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(54) **SYSTEM FOR DOSING AN AROMATIC PRODUCT INTO CONTAINERS**

(57) There is described a Dosing system (8) for dosing an aromatic product into containers (2) adapted to contain a pourable product, the system (8) comprising: a dosing valve (10) for sequentially feeding a dose of aromatic product in each container (2); a hydraulic circuit (11) for supplying the aromatic product to the dosing valve (10); and a cooling duct (12) for supplying a cooling medium; the hydraulic circuit (11) comprising: a tank (13) for containing the aromatic product hydraulically connected to the dosing valve (10); an input duct (14) for receiving the aromatic product from a source thereof; a delivery duct (15) for conveying the aromatic product from the input duct (14) to the tank (13); pumping means (18) for circulating the aromatic product; a heat exchanger (16) arranged along the delivery duct (15) upstream of the tank (13) and defining a heat exchange interface thermally interposed between the cooling duct (12) and the delivery duct (15) for cooling the aromatic product flowing therein; a recirculation duct (17) hydraulically connected to the delivery duct (15) at a first branching (15a) downstream of the heat exchanger (16), for receiving part of the aromatic product from the delivery duct (15), and at a second branching (15b) upstream of the heat exchanger (16), for feeding the received aromatic product back to the delivery duct (15); an inlet recirculation valve (19) arranged in the proximity of the first branching (15a) for selectively allowing the flow of aromatic product into the recirculation duct (17); a tank valve (20) arranged along the delivery duct (15) downstream of the heat exchanger (16) and of the first branching (15a) for selectively allowing the aromatic product into the tank (13); wherein the system (8) comprises a control unit (21) configured to control the pumping means (18), the tank

valve (20), the inlet recirculation valve (19) and the dosing valve (10) for defining a production mode of the system (8) in which, by means of the control unit (21): the pumping means (18) are activated for suctioning the aromatic product from the input duct (14) and circulating it along the delivery duct (15) and through the heat exchanger (16), the tank valve (20) is selectively activated to feed the aromatic product into the tank (13), the dosing valve (10) is selectively activated to feed the aromatic product from the tank (13) to the containers (2), and the inlet recirculation valve (19) is opened to allow recirculation of part of the aromatic product along the recirculation duct (17) and through the heat exchanger (16).

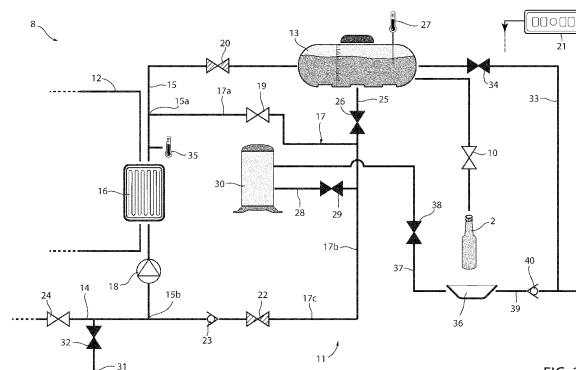


FIG. 2

Description

TECHNICAL FIELD

[0001] The present invention relates to a system for dosing an aromatic product, preferably an aromatic food product, into containers adapted to contain a pourable product, preferably a pourable food product.

BACKGROUND ART

[0002] Filling machines are known, which are used to fill containers, such as bottles, jars, cans or the like, with a pourable product.

[0003] Such machines essentially comprise a carousel rotatable about a vertical axis, a reservoir for containing the pourable product, and a plurality of filling valves.

[0004] According to a known configuration, the filling valves are peripherally carried by the carousel, are connected to the reservoir by respective ducts and are advanced by the carousel along a substantially arc-shaped filling path.

[0005] Generally, the above-mentioned filling machines further comprise an inlet device, such as an inlet star wheel configured to sequentially feed empty containers to the carousel, and an outlet device, such as an outlet star wheel, configured to receive the filled containers from the carousel.

[0006] Typically, the carousel comprises a plurality of support members, each apt to receive and hold in vertical position, below the respective filling valve, one container to be filled at a time.

[0007] Each filling valve is configured to feed a predetermined amount of pourable product to the relative container while the filling valve is advanced along the filling path due to the rotary motion imparted thereto by the carousel.

[0008] A typical filling valve comprises a tubular body, a shutter movably engaging the tubular body, and an actuator to control the movement of the shutter. Such valves are well-known and they will not be described in detail herein.

[0009] The need is felt in the industry for dosing an aromatic product into the containers previously filled with the pourable product.

[0010] In some cases the pourable product fed to the containers is a food product, for example still or sparkling water, tea, or the like; in this case the aromatic product is also a food product, for example a fruit essence (such as citrus fruits, berries or the like).

[0011] In other cases the pourable product fed to the containers is a non-food product, for example soaps, detergents, room fragrances, or the like; in this case the aromatic product does not need to be a food product.

[0012] Regardless of the type of pourable product, the known filling machines comprise a system for dosing the aromatic product into the previously filled containers.

[0013] The dosing system is typically arranged at a

dosing station operatively downstream of the carousel, for example at the outlet star wheel.

[0014] Such dosing system normally comprises a feeding circuit for supplying the aromatic product and at least one dosing valve hydraulically connected to the feeding circuit and configured to sequentially dose a predetermined quantity of aromatic product into each container when this latter transits at the dosing station.

[0015] In particular, the dosing valve comprises an inlet receiving the aromatic product from the feeding circuit, an outlet for sequentially feeding the aromatic product to each container, a shutter interposed between the inlet and the outlet and an actuator to control a reciprocating motion of the shutter between an open position and a closed position.

[0016] The dosing valve is typically fixed relative to the outlet star wheel, unlike the filling valves which are carried in rotation by the carousel to fill the respective containers placed under them. Therefore, the containers are to be dosed in a short time span corresponding to their transit below the dosing valve.

[0017] Although being functionally and structurally valid, the Applicant has observed that the dosing systems of the above-mentioned type are still open for further improvements. In particular, the aromatic products used are often highly flammable. Hence, the need is felt for an improvement of the overall safety of the filling and dosing operation.

DISCLOSURE OF INVENTION

[0018] It is therefore an object of the present invention to provide a dosing system which is designed to meet the above-mentioned need in a straightforward and low-cost manner.

[0019] This object is achieved by a dosing system as claimed in claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] 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 top view, with parts removed for clarity, of a filling machine comprising a dosing system according to the present invention; and Figures 2 to 6 shows hydraulic schemes, with parts removed for clarity, of the dosing system according to the invention, during distinct operative conditions.

BEST MODE FOR CARRYING OUT THE INVENTION

[0021] With reference to Figure 1, number 1 indicates as a whole a filling machine configured to fill a plurality of containers 2 with a pourable product, preferably a pourable food product.

[0022] According to this preferred embodiment, the

pourable product (for example still water, sparkling water, tea or the like) is of the type suitable for being diluted with an aromatic product, preferably an aromatic food product, for example a fruit essence or the like. The aromatic product can be a flavor.

[0023] However, the present invention is equally applicable in the case in which the pourable product is of a non-food type (for example soap, detergent, perfume for environments, or the like) and destined to be diluted with the aromatic product.

[0024] Preferably, the containers 2 are defined by bottles, jars or flasks, made of plastic or glass, or by cans.

[0025] As schematically shown in Figure 1, the filling machine 1 essentially comprises:

- a conveying device, in particular a carousel 3 rotatable around a central axis A, preferably vertical, and configured to advance the containers 2 along an arc-shaped filling path;
- a tank (not shown) suitable for containing the pourable product; and
- a plurality of filling valves 4 (known per se and not described in detail) for filling the containers 2 as they advance along the filling path.

[0026] In detail, each filling valve 4 is configured to selectively feed a predetermined quantity of pourable product to one container 2 at a time, while the same container 2 is conveyed along the filling path due to the rotary motion imparted thereto by the carousel 3.

[0027] In greater detail, each filling valve 4 is carried peripherally by the carousel 3 and is hydraulically connected to the tank by means of a respective duct 5 of the filling machine 1.

[0028] Conveniently, the filling machine 1 also comprises an inlet conveyor, preferably a star wheel 6 adapted to feed a succession of empty containers 2 to the carousel 3, and an outlet conveyor, preferably a star wheel 7, adapted to receive the containers 2 filled by the carousel 3.

