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(54) **Filling plant**

(57) A plant is proposed to fill, at room temperature, containing elements such as bottles or other containers, preferably but not exclusively with aerated liquids and/or beer.

Said plant is equipped with special devices which allow an isobaric filling of containing elements with gaseous fluids. In general, the gaseous fluids are difficult to control, especially in natural thermic conditions and in particular at a higher temperature than 5°C because of the formation of a froth which contaminates the outer surface of the bottle.

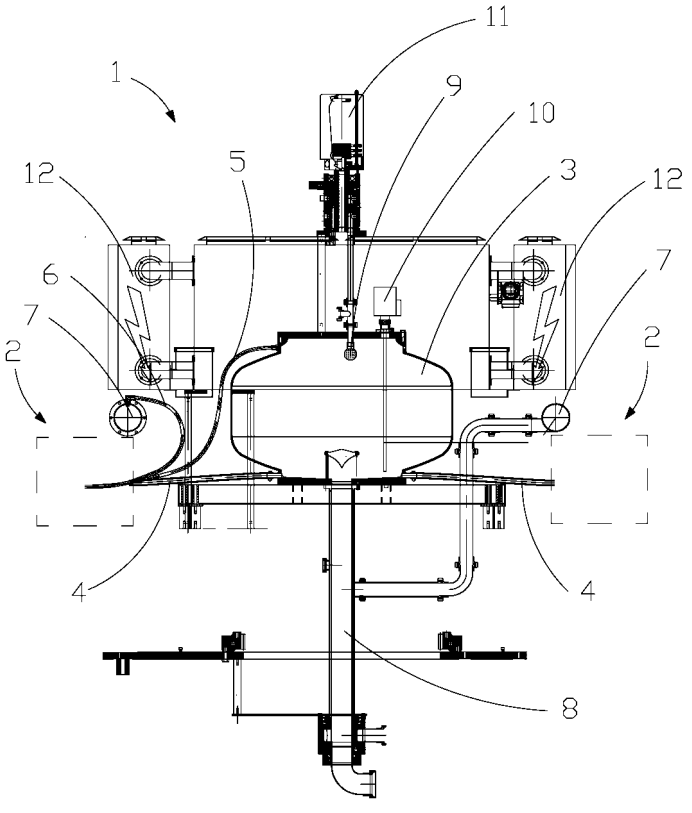


Fig. 1

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## Description

**[0001]** The present invention refers to a plant for the filling, at room temperature, of containing elements such as bottles or other containers, preferably but not exclusively with aerated liquids and/or beer.

**[0002]** The present system is equipped with special devices which allow an isobaric filling of containing elements with gaseous fluids. In general, the gaseous fluids are difficult to control, especially in natural thermic conditions.

**[0003]** As is known, the prior art plants for the filling of bottles with aerated liquids are provided with mechanisms in whichin general, the fluid must be brought to a lower temperature than 6° C because an aerated fluid is stabler when it is brought to low temperatures.

**[0004]** For instance, when the bottling is done by utilizing isobaric machines, at first the container is filled with an aeriform fluid at the same pressure as the pressure in the fluid source-reservoir or at a slightly higher pressure than the wished pressure for the container to be filled, at the end of the bottling process.

**[0005]** Then, the container is filled with the aerated fluid by gravity, the previously set-up pressure being maintained. The final phase of the filling process is very delicate because it is necessary to remove the gases from the upper empty part of the container before the container is separated from the plant. During said operation, if the fluid does not have the proper chemical-physical properties, in particular a quite low temperature, an unwished froth is produced with a consequent contamination of the outer surface of the container, for instance a contamination of the bottle-neck.

**[0006]** The above problem is avoided by utilizing a refrigerating plant which reduces the temperature of the fluid greatly, to about 5° C. However, the cost of the refrigerating plant increases the total cost of the whole plant as concerns both the initial expenses and the current expenses and the maintenance charges.

**[0007]** Besides, suitable nozzles are positioned on the same plants to wash and clean the outer surface of the blottle-neck that could be contaminated by the aerated fluid.

**[0008]** In addition, it is to be noted that said isobaric low-temperature plants allow a level filling which is obtained through a merely mechanical system which utilizes thin canes. In case said thin canes are inserted in the bottles with an even slight inequality or lack of precision, there will be different filling levels and the result will not be satisfactory.

**[0009]** Another problem of the prior art plants is the positioning of the valves that control the opening and closing of the bottle filling channes. In fact, the source-reservoir of the fluid is shaped like a ring and is provided with inner mechanisms that control the fluid flow toward the bottles or containing elements to be filled.

