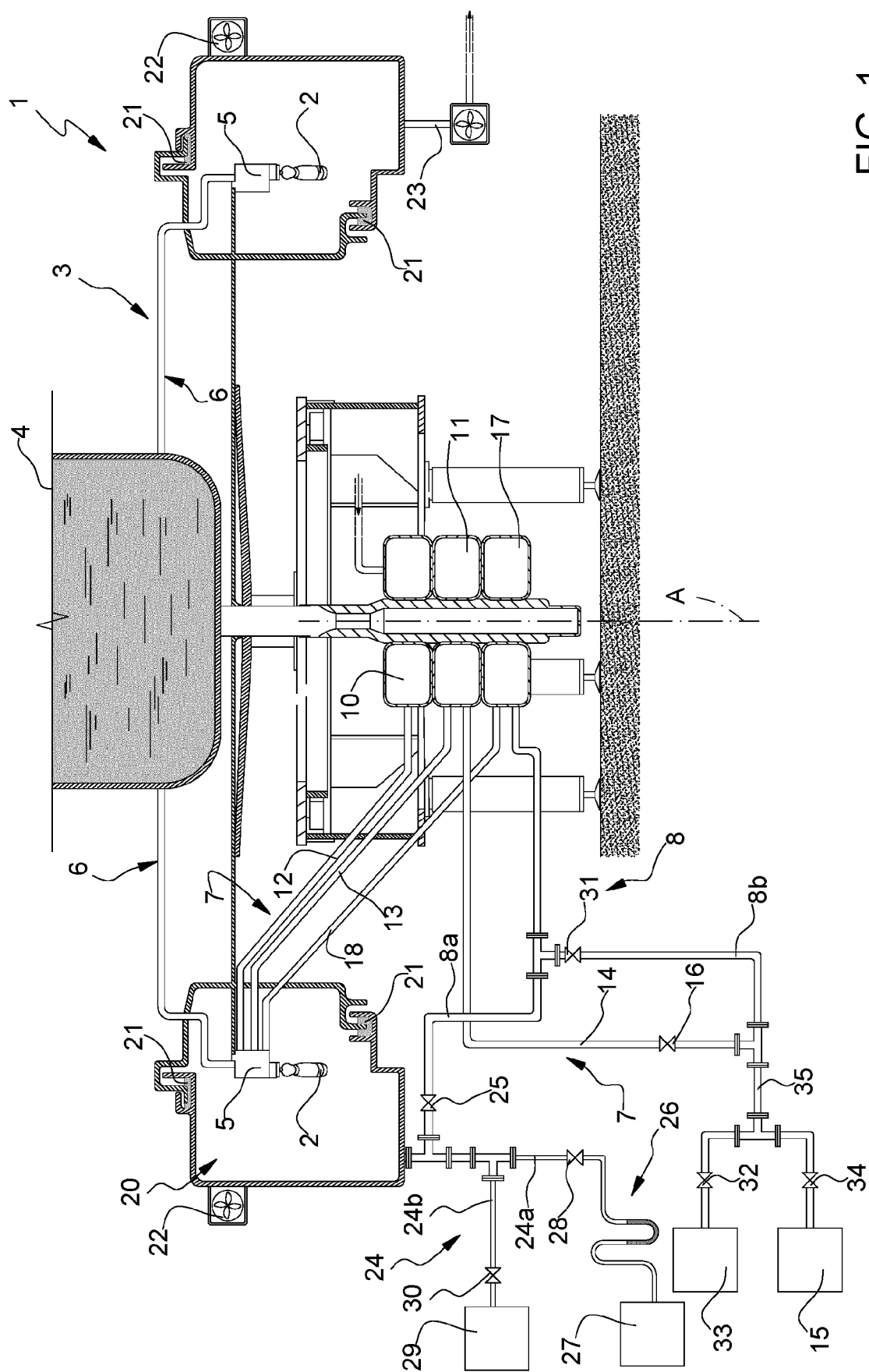


FIG. 1

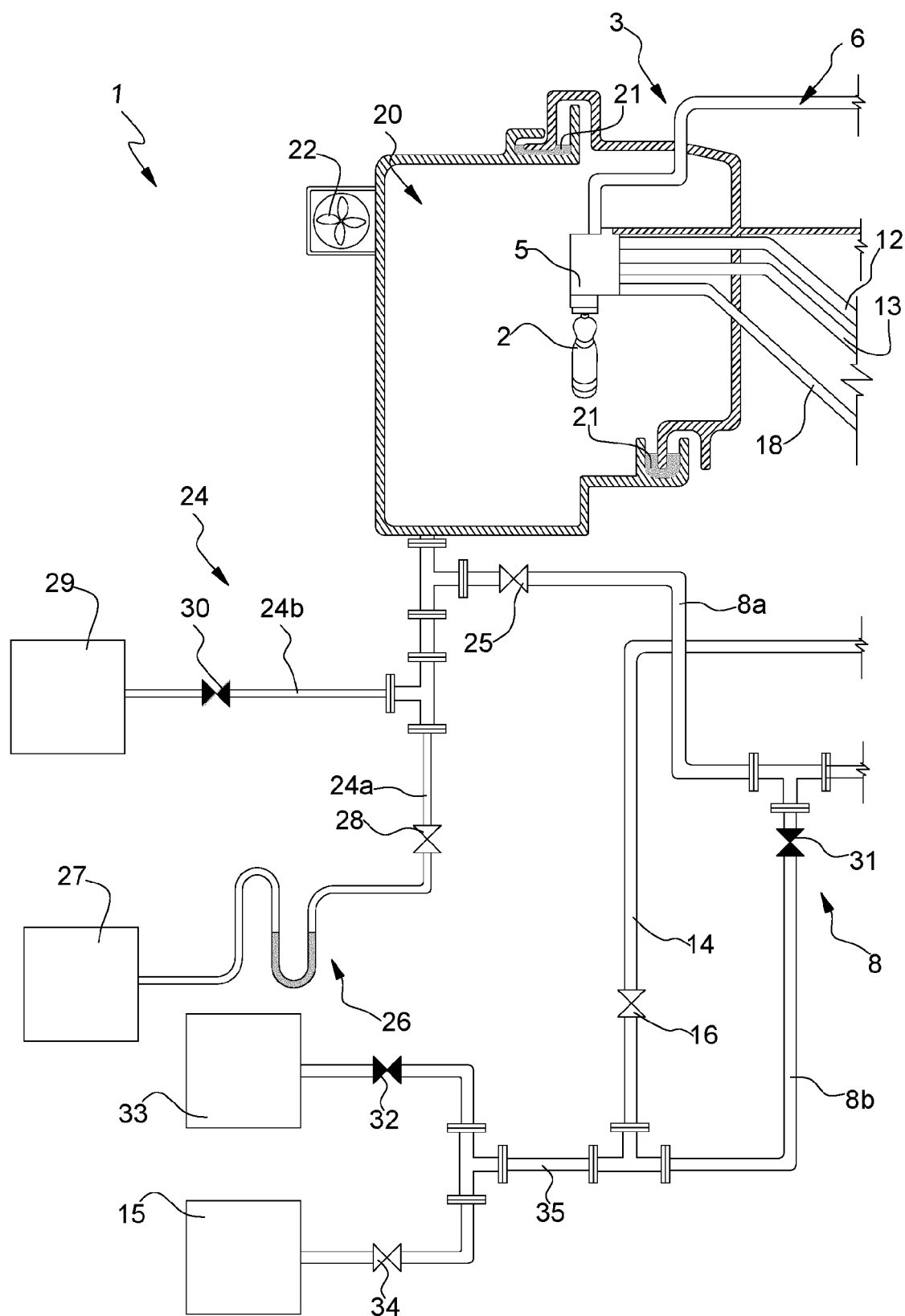


FIG. 2A