[0029] In particular, the star wheels 6 and 7 rotate around respective axes A' and A" which are substantially parallel to the axis A of the carousel 3.

[0030] In the example described, the axes A, A' and A" are vertical.

[0031] The filling machine 1 is further configured to feed a dose of aromatic product inside the containers 2, preferably into the containers 2 previously filled with the pourable product.

[0032] For this purpose, the filling machine 1 further comprises a dosing system 8 (schematically illustrated in Figure 1), which is operatively arranged downstream of the carousel 3.

[0033] Preferably, the dosing system 8 is arranged at the output star wheel 7 to feed the aromatic product to the filled containers 2 that transit on the latter.

[0034] According to an alternative embodiment not shown, the filling machine 1 is configured for feeding the

dose of aromatic product inside the containers 2 which are still to be filled with the pourable product.

[0035] In this last case, the dosing system 8 is arranged operatively upstream of carousel 3, for example at the inlet star wheel 6.

[0036] As schematically shown in Figures 2 to 6, dosing system 8 comprises at least one dosing valve 10. The dosing valve 10 is hydraulically connected to a hydraulic circuit 11. The hydraulic circuit is configured for supplying the aromatic product to the dosing valve 10.

[0037] The dosing valve 10 is configured for dosing (feed) a predetermined quantity of aromatic product inside each container 2, when this latter transits through a dosing station D.

[0038] In particular, unlike the filling valves 4 which are carried in rotation by the carousel 3 to fill the respective containers 2 located below them, the valve 10 is fixed with respect to the star wheel 7, with the aromatic product being dosed in each container 2 in the time interval corresponding to the transit of the container 2 below the valve 10 itself, at the dosing station D.

[0039] Accordingly, the dosing station D is arranged at the outlet star wheel 7.

[0040] Preferably, the valve 10 is of the known type and comprises a tubular body, a shutter movably engaging the tubular body and an actuator to control the motion of the shutter.

[0041] Dosing system 8 further comprises a cooling duct 12 for supplying a cooling medium, such as (preferably cooled) water or air or Freon®.

[0042] In detail, cooling duct 12 is configured for supplying, i.e. for circulating, the cooling medium in the vicinity of hydraulic circuit 11, as better explained below.

[0043] Hydraulic circuit 11 comprises:

- a tank 13 for containing the aromatic product, the tank 13 being hydraulically connected to dosing valve 10;
- an input duct 14 for receiving the aromatic product from a source thereof (not shown);
- a delivery duct 15 for conveying the aromatic product from the input duct 14 to the tank 13; and
- pumping means, such as an hydraulic pump 18, for circulating the aromatic product.

[0044] According to an important aspect of the present invention, hydraulic circuit 11 further comprises:

- a heat exchanger 16, which is arranged along the delivery duct 15; the heat exchanger 16 is arranged upstream of the tank 13 and defines a heat exchange interface; the heat interface is thermally interposed between the cooling duct 12 and the delivery duct 15, for cooling the aromatic product flowing therein;
- a recirculation duct 17, which is hydraulically connected to the delivery duct 15, at a first branching 15a downstream of the heat exchanger 16, for receiving part of the aromatic product from the delivery

duct 15; the recirculation duct 17 is hydraulically connected to the delivery duct 15 also at a second branching 15b, which is upstream of the heat exchanger 16, for feeding the received aromatic product back to the delivery duct 15;

- an inlet recirculation valve 19 arranged at the first branching 15a, i.e. in the proximity of the first branching 15a, for selectively allowing the flow of aromatic product into the recirculation duct 17; and
- a tank valve 20, which is arranged along the delivery duct 15, downstream of the heat exchanger 16 and of the first branching 15a, for selectively allowing the aromatic product into the tank 13.

[0045] In particular, the recirculation duct 17 comprises:

- a first portion 17a, which is immediately adjacent the first branching 15a, and along which the inlet recirculation valve 19 is arranged;
- a second portion 17b, which is immediately adjacent the first portion 17a; and
- a third portion 17c, hydraulically connecting the second portion 17b to the second branching 15b.

[0046] In use, when the recirculation valve 19 is open, part of the aromatic product flowing within the delivery duct 15 is spilled into the recirculation duct 17 through the first branching 15a, so as to be recirculated again, upstream of the heat exchanger 16 and through the second branching 15b.

[0047] In this way, the temperature of the aromatic product can be maintained low, i.e. at a temperature value below a certain predetermined threshold.

[0048] According to an important aspect of the present invention, the dosing system 8 comprises a control unit 21. The control unit 21 is configured for controlling the pump 18, the tank valve 20, the inlet recirculation valve 19 and the dosing valve 10, to define a production mode of the dosing system 8 in which, by means of the control unit 21:

the pump 18 is activated for suctioning the aromatic product from the input duct 14 and circulating it along the delivery duct 15 and through the heat exchanger 16;

the tank valve 20 is selectively activated to feed the aromatic product into the tank 13;

the dosing valve 10 is selectively activated to feed the aromatic product from the tank 13 to the containers 2; and

the inlet recirculation valve 19 is opened to allow recirculation of part of the aromatic product along the recirculation duct 17 and through the heat exchanger 16.

[0049] The above-mentioned production mode is

schematically depicted in Figure 2, in which the open valves are depicted as empty white, the closed valves are depicted as full black and the selectively activatable valves (such as the tank valve 20 and the dosing valve 10) are depicted in mixed black and white.

[0050] Thanks to the above configuration of the dosing system 8, according to the production mode, the aromatic product can be cooled during production, thereby avoiding undesired and dangerous combustion of the aromatic product. Hence, the safety problems related to the aromatic product being flammable can be avoided, resulting in an improvement of the overall safety of the dosing operation.

[0051] According to the non-limiting preferred embodiment shown, the tank 13 is pressurized by a pressurization gas (known per se and not shown), for example air or an inert gas, such as nitrogen.

[0052] Advantageously, the control unit 21 is configured for controlling the activation of the tank valve 20, based on the level of the aromatic product inside the tank 13 and/or based on the pressure of the pressurization gas inside the tank 13.

[0053] Preferably, the hydraulic circuit 11 further comprises:

- an outlet recirculation valve 22, which is arranged along the recirculation duct 17, the outlet recirculation valve 22 being arranged downstream of the inlet recirculation valve 19 and upstream of the second branching 15b; and
- a non-return valve 23, which is arranged along the recirculation duct 17, the non-return valve 23 being arranged downstream of the inlet recirculation valve 19, in particular downstream of the outlet recirculation valve 22, and upstream of the second branching 15b.

[0054] More precisely, the outlet recirculation valve 22 and the non-return valve 23 are arranged along the third portion 17c.

[0055] Expediently, the outlet recirculation valve 22 is configured for regulating the pressure of the aromatic product exiting the recirculation duct 17. In fact, the product coming from the recirculation duct 17 has been pressurized and is at a pressure greater than the pressure of the input duct 14. Therefore, there is a risk that the product coming from the recirculation duct 17 through the second branching 15b, pushes out the product coming from the input duct 14. Therefore the outlet recirculation valve 22 helps in allowing recirculation of the aromatic product.

[0056] In some embodiments, the hydraulic circuit 11 may comprise only one of the outlet recirculation valve 22 and the non-return valve 23.

[0057] Advantageously, dosing system 8 comprises an input valve 24, which is arranged at the input duct 14, for selectively allowing the supply of aromatic product into the hydraulic circuit 11.

[0058] According to a further aspect of the present invention, the control unit 21 is further configured for controlling the input valve 24 (i.e. for controlling the aforementioned components and additionally the input valve 24), to define a first recirculation mode of the dosing system 8 according to which, by means of the control unit 21:

the input valve 24 is closed for preventing the supply of new aromatic product into the hydraulic circuit 11, the tank valve 20 is closed for preventing a flow of the aromatic product into the tank 13, the dosing valve 10 is closed for preventing a dosing of the aromatic product into the containers 2, the inlet recirculation valve 19 is opened, to allow recirculation of the aromatic product along the recirculation duct 17 and through the heat exchanger 16, and the pump 18 is activated for circulating the aromatic product which is present in the hydraulic circuit 11.

[0059] Such first recirculation mode is schematically depicted in Figure 3.