**[0010]** It is evident that the structure of the prior art plants is complex and said complexity makes the cleaning of the plants very difficult.

**[0011]** Besides, the isobaric plants offered on the market do not guarantee a high production: the filling time is not satisfactory yet, especially on considering that once the filling has finished, the gas removal remains a long operation that is necessary to accomplish to avoid the formation of froth.

**[0012]** The object and aim of the present invention is to overcome all the cited problems and other ones through a bottle or other container filling plant,
characterized by the fact that it comprises at least a reservoir connected through at least two ducts with at least a filling device, a first duct being for the passage of the fluid and a second duct being for the passage of the aeriform fluid; said filling device comprises a flow measuring component which is connected, in the inlet, with said first duct and, in the outlet, with a duct with is in a tight contact with the container to be filled; said duct has at least an element for the opening and closing of the flow and at least a nozzle for the delivery of the liquid in the bottle to be filled; the inside of said nozzle comprises the initial part of a duct connected with at least three valves of which at least one is connected with said second duct, said regulating control valves regulate and control the flow of the aeriform fluid, between the container and the reservoir and/or the outside.

**[0013]** Firstly, said arrangement allows to fill containing elements such as bottles or other containers event at room temperature and it is not necessary to bring the fluid to be filled in at low temperatures, nor is it necessary to utilize any refrigerating plants. In this way, the cost of the whole plant is lowered and the relative operating expenses are lowered, as well.

**[0014]** In addition, the plant according to the present invention is provided with an only simply shaped source-reservoir, which allows to further lower the production costs as well as to clean the plant in a rapid comfortable way.

**[0015]** Another advantage of the present plant is the operative way through an electronic control of the various devices, which allos to fill the bottles according to the quantity and not according to the level. In this way, a greater precision is guaranteed as concerns the quantity of fluid to be poured in each single container on obtaining a simultaneous great flexibility.

**[0016]** Besides, the electronic control of the plant allows a control and an opening/closing of each means for the filling of a single container independently on each other. In this way, in case there is a problem in a single filling device, it is still possible to continue the bottling operations by isolating the anomalus part.

**[0017]** In addition, the plant according to the present invention permits to obtain both a considerable shortening of the filling time and the result of a higher number of filled bottles or containers under the same time conditions as the prior art plants.

**[0018]** Further features and details of the invention will be better understood from the following specification that

is provided as a non-exclusive embodiment on the base of the accompanying drawings wherein:

Fig. 1 is a schematical front view of the filling plant according to the present invention comprising at least a filling device, indicated schematically with a dashed square;
Fig. 2 is a detailed representation of a filling device;
Fig. 3 is a diagram of the plant of Fig. 1, comprising the filling device of Fig. 2;
Figg. 4 , 5 are a front section view and an orthogonal view, respectively, of a means of the filling device of Fig. 2.

**[0019]** With reference to the accompanying drawings, number 1 denotes a plant according to the present invention, comprising basically a reservoir 3 and a series of filling devices 2 which are arranged radially and are connected with said reservoir. The filling devices 2 are to fill a container 26 such as a bottle.

**[0020]** The reservoir 3 is filled intentionally only partially with the filling liquid while in the upper part of the reservoir there is an aeriform fluid. The whole contents is brought to a slightly higher pressure than the wished pressure of the bottled liquid at the end of the operations; said pressure is kept constant by suitable means 11 which act as detectors and regulators. In addition, it is possible to detect the temperature of the liquid in the reservoir 3 through suitable means 10.

**[0021]** The reservoir 3 is filled from the bottom through a duct 8 so as to give a higher stability of inner pressure to the reservoir 3 and to avoid the formation of froth in the inside of the reservoir 3.

**[0022]** The device 2 is represented schematically as a dashed square in Fig. 1 while it is represented completely in Fig. 2. The device 2 permits the filling of bottles 26 with an aeriform and liquid fluid coming from the reservoir 3.

**[0023]** In fact, the reservoir 3 is connected with each single filling device 2 through two different ducts 4, 5 relating to each device 2; more precisely, from the upper part of the reservoir, a first duct 5 extends to allow the passage of the aeriform fluid while the bottom of the reservoir is connected with the device 2 through a second duct 5 which allows the passage of the filling liquid.

**[0024]** The device 2 comprises a series of devices which permit to fill the container or bottle at room temperature and with the wished quantity without the formation of a froth that will make the filling operation difficult and could contaiminate the outer surface of the bottle or containing element.

