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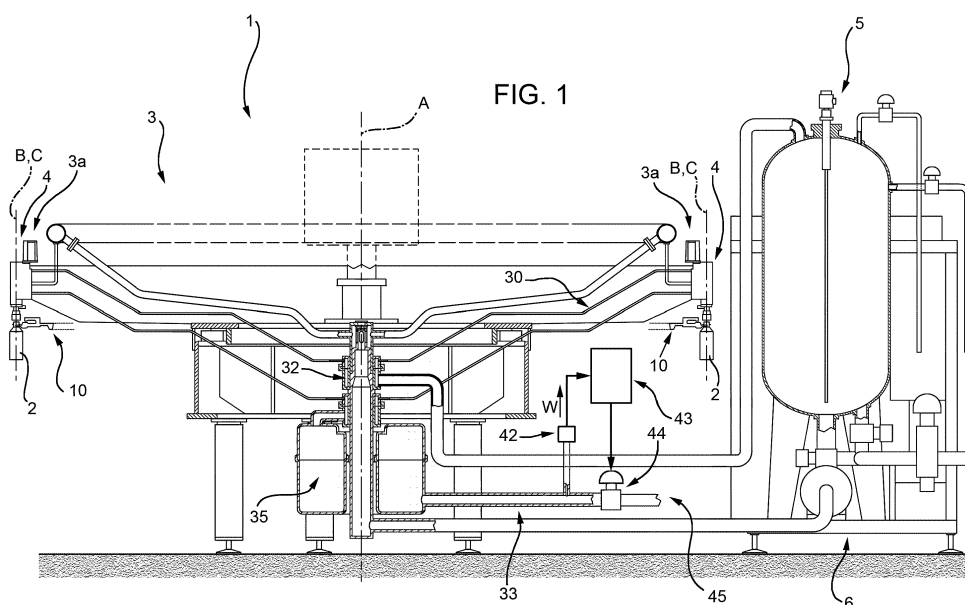
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(54) **FILLING MACHINE AND METHOD FOR FILLING RECEPTACLES WITH A POURABLE PRODUCT UNDER PRESSURE**

(57) The invention relates to a filling machine (1) comprising: at least one filling valve (8) configured to be connected to a respective receptacle (2) to be filled and selectively available between an opening configuration, in which the filling valve (8) feeds a pourable product to the receptacle (2) at a pressure higher than the atmospheric pressure, and a closing configuration in which the filling valve (8) interrupts the flow of the pourable product to the receptacle (2); and a decompression circuit (33) configured to depressurize the receptacle (2) after filling

and comprising in turn a decompression chamber (35), a decompression duct (34) connected both to the receptacle (2) and to the a decompression chamber (35), and a flow control valve (39) arranged in series on the decompression duct (34); the filling machine (1) further comprises pressure control means (42, 43, 44) configured to keep the pressure inside the decompression chamber (35) at a predetermined pressure value ( $P_0$ ) higher than the atmospheric pressure ( $P_a$ ).



## Description

**[0001]** The present invention relates to a filling machine configured for filling receptacles, in particular plastic receptacles, with a pourable product at a pressure higher than the atmospheric pressure, for example a pourable gasified product such as sparkling water, soft drinks or carbonated beverages, etc.

**[0002]** The present invention relates, furthermore, to a method for filling receptacles with a pourable product that can be pressurized at a pressure higher than the atmospheric pressure.

**[0003]** Typically filling machines used in this field essentially comprise a carousel rotating around a vertical axis, a reservoir containing the pourable product, and a plurality of filling devices peripherally carried by the carousel, connected to the reservoir by means of respective circuits or ducts and conveyed by the carousel along a circular transfer path.

**[0004]** In particular, the carousel receives a succession of empty receptacles from an inlet star wheel and directs the full receptacles to an outlet star wheel.

**[0005]** Each filling device essentially comprises a support element suited to receive and hold a respective receptacle in a vertical position, and a filling valve configured to feed a predetermined volume of pourable product into said receptacle, while the filling device moves along the transfer path due to the rotary motion imparted by the carousel.

**[0006]** An example of a filling valve of a known type is described in EP-B-1411023 and essentially comprises:

- a vertical tubular body fixed to a peripheral portion of the carousel and defining a vertical flow channel for feeding the pourable product into a respective receptacle to be filled arranged under the tubular body;
- a shutter which engages the tubular body in a sliding manner and movable inside the channel so that it can allow or prevent the outflow of the pourable product towards the respective receptacle; and
- an actuator configured for moving the shutter inside the channel defined by the tubular body.

**[0007]** In particular, the tubular body has a longitudinal axis parallel to the carousel axis and terminates at a lower end with an axial discharge opening configured to come into contact, in use, with a top end mouth of the respective receptacle to be filled.

**[0008]** The channel of the tubular body comprises a tapered-section portion located above the discharge opening and narrowing in the direction of the discharge opening, up to a section of minimum diameter.

**[0009]** The shutter is movable inside the channel of the tubular body between a lower closing position, in which the shutter sealingly closes the tapered-section portion of the channel itself and interrupts the flow of the pourable product towards the discharge opening, and an upper

opening position in which the shutter delimits, together with the tapered-section portion, an annular passage communicating with the discharge opening.

**[0010]** The filling machine comprises, furthermore, two circuits formed at least partially inside the tubular body of each filling valve:

- a pressurization-exhaust circuit used both to pressurize each receptacle up to a predetermined pressure value higher than the atmospheric pressure value, before starting the actual filling of the receptacle itself, and to exhaust the gas contained in said receptacle, during the filling operation with the pourable product; and
- a decompression circuit configured to perform a decompression step of each receptacle at the end of the filling.

**[0011]** In particular, with reference to each filling device, the decompression circuit has an end opening communicating, in use, with the receptacle located under the respective filling valve, and another end opening opposite the first end and connected by means of an on/off type valve, to a decompression chamber, one only for the entire filling machine, kept at atmospheric pressure.

**[0012]** The decompression step of each receptacle is carried out by opening, for one or more pre-set time intervals, the respective on/off valve that controls the connection of the decompression circuit, and thus the internal environment of the respective filled receptacle, with the decompression chamber.

