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

(11) **EP 3 718 454 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.10.2020 Bulletin 2020/41

(51) Int Cl.:
A47L 15/42 *(2006.01)* ***D06F 35/00*** *(2006.01)*
D06F 39/00 *(2020.01)*

(21) Application number: **20162274.3**

(22) Date of filing: **11.03.2020**

(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
Designated Validation States:
KH MA MD TN

(30) Priority: **02.04.2019 TR 201904918**

(71) Applicant: **Vestel Beyaz Esya Sanayi ve Ticaret A.S.**
45030 Manisa (TR)

(72) Inventor: **ASIK, Rustem**
45030 Manisa (TR)

(74) Representative: **Cayli, Hülya**
Paragon Consultancy Incorporated
Koza Sokak No: 63/2
GOP 06540 Ankara (TR)

(54) **A WASHING DEVICE**

(57) With the present invention, there is provided a washing device in which the water is electrolysed to obtain a washing liquid. The washing device comprises at least one washing compartment (K) adapted to receive at least one item (3) for washing; at least one electrolysis unit (E) for obtaining acidic water and basic water by electrolysing the water received from at least one water source, the electrolysis unit (E) having at least a first electrode (E1), at least a second electrode (E3) and at least one membrane (E2) separating the first electrode (E1) and the second electrode (E3); at least one resin chamber (RE) for filtering the water, which is to be electrolysed in the electrolysis unit (E), before entering the electrolysis unit (E) such that the water is purified from elements which cause hardness, such as calcium and magnesium; at least one resin line (4) connecting the resin chamber (RE) and the electrolysis unit (E); at least one electrolysis unit line (5) which is connected from one side to the resin line (4), and from another side to the electrolysis unit (E) and at least one electrolysis unit valve (V4) which is located on the electrolysis unit line (5); at least one collection reservoir line (6) which is connected from one side to the resin line (4), and from another side to the collection reservoir (T); and at least one collection reservoir valve (V3) located on the collection reservoir line (6).

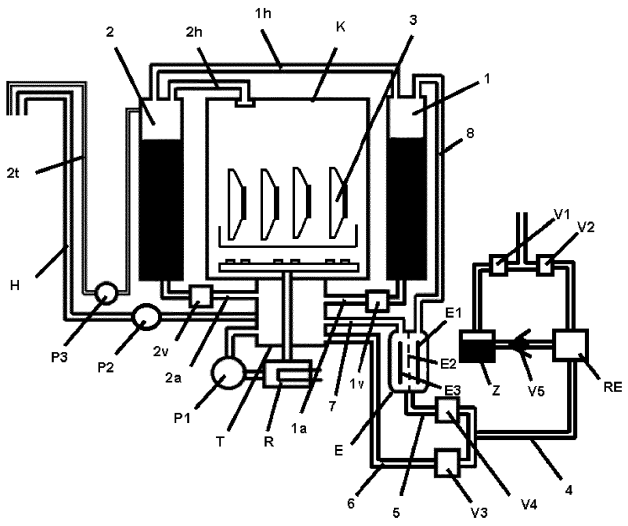

Figure – 1

EP 3 718 454 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to washing devices such as dishwashers and washing machines.

BACKGROUND OF THE INVENTION

[0002] In washing devices used for cleaning various items by washing, washing liquids are utilised to wash said items. Various chemicals are used to purify said items especially from water-insoluble foreign substances, such as oil. Chemical substances called detergents may both harm users by leaving residues in the washed items and damage the nature as a result of releasing the washing liquid to the nature after the washing process.

[0003] According to the embodiments covered by the known art, additional products like rinse aids or softeners may be used in order to prevent chemicals, such as detergents, from remaining on the washed items. Although the additional products decrease the detergent residue remaining on the items, said additional products may cause an increase in damage to nature since these additional products contain different chemicals, as well.

[0004] Within the known art, as disclosed in the patent document US2006266381A1, there are also washing devices which provide a washing process without using chemical substances such as detergents. In said washing devices, water received from the mains is passed through an electrolysis cell. By conducting an electrolysis process in the electrolysis cell, acidic water and basic water are able to be obtained. The basic water obtained may directly be used as a washing liquid. Therefore, foreign substances present on the items to be washed can be separated by the basic water instead of detergent. In such embodiments, however, foreign substances in the mains water may accumulate on electrodes of the electrolysis cell where the electrolysis process is conducted. In this case, performance efficiency of the electrolysis cell decreases over time.

BRIEF DESCRIPTION OF THE INVENTION

[0005] With the present invention, there is provided a washing device in which the water is electrolysed to obtain a washing liquid. The washing device comprises at least one washing compartment adapted to receive at least one item for washing; at least one electrolysis unit for obtaining acidic water and basic water by electrolysing the water received from at least one water source, the electrolysis unit having at least a first electrode, at least a second electrode and at least one membrane separating the first electrode and the second electrode; at least one resin chamber for filtering the water, which is to be electrolysed in the electrolysis unit, before entering the electrolysis unit such that the water is purified from elements which cause hardness, such as calcium and magnesium; at least one resin line connecting the resin chamber and the electrolysis unit; at least one electrolysis unit line which is connected from one side to the resin line, and from another side to the electrolysis unit and at least one electrolysis unit valve which is located on the electrolysis unit line; at least one collection reservoir line which is connected from one side to the resin line, and from another side to the collection reservoir; and at least one collection reservoir valve located on the collection reservoir line.

[0006] In the washing device according to the present invention, since the resin chamber is located before the electrolysis unit, a washing liquid such as the water received from the mains can be purified from elements which cause hardness, such as calcium and magnesium, before it is sent to the electrolysis unit. Therefore, cases like scaling in the electrolysis unit are prevented, and the electrolysis unit and thus the washing device are allowed to operate efficiently and have a long service life.

OBJECT OF THE INVENTION

[0007] An object of the present invention is to provide a washing device which is capable of washing without using a detergent.

[0008] Another object of the present invention is to provide a reliable and efficient washing device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Exemplary embodiments of the washing device according to the invention are illustrated in the attached figures, in which:

Figure 1 is a block diagram of the washing device according to the invention.

Figure 2 is a block diagram of an alternative embodiment of the washing device according to the invention.

Figure 3 is a block diagram of another alternative embodiment of the washing device according to the invention.

Figure 4 is a block diagram of another alternative embodiment of the washing device according to the invention.

Figure 5 is a block diagram of another alternative embodiment of the washing device according to the invention.

Figure 6 is a block diagram of another alternative embodiment of the washing device according to the invention.

Figure 7 is a block diagram of another alternative

embodiment of the washing device according to the invention.

