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

(11) EP 2 610 403 A1

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**03.07.2013 Bulletin 2013/27**

(51) Int Cl.:
***D06F 75/10*** *(2006.01)* ***D06F 75/12*** *(2006.01)*
***D06F 75/14*** *(2006.01)* ***D06F 79/00*** *(2006.01)*

(21) Application number: **12183366.9**

(22) Date of filing: **06.09.2012**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA ME**

(30) Priority: **14.09.2011 IT UD20110144**

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## (54) Regeneration device to regenerate a water decalcification unit in an ironing apparatus and relative regeneration method

(57) Regeneration device to regenerate a water decalcification unit (13) associated with an ironing apparatus (12) having a tank (19) for the water and a boiler (21) to transform the water into steam. The water decalcification unit (13) is provided with at least an anti-limescale filter (15) of the regenerable type, connected to the tank (19). The regeneration device comprises a compartment (27) into which a cartridge (28) containing a regenerating liquid is inserted, and a drainage unit (30) associated at least with the anti-limescale filter (15) and with the boiler (21). The drainage unit (30) is able to be selectively activated to assume a first operating position, in which the insertion of the cartridge (28) into the compartment (27) is prevented and the anti-limescale filter (15) is in hydraulic communication with the boiler (21) to supply decalcified water to the latter from the water decalcification unit (13), and a second operating position, in which the cartridge (28) is inserted into the compartment (27) so that the regenerating liquid can be conveyed toward the anti-limescale filter (15), and in which the hydraulic communication between the anti-limescale filter (15) and the boiler (21) is interrupted.

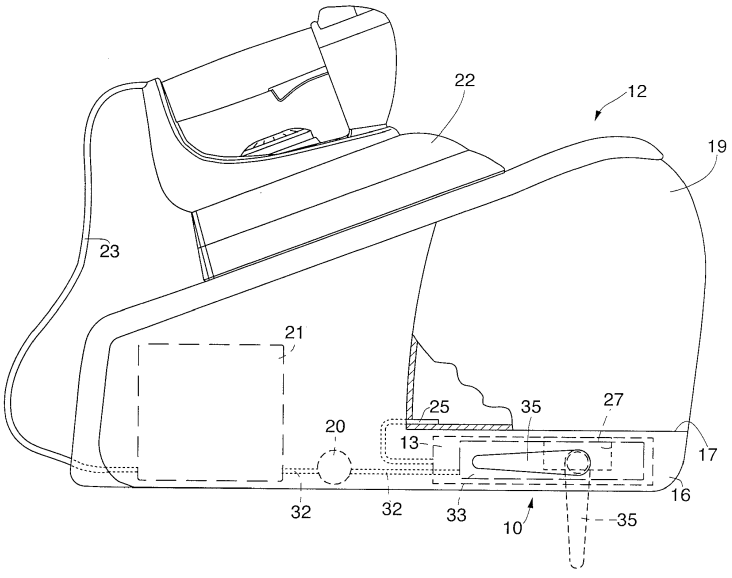


fig.1

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## Description

### FIELD OF THE INVENTION

**[0001]** The present invention concerns a device and a method for the regeneration of a water decalcification unit, suitable to be used in a steam ironing apparatus to prevent the water used to generate the steam needed for ironing from causing the formation of limescale inside the ironing apparatus, above all inside the boiler.

**[0002]** WO 2009/030633 A1 discloses a water decalcification method and unit with the features of the preamble of the main claims.

### BACKGROUND OF THE INVENTION

**[0003]** It is known that one of the main problems of steam ironing apparatuses is the formation of limescale inside them, and in particular in the boiler which transforms the water into steam, caused by an excessive degree of hardness in the water used, that is, the percentage of calcium contained therein. In particular, as the ironing apparatus is used, the water causes encrustations to form, which at first reduce the performance of the apparatus and then render it completely unusable. Therefore, in a first approximation, the functioning life of the apparatus is inversely proportional to the degree of hardness in the water used.

**[0004]** To obviate this problem, known ironing apparatuses are associated with, or include, a water decalcification unit, which uses a resin filter of the regenerable type, interposed between the water tank and the boiler.

**[0005]** Normally, in order to regenerate the resins contained in the filters, particular solutions are used, containing different types of acid, such as citric or acetic acid, which must be handled with care because they are hazardous.

**[0006]** From Applicant's international patent application WO-A-2010/128387, a device is known for the regeneration of a water decalcification unit, which is integrated in a steam ironing apparatus and is able to regenerate a filter containing a resin of the regenerable type interposed between the water tank and the pump which feeds the boiler. The known regeneration device comprises a single container divided into two parts, one of which makes up the water tank, while the other part contains a regenerating solution with a citric acid base; two valves are disposed at the exit of the two parts of the container and a hydraulic circuit connects both the valves to the resin filter. A third valve, of the three way type, is disposed between the pump and the boiler, with the function of allowing either the water to pass normally from the tank to the boiler, during ironing, or to make the solution with an acid base circulate in the regenerable resin filter, taking it from the second part of the container and then conveying it again inside the latter, during the regeneration step.

**[0007]** One disadvantage of this known regeneration device is that the container is divided into two parts, which therefore reduces the capacity of the water tank and therefore the ironing autonomy of the ironing apparatus.

**[0008]** Another method to regenerate a resin filter is also known, which provides to remove the decalcification unit from the ironing apparatus during the necessary regeneration operations.

**[0009]** This known method, however, has the disadvantage that it is complex for users to carry out the necessary disassembling, reassembling and handling of the parts which make up the regeneration device.

**[0010]** Purpose of the present invention is to obtain a regeneration device to regenerate a water decalcification unit of ironing apparatuses, which uses a resin filter of the regenerable type, which is simple and reliable and which allows the user to easily carry out, without any danger, all the necessary operations to regenerate the filter, without needing to remove the filter from the ironing apparatus.