**[0013]** The duration of the above mentioned time intervals is set at the same value for each filling device of the filling machine, before the start of production, being part of the predetermined filling procedure.

**[0014]** It is known that the amount of foam contained in each receptacle at the end of the decompression step depends on the method and speed at which the filling operation is performed, as well as by the method and the decompression rate during the decompression step.

**[0015]** The need is felt in the industry to reduce the amount of foam contained in each receptacle at the completion of the filling operation, which could overflow from the receptacle itself when the latter is detached from the respective filling device at the completion of the decompression step, so as to minimize product loss.

**[0016]** The object of the present invention is to provide a filling machine, which is of high reliability and limited cost, and can satisfy the aforementioned need.

**[0017]** According to the invention, this object is achieved by a filling machine as claimed in claim 1.

**[0018]** The present invention further relates to a method for filling a receptacle with a pourable product as defined in claim 10.

**[0019]** For a better understanding of the present invention, a preferred non-limiting embodiment of the invention will be described in the following, purely by way of example and with the aid of the accompanying drawings,

wherein:

Figure 1 is a schematic side view, partially sectioned and with parts removed for clarity, of a filling machine according to the teachings of the present invention; Figure 2 is an axial section, in enlarged scale and with parts removed for clarity, of a filling device of the filling machine of Figure 1;

Figures 3a, 3b, 3c and 3d schematically show the filling device of Figure 2 in a reduced scale and during different and subsequent operating conditions, in which it cooperates with parts of the filling machine shown in a schematic manner.

**[0020]** With reference to Figure 1, number 1 indicates as a whole a filling machine configured for filling a plurality of receptacles 2 with a pourable product at a pressure value  $P_S$  higher than the atmospheric pressure. In particular, the receptacles 2 are preferably made of plastic material, and the pourable product is a liquid with the addition of gas under pressure, for example, sparkling water or a carbonated drink.

**[0021]** The machine 1 is fed with empty receptacles 2 and is configured for filling the latter with the pourable product.

**[0022]** For this purpose, the machine 1 comprises a rotary conveyor, preferably a carousel 3, configured to rotate about a vertical axis A, and a reservoir 5 containing the pourable product at the pressure  $P_S$  and located peripherally with respect to the carousel 3.

**[0023]** The carousel 3 carries in a cantilevered manner at its own peripheral portion 3a a plurality of filling devices 4 configured for filling respective receptacles 2 up to a predetermined level during the rotation of the carousel 3 itself around the axis A.

**[0024]** The filling devices 4 are thus conveyed by the carousel 3 along a circular transfer path, at respective radially spaced positions with respect to the axis A.

**[0025]** In particular, each filling device 4 is fluidly connected to the reservoir 5 by means of a circuit 6 configured to convey the pourable product from the reservoir 5 to the filling device 4.

**[0026]** Preferably, the carousel 3 receives a succession of empty receptacles 2 from an inlet star wheel (not shown) and directs the filled receptacles 2 to an outlet star wheel (also not shown).

**[0027]** According to the preferred embodiment here described, each receptacle 2 is defined by a bottle having a longitudinal axis B and being advanced in a vertical position by the carousel 3. In particular, each receptacle 2 is advanced by the carousel 3 with its own axis B parallel to the axis A of the carousel 3.

**[0028]** In greater detail, each receptacle 2 has a neck 7 coaxial with the axis B and defining a threaded surface 7a designed to allow the closure by means of a screw cap (according to a known manner and not described in detail).

**[0029]** With reference to Figures 2 and 3a-3d, each

filling device 4 comprises a filling valve 8 configured to control the outflow of the pourable product towards a respective receptacle 2 to be filled, and support means 10 adapted for supporting said receptacle 2 in a vertical position under the respective filling valve 8. In this configuration, the upper edge of the neck 7 of the receptacle 2 is placed in contact with the filling valve 8, so as to receive from the latter the pourable product in a fluid-tight condition.

**[0030]** Therefore, each filling device 4 is configured to perform a so-called "contact filling operation", in which the respective receptacle 2 is supported in fluid-tight contact against the respective filling valve 8.

**[0031]** Each filling valve 8 essentially comprises:

- a vertical tubular body 11 fixed to the peripheral portion 3a of the carousel 3 having a longitudinal axis C, parallel to the axis A of the carousel 3, and defining a central flow channel 12 configured to feed the pourable product to the respective receptacle 2;
- a shutter 13 engaging the tubular body 11 in a sliding manner and movable inside the channel 12 so as to allow or prevent the outflow of the pourable product towards the respective receptacle 2 to be filled;
- an actuator 24 adapted to move the shutter inside the channel 12; and
- an expansion 9 transversely protruding from one side of the tubular body 11 and interposed between the tubular body 11 itself and the carousel 3.

**[0032]** In particular, the tubular body 11 comprises an upper end portion 14, an intermediate portion 17 provided with a transverse inlet opening 15 configured to receive the pourable product from the reservoir 5 through the circuit 6, and a lower end portion 16 ending with an axial outlet opening 18 configured to feed the pourable product to the respective receptacle 2.

**[0033]** The lower end portion 16 is adapted to come into contact, in use, with the neck 7 of the respective receptacle 2 to be filled so as to place the upper edge of the neck 7 itself in fluid connection with the outlet opening 18.

**[0034]** For this purpose, the end portion 16 comprises an annular gasket 20 defining, in use, an axial abutment for the neck 7 of the respective receptacle 2 and configured to seal the latter to the respective filling valve 8 during the filling process. In this way, the inner volume of said receptacle 2 is kept in a fluid-tight condition during such process.

**[0035]** With reference to the preferred embodiment described herein, the channel 12 comprises, at the lower end portion 16 of the tubular body 11, a tapered-section portion 21 defining the end portion of the channel 12 itself.

**[0036]** In particular, the portion 21 comprises a first frustum-conical segment 22 with a section tapering towards the outlet opening 18 and a second substantially cylindrical segment 23 extending from the minimum section of segment 22 and ending, after a further final taper-

ing, with the outlet opening 18. In practice, the segment 22 is located upstream of the segment 23 with respect to the flow direction of the pourable product inside the channel 12 and has a diameter gradually decreasing towards the diameter of the segment 23 itself.