**[0025]** More precisely, the device 2 comprises a flow meter 13 which is connected through the duct 4 with the bottom of the reservoir 3; said flow meter 13 permits to precisely fill the bottle with the wished and set-up quantity.

**[0026]** The duct 14 coming from the flow meter 13 has an initial duct part 28 that extends in a subsequent particularly shaped passage 27. The walls of said passage 27 cooperate with a diaphragm 16 of a suitable valve 15 which causes the inlet of the fluid through the same passage 27 in an end part 20 of the duct 14.

**[0027]** Said end part 20 of the duct 14 has a particular shape and goes through a particular diffuser 17, represented in Figures 4, 5, which diffuses the fluid flow evenly and according to a ring shape.

**[0028]** A special nozzle 18 is coupled with said diffuser 17. The end part 29 of said nozzle 18 has a longer diameter than the diameter of the central part 30 of the nozzle 18. In this way, the fluid flow follows the outline of the outer surface of the profile of the nozzle 18 so that the fluid can fall in the bottle 26, the end part 29 of the nozzle 18 being present in its inside and an umbrella effect being thus obtained.

**[0029]** Thanks to said particular shape of the nozzle 18, when the liquid falls in the bottle, the liquid touches the inner side of the bottle including the highest part of the bottle so that the formation of froth is avoided while froth is formed when the fluid touches the bottom of the bottle directly.

**[0030]** The nozzle 18 has an inner cavity which forms a duct 25 which is connected with three valves 21, 22, 23 which are actuated independently to each other and control the aeriform fluid of the container 26.

**[0031]** A first valve 21 is connected with the reservoir 3 through the duct 5. A second valve 22 is connected with an outlet duct 7 through a duct 6. Finally, a third valve 23 is connected with the outer environment directly.

**[0032]** Another element of the device 2 is represented by a pressure switch 24 which is to measure the inner pressure of the inside of the bottle and cooperates with the other electronic control and actuating means.

**[0033]** A very important aspect of the plant according to the present invention is that the bottle 26 exchanges aeriform fluid and/or liquid only with the device 2 since the upper part of the bottle touches a rubber means 19. In this way, the connection bottle 26 - device 2 avoids any form of passage in the inside of the system.

**[0034]** All the electronic and/or mechanical operating components of the present system are controlled by a suitale central unit that controls the switchboards 12.

**[0035]** Now, the working process of the filling plant 1 will be described.

**[0036]** The reservoir 3 is filled with the liquid that will be poured in bottles 26. It is necessary to exactly determine the fluid level, pressure and temperature to be reached inside the reservoir 3 through suitable means 10. As the fluid goes out of the reservoir 3 and flows towards the filling devices 2, the reservoir 3 is continuously filled through the duct 8 so that the level remains constant in the reservoir 3.

**[0037]** It is necessary that at first, all the valves 15, 21, 22, 23 of each single device 2 are closed.

**[0038]** The bottle 26 is brought with known means in the proximity of the nozzle 18 and the upper border of the bottle 26 is connected with the rubber means 19 in order to obtain a complete impenetrability as regards air

and liquid from the outside to the inside of the system bottle 26 — device 2.

**[0039]** Firstly, it is necessary to open the first valve 21, which can be described as a pressurization valve. In this way, the inner pressure in the bottle is the same as the inner pressure in the reservoir 3 so that an isobaric filling is made possible.

**[0040]** When the pressure meter 24 detects that the inner pressure in the bottle 26 is the same as the inner pressure in the reservoir 3, the first valve 21 is closed. Then, the valve 15, which is provided with the diaphragm 16 and lets the fluid to flow in the bottle 26, is opened. At the same time, the second valve 22 is opened to exhaust the air from the bottle 26. The air goes out from the bottle 26 as the liquid enters.

**[0041]** The exhaust air coming from the bottle 26 is brought to the suitable duct 7 through the duct 6 and is treated by purification means. In this way, it is not possible that the air that goes in the bottle and is potentially impure return to the reservoir 3 directly on contaminating the reservoir itself.

**[0042]** The quantity of liquid that goes in the bottle 26 is regulated by the flow meter 13. Once the wished quantity of passing fluid is measured, the passage 27 of the duct 14 is closed and the valve 15, provided with the diaphragm 16, is closed.

**[0043]** In addition, the second valve 22 is closed, as well.

**[0044]** In this phase, the wished fluid is present in the bottle 26. At the same time, in the upper part of the bottle 26 there is an aeriform fluid. The pressure of said aeriform fluid is the same as the pressure in the reservoir 3 and therefore, it is different from the atmospheric pressure.

