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(54) Device for filling containers and relative method of washing

(57) There is described a filling device (10) for filling a container (4) with a pourable product, comprising: a first reservoir (2) which can be connected to a mouth (5) of the container (4), a filling valve (11) comprising a fixed body (12) and a plunger (13) sliding with respect to the fixed body (12); the plunger (13) is movable between an open position and a closed position; the plunger (13), in the open position, defines with the body (12) a port (30) through which the pourable product can flow; the port (30) is placed in fluid communication with the first reservoir (2), when the plunger (13) is arranged in the open position, and is open toward the mouth (5) of the container (4); The plunger (13), when arranged in the closed position, cooperates with seal with the fixed body (12), in such a manner as to prevent the pourable product from reaching the mouth (5); the filling device comprises a second reservoir (40) which can be filled with a wash fluid and connected to a cavity (20) of the fixed body (12). And a regulating valve (45) movable between a wash position in which it allows the wash fluid to reach the cavity (20), and a rest position.

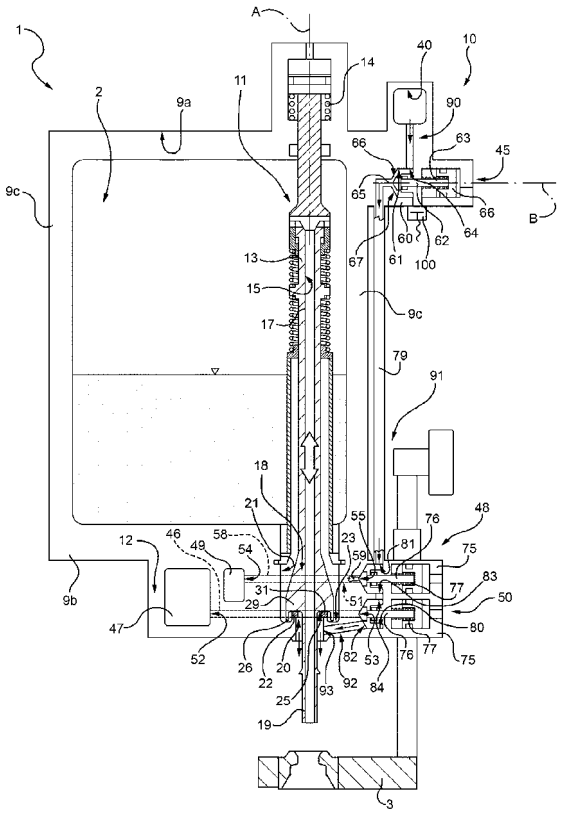

FIG. 1

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Description

[0001] The present invention relates to a filling device adapted to fill containers with a pourable product, for example of food type.

[0002] The present invention also relates to a method of washing said filling device.

[0003] There are known filling devices comprising a filling station fed, at the inlet, with empty containers and adapted to supply, at the outlet, containers filled with a pourable food product.

[0004] The filling station essentially comprises a carousel rotating about a rotation axis, a reservoir containing the pourable food product, and a plurality of filling valves supported by the carousel in radially external position with respect to the rotation axis of this carousel.

[0005] In greater detail, the carousel is provided with a plurality of elements to support the containers provided to arrange mouths of these containers in a position lower than the respective valves and to move the containers along a circular arc trajectory around said rotation axis together with the respective valves.

[0006] Each filling valve essentially comprises a fixed body connected to the carousel and a plunger sliding with respect to the fixed body between a open position and a closed position.

[0007] In greater detail, when the plunger is arranged in the open position, it defines with the fixed body a through port. The pourable product flows, in this way, from the reservoir to a mouth for filling the container, passing through the through port.

[0008] Differently, when the plunger is arranged in the closed position, it cooperates with seal with an abutment surface defined by the fixed body, preventing the pourable product from flowing from the reservoir toward the mouth of the container.

[0009] Filling machines of the type described above are commonly used to fill containers with food products, such as beer or water.

[0010] When these are made of a fragile material, such as glass, the containers can explode during the step to fill them.

[0011] More precisely, explosion can occur while filling containers with carbonated products. In fact, in this case the container is subjected to a pressurization process.