**[0011]** The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

### SUMMARY OF THE INVENTION

**[0012]** The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

**[0013]** In accordance with the above purpose, a regeneration device, according to the present invention, is suitable to regenerate, in a totally new and original way, a water decalcification unit, provided with at least an anti-limescale filter, of the regenerable type, for example with resin, and associated with an ironing apparatus, having at least a tank for water, connected to the anti-limescale filter, and a boiler to transform the water into steam.

**[0014]** In accordance with one characteristic of the present invention, the regeneration device comprises a compartment, into which a cartridge is suitable to be inserted, for example of the syringe-type, containing a regenerating liquid, and a drainage unit associated at least with the anti-limescale filter and with the boiler. In particular, the drainage unit is able to be selectively activated to assume a first operating position, in which the cartridge cannot be inserted into the corresponding compartment and the anti-limescale filter is in hydraulic communication with the boiler to supply decalcified water to the latter from the water decalcification unit, and, alternatively, a second operating position, in which the cartridge can be inserted into the corresponding compartment, so that the regenerating liquid can be conveyed toward the anti-limescale filter, and in which the hydraulic communication between the anti-limescale filter and the boiler is interrupted.

**[0015]** In accordance with another characteristic of the present invention, the drainage unit comprises a distrib-

utor valve provided with an internal chamber which is in hydraulic communication at least with the anti-limescale filter, by means of an inlet pipe, and with the boiler by means of an outlet pipe. The distributor valve is also in communication with a drainage pipe.

**[0016]** In accordance with another characteristic of the present invention, the distributor valve comprises a stopper element, hollow in the center and coaxially solid with a shaft provided with a through axial cavity, which is constantly in hydraulic communication with the drainage pipe. The stopper element is suitable to selectively close the entrance of the through axial cavity, or that of the outlet pipe toward the boiler.

**[0017]** In accordance with another characteristic of the present invention, clamping means, which for example comprise a tongue solid with the shaft of the distributor valve, are suitable to selectively enter, at least partly, inside the compartment when the drainage unit is in the first operating position.

**[0018]** In accordance with another characteristic of the present invention, actuation means, manual or automated, are associated with the drainage unit to cause it to pass from the first operating position to the second operating position and vice versa.

**[0019]** The regeneration method according to the present invention allows to regenerate, in a completely new and original way, a water decalcification unit of an ironing apparatus of the type described above, by means of at least an actuation step in which a drainage unit, associated at least with an anti-limescale filter of the regenerable type and with a boiler, is actuated to pass from a first operating position, in which the anti-limescale filter is in hydraulic communication with the boiler in order to decalcify the water during ironing, to a second operating position, in which a cartridge containing a regenerating liquid is inserted into a corresponding compartment associated with the anti-limescale filter, so that the regenerating liquid is conveyed toward the anti-limescale filter, and in which the hydraulic communication between the anti-limescale filter and the boiler is simultaneously interrupted.

## DESCRIPTION OF THE DRAWINGS

**[0020]** These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a lateral and schematic view of a regeneration device according to the present invention, installed in an ironing apparatus provided with a water decalcification unit;
- fig. 2 is a lateral view of a cartridge containing a regenerating liquid, suitable to be used in the regeneration device in fig. 1;
- fig. 3 is a perspective view of the regeneration device in fig. 1, associated with the water decalcification unit;
- fig. 4 is a view from above of the regeneration device in fig. 1 in a first operating position;
- fig. 5 is a transverse view, partly sectioned, of the device in fig. 1 in the first operating position;
- fig. 6 is a perspective view of the regeneration device in fig. 1 in a second operating position;
- fig. 7 is a transverse view, partly sectioned, of the device in fig. 1 in the second operating position.

## DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

**[0021]** With reference to fig. 1, a regeneration device 10 according to the present invention is installed on an ironing apparatus 12, provided with a water decalcification unit 13, having a regenerable anti-limescale filter 15 (fig. 3), of the known type, with a resin base for example.

**[0022]** The ironing apparatus 12 (fig. 1) is also substantially of the known type, for example of the type which comprises a support structure 16, shaped so as to have a seating 17, into which a tank 19 for the water is suitable to be removably inserted, a pump 20, a boiler 21 suitable to heat the water and transform it into steam, an iron 22 and a cable 23, for example of the type which allows both the electric current and also the steam to pass, in a suitable pipe.

**[0023]** In particular, the tank 19 is in hydraulic communication with the water decalcification unit 13 by means of a feed pipe 25 (figs. 1 and 4), in which a non-return valve 26 is disposed (fig. 4), which prevents the water from flowing back from the decalcification unit 13 to the tank 19 (fig. 1).

**[0024]** The regeneration device 10 comprises a compartment 27 (figs. 1, 3 and 4), substantially cylindrical, made in the water decalcification unit 13, below the seating 17 for the tank 19, and into which a cartridge 28 of the syringe type (figs. 2, 6 and 7) is suitable to be inserted, as will be described in detail hereafter.

**[0025]** The regeneration device 10 also comprises a drainage unit 30 (figs. 3 and 4), which is in hydraulic communication with the anti-limescale filter 15 of the water decalcification unit 13, by means of an inlet pipe 31, and with the pump 20 and the boiler 21, by means of an outlet pipe 32 (figs. 1, 3 and 4).

**[0026]** The drainage unit 30 comprises a distributor valve 33 (figs. 3 to 7) attached on one side of the water decalcification unit 13 and able to be driven by an actuation handle 35 (figs. 1 and from 3 to 7), to which a drainage pipe 36 is attached.

**[0027]** The distributor valve 33 comprises a cylinder 38 solid with the water decalcification unit 13 and having a cylindrical chamber 39 (fig. 5) and a central tube 40.

**[0028]** A shaft 41 is disposed, sliding axially, inside the central tube 40 and is provided with a through axial cavity 42, suitable to put the chamber 39 into hydraulic communication with the drainage pipe 36. A disk 45 is at-

tached to the internal end of the shaft 41, suitable to act as a stopper element, which is hollow in the center and has its external diameter substantially equal to that of the chamber 39. A first sealing ring 46, disposed on the periphery of the disk 45, guarantees the hydraulic seal of the latter with the internal surface of the chamber 39, and a second sealing ring 47, disposed on the periphery of the shaft 41, guarantees the hydraulic seal of the latter with the internal surface of the central tube 40.