**[0045]** Then, the inner pressure in the bottle-neck is brought to the same value of the atmospheric pressure. This phase is usually very delicate in the prior art systems since said operation can cause the formation of the unwished froth while the plant 1 according to the present invention is provided with a special valve, namely, the third valve 23 which is opened by means of an electronic control. More precisely, said third valve 23 is a needle valve. The peculiarity of said needle valve is to remain open even for few thousandths of a second.

**[0046]** In particular, through the electronic control unit, the valve 23 is initially opened for a relatively long period and then, said valve is opened only for very short periods. In this way, it is possible to obtain both an optimal result as concerns the time and the absence of froth on the bottle-neck.

**[0047]** Finally, the bottle is lowered and arranged in the wished position by means of known elements, not represented in the figures.

**[0048]** The present plant 1 permits through the so-described systems to fill the containers or bottles with aerated liquid at room temperature on saving the cost of the refrigerating plants and the relevant expenses.

**[0049]** The plant 1 allows a higher productive output since the bottling time is much shorter.

**[0050]** In addition, the cleaning of the plant is made simpler because there is an only central reservoir and the constructive structure of the control and filling valves is simpler than the prior art valves which were inserted in the inside of an annular reservoir.

**[0051]** A technician of the sector can make changes or variants which are to be considered as included in the scope of protection of the present invention.

## Claims

1. Plant (1) for filling containers at room temperature preferably with aerated liquids and/or beer, **characterized by** the fact that it comprises at least a reservoir (3) connected through at least two ducts (4, 5) with at least a filling device (2), a first duct (4) being provided for the passage of the fluid and a second duct (5) being provided for the passage of an aeriform fluid; said filling device (2) comprises a flow measuring component (13) which is connected, in the inlet, with said first duct (4) and, in the outlet, with a duct (14) with is in a tight contact with the container to be filled; said duct (14) has at least an element (15) for the opening and closing of the flow and at least a nozzle (18) for the delivery of the liquid in the bottle to be filled; the inside of said nozzle (18) comprises the initial part of a duct (25) connected with at least three valves (21, 22, 23), of which at least one valve (21) is connected with said second duct (5); said regulating control valves (21, 22, 23) regulate and control the flow of the aeriform fluid between the container and the reservoir and/or the outside; the whole system being controlled and managed by at least an electronic central switchboard.

2. Plant (1) for filling containers at room temperature according to the foregoing claim, **characterized by** the fact that at least a valve (23) is connected with the outer environment in order to regulate the pressure of the aeriform fluid of the upper part of the container, once the container has been filled.

3. Plant (1) for filling containers at room temperature according to the foregoing claims, **characterized by** the fact that at least a valve (22) is connected with an exhaust duct (7) and controls the flow of the aeriform fluid which goes out of the container during the filling phase.

4. Plant (1) for filling containers at room temperature according to the foregoing claims, **characterized by** the fact that said duct (14) coming from the flow meter (13) passes through a diffuser (17) which has the fluid diffused in an annular way between the inner walls of said duct (14) and the outer walls of the nozzle (18).

**5.** Plant (1) for filling containers at room temperature according to the foregoing claims, **characterized by** the fact that it comprises at least a pressure meter (24) to detect the inner pressure of the container to be filled.

**6.** Plant (1) for filling containers at room temperature according to the foregoing claims, **characterized by** the fact that it comprises an element (19) which is fixed to the filling device (2), is made of an elastic material and is to tightly close the opening of the container with the duct (20).

**7.** Plant (1) for filling containers at room temperature according to the foregoing claims, **characterized by** the fact that said element (15) for the opening and closing of the flow is a valve provided with a diaphragm (16) which is controlled to cooperate with the particularly shaped walls of a passage (27) of the duct (14).

**8.** Plant (1) for filling containers at room temperature according to the foregoing claims, **characterized by** the fact that said nozzle (18) is an essentially cylindrical hollow element the end part of which is turned toward the container in which it is partially inserted and has a longer diameter than the diameter of the central part of the nozzle (18) so that the liquid flow passing externally to said nozzle (18) forms an umbrella-shaped jet in the inside of the container.

**9.** Plant (1) for filling containers at room temperature according to the foregoing claims, **characterized by** the fact that the reservoir (3) comprises means (10) to detect the temperature and pressure in the inside of the reservoir (3)

**10.** Plant (1) for filling containers at room temperature according to the foregoing claims, **characterized by** the fact that the bottom of the reservoir (3) is connected with a duct (8) through which the reservoir (3) is filled without formation of froth.