[0012] In this circumstance, it is necessary to eliminate any fragments of glass which could collect in the body of the filling valve, in order to prevent these fragments of glass from being entrained by the product inside a new container, during a subsequent filling of this new container.

[0013] In order to eliminate the aforesaid fragments of glass, the filling valves involved by explosion of containers partially fill new containers with the pourable product.

[0014] These new containers are subsequently discarded.

[0015] However, the container subsequently discarded and the pourable product with which it is filled are inevitably lost.

[0016] In the sector, there is the need to wash the filling valves involved by explosion, without causing a waste of pourable product and containers.

[0017] The filling stations of prior art machines also comprise:

- a vacuum source which can be placed selectively in fluid communication with the mouth of the container, in such a manner as to depressurize the containers before they are filled; and
- a further reservoir of a fluid at atmospheric pressure which can be placed selectively in fluid communication with the mouth of the container, in such a manner as to reduce the pressure inside the containers after they have been filled.

[0018] The Applicant has observed that, in the case of explosion of the container, this vacuum source sucks up the fragments of glass into a duct which connects the further reservoir to a regulating valve.

[0019] Consequently, in the sector there is the need to ensure that this duct is not obstructed by fragments of glass, in the case of explosion of the container.

[0020] The object of the present invention is to produce a filling device, which allows at least one of the aforesaid needs to be satisfied in a simple and inexpensive manner.

[0021] The aforesaid object is achieved by the present invention, as it relates to a filling device, as defined by claim 1.

[0022] The present invention also relates to a method for washing a filling device, as defined by claim 12.

[0023] For better understanding of the present invention, there are described hereunder two preferred embodiments, by way of non limiting example and with reference to the accompanying drawings, wherein Figs. 1 and 2 show a filling device produced according to the present invention in two different operating positions.

[0024] With reference to Figs. 1 and 2, the numeral 1 indicates a filling machine limited to a station for filling containers 4 with a pourable food product.

[0025] In greater detail, the filling station is supplied with empty containers 4 and fills the containers 4 with the pourable product, in particular a carbonated food product, such as beer or mineral water.

[0026] The container 4 is produced in a material susceptible to explode, such as glass. More in particular, explosion is caused by pressurization of the container 4.

[0027] The filling station comprises:

- a reservoir 2 containing a food product;
- a carousel rotating about a vertical axis and carrying in a cantilever fashion a plurality of holding elements 3 (only one of which is shown), such as arms, of respecting containers 4; and
- a plurality of filling devices 10 adapted to fill respective containers 4 with the pourable food product and driven in rotation by the carousel.

[0028] The reservoir 2 extends annularly around the rotation axis of the carousel and is delimited by a pair of upper and lower walls 9a, 9b and a pair of cylindrical walls 9c coaxial and interposed axially between the walls 9a, 9b.

[0029] In particular, each container 4 comprises:

- a mouth 5 adapted to allow filling of the container 4 by means of the filling machine and subsequent pouring of the food product from this container 4;
- a bottom wall (not shown) opposite the mouth 5; and
- a portion of neck 6 supported by a relative holding element 3.

[0030] In the description that follows reference will be made, for the sake of simplicity, to a single device 10 and to the relative container 4, as the devices 10 are identical to one another.

[0031] The device 10 comprises a filling valve 11 passing through the reservoir 2 and formed essentially by:

- a body 12 secured in a manner not shown to the wall 9b of the reservoir 2; and
- a plunger 13 sliding with respect to the body 12 along an axis A parallel to the rotation axis of the carousel and connected elastically to the body 12 by means of a spring 14, in the specific case illustrated a helical spring with axis A.

[0032] In particular, the body 12 comprises, coaxial to the axis A:

- a bore 21, placed in fluid communication in a manner not shown with the reservoir 2;
- a bore 20 of smaller diameter to the bore 20 (???) (Dovrebbe essere "21") and open toward the mouth 5 of the container 4.

[0033] The body 12 also comprises, coaxial to the axis A:

- a ring 22 of intermediate diameter between the diameters of the bores 20, 21, projecting inside the bore 21 and delimiting, in radially external position, the bore 20; and
- a disk-shaped surface 23, orthogonal to the axis A and interposed between the edge of the bore 20 and the ring 22.