**[0037]** As can be seen in Figure 2 and in Figures 3a-3d, the shutter 13 of each filling valve 8 is coaxially mounted inside the channel 12 of the respective tubular body 11.

**[0038]** In particular, each shutter 13 comprises an externally cylindrical upper portion 25, an intermediate portion 26 having a diameter larger than the diameter of the upper portion 25 and arranged below the latter, and a lower portion 29 extending axially from the intermediate portion 26 in the direction of the lower end portion 16 of the respective tubular body 11 and terminating in close proximity to the outlet opening 18 and above the latter.

**[0039]** The intermediate portion 26 is preferably provided with flow-stabilizing means for the pourable product, such as a swirler 28, configured to impart a rotating motion to the pourable product itself.

**[0040]** Each shutter 13 is also provided at the intermediate portion 26, with a sealing ring 27, preferably made of elastomeric material and configured to selectively cooperate in a fluid-tight manner with the segment 22 of the respective channel 12 so as to prevent the outflow of the pourable product towards the outlet opening 18 and, therefore, inside the respective receptacle 2 to be filled.

**[0041]** Each shutter 13 is movable inside the channel 12 of the respective tubular body 11 between:

- a lower closing position (Figures 2, 3a, 3b and 3d), in which the shutter 13 sealingly closes, by means of the sealing ring 27, the segment 22 of the channel 12, thus interrupting the flow of the pourable product towards the respective receptacle 2; and
- an upper opening position (Figure 3c), in which the shutter 13 delimits, together with the segment 22 of the channel 12, an annular passage fluidly communicating with the outlet opening 18 so as to allow the outflow of the pourable product towards the respective receptacle 2 to be filled.

**[0042]** The movement of each shutter 13 from the closing position to the opening position is obtained by means of the respective actuator 24, preferably a fluid controlled actuator.

**[0043]** In particular, each actuator 24 comprises a plunger 24a housed inside a respective chamber 24b located at the upper end portion 14 of the respective filling device 4. The chamber 24b is adapted to receive a fluid under pressure (e.g. air, water or oil) configured to exert a thrust on the plunger 24a. Each shutter 13 is coupled to the respective plunger 24a, according to a known manner and not described in detail, and its movement between the closing and opening positions directly depends on the movement of the plunger 24a, this latter being

caused by the fluid under pressure inside the respective chamber 24b.

**[0044]** Alternatively, the movement of each shutter 13 could be achieved by means of a respective mechanical or electromagnetic actuator.

**[0045]** The filling machine 1 further comprises:

- a pressurization-exhaust circuit 30 configured both to pressurize each receptacle 2 at a predetermined pressure value higher than the atmospheric pressure value before starting the actual filling, and to exhaust the gas contained in the receptacle 2 during the filling operation; and
- a decompression circuit 33 configured to perform a decompression step of each receptacle 2 by means of gas outflow, once the filling is completed.

**[0046]** In particular, the pressurization-exhaust circuit 30 comprises an annular chamber 32 formed in the carousel 3 and containing a fluid under pressure, for example carbon dioxide, and, for each filling device 4, a duct 31, which fluidly connects the internal environment of the respective receptacle 2 to the chamber 32.

**[0047]** In particular, each duct 31 has a lower opening 36 communicating, in use, with the respective receptacle 2 and an upper opening 37 communicating with the chamber 32.

**[0048]** As can be seen in Figure 2, each duct 31 of the pressurization-exhaust circuit 30 comprises, proceeding from the direction starting from the respective lower opening 36 to the respective upper opening 37:

- a first portion 31a formed within the respective shutter 13 and extending coaxially with the latter;
- a second portion 31b formed within the respective tubular body 11 at its upper end 14 and extending in a substantially transverse direction to the axis C;
- a third portion 31c extending within the respective expansion 9 in an orthogonal direction to the axis C and comprising a respective flow control valve 38, preferably of the pneumatic type, configured to allow or prevent the flow of fluid under pressure from or towards the chamber 32; and
- a fourth portion 31d extending through the carousel 3 on the extension of the portion 31c and fluidly connected with the chamber 32.

**[0049]** The decompression circuit 33 comprises an annular decompression chamber 35 formed in the carousel 3 and, for each filling device 4, a duct 34 which fluidly connects the internal environment of the respective receptacle 2 to the decompression chamber 35; the decompression chamber 35 is kept at a pressure lower than the pressure inside each receptacle 2 at the end of the filling and can be connected in turn to an environment kept at atmospheric pressure  $P_a$ .

**[0050]** In particular, each duct 34 has a lower opening

40 communicating, in use, with the respective receptacle 2 and an upper opening 41 communicating with the chamber 35.

**[0051]** In greater detail, each duct 34 of the decompression circuit 33 comprises, proceeding in the direction from the respective lower opening 40 to the respective upper opening 41:

- a first annular portion 34a extending through the respective tubular body 11 in a radially outermost position with respect to the respective portion 31a of the respective duct 31 and in a direction substantially parallel to the axis C;
- a second portion 34b extending within the respective expansion 9 in a direction orthogonal to the axis C and comprising a respective flow control valve 39, preferably of the pneumatic type, configured to selectively open or close the fluid communication between the chamber 35 and the respective duct 34; and
- a third portion 34c extending through the carousel 3 on the extension of the respective portion 34b and fluidly connected with the chamber 35.

**[0052]** Advantageously, as shown in Figure 1, the filling machine 1 comprises, furthermore, pressure control means 45 configured to keep the pressure inside the decompression chamber 35 at a predetermined pressure value  $P_0$  higher than the atmospheric pressure  $P_a$ .

**[0053]** Preferably, the pressure control means 45 comprise:

- a pressure sensor 42, such as a pressure gauge, configured to generate a pressure signal W correlated with the pressure inside the decompression chamber 35;
- a pressure-sustaining valve 44, configured to selectively open and close the fluid communication between the decompression chamber 35 and an environment at atmospheric pressure  $P_a$ ; and
- a control unit 43 configured to receive the pressure signal W from the pressure sensor 42 and to control the pressure-sustaining valve 44 so as to keep the pressure inside the decompression chamber 35 at the pressure value  $P_0$ .

**[0054]** In particular, during the decompression step, each respective receptacle 2 is selectively put in communication with the decompression chamber 35 by opening the respective valve 39 for a pre-set time interval. The duration of this time interval is set at the same value for each valve 39 and is part of the predetermined filling procedure.

