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(54) **FILLING MACHINE FOR FILLING CONTAINERS WITH LIQUIDS**

(57) Filling machine (1) for filling containers with liquids, which comprises a plurality of valve groups (11), each of which provided with a delivery duct (16) in fluid communication with a containment tank (10) for the flow of a liquid in a corresponding container, a return tube (14) for the air return, a first shutter (22) susceptible of interfering with a portion of the delivery duct (16) in order to selectively allow the passage of the liquid, and first actuator means (25) connected to the return tube (14) in order to move it between a raised position and a lowered position.

The return tube (14) comprises a first section (14'), placed to traverse the containment tank (10), and a second section (14'') placed coaxially within the delivery duct (16), and made in a single body with the first section (14'). The first section (14') is also removably connected to the first actuator means (25) by means of quick coupling means (29).

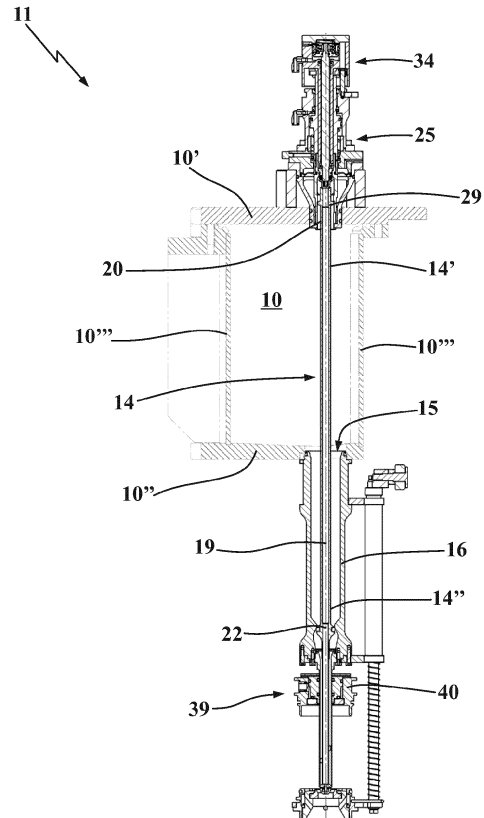


Fig. 2

Description

Field of application

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

[0002] The present machine is inserted in the field of industrial bottling plants and is intended to be employed for filling containers, such as bottles, with liquids of alimentary type, such as wines, liquors, mineral waters, fruit juices, etc.

[0003] The present machine is preferably employable within bottling lines comprising, typically, a rinsing machine, a corking machine, a capping machine, or also, in the more downstream part of the line, a labeling machine and a packaging machine.

State of the art

[0004] The filling machines for filling alimentary liquid products are conventionally provided with a fixed support frame, on which a rotary carousel is rotatably mounted, which supports a cylindrical tank in which a liquid to be bottled is contained. Peripherally fixed to the tank are a plurality of valve groups adapted to convey the liquid contained in the tank within underlying containers to be filled, such as in particular bottles.

[0005] For such purpose, each valve group comprises a delivery duct in communication with the tank and intercepted by a shutter, which adjusts the flow of the liquid from the tank to the underlying container.

[0006] Each valve group comprises, in addition, a return tube for the air return which is placed within the delivery duct, and is adapted to hydraulically adjust the maximum level of the liquid in the container.

[0007] In general, the valve group also comprises a shutter placed to intercept the delivery duct and driven to be opened in order to allow the dispensing of the liquid into the corresponding container. In particular, the shutter is fixed to the return tube, which is slidably movable along a vertical direction by means of corresponding actuator means, mounted on an upper portion of the tank, in order to move the shutter itself in turn.

[0008] During the filling of the container, the air present in the latter is evacuated by means of the return tube, until the liquid in the container reaches the open lower portion of the tube itself, interrupting the exit of air from the container and consequently the dispensing of the liquid in the container itself. The level of liquid within the containers is determined for all the valve groups in a manner such to fill all the containers substantially with the same maximum level height of liquid. Generally, the return tube consists of at least two separate sections, made separately and which are mechanically connected to each other by means of removable fixing means.

[0009] In particular, a first section is extended within the tank and is connected on the upper part to the actuator

means in order to vertically move the tube as indicated above. In addition, a second section is placed inside the delivery duct, is connected to the first section by means of the aforesaid removable fixing means and carries the shutter mounted thereon.

[0010] Generally, the seal between the two sections of the return tube is ensured by lip seals.

[0011] In order to operate a regular maintenance of the filling machine or to adapt the machine to operate with different sizes of containers, it is often necessary to remove the return tubes.

[0012] In particular, each return tube is removed by first disconnecting the second section from the first section and extracting it from a lower portion of the tank. Subsequently, it is necessary to disconnect the actuator means from the tank in order to remove also the first section of the tube connected thereto.

[0013] The aforesaid operations are executed in reverse order in order to remount a new return tube on the filling machine.

[0014] An example of a filling machine of the above-mentioned type is described in the document EP 2287107 A1.

[0015] The filling machines of known type, of the type summarily described above, have in practice demonstrated that they do not lack drawbacks.

[0016] A first important drawback lies in the fact that the lip seals placed for ensuring the seal between the sections which constitute the return tube can be subjected to wear and hence require frequent maintenance for ensuring the seal of the itself. In addition, the lip seals facilitate the deposition of liquid, which, being difficult to wash, remains in contact with the seals themselves also for a long period after the end of the filling step. The presence of a liquid deposit that is hard to wash thus places at risk of contamination all the liquid introduced within the tank of the filling machine in the subsequent filling cycles.

[0017] A second drawback lies in the fact that the operation of substituting the return tubes requires completely dismantling the valve group, hence requiring a high machine stop time.

[0018] In addition, when a new tube is mounted, the connection between the first section and the second section is complex to execute, since it is difficult to identify from outside the position of the lower end of the first section of the tube to which the second section must be fixed and the possible arrangement of the removable fixing means.

Presentation of the invention

[0019] In this situation, the problem underlying the present invention is to overcome the drawbacks manifested by the prior art, by providing a filling machine for filling containers with liquids, which allows reducing as much as possible the number of seals in contact with the liquid.

[0020] Further object of the present invention is to provide a filling machine, which allows ensuring the absence of contaminations of the liquid.

[0021] Further object of the present invention is to provide a filling machine, which allows carrying out ordinary maintenance on the air return tubes, reducing machine stop times as much as possible.

[0022] Further object of the present invention is to provide a filling machine, which allows carrying out the change of the return tube in a simple and quick manner.

[0023] Further object of the present invention is to provide a filling machine, which is capable of operating in a versatile manner upon varying the size of the containers to be filled.

[0024] Further object of the present invention is to provide a filling machine, which is structurally simple and inexpensive to produce.

[0025] Further object of the present invention is to provide a filling machine, which is entirely efficient and reliable in operation.

Brief description of the drawings

[0026] The technical characteristics of the invention, according to the aforesaid objects, can be clearly seen from the content of the below-reported claims and the advantages thereof will be more evident in the following detailed description, made with reference to the enclosed drawings, which represents several merely exemplifying and non-limiting embodiments of the invention, in which:

- figure 1 shows a perspective view of the filling machine, object of the present invention;
- figure 2 shows a sectional view of a valve group of the filling machine, object of the present invention, in accordance with a preferred embodiment;
- figure 3 illustrates a sectional view of a detail of a delivery duct of a valve group of the filling machine represented in figure 2;
- figure 4 illustrates a sectional view of a detail relative to actuator means of the valve group of the filling machine represented in figure 2;
- figure 5 illustrates a sectional view of a detail relative to quick coupling means of the valve group of the filling machine represented in figure 2;
- figure 6 shows a sectional view of a valve group of the filling machine, object of the present invention, in accordance with an alternative embodiment;
- figure 7 shows a partial sectional view over a different plane of the valve group of the filling machine represented in figure 6.