[0034] The plunger 13 slides along the axis A with respect to the body 12 between:

- an open position, in which it defines with the body 12 a through port 30 placed in fluid communication with the reservoir 2 and the mouth 5 of the container 4 (Fig. 2); and
- a closed position, in which it cooperates with fluid seal with the body 12 in such a manner as to prevent the pourable product from flowing from the reservoir 2 to the mouth 5.

[0035] The port 30 is in particular defined by a siphon, which is open when the plunger 13 is in the open position.

[0036] Moreover, passing coaxially through the plunger 13 is a bore 15, provided to allow outflow of air from the container 4 during the filling step thereof. The bore 15 is open toward the mouth 5 and is connected to a reservoir (not shown) for collection of the air flowing out of this container 4.

[0037] In detail, the plunger 13 comprises:

- an end portion 17, arranged in use in the upper part, and to which the spring 14 is secured;
- an end portion 18, arranged in use in the lower part, opposite the end portion 17, and adapted to be housed inside the container 4 during a filling step thereof; and
- an intermediate portion 19 adapted to abut against the body 12 and housed with radial clearance inside the bore 20.

[0038] More in detail, the end portion 18 is housed with radial clearance inside the bore 21 and projects in a cantilevered fashion from the body 12 inside the mouth 5 of the container 4 to be filled.

[0039] The intermediate portion 19 comprises a truncated cone shaped element 29 tapered toward the end portion 17.

[0040] The element 29 is delimited, on the side of the end portion 18, by a surface 25 configured as a circular crown and orthogonal to the axis A, and by a ring 26 with axis A.

[0041] In detail, the ring 26 projects axially from the surface 25 toward the end portion 18 and is radially spaced from the intermediate portion 17.

[0042] More in particular, the ring 26 projects from a radially external circumferential edge of the surface 25.

[0043] When the filling valve 11 is in the open position, the ring 26 is axially spaced from the surface 23 and the surface 25 is axially spaced from the ring 22 (Fig. 2).

[0044] In this circumstance, the bore 20, and consequently the reservoir 2, are in fluid communication with the bore 21 by means of the port 30.

[0045] Differently, when the filling valve is in closed position, the ring 26 cooperates, with fluid seal, with the surface 23 and the surface 25 cooperates, by means of interposing of a gasket 31, with fluid seal, with the ring 22 (Fig. 1).

[0046] In particular, the gasket 31 is annular and is carried by the ring 22.

[0047] Advantageously, the device 10 comprises:

- a reservoir 40 filled with a wash fluid and placed selectively in fluid communication with the bore 20; and
- a regulating valve 45 movable between an open position in which it allows the wash fluid to reach the

bore 20, and a closed position in which it prevents the wash fluid from reaching the bore 20.

[0048] In particular, the filling station comprises a single reservoir 40, which is connected selectively to the bores 20 of all the devices 10.

[0049] In the specific case illustrated, the wash fluid is pressurized water.

[0050] In particular, the regulating valve 45 is arranged below the wall 9a of the reservoir 2 and, more precisely, interposed between the wall 9a and the bore 20.

[0051] Moreover, the reservoir 40 is arranged above the reservoir 2.

[0052] The regulating valve 45 comprises:

- a body 60 secured to the wall 9c, elongated along an axis B orthogonal to the axis A, and defining a cavity 61;
- a stem 62 movable along the axis B between the open position and closed position; and
- a spring 63, in the specific case illustrated of helical type, interposed between (???) (manca "tra" (between) nell'italiano) a surface 67 of the body 60 and the stem 62.

[0053] The body 60 also comprises:

- an opening 64, which places the reservoir 20 and the cavity 61 in fluid communication;
- an opening 65 housed inside the cavity 61 and delimited by a truncated cone shape abutment surface 67 with axis B.

[0054] In detail, when the regulating valve 45 is in the open position, the stem 62 is distanced along the axis B by the surface 67. In this way, a port 66 remains open between the openings 64, 65.

[0055] Differently, when the regulating valve 45 is in closed position, a truncated cone shaped end of the stem 62 cooperates with fluid seal with the surface 65, fluidly isolating the openings 62, 64.

[0056] The spring 63 loads the stem 62 toward the closed position and the stem 62 is movable, against the action of the spring 63, from the closed position toward the open position by means of a drive of pneumatic type.