[0060] The above configuration is particularly advantageous when the production mode is stopped, for example voluntarily by the user due to a format change or to the need for resupplying containers 2, or the like. In fact, even if the production is stopped, the continue recirculation of the aromatic product allows to maintain the product at a desired low temperature for a nominal introduction of the same into the tank 13 when the production mode is restored.

[0061] Advantageously, the hydraulic circuit 11 further comprises:

- a connection duct 25, establishing an hydraulic connection between the tank 13 and the recirculation duct 17, the hydraulic connection being downstream of the inlet recirculation valve 19 and upstream of the second branching 15b; and
- a connection valve 26, which is arranged along the connection duct 25, for selectively allowing the flow of aromatic product from the tank 13 directly to the recirculation duct 17.

[0062] More precisely, the connection duct 25 connects the tank 13 to the second portion 17b.

[0063] According to a further aspect of the present invention, the control unit 21 is configured for further controlling the connection valve 26 (i.e. to control the aforementioned components and additionally the connection valve 26), to define a second recirculation mode of the dosing system 8 according to which, by means of the control unit 21:

the input valve 24 is closed, for preventing the supply of new aromatic product into the hydraulic circuit 11, the inlet recirculation valve 19 is closed, for preventing the supply of the aromatic product into the recir-

culating duct 17 therethrough, and for forcing the aromatic product towards the tank valve 20, the tank valve 20 is opened for allowing the aromatic product into the tank 13, the dosing valve 10 is closed for preventing a dosing of the aromatic product into the containers 2, the pump 18 is activated for circulating the aromatic product which is present in the hydraulic circuit 11, and the connection valve 26 is opened, to allow recirculation of aromatic product from the tank 13 along the connection duct 25, along the part of the recirculation duct 17 which is downstream of the inlet recirculation valve 19, through the heat exchanger 16, and (again) through the tank 13.

[0064] In greater detail, in the second recirculation mode, the pump 18 recirculates the aromatic product, in sequence: along the delivery duct 15 and through the heat exchanger 16, through the tank 13, along the connection duct 25, along the second portion 17b, along the third portion 17c and, through the second branching 15b, again along the delivery duct 15 and the tank 13.

[0065] Such second recirculation mode is schematically depicted in Figure 4.

[0066] The above configuration is particularly advantageous when the production mode is stopped and when the temperature of the aromatic product in the tank 13 reaches or is reaching a too high value.

[0067] Accordingly, the second recirculation mode, providing for a recirculation of the aromatic product also through the tank 13, allows to maintain the product contained therein at a desired low temperature.

[0068] Conveniently, the control unit 21 is configured for automatically controlling the dosing system 8 to operate in the first recirculation mode or in the second recirculation mode if the production mode is stopped.

[0069] Accordingly, the dosing system 8 comprises a tank temperature sensor, which is arranged at the tank 13 for detecting the temperature of the aromatic product contained therein.

[0070] Expediently, the control unit 21 is further configured for receiving a signal from the tank temperature sensor, and for automatically controlling the dosing system 8 to operate in the first recirculation mode or in the second recirculation mode, based on the temperature which has been detected by the tank sensor.

[0071] Preferably, the control unit 21 controls the dosing system 8 to operate in the second recirculation mode if the temperature which has been detected by the tank sensor is greater than a tank recirculation threshold.

[0072] In this way, when the production is stopped, a more efficient and automatic control of the temperature of the aromatic product can be achieved.

[0073] According to a preferred embodiment of the present invention, the hydraulic circuit 11 further comprises:

- a safety fluid inlet duct 28, which is preferably ar-

ranged at the recirculation duct 17; the safety inlet duct 28 is hydraulically connected to the recirculation duct 17, downstream of the inlet recirculation valve 19 and upstream of the second branching 15b; in particular, the safety inlet duct 28 is hydraulically connected to the second portion 17b;

- a safety valve 29, which is arranged at the safety fluid inlet duct 28, for allowing a flow of a safety fluid from a source 30 thereof into the hydraulic circuit 11, in particular in the recirculation duct 17;
- an output duct 31, for discharging a mixture of out of the hydraulic circuit 11, and preferably hydraulically connected to the delivery duct 15; the mixture comprising the safety fluid and the aromatic product; and
- an output valve 32 arranged at the output duct 31, for selectively allowing the discharge of said mixture.

[0074] According to a further important aspect of the present invention, the control unit 21 is further configured for controlling the safety valve 29 and the output valve 32 (i.e. for controlling the aforementioned components and additionally the safety valve 29 and the output valve 32), to define a local safety mode of the dosing system 8 according to which, by means of the control unit 21:

the input valve 24 is closed, for preventing the supply of new aromatic product into the hydraulic circuit 11, the pump 18 is deactivated, to stop the circulation of the aromatic product, the safety valve 29 is opened, to allow the supply of safety fluid into the hydraulic circuit 11, the recirculation valve 19 is opened, to allow the safety fluid to flow therethrough, the tank valve 20 is closed, for preventing the mixture of aromatic product and safety fluid to reach, in use, the tank 13, and the output valve 32 is opened, to allow the discharge of said mixture.

[0075] Such local safety mode is schematically depicted in Figure 5. Since the pump 18 is deactivated, the mixture is advanced along the hydraulic circuit 11 only by means of the push exerted by the safety fluid coming from the source 30.

[0076] The above configuration is particularly advantageous when the temperature of the aromatic product reaches a too high value, as better explained below.

[0077] Preferably, in the local safety mode, the connection valve 26 is closed and the outlet recirculation valve 22 is opened, by means of the control unit 21.

[0078] In this way, a better flushing of the hydraulic circuit 11 can be obtained.

[0079] Advantageously, the hydraulic circuit 11 further comprises:

- a discharge duct 33, which is hydraulically connected

to the tank 13, for discharging the mixture out of the hydraulic circuit 11; and

- a discharge valve 34, which is arranged at the discharge duct 33, for selectively allowing the discharge of said mixture.

[0080] According to a further important aspect of the present invention, the control unit 21 is further configured for controlling the discharge valve 34 (i.e. for controlling the aforementioned components and additionally the discharge valve 34), to define a global safety mode of the dosing system 8, according to which, by means of the control unit 21:

the input valve 24 is closed, for preventing the supply of new aromatic product into the hydraulic circuit 11, the safety valve 29 is opened, to allow the supply of safety fluid into the hydraulic circuit 11, the recirculation valve 19 is opened, to allow the safety fluid to flow therethrough, the tank valve 20 is opened, to allow the safety fluid into the tank 13, the pump 18 means are activated for circulating said mixture, the dosing valve 10 is closed, to prevent the mixture to outflow towards the containers 2, and the discharge valve 34 is opened, to allow the discharge of said mixture.

[0081] Such global safety mode is schematically depicted in Figure 6.

[0082] Opportunely, in the global safety mode, the control unit 21 controls the output valve 32 to be closed, to avoid outflow of the mixture through the outlet duct 31, which could cause the safety fluid not to reach the tank 13 and the discharge duct 33.

[0083] Furthermore, in the global safety mode, the control unit 21 is conveniently configured for controlling the connection valve 26 to be opened, to allow recirculation of the mixture along the connection duct 25.

[0084] Preferably, in the global safety mode, the outlet recirculation valve 22 is opened, by means of the control unit.

[0085] In this way, a better flushing of the hydraulic circuit 11 can be obtained.

[0086] Opportunely, the discharge valve 34 is closed in the production mode, in the first and second recirculation modes, and in the local safety mode.

[0087] The above configuration is particularly advantageous when the temperature of the aromatic product reaches a too high value, as better explained below.

[0088] The dosing system can comprise a first safety temperature sensor 35 and/or a second safety temperature sensor 27. The first safety sensor 35 is arranged at the delivery duct 15 and downstream of the heat exchanger 16, for detecting the temperature of the aromatic product at the delivery duct 15 and downstream of the heat exchanger 16. The second safety temperature sen-

sor 27 is arranged at the tank 13, for detecting the temperature of the aromatic product contained therein. The second safety sensor 27 can correspond to the above-mentioned tank sensor.

[0089] The control unit 21 can communicate with each safety sensor of the dosing system.

[0090] The control unit 21 is configured for automatically controlling the system 8 to operate in the local safety mode, if the temperature of the aromatic product at the delivery duct 15 and downstream of the heat exchanger 16, or the temperature of the aromatic product in the tank 13, is greater than a first temperature threshold and lower than a second temperature threshold. The second temperature threshold is greater than the first temperature threshold. The control unit 21 is configured for automatically controlling the system 8 to operate in the global safety mode, if the temperature of the aromatic product in the tank 13 is greater than the second temperature threshold.