**[0029]** The actuation handle 35 is mounted coaxially on the external terminal part of the shaft 41, so as to be axially constrained to it, although able to rotate with respect to it, together with the drainage pipe 36. To this purpose, a pin 49 is mounted on the actuation handle 35 and is inserted in an annular groove 50 of the shaft 41.

**[0030]** Moreover, a substantially L-shaped tongue 51 is disposed solid to the central part of the shaft 41, and has an end 52 which is normally inserted into the compartment 27 and is suitable to be selectively extracted from it (fig. 7), as will be described in detail hereafter. The tongue 51 is guided in its central part by an upper appendix 53 solid with the cylinder 38.

**[0031]** The cartridge 28 (figs. 2, 6 and 7), which as we saw before is of the syringe type, comprises in this case a container 60, substantially cylindrical and open at the upper part, which is able to contain a regenerating liquid, for example a solution with a citric or acetic acid base. The lower part of the container 60 is provided with a holed spout 61, from which the regenerating liquid is suitable to exit, and which, before use, is normally closed by a suitable closing element 64, of a known type, for example of the tear off type.

**[0032]** An actuation piston 62, provided at the lower part with at least a sealing ring 63, is mounted axially sliding into the container 60 in order to cause the regenerating liquid to selectively exit through the holed spout 61.

**[0033]** The cartridge 28 also comprises a safety collar 65, able to be torn open by means of a gripping ring 66, and disposed around the piston 62 in order to clamp it with respect to the container 60, by means of a tooth 67 inserted both in a slit 68 of the container 60 and also in an annular groove 69 of the piston 62. In this way the user is prevented from inadvertently driving the piston 62 and causing the regenerating liquid to exit from the container 60, before the cartridge 28 is inserted into the compartment 27.

**[0034]** The holed spout 61 is suitable to drive a ball-type valve 70, normally held in a closed position by a spring 71 and suitable to allow the selective access to a mixing zone 72 below, disposed between the feed pipe 25 and the anti-limescale filter 15.

**[0035]** The regeneration device 10 as described heretofore functions as follows.

**[0036]** In normal ironing conditions, the regeneration device 10 is in a first operating position, shown in figs. 1, 3, 4 and 5, in which the tank 19 is disposed in the seating 17 of the ironing apparatus 12 and the actuation handle 36 is substantially horizontal and thrust toward the water decalcification unit 13.

**[0037]** In this first operating position the disk 45 of the distributor valve 33 is close up to the innermost wall of the chamber 39 (on the left in fig. 5), so that the inlet pipe 31 and the outlet pipe 32 are in communication with each other through the chamber 39, while the entrance of the through axial cavity 42 is closed. Consequently, the water coming from the tank 19, after having been decalcified by the anti-limescale filter 15, can be introduced into the boiler 21 by the selective actuation of the pump 20. Moreover, in this first operating position, the end 52 of the tongue 51 is inside the compartment 27, so the insertion of a cartridge 28 therein is physically prevented.

**[0038]** When the anti-limescale filter 15 is to be regenerated, for example after a signal generated, in any known way, by the ironing apparatus 12 itself, the following operations must be carried out, which also define the regeneration method according to the present invention.

**[0039]** First of all the tank 19 is removed from its seating 17, to allow the user access to the compartment 27 below.

**[0040]** An actuation step of the drainage unit 30 is then carried out, pulling the actuation handle 35 toward the outside and turning it in an anti-clockwise direction by about 90° (position shown with a dotted line in fig. 1), so that the drainage pipe 36 which is connected to it faces with its exit downward.

**[0041]** In this way, a second operating position of the regeneration device 10 is defined, in which the shaft 41 connected to the actuation handle 35 is moved toward the outside (on the right in fig. 7) and the disk 45 solid with it is exactly in correspondence to the entrance of the outlet pipe 32, closing it, so that the hydraulic communication between the anti-limescale filter 15 and the boiler 21 is interrupted.

**[0042]** In this second operating position the inlet pipe 31 is in hydraulic communication with the drainage pipe 33, through the chamber 39 and the through axial cavity 42. At the same time, the tongue 51 is also moved (toward the right in fig. 7), with its end 52 completely outside the bulk of the compartment 27.

**[0043]** The user can then carry out a step of inserting the cartridge 28 into the compartment 27, as shown in figs. 6 and 7, after having removed the closing element 64 (fig. 2) from the holed spout 61. In particular, the cartridge 28 (fig. 7) is thrust downward so that its holed spout 61 moves the ball of the corresponding valve 70 downward, against the action of the spring 71, and opens access to the mixing zone 72 below.

**[0044]** The user then opens the safety collar 65, acting on the gripping ring 66 to free the tooth 67 from the slit 68 of the container 60 and from the annular groove 69 of the piston 62. Then the piston 62 is pushed inside the container 60, as is done with a normal syringe, until all the regenerating liquid contained in the container 60 has been introduced into the mixing zone 72.

**[0045]** Keeping the cartridge 28 in the compartment 27, with the piston 62 inside the container 60, the tank

19 is then returned into its seating 17, after it has been filled with water and after the drainage pipe 36 has been positioned above any collecting container, possibly provided with a discharge channel, such as a sink or similar, not shown in the drawings, in order to carry out a step of feeding the water.

**[0046]** The presence of the cartridge 28 in the compartment 27 has the advantage that it physically prevents the end 52 of the tongue 51 from entering the compartment 27, and therefore prevents the user, even inadvertently, from bringing the actuation handle 35 and the distributor valve 33 into their first operating position. Indeed, if this should occur during this regeneration step of the anti-limescale filter 15, the regenerating liquid, which contains acid, would pass through the outlet pipe 32, to the pump 20, to the boiler 21 and therefore to the iron 22, with considerable, even irreparable damage, both to many parts of the ironing apparatus 12 and also to the clothes being ironed during the regeneration step.