**11.** Plant (1) for filling containers at room temperature according to the foregoing claims, **characterized by** the fact that one or more means for the regulating and controlling of the filling process are controlled electronically by a central unit.

**12.** Process for filling containers at room temperature by utilizing the plant according to one o more of the foregoing claims, **characterized by** the fact that it comprises at least one of the following phases:

- the reservoir (3) is filled through the duct (8) with the liquid to be utilized to fill at least a container in order to keep both the inner pressure and the filling level of the reservoir (3) constant;
- all the valves (21, 22, 23) and closing/opening means (15) are closed;
- the container is put in tight contact with the duct (20);
- the first valve (21) is opened to connect the inside of the container with the reservoir (3) in order to bring the inner volume of the container to the same pressure of the reservoir (3);
- the first valve (21) is closed and the second discharge valve (22) is opened simultaneously to the opening of the flow opening/closing means (15) so that the container is filled with the falling liquid and the inner air of the container goes out of the container through said valve (22) to a collecting duct (7);
- the flow meter (13) detects the quantity of liquid going into the container;
- once the wished quantity has been reached, the opening/closing means (15) closes;
- then, according to the program the third valve (23) opens in order to bring the pressure of the upper part of the liquid of the container to the value of the atmospheric pressure;
- finally, the bottle is removed from the filling device (2).