[0010] All the parts illustrated in figures are individually assigned a reference numeral and the corresponding terms of these numbers are listed below:

Washing compartment	(K)
Main discharge line	(H)
Collection reservoir	(T)
First heating element	(R)
Second heating element	(S)
Resin chamber	(RE)
Salt chamber	(Z)
Electrolysis unit	(E)
First electrode	(E1)
Membrane	(E2)
Second electrode	(E3)
First valve	(V1)
Second valve	(V2)
Collection reservoir valve	(V3)
Electrolysis unit valve	(V4)
Interconnecting valve	(V5)
Filtering system	(F)
Flow rate adjusting element	(D)
Sensor	(A)
First pump	(P1)
Collection reservoir discharge pump	(P2)
Acidic water discharge pump	(P3)
Acidic water suction pump	(P4)
First chamber	(1)
First water line	(1a)
First air discharge line	(1h)
First chamber valve	(1v)
First chamber pump	(1p)
Second chamber	(2)
Second water line	(2a)
Second air discharge line	(2h)
Second chamber valve	(2v)
Acidic water discharge line	(2t)
Second chamber pump	(2p)
Item	(3)
Resin line	(4)
Electrolysis unit line	(5)
Collection reservoir line	(6)
Basic water line	(7)
Acidic water line	(8)
Acidic water suction line	(9)
First chamber flow rate adjuster	(10)
Collection reservoir flow rate adjuster	(11)
Return line	(12)

DESCRIPTION OF THE INVENTION

[0011] In washing devices such as washing machines or dishwashers, items to be cleaned are washed by washing liquids. In case detergent water is used as a washing liquid, chemical substances may remain on the washed item, and also the washing liquid may harm the nature. Therefore, with the present invention, there is disclosed a washing device in which the water is electrolysed to obtain a washing liquid.

[0012] The washing device according to the present invention, exemplary views of which are illustrated in figures 1-7, comprises at least one washing compartment (K) adapted to receive at least one item (3) for washing; at least one electrolysis unit (E) for obtaining acidic water and basic water by electrolysing the water received from at least one water source (e.g. a water mains); at least one resin chamber (RE) for filtering the water, which is to be electrolysed in the electrolysis unit (E), before entering the electrolysis unit (E) such that the water is purified from elements which cause hardness, such as calcium and magnesium; at least one resin line (4) connecting the resin chamber (RE) and the electrolysis unit (E); at least one electrolysis unit line (5) which is connected from one side to the resin line (4), and from another side to the electrolysis unit (E) and at least one electrolysis unit valve (V4) which is located on the electrolysis unit line (5); at least one collection reservoir line (6) which is connected from one side to the resin line (4), and from another side to the collection reservoir (T); and at least one collection reservoir valve (V3) located on the collection reservoir line (6). The electrolysis unit (E) comprises at least a first electrode (E1), at least a second electrode (E3), and at least one membrane (E2) separating the first electrode (E1) and the second electrode (E3).

[0013] In a preferred embodiment of the invention, the washing device comprises at least one collection reservoir (T) which is preferably located below the washing compartment (K), wherein the basic water obtained in the electrolysis unit (E) is transferred to the collection reservoir (T). In this embodiment, the washing device comprises at least one basic water line (7) for transferring the basic water obtained in the electrolysis unit (E) to the collection reservoir (T). The washing device further comprises at least a first pump (P1) (e.g. a circulation pump) which is in connection with the collection reservoir (T) from at least one side and in connection with the washing compartment (K) from at least another side, and which allows the fluids in the collection reservoir (T) to be sent to the washing compartment (K). Here, at least a first heating element (e.g. a resistance) (R) is also provided, which is preferably located between the first pump (P1) and the washing compartment (K). In another preferred embodiment, the washing device comprises at least one main discharge line (H) which is connected to the collection reservoir (T) from at least one side and is adapted to be connected to a drain from at least another side, and at least one collection reservoir discharge pump (P2) lo-

cated on the main discharge line (H).

[0014] In another preferred embodiment of the invention, at least a second heating element (S) is provided on the electrolysis unit line (5). In another preferred embodiment, at least one filtering system (F) is provided on the electrolysis unit line (5).

[0015] In a further preferred embodiment of the invention, the washing device comprises at least a first chamber (1) to which the acidic water obtained in the electrolysis unit (E) is transferred. In this embodiment, the washing device comprises at least one acidic water line (8) for transferring the acidic water obtained in the electrolysis unit (E) to the first chamber (1). The washing device may comprise at least a first water line (1a) which connects the first chamber (1) and the collection reservoir (T). At least a first chamber valve (1v) is preferably provided on the first water line (1a). Also, at least a first chamber pump (1p) may be provided on the first water line (1a). Here, the washing device may also comprise at least a second chamber (2). The second chamber (2) is connected to the first chamber (1) preferably by means of at least a first air discharge line (1h). The washing device may comprise at least a second water line (2a) which connects the second chamber (2) and the collection reservoir (T). Preferably, at least a second chamber valve (2v) is provided on the second water line (2a). At least a second chamber pump (2p) may also be provided on the second water line (2a). The washing device also comprises at least a second air discharge line (2h) which connects the second chamber (2) and the washing compartment (K). In another preferred embodiment, the washing device comprises at least one acidic water discharge line (2t) which is connected to the second chamber (2) from at least one side and is adapted to be connected to a drain from at least another side, and at least one acidic water discharge pump (P3) located on the acidic water discharge line (2t). While the acidic water discharge line (2t) may only be in connection with the second chamber (2), it may also be in connection with both the first chamber (1) and the second chamber (2). If the acidic water discharge line (2) is in connection with both the first chamber (1) and the second chamber (2), the first air discharge line (1h) can provide connection between the first chamber (1) and the washing compartment (K). In an alternative embodiment, the washing device comprises at least one acidic water suction line (9) which is connected to the first chamber (1) from at least one side and is adapted to be connected to a drain from at least another side, and at least one acidic water suction pump (P4) located on the acidic water suction line (9).

[0016] In another preferred embodiment of the invention, the washing device comprises at least one salt chamber (Z). In this embodiment, the washing device also comprises at least a first valve (V1) controlling the water transfer to the salt chamber (Z), at least a second valve (V2) controlling the water transfer to the resin chamber (RE), and at least one interconnecting valve (V5) located between the salt chamber (Z) and the resin chamber (RE).