[0091] Alternatively, the control unit 21 can be configured for automatically controlling the system 8 to operate in the local safety mode, if the increase per unit of time of the temperature of the aromatic product at the delivery duct 15 and downstream of the heat exchanger 16, or the increase per unit time of the temperature of the product in the tank 13, is greater than a first temperature increase threshold and lower than a second temperature increase threshold. The second temperature increase threshold is greater than the first temperature increase threshold. In this case, the control unit 21 is configured for automatically controlling the system 8 to operate in the global safety mode, if the increase per unit of time of the temperature of the product in the tank is greater than the second temperature increase threshold.

[0092] In this way, a more efficient and automatic control of the dosing system 8 can be achieved, which allows to increase the overall safety of the dosing operation.

[0093] According to a preferred embodiment of the present invention, the dosing system 8 comprises a receptacle, for example a tray 36. The tray is arranged below the dosing valve 10, for collecting aromatic product outflowing therefrom.

[0094] In use, it may happen, especially when the system 8 is switched from the production mode to the global safety mode, that the closing of the dosing valve 10 is not fast enough to prevent aromatic product being dosed at that time to immediately stop.

[0095] Hence, the tray 36 helps to collect such undesired outflowing product.

[0096] Advantageously, the hydraulic circuit 11 further comprises:

- a further safety fluid inlet duct 37, which is hydraulically connected to the tray 36, and preferably to the source 30; and
- a further safety valve 38, which is arranged along the further safety fluid inlet duct 37, for allowing a flow of safety fluid from the source 30 to the tray 36.

[0097] According to a further aspect of the present invention, the control unit 21 is further configured for controlling the further safety valve 38 to be opened for flushing the tray 36 with safety fluid.

[0098] Preferably, but not exclusively, such control is carried out in the global safety mode.

[0099] In this way, any trace of aromatic product can be safely collected and flushed out of the tray 36, thereby further reducing the risk of flammable product being uncontrolled within the system 8 and the machine 1.

[0100] Conveniently, the hydraulic circuit 11 further comprises:

- a further connection duct 39, hydraulically connecting the tray 36 to the discharge duct 33;
- a non-return valve or a siphon 40, which is arranged along the further connection duct 39 and is hydraulically interposed between the tray 36 and the discharge duct 33, for preventing the mixture flowing therein to flow back into the tray 36.

[0101] In this way, all the mixture can be easily discharged from one single duct, i.e. the discharge duct 33, thereby simplifying the architecture of the dosing system 8.

[0102] In one embodiment not shown, the further duct 37 is not connected to the source 30, and the safety liquid is not the same as the first safety liquid.

[0103] It is clear from the foregoing description that the dosing system 8 according to the invention enables to implement a method for dosing an aromatic product into containers 2 adapted to contain a pourable product, the method comprising the step of controlling the system 8 into a production mode including:

- supplying the aromatic product into a hydraulic circuit 11 through the input duct 14 and into the delivery duct 15;
- conveying the aromatic product through the heat exchanger 16;
- cooling the aromatic product by means of the heat exchanger 16;
- advancing the cooled aromatic product from the delivery duct into the tank 13;
- conveying the aromatic product from the tank 13 to the dosing valve 10;
- dosing the aromatic product into the containers 2, sequentially; and
- recirculating part of the aromatic product by means of the recirculation duct 17, during the dosing thereof.

[0104] Advantageously, the method comprises the step of controlling the system 8 into a first recirculation mode including: closing the input valve 24, closing the tank valve 20, closing the dosing valve 10, opening the inlet recirculation valve 19, recirculating the product by means of the recirculation duct 17.

[0105] Advantageously, the method comprises the

step of controlling the system 8 into a second recirculation mode including: closing the input valve 24, closing the inlet recirculation valve 19, opening the tank valve 20, closing the dosing valve 10, opening the connection valve 26 to recirculate the aromatic product also through the tank 13.

[0106] Advantageously, the method comprises the step of controlling the system 8 into a local safety mode including: closing the input valve 24, deactivating the pump 18, opening the safety valve 29, inletting safety fluid into the hydraulic circuit 11, opening the recirculation valve 19, closing the tank valve 20 and opening the output valve 32 for discharging the mixture.

[0107] Advantageously, the method comprises the step of controlling the system 8 into a global safety mode including: closing the input valve 24, opening the safety valve 29, inletting safety fluid into the hydraulic circuit 11, opening the recirculation valve 19, opening the tank valve 20, closing the dosing valve 10, opening the discharge valve 34.

[0108] Preferably, in this case the method further comprises opening the connection valve 26.

[0109] Preferably, the method further comprises the steps of:

- detecting a temperature downstream of the heat exchanger 16 and/or at the tank 13;
- controlling the system 8 to operate in one of the above-mentioned modes based on the detected temperature.

[0110] The advantages of the dosing system 8 according to the present invention will be clear from the foregoing description.

[0111] In particular, the aromatic product can be cooled during production, thereby avoiding undesired and dangerous combustion of the aromatic product.

[0112] Moreover, even if the production is stopped, the aromatic product is efficiently maintained at a suitable low temperature, both outside (first recirculation mode) and inside (second recirculation mode) the tank 13.

[0113] Furthermore, in the event of a high temperature, the system 8 is protected by flushing out the too hot aromatic product, partially (local safety mode) or completely (global safety mode), depending on the temperature time trend.

[0114] Hence, the safety problems related to the aromatic product being flammable can be avoided, resulting in an improvement of the overall safety of the dosing operation.

[0115] Clearly, changes may be made to the dosing system 8 as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. Dosing system (8) for dosing an aromatic product into containers (2) adapted to contain a pourable product, the system (8) comprising:

- a dosing valve (10) for sequentially feeding a dose of aromatic product in each container (2);
- a hydraulic circuit (11) for supplying the aromatic product to the dosing valve (10); and
- a cooling duct (12) for supplying a cooling medium;

the hydraulic circuit (11) comprising:

- a tank (13) for containing the aromatic product, the tank (13) being hydraulically connected to the dosing valve (10);
- an input duct (14) for receiving the aromatic product from a source thereof;
- a delivery duct (15) for conveying the aromatic product from the input duct (14) to the tank (13);
- pumping means (18) for circulating the aromatic product;
- a heat exchanger (16) arranged along the delivery duct (15), the heat exchanger being located upstream of the tank (13) and defining a heat exchange interface which is thermally interposed between the cooling duct (12) and the delivery duct (15), for cooling the aromatic product flowing therein;
- a recirculation duct (17), which is hydraulically connected to the delivery duct (15) at a first branching (15a), the first branching (15a) being located downstream of the heat exchanger (16), for receiving part of the aromatic product from the delivery duct (15), and at a second branching (15b), the second branching (15b) being located upstream of the heat exchanger (16), for feeding the received aromatic product back to the delivery duct (15);
- an inlet recirculation valve (19), which is arranged in the proximity of the first branching (15a), for selectively allowing the flow of aromatic product into the recirculation duct (17); and
- a tank valve (20), which is arranged along the delivery duct (15), the tank valve (20) being arranged downstream of the heat exchanger (16) and of the first branching (15a), for selectively allowing the aromatic product into the tank (13);

wherein the system (8) comprises a control unit (21) configured for controlling the pumping means (18), the tank valve (20), the inlet recirculation valve (19) and the dosing valve (10), to define a production mode of the system (8), according to which, by means of the control unit (21): the pumping means (18) are activated for suctioning the aromatic product

from the input duct (14) and circulating it along the delivery duct (15) and through the heat exchanger (16); the tank valve (20) is selectively activated to feed the aromatic product into the tank (13); the dosing valve (10) is selectively activated to feed the aromatic product from the tank (13) to the containers (2); and the inlet recirculation valve (19) is opened to allow recirculation of part of the aromatic product along the recirculation duct (17) and through the heat exchanger (16).