**[0047]** When all the water contained in the tank 19 has passed through the mixing zone 72 and, together with the regenerating liquid contained therein, with which it is mixed, has regenerated the anti-limescale filter 15, that is, the resin contained therein, the tank 19 can be once again removed from its seating 17. During the actual regeneration step, which lasts about 30 minutes, the mixture of water and regenerating liquid is discharged through the drainage pipe 36.

**[0048]** Moreover, during this time the user can still use the ironing apparatus 12 to iron using the iron 22, possibly using the steam generated by the boiler 21 with the remaining water contained therein, at the beginning of the regeneration operations as described above.

**[0049]** The cartridge 28 is then removed from the compartment 27, and can thus be properly disposed of.

**[0050]** Finally, the actuation handle 35 is returned into the first operating position, making it rotate in a clockwise direction by about 90° and then thrusting it toward the support structure 16 of the ironing apparatus 12 (figs. 1, 3, 4 and 5).

**[0051]** The normal ironing step can then be resumed, after having filled the tank 19 with water and having positioned it in its seating 17.

**[0052]** It is clear that modifications and/or additions of parts may be made to the regeneration device 10 as described heretofore, without departing from the field and scope of the present invention.

**[0053]** For example, the distributor valve 33 and the tongue 51 associated therewith, rather than commanded manually, could be commanded by means of a servomechanism fed electrically,

**[0054]** It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of regeneration devices, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

## Claims

1. Regeneration device to regenerate a water decalcification unit (13) associated with an ironing apparatus (12) having a tank (19) for the water and a boiler (21) to transform said water into steam, and in which said water decalcification unit (13) is provided with at least an anti-limescale filter (15) of the regenerable type, connected to said tank (19), **characterized in that** said regeneration device comprises a compartment (27) into which a cartridge (28) containing a regenerating liquid is suitable to be inserted, and a drainage unit (30) associated at least with said anti-limescale filter (15) and with said boiler (21), said drainage unit (30) being able to be selectively activated to assume a first operating position, in which the insertion of said cartridge (28) into said compartment (27) is prevented and said anti-limescale filter (15) is in hydraulic communication with said boiler (21) to supply decalcified water to the latter from said water decalcification unit (13), and a second operating position, in which said cartridge (28) can be inserted into said compartment (27) so that said regenerating liquid can be conveyed toward said anti-limescale filter (15), and in which said hydraulic communication between said anti-limescale filter (15) and said boiler (21) is interrupted.

2. Device as in claim 1, **characterized in that** said drainage unit (30) comprises a distributor valve (33) provided with a chamber (39) in hydraulic communication at least with said anti-limescale filter (15), by means of an inlet pipe (31), and with said boiler (21) by means of an outlet pipe (32).

3. Device as in claim 2, **characterized in that** said distributor valve (33) comprises a shaft (41) disposed sliding axially inside said chamber (39) and provided with a through axial cavity (42), suitable to put said chamber (39) selectively in hydraulic communication with a drainage pipe (36) as well.

4. Device as in claim 3, **characterized in that** said distributor valve (33) also comprises a stopper element (45), hollow in the center, and coaxially solid with said shaft (41), and suitable to selectively close the entrance of said through axial cavity (42), or that of said outlet pipe (32).

5. Device as in claim 2, 3 or 4, **characterized in that** clamping means (51, 52) are associated with said distributor valve (33) to selectively enter, at least partially, inside said compartment (27) when said drainage unit (30) is in said first operating position.

6. Device as in any claim hereinbefore, **characterized in that** actuation means (35) are associated with said drainage unit (30) to cause its passage from said

first operating position to said second operating position and vice versa.

**7.** Device as in claims 3 and 6, **characterized in that** said actuation means comprise an actuation handle (35) coupled with said shaft (41).

**8.** Device as in claim 7, **characterized in that** said drainage pipe (36) is attached to said actuation handle (35), which is assembled coaxially on a terminal part of said shaft (41), outside said chamber (39), so that said actuation handle (35) is constrained axially to said shaft (41), even though it is able to rotate with respect thereto, together with said drainage pipe (36).

**9.** Device as in any claim hereinbefore, **characterized in that** said cartridge (28) is of the syringe type and comprises a container (60), substantially cylindrical and open at the upper part, which is suitable to contain said regenerating liquid, and an actuation piston (62), assembled sliding axially in said container (60).

**10.** Device as in claim 9, **characterized in that** said container (60) is provided with a holed spout (61), from which said regenerating liquid is suitable to exit, and which is normally closed by a removable closing element (64).

**11.** Device as in claim 9 or 10, **characterized in that** said cartridge (28) also comprises a safety collar (65), disposed around said piston (62) and around said container (60) in order to clamp them reciprocally.

**12.** Device as in any claim hereinbefore, **characterized in that** said compartment (27) is disposed in a seating (17) for said water tank (19), so that said compartment (27) is accessible only after the temporary removal of said tank (19) from said seating (17).

**13.** Regeneration method to regenerate a water decalcification unit (13) associated with an ironing apparatus (12) having a tank (19) for the water and a boiler (21) to transform said water into steam, and wherein said water decalcification unit (13) is provided with at least an anti-limescale filter (15) of the regenerable type, connected to said tank (19), **characterized in that** it comprises at least an actuation step in which a drainage unit (30), associated at least with said anti-limescale filter (15) and with said boiler (21), is actuated to pass from a first operating position, in which said anti-limescale filter (15) is in hydraulic communication with said boiler (21) to decalcify the water during ironing, to a second operating position, in which a cartridge (28) containing a regenerating liquid is inserted into a corresponding compartment (27) associated with said anti-limescale filter (15), so that said regenerating liquid is conveyed toward said anti-limescale filter (15), and in which said hydraulic communication between said anti-limescale filter (15) and said boiler (21) is simultaneously interrupted.

**14.** Regeneration method as in claim 13, **characterized in that** after said actuation step, while said drainage unit (30) is in said second operating position, an insertion step is provided during which said cartridge (28) is inserted into said compartment (27).