Detailed description of a preferred embodiment

[0027] With reference to the enclosed drawings, reference number 1 overall indicates a filling machine for filling containers with liquids, object of the present invention. Hereinbelow, two preferred embodiments of the present

invention will be described in detail, relative to a filling machine of low vacuum type and to a filling machine of isobaric type at low pressure; nevertheless, it is intended that the technical solutions, object of the present invention, are also advantageously applicable to other types of filling machines, such as gravity machines, etc.

[0028] Advantageously, the filling machine 1 is conventionally inserted within a bottling plant downstream of a rinsing machine and upstream of a capping machine. The containers to be filled are transferred from one machine to the other by means of transport lines, such as for example conveyor belts 3', 3", star conveyors 4', 4", screw pumps 5', 5", etc.

[0029] In particular, the containers, generally constituted by bottles made of glass or PET, comprise a lower widened body from which an elongated neck is extended above, terminating at the top with a head provided with an opening through which the liquid is susceptible of being introduced within the container itself.

[0030] With reference to the embodiments illustrated in the enclosed figures, the present filling machine 1 is advantageously provided with an inlet station 6, at which it receives (preferably by means of a first star conveyor 4' and/or an inlet screw pump 5') the containers to be filled, carried for example by a first conveyor belt 3' upstream. In addition, the filling machine 1 is provided with an outlet station 7, at which it releases (preferably by means of a second star conveyor 4" and/or an outlet screw pump 5") the filled containers, preferably at a second conveyor belt 3" downstream, adapted to convey such filled containers to the capping machine.

[0031] In addition, the filling machine 1 advantageously comprises transport means 8 adapted to transport the containers from the inlet station 6, at which the containers are empty, to the outlet station 7, at which the containers have been filled with a liquid up to a specific fill level.

[0032] The present filling machine 1 comprises a rotary carousel 12 provided with at least one tank 10 for containing a liquid to be bottled.

[0033] Advantageously, with reference to the embodiments illustrated in the enclosed figures, the filling machine 1 also comprises a support structure 9, which is intended to be abutted against the ground and rotatably carries the aforesaid carousel mounted thereon. More in detail, the rotary carousel 12 is adapted to rotate around a vertical central rotation shaft 13 thereof mounted on the support structure 9.

[0034] The containment tank 10 preferably has annular shape and is fixed coaxially to the rotary carousel 12 in order to rotate together with the latter during the operation of the filling machine 1.

[0035] In addition, the containment tank 10 is advantageously delimited by an upper closure wall 10', an opposite lower closure wall 10" and at least one lateral wall 10''' placed to connect between the upper closure wall 10' and the lower closure wall 10".

[0036] The filling machine, object of the invention, also comprises a plurality of valve filling groups 11, advanta-

geously hydraulically connected to the containment tank 10 in order to receive the liquid from the latter.

[0037] More in detail, the valve groups 11 are mechanically connected to the support structure 9 and susceptible of transferring the liquid provided by the containment tank 10 to the containers.

[0038] Advantageously, the rotary carousel 12 carries, peripherally mounted thereon, the valve groups 11, which in particular are placed equidistant from each other around the central rotation shaft 13 of the rotary carousel 12 itself.

[0039] Each valve group 11 is provided with a delivery duct 16 which is in fluid communication with the containment tank 10 for the flow of the liquid from the containment tank 10 to a container to be filled with the liquid.

[0040] The delivery duct 16 is provided with a first conveyance portion 16' fixed below said tank and a second conveyance portion 16'' mechanically connected in fluid continuity to the first conveyance portion 16' itself, by means of removable fixing means. For example, the removable fixing means can be screws.

[0041] More in detail, the first conveyance portion 16' is mechanically connected in fluid continuity below the containment tank 10 for the flow of the liquid from the latter to the containers to be filled, preferably through an opening 15 made on the lower closure wall 10' of the containment tank 10 itself.

[0042] Advantageously, the second conveyance portion 16'' is extended up to an outlet mouth 18 of the liquid susceptible of being at least partially inserted within the container.

[0043] Each valve group 11 also comprises a return tube 14 for the air return, which is provided with at least one first section 14', placed to traverse the containment tank 10 and extended up to an upper end 20 thereof, and with at least one second section 14'', placed coaxially within the delivery duct 16 and extended up to a lower end 21 thereof.

[0044] Advantageously, the return tube 14 defines an internal channel 19 and allows, during a step of filling the container, evacuating the air contained within the latter. In this manner, the air is progressively substituted by the liquid and its evacuation by means of the return tube 14 prevents the formation of a counter-pressure that opposes the descent of the liquid itself.

[0045] According to the invention, each valve group 11 also comprises a first shutter 22, which is placed to intercept the delivery duct 16 and is provided with a widened portion 23 fixed to the second section 14'' of the return tube 14 and susceptible of interfering with a portion of the delivery duct 16 in order to open and close the first shutter itself. Preferably, the widened portion 23 is in a single body with the second section 14'' of the return tube 14. Of course, without departing from the protective scope of the present invention, the widened portion 23 can be made separately with respect to the second section 14'' and be subsequently fixed to the latter.

[0046] According to a preferred embodiment, the first

shutter 22 comprises a narrow portion 26 made in the second conveyance portion 16'' of the delivery duct 16, on which the widened portion 23 is adapted to act abuttingly when the shutter is closed. The valve group 11 also comprises first actuator means 25, which are mounted on the rotary carousel 12, advantageously in order to rotate together with the latter during the operation of the filling machine 1. For example, the first actuator means are mounted above the upper closure wall 10' of the containment tank 10.

[0047] The first actuator means 25 are mechanically connected to the upper end 20 of the first section 14' of the return tube 14 in order to move it between a raised position and a lowered position. In particular, in the raised position, the first shutter 22 is closed, and in the lowered position the first shutter 22 is open.

[0048] More in detail, since the widened portion 23 of the first shutter 22 is fixed to the second section 14'' of the return tube 14, the movement of the return tube 14 by means of the first actuator means 25 involves the opening and closing of the first shutter 22 itself.

[0049] Advantageously, the widened portion 23 of the first shutter 22 carries a seal 24 peripherally mounted thereon, which is susceptible of making a seal on the second conveyance portion of the delivery duct 16' by interfering with the latter, preferably with its narrow portion 26, when the return tube 14 is in raised position. Otherwise, with the return tube 14 in lowered position, the seal 24 no longer ensures the seal between the widened portion 23 of the first shutter 22 and the second conveyance portion 16' of the delivery duct 16, allowing the liquid to flow from the containment tank 10 within the container by traversing the delivery duct 16 itself. In accordance with the idea underlying the present invention, the first and the second section 14', 14'' of the return tube 14 are made in a single body. In particular, the two sections can be rigidly fixed to each other, for example by means of screwing of the first section 14' to the second section 14'' or they can be made integrally in a single body.

[0050] In addition, according to the invention, the upper end 20 of the first section of the return tube 14 is mechanically connected to the first actuator means 25 by means of quick coupling means 29.

[0051] In accordance with the preferred embodiment illustrated in the enclosed figures, the first actuator means 25 comprise a support body 27, which is mounted on the rotary carousel 12 and is advantageously susceptible of being moved therewith, and a piston 28, which is slidably mounted on the support body 27 itself and is actuable between a raised position and a lowered position. In particular, the raised position and the lowered position of the piston 28 correspond to the positions of the return tube 14.