[0017] In another preferred embodiment of the invention, the washing device comprises at least one flow rate adjusting element (D) which is preferably located at the entry of the resin chamber (RE). In a further preferred embodiment, the washing device comprises at least one collection reservoir flow rate adjuster (11) which is located on the basic water line (7). Here, the washing device also comprises at least one return line (12) which is located between the collection reservoir flow rate adjuster (11) and the electrolysis unit (E). In another preferred embodiment, the washing device further comprises at least a first chamber flow rate adjuster (10) located on the acidic water line (8). Moreover, the washing device comprises at least one sensor (A) for sensing at least one feature of the washing liquids (e.g. temperature, pH, TDS, conductivity, flow rate, hardness) used for the washing process. Here, at least one sensor (A) may be located on the resin line (4), the basic water line (7) and/or the acidic water line (8).

[0018] Various exemplary operations of the washing device according to the present invention are disclosed below, with reference to figures 1 to 7.

[0019] As illustrated in figure 1, washing water to be received in a washing step of the washing device is passed through the resin chamber (RE) by opening the second valve (V2). After the washing water that has passed through the resin chamber (RE) is purified from the elements causing hardness, such as calcium and magnesium, it is sent to the electrolysis unit (E) via the resin hose (4) and electrolysis unit valve (V4). Thanks to the fact that the electrolysis unit (E) comprises the first electrode (E1) (e.g. an anode plate), the second electrode (E3) (e.g. a cathode plate), and the membrane (E2) located between them, the washing water is ionised into H+ and OH-. By altering the positive and negative currents of the first electrode (E1) and second electrode (E3), operation of the first electrode (E1) and the second electrode (E3) as anode and cathode is able to be controlled. Preferably, while the acidic water having H+ ions is created in the first electrode (E1) portion of the unit (E), the basic water having OH- ions is created in the second electrode (E3) portion thereof. The acidic water accumulates in the first chamber (1), which is preferably located next to the washing device, through the acidic water line (8) while the basic water is sent to the collection reservoir (T) through the basic water line (7). By this way, after the water softened in the resin chamber (RE) is separated in the electrolysis unit (E), the basic water is sent to the collection reservoir (T) for use in a washing step of the washing device. The basic water is circulated within the washing compartment (K) by means of the first pump (P) and, if needed, it is heated via the first heating element (R) for use in a washing program. In case that the basic water to be received into the collection reservoir (T) is used for the main washing program more than once, the first chamber (1) and the second chamber (2) are used to reduce water consumption. When the basic water to

be used in the washing device is received into the washing device for the first time, a part of the first chamber (1) is filled with acidic water. In case the basic water is received into the washing device for the second time, as the first chamber (1) will be filled completely with the acidic water for this time, the acidic water is allowed to pass to the second chamber (2) through the first air discharge line (1h). If the basic water is produced more than two times in a row, in order to prevent the acidic water accumulated in the second chamber (2) from overflowing into the washing compartment (K), it can be discharged into a waste water drain through the acidic water discharge line (2t) by operating the acidic water discharge pump (P3) in a certain step of the main washing step or when needed. The acidic water discharge pump (P3) may be opened depending on the time while it may be opened by determining the level by the measurement elements (not illustrated in the figures) such as water level sensor that will be located at the first chamber (1) and/or the second chamber (2). In the main washing steps, after a desired number of washing processes with basic water is provided depending on the number of washing steps of the program, the first chamber valve (1v) is opened and the water in the first chamber (1) is sent to the collection reservoir (T) through the first water line (1a) for use in the washing step. Following use of acidic water for the main washing step, the second chamber valve (2v) is opened in the next step and the acidic water is sent to the collection reservoir (T) through the second water line (2a) for use in washing steps. Since the first chamber (1) and the second chamber (2) in the washing device are connected to each other, during filling of the first chamber (1) and the second chamber (2) with acidic water, air remaining in the first chamber (1) and the second chamber (2) is sent into the washing compartment (K) through the second air discharge line (2h). The above-mentioned process also applies for energising the first electrode (E1) and the second electrode (E3), which are provided in the electrolysis unit, (E) in the reverse direction (i.e. reverse bonding of + and - charges). In other words, while the basic water is stored at the first chamber (1) and/or the second chamber (2), it is also possible to send acidic water to the collection reservoir (T).

[0020] As illustrated in figure 1, outlet of the resin line (4) provided at outlet of the resin chamber (RE) branches into two separate ways. The softened washing water coming from the resin hose (4) can optionally be sent to the electrolysis unit (E) when the electrolysis unit valve (V4) is energised and to the collection reservoir (T) when the collection reservoir valve (V3) is energised. When there is a need to separate the water, the electrolysis unit valve (V4) is energised to send the washing water to the electrolysis unit (E). When there is no need to separate the water, the collection reservoir valve (V3) is opened to send the washing water to the collection reservoir (T) through the collection reservoir line (6). Another use of the collection reservoir valve (V3) is to regenerate the resin chamber (RE). For regenerating the resin chamber (RE) that is filled with calcium and magnesium, the first valve (V1) is opened and the mains water is sent to the salt chamber (Z) so that the resin chamber (RE) is filled with salt water. In this case, the collection reservoir valve (V3) is used to prevent the water that fills the resin line (4) from passing to the electrolysis unit (E) and to prevent the electrolysis unit (E) from deteriorating. Salt water from the resin chamber (RE) may directly be sent to the collection reservoir (T) through the collection reservoir valve (V3) without passing through the electrolysis device (E). The interconnecting valve (V5) is used to prevent water passage from the resin chamber (RE) to the salt chamber (Z). The interconnecting valve (V5) is only used for passage of the salt water coming from the salt vessel (Z) to the resin chamber (RE).

[0021] In another embodiment of the present invention, the acidic water pump (P3) is simultaneously connected to both the first chamber (1) and the second chamber (2) via the acidic water suction line (9), as illustrated in figure 2. Therefore, while the acidic water is filled into the first chamber (1) and the second chamber (2), any of the first chamber (1) and the second chamber (2) is filled with ionized water such that any possible overflow into the washing compartment (K) is completely eliminated. In this alternative embodiment, using the first air discharge line (1h) between the first chamber (1) and the second chamber (2) removes the need of providing a connection in between. For air release, the second chamber (2) is directly connected to the washing compartment (K) via the second air discharge line (2h). Thus, ionized water filling into the second chamber (2) while the electrolysis unit (E) operates is sent to the collection reservoir (T) by the first chamber valve (1v) at the end of the washing step before the electrolysis unit (E) re-operates, and can be received into the first chamber (1) by the second chamber pump (2p).