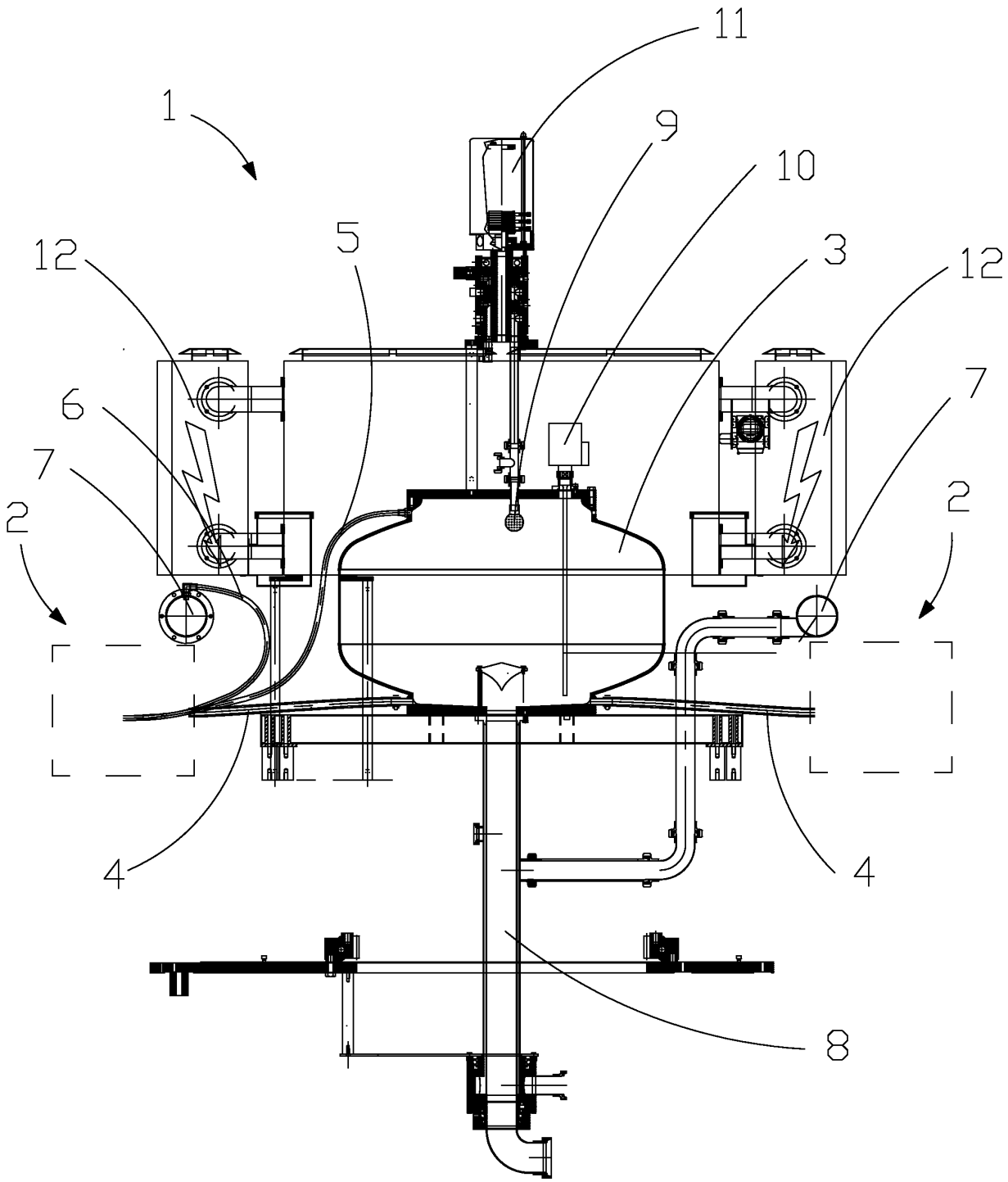


Fig. 1

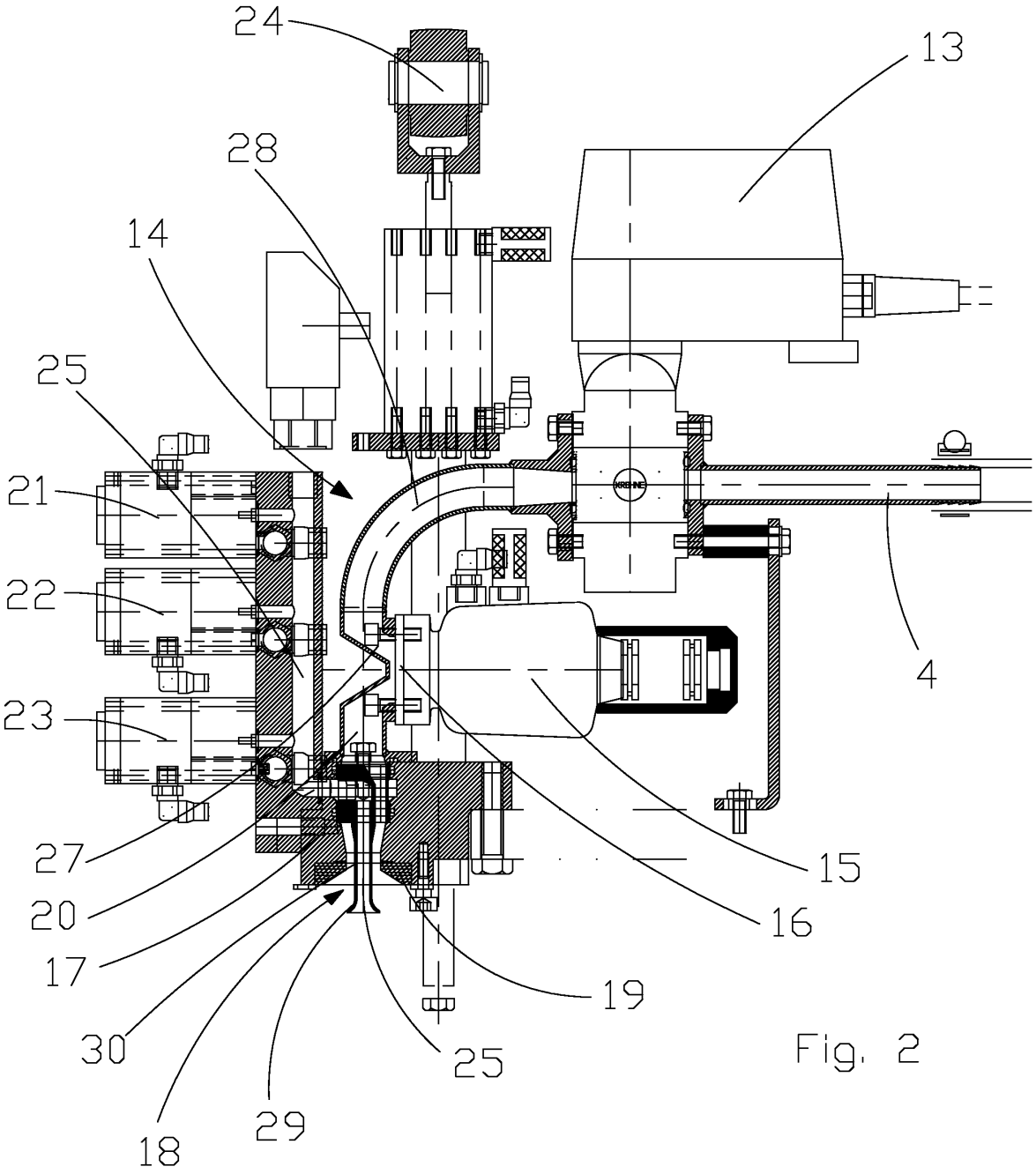


