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

(11) **EP 1 995 208 B2**

(12) **NEW EUROPEAN PATENT SPECIFICATION**
After opposition procedure

(45) Date of publication and mention of the opposition decision:
18.11.2015 Bulletin 2015/47

(45) Mention of the grant of the patent:
07.10.2009 Bulletin 2009/41

(21) Application number: **07120506.6**

(22) Date of filing: **12.11.2007**

(51) Int Cl.:
B67C 3/26 *(2006.01)*

(54) **Rotary filling machine for filling containers with liquids**

Rotationsfüllmaschine zur Füllung von Behältern mit Flüssigkeiten

Machine rotative de remplissage pour le remplissage de récipients avec du liquide

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR

(30) Priority: **03.04.2007 IT VI20070100**

(43) Date of publication of application:
26.11.2008 Bulletin 2008/48

(73) Proprietor: **Gruppo Bertolaso S.p.A.**
37040 Zimella (Verona) (IT)

(72) Inventors:
- **Stella, Gianluca**
  36025 Noventa Vicentina (VI) (IT)
- **Stefanello, Stefano**
  37047 San Bonifacio (VR) (IT)
- **Benetti, Dario**
  37040 Zimella (VR) (IT)

(74) Representative: **Gallo, Luca et al**
Gallo & Partners S.r.l.
Via Rezzonico, 6
35131 Padova (IT)

(56) References cited:
EP-A1- 0 628 512
EP-A2- 1 457 457
BE-A- 499 164
DE-A1-102005 003 222
FR-A- 1 321 660
GB-A- 1 316 629
EP-A1- 1 544 157
WO-A1-99/03774
DE-A1- 3 048 257
DE-U1- 29 615 630
FR-A- 2 320 257

EP 1 995 208 B2

Description

Field of application

[0001] The present invention relates to a rotary filling machine for filling containers with liquids, according to the preamble of the main claim.

[0002] The machine in question is advantageously intended to be used in industrial bottling plants for filling containers, and preferably bottles, with liquids in particular of the alimentary type, such as beverages, wine, mineral water, etc.

[0003] The machine in question can be preferably used in bottling lines comprising typically a rinsing machine, a capping/capsuling machine or also, along the part of the line furthest downstream, a labelling machine and a packaging machine.

[0004] More precisely, the machine in question is of the type which is provided, in a per se entirely conventional manner, with a rotating carousel (or turret) having, mounted along its periphery, a plurality of filling valves which are able to convey the liquid contained in a cylindrical tank inside the bottles.

State of the art

[0005] As is known, depending on the methods used to perform the filling operations, filling machines are commonly classified as reduced-vacuum machines, isobaric machines, reduced-pressure machines, gravity machines, etc.

[0006] Reduced-vacuum filling machines have been designed mainly for filling containers with wines which are gas-free and are able to operate so that the pressure inside the container is reduced to the pressure (below atmospheric pressure) of the tank inside which the liquid to be introduced is stored and so that the air contained in the container is conveyed externally without coming into contact with the product. The valves of these machines, according to standard construction technology, usually consist of a set of concentric tubes (usually two in number) one of which is inserted inside the other one; the outer tube is used for introducing the liquid into the bottle, while the air or gas contained inside the bottle rises up along the inner tube.

[0007] So-called isobaric filling machines have been designed mainly for filling containers with fizzy wines and operate under pressures much higher than atmospheric pressure. Filling of the containers is performed when the final pressure in the container is the same as the pressure inside a tank which is suitably mounted above the valves.

[0008] Reduced-pressure filling machines perform bottling in conditions where there is a slight pressure such that the fluid retains a small amount of gas, but without being subject to the technical requirements and regulations governing isobaric machines. This latter type of machine is particularly suitable for bottling smooth products and liquids which are slightly fizzy.

[0009] Volumetric or gravity filling machines envisage that filling is performed by means of free falling and constant metering; in this case, the product, drawn from a container, is conveyed to a series of metering devices and dispensed by the latter into the containers.

[0010] The filling machines of the known type described above provide ample possibility for adjusting, by means of a simplified user interface, the operating times and pressures of the filling valves. Owing to the possibility of adjusting the times required by the valves to execute given filling steps, it is possible to optimize the operations in relation to the instantaneous speed of the filling machine and the type of product to be bottled.

[0011] Another increasingly urgent requirement in the bottling industry, in particular in the sector for bottling alimentary products, is the development of filling machines with bottling cycles performed in the presence of inert gas in order to avoid oxidation effects.

[0012] In this connection the patent WO 99/03774 describes a filling machine which performs pre-evacuation of the air present in the bottle and the subsequent blowing-in of inert gas.

[0013] A further characteristic of more modern filling machines is the possibility of performing daily complete flushing, and in particular flushing of any part of the machine which comes into contact with the alimentary products to be bottled.

[0014] The filling machines which exist at present on the market, in particular for the wine industry, envisage typically a preparation and setting stage for adapting the filling product and the quantity of product to be introduced into the container to the format of the container to be filled.

[0015] These adaptation operations performed by the operator result in production downtime, the risk of contaminating the machine and generally allow only separate and not continuous adjustment which is therefore by its nature somewhat imprecise.

[0016] At present a change in format of the bottle results in the need to perform several replacement and/or adjustment operations in order to adapt various mechanical parts of the machine to the new format. In particular, these operations must be performed for the means which transfer bottles (for example from the conveyor belts to the support plates) and for the valve filling pipes (or tubes).

[0017] The latter must in fact be replaced in all the valves with other different-size tubes using operating spanners or quick-fit connections or else must be adjusted in all the valves for example by means of screwing or unscrewing of telescopic parts.

[0018] During a format change, normally the container centring cone mounted underneath the valve must also be replaced.

[0019] More recently, filling machines able to perform the heightwise adjustment of all the valve filling tubes simultaneously have been introduced onto the market.

[0020] This adjustment is achieved by means of overly complex mechanisms which slow down circulation of the

liquids, increasing the loss of head therein and basically proving to be too expensive from a cost point of view and operationally disadvantageous.

[0021] At present, therefore, each format change requires the intervention of specialized operators in particular to modify the setting of the air return tubes.

[0022] This fact results in numerous drawbacks, including a loss of productivity due to the momentary stoppage of production along the whole bottling line (until the adjustment operations have been completed) and the risk of contaminating the container filling parts.

[0023] Another drawback associated with the format changeover operations consists in the need for the company to provide competent and expert technicians who are able to manage correctly and quickly all the abovementioned adjustment operations.

[0024] Finally a further drawback consists in the risk that the operator may perform inadvertently an incorrect manoeuvre which may result in a major malfunction and therefore also serious damage to the entire line.

[0025] In this connection, the patent GB - A- 1,316,629 describes a filling machine with a plurality of filling valves, which machine performs the adjustment of the level of the liquid into the containers by means of probes mounted on each of the filling valves at the end of corresponding shafts. It is possible to provide a common adjustment of the position of the probes of all the filling valves by means of pinions engaged on the corresponding probes, and moved, by a common driven mechanism, down and up for regulating the level of the filling liquid into the containers.

Disclosure of the invention

[0026] In this situation, the main object of the present invention is therefore that of overcoming the drawbacks of the art known hitherto by providing a rotary filling machine for filling containers with liquids, which allows a change in format of the containers to be performed simply and rapidly.

[0027] Another object of the present invention is to provide a rotary filling machine for filling containers with liquids, which allows adjustment of the level in the containers to be performed automatically and with a high degree of precision and reliability.

[0028] Another object of the present invention is to provide a rotary filling machine for filling containers with liquids, which allows changing of the specific settings for each user, relating to the parameters associated with the bottles, the product and the filling temperature.

[0029] Another object of the present invention is to provide a rotary filling machine for filling containers with liquids, which allows optimization of the flushing operations as regards speed and working times and quality of flushing performed.

[0030] Another object of the present invention is to provide a rotary filling machine for filling containers with liquids, which allows the operator to switch over easily via a control panel the operating cycle envisaged between reduced-vacuum filling, reduced-pressure filling and finally gravity filling.

[0031] Another object of the present invention is to provide a rotary filling machine for filling containers with liquids, which is extremely safe for operators and highly reliable in terms of operation.