[0022] In another embodiment of the present invention, pumps of the second chamber (2) and the first chamber (1) may be distinct from each other, as illustrated in figure 3. Here, when the acidic water suction pump (P4) is connected to the first chamber (1), the acidic water discharge pump (P3) is connected to the second chamber (1). In another embodiment of the present invention, the second heating element (S) is connected in front of the electrolysis unit (E), as illustrated in figure 4. The second heating element (S) may be mounted anywhere between the electrolysis unit (E) and the second valve (V2). The second heating element (S) is used for heating cool water, which may come from the mains, before the cool water enters into the electrolysis unit (E). Since the cool water to be sent into the electrolysis unit (E) affects water separation performance of the electrolysis unit (E) in a negative way, pH values of acidic and basic water to be formed may deviate. In case that the cool water is separated in the electrolysis unit (E), ion concentration of basic and acidic water is reduced, and water with desired pH levels cannot be generated. In an effort to avoid this, inlet temperature of the mains water is measured by

means of a sensor (A) and the water can be heated up to a desired temperature by operating the heater (S) as soon as the electrolysis unit (E) is operated, if needed.

[0023] In a further embodiment of the present invention, the flow rate adjusting element (D) is used due to the fact that pressure of the mains may vary depending on where the washing device will be used, and that the electrolysis unit (E) should not be damaged and the water to be separated in the electrolysis unit (E) should be in the determined flow rate range, as illustrated in figure 4. The flow rate adjusting element (D) may be used anywhere between the electrolysis unit (E) and the second valve (V2) or in front of the second valve (V2). If a flow rate of the washing water to be passed through the electrolysis unit (E) is too much, operational performance of the electrolysis unit (E) is affected negatively. Furthermore, if a flow rate of the washing water to be passed through the second heating element (S) is too much, insufficient heating or excessive heating may occur. For preventing such cases, the flow rate adjusting element (D) is used depending on the variable pressure of the mains. Using the flow rate adjusting element (D) allows controlling the heating amount of the mains water before the electrolysis unit (E), as well as controlling a flow rate of the washing water which will be passed through the electrolysis unit (E) so that a controlled production of acidic and basic water with desired pH values is provided. The flow rate adjusting element (D) may be a separate device, but if the second valve (V2) has a flow rate adjustment feature, only the second valve (V2) with flow adjustment may be used. The flow rate adjusting element (D) and the second valve (V2) may adjust flow rate of the mains automatically or manually.

[0024] In another embodiment of the present invention, a filtering system (F) is mounted at the entry of the electrolysis unit (E), as illustrated in figure 5. In order to prevent possible particles in the mains water, such as sand, iron, gravel, from entering the electrolysis unit (E) and avoid malfunction of the electrolysis unit (E), said filtering system (F) is used. Moreover, depending on where the washing device is used, if an amount of solid particles (TDS) dissolved in mains water is out of a determined value range, operational performance and economic life of the electrolysis unit (E) are affected in a negative manner. The filtering system can both retain solid particles, such as sand, which are not dissolved in water, and adjust balance of the solid particles (TDS) dissolved in water to a determined level range. The filtering system (F) may also change the alkalinity of the inlet water. The filtering system may have a carbon filter and such different filters. The filtering system (F) may be mounted and used anywhere between the resin chamber (RE) and the electrolysis unit (E) or between the resin chamber (RE) and the second valve (V2), as illustrated in figure 5. In another embodiment of the present invention, the filtering system (F) may directly be connected to the inlet (not illustrated in figures) of the electrolysis unit (E) without being connected to the inlet or outlet of the resin chamber (RE). The filtering system (F) may optionally be a demountable filtering system (F). Operational performance of the electrolysis unit (E) varies according to some factors such as a temperature of the water from the mains, hardness of the water, flow rate of the water, capacity of the resin chamber (RE) to retain elements such as calcium and magnesium, pressure of the mains, amount of the solid particles dissolved in water (TDS), pH value of the mains water, ambient temperature, voltage change of the mains, salt rate of the water, ORP value, etc. Since operational performance of the electrolysis unit (E) varies according to different ambient conditions, the sensor (A), in a further embodiment of the present invention, is used anywhere between inlet of the electrolysis unit (E) and the resin chamber (RE) for measuring parameters of the washing water such as pH, hardness, saltiness, ORP, TDS, temperature and water pressure, as illustrated in figure 6. Though the sensor (A) may also be mounted before the resin chamber (RE), a difference of hardness value at the inlet or outlet of the resin chamber (RE) is able to be measured. By means of the sensor (A), parameters of ionized waters such as pH, hardness, saltiness, ORP, TDS, temperature or water pressure can also be measured at the outlet of the electrolysis unit (E). While the sensor (A) may be connected anywhere between the second valve (V2) and the electrolysis unit (E), it may be connected to the outlet of the electrolysis unit (E), as well. More than one sensor (A) can be mounted both before the electrolysis unit (E) and at the outlet of the electrolysis unit (E).

[0025] In another embodiment of the present invention, the first chamber flow rate adjuster (10) and the collection reservoir flow rate adjuster (11) are used as illustrated in figure 6. Flow rates of the acidic and basic water at the outlet of the electrolysis unit (E) can be changed as desired by means of the first chamber flow rate adjuster (10) and the collection reservoir flow rate adjuster (11). For example, if it is desired to receive more basic water into the collection reservoir (T), the collection reservoir flow rate adjuster (11) reduces the flow rate and the first chamber flow rate adjuster (10) increases the flow rate so that denser basic water is achieved while weaker acids are produced in the acidic part. Alternatively, it is possible to have an exact opposite case. Therefore, pH values of the water separated at the outlet of the electrolysis unit (E) can be controlled as desired thanks to the first chamber flow rate adjuster (10) and the collection reservoir flow rate adjuster (11).

[0026] In another embodiment of the present invention, the return line (12) enables that some of the water, which has left the electrolysis unit (E) and has been ionized into H+ and OH-ions, is optionally returned to the electrolysis unit (E) at desired different flow rates by means of the collection reservoir flow rate adjuster (11), as illustrated in figure 7. By this way, some of the separated water is sent to the collection reservoir (T) while some thereof is returned to the electrolysis unit (E). For example, some of the basic water sent to the basic water line (7) is re-

turned to the electrolysis unit (E) to increase basicity level of the water at the electrolysis unit (E). Or, on the contrary, if some of the acidic water is sent to the basic water line (7) at the outlet of the electrolysis unit (E), acidity level of the water at the inlet of the electrolysis unit (E) can be increased. If basicity level of the water at the inlet of the electrolysis unit (E) increases, denser basic water can be generated. If acidity level of the water at the inlet of electrolysis unit (E) increases, denser acidic water can be generated. Thanks to this embodiment, since pH values of the mains water at the inlet of the electrolysis unit (E) are able to be adjusted as desired, the need for denser acidic water or basic water can be met depending on the washing dirt density.