**15.** Regeneration method as in claim 14, **characterized in that** after said insertion step a step is provided to feed the water from said tank (19) to said anti-limescale filter (15), through a mixing zone (72) below said compartment (27), during which a mixture of water and of said regenerating liquid passes through said anti-limescale filter (15) and exits from a drainage pipe (36) connected to a distributor valve (33) of said drainage unit (30).

**16.** Regeneration method as in claim 15, **characterized in that** at the end of said water feeding step said cartridge (28) is removed from said compartment (27) and said drainage unit (30) is returned to said first operating position.

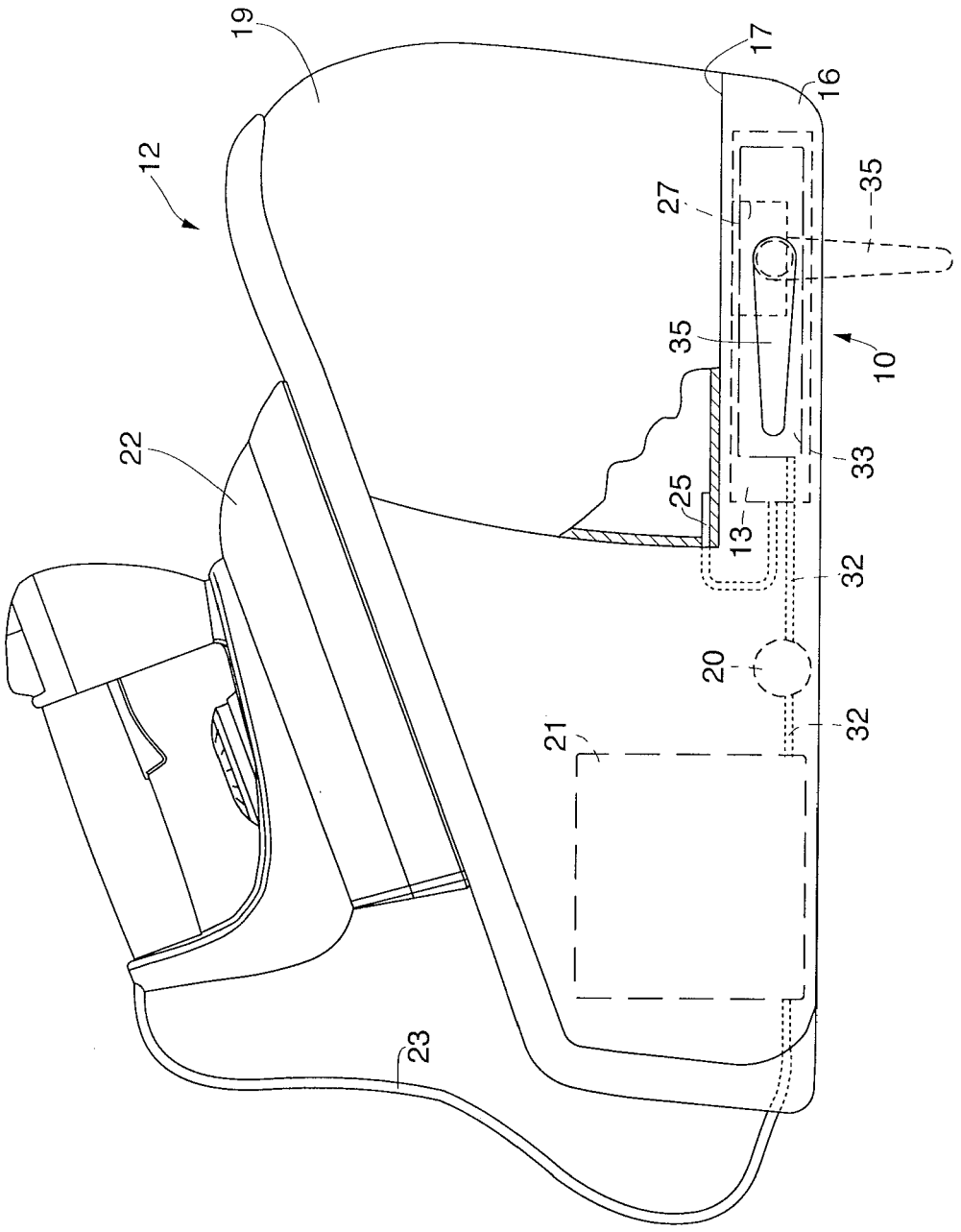


fig.1

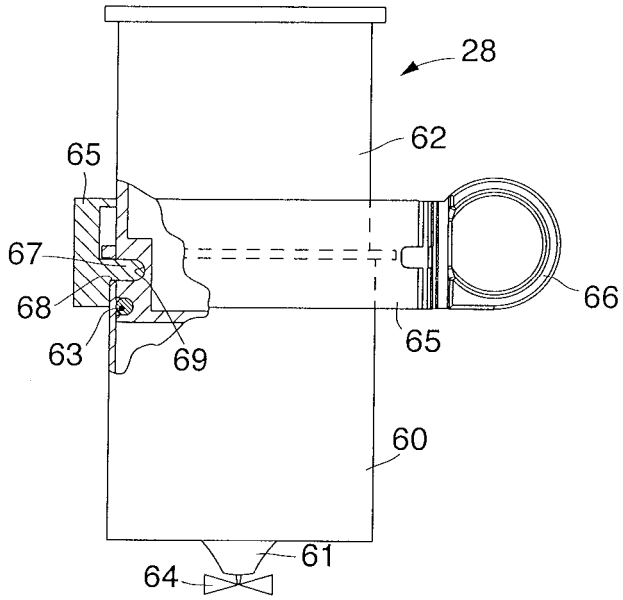
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fig.2

