

Description

[0001] The present invention relates to an innovative water supply and treatment system for household appliances which complies with all safety requirements currently in force and which is adapted to operate at atmospheric pressure.

[0002] The present invention also relates to a household appliance comprising a water supply and treatment system according to the present invention.

[0003] It is known that household appliances like dishwasher machines comprise a water supply and treatment system that includes a backflow prevention system, called safety air gap.

[0004] All washing appliances connected to a water mains must be equipped with a backflow prevention system in compliance with the regulations currently in force, e.g. the EN 61770 standard.

[0005] Depending on the type of liquid treated by the backflow prevention system, the latter can be classified, for example, as a type 5 backflow prevention system, which is used in order to avoid any backflow of washing water that may be contaminated by, in addition to detergent, germs and bacteria that might be present on the product to be washed. A type 3 backflow prevention system is, on the other hand, a system adapted to prevent any backflow of water that comes in contact with the water treatment system.

[0006] Two possible hydraulic solutions are currently known which aim at fulfilling the safety requirements. According to a first solution, the backflow prevention system is hydraulically positioned upstream of the water treatment system. According to a second solution, the backflow prevention system is hydraulically positioned downstream of the treatment system.

[0007] In both of the above-mentioned solutions, the water supply and treatment system can operate on the pressure generated by the water mains alone.

[0008] Describing now more in detail the solutions according to the current state of the art, said first solution envisages that the backflow prevention system is positioned upstream of the water treatment system and operates on the basis of the Venturi tube concept in the intake channel, called injector in technical jargon. A cross-section reduction in said intake channel generates an increased flow velocity that results in the application of a pressure on the outlet receiver, such pressure being useful for overcoming the counter pressure generated by the water treatment system when water is flowing through it. Said intake channel, shaped in such a way as to exploit the Venturi principle, may have many possible conformations, but the principle of operation still remains the same. In fact, such solutions, as well as the outlet, operate under pressure to overcome the load losses generated by the water treatment system. Although such construction solutions are simple, compact and inexpensive, their most important drawback is that, since the outlet is under pressure, when the supply valve is closed a

part of the fluid, which can be classified as class 5, flows back and contaminates the injector of the backflow prevention system. Therefore, such a solution can no longer be certified as compliant with the EN 61770 standard. Furthermore, since this is a system that operates under pressure, it suffers high load losses at low pressures, and in such conditions the intake flow rate is reduced, leading to increased load losses.

[0009] On the other hand, the second one of the above-mentioned solutions envisages that, as previously specified, the backflow prevention system, designed for class 3 liquids, is positioned downstream of the water treatment system and has an outlet under atmospheric pressure, in that the water can directly reach the sump by gravity.

The systems made in accordance with this solution include an additional type 3 safety system before the water treatment system. Although this solution appears to comply with the EN 61770 standard, because the injector outlet is not under pressure, it still suffers from the drawback that, should the user not correctly close the cap on the neck of the tank containing the regenerating substance, in particular salt, after having poured such substance into the tank, the neck being located inside the wash chamber, the treatment system would come in contact with the class 5 washing liquid, and upstream of the hydraulic circuit only a type 3 safety system is envisaged, which is insufficient for class 5 liquids, resulting in the risk of contamination of the water mains. What is more, this solution is very costly and therefore hardly applicable.

[0010] It should also be remarked that both of the above-described solutions according to the state of the art require the pressure of a water network to operate correctly. As a matter of fact, in both solutions the decalcifying substances, e.g. resins in the form of granules, work while remaining mutually packed, thus generating a high load loss in the water supply and treatment system.

[0011] Furthermore, experimental tests have shown that in those solutions wherein the water treatment system uses compacted decalcifying substances with no motion of the granules that constitute such decalcifying substances, load losses vary over time; in particular, they tend to increase after the first use. It has been observed, in fact, that the granules, already packed at the assembly stage, are further compacted every time the supply electro valve is opened, until they settle. Moreover, such load loss changes cannot be easily predicted, since they depend on several factors, such as pressure, flow rate, presence of suspensions, etc.

[0012] In general, the present invention aims at solving these and other technical problems by providing a water supply and treatment system compliant with the EN 61770 standard while requiring low production costs and being independent of the mains pressure.

[0013] One aspect of the present invention relates to a water supply and treatment system having the features set out in the appended claim 1.

[0014] A further aspect of the present invention relates

to a household appliance having the features set out in the appended claim 23.

[0015] Auxiliary features are set out in respective dependent claims appended hereto.

[0016] The features and advantages of the system and household appliance will become apparent in light of the following description of some possible, though illustrative and non-limiting, embodiments of the water supply and treatment system and of the household appliance, as well as from the annexed drawings, wherein:

- Figures 1A and 1B show two possible embodiments of the water supply and treatment system, connected to a hydraulic system of a household appliance; in particular, Figure 1A shows a first embodiment wherein decalcified water is supplied into a wash chamber of the household appliance through a conduit connected to a sump that is present in said wash chamber; Figure 1B shows a second embodiment wherein decalcified water is supplied into a wash chamber of the household appliance through a neck of a cap comprised in a second tank;
- Figures 2A and 2B schematically show one possible embodiment of a water supply and treatment system according to the present invention in two different operating configurations; in particular, Figure 2A shows the path of the water flow in a configuration of decalcification of the water to be supplied into the wash chamber of the water supply and treatment system; Figure 2B shows the path of the water flow in the same water supply and treatment system in a configuration of regeneration of the decalcifying substances;
- Figures 3A, 3B and 3C are graphs relating to the load losses occurring in a water supply and treatment system as a function of different design variables of said water supply and treatment system; in particular, Figure 3A shows, on the axis of abscissas, the ratio between the volume of the decalcifying substances and the volume of the first tank adapted to contains such volume of decalcifying substances, while the axis of ordinates indicates the load loss; Figure 2B shows, on the axis of abscissas, the flow rate value expressed in litres per minute, while the axis of ordinates indicates the load loss; Figure 3C shows a comparison between two curves on a graph wherein the axis of abscissas indicates time and the axis of ordinates indicates the load loss, wherein the first curve, drawn with a dashed line, represents a construction solution in which the volume ratio between the volume of the decalcifying substances and the volume of the first tank is below a given threshold; whereas the second curve, drawn with a continuous line, represents a construction solution in which the volume ratio between the volume of the decalcifying substances and the volume of the first tank is above

a given threshold;

- Figure 4 shows a dishwasher machine according to the present invention;

- Figure 5 schematically shows one possible embodiment of a hydraulic circuit of the water supply and treatment system according to the present invention.

[0017] With reference to the above-listed figures, reference numeral 2 designates as a whole a water supply and treatment system according to the present invention. Reference numeral 1 designates as a whole a household appliance, e.g. a dishwasher.

[0018] Water supply and treatment system 2 according to the present invention is particularly suitable for use in household appliances 1 such as, for example, washing machines, in particular dishwasher machines.

[0019] Water supply and treatment system 2 according to the present invention has anti-backflow features. In fact, water supply and treatment system 2 comprises a backflow prevention device 3. Said backflow prevention device 3 is of the type with outlet at atmospheric pressure.

[0020] Said backflow prevention device 3 comprises an outlet 32. Said outlet 32 being an outlet under atmospheric pressure.

[0021] For the purposes of the present description, the term "anti-backflow features" refers to structural specifications, e.g. dictated by regulations in force, for avoiding water contamination, e.g. providing compliance with the EN61770 standard.

[0022] Water supply and treatment system 2 according to the present invention comprises a first tank 5. Said first tank 5 defines a first volume "V1" containing a water decalcifying substance, e.g. epoxy resins, in the form of granules.

[0023] Water supply and treatment system 2 according to the present invention is designed to operate at atmospheric pressure, being hydraulically disconnected from a water supply, in particular through said backflow prevention device 3.

[0024] For the purposes of the present description, the expression "hydraulically disconnected from a water supply" means that it is disconnected from the pressure that is present in a water network.

[0025] Water supply and treatment system 2 according to the present invention comprises an element 32A. In particular, a part of said element 32A is adapted to receive the water exiting through said outlet 32 of backflow prevention device 3 and to be under atmospheric pressure.

[0026] Said element 32A has a hydraulic head with respect to an outlet 52 of the first tank 5 towards a wash chamber 12 of household appliance 1 such as to allow the passage of a water flow into said first tank 5.

[0027] In water supply and treatment system 2 according to the present invention, the ratio between a volume of decalcifying substance "V2" and volume "V1" of the

first tank 5, adapted to contain said volume "V2" of decalcifying substance, is such as to allow the decalcifying substance to move in different operating configurations of water supply and treatment system 2. Moreover, the ratio between the volume of decalcifying substance "V2" and volume "V1" of the first tank 5 is such as to prevent said granules from getting compacted.