Claims

1. A washing device comprising at least one washing compartment (K) adapted to receive at least one item (3) for washing, **characterized by** comprising:

   - at least one electrolysis unit (E) for obtaining acidic water and basic water by electrolysing the water received from at least one water source, the electrolysis unit (E) having at least a first electrode (E1), at least a second electrode (E3) and at least one membrane (E2) separating the first electrode (E1) and the second electrode (E3);
   - at least one resin chamber (RE) for filtering the water, which is to be electrolysed in the electrolysis unit (E), before entering the electrolysis unit (E) such that the water is purified from elements which cause hardness, such as calcium and magnesium;
   - at least one resin line (4) connecting the resin chamber (RE) and the electrolysis unit (E);
   - at least one electrolysis unit line (5) which is connected from one side to the resin line (4), and from another side to the electrolysis unit (E) and at least one electrolysis unit valve (V4) which is located on the electrolysis unit line (5);
   - at least one collection reservoir line (6) which is connected from one side to the resin line (4), and from another side to the collection reservoir (T); and
   - at least one collection reservoir valve (V3) located on the collection reservoir line (6).

2. A washing device according to claim 1, **characterized by** comprising at least one collection reservoir (T), wherein the basic water obtained in the electrolysis unit (E) is transferred to the collection reservoir (T).

3. A washing device according to claim 2, **characterized by** comprising at least a first pump (P1) which is in connection with the collection reservoir (T) from at least one side and in connection with the washing compartment (K) from at least another side, and which allows the fluids in the collection reservoir (T) to be sent to the washing compartment (K).

4. A washing device according to claim 3, **characterized by** comprising at least a first heating element (R) which is located between the first pump (P1) and the washing compartment (K).

5. A washing device according to any of the claims 2 to 4, **characterized by** comprising at least one main discharge line (H) which is connected to the collection reservoir (T) from at least one side and is adapted to be connected to a drain from at least another side, and at least one collection reservoir discharge pump (P2) located on the main discharge line (H).

6. A washing device according to claim 1, **characterized by** comprising at least a second heating element (S) provided on the electrolysis unit line (5).

7. A washing device according to claim 1 or claim 6, **characterized by** comprising at least one filtering system (F).

8. A washing device according to any of the claims 1 to 7, **characterized by** comprising at least a first chamber (1) to which the acidic water obtained in the electrolysis unit (E) is transferred.

9. A washing device according to claim 8, **characterized by** comprising at least a second chamber (2).

10. A washing device according to claim 9, **characterized by** comprising at least a first air discharge line (1h) connecting the second chamber (2) to the first chamber (1).

11. A washing device according to claim 9 or claim 10, **characterized by** comprising at least a second water line (2a) which connects the second chamber (2) and the collection reservoir (T).

12. A washing device according any of the claims 9 to 11, **characterized by** comprising at least one acidic water discharge line (2t) which is connected to the second chamber (2) from at least one side and is adapted to be connected to a drain from at least another side, and at least one acidic water discharge pump (P3) located on the acidic water discharge line (2t).

13. A washing device according to any of the claims 8 to 12, **characterized by** comprising at least one acidic water suction line (9) which is connected to the first chamber (1) from at least one side and is

adapted to be connected to a drain from at least another side, and at least one acidic water suction pump (P4) located on the acidic water suction line (9).

14. A washing device according to any of the claims 1 to 13, **characterized by** comprising at least one flow rate adjusting element (D).

15. A washing device according to any of the claims 1 to 14, **characterized by** comprising at least one sensor (A) for sensing at least one feature of the washing liquids used for the washing process.

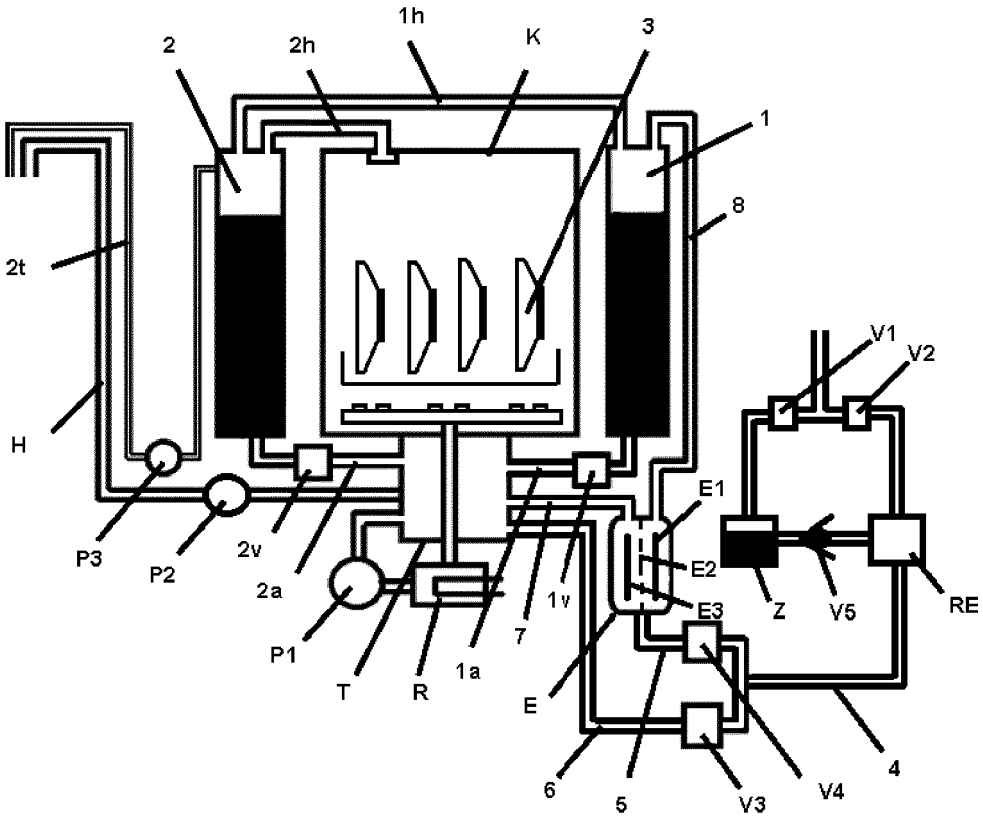
1h
2
2h
K
3
1
8
2t
H
V1
V2
E1
E2
E3
Z
V5
RE
P3
P2
2v
2a
P1
T
R
1a
7
1v
E
6
5
V3
V4
4