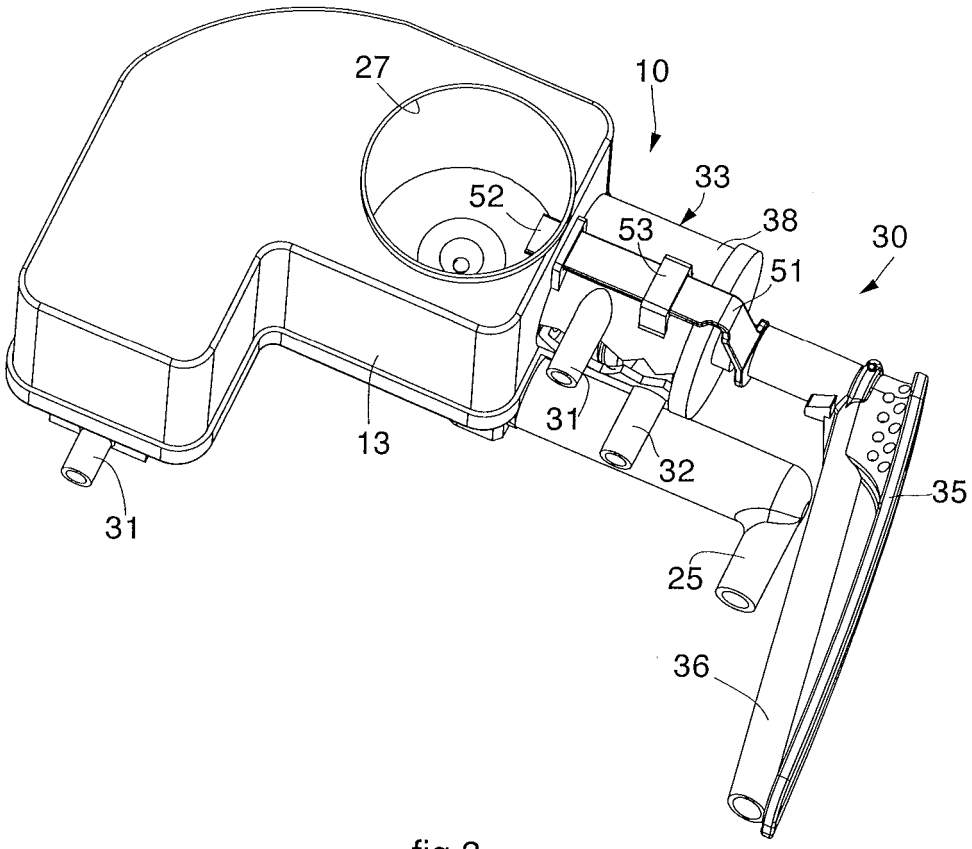
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fig.3