Brief description of the drawings

[0032] The technical features of the invention, in accordance with the abovementioned objects, may be clearly determined from the claims below and the advantages thereof will emerge more clearly from the detailed description which follows, provided with reference to the accompanying drawings which show a purely exemplary and non-limiting embodiment thereof, where:

- Figure 1 shows a plan and overall view of the rotary filling machine for filling containers with liquids, according to the present invention;
- Figure 2 shows a side view of an enlarged detail of the machine according to Figure 1 with some parts removed so that other parts may be seen more clearly, relating to a filling valve mounted on a tank;
- Figure 3 shows a cross-sectional view of the valve according to Figure 2;
- Figure 4 shows an overall perspective view of the rotary filling machine for filling containers with liquids, according to the present invention;
- Figure 5 shows a side view of an enlarged detail of the machine according to Figure 1 with some parts removed so that other parts may be seen more clearly, relating to a different embodiment of a filling valve mounted on a tank with an associated fast-discharge tray;
- Figure 6 shows a side view of an enlarged detail of the machine according to Figure 1 with some parts removed so that other parts may be seen more clearly, relating to a filling valve mounted on a tank with, indicated, a lid for flushing the valve;
- Figure 7 shows a side view of en enlarged detail of the machine according to Figure 1 with some parts removed so that other parts may be seen more clearly, relating to a filling valve mounted on a tank with, indicated, first actuating means acting by means of transmission means so as to raise a pair of coaxial pipes.

Detailed description of a preferred example of embodiment

[0033] With reference to the accompanying drawings, 1 denotes in its entirety the rotary filling machine for filling containers with liquids, according to the present invention.

[0034] The abovementioned machine 1 may be arranged, in a per se entirely conventional manner, inside

a bottling plant, for example downstream of a rinsing machine and upstream of a capping machine to which it is operationally connected by means of conveying means.

[0035] The filling machine 1 (Figure 4) is provided with an external frame 23, protective walls 24, 25 on the perimeter of the machine 1 and an external cabin 1a containing the electric and electronic operating devices (Figure 1).

[0036] The machine is also provided, in a manner known per se, with a rotating carousel or turret 4 arranged inside the frame 23 and having, mounted along its periphery, a plurality of filling valves 6.

[0037] The containers 3, in particular bottles, to be filled are inserted inside the frame 23 and loaded onto the guide or conveyor belt 2 so that they proceed in the direction and sense defined by the entry arrow F1 and exit arrow FU.

[0038] The containers 3 must preferably be filled with alimentary substances such as milk, wine, fruit juice, etc., and for this purpose are conveyed, one after another, along the guide belt 2 and then transported into the vicinity of an entry starwheel 31 of the carousel 4 which performs, by means of the filling valves 6, all the steps necessary for bottling.

[0039] The actual presence of the containers 3 is verified by means of a sensor 22 which is situated at the end of the feeder screw 26 and immediately ahead of the entry starwheel 31 and is able to stop operation of the corresponding filling valve 6 should there be no containers 3 entering the carousel 4.

[0040] If there should be no container 3, operation of the individual filling valve 6, but not the filling machine 1 is interrupted, the latter continuing to operate correctly so as to keep the productivity high since the following container 3 may be correctly filled.

[0041] Each valve 6 has a pair of coaxial pipes 7, 8, i.e. an outer pipe 7 for supplying the liquid from a storage tank 20 to the container 3 to be filled which rotates on the carousel 4 underneath the corresponding valve 6, and an inner compensation pipe 8 (or air return tube) for determining the level of liquid inside the container 3.

[0042] The bottom portion of the pipes (or tubes) 7 and 8 is shaped so as to be inserted along at least a section of the neck of the bottle 3.

[0043] In particular, the terminal section of the inner compensation pipe 8 is intended to regulate hydraulically the maximum level of the liquid inside the container 3 as will be clearly specified below.

[0044] The liquid conveying duct is defined by the interspace existing between the outer surface of the inner compensation pipe 8 and the inner surface of the outer liquid supply pipe 7.

[0045] The two pipes 7, 8 are movable slidably with respect to each other so as to open and close a closing member arranged between them and, in accordance with a preferred solution of the present invention, consisting of a headpiece 120 fixed to the bottom end of the compensation pipe 8 against which the mouth 121 situated at the bottom end of the liquid supply pipe 7 is able to come into contact. Therefore, opening of the closing member 120 will occur when the outer pipe 7 is displaced with respect to the inner pipe 8, leaving a fluid flow aperture open.

[0046] More generally, the conveying duct is defined by the interspace between two concentric pipes, i.e. outer pipe and inner pipe. Therefore, it will be possible to envisage providing a dedicated compensation and air return pipe situated concentrically inside the outer pipe between which there will still be defined the duct for supplying the liquid from the tank 20 to the container 3 with the closing member arranged in between in a manner similar to that described above.

[0047] The closing member in the conveying duct may also be formed in another way known per se, such as, for example, by a widened nose-shaped portion of the inner pipe of the conveying duct able to come into contact against the annular shoulder provided on the inner side of the outer pipe of the conveying duct.

[0048] An extension guide 11 extends vertically downwards from the bottom 104 of the tank 20, said guide being coaxial and external with respect to the two pipes 7 and 8 and having, fixed at the bottom end, a seal 13 which is able to receive against it the mouth of the container 3.

[0049] According to the idea underlying the present invention, the filling machine 1 comprises first actuator means 100 acting on the compensation pipe 8 of each filling valve 6 by means of transmission means 101 so as to vary simultaneously in an adjustable manner the vertical position of all the compensation pipes 8 with respect to the seal 13.

[0050] The position of the compensation pipe 8 with respect to the seal 13 determines the portion of the said compensation pipe 8 which penetrates into the container 3 and therefore, as will be clarified below, the filling level 9 inside the said container 3.

[0051] In accordance with the present invention shown in the accompanying figures, the first actuator means 100 act on the outer pipe 7 of each filling valve 6 by means of transmission means 101, varying simultaneously in an adjustable manner the vertical position of both the pipes 7, 8 with respect to the seal 13. In this case, the transmission of the vertical movement to the compensation pipe 8 by the outer pipe is achieved by means of mechanical connections between the two pipes 7 and 8 and advantageously consisting of a spring 15 fixed at its ends to the pipes 7, 8.

[0052] It will be possible to envisage providing a dedicated compensation and air return pipe situated concentrically inside the outer pipe between which the duct for supplying liquid from the tank to the container with the arrangement in between of the closing member will remain defined.

[0053] Furthermore, the term "seal" 13 must be understood as referring to that part which is fixed to the tank 20 (in the examples consisting of a bottom end part of

the extension guide 11 fixed underneath the tank) and against which the mouth of the container is intended to come into contact directly.

[0054] At the start of operation, namely whenever there is a change in format of the containers 3, the machine 1 envisages an operation for setting the level of the container 3; this adjustment is entered by the operator directly on the panel, or one of the settings previously recorded in a special logic control unit of the machine is retrieved.

[0055] Depending on the commands imparted, the first actuator means, for example consisting of an electromechanical system such as, for example, one or more electric motors, operate simultaneously all the filling valves 6, via transmission means 101 for example formed by a regulating ring 17 connected on the one hand to the first actuator means 100 and fixed on the hand to the outer liquid supply pipe 7 of each of the filling valves 6 by means of mechanical transmission arms 10.

[0056] In greater detail, with reference to the example in Figure 7, the first actuator means consist of a motor 110 mounted on a motor support bracket 111 which is connected by means of an angular transmission to an internally threaded driven wheel 112 inside which an acme-thread screw 113 fixed at its bottom end to the regulating ring 17 engages.

[0057] Operationally speaking, activation of the motor 110 (to be performed normally during machine set-up or at the start of a working cycle or also upon a change in format of the containers) causes, via the transmission means 101, raising and lowering of the two pipes 7 and 8, adjusting the filling level 9 of the containers 3.

[0058] Obviously, without thereby departing from the scope of protection of the present invention, the first actuator means 100 may be formed by other driving systems such as linear actuators or other equivalent means for raising the ring 17. The transmission means 101 may similarly in turn be formed with kinematic mechanisms of various types which are well known to the person skilled in the art.

[0059] For example, the outer pipe 7 may have advantageously at the top end a widened part 102 for fastening to the corresponding transmission 10 (for example between two parallel plates). The transmission 10 may however, differently, also be connected to other parts of the valve 6 in turn connected to the pipes 7 and 8.

[0060] Therefore the regulating ring 17 acts as a locating element for determining the level 9 reached inside the containers 3, being able to determine simultaneously the position of all the pipes 8 for compensating the level 9.

[0061] In accordance with the preferred embodiment of the present invention shown in the accompanying figures, the coaxial pipes 7, 8 pass through the lid 104 and the bottom 105 of the tank 20, there being provided an upper seal 106 and a bottom seal 107 through which the pipes 7, 8 slide following operation of the first actuator means 100.