[0028] In water supply and treatment system 2 according to the present invention, the first tank 5 is so sized that, upon any variation, e.g. interruption, of the water flow in said first tank 5, e.g. following the closing of a valve system 21, e.g. a supply valve, the granules of the decalcifying substance will move, e.g. falling by gravity. Water supply and treatment system 2 according to the present invention prevents the granules of decalcifying substance from getting packed or compacted, in particular as time passes during the life of the system, e.g. of the first tank 5, thereby ensuring the proper operation of water supply and treatment system 2, in particular avoiding a possible clogging thereof. Water supply and treatment system 2 can, therefore, operate at atmospheric pressure, thanks to its own hydraulic head, e.g. the one generated by said element 32A.

[0029] For the purposes of the present description, the life of the system is meant to be the service life of the water supply and treatment system, before the whole system or its components stop operating in accordance with the design specifications.

[0030] Water supply and treatment system 2 is adapted to operate at atmospheric pressure in all the operating configurations of said water supply and treatment system 2. In particular, said element 32A is designed to avoid the presence of any shut-off elements, such as solenoid valves, which are actually absent. In fact, along the extension of said element 32A there are no shut-off elements. Besides, water supply and treatment system 2 can operate at atmospheric pressure, i.e. by gravity only, both in an operating configuration of water decalcification or treatment and in an operating configuration of regeneration.

[0031] Because it can operate at atmospheric pressure, water supply and treatment system 2 offers some advantages in terms of safety, which are well-known to those skilled in the art, both upstream and downstream of element 32A.

[0032] More in general, in one illustrative and non-limiting possible embodiment of said element 32A, its shape and dimensions are similar to those of a channel or other such conduits.

[0033] In a preferred embodiment of water supply and treatment system 2 according to the present invention, said element 32A is designed to allow a water flow to enter said first tank 5 under atmospheric pressure, with an outflow defined by volume "V2" of the decalcifying substance in relation to volume "V1" of said first tank 5.

[0034] In a preferred, though illustrative and non-limiting, embodiment, such ratio between volume "V2" of the decalcifying substances and volume "V1" of said first tank

5 is lower than or equal to 0.87.

[0035] For the purposes of the present description, said volume "V2" of the decalcifying substance is determined by pouring such decalcifying substance into a graduated container containing water, leaving such decalcifying substance to settle for some time, e.g. two hours, and then measuring the level of such decalcifying substance in such graduated container. Furthermore, the volume value determined in this way is smaller by approximately 8% than obtainable by means of the international method of measurement.

[0036] Figure 3A shows a graph concerning the load losses occurring in a water supply and treatment system 2 as a function of the volume ratio between volume "V2" of the decalcifying substances and volume "V1" of the first tank 5. In particular, the axis of abscissas shows the ratio between volume "V2" of the decalcifying substances and volume "V1" of the first tank 5 adapted to contain such volume of decalcifying substance. Based on experimental data, without reference to any particular scientific theory, it has been found that, as shown in Figure 3A, load losses increase considerably when the ratio between the volumes ($V2/V1$) exceeds a certain threshold, in particular the value of 0.87.

[0037] Furthermore, with reference to Figure 3C, which shows a comparison between two curves on a graph, wherein the axis of abscissas indicates time, while the axis of ordinates indicates the load loss, the first curve, drawn with a dashed line, represents a first case in which the volume ratio between volume "V2" of the decalcifying substances and volume "V1" of the first tank 5 is below a certain threshold, e.g. a predetermined threshold; whereas the second curve, drawn with a continuous line, represents a second case in which the volume ratio between volume "V2" of the decalcifying substances and volume "V1" of the first tank 5 is above said threshold, e.g. said predetermined threshold.

[0038] By way of non-limiting example, both curves refer to volume ratios ($V2/V1$) which are, respectively, below and above a predetermined threshold of 0.87.

[0039] Based on experimental data, without reference to any particular scientific theory, it was observed that, when said predetermined threshold of the volume ratio ($V2/V1$) was exceeded, the load losses increased over time, as visible for case 2 represented by the curve drawn with a continuous line. From the same data it emerged, on the other hand, that for volume ratios ($V2/V1$) below said predetermined threshold the load losses were much lower by at least one order of magnitude and also remained substantially unchanged over time; in particular, no perceptible load-loss increase was noticed over time.

[0040] The analysis of the experimental data has shown that below said predetermined volume ratio threshold the decalcifying substances can move freely every time a variation occurs in the water flow.

[0041] In one possible embodiment of water supply and treatment system 2 according to the present invention, the hydraulic head of said element 32A, with respect

to outlet 52 of the first tank 5, is lower than 600 mm.

[0042] Preferably, said hydraulic head is such as to allow the passage of the water flow in said first tank 5, with an outflow defined by volume "V2" of the decalcifying substance in relation to volume "V1" of said first tank 5, which is lower than or equal to said threshold, preferably lower than or equal to 0.87.

[0043] In a preferred, illustrative and though non-limiting, embodiment of water supply and treatment system 2 according to the present invention, said backflow prevention device 3 is an air gap 3. In a preferred, illustrative and though non-limiting, embodiment, said air gap 3 comprises, in turn, a first outlet 32, referred to as injector in technical jargon. Preferably, the structure of air gap 3 is adapted to define an overflow aperture 33, adapted to supply water directly into the wash chamber. Said aperture 33 is hydraulically connected to said wash chamber 12 of household appliance 1, and is adapted to define the hydraulic head of element 32A of water supply and treatment system 2 according to the present invention. Said overflow aperture 33 will not be described any further herein, because it is *per se* well-known to a person skilled in the art.

[0044] Preferably, in water supply and treatment system 2 according to the present invention, which is compliant with the EN 61770 "AB Type" standard, the circuit downstream of backflow prevention device 3, including a water decalcification system 4, which works hydraulically separate from the supply system, is so designed that the height between outlet 52 of the first tank 5 and said overflow aperture 33 is less than 600 mm, thereby defining the hydraulic head of element 32A.

[0045] Preferably, said element 32A comprises a part adapted to receive the water exiting through said outlet 32 of air gap 3 and under atmospheric pressure, being preferably of the type having a non-pressurized outlet.

[0046] In a preferred, illustrative and though non-limiting, embodiment of water supply and treatment system 2 according to the present invention, said element 32A is adapted to define the hydraulic connection downstream of outlet 32 of backflow prevention device 3, up to said first tank 5, having a diameter greater than 8 mm.

[0047] In a preferred embodiment of water supply and treatment system 2 according to the present invention, the load losses downstream of backflow prevention device 3 are generated by a decalcification system 4, in which said first tank 5 is comprised. The technical and working features of decalcification system 4 will be further described in detail later on.

[0048] Preferably, the load losses downstream of outlet 52 of the first tank 5 are substantially irrelevant, particularly from an engineering viewpoint.

[0049] Therefore, water supply and treatment system 2 according to the present invention is designed in such a way that all load losses downstream of air gap 3 are exclusively attributable to a decalcification system 4, in particular decalcification system 4 that includes said first tank 5. In water supply and treatment system 2, load losses

are unaffected by the components of household appliance 1 to which such water supply and treatment system 2 is connected. For example, from an engineering viewpoint, the load losses downstream of the first tank 5 do not change between an embodiment wherein the water coming from the first tank 5 enters wash chamber 12 through a conduit connected to a sump 11 that is present in said wash chamber 12 and an embodiment wherein the water coming from the first tank 5 enters said wash chamber 12 through a neck of a cap 63 comprised in a second tank 6.

[0050] In a preferred, illustrative and though non-limiting, embodiment of water supply and treatment system 2 according to the present invention, said element 32A defines the hydraulic connection with said first tank 5 at a level below said outlet 52 of the first tank 5.

[0051] Continuing the description of a water supply and treatment system 2 according to the present invention, in one illustrative and non-limiting possible embodiment thereof, it comprises at least one valve system 21. Said valve system 21 is adapted to selectively control, by selectively adjusting it, the transit in said water supply and treatment system 2 of a water flow coming from a water mains. Said valve system 21 is, for example, a supply valve and/or a proportional valve.

[0052] Preferably, valve system 21 is hydraulically situated upstream of an inlet 31 of the backflow prevention device 3, thus controlling the supply thereto.

[0053] More in general, water supply and treatment system 2 according to the present invention is designed in a manner such that, with a pressure of 0 to 10 bar coming from a water mains, said water supply and treatment system 2 can adjust the inlet flow rate, in particular through the inlet of said first tank 5, from 0 l/min to 4 l/min.

[0054] Water supply and treatment system 2 is adapted to adjust the inlet flow rate by appropriately controlling said valve system 21.

[0055] Said water supply and treatment system 2 is adapted to be commanded to execute a supply phase, wherein a known quantity of water to be treated and supplied into a wash chamber 12 of a household appliance 1 is made to flow through the water supply and treatment system 2. Preferably, during said supply phase water supply and treatment system 2 takes an operating configuration referred to herein as water decalcification configuration, for decalcifying the water to be supplied into the wash chamber.

[0056] Figure 2A shows one possible path followed by the water flowing through water supply and treatment system 2 when said water supply and treatment system 2 is in the water decalcification configuration. Figure 2A will be described in more detail later on in this specification.