**[0055]** This causes an increase in the pressure inside the decompression chamber 35 each time the decompression step of a respective receptacle 2 is carried out.

**[0056]** Consequently, when the pressure measured by the pressure sensor 42 inside the decompression cham-

ber 35 exceeds the pressure value  $P_0$ , the control unit 43 controls the opening of the pressure-sustaining valve 44 so as to allow a depressurization of the decompression chamber 35 itself, thus keeping it at the pressure value  $P_0$ .

**[0057]** Advantageously, said pressure value  $P_0$  is higher than the atmospheric pressure  $P_a$  of an amount ranging between 0.1 and 0.5 bar, more preferably between 0.2 and 0.3 bar.

**[0058]** Preferably, the pressure-sustaining valve 44 is a modulating valve, that is a valve apt to define a plurality of opening positions having passage sections different from one another.

**[0059]** Alternatively, the pressure-sustaining valve 44 could be an on/off type valve, that is a valve selectively movable between two opening and closing positions following the control received from the control unit 43.

**[0060]** The Applicant observed that by selecting a pressure value  $P_0$  inside the decompression chamber 35 above the atmospheric pressure  $P_a$  of the above quantity, it is possible to minimize the "agitation" of the pourable product inside the receptacle 2 at the time of detachment of the latter from the respective filling device 4, thereby limiting foam formation and possible leakage of the pourable product itself.

**[0061]** The pressure sensor 42 is preferably mounted along the decompression circuit 33 in a position downstream of the decompression chamber 35; the pressure detected at said point corresponds to the pressure inside the decompression chamber 35.

**[0062]** The operation of the filling machine 1 according to the present invention will be described in the following, with particular reference to Figures from 3a to 3d and referring to a single filling device 4 carried by the carousel 3 and to a single receptacle 2 to be filled.

**[0063]** In particular, Figures from 3a to 3d show the operation of the filling machine 1 during four successive moments.

**[0064]** In detail, the receptacle 2 is fed by the carousel 3 in a position lower than the respective filling device 4 and is arranged by the support means 10 so as to be arranged with the upper end of the neck 7 in abutment against the annular gasket 20 of the tubular body 11 (Figure 3a).

**[0065]** Once the tight-seal contact between the receptacle 2 and the tubular body 11 is ensured, the valve 38 is opened to start the pressurization step: the gas under pressure, typically carbon dioxide, contained in chamber 32 flows along the pressurization-exhaust circuit 30, inside the receptacle 2, until the pressure on its inside reaches the pressure value of the reservoir 5 of the pourable product to be introduced into the receptacle 2 itself (Figure 3b).

**[0066]** At this point, the shutter 13 is moved, by means of the actuator 24, from the closing position to the opening position. The pourable product can therefore flow into the channel 12, through the outlet opening 18 and, then, inside the receptacle 2. At the same time, the gas con-

tained in the receptacle 2 is released through the pressurization-exhaust circuit 30 (Figure 3c).

**[0067]** After the filling is completed, the shutter 13 is moved into the closing position by means of the actuator 24, and the valve 38 is closed (Figure 3d).

**[0068]** At this point, the valve 39 is opened to start the decompression step: the receptacle 2 is depressurized by means of the outflow of the gas contained in the upper part of the neck 7, in the pressurization-exhaust circuit 30 up to the closed valve 38 and in the channel 12 up to the sealing ring 27, along the decompression circuit 33 towards the chamber 35. At the same time, the pressure sensor 42 measures the pressure value in the decompression chamber 35; as soon as this value exceeds the predetermined pressure value  $P_0$ , the control unit 43 controls the temporary opening of the pressure-sustaining valve 44 for a pre-set period of time, thus allowing the gas in excess contained inside the decompression chamber 35 to flow out, and to the pourable product contained in receptacle 2 to reduce its "agitation" by adjusting to the new pressure value. When the pressure value  $P_0$  is reached in the decompression chamber, the control unit 43 controls the closing of the pressure-sustaining valve 44.

**[0069]** The receptacle 2 is then detached from the filling device 4 at the pressure value  $P_0$  higher than the atmospheric pressure  $P_a$  to be conveyed by the carousel 3 to the outlet star wheel. During such step, the pressure of the receptacle 2 will drop to the value of the atmospheric pressure  $P_a$ .

**[0070]** It is clear that the foregoing applies equally to each filling device 4 and to each receptacle 2 to be filled.

**[0071]** An examination of the characteristics of the filling machine 1 and of the filling method, according to the present invention, clearly shows the advantages it allows to achieve.

**[0072]** In particular, the selective control of the pressure-sustaining valve 44, correlated with the pressure value measured inside the decompression chamber 35 by the pressure sensor 42, allows to keep, in the decompression chamber 35, a predetermined pressure value  $P_0$ , throughout the entire decompression step of each receptacle 2. As a result, the amount of foam generated is kept to a minimum, thus avoiding unwanted product loss.

**[0073]** It is clear that modifications and alternatives can be made to the filling machine 1 and to the filling method described and illustrated herein without departing from the protective scope defined by the claims.

## Claims

1. A filling machine (1) comprising:

- at least one filling valve (8) configured to be connected with a respective receptacle (2) to be filled and selectively movable between an open-

ing configuration, in which said filling valve (8) feeds a pourable product to said receptacle (2) at a pressure higher than the atmospheric pressure, and a closing configuration, in which said filling valve (8) interrupts the flow of said pourable product towards the receptacle (2); and  
- a decompression circuit (33) configured to depressurize said receptacle (2) after filling;

said decompression circuit (33) comprising:

- a decompression chamber (35) kept at a pressure lower than the pressure inside said receptacle (2) at the completion of the filling;
- a decompression duct (34) having a first end (40) communicating, in use, with said receptacle (2) and a second end (41) opposite to the first end (40) connected to said decompression chamber (35); and
- a flow control valve (39) configured to selectively open and close the fluid communication between said decompression chamber (35) and said decompression duct (34);

**characterized in that** it further comprises pressure control means (42, 43, 44) configured to keep the pressure inside said decompression chamber (35) at a predetermined pressure value ( $P_0$ ) higher than atmospheric pressure ( $P_a$ ).