[0062] Therefore, the abovementioned transmission 10 imparts a vertical movement to the entire filling valve 6 (denoted by a dot-dash line) so that the latter slides inside the tank 20 and the extension guide 11.

[0063] Operationally speaking, the operating principle of the machine 1 described above is as explained below.

[0064] The container 3 to be filled, in particular a bottle, once it arrives underneath the respective filling valve 6, is brought into sealing contact against the extension guide 11 by means of a raising cylinder 5, while the vertical position of the filling valve 6, which is predetermined as described, allows the level to be obtained uniformly among all the filling valves 6 with a height which may be defined entirely as desired.

[0065] This regulating system is extremely rapid as regards setting thereof, has a fast movement and reliable dynamic seals and reaches the given height in a precise manner. This movement system also has the convenient advantage that it does not require any further movement during operation with the same batch of containers 3, reducing substantially wear and consumption.

[0066] The container 3 is rested on the raising cylinder 5 which rises and brings the neck 14 of the container 3 (in the case in question, the neck 14 of a bottle) into sealing contact with the seal 13 situated underneath the filling valve 6, with a pressure suitably designed to ensure optimum operation of the machine according to the invention (Figures 2 - 4) and at the same time reduce as far as possible the stresses acting on the neck 14; at the same time, a first valve 18 of the filling valve 6 is opened and is connected to a vacuum circuit by means of a first suitably separated duct 27 and causes suction of all the air from the bottle 3

[0067] A vacuum is thus created inside the bottle 3 so as to evacuate any polluting gas which may be present.

[0068] This is followed by closing of the first valve 18 of the first vacuum duct 27, while the subsequent opening of a second valve 19 connected to a second duct supplying inert gas under pressure 29 allows the injection of inert gas inside the container 3. When a balance between the pressures inside the tank 20 of the filling machine 1 and the inside of the container 3 is reached, opening of the filling valve 6 is performed by means of operation of second actuator means consisting of a pneumatic cylinder 28 which is mounted above the valve 6 and which is lowered by acting on the top end of the compensation pipe 8 which is thus forced to slide inside the outer pipe 7, causing opening of the closing member 120.

[0069] Each regulating valve 6 is provided at the top, above the tank 20, with associated second actuator means 28 which are advantageously supported and fixed to the outer pipe 7 (together with which they are therefore able to move) and are able act on the top end of the inner compensation pipe 8 so as to vary the relative position thereof with respect to the outer pipe 7, causing opening of the closing member.

[0070] Lowering of the pneumatic cylinder 28 causes at the same time also opening of a third valve 12B, which connects the inside of the container 3 to a separate re-

duced-vacuum circuit 16 by means of the compensation pipe 8, allowing filling of the container 3 to the desired level 9 when the filling valve 6 closes again as a result of the action of the spring 15 which pushes against the action of the pneumatic cylinder 28, overcoming the pressure thereof, when the latter is deactivated.

[0071] The pressure of the separate reduced-vacuum circuit 16 is suitably stabilized in relation to the pressure of the tank 20 and the inside of the container 3, in order to optimize the filing speed and fluidity.

[0072] This pressure of the separate circuit 16 is typically, although not exclusively, defined so that it is the same as the internal pressure of the tank 20. The suitable introduction of the abovementioned completely separate circuit 16 allows the total evacuation of the gas contained inside the container 3, so as to prevent in an entirely reliable manner the gas present in the container 3 from contaminating the gas present inside the tank 20.

[0073] Once filling has been completed, after a predetermined period of time, the third valve 12B closes, while a fourth valve 12A opens and connects the compensation pipe 8 inside the tank 20. Release of the pneumatic cylinder 28 and suitable opening of the second valve 19 connects the pressurised gas circuit 29 to the neck 14 of the container 3 and to the pipes of the filling valve 6 so that the pressurised gas pushes the excess liquid through the central hole of the compensation pipe 8.

[0074] Preferably, the excess liquid, instead of being introduced again into the tank 20, may be conveyed to a separate recirculation circuit 21 in order to prevent any possible contamination inside the tank 20 of the filling machine 1. It is also possible to provide a simplified version of the subject of the invention, in which the valves 12A, 12b are combined as a single valve, which envisages the return of self-levelling gas and liquid inside a single separate return duct 16 or alternatively the return completely into the tank 20.

[0075] Once the levelling stage has been completed, the valves 12A, 12B and 19 are closed so as to optimize the consumption of inert gas and without any further movement of any mechanical part. During the final descent of the container 3, opening of the second valve 19 occurs so as create a layer of inert gas inside the neck 14 of the bottle (container 3) and all around, since opening of the second valve 19 remains as such also during removal of the container 3 from the filling valve 6.

[0076] As a result of the outflow of gas inside the neck 14 of the container 3 and in the outer region thereof, while the compensation pipe 8 has already been detached from the level 9 of the filling liquid, it is possible to achieve final protection of the container 3 and ensure reduced exposure of the liquid to the air.

[0077] Only when the container 3 is detached from the filling valve 6 is there definitive closing of the second valve 19.

[0078] It is also possible to envisage a suitable variation in the sequence of the cycle for flushing the neck 14 of the container 3. This variation, which is absolutely preferable when the improved filling apparatus reaches the maximum production speed, envisages that, after correction of the level, suitable closing of only the third and fourth valve 12A and 12B occurs and there is an immediate separation of the neck 14 of the container 3 from the seal 13, while the second valve 19 may remain open. In this way, the downtime is advantageously recovered while reducing the possibility of negative infiltration of harmful gases inside the neck 14 of the container 3.

[0079] Owing to positioning, in each filling valve 6, of the first and second valves 18 and 19 on the bottom of the extension guide 11, it is possible to optimize the time needed for execution of the filling cycle operations, speeding up the vacuum and gas insertion stages, since it is required to fill a smaller volume consisting of only the container 3 (bottle) and the suitably sized through-holes in the seal 13.

[0080] Moreover, advantageously, the valves 12A, 12B, 18, 19 are electro-valves which are controlled by the logic control unit so that the respective opening times are determined accurately in order to optimize the filling cycle, it being possible to adjust them independently for each filling valve 6, so as to optimize the cycle for each filling valve 6, counteracting the effects of the mechanical machining tolerances.

[0081] Moreover, the logic control unit is able to memorize the heightwise positions of the pipes 7, 8 or the filling valves 6 to which different container formats correspond and reproduce them with operation of the first actuator means simply via a control panel, so as to allow during a change in format of the bottles 3 rapid adjustment of the levels 9 set for all the filling valves 6.

[0082] Each filling valve 6 is operated so as to move vertically in a controlled manner simultaneously by the first actuator means 100 for adjusting the level 9 in the container 3 and includes the coaxial pipes 7, 8, the second actuator means 28, the closing member 120 and at least one valve 12A, 12b arranged so as to intercept the inner compensation pipe 8.

[0083] In order to automate and simplify as far as possible the operation of washing the filling machine 1, a particular position of the filling valve 6 has also been studied such that washing of all the parts is facilitated, eliminating any possibility of stagnation. For this purpose, the concentric pipes 7, 8 can be operated by the first actuator means 100 so as to move upwards until they are completely retracted inside the extension guide 11 and preferably until they pass beyond the seal 13 so as to form, together with a closing lid 32 preferably pivotably mounted on the bottom portion of the extension guide 11, a closed receptacle 160 suitable for allowing recirculation of a flushing product both inside and outside the surface of the filling valve 6. For this purpose, the lid 32 is operated automatically or manually so as to move between a closed position underneath the extension guide 11 (and in particular underneath the centring cone 150 as shown in Figure 6) and an open position for normal operation of the machine, where it is separated from the bottom of

the guide 11.

[0084] Owing to automation of the filling machine 1, not only can specific time schedules be determined for each format or group of containers 3, for each working temperature and for each substance treated, but it is also possible to personalize the individual operations of the pneumatic electro-valves 12A, 12B, 18, 19 of each filling valve 6 for their adjustment heightwise or depending on the liquid level to be obtained inside the bottle 3. Owing to this operational versatility, the machine may be used to operate with different operating cycles, including reduced-vacuum filling, reduced-pressure filling and also reduced-gravity filling.

[0085] This possibility is of decisive importance for obtaining the maximum performance from all the filling valves 6 and so as to ensure that the quality of the filling process is uniform and constant. Moreover, the actuators of the valves 12A, 12B, 18, 19 and the pneumatic cylinder 28 may be made of materials which are entirely compatible with alimentary products, can be perfectly flushed and be equipped with a suitable control chamber which allows verification of any malfunctions, without contaminating the product used for filling the containers.

