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(54) FILLING MACHINE, IN PARTICULAR OF THE WEIGH FILLING TYPE, FOR FILLING CONTAINERS, SUCH AS FOR EXAMPLE BARRELS, BOTTLES, CANS AND/OR THE LIKE, AND THE RELATIVE FILLING METHOD

(57) The present invention concerns a filling machine (1) of the weigh filling type for filling containers (C) with a liquid (2). The filling machine (1) comprises: a source (1a) of liquid (2); at least one nozzle (3) connected to the source (1a); at least one duct (4) that extends between the feeding source (1a) and the nozzle (3); at least one control unit (5), arranged along the duct (4) between the source (1a) and the nozzle (3), being switchable between a closing condition, in which the nozzle (3) is not in fluid communication with the source (1a), and an opening condition, in which the dispensing nozzle (3) is in fluid communication with the source (1a) for dispensing the liquid (2); detection means (3a) associated with the nozzle (3) for detecting the filling status of the container (C), which are connected to the control unit (5) for switching the latter from the opening condition to the closing condition once a predetermined filling level has been achieved; a collecting device (6) interposed between the nozzle (3) and the control unit (5), for collecting a predetermined volume of liquid (2) and supplying at least one part of such a volume to the nozzle (3) after the control unit (5) has switched from the opening condition to the closing condition, according to a programmable closing time.

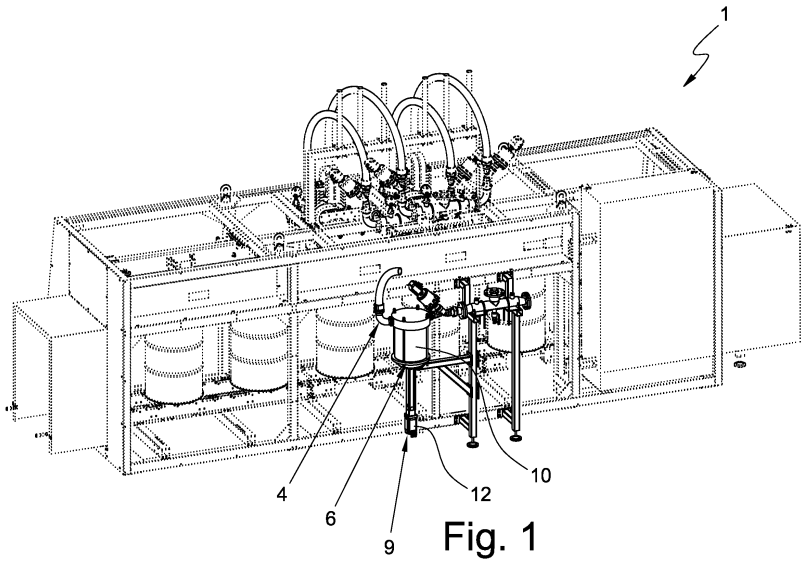

Fig. 1

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Description

[0001] The present invention concerns a filling machine, in particular of the weigh filling type, for filling containers, such as for example bottles, cans and/or the like, with at least one filling liquid.

[0002] Another object of the present invention is a method for filling containers, such as for example bottles, cans and/or the like, with at least one filling liquid.

[0003] The object of the present invention is particularly used in the field of packing barrels, bottles, cans and/or similar containers which involves a series of machines and/or similar equipment for filling containers, bottles, cans and/or the like, with liquids of different nature.

[0004] As it is known, containers are typically filled through filling machines and/or similar devices that exploit different detection means to verify the filling status. Technology involving the aid of scales and/or flow measuring devices that instantaneously detect the amount of liquid that enters the respective container being filled, is widespread.

[0005] Based on the increasing weight value or on the amount of liquid dispensed, it is possible to reduce the flow rate of liquid coming out. Once the predetermined weight value and/or the predetermined value of dispensed volume corresponding to the filling status of the container has been reached, the dispensing is definitively interrupted so as to allow the filled container to be removed and a new empty container to be positioned in order to be filled.

[0006] The dispensing of liquid is made possible by a valve that is connected to a proper feeding pipeline. The valve is controlled by a central control unit that manages the advance closure time of the latter during the final filling step.

[0007] In order to obtain the correct weight value and/or the correct value of dispensed volume, the advance time is established based on the data detected during the previous filling step.

[0008] Of course, such a detection and dispensing system operates correctly until the conditions of flow rate of the filling liquid during each filling cycle do not change.

[0009] If considering the variations of the distance between the dispensing nozzles and the pump of the feeding source for feeding the filling liquid and the fact that the same pump simultaneously supplies different dispensing nozzles, each provided with its own dispensing valve, the combination of these factors lead to disturbance to the feeding process of the filling liquid to the dispensing nozzles during the filling step. When this occurs, the dispensing nozzles receive the filling liquid under different conditions from the previous filling thus not managing to ensure the same desired weight value and/or the same desired value of dispensed volume.

[0010] It is also worth noting that at the end of the filling step each valve associated with the respective dispensing nozzle closes the respective piping completely and in a rapid manner generating, upstream thereof, the undesired phenomenon of water hammer that causes a substantial increase in pressure along the piping with the risk of producing considerable damage to the whole feeding system of the filling liquid.

[0011] The main purpose of the present invention is to propose a filling machine, in particular of the weigh filling type, for filling containers, such as for example barrels, bottles, cans and/or the like, with at least one filling liquid, and a filling method, which are capable of solving the problems found in the prior art. One purpose of the present invention is to ensure that the filling conditions are repeated during each filling cycle.

[0012] A further purpose of the present invention is to eliminate and/or drastically reduce water hammer due to the sudden closing of the valves of the dispensing nozzles.