Fig. 2

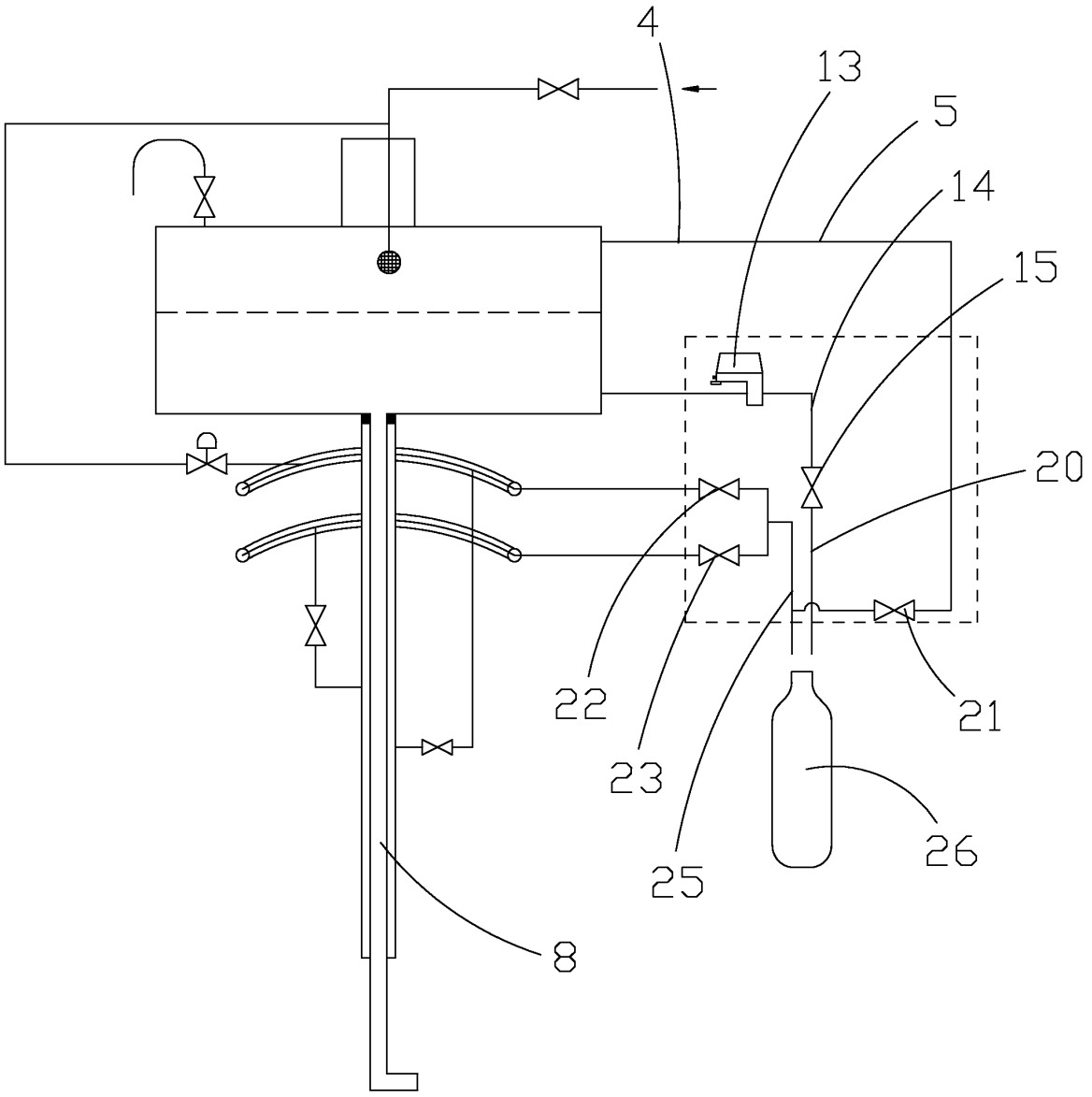


Fig. 3