[0057] The filling station also comprises:

- a vacuum source 47; and
- a reservoir 49 filled with a fluid at ambient pressure.

[0058] The device 10 also comprises:

- a regulating valve 50 housed in the body 12, and movable between an open position in which it places the vacuum source 47 and the bore 20 in fluid communication, and a closed position in which it prevents fluid communication between the vacuum source 47 and the bore 20; and
- a regulating valve 48 housed in the body 12 and movable between an open position in which it places the reservoir 49 and the bore 20 in communication, and a closed position in which it prevents fluid communication between the reservoir 49 and the bore 20.

[0059] The body 12 also defines a cavity 80 for housing the regulating valves 48, 50.

[0060] The cavity 80 also comprises a pair of openings 81, 82, opposite and in fluid communication with each other.

[0061] More in detail, the device 10 comprises a duct 46 having an end mouth 52 open inside the reservoir 49 and a mouth 53, opposite the mouth 52.

[0062] Similarly, the device 10 comprises a duct 51 having an end mouth 54 open inside the vacuum source 47 and a mouth 55, opposite the mouth 54.

[0063] The duct 51 comprises, in particular, a segment 58 of greater diameter and a segment 59 of lesser diameter.

[0064] The segment 58 defines the mouth 54, the segment 59 defines the mouth 55 and the segment 58 is interposed between the mouth 54 and the segment 59.

[0065] The regulating valve 48 (50) essentially comprises:

- a fixed body 75 defining the opening 81 (82) and connected in a manner not shown to the body 12;
- a stem 76 sliding orthogonally to the axis A between a closed position in which it abuts with fluid seal against the mouth 55 (53), and an open position in which it is spaced from the mouth 55 (53); and
- a spring 77 interposed between the fixed body 75 and the stem 76 and adapted to load the stem 76 toward the closed position.

[0066] The fixed body 75 of the regulating valve 48 also defines an opening 83 opposite the opening 81 and in fluid communication with this opening 81.

[0067] The fixed body 75 of the regulating valve 50 also defines an opening 84 opposite the opening 82 and in fluid communication with the opening 83.

[0068] In other words, when the regulating valve 45 is in the open position, the wash fluid passes sequentially through the openings 81, 83, 84, 82.

[0069] The device 10 also comprises a duct 79 extending between the reservoir 40 and the bore 20.

[0070] In greater detail, the duct 79 comprises:

- a segment 90 extending between the reservoir 40 and the opening 64;
- a segment 91 extending between the opening 65 and the opening 81; and
- a segment 92 inclined with respect to the axis A and extending between the opening 82 and the bore 20.

[0071] In detail, the segment 92 comprises an end 93, opposite the segment 91, and open inside the bore 20,

downstream of the gasket 31 and of the port 30.

[0072] The device 10 also comprises a pressure measuring device 100 adapted to detect the difference in pressure between the inside of the container 4 and the external environment.

[0073] In particular, the pressure measuring device 100 detects explosion of the container 4 when this difference in pressure is below a given threshold value.

[0074] Differently, when this difference is above the threshold value, the pressure measuring device 100 detects that the container 4 has not exploded.

[0075] Operation of the device 10, is shown starting from a step to fill the container 4 (Fig. 1).

[0076] In this situation, the regulating valve 45 is in the closed position and the filling valve 11 is in the open position.

[0077] The ring 26 of the plunger 13 is spaced from the surface 23 parallel to the axis A and the surface 25 is spaced from the ring 22 parallel to the axis A.

[0078] In this way, the port 30, through which the pourable product can flow from the reservoir 2 to the bore 20 and, from this latter, inside the mouth 5 of the container 4, remains open.

[0079] At the end of the filling step, the valve 11 is moved into the closed position (Fig. 1), in which the ring 26 of the plunger 13 cooperates with fluid seal with the surface 23 and the surface 25 cooperates with the gasket 31.

[0080] In the case in which it is necessary to depressurized the container 4 after filling, the regulating valve 48 is moved to the open position in such a manner as to place the mouth 5 in communication with the reservoir 49.

[0081] At the end of the depressurization step, the regulating valve 48 is moved to the closed position.

[0082] In the case in which it is necessary to create the vacuum before filling the container 4, the regulating valve 50 is moved to the open position so as to place the mouth 5 in communication with the reservoir 47.