[0052] Preferably, the first actuator means 25 comprise a pneumatic actuator and a spring, which exert forces in opposite senses on the piston 28 itself, inducing the movement thereof between the raised position and

the lowered position. More in detail, the pneumatic actuator acts on the piston 28 in a first sense from the raised position to the lowered position, so as to bring the first shutter 22 towards the open position. In addition, the spring acts on the piston 28 in a second sense from the lowered position to the raised position, so as to bring the first shutter 22 towards the closed position. In particular, the spring acts continuously on the piston 28 and the pneumatic actuator must act with a force adapted to overcome such action in order to move the piston 28 itself. In this manner, advantageously, in case of malfunction of the pneumatic actuator, the first actuator means 25 thus configured maintain the first shutter 22 in closed position, preventing the exit of liquid from the containment tank 10. Advantageously, therefore, the first actuator means 25 configured with such actuation mechanism type ensure the operating reliability of the filling machine 1. In accordance with the preferred embodiment, the upper end 20 of the first section 14' of the return tube 14 is mechanically connected by means of quick coupling means 29 to the piston 28 of the first actuator means 25.

[0053] Advantageously, the quick coupling means 29 comprise a first coupling element 52, which is fixed to the piston 28, and a second coupling element 53, which is fixed to the return tube 14 of the aforesaid valve group 11. In particular, the first coupling element 52 and the second coupling element 53 are mechanically engaged with each other.

[0054] In accordance with the preferred embodiment, the first coupling element 52 comprises a retention body 50 provided with a perimeter wall 51, which delimits a retention seat 30, and with an abutment wall 31 radially projecting from the perimeter wall 51 itself towards the interior of the retention seat 30. Advantageously, the second coupling element 53 comprises at least one retention tab 32 and one small collar 17, which are projectingly extended from an external surface of the upper end 20 of the first section 14' and between them define an engagement seat.

[0055] In particular, when the first coupling element 52 and the second coupling element 53 are engaged with each other, the end 20 of the first section 14' is inserted within the retention seat 30 and the abutment wall 31 is retained in the engagement seat between the retention tab 32 and the small collar 17.

[0056] In particular, the return tube 14 is rotatable, preferably around an axis parallel to the main extension thereof, between a coupling position and a release position. More in detail, with the return tube 14 in the coupling position, the first coupling element 52 and the second coupling element 53 are engaged with each other. In particular, the retention tab 32 is vertically aligned with the abutment wall 31, preferably in abutment against the latter, in order to prevent the exit of the upper end 20 of the first section 14' of the return tube 14 from the retention seat 30 made on the piston 28.

[0057] With the return tube 14 in the release position, the first coupling element 52 and the second coupling

element 53 are disengaged from each other. In particular, the retention tab 32 is vertically non-aligned with respect to the abutment wall 31, preferably no longer being in abutment against the latter, in order to allow the exit of the upper end 20 of the first section 14' of the return tube 14 from the retention seat 30.

[0058] Advantageously, in standard operating condition of the filling machine 1, the return tube 14 is in coupling position, ensuring the mechanical connection between return tube 14 itself and first actuator means 25 by means of the engagement between the first coupling element 52 and the second coupling element 53.

[0059] In operation, in order to remove the return tube 14 from the filling machine 1 so to carry out the normal ordinary maintenance procedures or for reconfiguring the filling machine 1, adapting it to containers with a different size, in particular with a different size of the head of the container itself, the second conveyance portion 16" of the delivery duct 16 is first advantageously removed, removing the suitable removable fixing means. Once the second conveyance portion 16" of the delivery duct 16 has been removed from the valve group 11, the return tube 14 is rotated into the release position, preferably in a manner such that the upper end 20 of the first section of the return tube 14' is released from the first actuator means 25 due to the disengagement between the first coupling element 52 and the second coupling element 53, and in particular between the retention tabs 32 and the retention seat 30 of the quick coupling means 29. Following such operations, the return tube 14 can be easily removed from the valve group 11 of the filling machine, removing it from below and in particular making it pass within the first conveyance portion 16' of the delivery duct.

[0060] Advantageously, the operations necessary for newly installing the return tube 14 on the valve group 11 of the filling machine 1 are the same just described for removing the return tube 14 itself, executed in reverse order.

[0061] In this manner, it is possible to advantageously substitute the return tube 14 in a simple and facilitated manner. Indeed, during the installation operations, the centering of the return tube 14 with the retention seat 30 is preferably aided by the abutment of the upper end of the return tube 14 itself against the upper closure wall of the containment tank 10, and by the abutment of the small collar 17 against the undercut portion 49 of the piston 28.

[0062] In accordance with the preferred embodiment, each valve group 11 comprises a second shutter 33, which is placed to intercept the return tube 14 in order to selectively allow or prevent the passage of air within the return tube 14 itself. Advantageously, each valve group 11 also comprises second actuator means 34, which are mounted, preferably indirectly, on the containment tank 10 and are connected to the second shutter 33 in order to drive the latter to close or open of the return tube 14 itself.

[0063] Advantageously, the second actuator means 34 are mechanically connected to the piston 28 of the first

actuator means 25 and are susceptible of being moved integrally with the return tube 14, in particular between the lowered position and the raised position.

[0064] In accordance with the preferred embodiment, the second shutter 33 is provided with a terminal portion 37, which is susceptible of interfering with the upper end 20 of the first section 14' of the return tube 14, preferably for closing the internal channel 19 of the return tube 14, and a connection portion 38 which is mechanically connected to the second actuator means 34.

[0065] In particular, the second shutter 33 is movable between an engagement position, in which it closes the return tube 14 in order to prevent the passage of air at its interior, and a vent position, in which it frees the passage of the return tube 14, allowing the return of air exiting from the container.

[0066] More in detail, the second actuator means 34 comprise a pneumatic cylinder 35, on which the second shutter 33 is slidably mounted in order to move it between the engagement position and the vent position. Preferably, the pneumatic cylinder 35 is a pneumatic actuator of known type, for example of the type described above for the first actuator means 25 (comprising a spring and a pneumatic actuator), and therefore this will not be described more in detail hereinbelow.

[0067] In accordance with the preferred embodiment, each valve group 11 comprises adjustment means 39 in order to set the level of the liquid to be inserted in the container, i.e. in particular the maximum level reached by the liquid within the container during a filling step.

[0068] More in detail, such adjustment means 39 comprise an adjustment body 40, which is mounted, preferably removably fixed, on the second conveyance portion 16" of the delivery duct 16. In particular, the adjustment body 40 is selectively positionable along the second conveyance portion 16" itself closer to or further away from the outlet mouth 18 in order to adjust the length of the second conveyance portion 16" susceptible of being inserted within the container, advantageously during a step of filling the latter.

[0069] According to an alternative embodiment, represented in figures 6 and 7, the present filling machine 1 can operate as an isobaric filling machine at low pressure. Such filling machine 1 advantageously comprises an isobaric circuit (not illustrated) of pressurized inert gas, which is placed in fluid communication with the containment tank 10, and maintains the latter at a pressure higher than the ambient pressure. In particular, the containment tank 10 is of the type provided with sufficient mechanical strength for sustaining the pressure set by the inert gas isobaric circuit. More in detail, the adjustment body 40 comprises a compensation chamber 42, which is susceptible of being placed in fluid communication with the container. In particular, the adjustment body 40 also comprises a bottom wall 41, which on the lower part delimits the compensation chamber and is in turn provided with at least one through opening, in particular concentric with the return tube 14, susceptible of placing the con-

tainer in fluid communication with the compensation chamber 42 itself. Advantageously, the head of the container, during all the characteristic operating steps of the filling machine 1, is placed sealingly against the bottom wall 41 of the adjustment body 40.