[0086] It is also envisaged being able to modify the filling mode of the containers 3, by introducing a suitably sized constriction in the passages of the fourth valve 12A such that filling of the container 3 is slowed down during the final stage so as to prevent entirely the formation of foam in the neck 14 of the container 3. In order to reduce as far as possible the product changeover downtime, it is also envisaged being able to equip the filling machine 1 with a series of retractable discharge trays 33, via which the product still present inside the tank 20 may be discharged, when filling of the batches of containers 3 envisaged has been completed. The abovementioned trays 33 are operated and positioned only at the time required, in particular when the flow of the containers 3 being supplied is interrupted, by means of suitable actuators 35, so that the individual filling valves 6 open and allow the product to flow out when they pass above the trays 33.

Claims

1. Rotary filling machine for filling containers with liquids, which comprises:

- a rotating carousel (4) having, mounted along its periphery, a plurality of filling valves (6), each of which has:
- at least two coaxial pipes (7, 8), i.e. an outer pipe (7) for supplying the liquid from a storage tank (20) to a container (30) to be filled with said liquid; and an inner compensation pipe (8) for defining the liquid level inside said container (3); the bottom portion of the pipes (7, 8) being shaped so as to be inserted along at least a section of the neck of the container (3);
- said coaxial pipes (7, 8) defining between them a duct for conveying liquid between said storage tank (20) and said container (3) and being movable slidably with respect to each other so as to open and close a closing member (120) arranged between them;
- at least one seal (13) mounted fixed underneath the tank (20) and arranged concentrically and externally with respect to said pipes and able to receive against it the mouth of said container (3);

characterized in that it comprises:

- transmission means (101);
- and first actuator means (100) acting on at least said inner compensation pipe (8) of each filling valve (6) by means of said transmission means (101) so as to vary simultaneously in an adjustable manner the vertical position of said compensation pipes (8) of all the filling valves (6) with respect to said seal (13); said first actuator means (100) acting on the outer pipe (7) of each filling valve (6) by means of said transmission means (101), varying simultaneously in an adjustable manner the vertical position of both the pipes (7, 8) with respect to the seal (13); the transmission of the vertical movement to the compensation pipe (8) being achieved by the outer pipe (7) by means of mechanical connections (15) between the two pipes (7, 8).

2. Rotary filling machine according to Claim 1, in which said transmission means comprising at least one regulating ring (17) fixed by means of mechanical transmissions (10) to the outer liquid supply pipe (7) of each of said filling valves (6).

3. Rotary filling machine according to Claim 1, in which said coaxial pipes (7, 8) pass through the lid (105) and the bottom (106) of said tank (20), there being provided at least one upper seal (106) and at least one bottom seal (107) through which said pipes (7, 8) slide following operation of said first actuator means (100).

4. Rotary filling machine according to Claim 1, **characterized in that** it comprises an extension guide (11) fixed underneath to the bottom (20) of said tank (20) concentrically and externally with respect to said pipes (7, 8) and having said seal (13) fixed to its bottom end.

5. Rotary filling machine according to Claim 1, **characterized in that** each valve comprises second actuator means (28) supported by said outer pipe (7) and movable therewith, being able to act on the top end

of said inner compensation pipe (8) so as to vary its relative position with respect to said outer pipe (7), causing opening of said closing member (120).

6. Rotary filling machine according to Claim 2, **characterized in that** said outer pipe (7) has, at its top end, a widened part (102) for fastening to the corresponding transmission (110) of said transmission means (101).

7. Rotary filling machine according to Claim 5, **characterized in that** each said filling valve (6) including said coaxial pipes (7, 8), said second actuator means (28), said closing member (120) and at least one valve (12A, 12B) arranged so as to intercept said inner compensation pipe (8) is operated to move vertically in a controlled manner by said first actuator means (100).

8. Rotary filling machine according to Claim 5, **characterized in that** it is equipped with a logic control unit able to store the heightwise positions of said pipes (7, 8) corresponding to different formats of containers (3) and reproduce them by operating said first actuator means (100).

9. Rotary filling machine according to Claim 1, **characterized in that** it comprises a pressurised circuit (29) intercepted by a second valve (19) mounted on said extension guide (11) at the bottom end in the vicinity of the receiving cone of said container (3) and able to blow inert gas into said container (3) through holes formed in said seal (13), and at least one third valve mounted so as to intercept said compensation pipe (8), said pressure circuit (29) with said second and third valves open being able to force, with the inert pressurised gas, the excess liquid level contained inside said container (3) through said compensation pipe (8), inside said tank (20) or into a separate recovery circuit (16).

10. Rotary filling machine according to Claim 5, **characterized in that** said second actuator means (28) consist of a pneumatic cylinder (28) for each valve (6).

11. Rotary filling machine according to Claim 1, **characterized in that** said concentric pipes (7, 8) can be operated by said first actuator means (100) so as to move upwards until they are retracted completely inside said extension guide (11), so as to form, with a closing lid (32), a closed receptacle (16) suitable for allowing recirculation of a flushing product both inside and outside the surface of the filling valve (6).

Patentansprüche

1. Rotationsfüllmaschine zur Füllung von Behältern mit Flüssigkeiten, die umfasst:

- ein drehendes Karussell (4), das eine auf seinen Umfang montierte Vielzahl von Füllventilen (6) trägt, von denen jedes mit Folgendem versehen ist:
- mindestens zwei koaxiale Rohre (7, 8), davon ein äußeres Rohr (7) für den Zufluss der Flüssigkeit von einem Lagerbehälter (20) zu einem mit der genannten Flüssigkeit zu füllenden Behälter (3); und ein inneres Ausgleichsrohr (8) zum Bestimmen des Flüssigkeitsniveaus im Innern des Behälters (3); wobei der untere Teil der Rohre (7, 8) so geformt ist, dass er entlang mindestens eines Abschnitts des Behälterhalses (3) eingeführt werden kann;
- wobei die genannten koaxialen Rohre (7, 8) zwischen sich einen Kanal zum Befördern von Flüssigkeit zwischen dem genannten Lagerbehälter (20) und dem genannten Behälter (3) definieren und zueinander beweglich verschiebbar sind, um ein zwischen ihnen angeordnetes Verschlusselement (120) zu öffnen und zu schließen;
- mindestens eine unter dem Behälter (20) fest montierte Dichtung (13), die außen um die Rohre und konzentrisch zu ihnen angeordnet und in der Lage ist, den anschlagenden Mund des Behälters (3) aufzunehmen;
dadurch gekennzeichnet, dass sie umfasst:

- Übertragungsmittel (101);
- und erste Betätigungsmittel (100), die durch die genannten Übertragungsmittel (101) zumindest auf das genannte innere Ausgleichsrohr (8) jedes Füllventils (6) einwirken, um simultan die vertikale Position der genannten Ausgleichsrohre (8) aller Füllventile (6) gegenüber der Dichtung (13) in regulierbarer Weise zu ändern;
wobei die genannten ersten Betätigungsmittel (100) durch die Übertragungsmittel (101) auf das Außenrohr (7) jedes Füllventils (6) einwirken und simultan die vertikale Position beider Rohre (7, 8) gegenüber der Dichtung (13) in regulierbarer Weise ändern; wobei die Übertragung der vertikalen Bewegung auf das Ausgleichsrohr (8) seitens des Außenrohrs (7) durch mechanische Verbindungen (15) zwischen den zwei Rohren (7,8) erhalten wird.

2. Rotationsfüllmaschine nach Anspruch 1, bei der die genannten Übertragungsmittel mindestens einen Stellring (17) umfassen, der mittels mechanischer Umlenkungen (10) am Außenrohr für den Zufluss der Flüssigkeit (7) jedes der Füllventile (6) befestigt ist.

3. Rotationsfüllmaschine nach Anspruch 1, bei der die genannten koaxialen Rohre (7, 8) durch den Deckel (105) und den Boden (106) des genannten Behälters (20) verlaufen, wobei mindestens eine obere Dichtung (106) und mindestens eine untere Dichtung (107) vorgesehen sind, durch welche die genannten Rohre (7, 8) infolge der Betätigung der ersten Betätigungsmittel (100) gleiten.

4. Rotationsfüllmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** sie eine Führungsverlängerung (11) umfasst, die unterhalb des Bodens (104) des genannten Behälters (20) außen um die Rohre (7, 8) und konzentrisch zu ihnen angeordnet ist und die genannte Dichtung (13) trägt, die am unteren Ende befestigt ist.

5. Rotationsfüllmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** jedes Ventil von dem genannten Außenrohr (7) getragene und mit diesem bewegbare zweite Betätigungsmittel (28) umfasst, die in der Lage sind, auf das obere Ende des genannten inneren Ausgleichsrohrs (8) einzuwirken, um seine Relativposition gegenüber dem genannten Außenrohr (7) zu verändern und das Öffnen des genannten Verschlusselements (120) zu bewirken.

6. Rotationsfüllmaschine nach Anspruch 2, **dadurch gekennzeichnet, dass** das genannte Außenrohr (7) auf Höhe des oberen Endes eine Verbreiterung (102) aufweist, um an der entsprechenden Umlenkung (110) der genannten Übertragungsmittel (101) verankert zu werden.

7. Rotationsfüllmaschine nach Anspruch 5, **dadurch gekennzeichnet, dass** jedes genannte Füllventil (6) einschließlich der genannten koaxialen Rohre (7, 8), der zweiten Betätigungsmittel (28), des genannten Verschlusselements (120) und mindestens eines Ventils (12A, 12B) zum Absperren des genannten inneren Ausgleichsrohrs (8) von den genannten ersten Betätigungsmitteln (100) so betätigt wird, dass es sich in geregelter Weise vertikal bewegt.

8. Rotationsfüllmaschine nach Anspruch 5, **dadurch gekennzeichnet, dass** sie über eine logische Steuereinheit verfügt, die in der Lage ist, die verschiedenen Formaten von Behältern (3) entsprechenden Höhenpositionen der genannten Rohre (7, 8) zu speichern und zu reproduzieren und dadurch die genannten ersten Betätigungsmittel (100) zu betätigen.

9. Rotationsfüllmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** sie einen unter Druck stehenden Kreislauf (29), der von einem zweiten Ventil (19) abgesperrt wird, das auf die genannte Führungsverlängerung (11) auf Höhe des unteren Endes in der Nähe des Aufnahmekegels des genannten Behälters (3) montiert ist, und der in der Lage ist, durch in der genannten Dichtung (13) ausgebildete Löcher Inertgas in den genannten Behälter (3) einzublasen, und mindestens ein drittes Ventil umfasst, das zum Absperren des genannten Ausgleichsrohrs (8) montiert ist, wobei der genannte Druckkreislauf (29), wenn das zweite und das dritte Ventil geöffnet sind, in der Lage ist, die im genannten Behälter (3) enthaltene überschüssige Niveauflüssigkeit mit dem unter Druck stehenden Inertgas durch das genannte Ausgleichsrohr (8) in den genannten Behälter (20) oder in einen separaten Rückgewinnungskreislauf (16) zu drücken.

10. Rotationsfüllmaschine nach Anspruch 5, **dadurch gekennzeichnet, dass** die genannten zweiten Betätigungsmittel (28) aus einem Pneumatikzylinder (28) für jedes Ventil (6) bestehen.

11. Rotationsfüllmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die genannten konzentrischen Rohre (7, 8) von den genannten ersten Betätigungsmitteln (100) derart angetrieben werden können, dass sie bis zum vollständigen Eintritt in die genannte Führungsverlängerung (11) angehoben werden, so dass zusammen mit einem Verschlussdeckel (32) ein geschlossenes Gefäß (160) gebildet wird, das geeignet ist, einen Umlauf eines Spülmittels sowohl innen als auch außen auf der Oberfläche des Füllventils (6) zu ermöglichen.

Revendications

1. Machine de remplissage rotative pour le remplissage de récipients avec des liquides, laquelle comprend :

   - un carrousel tournant (4) supportant une pluralité de vannes de remplissage (6) montées sur la périphérie, chacune desquelles est munie :
   - d'au moins deux tubes coaxiaux (7, 8), dont un tube externe (7) pour l'amenée du liquide d'un réservoir de stockage (20) à un récipient (3) à remplir avec ledit liquide ; et un tube interne de compensation (8) pour la détermination du niveau de liquide à l'intérieur du récipient (3) ; la partie finale des tubes (7, 8) étant formée de façon à pouvoir être insérée au moins dans une section du col du récipient (3) ;
   - lesdits tubes coaxiaux (7, 8) définissent entre eux un conduit d'acheminement de liquide entre ledit réservoir de stockage (20) et ledit récipient (3) et sont déplaçable par coulissement l'un par rapport à l'autre pour ouvrir et fermer un obturateur (120) interposé entre eux ;
   - d'au moins un joint d'étanchéité (13) monté fixe sous le réservoir (20), disposé de manière con-

centrique et extérieure auxdits tubes et susceptible de recevoir en butée l'embouchure dudit récipient (3) ;
caractérisée en ce qu'elle comprend :

- des moyens de transmission (101) ;
- et des premiers moyens actuateurs (100) agissant sur au moins ledit tube interne de compensation (8) de chaque vanne de remplissage (6) au moyen desdits moyens de transmission (101) pour faire varier simultanément de manière réglable la position verticale desdits tubes de compensation (8) de toutes les vannes de remplissage (6) par rapport audit joint d'étanchéité (13) ; lesdits premiers moyens actuateurs (100) agissent sur le tube externe (7) de chaque vanne de remplissage (6) au moyen desdits moyens de transmission (101), en faisant varier simultanément de manière réglable la position verticale des deux tubes (7, 8) par rapport au joint d'étanchéité (13) ; la transmission du mouvement vertical au tube de compensation (8) par le tube externe (7) est obtenue par l'intermédiaire de liaisons mécaniques (15) entre les deux tubes (7, 8).

2. Machine de remplissage rotative selon la revendication 1, dans laquelle lesdits moyens de transmission comprenant au moins un anneau de réglage (17) fixé au moyen de renvois mécaniques (10) au tube externe pour l'amenée du liquide (7) de chacune desdites vannes de remplissage (6).

3. Machine de remplissage rotative selon la revendication 1, dans laquelle lesdits tubes coaxiaux (7, 8) traversent le couvercle (105) et le fond (106) dudit réservoir (20), étant prédisposés au moins un joint d'étanchéité supérieur (106) et au moins un joint d'étanchéité inférieur (107) à travers lesquels lesdits tubes (7, 8) coulissent suite à l'actionnement desdits premiers moyens actuateurs (100).

4. Machine de remplissage rotative selon la revendication 1, **caractérisée en ce qu'**elle comprend une extension de guidage (11) fixée au-dessous du fond (104) dudit réservoir (20) de manière concentrique et extérieure par rapport auxdits tubes (7, 8) et portant ledit joint d'étanchéité (13) fixé à l'extrémité inférieure.

5. Machine de remplissage rotative selon la revendication 1, **caractérisée en ce que** chaque vanne comprend des deuxièmes moyens actuateurs (28) supportés par ledit tube externe (7) et déplaçables avec ce dernier, susceptibles d'agir sur l'extrémité supérieure dudit tube interne de compensation (8) pour faire varier sa position relative par rapport audit tube externe (7) en déterminant l'ouverture dudit obturateur (120).

6. Machine de remplissage rotative selon la revendication 2, **caractérisée en ce que** ledit tube externe (7) présente, en correspondance de l'extrémité supérieure, un élargissement (102) pour s'accrocher au renvoi correspondant (110) desdits moyens de transmission (101).

7. Machine de remplissage rotative selon la revendication 5, **caractérisée en ce que** chaque vanne de remplissage (6) incluant lesdits tubes coaxiaux (7, 8), lesdits deuxièmes moyens actuateurs (28), ledit obturateur (120) et au moins une vanne (12A, 12B) placée pour l'étranglement dudit tube interne de compensation (8), est actionnée pour se déplacer verticalement de manière réglable par lesdits premiers moyens actuateurs (100).

8. Machine de remplissage rotative selon la revendication 5, **caractérisée en ce qu'**elle est équipée d'une unité de commande logique capable de mémoriser les positions en hauteur desdits tubes (7, 8) correspondant à différents formats de récipients (3) et de les reproduire en actionnant lesdits premiers moyens actuateurs (100).