[0013] The purposes specified above and yet others, are substantially achieved by a filling machine, in particular of the weigh filling type, for filling containers, such as for example barrels, bottles, cans and/or the like, with at least one filling liquid, and a relative filling method, according to what is described and claimed in the rest of the description. The description will be carried out in the rest of the description with reference to the attached drawings, provided purely as an indication and therefore not for limiting purposes, in which:

figure 1 is a schematic representation of a filling machine, in particular of the weigh filling type, for filling containers, such as for example barrels, bottles, cans and/or the like, with a filling liquid, in accordance with the present invention;

figure 2 is a perspective view of a collecting device of the filling machine according to figure 1, in accordance with a first embodiment of the invention;

figure 3 is a section view of the collecting device of figure 2, shown in a first position;

figure 4 is a further section view of the collecting device of figures 2 and 3, illustrated in a second position;

figure 5 is a schematic representation of a collecting device of the filling machine according to figure 1, in accordance with a second embodiment of the present invention;

figure 6 is a schematic representation of a first filling step that can be actuated by means of the collecting device according to figures 2 to 4;

figure 7 is a schematic representation of a second filling step that can be actuated by means of the collecting device according to figures 2 to 4;

figure 8 is a schematic representation of a third filling step that can be actuated by means of the collecting device according to figures 2 to 4;

figure 9 is a schematic representation of a fourth filling step that can be actuated by means of the collecting device according to figures 2 to 4;

figure 10 is a schematic representation of a fifth filling step that can be actuated by means of the collecting

device according to figures 2 to 4.

[0014] With reference to figure 1, reference numeral 1 wholly indicates a filling machine, in particular of the weigh filling type, for filling containers C, such as for example barrels, bottles, cans and/or the like, with at least one filling liquid 2, in accordance with the present invention.

[0015] The filling machine 1 comprises at least one feeding source 1a (schematically illustrated in figures 6 to 10) or a feeding joint (not illustrated), which is hydraulically connectable to a feeding source that does not form part of the filling machine 1, for feeding a filling liquid 2.

[0016] The filling machine 1 comprises at least one dispensing nozzle 3 (schematically represented with an arrow in figures 6 to 10), generally a plurality of dispensing nozzles 3, each in fluid communication with the feeding source 1a or the feeding joint for feeding the filling machine 1.

[0017] The filling machine 1, comprises for each dispensing nozzle 3, at least one main connection duct 4 extending between the latter and the feeding source 1a or the feeding joint of the same.

[0018] The filling machine 1 comprises, preferably for each dispensing nozzle 3 or for a group of dispensing nozzles 3, at least one control unit 5, optionally a valve element, like for example a solenoid valve or the like, operatively arranged along the respective main connection duct 4 between the feeding source 1a or the feeding joint for feeding the filling machine 1 and the respective dispensing nozzle 3.

[0019] Each control unit 5 is switchable between a closing condition (represented with the symbol 0 in figures 6, 9 and 10), wherein the respective dispensing nozzle 3 is not in fluid communication with the feeding source 1a or the feeding joint for feeding the filling machine 1, and an opening condition (represented with the symbol 1 in figures 7 and 8), in which the respective dispensing nozzle 3 is in fluid communication with the feeding source 1a or the feeding joint for feeding the filling machine 1 to dispense the filling liquid 2 being fed.

[0020] Advantageously, the switching of the closing unit 5 from the opening condition to the closing condition is carried out slowly, according to a programmable closing time that prevents the undesired occurrence of water hammer.

[0021] Every dispensing nozzle 3 is advantageously operatively associated with respective detection means (for detecting the weight or volume) 3a (schematically illustrated in figures 6 to 10) for detecting the filling status of the containers C (figures 6 to 10) being fed.

[0022] Advantageously, the detection means 3a comprise at least one weight sensor, like for example a scale, and/or a detection device for detecting the dispensed flow, so that the filling status is detected based on the increase in weight of the container C and/or of the amount of dispensed filling liquid 2.

[0023] The detection means 3a are operatively connected to the respective control unit 5 for switching the latter from the opening condition to the closing condition once a predetermined filling level has been achieved.

[0024] In accordance with an advantageous aspect of the present invention, the filling machine 1 comprises at least one collecting device 6 that is interposed between each dispensing nozzle 3 and the control unit 5. Each collecting device 6 is suitable for advantageously collecting a predetermined volume of filling liquid 2 coming from the feeding source 1a or from the feeding joint for feeding the filling machine 1 to supply at least one part of such a volume to the respective dispensing nozzle 3 after the switching of the respective control unit 5 from the opening condition (figures 7 and 8) to the closing condition (figure 9), according to a programmable closing time. As visible in the schematic figures 6 to 10, at least one control mechanism 7, optionally a valve element, like for example a solenoid valve or the like, is operatively interposed between each collecting device 6 and the respective dispensing nozzle 3. Each control mechanism 7 is switchable between a closing condition (indicated with the symbol 0 in figures 6 and 10), in which it is not in fluid communication with the respective dispensing nozzle 3, and an opening condition (indicated with the symbol 1 in figures from 7 to 9), in which it is in fluid communication with the respective dispensing nozzle 3.

[0025] As visible in figures 3 to 10, each collecting device 6 comprises at least one collecting compartment 8 for collecting the filling liquid 2 that comes from the feeding source 1a or from the feeding joint for feeding the filling machine 1.

[0026] Advantageously, the collecting compartment 8 is in fluid communication with the respective main connection duct 4 being, consequently, hydraulically arranged in series between the respective control unit 5 and the respective dispensing nozzle 3.

[0027] It should be noted however that for the purposes of the present invention, each collecting device 6 can also be in fluid communication with an auxiliary connection duct (not illustrated) which extends in parallel to at least one portion of the respective main connection duct 4 between the feeding source 1a or the feeding joint for feeding the filling machine 1 and the respective control mechanism 7.