[0057] Said water supply and treatment system 2 is adapted to be commanded to execute a regeneration phase, wherein a quantity of regenerating substance is supplied into said first tank 5 for the purpose of regenerating said decalcifying substances. Preferably, during

said regeneration phase water supply and treatment system 2 takes an operating configuration referred to herein as decalcifying substance regeneration configuration.

[0058] Figure 2B shows one possible path followed by the water flowing through water supply and treatment system 2 when said water supply and treatment system 2 is in the decalcifying substance regeneration configuration. Figure 2B will be described in more detail later on in this specification.

[0059] In one possible embodiment of water supply and treatment system 2 according to the present invention, said valve system 21 can be controlled by means of an electric/electronic power signal. Preferably, said electric/electronic power signal has a duty cycle.

[0060] For the purposes of the present description, the power signal having a duty cycle is meant to be the time fraction in which the signal is in the high logic state, which in the case considered herein can activate said valve system 21.

[0061] Preferably, said duty cycle of the electric/electronic power signal sent to valve system 21 is defined on the basis of settings concerning the hardness of the supplied water, managed by a control system 13 of household appliance 1.

[0062] Preferably, said valve system 21 is adapted to be controlled in at least a first mode. Said first mode of controlling valve system 21, executed by a control system 13, is adapted to prevent the transit of a water flow, for at least a first interval "T1", during a phase of supplying water into water supply and treatment system 2.

[0063] In one possible embodiment of water supply and treatment system 2 according to the present invention, said first mode of controlling valve system 21 is designed to control said valve system 21 by means of an electric/electronic power signal, e.g. a power signal having a duty cycle, e.g. a pulsed electric/electronic signal.

[0064] In one possible embodiment of water supply and treatment system 2 according to the present invention, said valve system 21 is adapted to be controlled in at least a second mode. Said second mode of controlling valve system 21, executed by a control system 13, is adapted to allow the transit of the water flow, for a second interval "T2", during a phase of supplying water into water supply and treatment system 2.

[0065] The present embodiment makes it possible to control the water flow rate in a simple, quick and inexpensive manner, since the flow rate can be adjusted by appropriately controlling a single valve system 21, which may be the supply valve of a generic water supply and treatment system. The present embodiment turns out to be particularly advantageous, cost-effective and easy to implement.

[0066] In an alternative embodiment of water supply and treatment system 2 according to the present invention, said valve system 21 can be controlled in a further mode adapted to adjust the flow rate of the water flowing through water supply and treatment system 2 while allowing a continuous transit of the water flow through wa-

ter supply and treatment system 2, e.g. during a phase of supplying water into water supply and treatment system 2. Such an embodiment envisages the use of a proportional valve. The present embodiment is more costly and complex than the previously described one.

[0067] More in general, in one possible embodiment of water supply and treatment system 2 according to the present invention, said valve system 21 is adapted to be controlled in at least a third mode. Said third mode of controlling valve system 21, executed by control system 13, is adapted to mix decalcified water with non-decalcified water for a time period "T3". Preferably, said control system 13 is adapted to control a valve system 21. In one possible configuration, said valve system 21 is adapted to adjust the flow rate in such a way as to generate a counterpressure overcoming the hydraulic head with respect to an outlet 52, for the purpose of mixing treated water, flowing in said first tank 5, with hard water, not flowing in said first tank 5; in particular, such mixing occurs in a wash chamber 12 of the household appliance.

[0068] In the present embodiment, said valve system 21 is appropriately controlled to cause the water exiting through outlet 32 of backflow prevention device 3 to also, in addition to flowing via said element 32A towards the first tank 5, thereby decalcifying such water before it arrives at wash chamber 12, flow out through said aperture 33, thus overflowing into wash chamber 12. In such an embodiment of water supply and treatment system 2, the mixing of treated water, in particular decalcified water, flowing through the first tank 5, with untreated hard water, in particular water that has not been decalcified because it has not flowed in tank 5, is effected without using any further valve systems, e.g. situated downstream of backflow prevention device or air gap 3. Such an embodiment permits, therefore, reducing the costs incurred for engineering and manufacturing water supply and treatment system 2.

[0069] In one preferred possible embodiment of water supply and treatment system 2 according to the present invention, such system 2 can obtain variable water flow rates at the inlet of the first tank 5; such variations are obtained by controlling said valve system 21, for example, by means of a suitable electric/electronic signal, e.g. a power signal having an appropriate duty cycle sent to valve system 21.

[0070] In one possible embodiment of water supply and treatment system 2 according to the present invention, it is designed to be able to manage variable flow rates, which are defined according to the hardness level of the inflowing water, such parameter being set in the household appliance, e.g. in a memory included in a control system 13, e.g. of household appliance 1, said control system 13 being capable of changing the duty cycle of the power signal sent to valve system 21.

[0071] In a preferred embodiment of water supply and treatment system 2 according to the present invention, it comprises at least one sensing device 22. Said at least one sensing device 22 is at least adapted to sense the

water being supplied into water supply and treatment system 2, in particular during a water supply phase. Preferably, said at least one sensing device 22 is adapted to sense the flow rate of the water flowing through water supply and treatment system 2.

[0072] In a first possible embodiment, said at least one sensing device 22 is located upstream of backflow prevention device or air gap 3. Said sensing device 22 being, for example, a flow meter, preferably a turbine flowmeter. Preferably, said sensing device 22 is arranged downstream of valve system 21 and upstream of an air gap 3. Figures 1A, 1B, 2A, 2B and 5 show some embodiments of water supply and treatment system 2 in which said at least one sensing device 22 is located upstream of backflow prevention device 3.

[0073] In another possible embodiment, said at least one sensing device 22 is located in a wash chamber 12 of said household appliance 1. Said sensing device 22 being, for example, a pressure sensor, e.g. a pressure switch.

[0074] The operating characteristics of said sensing device 22 will not be described any further herein with reference to the numerous possible embodiments thereof, in that such technical information is *per se* known to a person skilled in the art.

[0075] More in general, in a preferred, illustrative and though non-limiting, embodiment of water supply and treatment system 2 according to the present invention, it comprises an inlet duct 20 adapted to be connected to a water mains. Said inlet duct being situated upstream of valve system 21 adapted to selectively adjust the transit of a water flow coming from said water mains, as previously specified.

[0076] Continuing the description of a preferred, though illustrative and non-limiting, embodiment of water supply and treatment system 2 according to the present invention, said system comprises at least one water decalcification system 4.

[0077] Said decalcification system 4 comprises, in addition to said first tank 5, a regeneration circuit 7.

[0078] Preferably, said decalcification system 4 further comprises a second tank 6, adapted to contain a regenerating substance for regenerating said decalcifying substances. In the embodiment wherein said decalcifying substance consists of resins in the form of granules, such regenerating substance is sodium chloride or salt dissolved in water, e.g. brine. Said second tank 6 comprises a neck for suitably refilling said second tank 6 with regenerating substance, for regenerating said decalcifying substance. Such neck is advantageously situated within wash chamber 12 of the household appliance 1, in particular a dishwasher machine. Said neck is suitably closed by means of a cap 63.

[0079] In a preferred, illustrative and though non-limiting, embodiment of said water supply and treatment system 2 according to the present invention, said regeneration circuit 7 comprises at least one channel or other similar conduits adapted to supply a known quantity of

water into said second tank 6. In one possible embodiment of water supply and treatment system 2 according to the present invention, said regeneration circuit 7 comprises at least one channel or other similar conduits adapted to supply a known quantity of a regenerating substance into the first tank 5. Said regeneration circuit 7 is adapted to selectively allow the transit of a regenerating substance from the second tank 6 towards the first tank 5. In particular, said regeneration circuit 7 is selectively capable of supplying a known quantity of regenerating substance for regenerating said decalcifying substance. In particular, such regeneration phase, or regeneration configuration, occurs after a known period of time and/or number of wash cycles, as a function of the hardness of the water supplied into water supply and treatment system 2. This procedure allows the decalcifying substance to regain its decalcifying properties, as is known to those skilled in the art.

[0080] In one illustrative and non-limiting possible embodiment of said regeneration circuit 7, it comprises a pump capable of supplying into the first tank 5 a known quantity of regenerating substance per time unit. In the present embodiment, the regeneration phase occurs in a closed loop, said pump being able to deliver into the first tank 5 a known quantity of a regenerating substance coming from said second tank 6, which takes in water contained in said first tank 5 to produce said regenerating substance.

[0081] One illustrative and non-limiting possible embodiment of regeneration circuit 7 is described in patent application EP2564752A1 and/or in patent application WO2016203443A1.

[0082] Other alternative embodiments of regeneration circuit 7, comprising switching valves and circuits, should be considered as possible embodiments of regeneration circuit 7 of water supply and treatment system 2 according to the present invention.

[0083] By way of non-limiting example, the embodiments of regeneration circuit 7 illustrated in Figures 1A, 1B, 2A and 2B include a valve element, which may be a non-return valve and/or a solenoid valve adapted to control the transit of a regenerating substance from said second tank 6 towards said first tank 5.