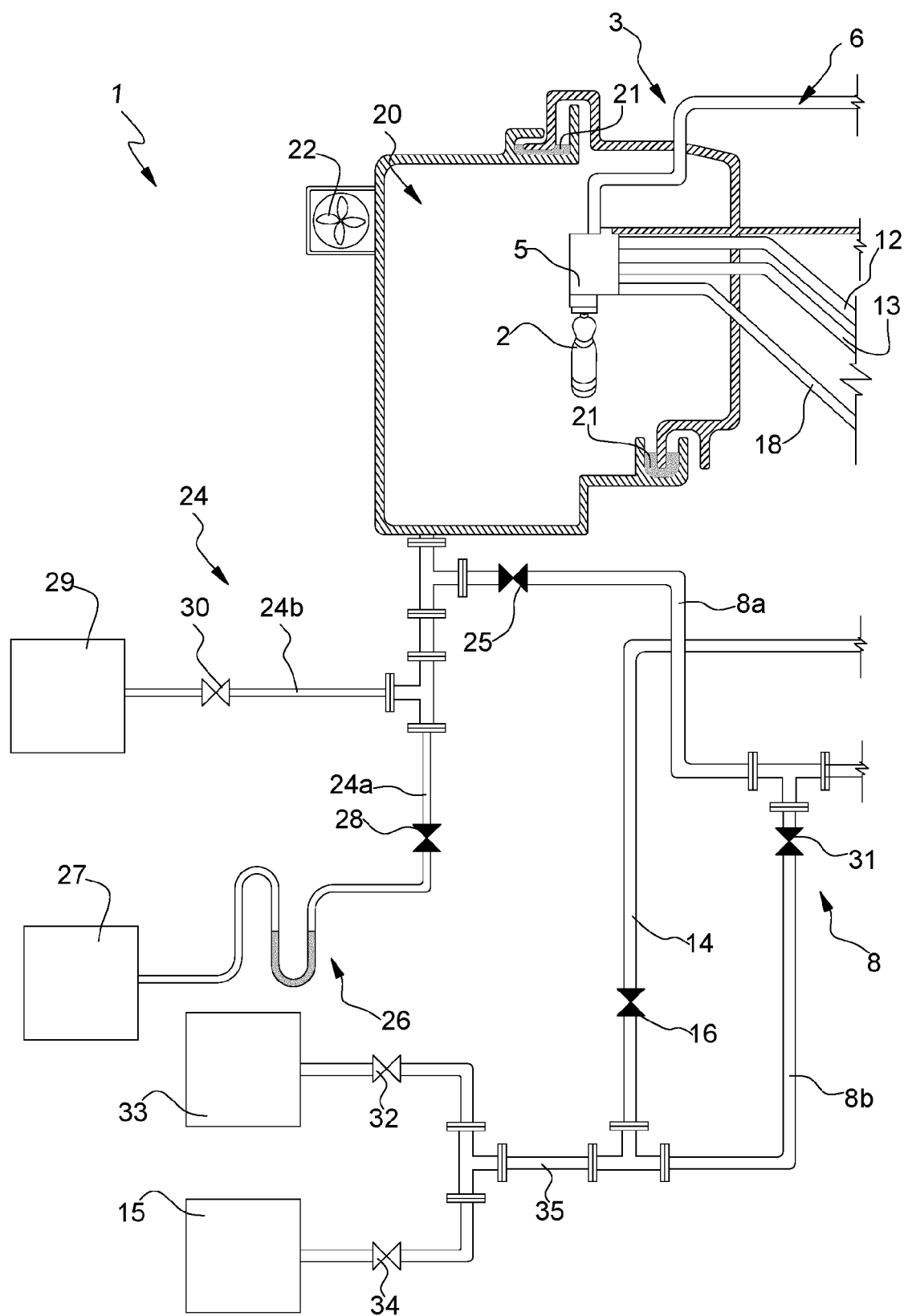


FIG. 2B

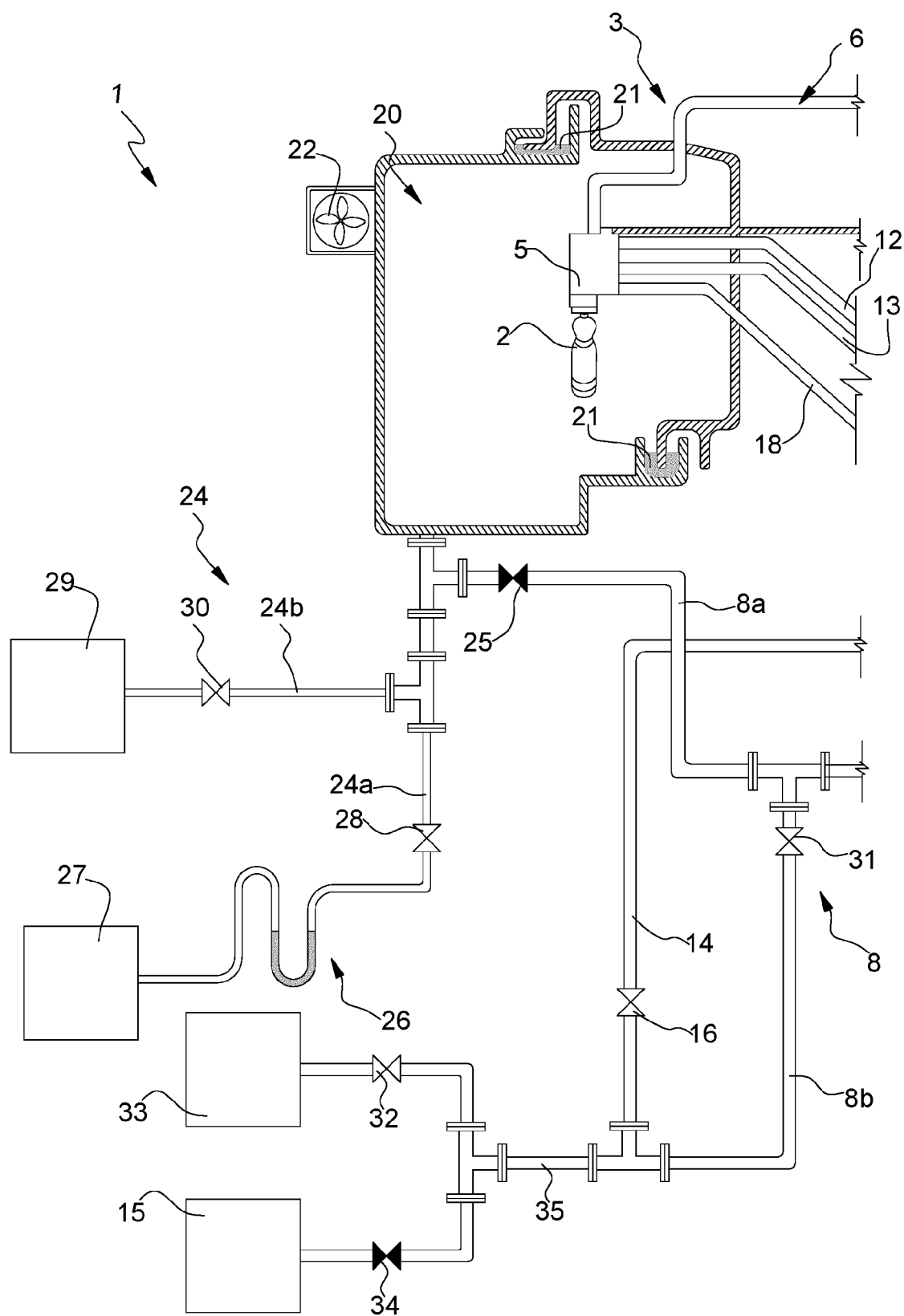


FIG. 2C



EUROPEAN SEARCH REPORT

Application Number
EP 19 30 6470

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 27 May 2020	Examiner Oliveira, Casimiro
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