[0028] Preferably, each collecting device 6 comprises pushing means 9 operatively associated with the respective collecting compartment 8 to send the filling liquid 2 therein contained to the respective dispensing nozzle 3 when the respective control mechanism 7 is in the opening condition (figure 9) and the respective control member 5 is in the closing condition (figure 9).

[0029] In accordance with the embodiment illustrated in figures 1 to 4 and 6 to 10, each collecting device 6 comprises at least one cylinder 10 that defines in its inside, the respective collecting compartment 8.

[0030] Still with reference to figures 3, 4 and 6 to 10, each collecting device 6 also comprises at least one piston 11, forming part of the pushing means 9, which is

operatively arranged inside the respective cylinder 10. The piston 11 is movable between a first position (figures 3, 8 and 9), in which the respective collecting compartment 8 has a maximum volume value for collecting the filling liquid 2, and a second position (figures 4, 6, 7 and 10), in which the respective collecting compartment 8 has a minimum volume value. Advantageously, the pushing means 9 further comprise at least one actuator 12, optionally an electric motor, and at least one transmission member 13, optionally a recirculation ball screw, operatively interposed between the respective actuator 12 and the respective piston 11 to direct the latter at least from the first position (figures 3, 8 and 9) to the second position (figures 4, 6, 7 and 10), preferably between the first and the second position.

[0031] When the pushing means 9 make the respective piston 11 move from the second (figures 4, 6, 7 and 10) to the first position (figures 3, 8 and 9) they determine a suction action of the filling liquid 2 present inside the respective main connection duct 4, which is accumulated in the respective collecting compartment 8. Vice versa, when the pushing means 9 make the respective piston 11 move from the first (figures 3, 8 and 9) to the second position (figures 4, 6, 7 and 10), they send the filling liquid 2 that is accumulated inside the respective collecting compartment 8 into the respective main duct 4 for connecting in the direction of the respective control mechanism 7 and of the respective dispensing nozzle 3.

[0032] In accordance with the embodiment illustrated in figure 5, the compartment 8 is delimited inside a tank 13, whereas the pushing means 9 comprise at least one pressurized gas source 14 connected to the relative collecting compartment 8 by means of respective pipes and at least one control device 15, optionally a valve element, operatively interposed between the gas source 14 and the collecting compartment 8.

[0033] The control device 15 is switchable between a closing condition, in which the gas source 14 and the collecting compartment are not in fluid communication, and an opening condition, in which the gas source 14 and the collecting compartment 8 are in fluid communication, so that the gas coming from the source 14 flows into the collecting compartment 8 sending the filling liquid 2 therein contained towards the respective dispensing nozzle 3.

[0034] Another object of the present invention is a method for filling containers C, such as for example barrels, bottles, cans and/or the like, which comprises a feeding step for feeding at least one dispensing nozzle 3 with a filling liquid 2.

[0035] Such a method also comprises a step of continuously detecting the filling status of the container C arranged at the nozzle 3 fed with the filling liquid 2. The filling status is advantageously detected by detecting the weight increase of the container C being filled and/or the amount of the dispensed filling liquid 2 by the respective dispensing nozzle 3.

[0036] Once the filling status has almost reached a predetermined reference value, we proceed with an interruption in the feeding of the filling liquid 2 to the relative dispensing nozzle 3, so that the filled container C can be removed and replaced with a new empty container C to be filled.

[0037] In order to ensure the same filling conditions during the various filling cycles, at the same time avoiding the undesired phenomenon of water hammer along the respective main connection duct 4, the method advantageously provides at least one collecting step for collecting a predetermined volume of filling liquid 2 and a feeding step for feeding at least one part of such a volume to the respective dispensing nozzle 3.

[0038] In particular, the collecting step for collecting filling liquid 2 is carried out during the feeding of the same to the respective dispensing nozzle 3, whereas the feeding step for feeding the filling liquid 2 accumulated during the filling step for filling the container C is carried out before reaching a final level of filling of the same and once the main feeding has been interrupted.

[0039] With reference to figures 6 to 10, these show a complete filling cycle for filling a container C.

[0040] Each filling cycle for filling a container C begins (figure 6) with the respective control unit 5 and the respective control mechanism 5 under the closing condition, so that the filling liquid 2 coming from the respective feeding source 1a cannot flow along the respective main connection duct 4 so as to reach the respective dispensing nozzle 3. In such a situation, the piston 11 of the respective collecting device 6 is in the second position and the respective dispensing nozzle 3 does not dispense the filling liquid 2 so that the detection means 3a detect the presence of an empty container C.

[0041] When the control unit 5 and the control mechanism 7 are switched from the closing condition (figure 6) to the opening condition (figure 7) the container C begins to be filled. The filling liquid 2 coming from the relative feeding source 1a flows through the main connection duct 4 so as to reach the respective dispensing nozzle 3 and to invade the relative empty container C that starts to be filled.

[0042] When the detection means 3a detect that a first relevant filling level has been reached (figure 7), preferably corresponding to around 5% of the overall filling volume of the container C, the pushing means 9 are actuated so as to lead the piston 11 of the respective collecting device 6 from the second position (figures 6 and 7) to the first position (figures 8 and 9) and to suck the filling liquid 2 being fed into the respective collecting compartment 8.

[0043] The filling of the container C continues simultaneously with the filling of the collecting compartment 8 of the respective collecting device 6.

[0044] When the detection means 3a detect that a second relevant filling level has been reached (figure 8), preferably corresponding to around 20% of the overall filling volume of the container C, the piston 11 of the pushing means 9 of the respective collecting device 6 is in the first position, with the collecting compartment 8 that is

completely filled in with the filling liquid 2.