[0070] Advantageously, according to the alternative embodiment, the filling machine 1 is provided with an auxiliary tank (not illustrated), which is placed in fluid communication with the isobaric circuit, and is therefore maintained at the same pressure as the containment tank. In addition, the auxiliary tank is placed in fluid communication with the upper end 20 of the first section 14' of the return tube 14, in a manner such that when the second shutter 33 is placed in the vent position, the container is in turn placed in fluid communication with the auxiliary tank. Advantageously, each valve group 11 comprises a degassing valve 44, which is mechanically connected to the adjustment body 40, is placed in fluid communication with the compensation chamber 42 and is arranged for bringing the container to atmospheric pressure.

[0071] In particular, the degassing valve 44 is configured for selectively placing in fluid communication the compensation chamber 42 and the outside environment.

[0072] Advantageously, each valve group 11 of the filling machine 1 also comprises a first auxiliary valve 45, which is mechanically connected to the adjustment body 40, is placed in fluid communication with the compensation chamber 42 and is arranged for bringing the container to a pressure lower than the atmospheric pressure.

[0073] In particular, the first auxiliary valve 45 is configured for selectively placing in fluid communication the compensation chamber 42 and a vacuum pump for suctioning the air within the container, preferably before its filling.

[0074] Advantageously, each valve group 11 of the filling machine 1 comprises a second auxiliary valve 46, which is mechanically connected to the adjustment body 40, is placed in fluid communication with the compensation chamber 42 and is arranged for bringing the container to a pressure higher than the pressure of the containment tank 10.

[0075] In particular, the second auxiliary valve 46 is configured for selectively placing in fluid communication the compensation chamber 42 and a tank of pressurized inert gas. The aforesaid inert gas tank may possibly also be connected to the above-described inert gas circuit.

[0076] Advantageously, each valve group 11 comprises a common duct 47, which is connected to the adjustment body 40 and is placed in fluid communication with the compensation chamber 42 by means of a lateral opening 48 made on the adjustment body 40 itself.

[0077] Preferably, each of the above-described valves is in fluid communication with the compensation chamber 42 by means of the common duct 47.

[0078] In operation, the filling machine 1 configured for operating as an isobaric filling machine according to the alternative embodiment, once the container is placed

sealingly with the bottom wall 41 of the adjustment body, advantageously executes an optional step of evacuating the air contained in the container by means of the opening of the first auxiliary valve 45. By means of such operation, a level of vacuum is created that suctions the air from the container. When the air has been evacuated, the first auxiliary valve 45 is advantageously closed.

[0079] Subsequently, the filling machine 1 advantageously executes a balancing step by means of the opening of the second shutter 33. In this manner, a pressure equilibrium condition is previously achieved between the containment tank 10 and the containers themselves, which are filled with pressurized inert gas.

[0080] Once the filling step has terminated, there is an optional self-leveling step, during which the second auxiliary valve 46 is advantageously opened in order to insufflate a flow of inert gas within the container and determine the re-ascent in the return tube 14 of a fraction of liquid (and foam) placed above the desired level, i.e. at the outlet mouth 18 of the liquid from the delivery duct 16. At the end of such self-leveling step, the second auxiliary valve 46 is advantageously closed.

[0081] Finally, before the container is disconnected from the respective valve group 11, the same container is brought back to atmospheric pressure by means of a degassing step, in which the degassing valve 44 is opened. At the end of such degassing step, the degassing valve 44 is advantageously closed.

[0082] The invention thus conceived therefore attains the pre-established objects.

Claims

1. Filling machine (1) for filling containers with liquids, which comprises:

- a rotary carousel (12) provided with at least one tank (10) for containing a liquid to be bottled;
- a plurality of valve filling groups (11), each of which provided with:

- a delivery duct (16) in fluid communication with said containment tank (10) for the flow of the liquid from said containment tank (10) to a container to be filled with said liquid; said delivery duct (16) being provided with a first conveyance portion (16') fixed on the lower part to said containment tank (10), and a second conveyance portion (16'') mechanically connected in fluid continuity with said first conveyance portion (16') by means of removable fixing means and extended up to an outlet mouth (18) for the liquid susceptible of being at least partially inserted in said container;

- a return tube (14) for the air return provided with at least one first section (14'), placed

to traverse said containment tank (10) and extended up to an upper end (20) thereof, and with at least one second section (14'') placed coaxially within said delivery duct (16) and extended up to a lower end (21) thereof;

- a first shutter (22) placed to intercept said delivery duct (16) and provided with a widened portion (23) fixed to the second section (14'') of said return tube (14) and susceptible of interfering with a portion of said delivery duct (16) in order to open and close said first shutter (22);

- first actuator means (25) mounted on said rotary carousel (12) and mechanically connected to the upper end (20) of the first section (14') of said return tube (14) in order to move it between a raised position, in which said first shutter (22) is closed and a lowered position in which said first shutter (22) is open;

said filling machine (1) being **characterized in that** said first and second sections (14', 14'') of said return tube (14) are made in a single body, the upper end (20) of the first section (14') of said return tube (14) being removably connected to said first actuator means (25) by means of quick coupling means (29).

2. Filling machine (1) according to claim 1, **characterized in that** said first actuator means (25) comprise a support body (27) mounted on said rotary carousel (12), a piston (28), which carries said return tube (14) mounted thereon and is slidably mounted on said support body (27) and actuatable between a raised position and a lowered position.

3. Filling machine (1) according to claim 2, **characterized in that** said quick coupling means (29) comprise:

- a first coupling element (52) fixed to said piston (28);
- a second coupling element (53) fixed to said return tube (14) of said valve group (11),

said first coupling element (52) and said second coupling element (53) being mechanically engaged with each other.

4. Filling machine (1) according to claim 3, **characterized in that** said first coupling element (52) comprises a retention body (50) provided with a perimeter wall (51), which delimits a retention seat (30) and with an abutment wall (31) radially projecting from said perimeter wall (51) towards the interior of the retention seat (30);