Figure – 1

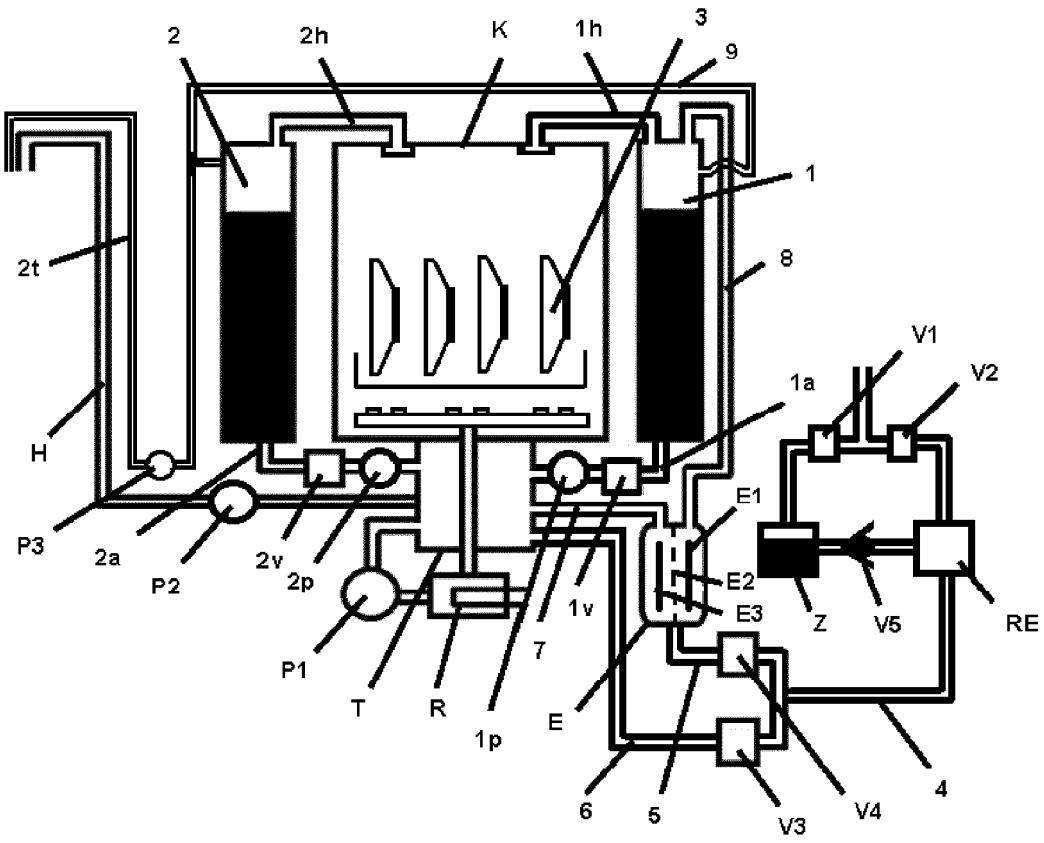
2
2h
K
1h
3
9
1
2t
8
V1
V2
1a
H
E1
P3
2a
P2
2v
2p
E2
E3
Z
V5
RE
1v
7
P1
T
R
1p
E
6
5
V3
V4
4

Figure – 2

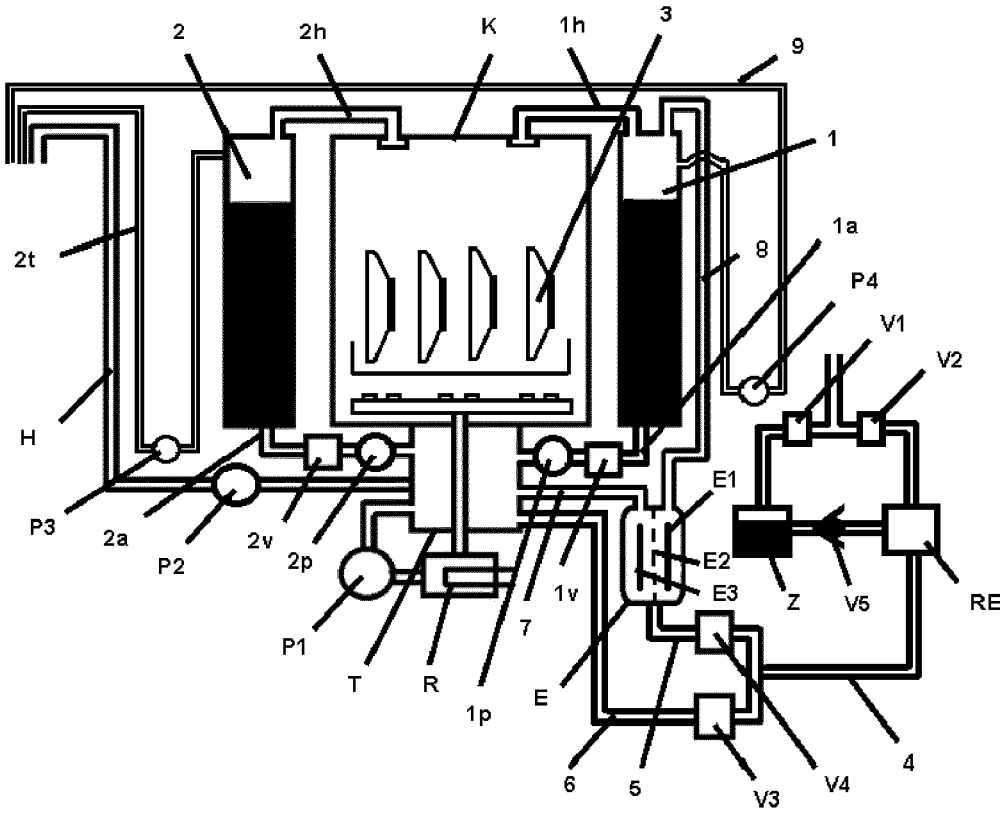
2
2h
K
1h
3
9
1
2t
1a
8
P4
V1
V2
H
P3
2a
P2
2v
2p
P1
T
R
1p
7
1v
E
E1
E2
E3
Z
V5
RE
6
5
V3
V4
4