[0045] The filling liquid 2 continues flowing through the respective dispensing nozzle 3 filling the respective container C until a third relevant filling level is detected (figure 9) by the detection means 5, preferably corresponding to 95% of the overall volume of the container itself. In such a situation, the control unit 5 is switched from the opening condition to the closing condition, preferably slowly, namely, according to a programmable time period that prevents water hammer.

[0046] Simultaneously, the pushing means 9 of the relative collecting device 6 are actuated so as to bring the piston 11 from the first to the second position and to send the filling liquid 2 previously collected towards the respective dispensing nozzle 3.

[0047] In such a way, the container C is filled in up to a quarter of the relevant filling value (figure 10), corresponding to around 100% of the overall volume of the same, and the piston 11 returns to the second position ready to start a new filling cycle.

[0048] The aforementioned filling cycle can be carried out in the same way also using the collecting device 6 illustrated in figure 5.

[0049] Differently from the piston 11 collecting device 6, the tank 13 device 5 requires pressurised gas to be introduced into the collecting compartment 8 so as to determine the push of the filling liquid 2 previously collected during feeding towards the respective dispensing nozzle 3 once the respective control unit 5 has been closed.

[0050] The object of the present invention solves the drawbacks found in the prior art and achieves important advantages.

[0051] Firstly, the presence of the collecting device between the feeding source for feeding the filling liquid and the respective dispensing nozzle allows the control unit to be closed according to a programmable time that prevents the undesired phenomenon of water hammer. Moreover, the presence of the collecting device upstream of each dispensing nozzle permits a controlled feeding of the final filling step for filling the containers, ensuring the same filling conditions during each cycle.

Claims

1. Filling machine (1), in particular of the weigh filling type, for filling containers (C), such as for example barrels, bottles, cans and/or the like, with at least one filling liquid (2), said filling machine (1) comprising:

   at least one feeding source (1a) or one feeding joint which is hydraulically connectable to a feeding source, not forming part of said filling machine (1), for feeding a filling liquid (2);
   at least one dispensing nozzle (3) for dispensing said filling liquid (2) connected to the feeding source (1a) or to said feeding joint for feeding said filling machine (1),
   at least one main connection duct (4) extending between said feeding source (1a) or said feeding joint for feeding said filling machine (1) and said dispensing nozzle (3);
   at least one control unit (5), optionally a valve element, operatively arranged along said main connection duct (4) between said feeding source (1a) or said feeding joint for feeding said filling machine (1) and said dispensing nozzle (3), said control unit (5) being switchable between a closing condition, wherein said dispensing nozzle (3) is not in fluid communication with said feeding source (1a) or said feeding joint for feeding said filling machine (1), and an opening condition, wherein said dispensing nozzle (3) is in fluid communication with said feeding source (1a) or said feeding joint for feeding said filling machine (1) in order to dispense said filling liquid (2) being fed;
   detection means (3a) operatively associated with said dispensing nozzle (3) for detecting the filling status of said container (C), said detection means (3a) being operatively connected to said control unit (5) for switching the latter from the opening condition to the closing condition once a predetermined filling level has been achieved;
   characterized in that it comprises at least one collecting device (6) interposed between said dispensing nozzle (3) and said control unit (5), optionally said collecting device (6) collecting a predetermined volume of said filling liquid (2) coming from said feeding source (1a) or from said feeding joint for feeding said filling machine (1) to supply at least one part of said volume to said dispensing nozzle (3) after the control unit (5) has switched from the opening condition to the closing condition according to a programmable closing time.

2. Filling machine (1) according to claim 1, further comprising at least one control mechanism (7), optionally a valve element, operatively interposed between said collecting device (6) and said dispensing nozzle (3), said control mechanism (7) being switchable between a closing condition, wherein said dispensing nozzle (3) is not in fluid communication with said collecting device (6), and an opening condition, wherein said dispensing nozzle (3) is in fluid communication with said collecting device (6).

3. Filling machine (1) according to claim 2, wherein said collecting device (6) comprises at least one collecting compartment (8) for collecting said filling liquid (2) coming from said feeding source (1a) or from said feeding joint for feeding the filling machine (1).

4. Filling machine (1) according to claim 3, wherein said collecting compartment (8) is in fluid communication with said main connection duct (4), said collecting compartment (8) being hydraulically arranged in series between said control unit (5) and said dispensing nozzle (3).

5. Filling machine (1) according to claim 3, wherein said collecting compartment (8) of said collecting device (6) is in fluid communication with an auxiliary connection duct (4) extending in parallel to at least one portion of said main connection duct (4) between said feeding source (1a) or said feeding joint for feeding said filling machine (1) and said control mechanism (7).

6. Filling machine (1) according to any claims 3 to 5, wherein said collecting device (6) comprises pushing means (9) operatively associated with said collecting compartment (8) of said collecting device (6) to send said filling liquid therein contained to said dispensing nozzle (3) when said control mechanism (7) is in the opening condition and said control unit (5) is in the closing condition.

7. Filling machine (1) according to claim 6, wherein said collecting device (6) comprises:

at least one cylinder (10) internally delimiting said collecting compartment (8);
at least one piston (11) forming part of said pushing means (9) and operatively arranged inside said cylinder (10), said piston (11) being movable between a first position, wherein said collecting compartment (8) has a maximum volume value for said filling liquid (2), and a second position, wherein said collecting compartment (8) has a minimum volume value for said filling liquid (2).

8. Filling machine (1) according to claim 7 when it depends on claim 6, wherein said pushing means (9) comprise:

at least one actuator (12), optionally an electric motor;
at least one transmission member (13), optionally a recirculation ball screw, operatively interposed between said actuator (12) and said piston (11) to direct the latter at least from the first to the second position, preferably between the first and the second position.