[0083] If the pressure measuring device 100 detects explosion of the container 4, the device 10 is washed by means of jets of water delivered externally to the device 10.

[0084] Simultaneously, the regulating valve 45 is moved to the open position.

[0085] In this way, the wash fluid flows from the reservoir 40 to the bore 20, passing in succession through the segments 90, 91, 92 and the bore 20.

[0086] More in detail, while the wash fluid flows through the segment 92, it passes in sequence through the openings 81, 83, 84, 82 and removes any fragments of glass trapped in the bodies 75 of the regulating valves 48, 50. In this way, the wash fluid prevents any fragments of glass sucked up by the vacuum source 47 inside the body 75 of the regulating valve 48 from subsequently remaining trapped inside the segment 59 of the duct 51.

[0087] Moreover, the wash fluid removes any fragments of glass remained trapped in the bore 20, preventing them from being introduced into the mouth 5 of a new container 4 during a subsequent step to fill this new container 4.

[0088] After the wash step has finished, the regulating valve 45 is moved to the closed position.

[0089] Subsequently, a new container 4 can be filled.

[0090] From examining the characteristics of the device 10 and of the method of washing produced according to the present invention, the advantages it achieves are evident.

[0091] In particular, the device 10 comprises a regulating valve 45 connected to the reservoir 40 filled with a wash fluid.

[0092] In this way, when explosion of the container 4 is detected, the regulating valve 45 is moved to the open position and the wash liquid, through the duct 79, reaches the bore 20.

[0093] The wash liquid can thus remove any fragments of glass from the bore, thereby preventing these fragments from being introduced into the container 4 during the subsequent filling step.

[0094] It is important to point out that the device 10 and the method of washing according to the present invention do not require any container 4 to be discarded in order to ensure that there are no fragments of glass inside the subsequent containers 4.

[0095] Moreover, the wash liquid passes through the fixed bodies 75 of the regulating valves 48, 50.

[0096] In this way, the wash liquid prevents fragments of glass sucked up by the vacuum source 47 from remaining inside these fixed bodies 75. In particular, the wash liquid prevents these fragments of glass from obstructing the segment 59 of the duct 51, preventing depressurization of the container 4, after filling of this container 4.

[0097] The pressure measuring device 100 is particularly advantageous, as it allows explosion of the container 4 to be detected even when this container 4 remains in contact with the holding element 3 after exploding.

[0098] Finally, it is clear that the device 10 and the method of washing described herein can be subject to modifications and variants which do not depart from the scope of protection of the claims.

Claims

1. A filling device (10) for filling a container (4) with a pourable product, comprising:

   - a first reservoir (2) which can be filled with said pourable product and placed selectively in fluid communication with a first mouth (5) of said container (4);
   - a filling valve (11) comprising, in turn, a fixed body (12) and a first plunger (13) sliding with respect to said fixed body (12);
   said first plunger (13) being movable between a first open position and a first closed position;

said first plunger (13), when arranged in said first open position, defining with said body (12) a port (30) through which said pourable product can flow and which can be placed in fluid communication with said first mouth (5);
said port (30) being placed in fluid communication with said first reservoir (2), when said plunger (13) is arranged in said first open position, and being open, in use, toward said first mouth (5) of said container (4);
said plunger (13), when arranged in said first closed position, cooperating with seal with said fixed body (12), in such a manner as to prevent said pourable product from reaching said first mouth (5);

characterised in that it comprises:

- a second reservoir (40) which can be filled with a wash fluid and placed selectively in fluid communication with a cavity (20) of said fixed body (12) open toward said first mouth (5) of said container (4); and
- a regulating valve (45) movable selectively between a second open position in which it allows said wash fluid to reach said cavity (20), and a second closed position in which it prevents said wash fluid from reaching said cavity (20).

2. The device according to claim 1, **characterised in that** said first reservoir (2) is arranged, in use, below said second reservoir (40).

3. The device according to claim 1 or 2, **characterised in that** it comprises a plate (9a) delimiting at the top, in use, said first reservoir (2) and **in that** said regulating valve (45) is interposed between said plate (9a) and said cavity (20).