Figure – 3

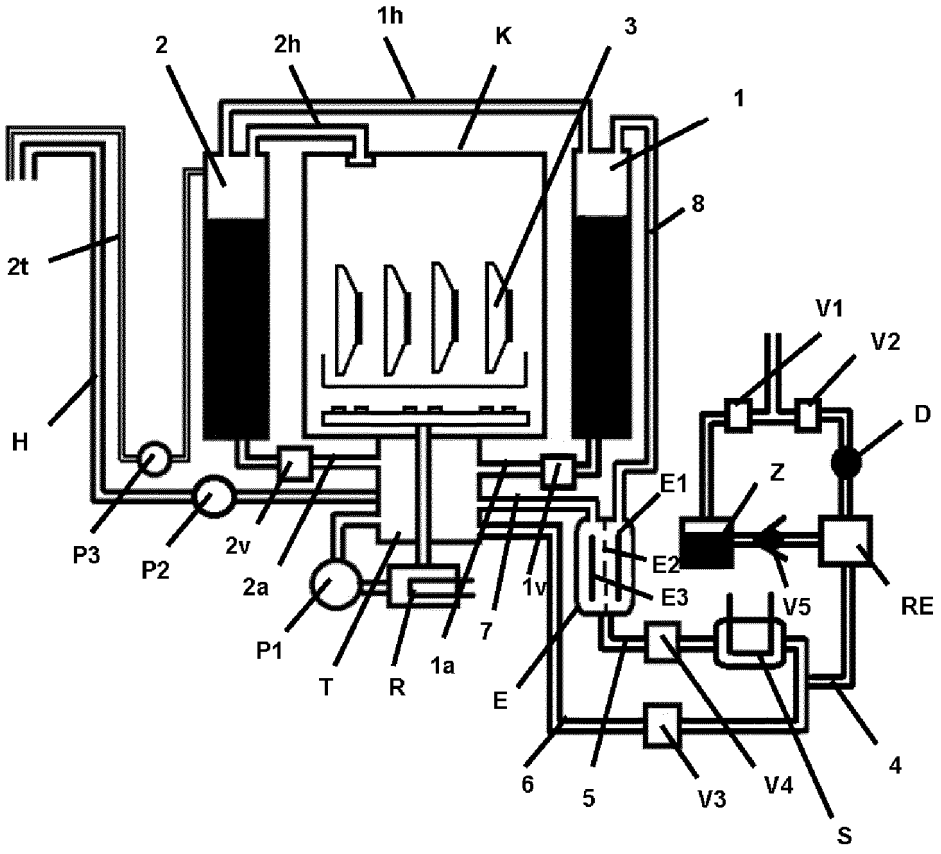
1h
2
2h
K
3
1
8
2t
V1
V2
D
H
E1
Z
E2
E3
V5
RE
P3
P2
2v
2a
1v
P1
7
T
R
1a
E
6
5
V3
V4
4
S

Figure – 4

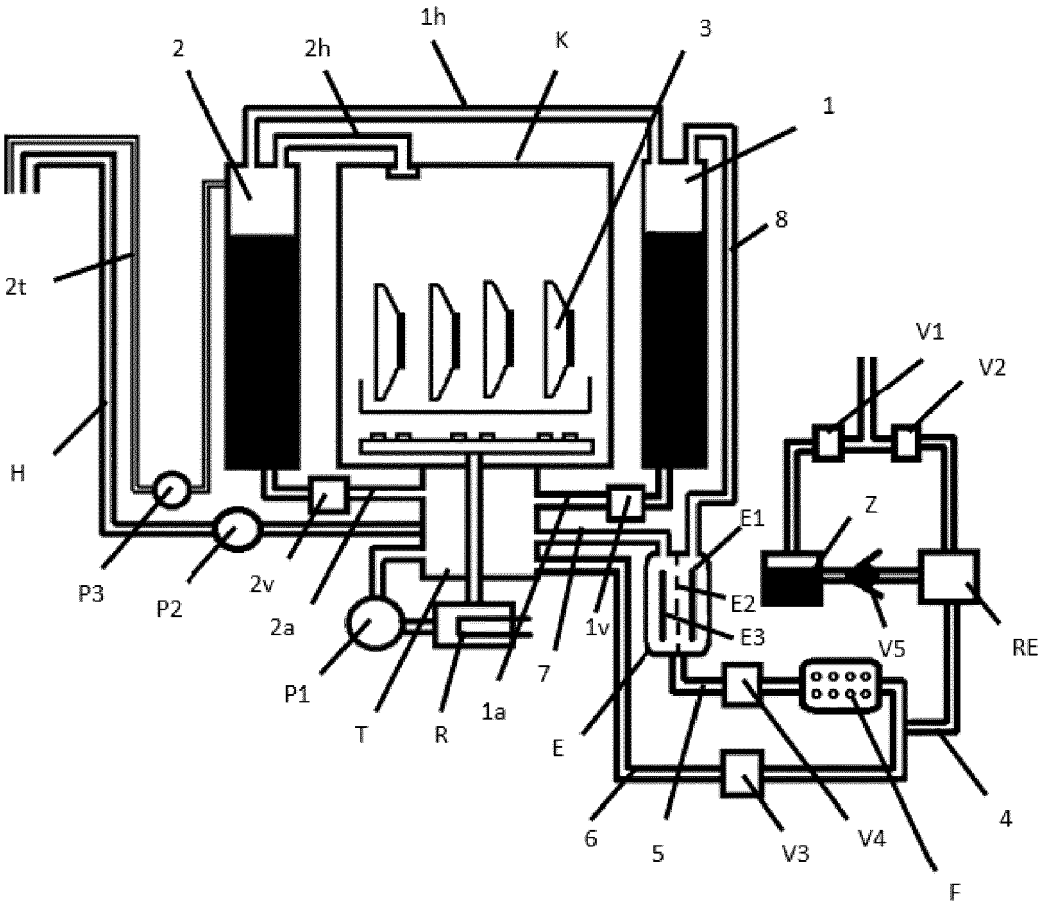
1h
2
2h
K
3
1
8
2t
V1
V2
H
Z
E1
E2
E3
V5
RE
P3
P2
2v
2a
1v
P1
7
T
R
1a
E
6
5
V3
V4
4
F