9. Machine de remplissage rotative selon la revendication 1, **caractérisée en ce qu'**elle comprend un circuit sous pression (29) étranglé par une deuxième vanne (19) montée sur ladite extension de guidage (11) en correspondance de l'extrémité inférieure à proximité du cône de réception dudit récipient (3), et susceptible d'insuffler un gaz inerte dans ledit récipient (3) à travers des trous ménagés dans ledit joint d'étanchéité (13), et au moins une troisième vanne montée pour l'étranglement dudit tube de compensation (8), ledit circuit de pression (29) avec lesdites deuxième et troisième vannes ouvertes étant conçu, avec le gaz inerte sous pression, pour forcer le liquide de niveau contenu en excès dans ledit récipient (3) à travers ledit tube de compensation (8) à l'intérieur dudit réservoir (20) ou bien dans un circuit séparé de récupération (16).

10. Machine de remplissage rotative selon la revendication 5, **caractérisée en ce que** lesdits deuxièmes moyens actuateurs (28) sont constitués d'un cylindre pneumatique (28) pour chaque vanne (6).

11. Machine de remplissage rotative selon la revendication 1, **caractérisée en ce que** lesdits tubes concentriques (7, 8) sont actionnables par lesdits premiers moyens actuateurs (100) pour se soulever jusqu'à rentrer complètement dans ladite extension de guidage (11), de manière à constituer, avec un couvercle de fermeture (32), un récipient fermé (16)

adapté pour permettre une recirculation d'un produit d'assainissement aussi bien à l'intérieur qu'à l'extérieur de la surface de la vanne de remplissage (6).