4. The device according to any one of the preceding claims, **characterised in that** said regulating valve (45) comprises:

- a second body (60);
- a second plunger (62) movable between a third open position in which it defines a second port (66) with said second body (60), and a third closed position in which it cooperates with seal with said second body (60) and prevents said wash fluid from reaching said cavity (20); and
- elastic means (63) adapted to load said second plunger (62) toward said second closed position.

5. The device according to claim 4, **characterised in that** said second plunger (62) is movable from said third closed position to said third open position, by means of a pneumatic drive.

6. The device according to any one of the preceding claims, **characterised in that** it comprises a fluid line (79) adapted to place in fluid communication said second reservoir (40) and said cavity (20) and along which said regulating valve (45) is interposed.

7. The device according to claim 6, **characterised in that** it comprises at least one between:

- a first duct (46) connected to a vacuum source (47) and having a second mouth (63) which can be placed selectively in fluid communication with said cavity (20); and
- a second duct (51) connected to a third reservoir (49) comprising a fluid and having a third mouth (55) which can be placed selectively in fluid communication with said cavity (20), during a depressurization step of said container (4) subsequent to filling of this container (4);
and at least one between:
- a second regulating valve (50) adapted to place selectively in fluid communication said cavity (20) and said mouth (53); and
- a third regulating valve (48) adapted to place selectively in fluid communication said cavity (20) and said third mouth (55);

said second and third mouth (53, 55) being interposed along said fluid line (79).

8. The device according to claim 7, **characterised in that** said first regulating valve (45) is interposed along said fluid line (79) between said second reservoir (40) and said second and/or third regulating valve (48, 50).

9. The device according to any one of claims 6 to 8, **characterised in that** said fluid line (79) comprises an end segment (92) having an end (93) open in said cavity (20) in a position arranged downstream of said port (30), with reference to the direction of feed of said pourable product from said first reservoir (2) toward said first mouth (5).

10. The device according to any one of claims 6 to 9, **characterised in that** said fixed body (12) comprises a gasket (31) adapted to provide a seal against said fixed body (12) when said first plunger (13) is in the closed position; said end (93) being open inside said cavity (20) in a position arranged downstream of said gasket (31), with reference to said direction of feed of said pourable product.

11. The device according to any one of the preceding claims, **characterised in that** it comprises a device (100) to detect explosion of said container (4); said detection device (100) comprising a pressure measuring device (100) adapted to detect the difference

in pressure between the inside of said container (4) and the external environment.

12. A method of washing a filling device (10) adapted to fill a container (4) destined to be filled with a pourable product; said device (10) comprising:

- a first reservoir (2) which can be filled with said pourable product and placed selectively in communication with a first mouth (5) of said container (4);
- a filling valve (11) comprising, in turn, a fixed body (12) and a plunger (13) sliding with respect to said fixed body (12);

said plunger (13) being movable between an open position in which it defines with said body (12) a port (30) through which said pourable product can flow and which can be placed in fluid communication with said first mouth (5), and a closed position in which it cooperates with seal with said fixed body (12), so as to obstruct said port (30) and prevent said pourable product from reaching said first mouth (5); said method comprising the step of detecting breakage of said container (4);
said method being **characterised in that** it comprises the step of placing in fluid communication a second reservoir (40) filled with a wash fluid with a cavity (20) of said fixed body (12) facing said first mouth (5) and placed in fluid communication with said port (30).

13. The method according to claim 12, **characterised in that** it comprises the step of directing wash jets onto said fixed body (12).

14. The method according to any one of claims 12 or 13, **characterised in that** said step of placing in communication comprises the step of making said wash fluid flow through at least one between:

- a second mouth (53) of a first duct (46) connected to a vacuum source (47); said first duct (46) which can be placed selectively in fluid communication with said cavity (20) by means of a second regulating valve (50); and
- a second mouth (55) of a second duct (51) connected to a third low pressure reservoir (49); said second duct (51) which can be placed selectively in fluid communication with said cavity (20) by means of a third regulating valve (48).

15. The method according to any one of claims 12 to 14, **characterised in that** said step of detecting comprises the step of measuring the pressure difference between the inside of said container (4) and the outside and of detecting explosion, when said pressure difference is below a threshold value.