- wherein said second coupling element (53) comprises at least one retention tab (32) and a small collar (17), which are projectingly extended from an external surface of the upper end (20) of said first section (14') and between them define an engagement seat; wherein, with said first coupling element (52) and said second coupling element (53) engaged with each other, the end (20) of said first section (14') is inserted in said retention seat (30) and said abutment wall (31) is retained in said engagement seat between said retention tab (32) and said small collar (17).
5. Filling machine (1) according to claim 4, **characterized in that** said return tube (14) is rotatable between a coupling position, in which the retention tab (32) is vertically aligned with said abutment wall (31) in order to prevent the exit of the upper end (20) of said first section (14') from the retention seat (30), and a release position, in which the retention tab (32) is vertically non-aligned with respect to said abutment wall (31) in order to allow the extraction of the upper end (20) of said first section (14') from the retention seat (30).
6. Filling machine (1) according to any one of the preceding claims, **characterized in that** each said valve group (11) comprises a second shutter (33) placed to intercept said return tube (14) in order to selectively allow or prevent at least the passage of air within said return tube (14); said valve group (11) also comprising second actuator means (34) mounted on said containment tank (10) and connected to said second shutter (33), in order to drive said second shutter (33) to close or open said return tube (14).
7. Filling machine (1) according to claim 6, **characterized in that** said second actuator means (34) are mechanically connected to said piston (28) and are susceptible of being moved integrally with said return tube (14).
8. Filling machine (1) according to any one of the preceding claims, **characterized in that** each said valve group (11) comprises adjustment means (39) in order to set the level of the liquid to be inserted in the container, which comprise an adjustment body (40) mounted on the second conveyance portion (16'') of said delivery duct (16) and selectively positionable along said second conveyance portion (16'') closer to or further away from said outlet mouth (18) in order to adjust the length of said second conveyance portion (16'') susceptible of being inserted in the container.
9. Filling machine (1) according to claim 8, **characterized in that** said adjustment body (40) comprises:
- a compensation chamber (42), susceptible of being placed in fluid communication with said container;
 - a bottom wall (41), which on the lower part delimits said compensation chamber (42) and is provided with at least one through opening, in particular concentric with said return tube (14), susceptible of placing said container in fluid communication with said compensation chamber (42);
- wherein said valve group (11) comprises a degassing valve (44), mechanically connected to said adjustment body (40), placed in fluid communication with said compensation chamber (42) and arranged for bringing said container to atmospheric pressure.
10. Filling machine (1) according to claim 9, **characterized in that** said valve group (11) comprises a first auxiliary valve (45), mechanically connected to said adjustment body (40), placed in fluid communication with said compensation chamber (42) and arranged for bringing said container to a pressure lower than the atmospheric pressure.
11. Filling machine (1) according to claim 9 or 10, **characterized in that** said valve group (11) comprises a second auxiliary valve (46), mechanically connected to said adjustment body (40), placed in fluid communication with said compensation chamber (42) and arranged for bringing said container to a pressure higher than the pressure of said containment tank (10).