Figure – 5

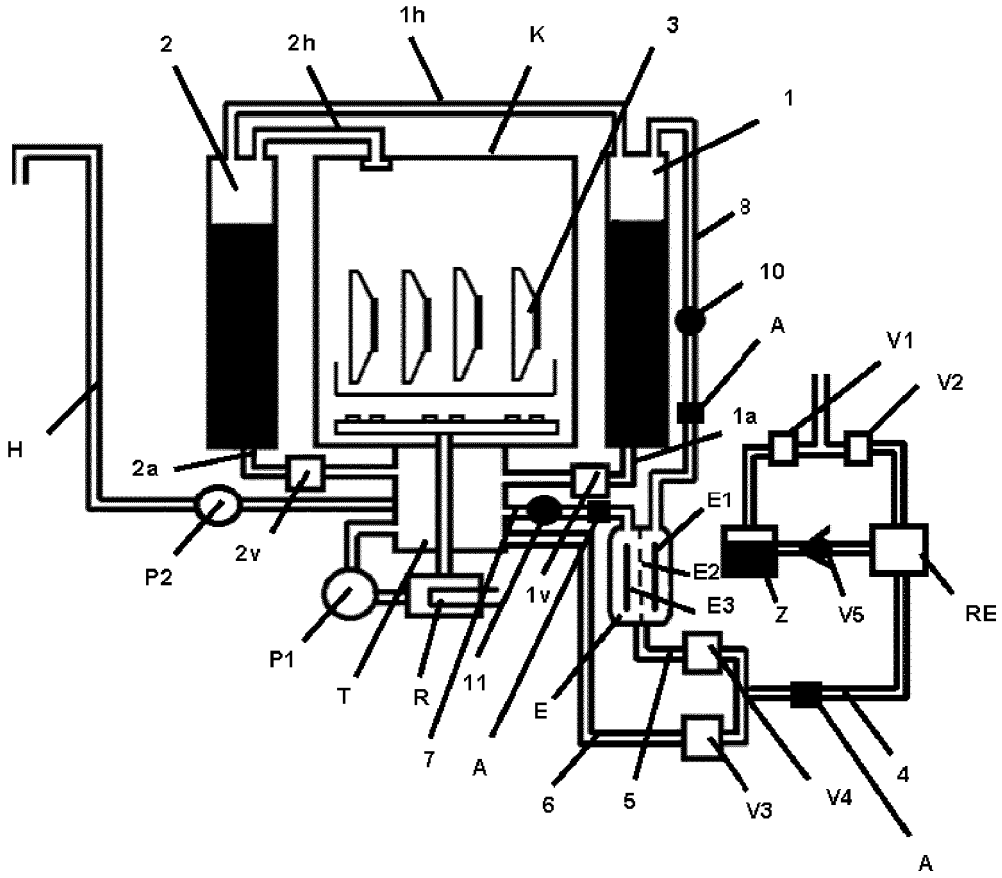
1h
2
2h
K
3
1
8
10
A
V1
V2
1a
H
2a
E1
E2
E3
Z
V5
RE
P2
2v
1v
P1
T
R
11
E
7
A
6
5
V3
V4
4
A

Figure – 6

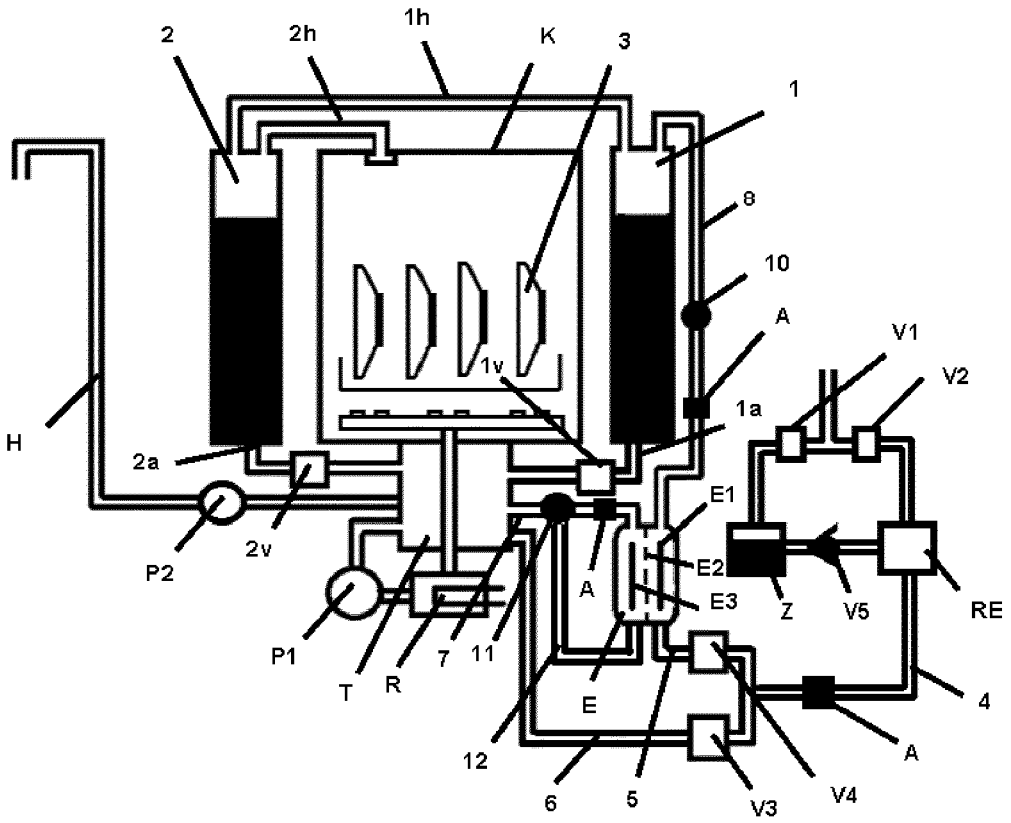
2
2h
1h
K
3
1
8
10
A
V1
V2
1v
1a
H
2a
E1
E2
E3
Z
V5
RE
2v
P2
A
P1
T
R
7
11
E
4
A
12
6
5
V3
V4

Figure – 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 16 2274

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 6 766 812 B1 (GADINI COSTANZO [IT]) 27 July 2004 (2004-07-27) * the whole document * -----	1-5,7, 14,15 6,8-13	INV. A47L15/42 D06F35/00
A	EP 0 083 739 A1 (ZANUSSI A SPA INDUSTRIE [IT]) 20 July 1983 (1983-07-20) * the whole document * -----	1-15	ADD. D06F39/00
A,D	US 2006/266381 A1 (DOHERTY JAMES E [US] ET AL) 30 November 2006 (2006-11-30) * the whole document * -----	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

A47L
D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 April 2020	Jezierski, Krzysztof

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 16 2274

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

24-04-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6766812 B1	27-07-2004	AT 280532 T	15-11-2004
		AU 4136100 A	10-11-2000
		DE 60015350 D1	02-12-2004
		EP 1204364 A2	15-05-2002
		ES 2230092 T3	01-05-2005
		IT TO990320 A1	23-10-2000
		US 6766812 B1	27-07-2004
		WO 0064325 A2	02-11-2000
EP 0083739 A1	20-07-1983	AT 14667 T	15-08-1985
		DE 3265293 D1	12-09-1985
		EP 0083739 A1	20-07-1983
		ES 8400861 A1	01-12-1983
		IT 1147150 B	19-11-1986
		US 4481086 A	06-11-1984
US 2006266381 A1	30-11-2006	BR PI0610174 A2	01-06-2010
		CA 2608647 A1	30-11-2006
		US 2006266381 A1	30-11-2006
		WO 2006127793 A1	30-11-2006

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2006266381 A1 **[0004]**