9. Filling machine (1) according to any claims 3 to 6, wherein said pushing means (9) comprise:

at least one pressurized gas source (13) in fluid communication with said collecting compartment (8);
at least one control device (15), optionally a valve element, operatively interposed between said gas source (13) and said collecting compartment (8), said control device (15) being switchable between a closing condition, wherein said gas source (13) and said collecting compartment (8) are not in fluid communication, and an opening condition, wherein said gas source (13) and said collecting compartment (8) are in fluid communication so that said gas flows into said collecting compartment (8) sending the filling liquid (2) therein contained towards said dispensing nozzle (3).

10. Method for filling containers, in particular barrels, bottles, cans and/or the like, with a filling liquid (2), said method comprising the steps of:

feeding at least one filling liquid (2) to at least one dispensing nozzle (3) for filling at least one container (C) corresponding thereto;
detecting the filling status of said container, optionally by detecting the weight increase of the same and/or of the quantity of the dispensed filling liquid (2), until detecting the predetermined filling level, preferably corresponding to the total filling of the relative container (C),
characterized in that it further comprises the steps of:

collecting a predetermined volume of filling liquid (2), optionally during the step of feeding the same to said dispensing nozzle (3);
feeding at least one part of the volume of the collected filling liquid to said dispensing nozzle (3), preferably while almost reaching the predetermined filling level, upon closing the main feeding of the filling liquid (2) according to a programmable closing time.