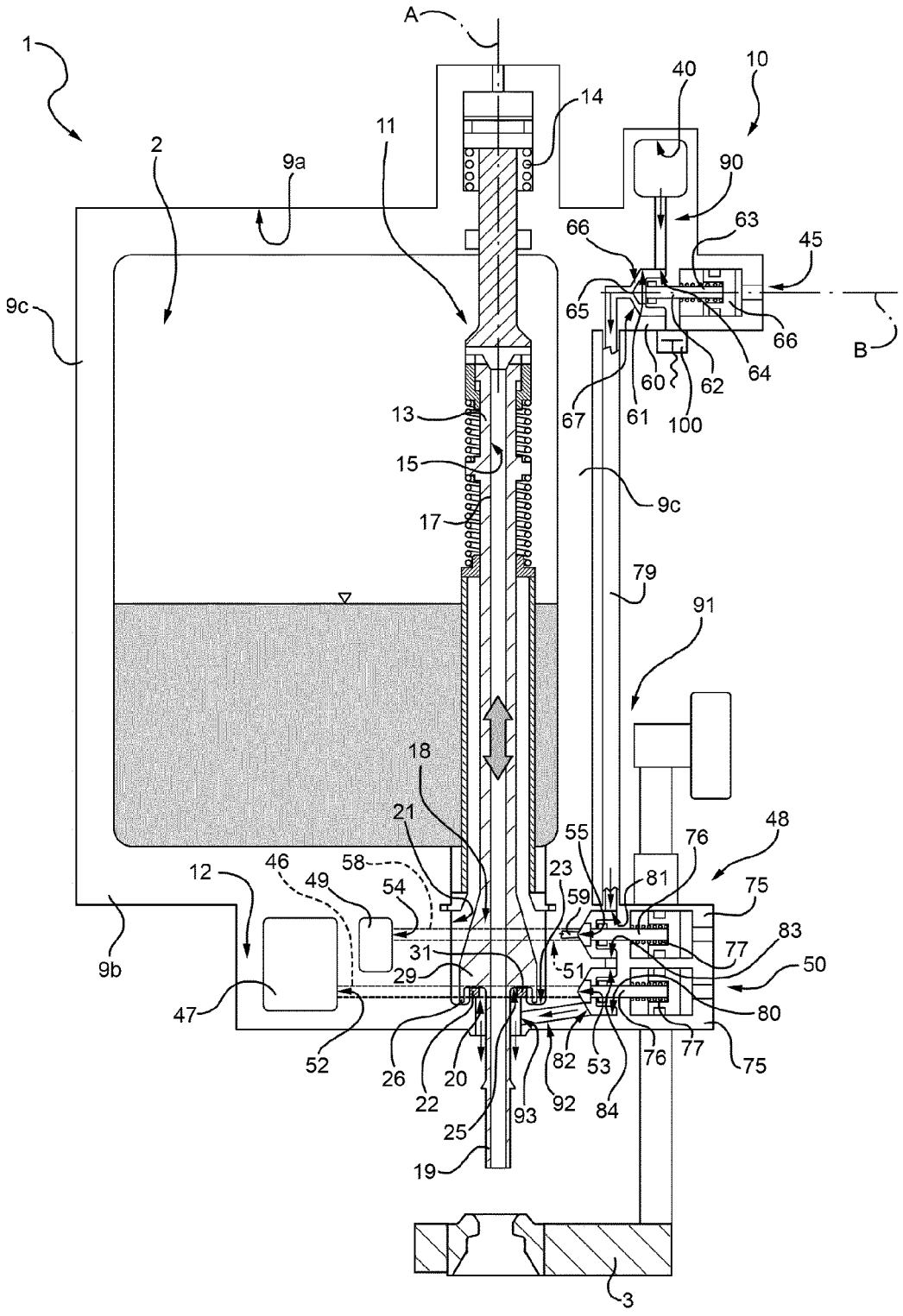
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FIG. 1