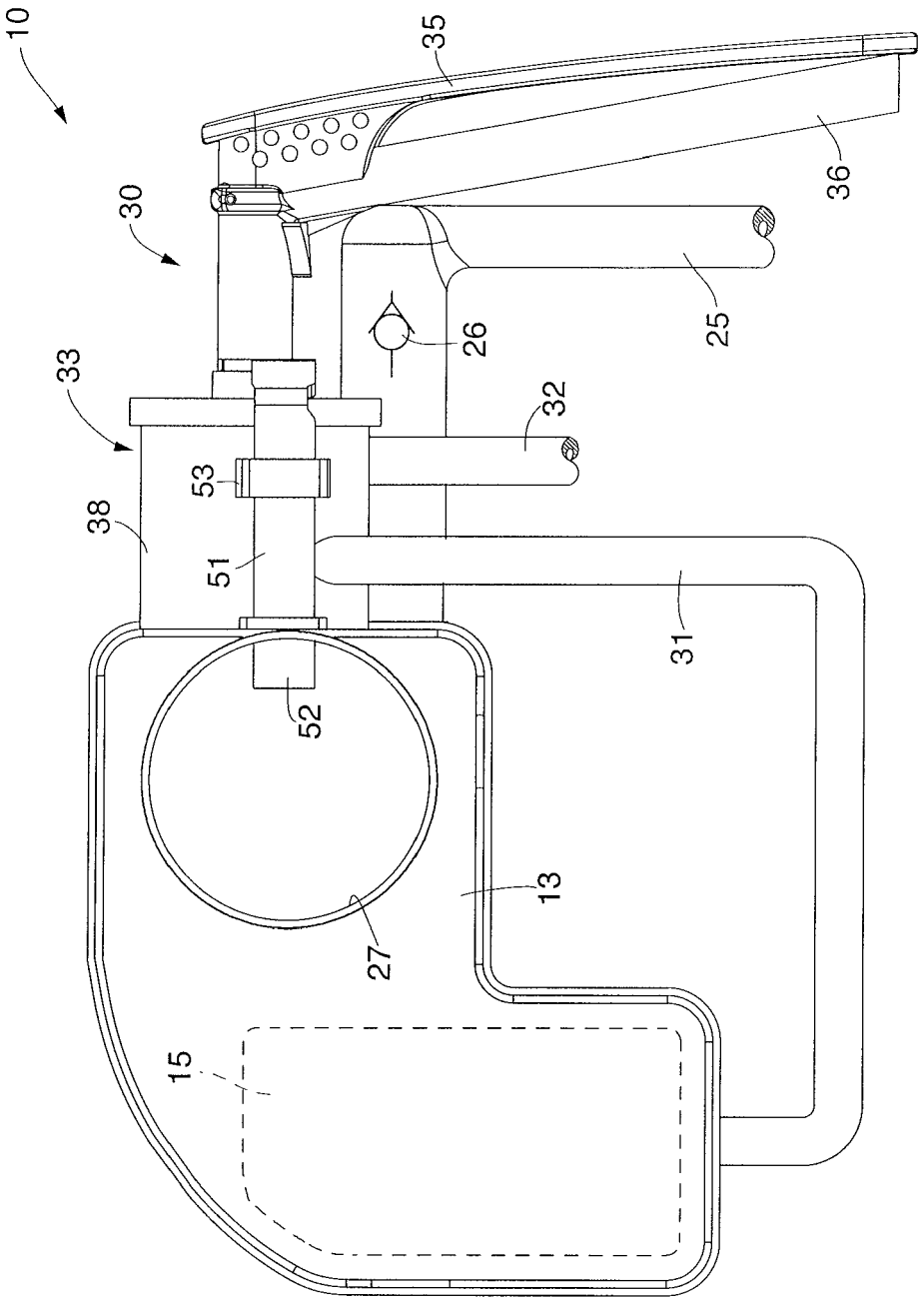


fig.4

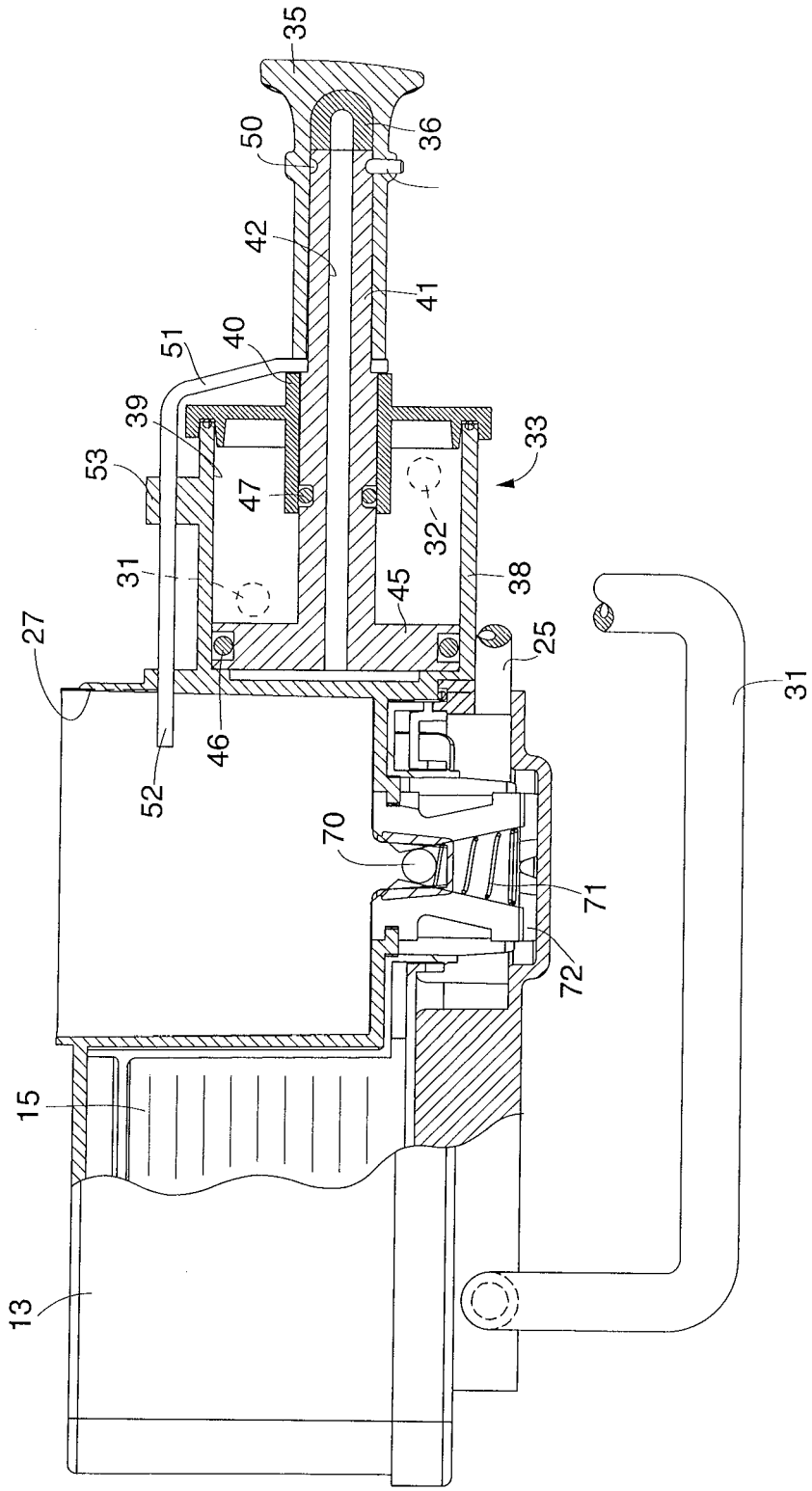
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fig.5