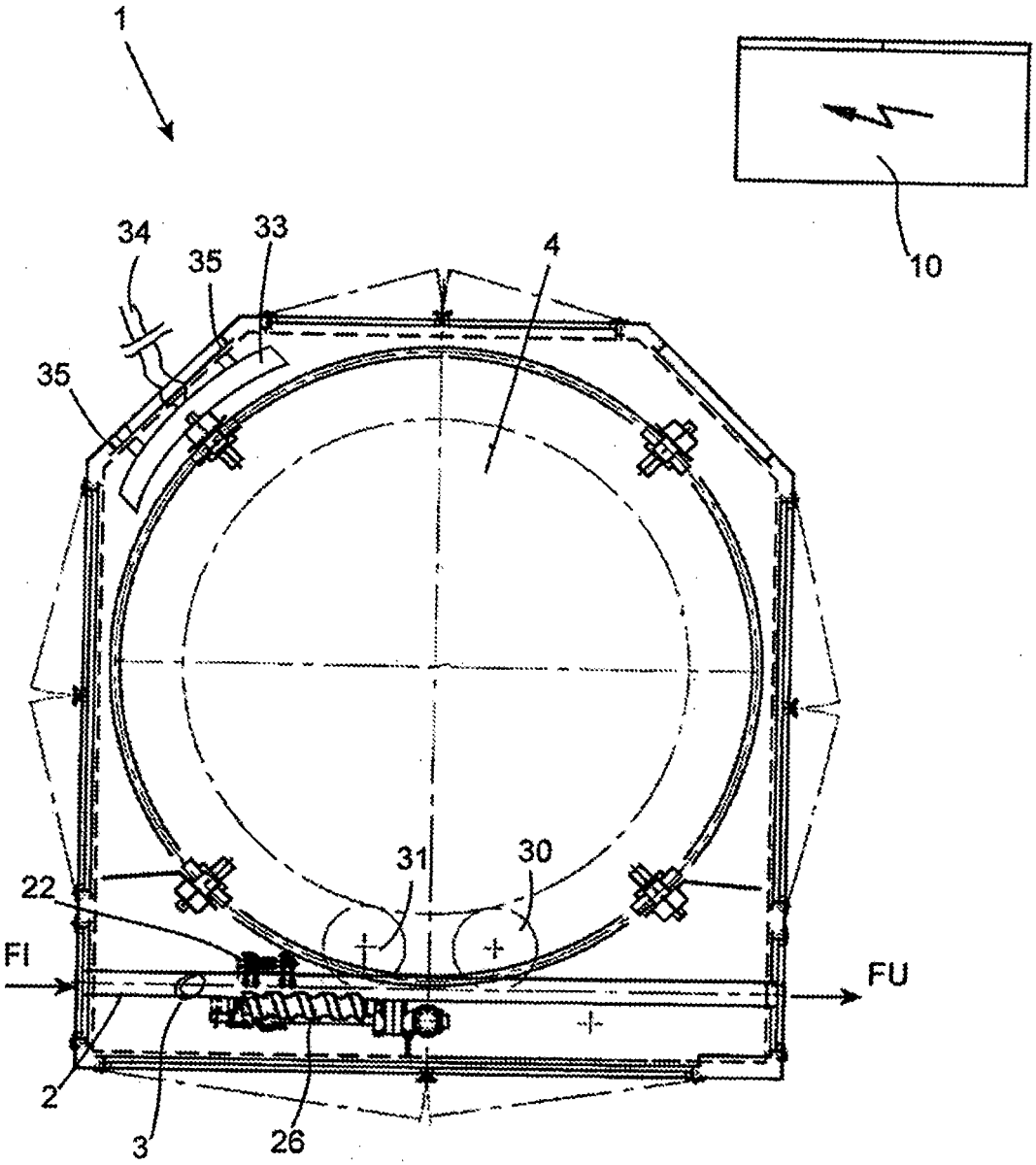

Fig. 1

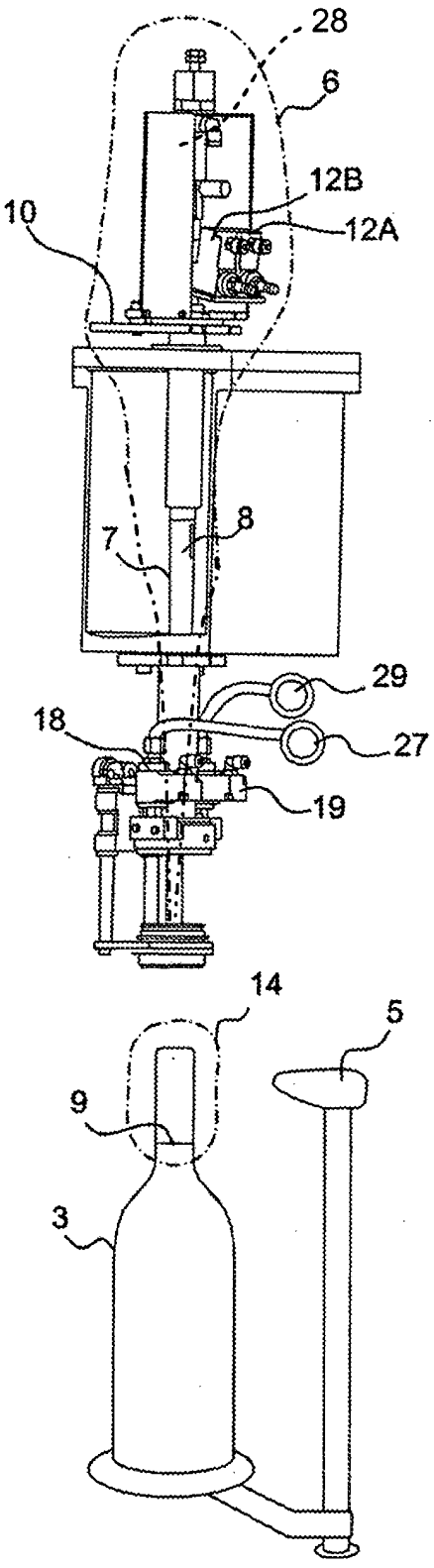

Fig. 2

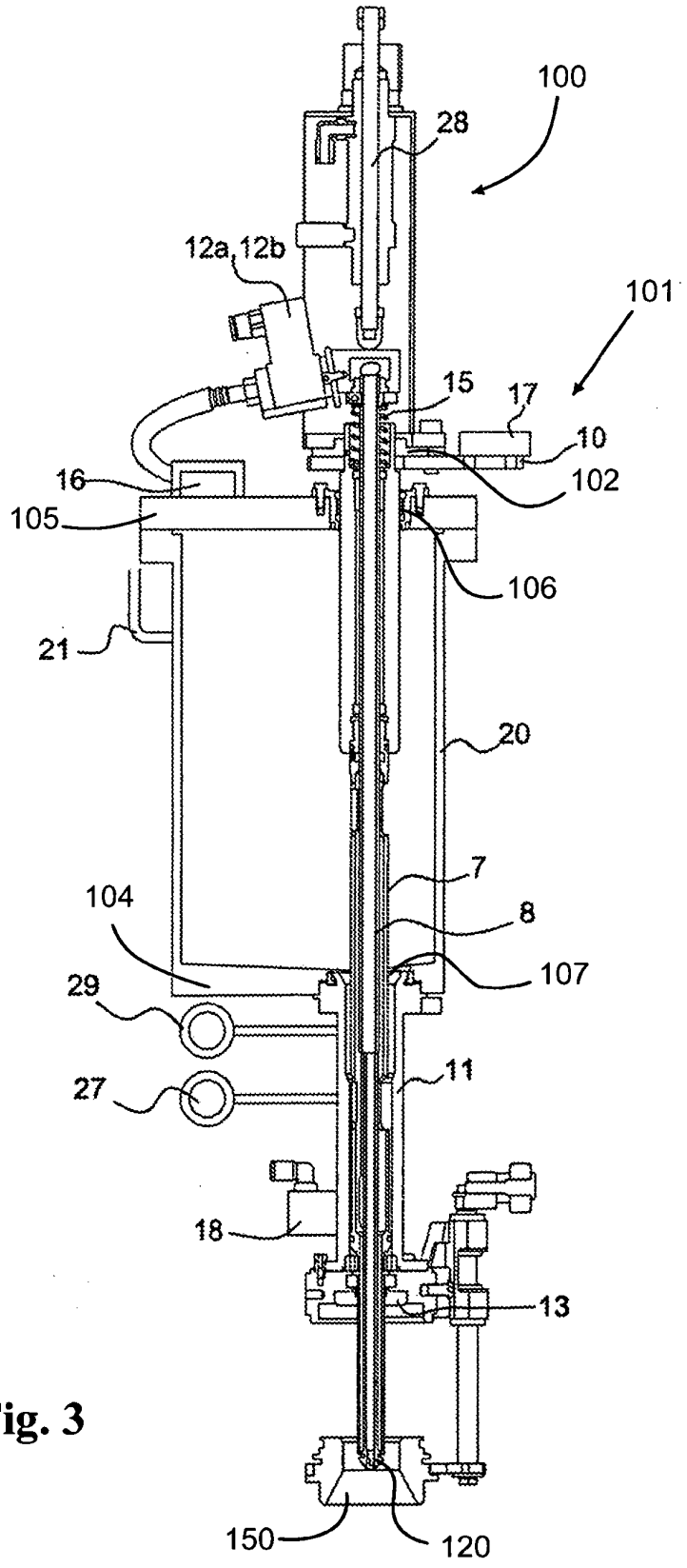
100
28
12a,12b
101
15
17
10
16
102
105
106
21
20
7
104
8
107
29
11
27
18
13
150
120

Fig. 3

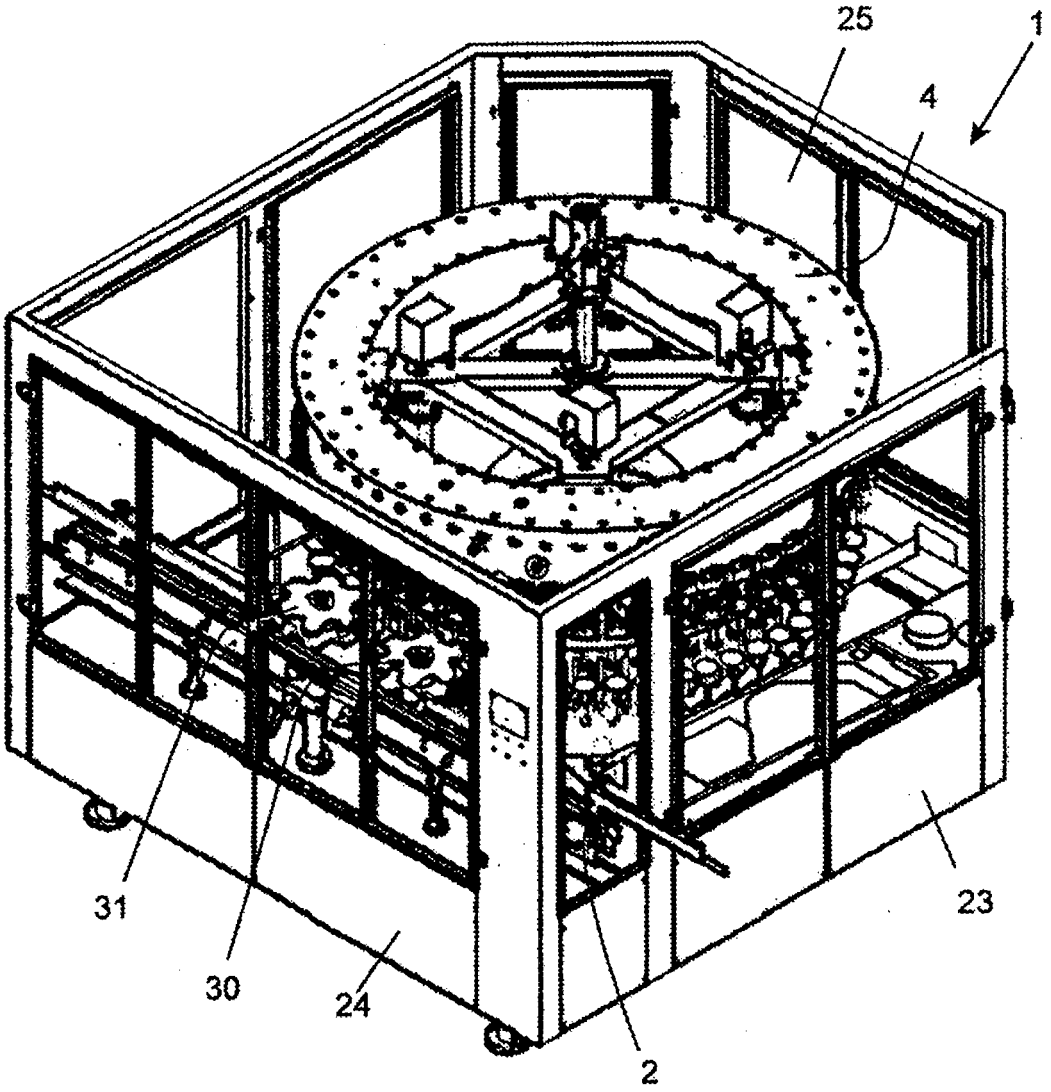

Fig. 4

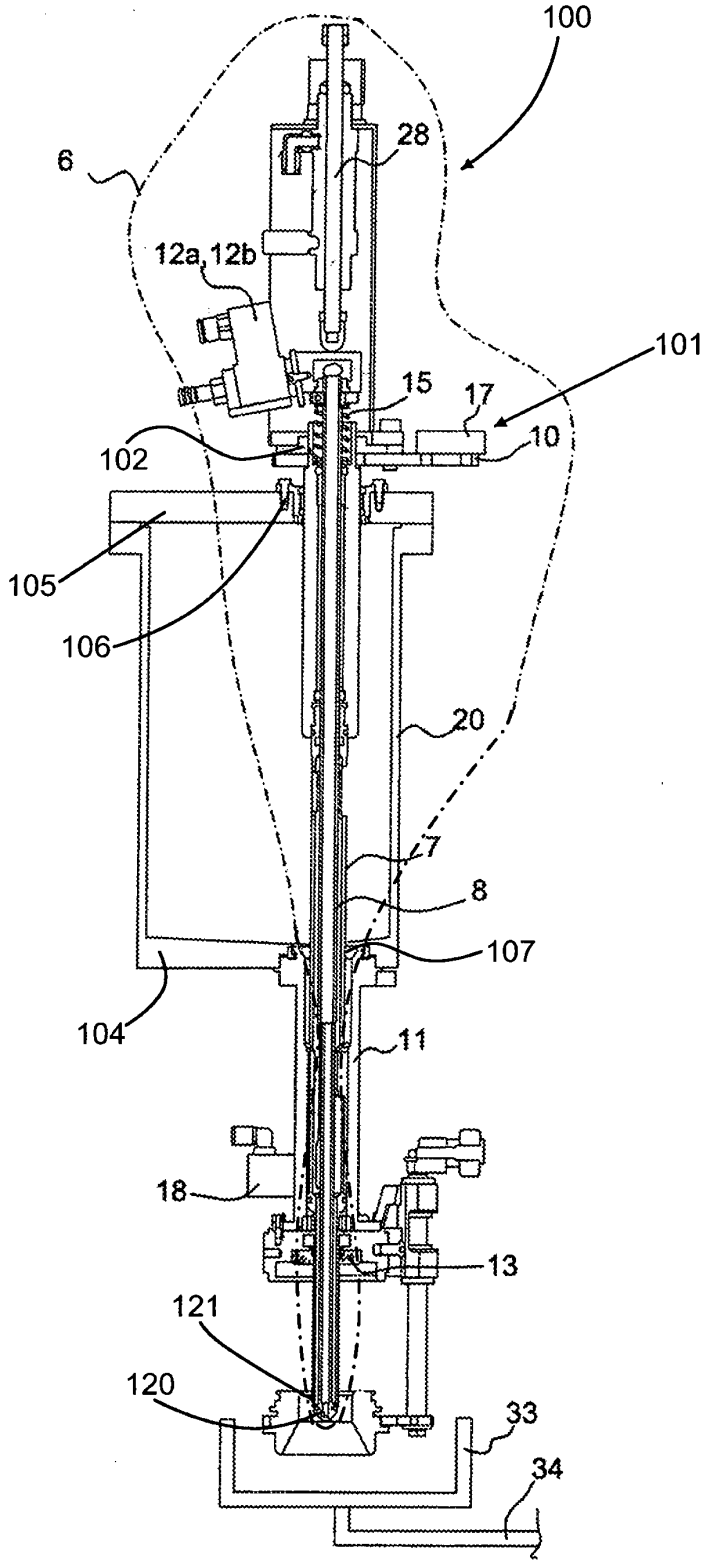
100
6
28
12a,12b
101
15
17
10
102
105
106
20
7
8
107
104
11
18
13
121
120
33
34