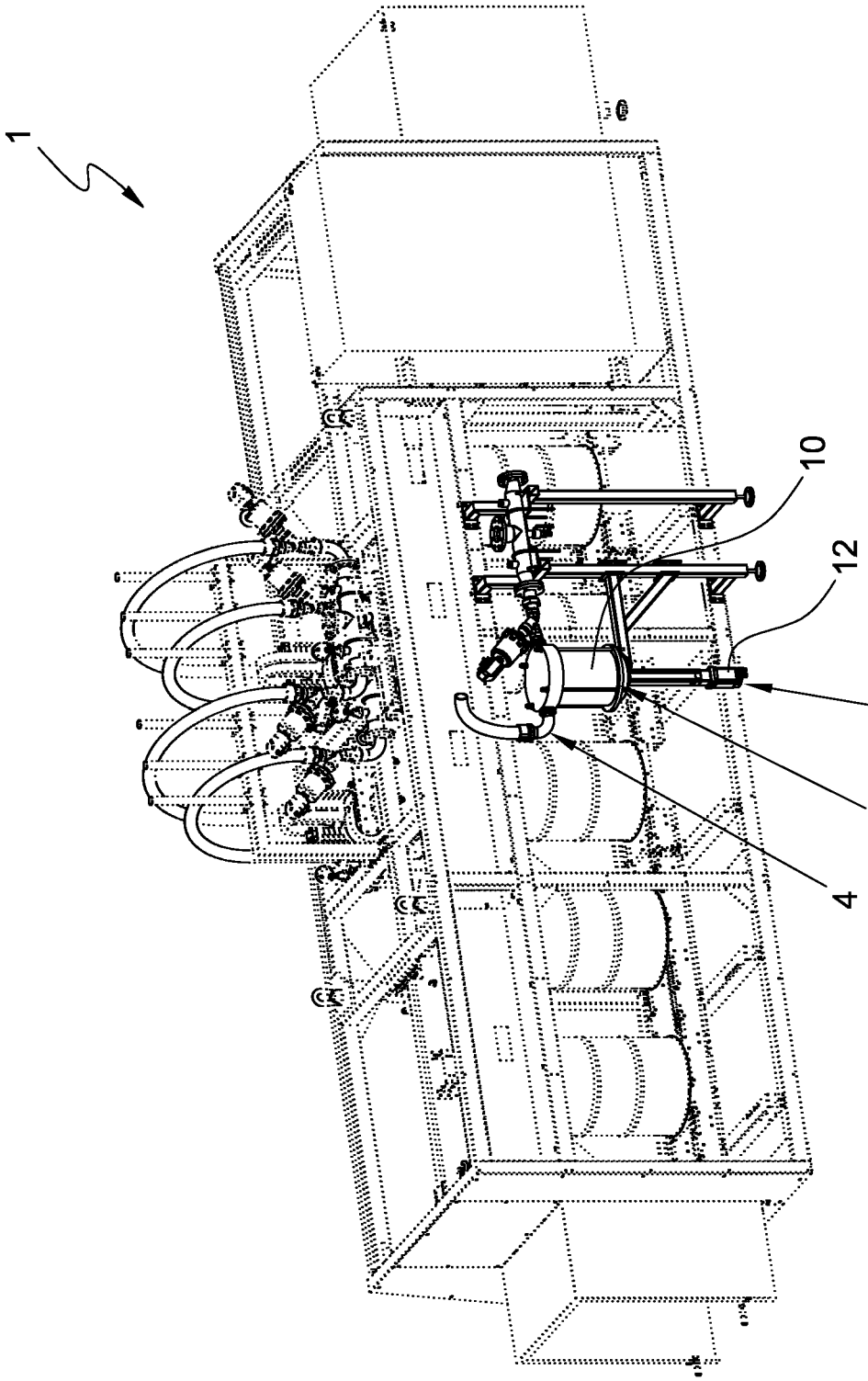

Fig. 1

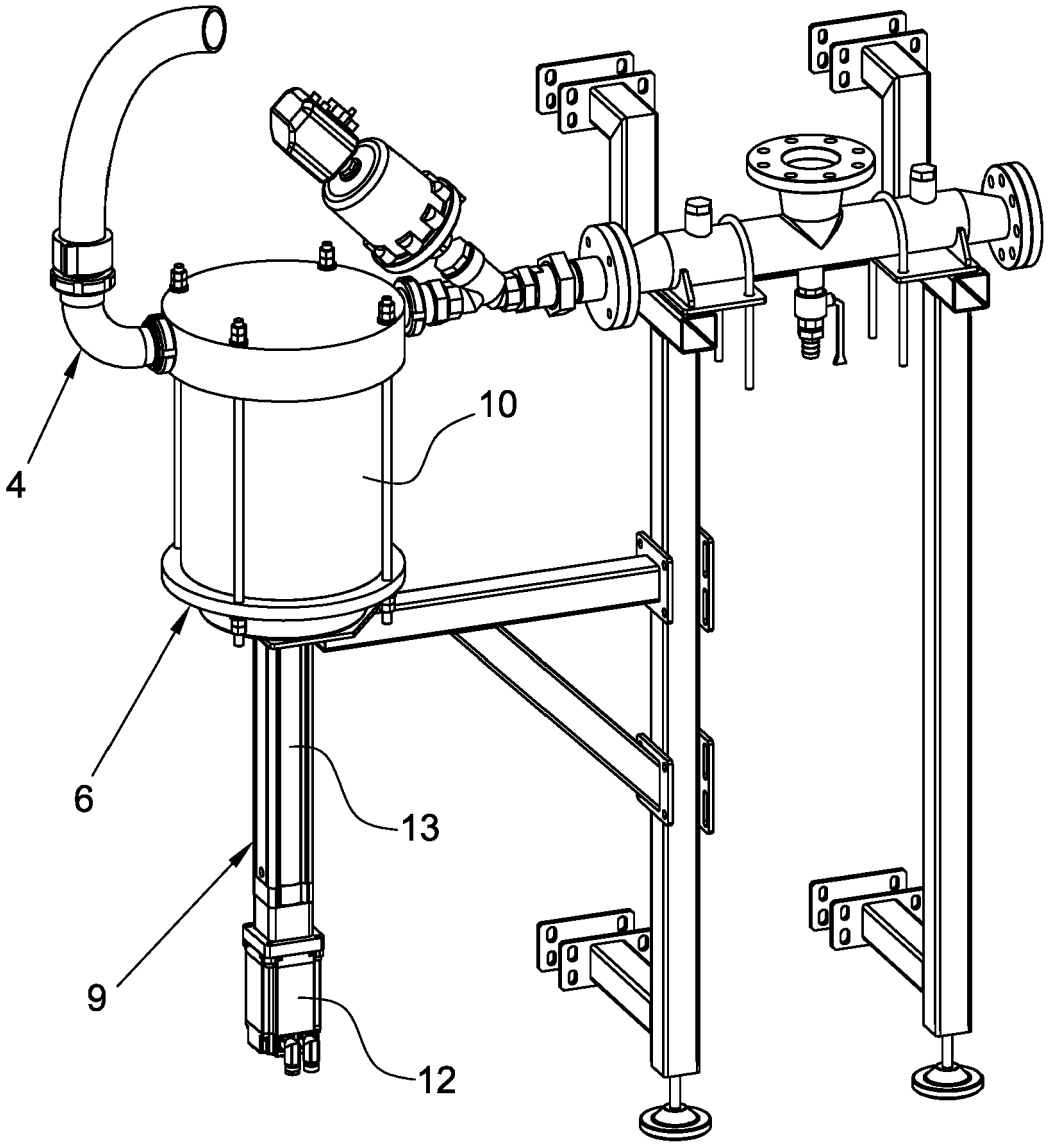

Fig. 2

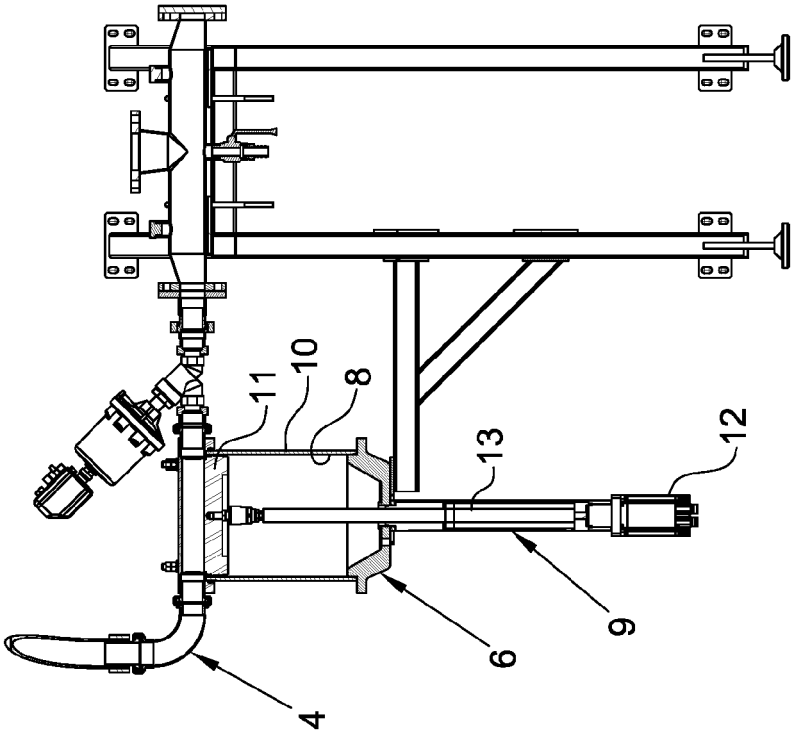

Fig. 4

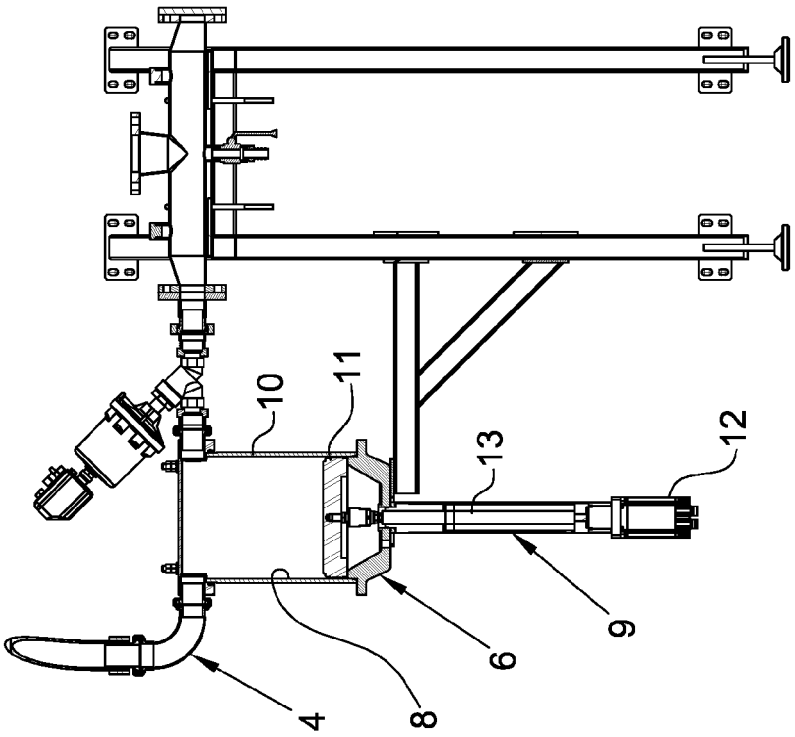

Fig. 3

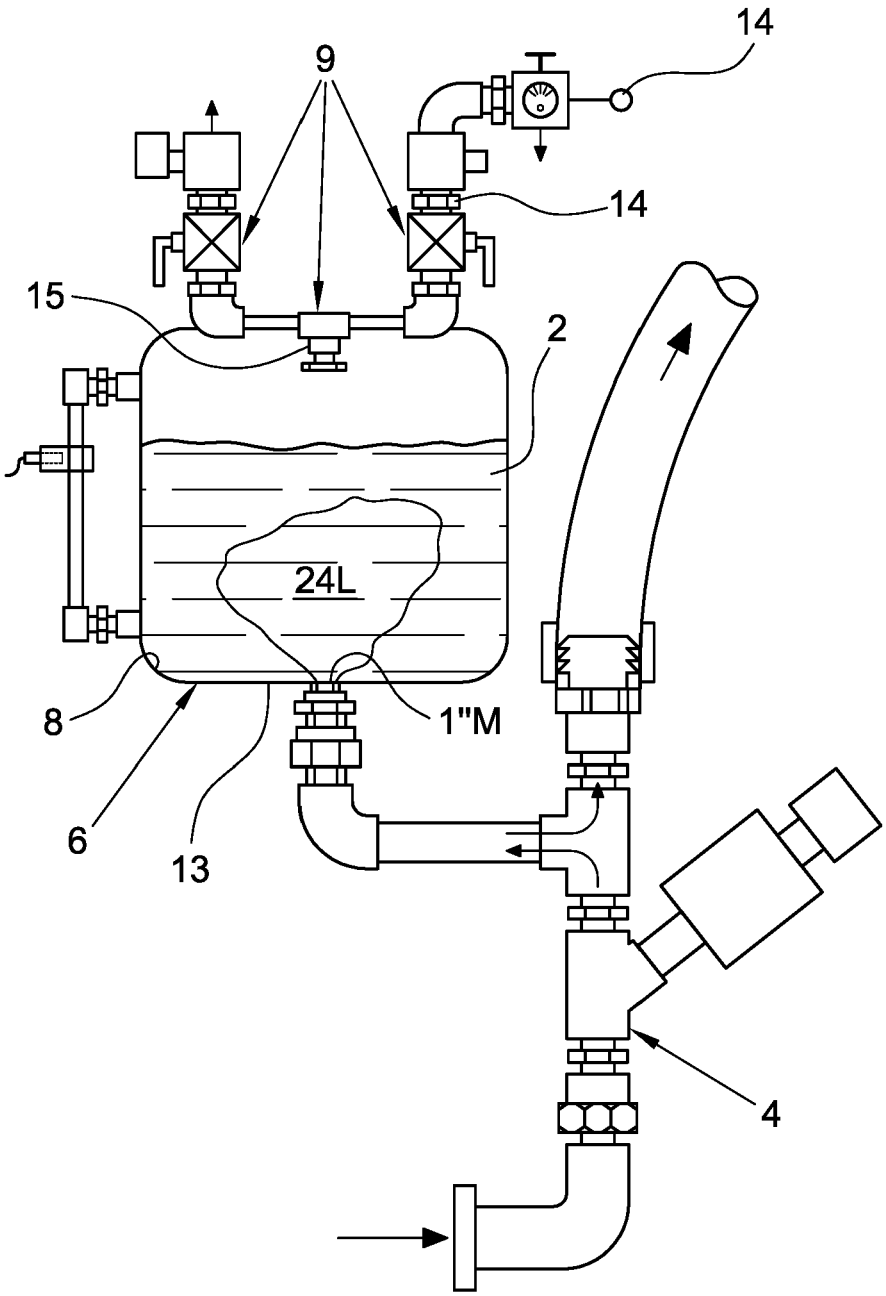

Fig. 5

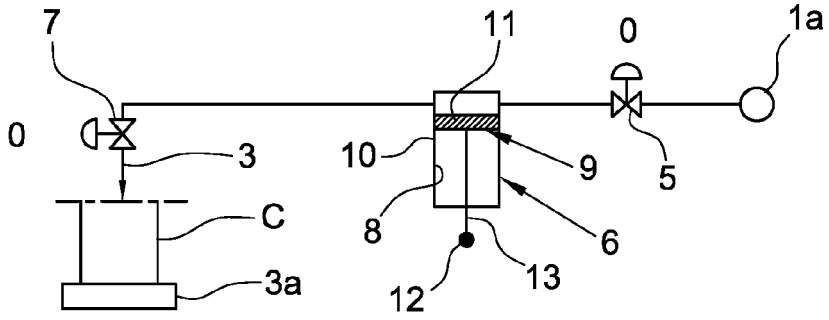

Fig. 6

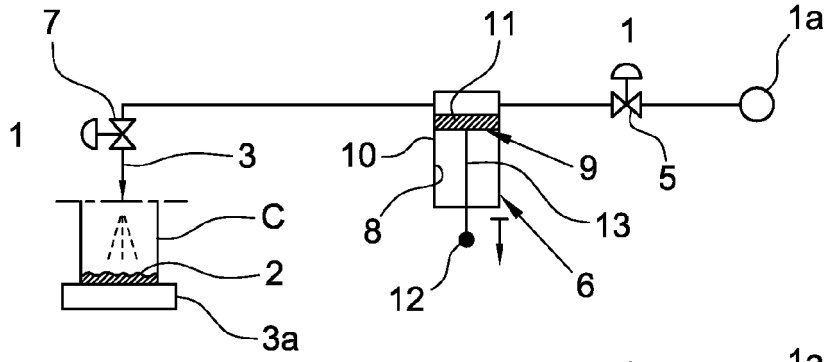

Fig. 7

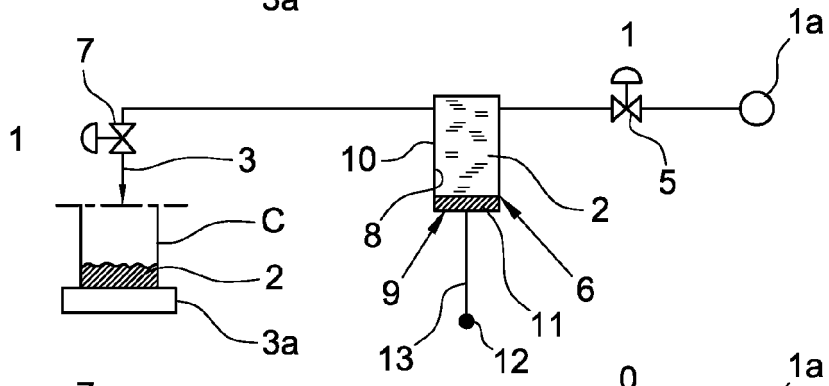

Fig. 8