2. Dosing system as claimed in claim 1, and comprising an input valve (24), which is arranged at the input duct (14), for selectively allowing the supply of aromatic product into the hydraulic circuit (11); wherein the control unit (21) is configured for further controlling the input valve (24), to define a first recirculation mode of the system (8), according to which, by means of the control unit (21): the input valve (24) is closed for preventing the supply of new aromatic product into the hydraulic circuit; the tank valve (20) is closed for preventing a flow of the aromatic product into the tank (13); the dosing valve (10) is closed for preventing a dosing of the aromatic product into the containers (2); the inlet recirculation valve (19) is opened to allow recirculation of the aromatic product along the recirculation duct (17) and through the heat exchanger (16); and the pumping means (18) are activated for circulating the aromatic product present in the hydraulic circuit (11).
3. Dosing system as claimed in claim 2, wherein the hydraulic circuit (11) further comprises:

- a connection duct (25) establishing a fluid connection between hydraulically the tank (13) to the recirculation duct (17), said hydraulic connection being downstream of the inlet recirculation valve (19) and upstream of the second branching (15b); and
- a connection valve (26), which is arranged along the connection duct (25), for selectively allowing the flow of aromatic product from the tank (13) to the recirculation duct (17);

wherein the control unit (21) is configured for further controlling the connection valve (26), to define a second recirculation mode of the system (8) according to which, by means of the control unit (21): the input valve (24) is closed for preventing the supply of new aromatic product into the hydraulic circuit (11); the inlet recirculation valve (19) is closed for preventing the supply of the aromatic product into the recirculating duct (17) therethrough, and for forcing the aromatic product towards the tank valve (20); the tank valve (20) is opened for allowing the aromatic product into the tank (13); the dosing valve (10) is closed for preventing a dosing of the aromatic product into

the containers (2); the pumping means (18) are activated for circulating the aromatic product present in the hydraulic circuit (11); and the connection valve (26) is opened to allow recirculation of aromatic product from the tank (13), along the connection duct (25), along the part of the recirculation duct (17) which is downstream of the inlet recirculation valve (19), through the heat exchanger (16), and again through the tank (13).

4. Dosing system as claimed in claim 3, wherein the control unit (21) is configured for automatically controlling the system (8) to operate in the first recirculation mode or in the second recirculation mode if the production mode is stopped.
5. Dosing system as claimed in claim 4, and comprising a tank temperature sensor (27) arranged at the tank (13) for detecting the temperature of the aromatic product therein; wherein the control unit (21) is further configured for receiving a signal from the temperature sensor (27), and for automatically controlling the system (8) to operate in the first recirculation mode or in the second recirculation mode, based on the detected temperature.
6. Dosing system as claimed in any of the claims 3 to 5, wherein the recirculation duct (17) comprises:
 - a first portion (17a) immediately adjacent the first branching (15a) and along which the inlet recirculation valve (19) is arranged;
 - a second portion (17b) immediately adjacent the first portion (17a); and
 - a third portion (17c) hydraulically connecting the second portion (17b) to the second branching (15b);

wherein the connection duct (25) hydraulically connects the tank (13) to said second portion (17b); and wherein, in the second recirculation mode, the pumping means (18) recirculate the aromatic product, in sequence: along the delivery duct (15) and through the heat exchanger (16), through the tank (13), along the connection duct (25), along said second portion (17b), along said third portion (17c), and, through the second branching (15b), again along the delivery duct (15).

7. Dosing system as claimed in any one of the foregoing claims, wherein the hydraulic circuit (11) further comprises:
 - an outlet recirculation valve (22) arranged along the recirculation duct (17), the outlet recirculation valve (22) being arranged downstream of the inlet recirculation valve (19) and

- upstream of the second branching (15b); and/or
 - a non-return valve (23) arranged along the recirculation duct (17), the non-return valve (23) being arranged downstream of the inlet recirculation valve (19) and upstream of the second branching (15b).
8. Dosing system as claimed in any one of the foregoing claims, wherein the hydraulic circuit (11) further comprises:
- an input valve (24) arranged at the input duct (14), for selectively allowing the supply of aromatic product into the hydraulic circuit (11);
 - a safety fluid inlet duct (28);
 - a safety valve (29) arranged at the safety fluid inlet duct (28), for allowing a flow of a safety fluid from a source (30) thereof into the hydraulic circuit.
9. Dosing system as claimed in Claim 8, wherein the hydraulic circuit (11) comprises:
- an output duct (31), for discharging a mixture out of the hydraulic circuit (11), said mixture comprising the safety fluid and the aromatic product; and
 - an output valve (32), which is arranged at the output duct (31), for selectively allowing the discharge of said mixture;
- and wherein the control unit (21) is configured for further controlling the input valve (24), the safety valve (29) and the output valve (32), for defining a local safety mode of the system (8), according to which, by means of the control unit (21): the input valve (24) is closed for preventing the supply of new aromatic product into the hydraulic circuit (11); the pumping means (18) are deactivated to stop the circulation of the aromatic product; the safety valve (29) is opened to allow the supply of safety fluid into the hydraulic circuit (11); the inlet recirculation valve (19) is opened to allow the safety fluid to flow there-through; the tank valve (20) is closed for preventing a mixture of aromatic product and safety fluid to reach the tank (13); and the output valve (32) is opened to allow the discharge of said mixture.
10. Dosing system as claimed in claim 9, wherein:
- the safety fluid inlet duct (28) is arranged at the recirculation duct (17) and is hydraulically connected thereto downstream of the inlet recirculation valve (19) and upstream of the second branching (15b);
 - the output duct (31) is hydraulically connected to the delivery duct (15).
11. Dosing system as claimed in any of Claims 8 to 10, wherein the hydraulic circuit (11) further comprises:
- a discharge duct (33) hydraulically connected to the tank (13) for discharging a mixture out of the hydraulic circuit (11), the mixture comprising safety fluid and aromatic product; and
 - a discharge valve (34) arranged at the discharge duct (33) for selectively allowing the discharge of said mixture;
- and wherein the control unit (21) is configured for further controlling the input valve (24), the safety valve (29) and the discharge valve (34), to define a global safety mode of the system (8) according to which, by means of the control unit (21): the input valve (24) is closed for preventing the supply of new aromatic product into the hydraulic circuit (11), the safety valve (29) is opened to allow the supply of safety fluid into the hydraulic circuit (11), the inlet recirculation valve (19) is opened to allow the safety fluid to flow therethrough, the tank valve (20) is opened to allow the safety fluid into the tank (13), the pumping means (18) are activated for circulating said mixture, the dosing valve (10) is closed to prevent the mixture to outflow towards the containers (2), and the discharge valve (34) is opened to allow the discharge of said mixture.
12. Dosing system as claimed in claims 3 and 11, wherein, in the global safety mode, the control unit (21) is configured to control the connection valve (26) to be opened to allow the circulation of said mixture along the connection duct (25).
13. Dosing system as claimed in Claim 9 or 10 and in Claim 11 or 12, and comprising a safety temperature sensor (35), which is arranged at the delivery duct (15) and downstream of the heat exchanger (16), for detecting the temperature of the aromatic product at the delivery duct (15) and downstream of the heat exchanger (16), or is arranged at the tank (13), for detecting the temperature of the aromatic product thereat;
- and wherein the control unit (21) is further configured for automatically controlling the system (8) to operate in the local safety mode or in the global safety mode based on the temperature which has been detected by the safety temperature sensor (35).
14. Dosing system as claimed in claim 13, wherein the control unit (21) is configured for automatically controlling the system (8) to operate in the local safety mode, if the temperature of the aromatic product at the delivery duct (15) and downstream of the heat exchanger (16), or the temperature of the aromatic product in the tank (13), is greater than a first temperature threshold and lower than a second temper-

ature threshold, the second temperature threshold being greater than the first temperature threshold, and is configured for automatically controlling the system (8) to operate in the global safety mode, if the temperature of the aromatic product in the tank (13) is greater than the second temperature threshold; or
 the control unit (21) is configured for automatically controlling the system (8) to operate in the local safety mode, if the increase per unit of time of the temperature of the aromatic product at the delivery duct (15) and downstream of the heat exchanger (16), or the increase per unit time of the temperature of the product in the tank (13), is greater than a first temperature increase threshold and lower than a second temperature increase threshold, the second temperature increase threshold being greater than the first temperature increase threshold, and is configured for automatically controlling the system (8) to operate in the global safety mode, if the increase per unit of time of the temperature of the product in the tank (13), is greater than the second temperature increase threshold.

and wherein the control unit (21) is configured to control the activation of the tank valve (20) based on the level of the aromatic product inside the tank (13) and/or based on the pressure of the pressurization gas inside the tank (13).