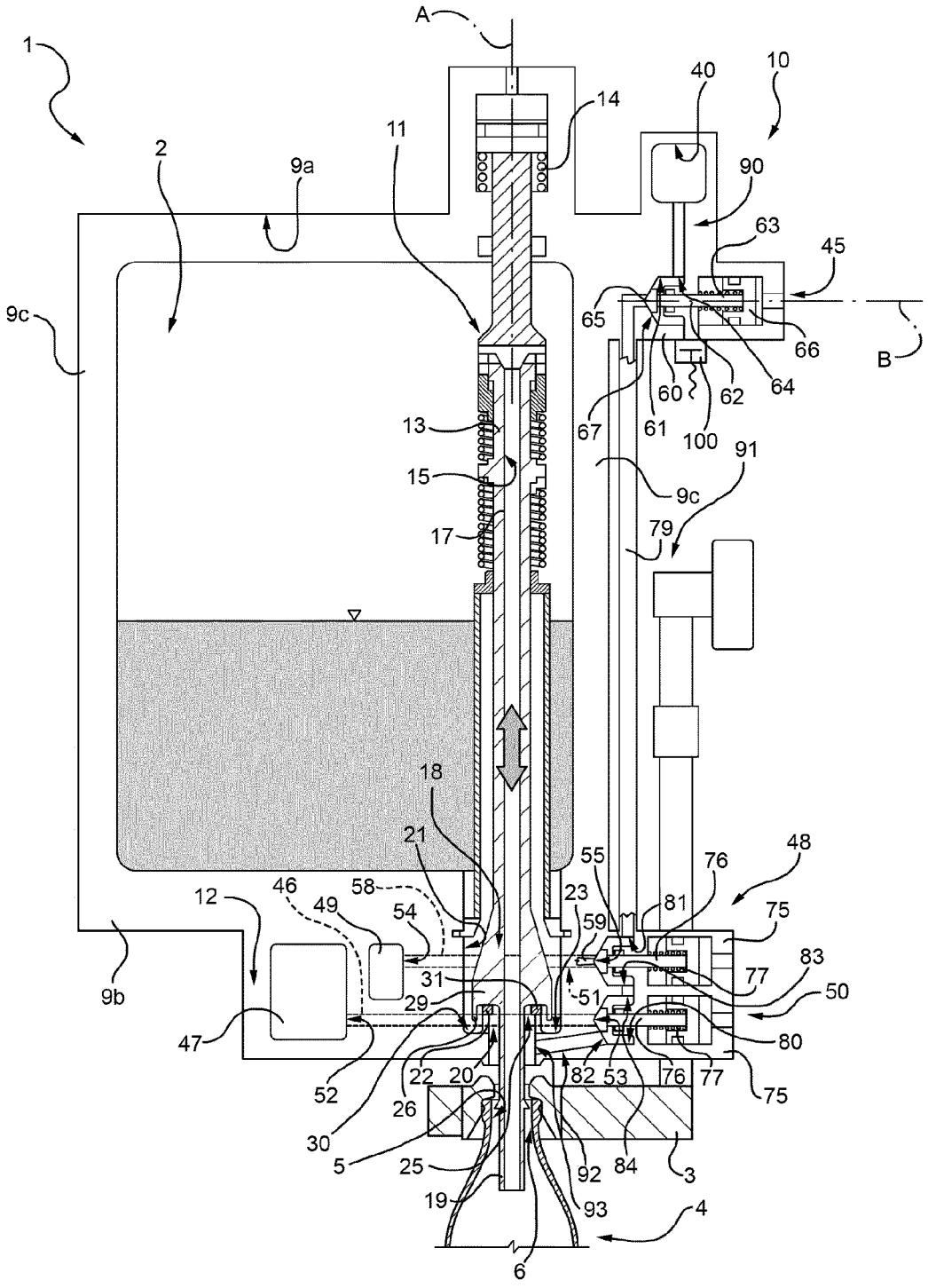
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FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 12 17 7186

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 298 039 A (KNABE UWE ET AL) 3 November 1981 (1981-11-03) * the whole document *	1-7,9, 12-14	INV. B67C3/00
A	DE 42 03 786 A1 (SEITZ ENZINGER NOLL MASCH [DE]) 12 August 1993 (1993-08-12) * abstract; figures 1-5 *	1,12	
A	US 4 136 719 A (KRONSEDER HERMANN [DE] ET AL) 30 January 1979 (1979-01-30) * abstract; figures 1,2 *	1,12	

TECHNICAL FIELDS SEARCHED (IPC)

B67C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 October 2012	Wartenhorst, Frank

CATEGORY OF CITED DOCUMENTS

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