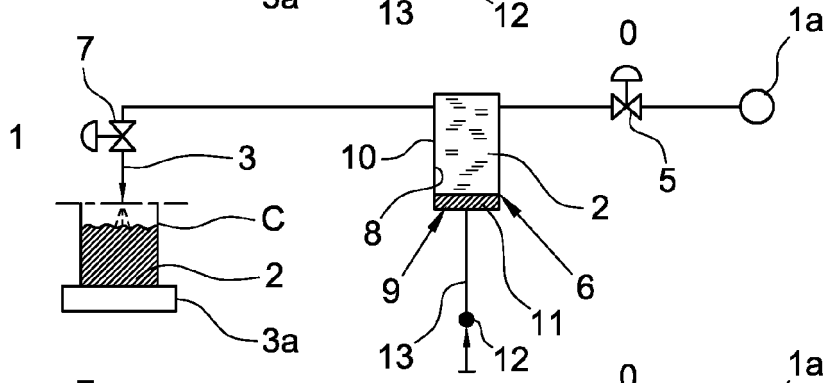

Fig. 9

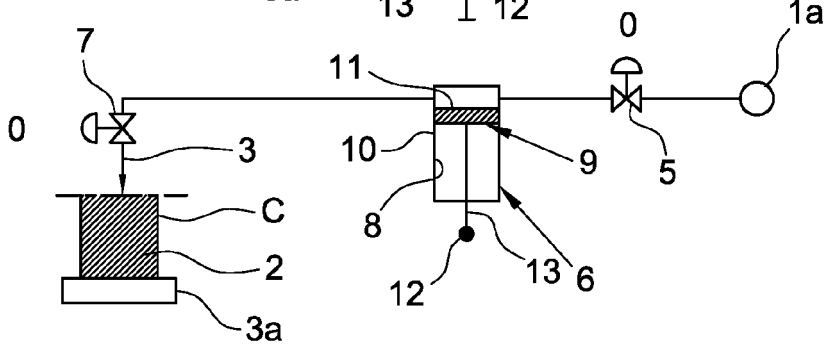

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 6531

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	EP 0 260 532 A1 (MITSUBISHI HEAVY IND LTD [JP]) 23 March 1988 (1988-03-23)	10	INV. B65B3/26 B65B3/28 B65B3/30
A	* the whole document *	1	
X	EP 0 196 410 A1 (GROSSKREUZ GERHARD [DE]; KLEINOPHORST EDITH [DE]) 8 October 1986 (1986-10-08)	10	
A	* the whole document *	1	
A	DE 102 09 435 C1 (FEIGE ABFUELLTECHNIK [DE]) 14 August 2003 (2003-08-14) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (IPC)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 July 2015	Ungureanu, Mirela

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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