2. The machine according to claim 1, wherein said pressure control means (42, 43, 44) comprise:

- a pressure sensor (42) configured to generate a pressure signal (W) correlated with the pressure inside said decompression chamber (35);
- a pressure-sustaining valve (44), configured to selectively open and close the fluid communication between said decompression chamber (35) and an environment at a pressure lower than said pressure value ( $P_0$ ); and
- a control unit (43) configured to receive said pressure signal (W) from said pressure sensor (42) and to control said pressure-sustaining valve (44) according to said pressure signal (W).

3. The machine according to claim 2, wherein said environment is at atmospheric pressure ( $P_a$ ).

4. The machine as claimed in claim 2 or 3, wherein said control unit (43) is configured to control the opening of said pressure-sustaining valve (44) when the pressure detected inside said decompression chamber (35) is higher than said pressure value ( $P_0$ ).

5. The machine according to any one of the preceding claims, wherein said pressure value ( $P_0$ ) is higher than the atmospheric pressure ( $P_a$ ) of an amount

ranging between 0.1 bar and 0.5 bar.

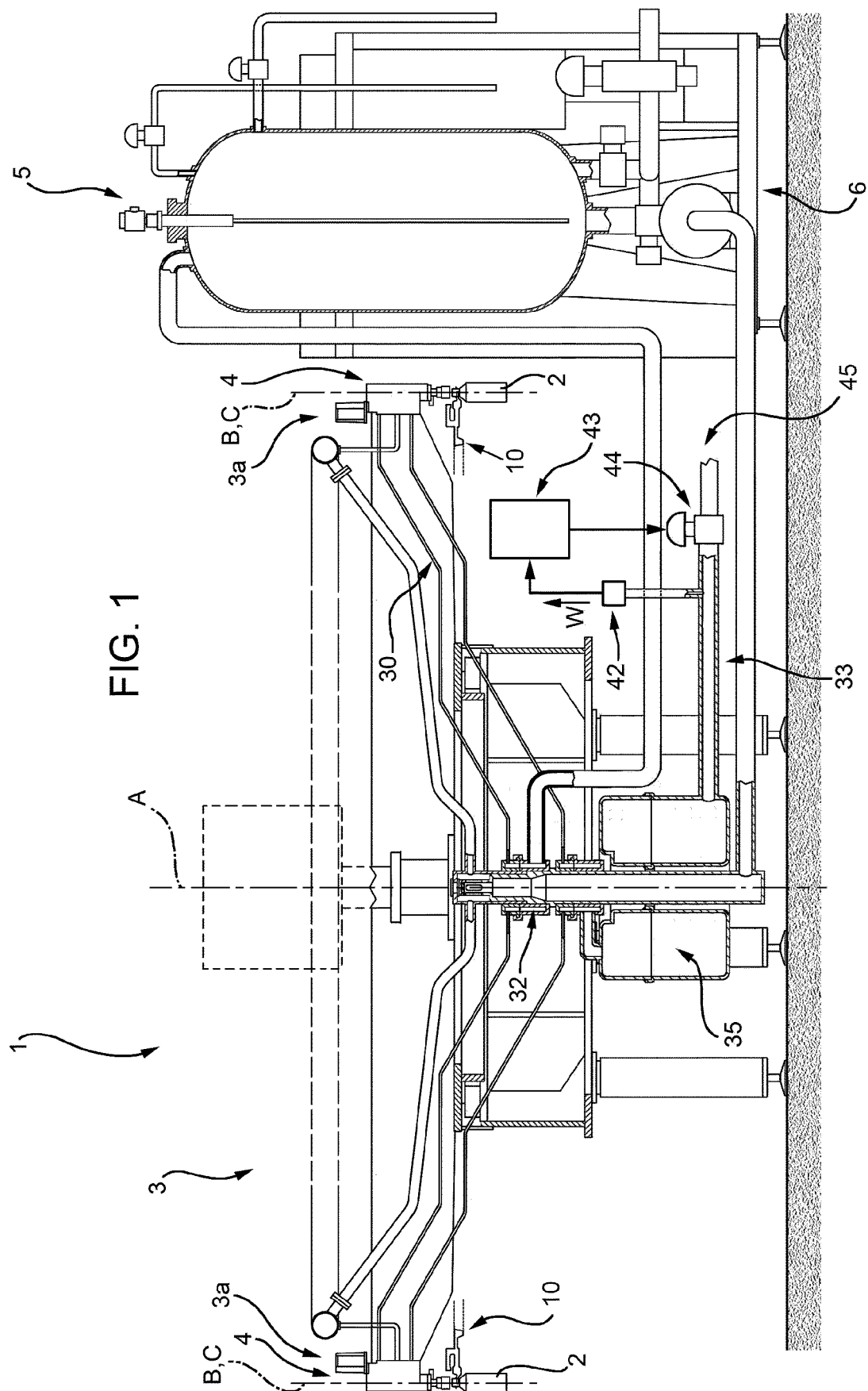
6. The machine according to claim 5, wherein said pressure value ( $P_0$ ) is higher than the atmospheric pressure ( $P_a$ ) of an amount ranging between 0.2 bar and 0.3 bar. 5
7. The machine according to any one of the claims from 2 to 6, wherein said pressure-sustaining valve (44) is an on/off type valve. 10
8. The machine according to any one of the claims from 2 to 6, wherein said pressure-sustaining valve (44) is a modulating valve. 15
9. The machine according to any one of the preceding claims, wherein said filling valve (8) comprises:
  - a tubular body (11) having a longitudinal axis (C) defining a central flow channel (12) for said pourable product and ending at a lower end (16) with an axial outlet opening (18) configured for feeding said pourable product to said receptacle (2); 20
  - a shutter (13) movable inside said channel (12) between a closing position and an opening position defining said closing and opening configurations, respectively, to prevent or allow the outflow of said pourable product towards said receptacle (2). 25 30
10. A method for filling a receptacle (2) with a pourable product comprising the steps of:
  - i) feeding said pourable product to said receptacle (2) at a pressure higher than the atmospheric pressure ( $P_a$ ), so as to fill said receptacle (2) up to a predetermined level; and 35
  - ii) depressurizing said receptacle (2) after filling by selectively connecting, by means of a flow control valve (39), the inner part of said receptacle (2) with a decompression chamber (35) kept at a pressure lower than the pressure inside the receptacle (2); 40 45

**characterized in that** it further comprises the steps of:

  - iii) keeping the pressure inside said decompression chamber (35) at a predetermined pressure value ( $P_0$ ) higher than the atmospheric pressure ( $P_a$ ). 50
11. The method according to claim 10, wherein said step iii) comprises the steps of: 55
  - iv) measuring the pressure inside said decompression chamber (35);

v) generating a pressure signal (W) correlated with the pressure measured at step iv); and  
vi) controlling the fluid connection of said decompression chamber (35) with an environment at a pressure lower than said pressure value ( $P_0$ ) by means of a pressure-sustaining valve (44) according to said pressure signal (W).