[0084] Continuing the description of some possible embodiments of water decalcification system 4 comprised in a water supply and treatment system 2 according to the present invention, said outlet 52 of the first tank 5 is in fluidic communication with a wash chamber 12 of a household appliance 1, as previously specified, thus allowing the water flowing through said first tank 5 to reach, in a decalcified condition, said wash chamber 12. In a first possible embodiment, the water coming from the first tank 5 enters said wash chamber 12 through the neck of a cap 63 comprised in the second tank 6. In the present embodiment of water supply and treatment system 2 according to the present invention, the entry of the water into wash chamber 12 occurs through the neck of cap 63 of the second tank 6, adapted to contain salt or

brine.

[0085] The embodiment of Figure 1B, which is merely an illustrative and non-limiting one, shows a water supply and treatment system 2 in which inlet duct 20, connected to a water mains, receives a water flow. The water flow through water supply and treatment system 2 is adjusted by means of a valve system 21, which is, for example, a supply valve. Downstream of valve system 21 there is a sensing device 22, e.g. a flowmeter. Downstream of sensing device 22 there is backflow prevention device 3. Outlet 32 of the backflow prevention device 3 is adapted to let out the water flow, and a part of element 32A is adapted to receive the water flowing out of said outlet 32. In this figure, one can also see overflow aperture 33, adapted to define the hydraulic head of said element 32A. The water flow arrives at the first tank 5 by gravity, through said element 32A. Said first tank 5 contains a volume "V2" of decalcifying substance in its volume "V1" adapted to contain such decalcifying substance. The volume ratio ($V2/V1$) is such as to allow said decalcifying substance to move.

[0086] The water flow through said first tank 5 is decalcified and exits through said outlet 52 of the first tank 5, arriving in a decalcified condition at said wash chamber 12 through a neck of cap 63 comprised in the second tank 6, which is adapted to contain the regenerating substance. Figure 1B also shows one possible embodiment of decalcification system 4, and in particular of regeneration circuit 7, which permits, upon suitable activation of a valve element, the transit of a known quantity of regenerating substance from the second tank 6 towards the first tank 5.

[0087] In an alternative embodiment of water supply and treatment system 2 according to the present invention, the water coming from the first tank 5 enters said wash chamber 12 through a conduit connected to a sump 11 that is present in said wash chamber 12.

[0088] The embodiment of Figure 1A, which is merely an illustrative and non-limiting one, shows a water supply and treatment system 2 in which inlet duct 20, connected to a water mains, receives a water flow. The water flow through water supply and treatment system 2 is adjusted by means of a valve system 21, which is, for example, a supply valve. Downstream of valve system 21 there is a sensing device 22, e.g. a flowmeter. Downstream of sensing device 22 there is backflow prevention device 3. Outlet 32 of backflow prevention device 3 is adapted to let out the water flow, and a part of element 32A is adapted to receive the water flowing out of said outlet 32. In this figure, one can also see overflow aperture 33, adapted to define the hydraulic head of said element 32A. Such hydraulic head is indicated, by way of example, as a vertical line with arrows at both ends, drawn between the level of said aperture 33 and the level of said outlet 52 of the first tank 5.

[0089] The water flow reaches the first tank 5 by gravity, through said element 32A. Said first tank 5 contains a volume "V2" of decalcifying substance in its volume

"V1" adapted to contain such decalcifying substance. The volume ratio ($V2/V1$) is such as to allow said decalcifying substance to move.

[0090] The water flow flowing through said first tank 5 is decalcified and exits through said outlet 52 of the first tank 5, moving in a suitable conduit towards a sump 11 that is present in wash chamber 12 of household appliance 1.

[0091] Figure 1A also shows one possible embodiment of decalcification system 4, and in particular of regeneration circuit 7, which is substantially similar to the one shown in Figure 1B.

[0092] More in general, water supply and treatment system 2 according to the present invention comprises at least one control system 13. Said control system 13 is adapted to control the devices included in water supply and treatment system 2.

[0093] Preferably, said control system 13 is adapted to vary the flow rate of the water flowing through water supply and treatment system 2 during a water supply phase.

[0094] In a preferred embodiment, said control system 13 is adapted to monitor at least one sensing device 22 for the purpose of varying the flow rate of the water flowing through water supply and treatment system 2 during the water supply phase.

[0095] The present embodiment provides dynamic control over the water flow towards decalcification system 4, and in particular towards the first tank 5, by monitoring a sensing device 22, the latter having the above-described features. Preferably, said control system 13 is adapted to vary the flow rate of the water flowing through water supply and treatment system 2 as a function of the data received from said sensing device 22, by appropriately controlling said valve system 21 to obtain the desired flow rate.

[0096] Moreover, the flow rate of the water flowing through water supply and treatment system 2 may vary as a function of the hardness level of the water entering water supply and treatment system 2 from a water mains. Such parameter may be suitably stored in a memory means 132 of control system 13, as previously mentioned, and is taken into account by control system 13 when controlling said valve system 21.

[0097] In one possible embodiment, said control system 13 is, for example, the control and management system of household appliance 1.

[0098] In an alternative embodiment, said control system 13 is a slave system subject to the control and management system of household appliance 1, which is the master system.

[0099] In one possible embodiment of control system 13, it comprises a control unit 131 and a memory means 132. Said memory means 132 stores computer programs comprising the phases of the methods for controlling water supply and treatment system 2 and/or household appliance 1 according to different configurations and/or wash programs. Said computer programs being execut-

able by control unit 131, which can send control signals to the devices and systems included in water supply and treatment system 2 and/or in household appliance 1.

[0100] One possible, though merely illustrative and non-limiting, computer program executable by the control system is, for example, a method for controlling water supply and treatment system 2 according to the present invention. Said method comprises a sequence of phases, preferably carried out in succession, in particular the following phases:

- receiving a command for activating water supply and treatment system 2 in order to supply a desired quantity of water into said household appliance 1;
- activating valve system 21 in order to permit the transit of a water flow through water supply and treatment system 2;
- monitoring at least one sensing device 22;
- determining the flow rate of the water flowing through water supply and treatment system 2;
- executing a decision-making step, wherein it is evaluated if the determined water flow rate exceeds a predefined threshold;
 - o if the determined flow rate value is greater than or equal to said threshold, then continuing to supply water into household appliance 1 until the desired quantity is reached, by controlling said valve system 21 in a first mode;
 - o if the determined flow rate value is smaller than said threshold, then continuing to supply water into household appliance 1 until the desired quantity is reached, by controlling said valve system 21 in a second mode, different from said first mode;
- deactivating valve system 21 in order to prevent the transit of a water flow through water supply and treatment system 2 upon reaching the desired water quantity in said household appliance 1.

[0101] The control method is designed in a manner such that said first control mode of valve system 21, as previously described, is adapted to control said valve system 21 in such a way as to adjust the water flow through water supply and treatment system 2 by varying, in particular reducing, the flow rate of the water flowing through water supply and treatment system 2 downstream of valve system 21, so as to permit an outflow towards water decalcification system 4 as defined by the structural characteristics of said water decalcification system 4, e.g. as a function of a volume "V2" of a decalcifying substance in relation to volume "V1" of the first tank 5 adapted to contain said decalcifying substance.

[0102] The different modes of controlling valve system 21 previously described herein can, therefore, be executed by means of a respective control method in line with the above-described phases.

[0103] Figure 5 schematically shows one illustrative and non-limiting possible embodiment of the hydraulic circuit of water supply and treatment system 2 according to the present invention. In Figure 5 one can see an inlet duct 20 adapted to be hydraulically connected to a water mains. Downstream of inlet duct 20 there is valve system 21. Downstream of valve system 21 there is sensing device 22, e.g. a flowmeter. In the illustrated embodiment, said valve system 21 and said sensing device 22 are controlled by a control system 13, the latter being comprised in water supply and treatment system 2 or being the control system comprised in household appliance 1, e.g. a dishwasher machine. In the illustrated embodiment, said control system 13 comprises a control unit 131 and a memory means 132. Said memory means 132 stores computer programs for controlling water supply and treatment system 2 and/or wash programs of said household appliance 1. Said computer programs can be executed by control unit 131, which can send control signals to the devices and systems included in water supply and treatment system 2 and/or in household appliance 1.

[0104] Downstream of sensing device 22 there is a backflow prevention device 3, which is preferably adapted to fulfil all the requirements of the EN 61770 Air gap AB specification.

[0105] The water flow exiting backflow prevention device 3 through said outlet 32 can reach, by gravity via said element 32A, both decalcification system 4 and wash chamber 12 of a dishwasher machine 1.

[0106] In the embodiment illustrated in Figure 5, the water flow falling by gravity into decalcification system 4 enters said first tank 5 containing decalcifying substances according to a volume ratio (V_2/V_1) as described above. Said first tank 5 is in fluidic communication with wash chamber 12, thus allowing the water flowing through the first tank 5 to exit through said outlet 52 and arrive decalcified at wash chamber 12. The same first tank 5 is in fluidic communication with both the second tank 6 and said regeneration circuit 7 to allow, whenever necessary, a quantity of regenerating substance to be supplied to said first tank 5 from said second tank 6 in order to regenerate the decalcifying substances, as previously specified, through regeneration circuit 7.

