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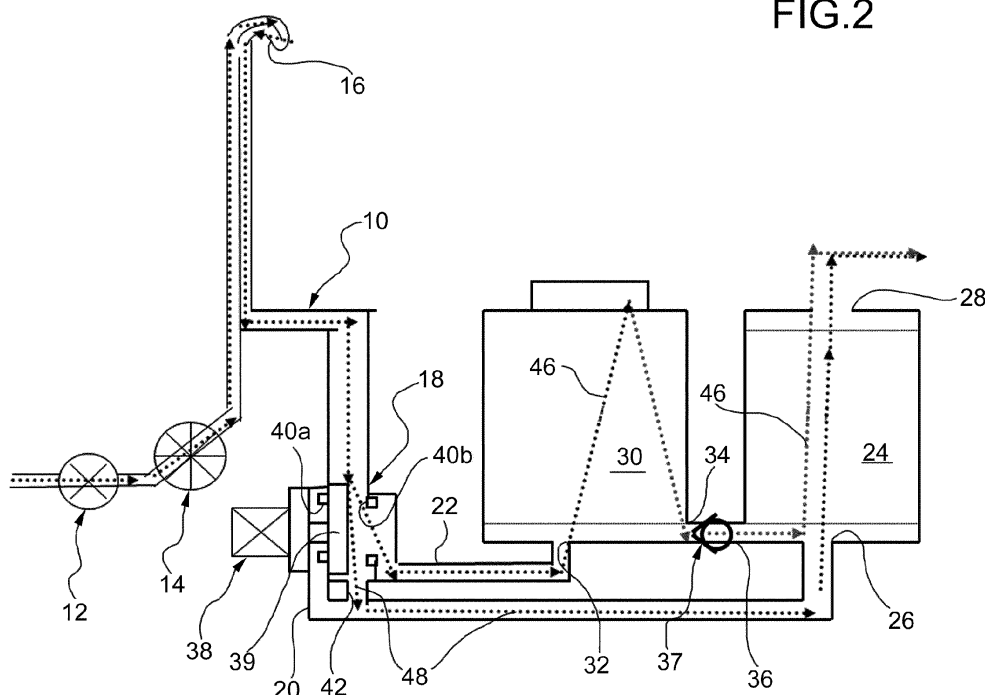
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(54) **Improved water-softening device**

(57) The water-softening device for electrical household appliances comprises: a first tank (24) for containing substances with water-softening properties, having at least one inlet opening (26) for water to be softened and an outlet opening (28) for softened water; a second salt-containing tank (30), having at least one water inlet opening (32) and an outlet opening (34) for a regenerating brine formed following the dissolution of the salt in the water; a line (36) connecting the second tank (30) to the first tank (24) so that the brine formed in the second tank

(30) can flow out towards the first tank (24); a water supply line (10) having a branch-off point (18) into a first branch (20) supplying the first tank (24) and into a second branch (22) which leads to the inlet opening (32) of the second tank (30); and a switching valve (38) with a shutter adapted to cause the water to flow into the first or second branch (20, 22). The valve (38) further comprises a passage (42) which puts into communication the water supply line (10) and the first branch (20) independently of the position of the shutter.

FIG.2



Description

[0001] The present invention relates to a water-softening device for an electrical household washing machine, such as a dishwasher or a washing machine for laundry purposes.

[0002] More specifically, a device of this kind comprises:

- a first tank for containing substances with water-softening properties, having at least one inlet opening for water to be softened and an outlet opening for softened water,
- a second salt-containing tank, having at least one water inlet opening and an outlet opening for a regenerating brine formed following the dissolution of the salt in the water,
- a line connecting the second tank to the first tank so that the brine formed in the second tank can flow out towards the first tank,
- a water supply line having a branch-off point into a first branch supplying the first tank and into a second branch which leads to the inlet opening of the second tank, and
- a switching valve with a shutter adapted to cause the water to flow into the first or second branch.

[0003] A device of this kind is described in patent application PCT WO-2005/060 817 and, owing to the presence of the aforesaid switching valve, allows the water to be directed alternatively into the first or second tank.

[0004] The first mode relates to the normal operation condition in which the water passes through the water-softening substances and is thus softened in such a way that it can then be directed into the washing chamber of the household appliance without causing harmful incrustations or the like.

[0005] The second mode relates to the step of regeneration which must be carried out periodically in order to reactivate the water-softening substances. In this case, the brine formed in the second tank is subsequently made to pass through the water-softening substances, typically ion-exchange resins, contained in the first tank, which are thus regenerated.

[0006] Owing to the presence of the switching valve, all of the water supplied to the known device described above is each time sent directly into the tank containing the ion-exchange resins, or into the tank containing the salt and from there into the tank containing these resins. This makes it unnecessary to use a container for collecting the water to be supplied to the tank containing the salt. Such a container is, however, typically present in most conventional water-softening devices.

[0007] Thus the overall structure of the device described in WO-2005/060 817 is simplified. Furthermore, the overall dimensions of this device are reduced and the space saved in this way can be occupied by other components of the dishwasher. However, causing the

whole flow of water supplied to the device through the salt tank can lead to harmful excess pressures, due for example to the jamming of salt grains in the narrow slits forming the inlet and outlet openings of the second tank, with the risk that the outflow of the water through the device may become blocked completely. Moreover, in a device of this kind it is difficult to provide accurate measured doses of water to be used for the regeneration step.