15. Dosing system as claimed in claims from 11 to 14, and comprising a receptacle (36) arranged below the dosing valve (10) for collecting aromatic product outflowing from the dosing valve (10);

wherein the hydraulic circuit (11) comprises:

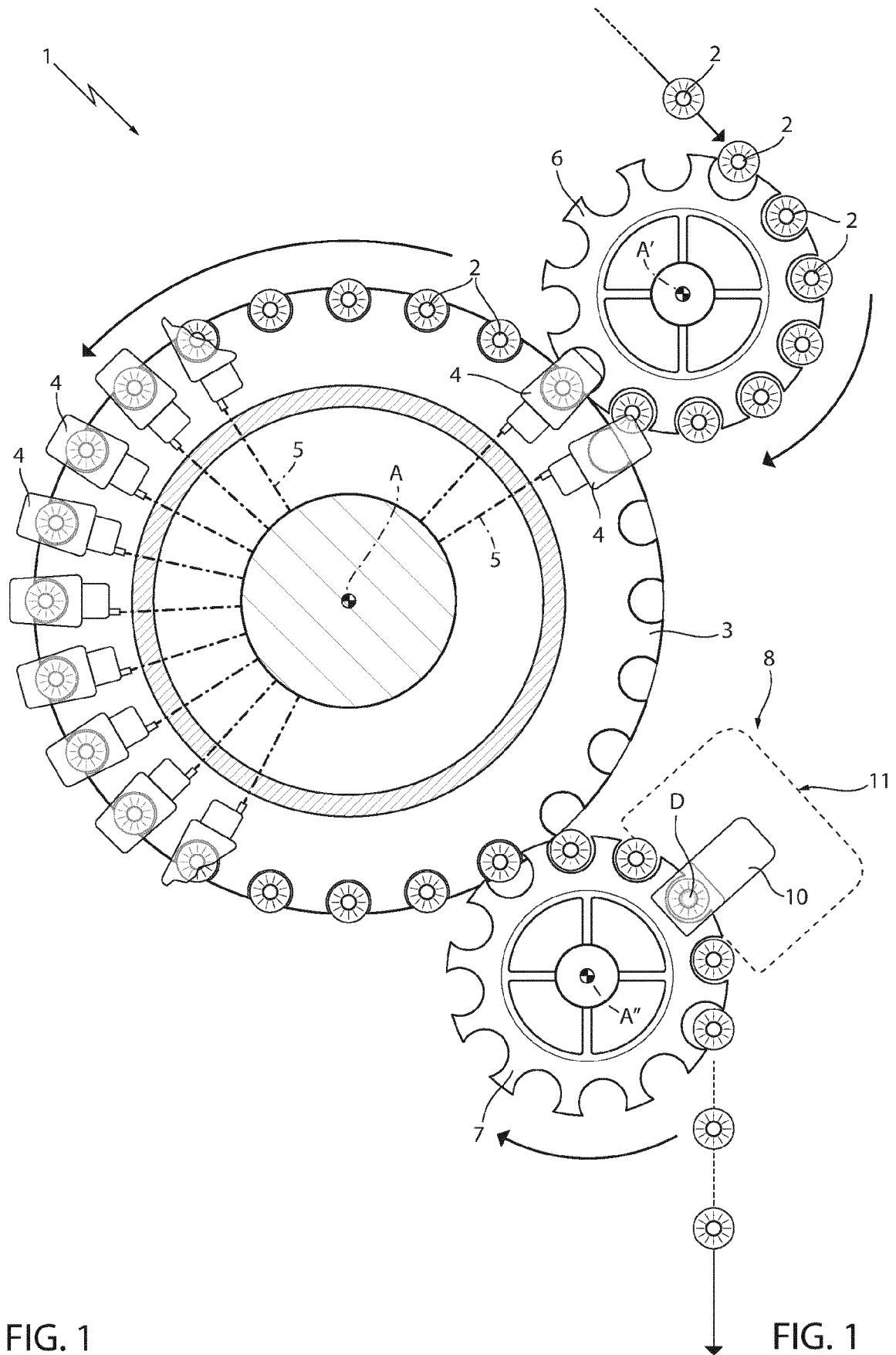
- a further safety fluid inlet duct (37) hydraulically connected to the receptacle (36); and
- a further safety valve (38) arranged along the further safety fluid inlet duct (37), for allowing a flow of safety fluid from a source (30) thereof to the receptacle (36);

and wherein, in the global safety mode, the control unit (21) is further configured to control the further safety valve (38) to be opened for flushing the receptacle (36) with safety fluid.

16. Dosing system as claimed in claim 15, wherein the hydraulic circuit (11) further comprises:

- a further connection duct (39) hydraulically connecting the receptacle (36) to the discharge duct (33);
- a non-return valve or a siphon (40) arranged along the further connection duct (39) and hydraulically interposed between the receptacle (36) and the discharge duct (33), for preventing said mixture to flow into the receptacle (36).

17. Dosing system as claimed in any one of the foregoing claims, wherein the tank (13) is pressurized by a pressurization gas;