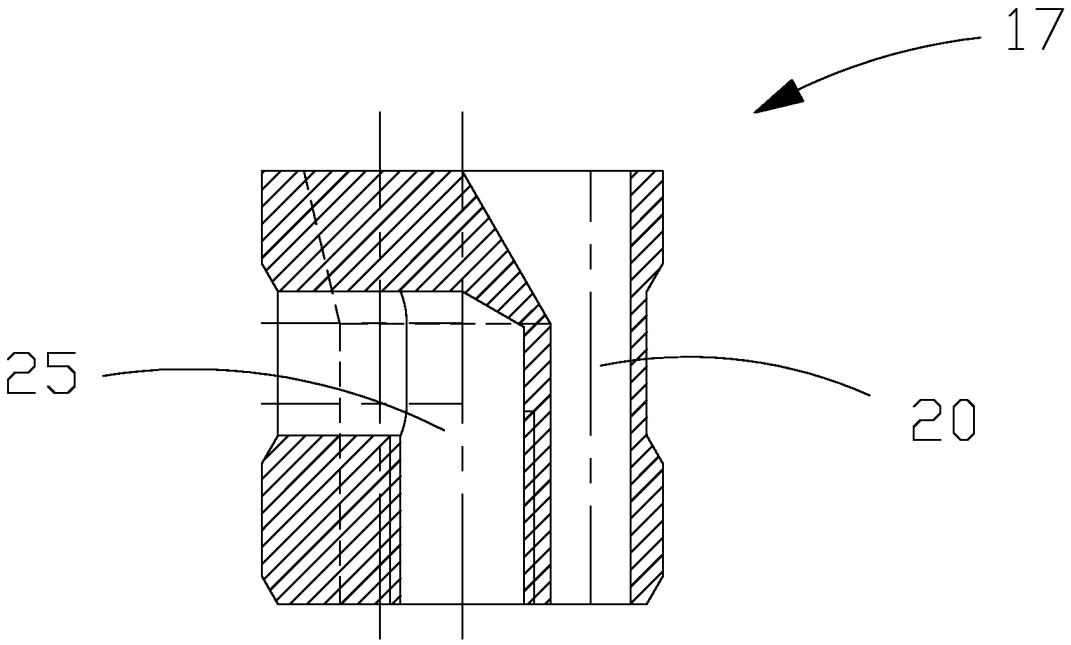


Fig. 4

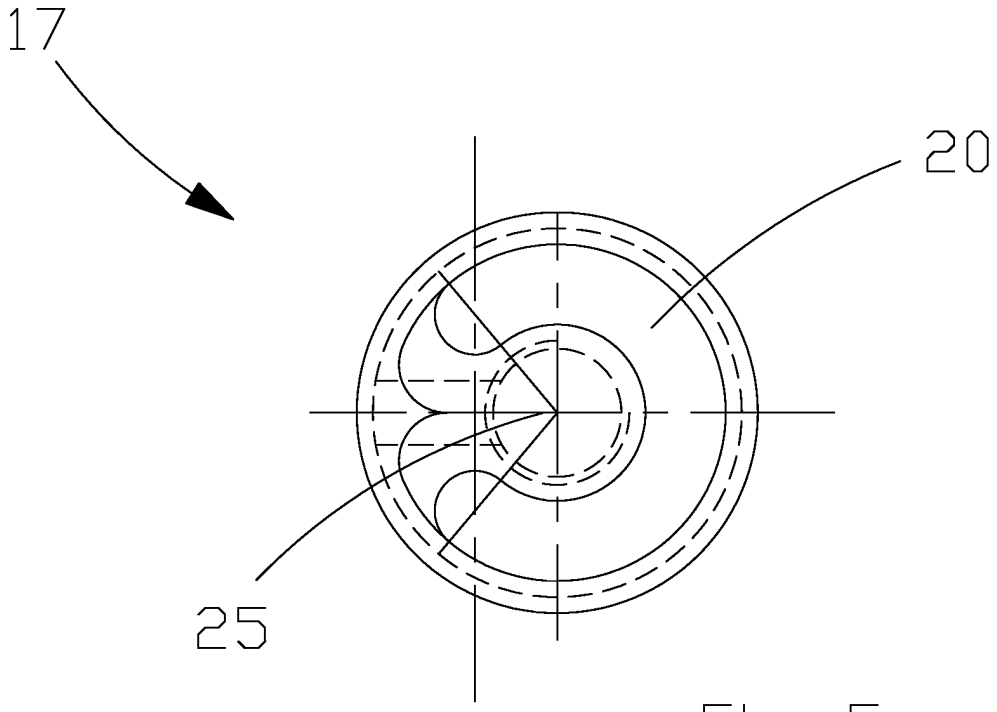


Fig. 5