[0107] Water supply and treatment system 2 according to the present invention, as previously specified herein, is adapted to assume at least the following operating configurations:

- configuration for decalcifying the water to be supplied into a wash chamber;
- configuration for regenerating the decalcifying substances.

[0108] Water supply and treatment system 2 is designed to operate at atmospheric pressure in both the decalcification configuration and the regeneration configuration, with the hydraulic head defined, at least partly, by the respective tanks (5, 6).

[0109] Figures 2A and 2B schematically show one possible embodiment of a water supply and treatment system 2 according to the present invention in the above-mentioned two different operating configurations.

[0110] In particular, Figure 2A shows water supply and treatment system 2 in the decalcification configuration during a phase of treating the water to be supplied into wash chamber 12. Figure 2A schematically shows one illustrative and non-limiting possible embodiment of the hydraulic circuit of water supply and treatment system 2, wherein an inlet duct 20 is visible which is adapted to be hydraulically connected to a water mains. Downstream of inlet duct 20 there is valve system 21, e.g. a supply valve. Downstream of valve system 21 there is sensing device 22, e.g. a flowmeter, preferably a turbine flowmeter.

[0111] Downstream of sensing device 22 there is a backflow prevention device 3, which receives the water flow through inlet 31 and lets the water flow out through said outlet 32.

[0112] The water flow exiting backflow prevention device 3 through said outlet 32 arrives, by gravity via said element 32A, at decalcification system 4, in particular at said first tank 5. Said first tank 5 having a volume "V1" adapted to contain a volume "V2" of decalcifying substance. Said volume ratio ($V2/V1$) is selected as previously specified.

[0113] The water flow flows through the first tank 5 and, after exiting through said outlet 52 of the first tank 5, reaches wash chamber 12, according to the modes envisaged by the various possible embodiments. More in detail, the water flow reaching decalcification system 4 by gravity enters said first tank 5 via said element 32A.

[0114] Figure 2A also shows the hydraulic head of element 32A that allows the water to flow towards the first tank 5. This figure also shows an illustrative and non-limiting possible embodiment of the remaining part of decalcification system 4, comprising a second tank 6, whose neck is closed by means of a cap 63, and regeneration circuit 7.

[0115] Figure 2B shows water supply and treatment system 2 in the regeneration configuration during a phase of regenerating the decalcifying substances. Figure 2B schematically shows one illustrative and non-limiting possible embodiment of hydraulic circuit of the water supply and treatment system 2, wherein an inlet duct 20 is visible which is adapted to be hydraulically connected to a water mains. Downstream of inlet duct 20 there is valve system 21, e.g. a supply valve. Downstream of valve system 21 there is sensing device 22, e.g. a flowmeter, preferably a turbine flowmeter.

[0116] Downstream of sensing device 22 there is a backflow prevention device 3, which receives the water flow through inlet 31 and lets the water flow out through said outlet 32.

[0117] The water flow exiting backflow prevention device 3 through said outlet 32 arrives, by gravity, at the second tank 6 of decalcification system 4.

[0118] In particular, the water flow is made to reach said second tank 6 because regeneration circuit 7 is suitably arranged to selectively allow some regenerating substance to flow from the second tank 6 to the first tank 5, in particular by appropriately activating a solenoid valve situated along a conduit that puts the two tanks (5, 6) in fluidic communication with each other. By gravity, due to the hydraulic head, the flow of regenerating substance arrives at said first tank 5, thus regenerating volume "V2" of decalcifying substances contained therein. The water obtained after the process of regenerating the decalcifying substances can be supplied into wash chamber 12 through said outlet 52 of the first tank 5.

[0119] Water supply and treatment system 2 according to the present invention is particularly suitable for use in household appliances 1, in particular in washing machines such as, for example, a dishwasher machine.

[0120] More in general, said household appliance 1, e.g. a dishwasher machine, comprises a wash chamber 12 and a door 10. Said door 10 is adapted to allow access to said wash chamber 12.

[0121] Said household appliance 1 further comprises a control system 13, e.g. having the features previously described herein.

[0122] Figure 4 shows an illustrative and non-limiting possible embodiment of a dishwasher machine 1 according to the present invention. Dishwasher machine 1 comprises a wash chamber 12, in which one or more racks can be positioned which are adapted to contain crockery; a door 10, adapted to sealingly close said wash chamber 12; and a sump 11 for recovering the water, as is known to those skilled in the art. In Figure 4 it is also possible to see cap 63 associated with the neck of the second tank comprised in the decalcification system of water supply and treatment system 2 according to the present invention.

[0123] Water supply and treatment system 2 according to the present invention is designed in a manner such that the pressure at the inlet of said element 32A is null, the latter being under atmospheric pressure, while the pressure at the inlet of the first tank 5, i.e. at the opposite end of said element 32A, is determined by the hydraulic head, as previously specified.

[0124] This feature of water supply and treatment system 2 is always present, particularly for flow rates in the range of 0 l/min and 4 l/min.

[0125] Figure 3B shows how the load losses of water supply and treatment system 2 increase with the water flow rate; in particular, it is apparent that above a flow rate of 4 l/min load losses become excessive, and it is therefore appropriate to keep them below said threshold, e.g. by controlling valve system 21 as previously specified.

[0126] The water supply and treatment system does not require the use of any shut-off elements between backflow prevention device 3 and the first tank 5, thus reducing the production costs and avoiding the accumulation of precipitates contained in the water not yet treated

by decalcification system 4. Such a solution ensures full operability of water supply and treatment system 2 even after many hours of service.

[0127] Water supply and treatment system 2 is designed in a manner such that the hydraulic head is generated by the sum of all load losses, which may depend on volume "V2" of regenerating substance contained in volume "V1" of the first tank 5. In one illustrative and non-limiting possible embodiment of water supply and treatment system 2, said load losses depend exclusively on volume "V2" of regenerating substance contained in volume "V1" of the first tank 5.

[0128] Preferably, for high flow rates, e.g. exceeding 4 l/min, the maximum hydraulic head corresponds to aperture 33 leading into the wash chamber.

[0129] Preferably, the hydraulic head of water supply and treatment system 2 is determined by the relation between the water flow rate and the load losses of water supply and treatment system 2 itself.

[0130] More in general, also depending on the different possible embodiments thereof, the hydraulic head of water supply and treatment system 2 may be determined not only by the relation between the water flow rate and the load losses of water supply and treatment system 2, but also on possible additional load losses downstream of said water supply and treatment system 2, e.g. on the level of the water in the wash chamber.

[0131] Water supply and treatment system 2 has small load losses because the load losses of the decalcifying substances contained in the first tank are reduced by appropriately selecting a ratio between volume "V2" of the decalcifying substances and volume "V1" of the first tank 5 which is smaller than or equal to a predetermined threshold, e.g. 0.87. Moreover, water supply and treatment system 2 is designed to operate mainly with flow rates in the range of 0 l/min to 4 l/min, thus further reducing the load losses.

[0132] Water supply and treatment system 2 can operate with variable flow rates, generated by appropriately controlling valve system 21, e.g. by appropriately controlling the opening and closing thereof, e.g. by opening said valve system 21 in a pulsed manner.

[0133] Such variable flow rates are defined, for example, based on the hardness level of the inflowing water, by setting such parameter in household appliance 1, e.g. whenever the user connects the household appliance to a different water network.

[0134] Water supply and treatment system 2 makes it possible to mix decalcified water with untreated water without using any further valve devices, in particular downstream of backflow prevention device 3. In fact, the mixing of treated water with untreated water is effected by controlling valve system 21, e.g. by opening and/or closing valve system 21 in a controlled manner during a supply phase of water supply and treatment system 2.

[0135] In water supply and treatment system 2 according to the present invention, said element 32A is positioned upstream of the first tank 5, and hence also up-

stream of water decalcification system 4, and is separate from the mains pressure, since it is arranged downstream of a backflow prevention device, e.g. an air gap 3, with all the advantages resulting from such a solution.

[0136] Water supply and treatment system 2 according to the present invention is also capable of defining the height of the hydraulic head by means of said element 32A; therefore, water supply and treatment system 2 is easier to engineer and manufacture.

[0137] Preferably, water supply and treatment system 2 according to the present invention can supply water into the first tank 5, and more in general into decalcification system 4, by gravity, without it overflowing through overflow aperture 33, which defines the overflow level.

Tests and experiments have shown that such a technical effect is preferably attained with flow rates lower than or equal to 2.5 l/min.

[0138] Water supply and treatment system 2 can operate at atmospheric pressure in both the water treatment phase, or decalcification configuration, and the regeneration phase, or regeneration configuration.

[0139] The quantity of decalcifying substance, e.g. epoxy resins in the form of granules, inserted in the first tank 5, and in particular their volume "V2" compared to volume "V1" of the first tank 5, is such that, every time valve system 21 is closed, the decalcifying substance can move and mix, thus not becoming compacted. The present embodiment of water supply and treatment system 2 reduces to a minimum the admission of air into the first tank 5, and hence through the decalcifying substance.