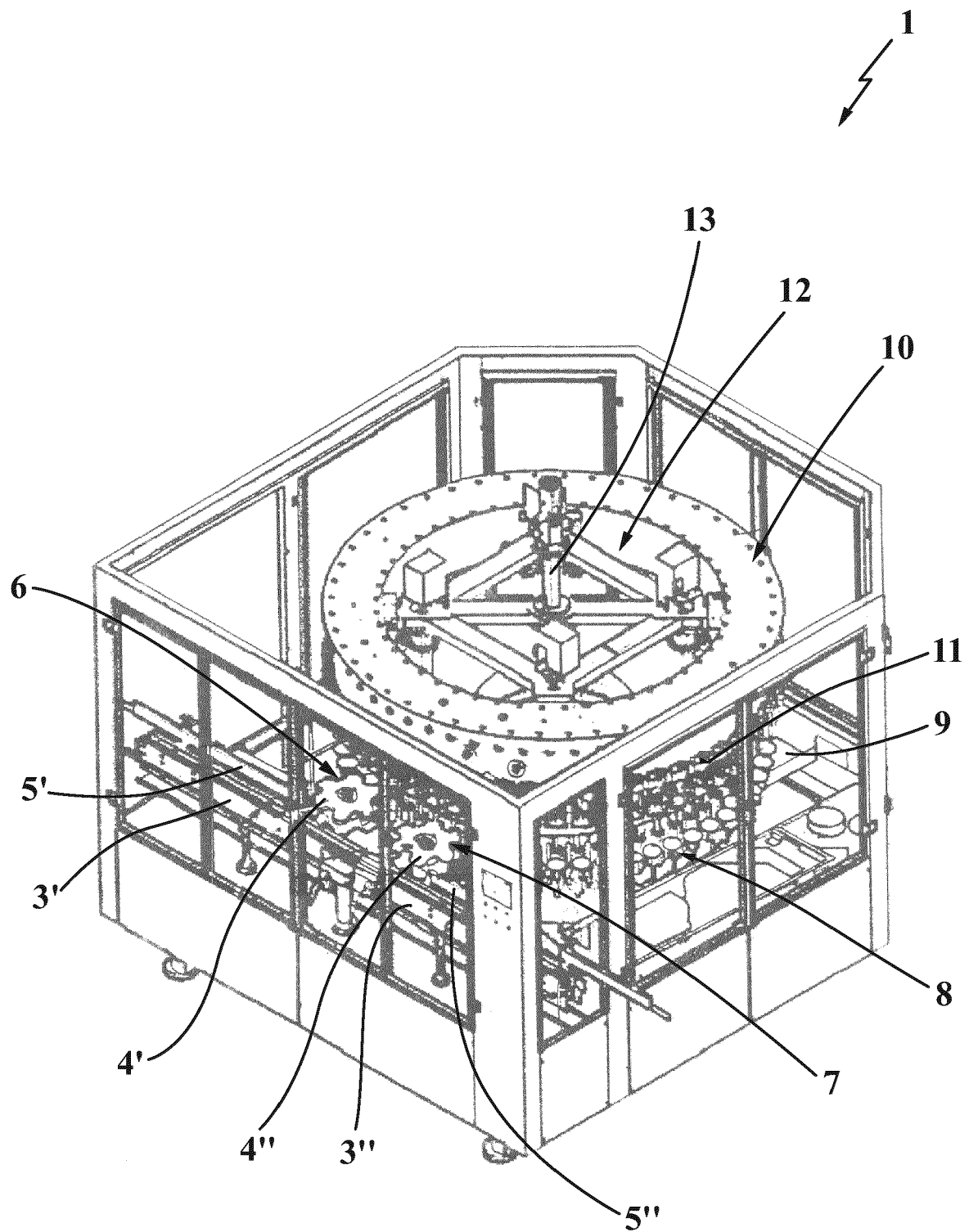


Fig. 1

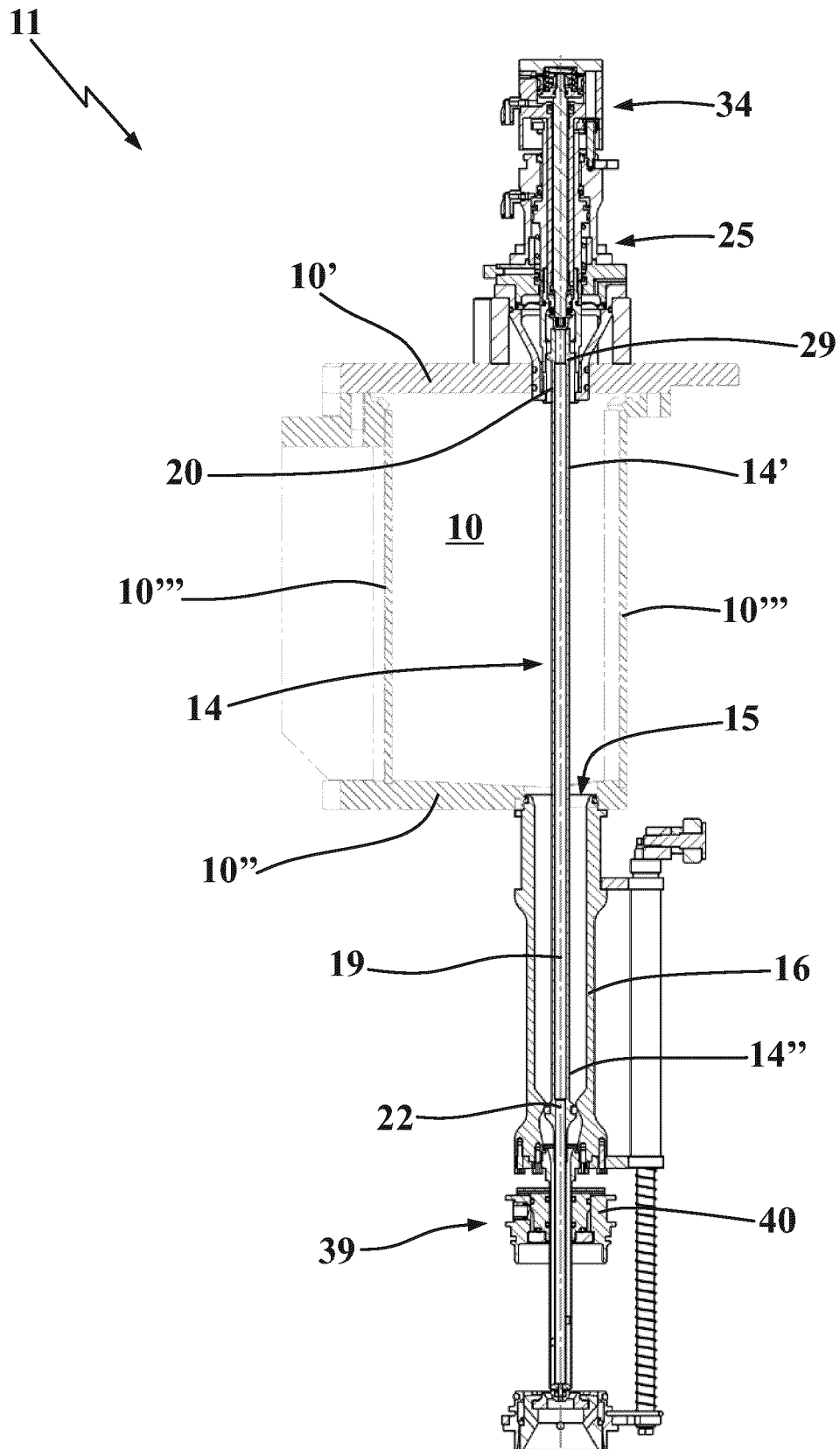


Fig. 2

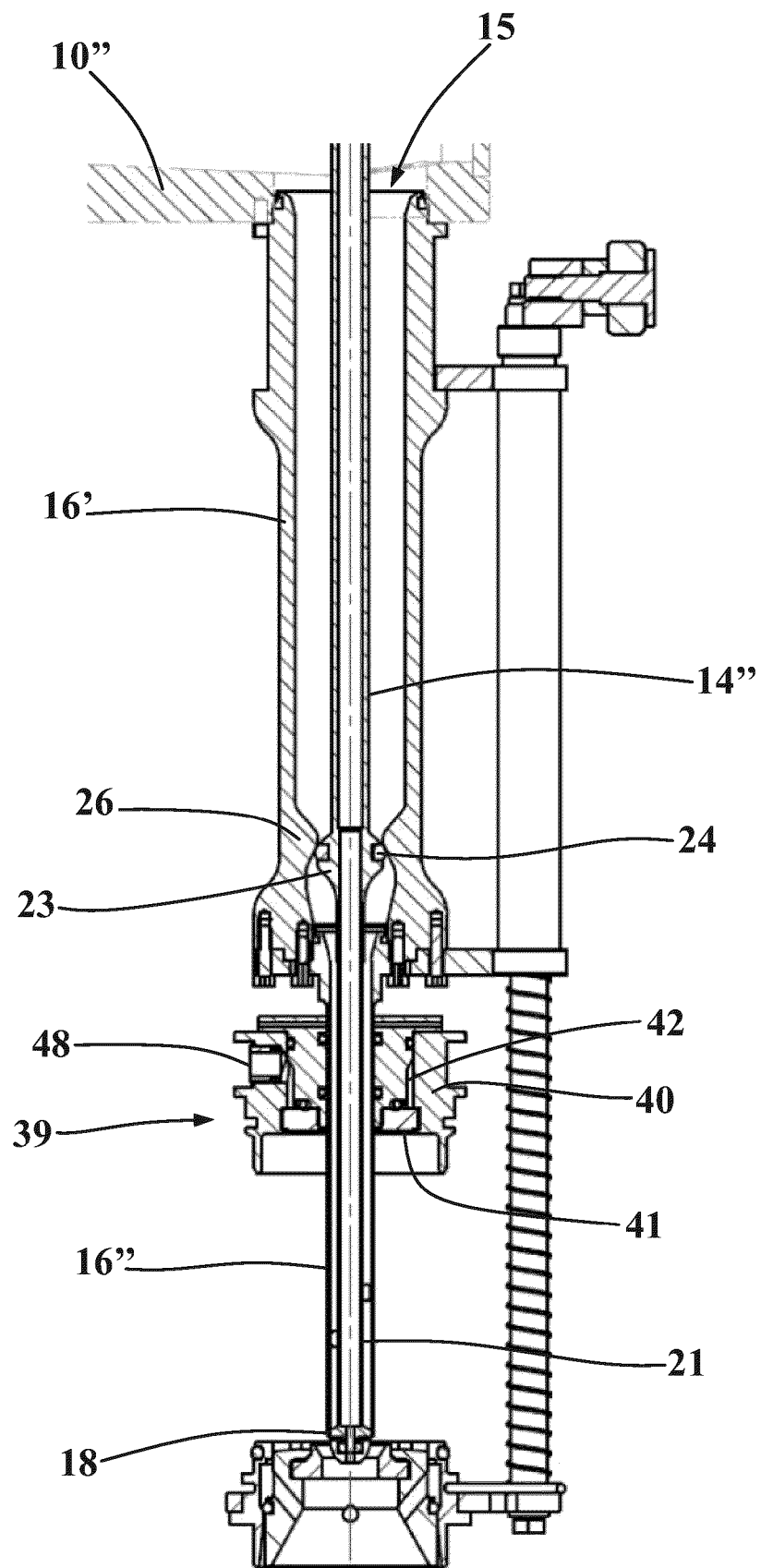


Fig. 3

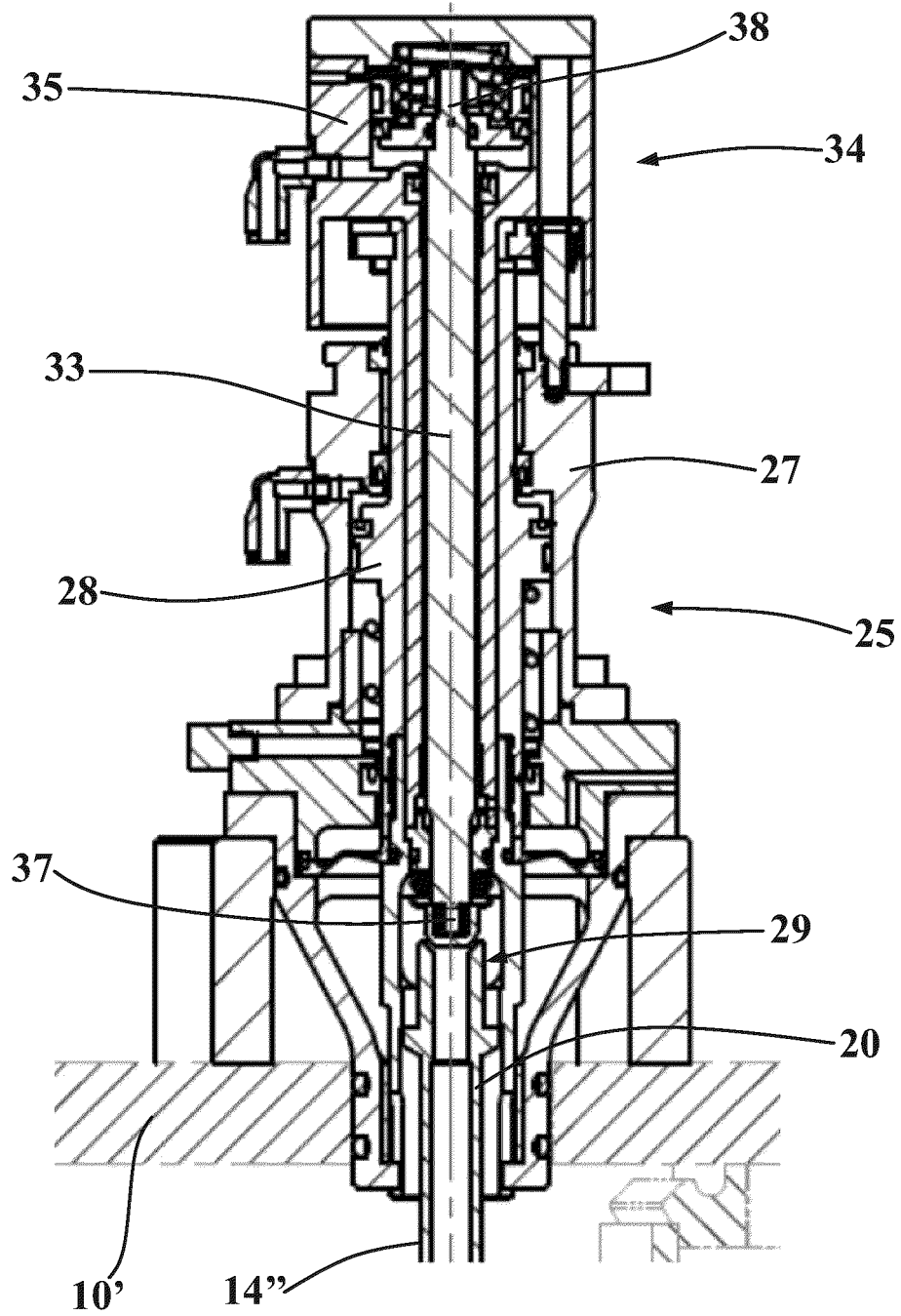


Fig. 4

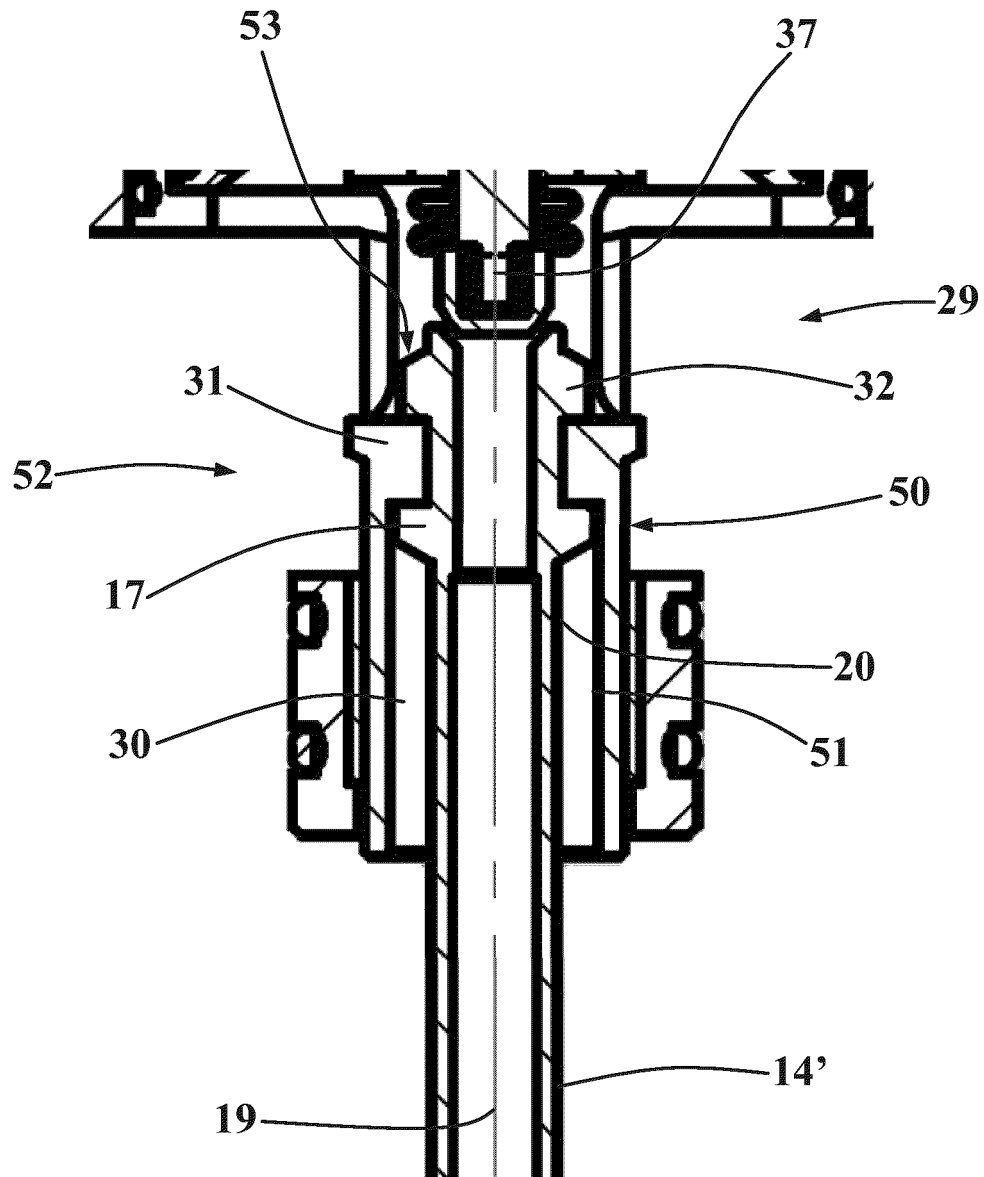


Fig. 5

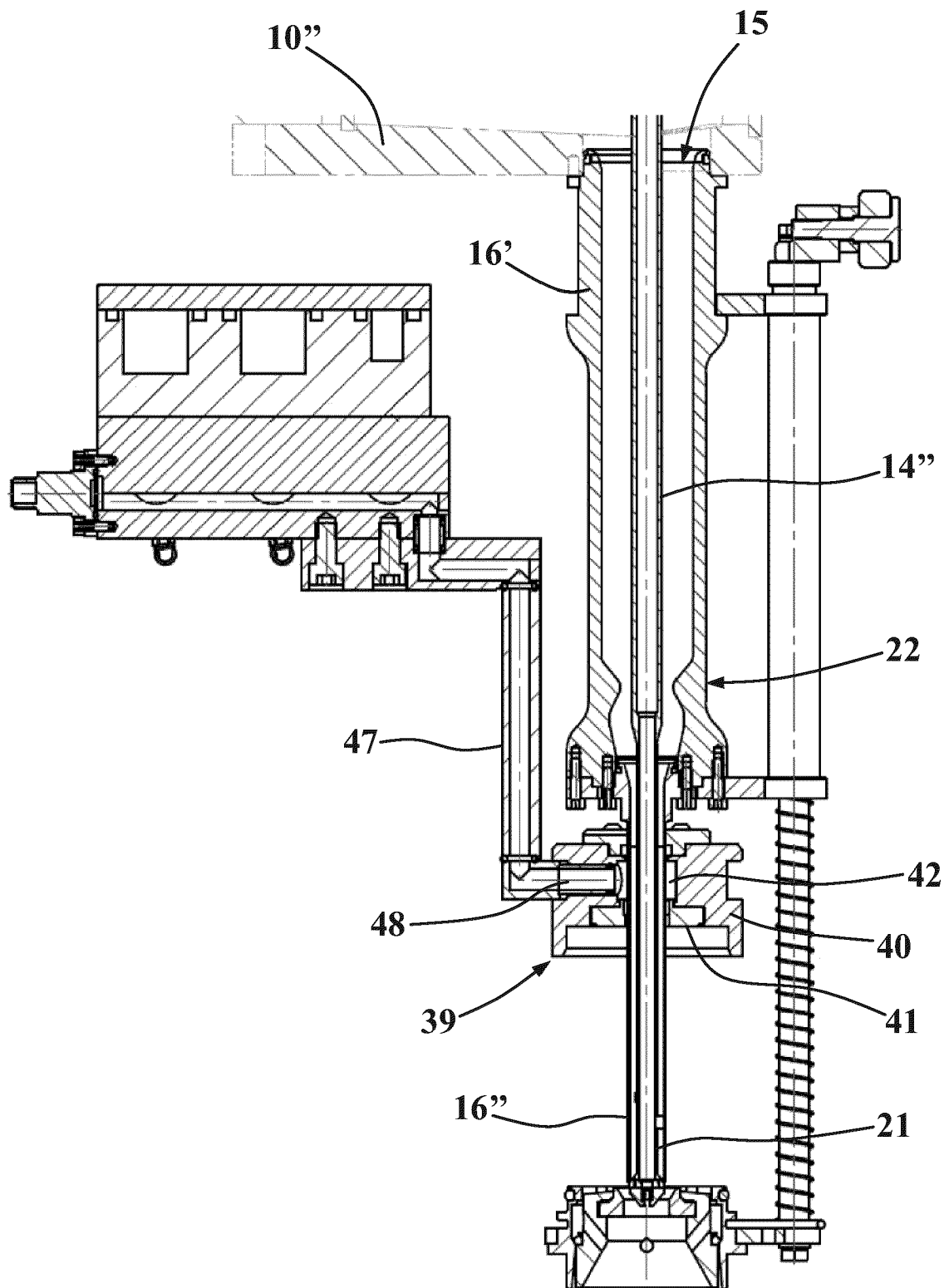


Fig. 6

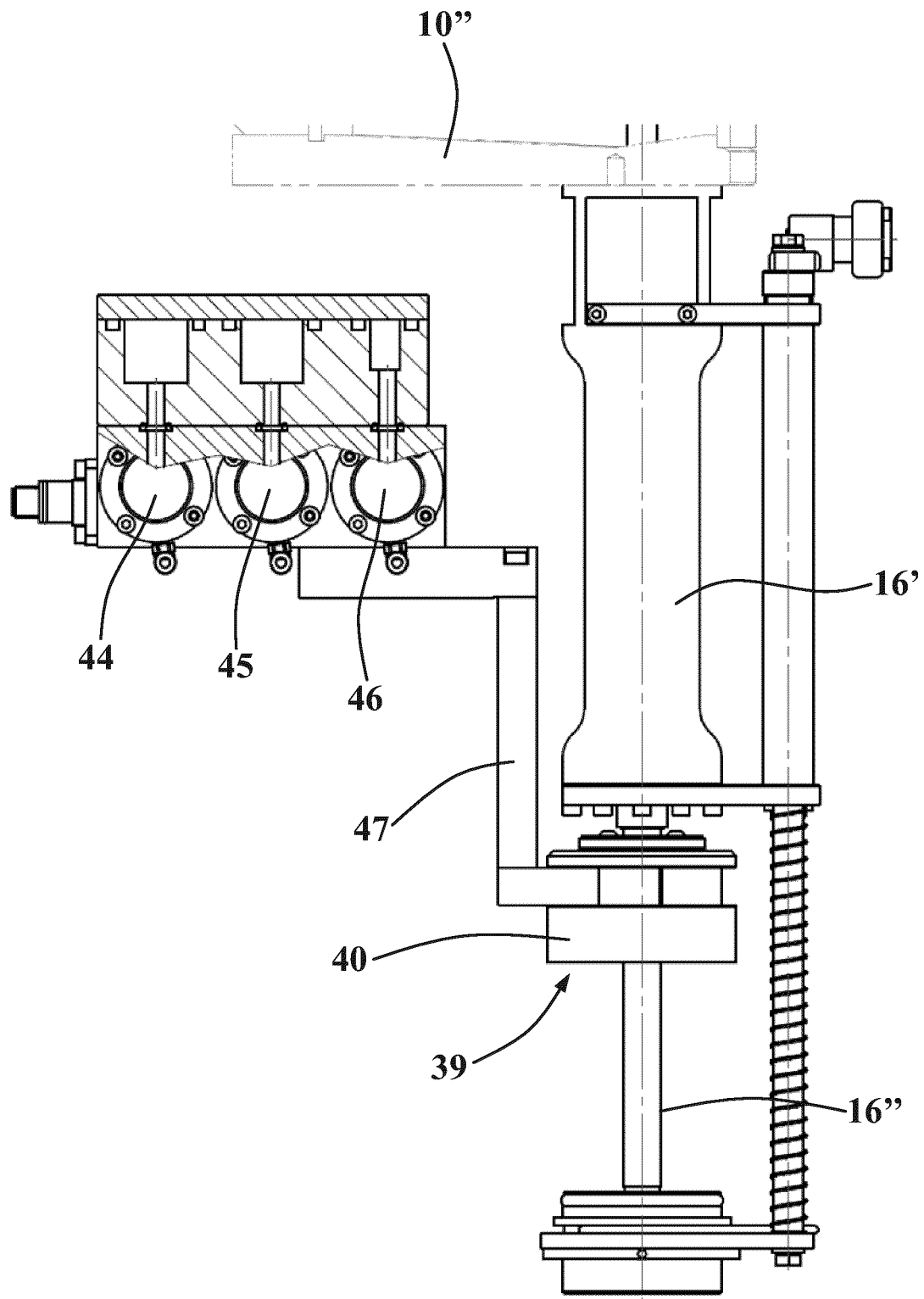


Fig. 7



EUROPEAN SEARCH REPORT

Application Number

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 287 107 A1 (GRUPPO BERTOLASO SPA [IT]) 23 February 2011 (2011-02-23) * paragraphs [0040], [0043], [0091]; figures 1, 3-5 *	1-11	INV. B67C3/26
A	DE 203 19 789 U1 (KHS MASCH & ANLAGENBAU AG [DE]) 26 February 2004 (2004-02-26) * paragraph [0014]; figure 1 *	1-11	
A	EP 2 236 454 A1 (GRUPPO BERTOLASO SPA [IT]) 6 October 2010 (2010-10-06) * paragraphs [0041], [0042], [0046]; figure 4 *	1-11	
			TECHNICAL FIELDS SEARCHED (IPC)
			B67C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 August 2022	Examiner Luepke, Erik
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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ON EUROPEAN PATENT APPLICATION NO.**

EP 22 16 2044

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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19-08-2022

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2287107 A1	23-02-2011	EP 2287107 A1	23-02-2011
		IT 1395203 B1	05-09-2012

DE 20319789 U1	26-02-2004	DE 20319789 U1	26-02-2004
		EP 1544156 A1	22-06-2005
		PT 1544156 E	31-03-2011
		RU 2365538 C2	27-08-2009
		US 2005150571 A1	14-07-2005

EP 2236454 A1	06-10-2010	EP 2236454 A1	06-10-2010
		IT 1393727 B1	08-05-2012
		SI 2236454 T1	31-01-2014

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EPO FORM P0459

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2287107 A1 [0014]