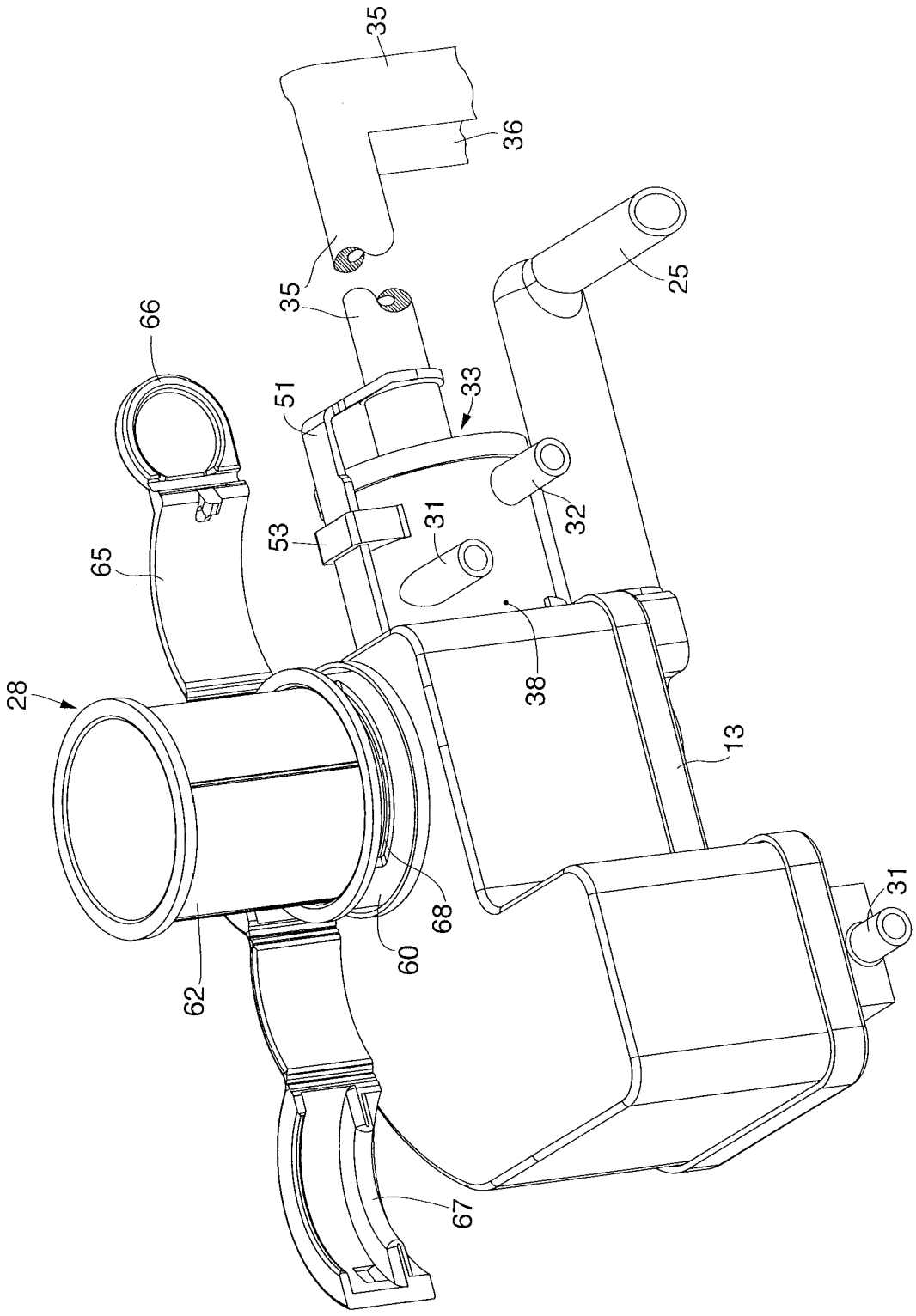


fig.6

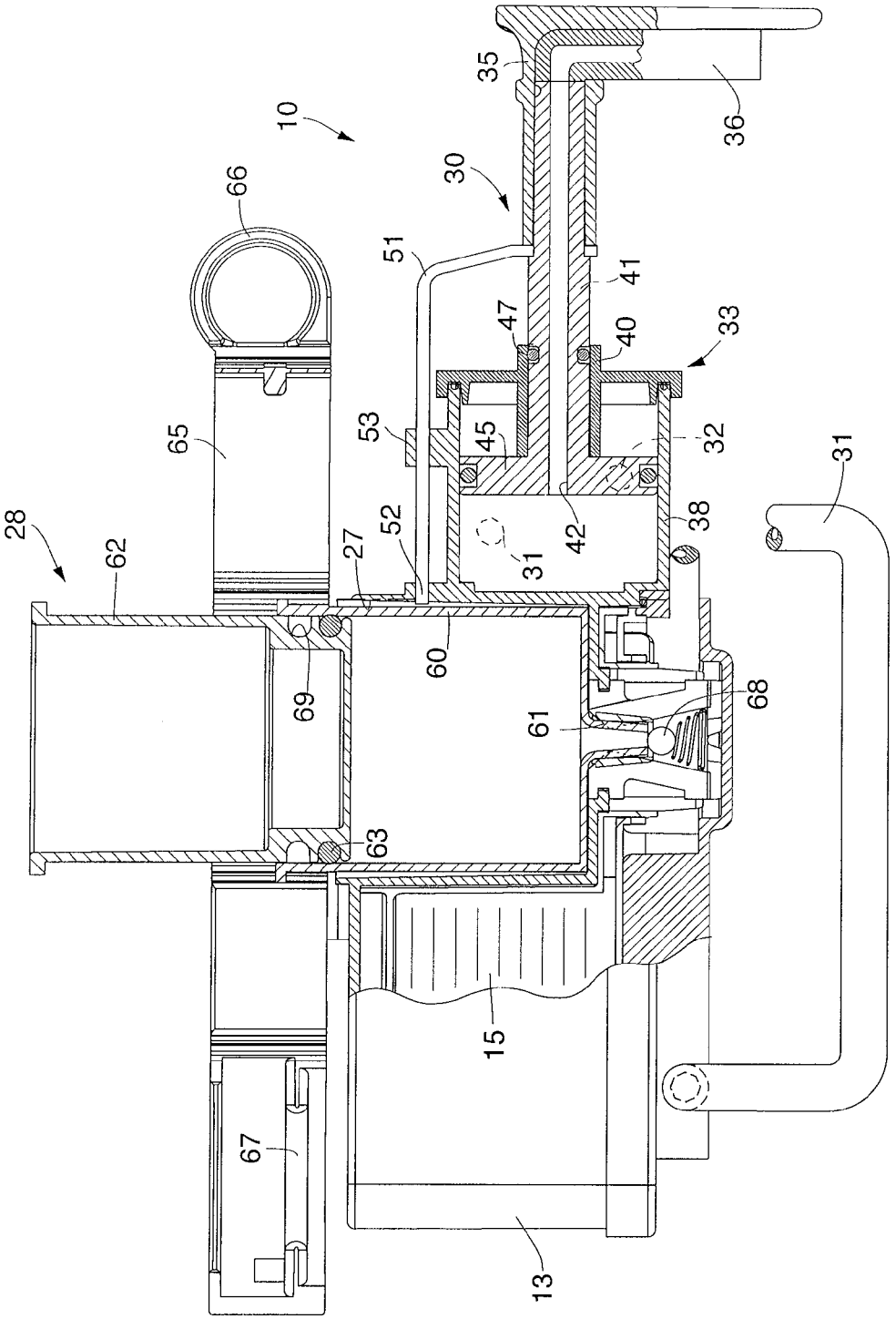
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fig.7

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# EUROPEAN SEARCH REPORT

Application Number
EP 12 18 3366

## DOCUMENTS CONSIDERED TO BE RELEVANT

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| Munich | 27 May 2013 | Clivio, Eugenio |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 18 3366

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