12. The method according to claim 11, wherein said environment is at atmospheric pressure ( $P_a$ ). 10
13. The method according to claims 11 or 12, wherein said step vi) comprises the step of:
  - vii) controlling the opening of said pressure-sustaining valve (44) when the pressure measured inside said decompression chamber (35) is higher than said pressure value ( $P_0$ ). 15
14. The method according to any one of the claims from 10 to 13, wherein said pressure value ( $P_0$ ) is higher than the atmospheric pressure ( $P_a$ ) of an amount comprise between 0.1 bar and 0.5 bar. 20
15. The method according to any one of claims from 10 to 13, wherein said final pressure value ( $P_0$ ) is higher than the atmospheric pressure ( $P_a$ ) of an amount ranging between 0.2 bar and 0.3 bar. 25 30



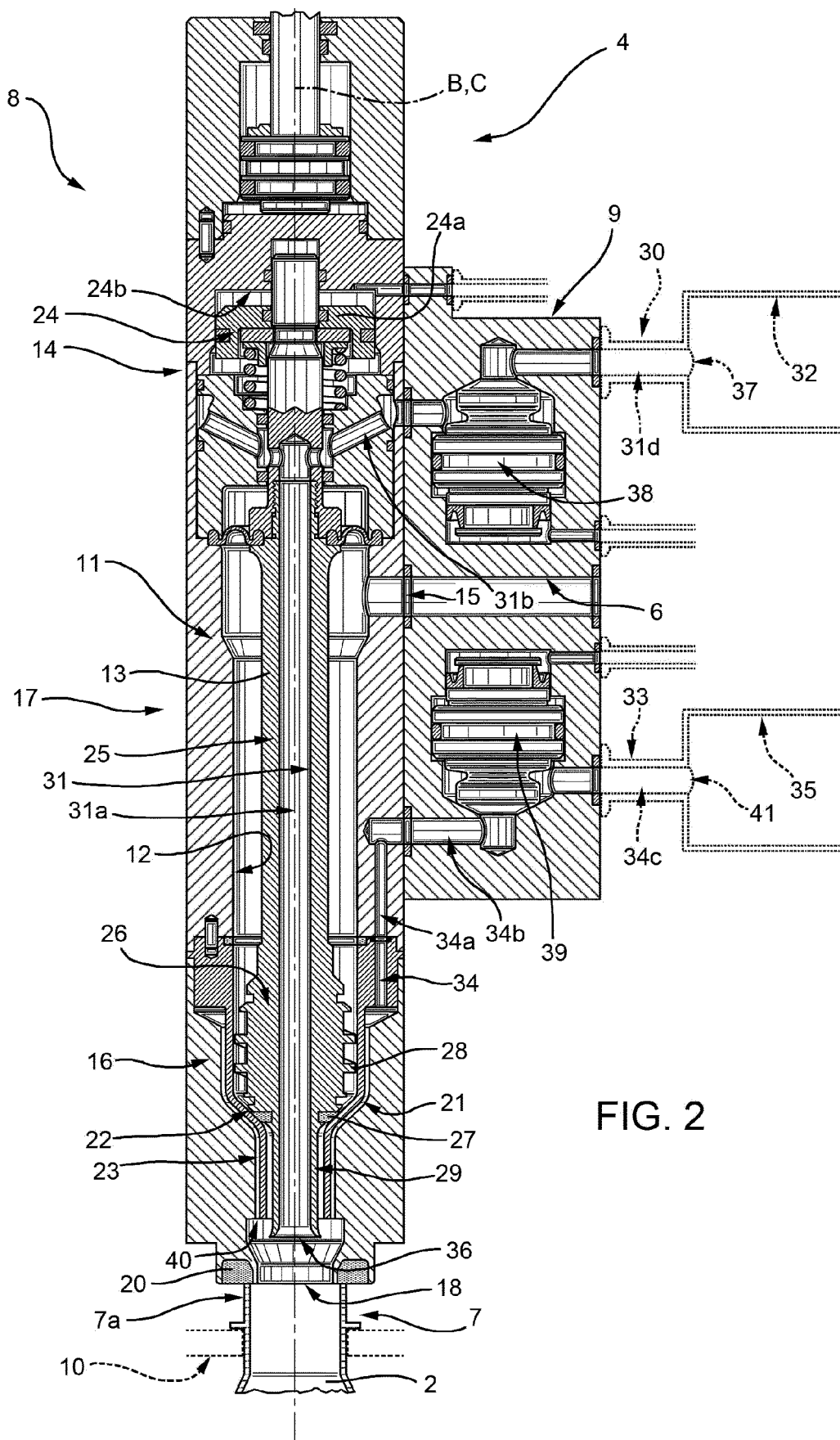


FIG. 2

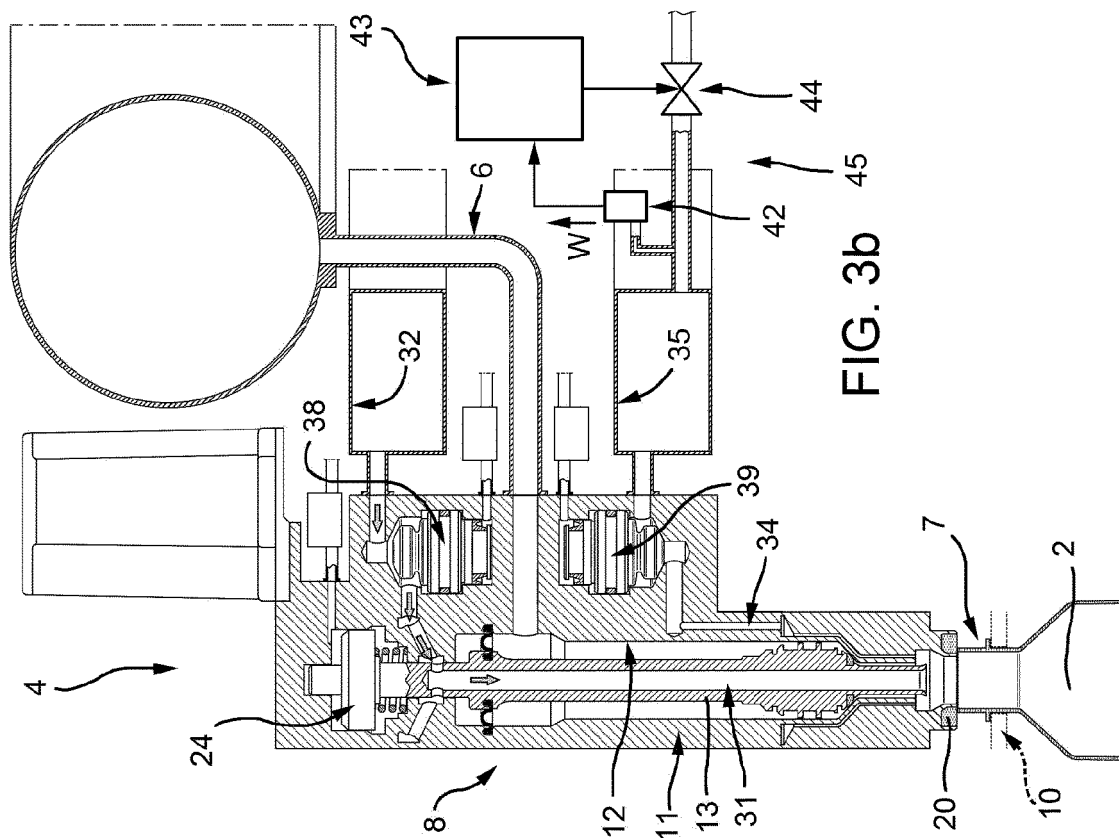


FIG. 3b

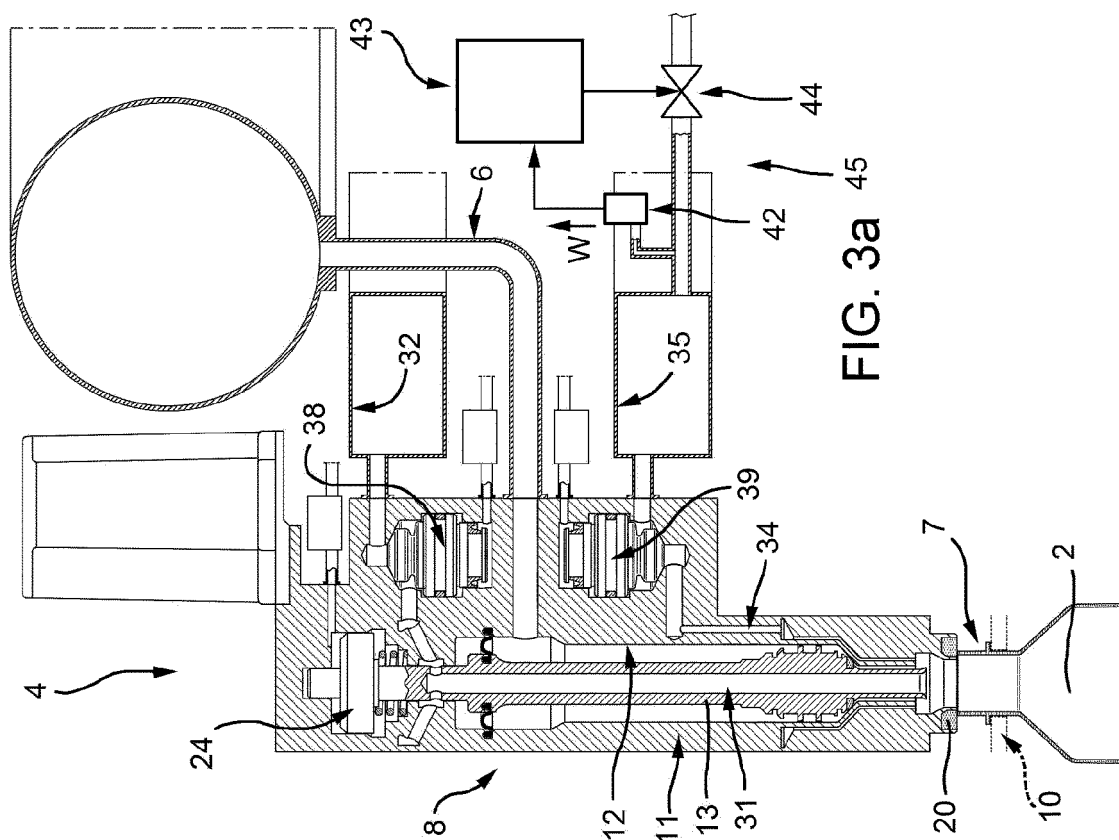


FIG. 3a

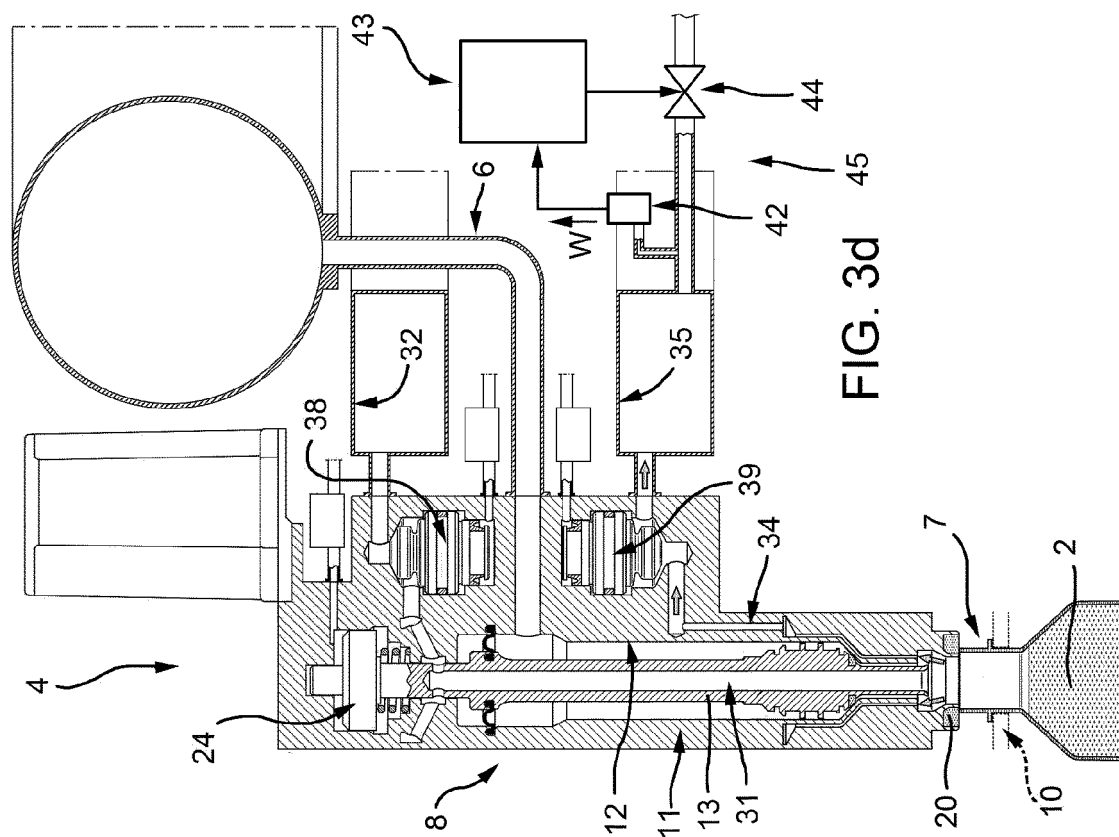


FIG. 3d

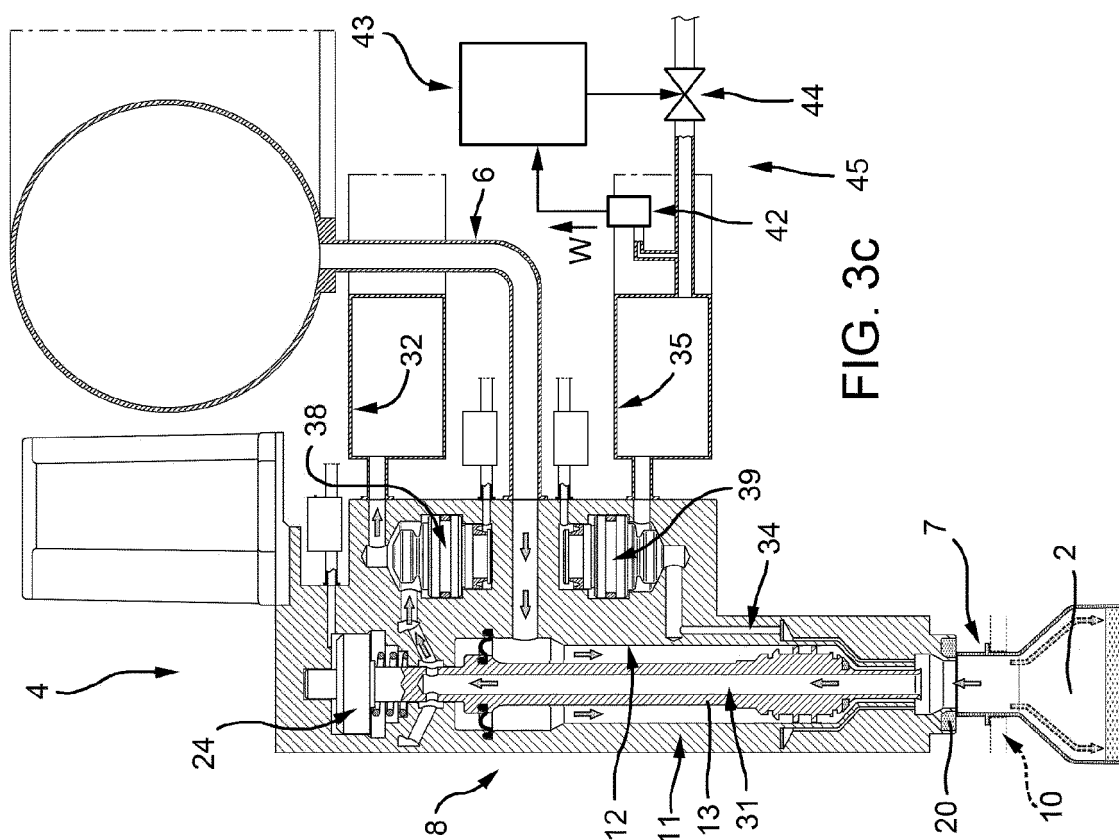


FIG. 3c



## EUROPEAN SEARCH REPORT

Application Number  
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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                  |                                                          |                                         |
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| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Citation of document with indication, where appropriate, of relevant passages                                                                    | Relevant to claim                                        | CLASSIFICATION OF THE APPLICATION (IPC) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | DE 41 34 446 A1 (KRONSEDER MASCHF KRONES [DE]) 22 April 1993 (1993-04-22)<br>* column 5, line 42 - column 7, line 29;<br>figure 1 *<br><br>----- | 1-15                                                     | INV.<br>B67C3/08<br>B67C3/12            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                  |                                                          | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                  |                                                          | B67C                                    |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                  |                                                          |                                         |
| Place of search<br><b>The Hague</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                  | Date of completion of the search<br><b>14 March 2019</b> | Examiner<br><b>Wartenhorst, Frank</b>   |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>.....<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                                  |                                                          |                                         |

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EPO FORM 1503 03/82 (P04C01)

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| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| DE 4134446                                | A1                  | 22-04-1993                 | NONE                |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- EP 1411023 B [0006]