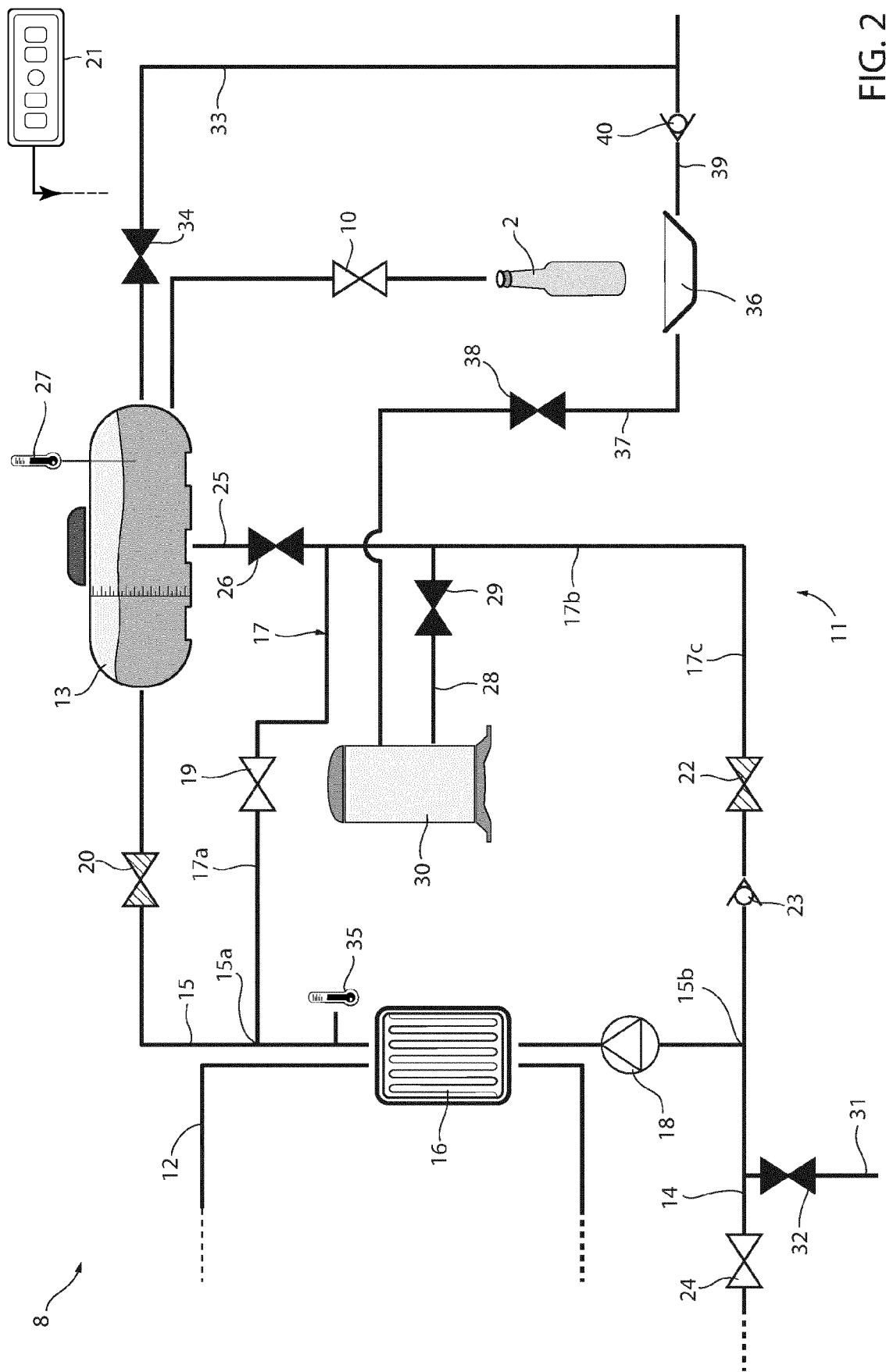


FIG. 2

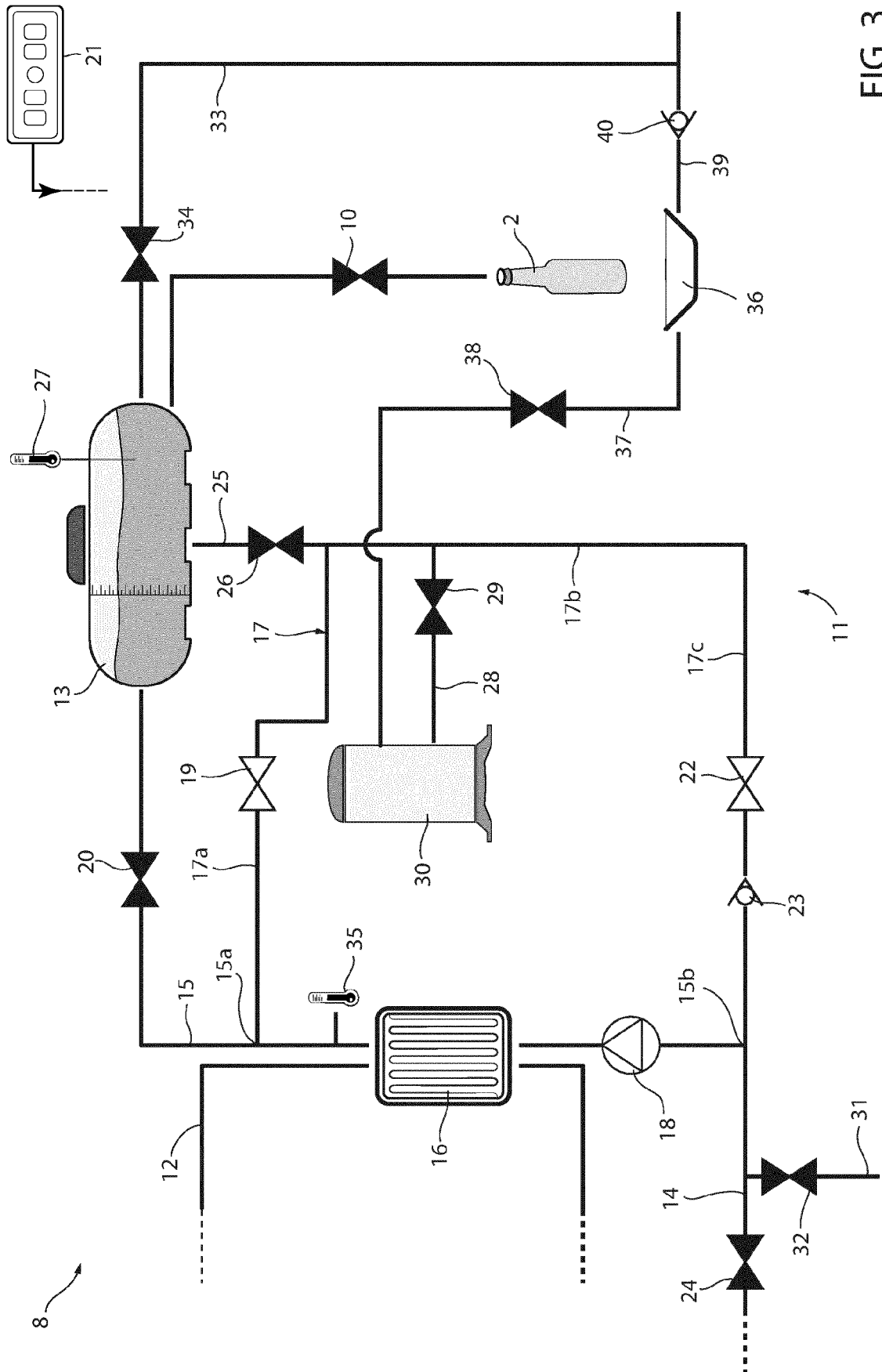


FIG. 3

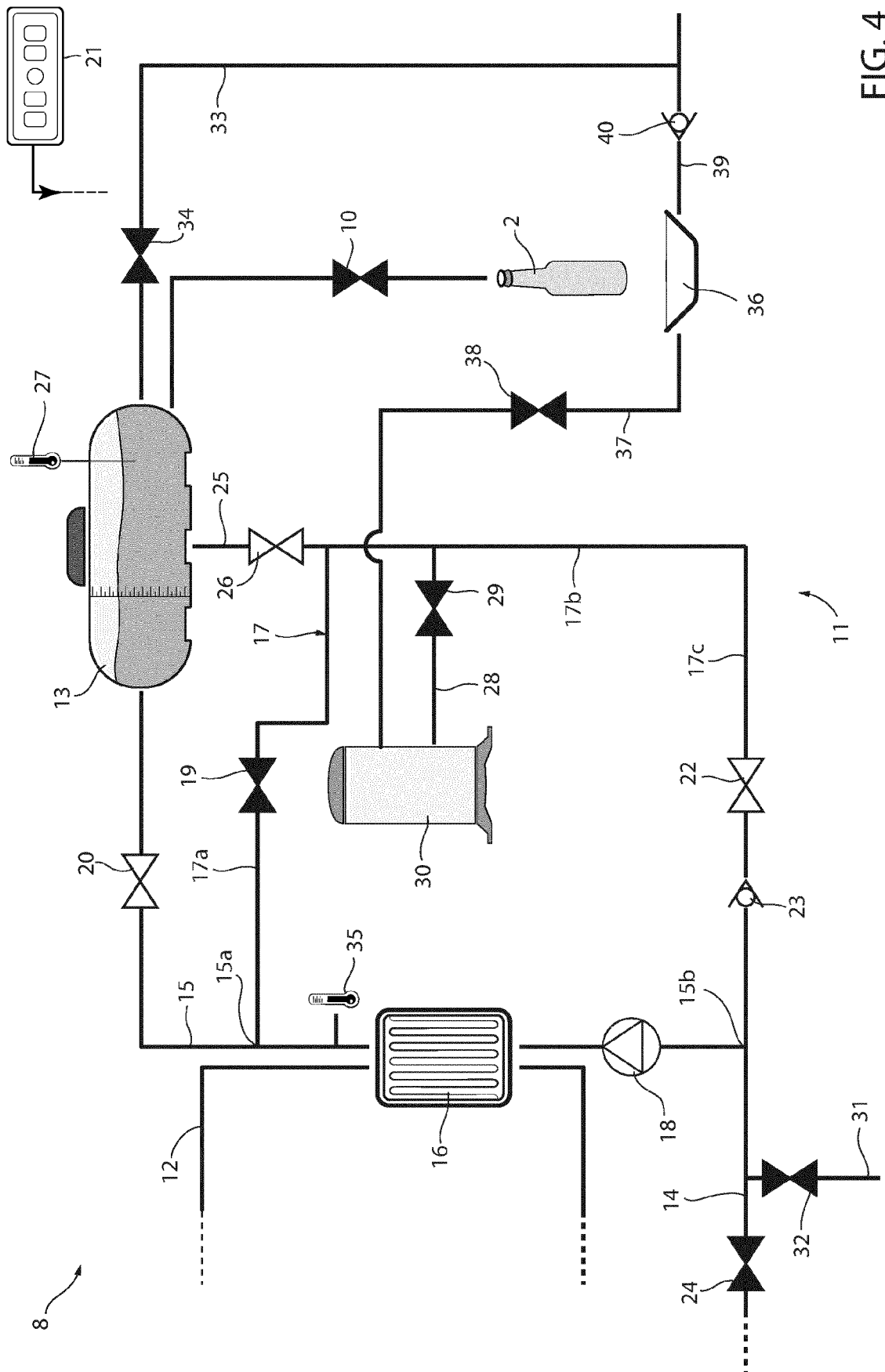
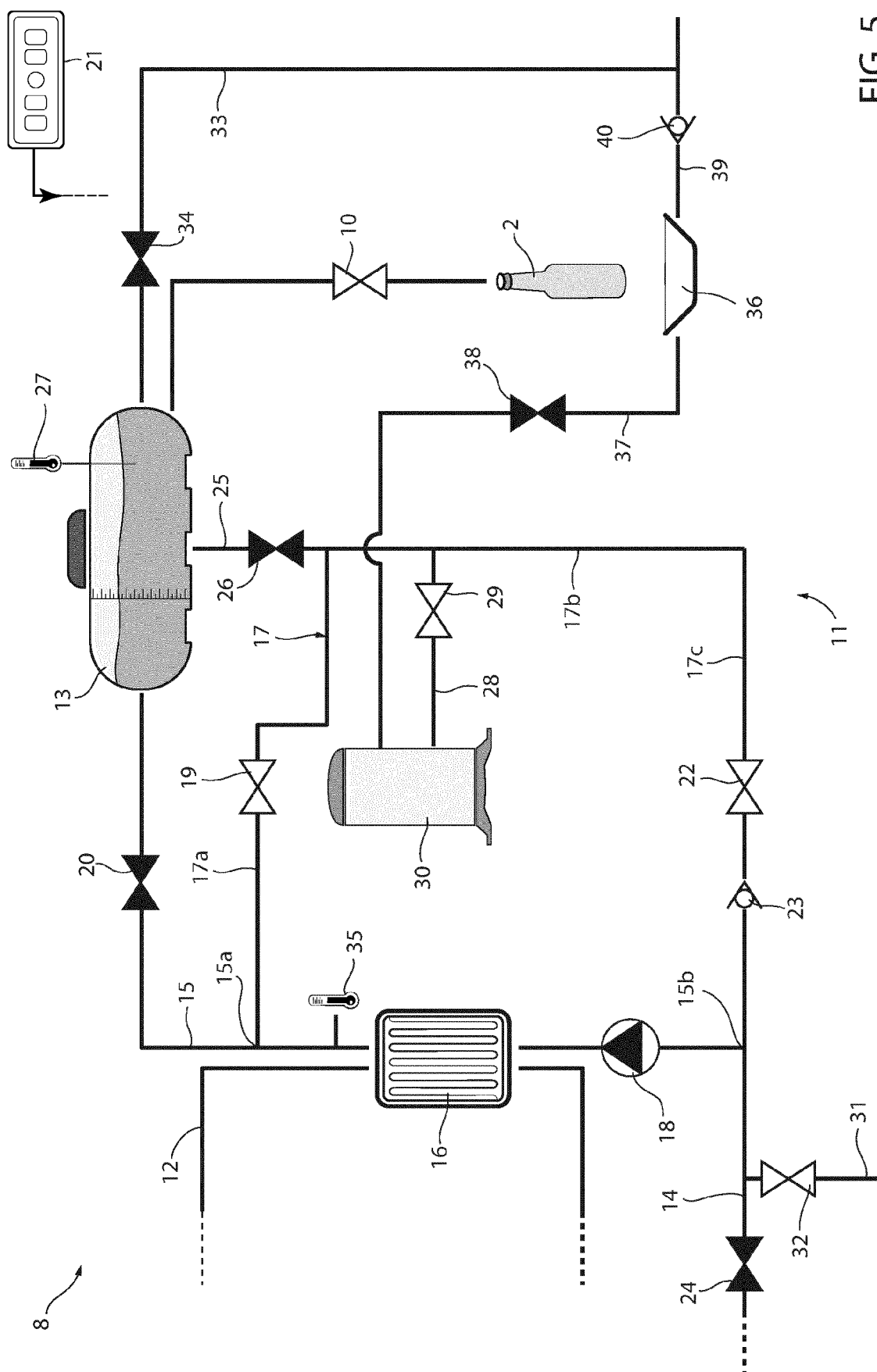


FIG. 4



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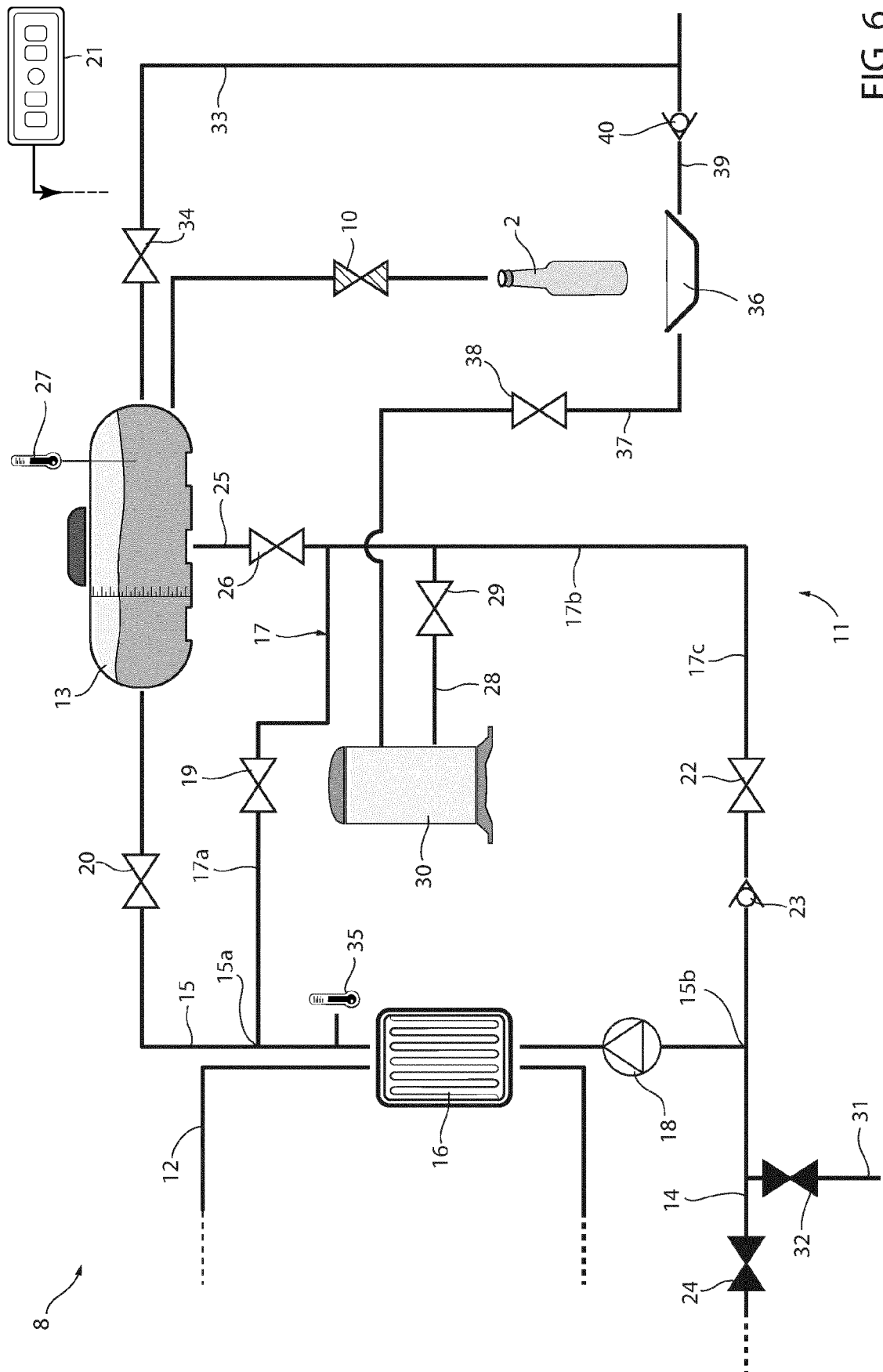


FIG. 6



EUROPEAN SEARCH REPORT

Application Number

EP 21 20 0659

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 719 419 A1 (QUAKER OATS CO [US]) 8 November 2006 (2006-11-08) * paragraphs [0033], [0040] - [0042], [45.47]; figures 2,3 * -----	1-17	INV. B67C3/02
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			B67C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		22 March 2022	Wartenhorst, Frank
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			

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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22-03-2022

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