[0140] Water supply and treatment system 2 according to the present invention can operate even when the pressure in the water mains it is connected to is low, in which condition the proper operation of water supply and treatment system 2 is still ensured.

[0141] Water supply and treatment system 2 according to the present invention does not require precise flow regulators, in that the flow rate is controlled by control system 13 via a sensing device 22, e.g. a flowmeter or a pressure switch.

[0142] Any alternative embodiments of water supply and treatment system 2 which have not been described in detail herein, but which will be apparent to a person skilled in the art in light of the contents of the present patent application, shall be considered to fall within the protection scope of the present invention.

REFERENCE NUMERALS

Household appliance	1
Door	10
Sump	11
Wash chamber	12
Control system	13
Control unit	131
Memory means	132
Water supply and treatment system	2

(continued)

compacted during the life of the system.

Inlet duct	20
Valve system	21
Sensing device	22
Backflow prevention device	3
Inlet	31
First outlet	32
Element	32A
Aperture	33
Decalcification system	4
First tank	5
Outlet	52
Volume	V1
Second tank	6
Cap	63
Regeneration circuit	7
Volume	V2

2. Water supply and treatment system (2) according to claim 1, wherein it is adapted to operate at atmospheric pressure in all of the operating configurations of the same water supply and treatment system (2).
3. Water supply and treatment system (2) according to claim 1, wherein said ratio between the volume (V2) of the decalcifying substances and the volume (V1) of said first tank (5) is lower than or equal to 0.87.
4. Water supply and treatment system (2) according to claim 1, wherein the hydraulic head of said element (32A) with respect to the outlet (52) of the first tank (5) is less than 600 mm.
5. Water supply and treatment system (2) according to claim 1, comprising at least one valve system (21), adapted to selectively adjust the transit through said water supply and treatment system (2) of a water flow coming from a water mains.

Claims

1. Water supply and treatment system (2) for household appliances (1), comprising:
 - a backflow prevention device (3), of the type with an outlet at atmospheric pressure, comprising an outlet (32);
 - a first tank (5) defining a first volume (V1) containing a water decalcifying substance in the form of granules; said water supply and treatment system (2) being **characterized in that**:
 - it is designed to operate at atmospheric pressure;
 - it comprises an element (32A), wherein a part of said element (32A) being adapted to receive the water exiting through said outlet (32) of the backflow prevention device (3) and being under atmospheric pressure, having a hydraulic head with respect to an outlet (52) of the first tank (5) towards a wash chamber (12) of the household appliance (1) such as to allow the passage of a water flow into said first tank (5);
 - and **in that** the ratio between a volume (V2) of the decalcifying substance and the volume (V1) of the first tank (5), adapted to contain said volume (V2) of decalcifying substance, is such as to:
 - allow the decalcifying substance to move in different operating configurations of the water supply and treatment system (2); and
 - prevent said granules from getting
6. Water supply and treatment system (2) according to claim 5, wherein said valve system (21) can be controlled by means of an electric/electronic power signal having a duty cycle.
7. Water supply and treatment system (2) according to claim 6, wherein said duty cycle of the electric/electronic power signal for the valve system (21) is defined on the basis of a setting concerning the hardness of the supplied water, managed by a control system (13) of the household appliance (1).
8. Water supply and treatment system (2) according to claim 5, wherein said valve system (21) can be controlled in at least one mode adapted to adjust the flow rate of the water flowing through the water supply and treatment system (2), so as to permit a continuous transit of the water flow through the water supply and treatment system (2).
9. Water supply and treatment system (2) according to claim 1, comprising at least one sensing device (22) adapted to sense the flow rate of the water flowing through the water supply and treatment system (2).
10. Water supply and treatment system (2) according to claim 9, wherein said at least one sensing device (22) is located upstream of the backflow prevention device (3).
11. Water supply and treatment system (2) according to claim 9, wherein said at least one sensing device (22) is located in a wash chamber (12) of said household appliance (1).

12. Water supply and treatment system (2) according to claim 1, comprising at least one water decalcification system (4) comprising, in addition to said first tank (5), a regeneration circuit (7);
said regeneration circuit (7) comprises a pump capable of supplying into the first tank (5) a known quantity of a regenerating substance per time unit. 5
13. Water supply and treatment system (2) according to claim 1, comprising at least one control system (13) adapted to vary the flow rate of the water flowing through the water supply and treatment system (2) during a water supply phase. 10
14. Water supply and treatment system (2) according to claim 13, wherein said at least one control system (13) is adapted to monitor at least one sensing device (22) for the purpose of varying the flow rate of the water flowing through the water supply and treatment system (2) during the water supply phase. 15
15. Water supply and treatment system (2) according to claim 14, wherein said at least one control system (13) is adapted to control a valve system (21); wherein, in one configuration, said valve system (21) is adapted to adjust the flow rate so as to generate a counter pressure exceeding the hydraulic head with respect to an outlet (52), for the purpose of mixing treated water, flowing through said first tank (5), and hard water, not flowing through said first tank (5). 20
16. Water supply and treatment system (2) according to claim 1, wherein said outlet (52) of the first tank (5) is in fluidic communication with a wash chamber (12) of a household appliance (1), thus allowing the water flowing through said first tank (5) to arrive in a decalcified condition at said wash chamber (12), wherein the water coming from the first tank (5) enters said wash chamber (12) through a neck of a cap (63) comprised in said second tank (6). 25
17. Water supply and treatment system (2) according to claim 1, wherein said outlet (52) of the first tank (5) is in fluidic communication with a wash chamber (12) of a household appliance (1), thus allowing the water flowing through said first tank (5) to arrive in a decalcified condition at said wash chamber (12), wherein the water coming from the first tank (5) enters said wash chamber (12) through a conduit connected to a sump (11) that is present in said wash chamber (12). 30
18. Water supply and treatment system (2) according to claim 1 or 2, wherein said water supply and treatment system (2) is adapted to assume at least the following operating configurations: 35
- configuration for decalcifying the water to be supplied into a wash chamber (12);
 - configuration for regenerating the decalcifying substances;
- the water supply and treatment system (2) being adapted to operate at atmospheric pressure in both the decalcification configuration and the regeneration configuration, with the hydraulic head defined by the respective tanks (5, 6). 40
19. Water supply and treatment system (2) according to claim 1, wherein the load losses downstream of the backflow prevention device (3) are generated by a decalcification system (4) in which said first tank (5) is comprised. 45
20. Water supply and treatment system (2) according to claim 19, wherein the load losses downstream of the outlet (52) of the first tank (5) are substantially irrelevant. 50
21. Water supply and treatment system (2) according to claim 1, wherein said element (32A) that defines the hydraulic connection downstream of the outlet (32) of the backflow prevention device (3) up to said first tank (5) has a diameter greater than 8 mm. 55
22. Water supply and treatment system (2) according to claim 1 or 21, wherein said element (32A) defines the hydraulic connection with said first tank (5) at a level below said outlet (52) of the first tank (5).
23. Household appliance (1) comprising a wash chamber (12) and a door (10) adapted to allow access to said wash chamber (12) and a control system (13); said household appliance comprising a water supply and treatment system (2) according to claim 1.