Fig. 5

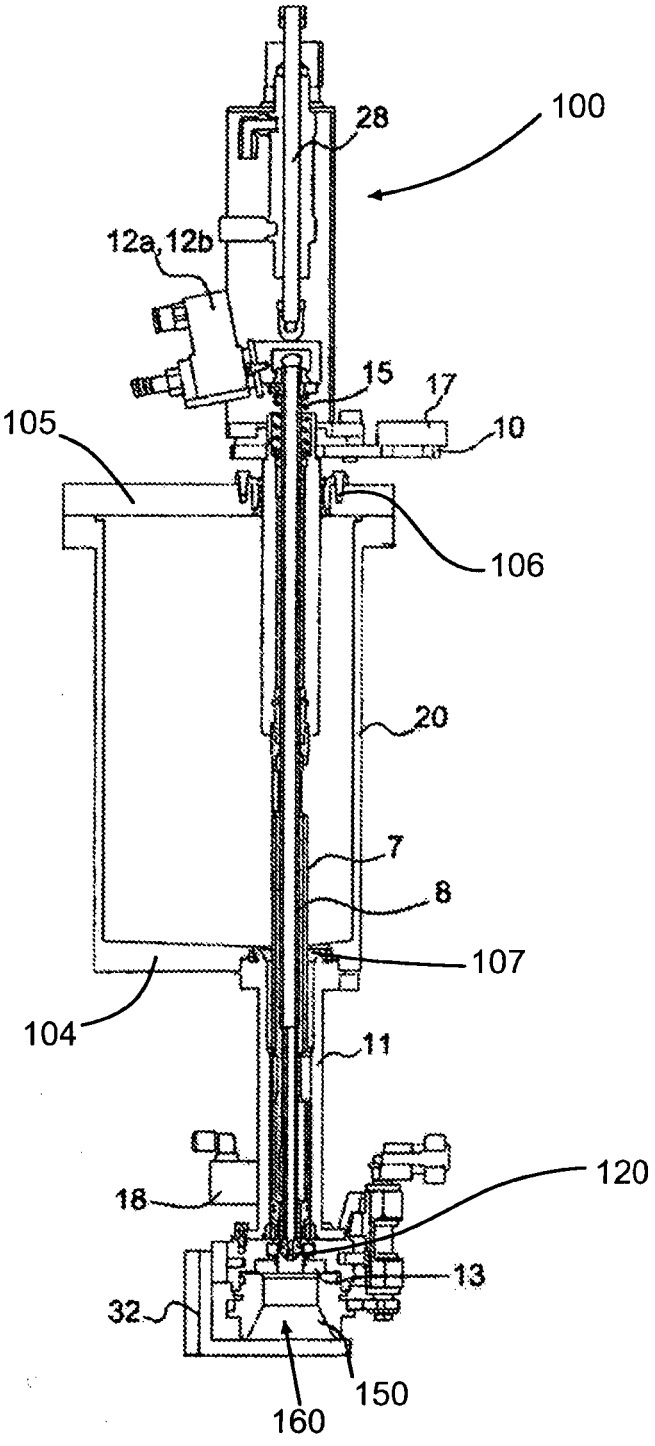
100
28
12a, 12b
15
17
10
105
106
20
7
8
107
104
11
120
18
13
32
150
160

Fig. 6

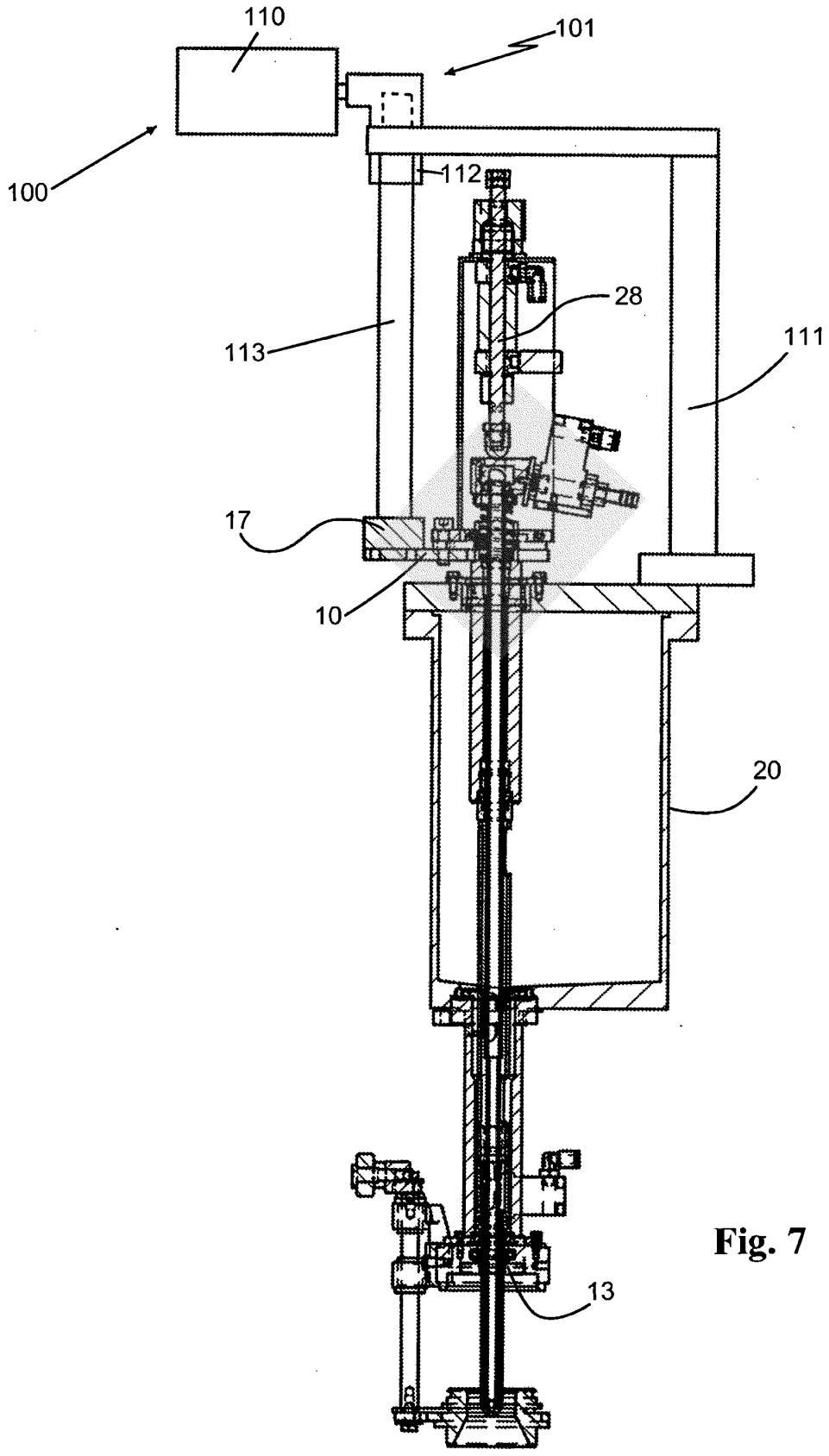

Fig. 7

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 9903774 A **[0012]**
- GB 1316629 A **[0025]**