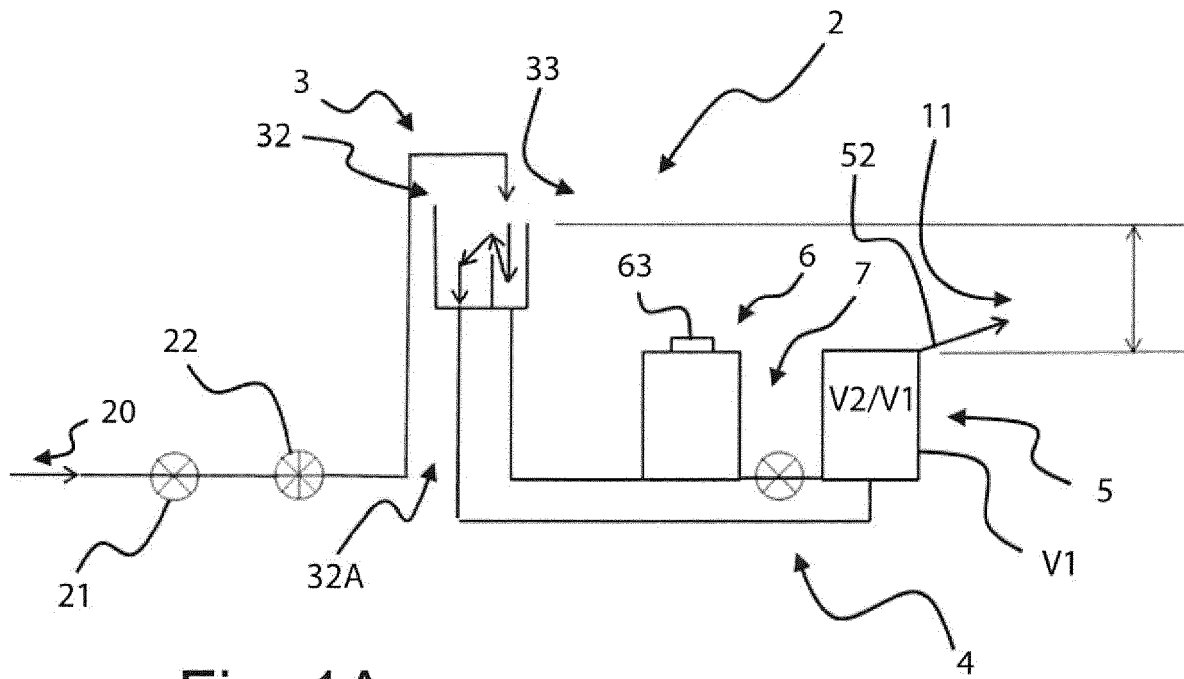


Fig. 1A

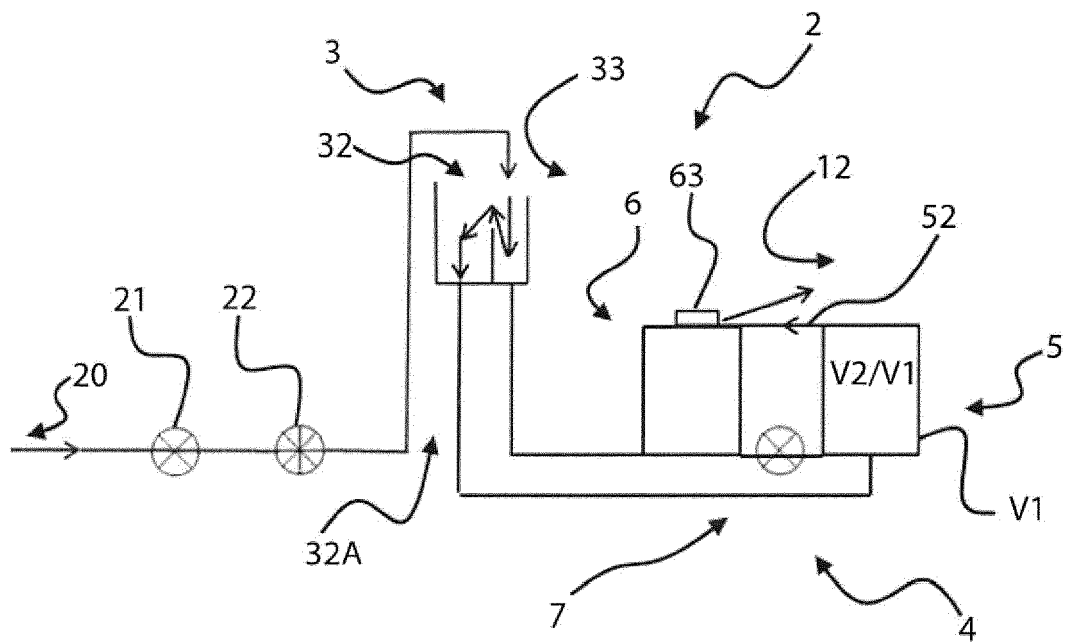


Fig. 1B

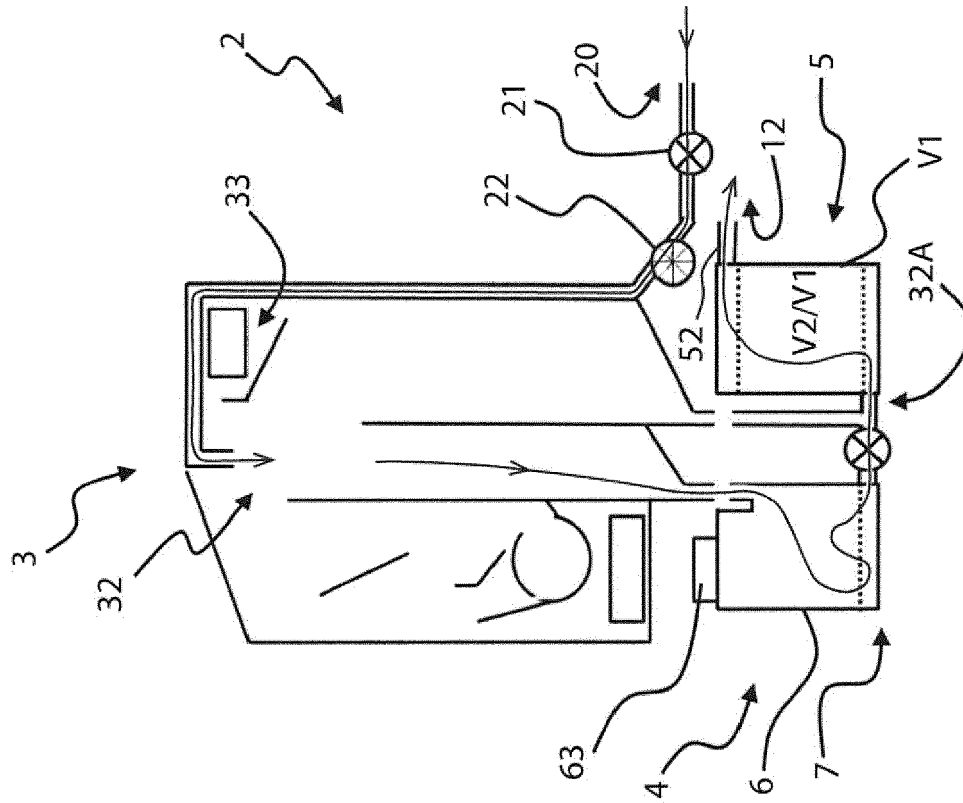


Fig. 2B

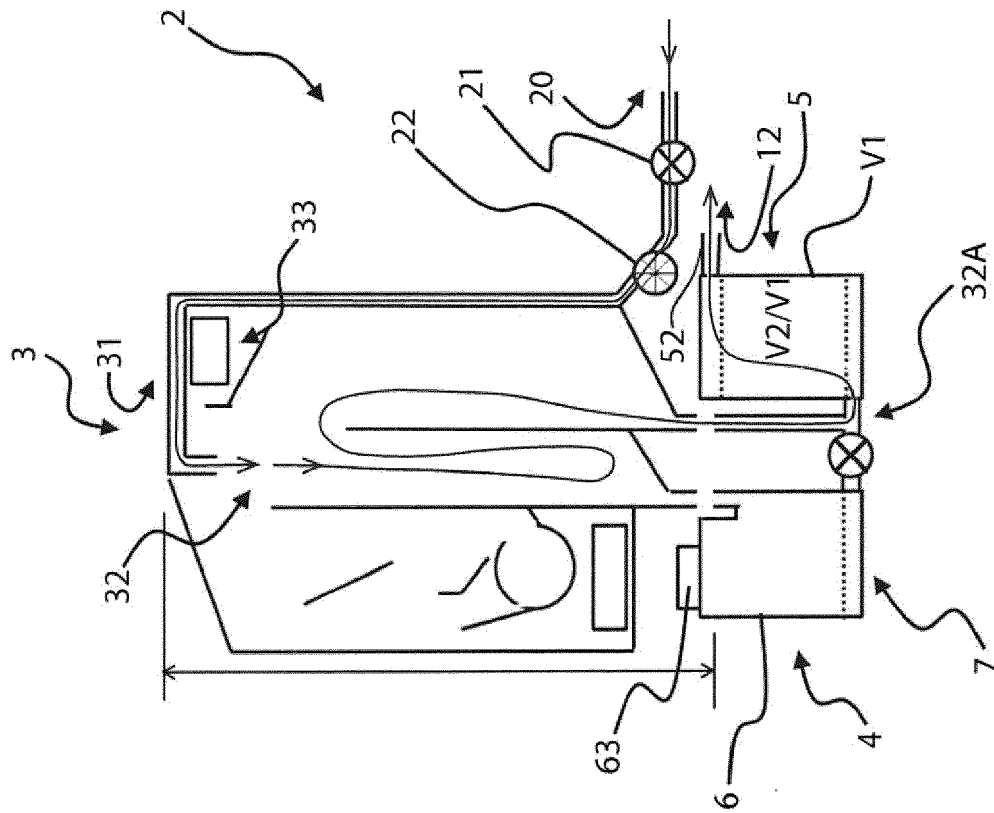


Fig. 2A

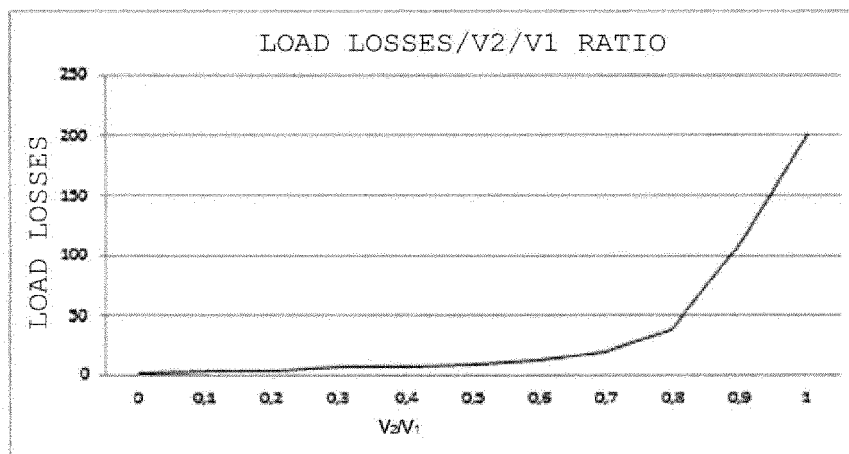


Fig. 3A

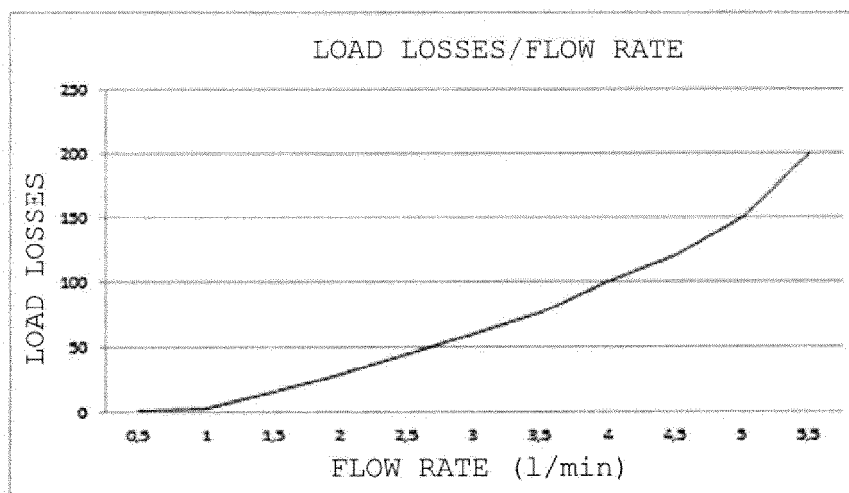


Fig. 3B

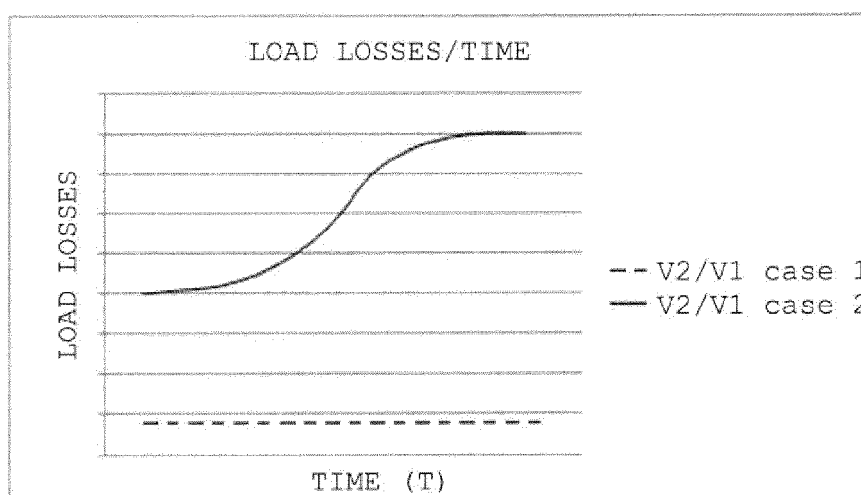


Fig. 3C

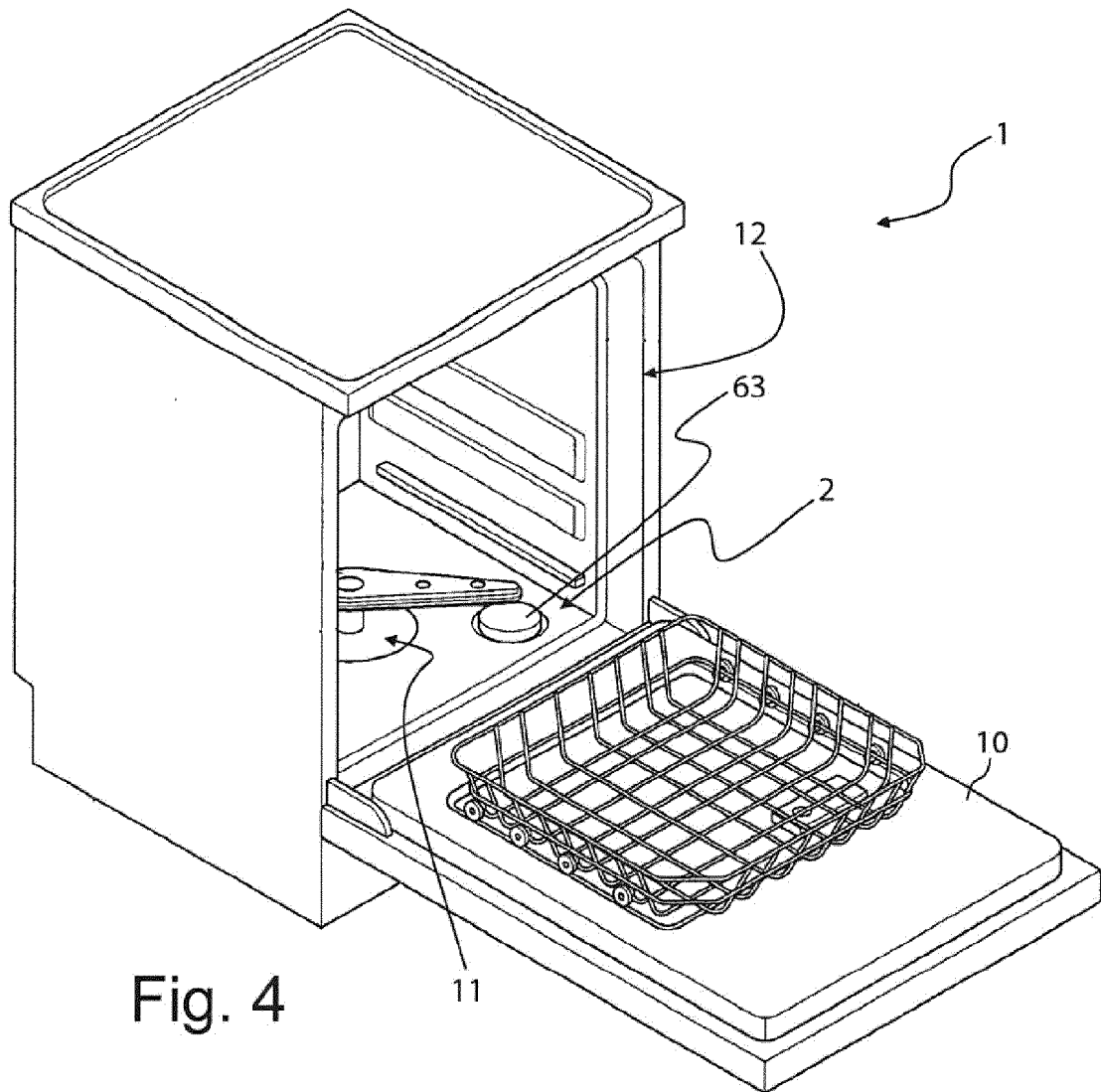


Fig. 4

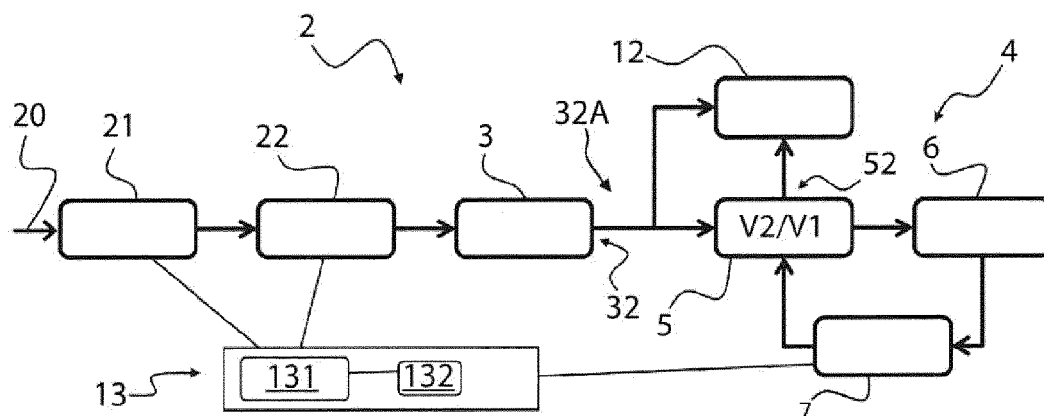


Fig. 5



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Application Number

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Y	* column 1, line 34 - line 36 *	7, 9, 10,	ADD.
A	* column 2, line 49 - column 3, line 6 *	12, 14	D06F39/00
	* column 4, line 2 - line 6 *	15	
	* claims; figures *		
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Place of search Munich		Date of completion of the search 7 July 2022	Examiner Popara, Velimir
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2564752 A1 [0081]
- WO 2016203443 A1 [0081]