[0008] On the other hand, EP-1 844 693 describes a water-softening device of the general type described above, which is provided with a switching and mixing valve, instead of a switching valve, as a result of which the flow passing through the first branch of the supply line and directed towards the tank containing the water-softening substances is never shut off. However, a valve of the switching and mixing type is intrinsically more noisy and less robust than a switching valve.

[0009] The object of the present invention is to provide an improved water-softening device, particularly a device free of the drawbacks mentioned above.

[0010] According to the invention, this object is achieved by means of a device of the type mentioned at the start of the present description, **characterized in that** the aforesaid switching valve further comprises a passage which puts into communication said water supply line and said first branch, independently of the position of the shutter, and in particular independently of whether or not the shutter closes the aperture of the valve seat which forms the inlet of the first branch.

[0011] The device according to the invention does not require a tank for collecting the water to be supplied to the salt containing tank. At the same time, because of the presence of the passage, the flow within the first branch of the supply line towards the tank containing the water-softening substance is not shut off in any operating configuration of the valve. Therefore, even if the inlet and/or outlet openings of the salt-containing tank become obstructed, the water supplied to the device can still flow out of it without creating harmful excess pressures.

[0012] Furthermore, in the device according to the invention, the regeneration step is carried out by supplying both mains water and brine simultaneously to the tank for containing the water-softening substances. The brine is thus diluted, with the advantage that it is less aggressive in relation to the water-softening substances.

[0013] The device according to the invention is also advantageous by comparison with that described in the further prior document EP-1 844 693. This is because it uses a switching valve which is less noisy and more robust than a valve of the switching and mixing type. Furthermore, in the device according to the invention the ratio between the amounts of flow in the two branches is determined in a more precise way, since it depends on the apertures of the passage and of the valve seat, which are fixed and not dependent on the positioning of a movable member such as a shutter, which is intrinsically subject to inaccuracies.

[0014] A further object of the present invention is an

electrical household washing machine comprising a water-softening device of the type described above.

[0015] Further advantages and characteristics of the present invention will be made clear by the following detailed description, which refers to the attached drawings provided by way of non-limiting example, in which:

Figure 1 is a schematic illustration of a device according to the invention during the water-softening treatment step, and

Figure 2 is a schematic illustration of the device of Figure 1 during the regeneration step.

[0016] A water-softening device for an electrical household washing machine includes (Figs. 1 and 2) a supply line 10 which has an upstream portion in which a filling valve 12 and a flow gauge 14 are fitted, and which has a subsequent air head portion 16. Downstream of the latter, the line 10 has a branch-off point 18 into a first and a second branch 20, 22.

[0017] The device further comprises a first tank 24 for containing substances with water-softening properties, having an inlet opening 26 for water to be softened and an outlet opening 28 for softened water, and a second salt-containing tank 30, having a water inlet opening 32 and an outlet opening 34 for a regenerating brine formed following the dissolution of the salt in the water. A line 36, on which a one-way valve 37 is positioned, connects the second tank 30 to the first tank 24 so that the brine formed in the second tank 30 can flow out towards the first tank 24.

[0018] The first branch 20 of the supply line 10 opens into the inlet opening 26 of the first tank 24, while the second branch 22 opens into the inlet opening 32 of the second tank 30.

[0019] A switching valve 38, particularly a solenoid valve, is located at the branch-off point 18. The valve has a shutter 39 adapted to cause the water to flow into the first branch 20 or the second branch 22, by closing the free aperture of one or other of the valve seats 40a, 40b which forms the inlet of the branch 20, 22 respectively. The valve 38 further comprises a supplementary passage 42 which puts into constant communication the water supply line 10 and the first branch 20 independently of the position of the shutter 39.

[0020] During the step of the water-softening treatment of the supplied water (Fig. 1), the shutter 39 of the valve 38 assumes a first operating configuration in which it blocks the outflow from the supply line 10 towards the second branch 22, by closing the aperture of the seat 40b, while it allows the flow into the first branch 20 towards the first tank 24 through the aperture of the seat 40a. Thus all of the water flowing in the line 10 is directed, through the aperture of the seat 40a or the passage 42, directly into the first branch 20 and then into the first tank 24, where it is softened (see the path 44).

[0021] During the step of regeneration of the water-softening substances (Fig. 2), the shutter 39 of the valve 38

assumes a second operating configuration in which it allows the outflow from the supply line 10 towards the second branch 22, by closing the aperture of the seat 40a and leaving open the aperture of the seat 40b. Thus the water supplied to the second branch 22 is directed into the second tank 30, where it forms a brine which, when it subsequently passes through the first tank 24 (see path 46), regenerates the water-softening substances.

[0022] However, even during the regeneration step in which the shutter closes the aperture of the inlet seat 40a of the first branch 20, part of the flow of supplied water continues to be directed through the passage 42 into the first branch 20 and thence into the first tank 24 (see path 48). This prevents the passage of the whole supply flow through the salt tank 30, which would be functionally unnecessary and could also cause dangerous blockages.

[0023] It should also be noted that the ratio between the water flows in the first and second branches 20, 22 depends on the apertures of the passage 42 and of the seats 40a, 40b, in other words on fixed geometrical quantities which can be provided with very high precision and low tolerances, thus ensuring highly precise operation.

[0024] Clearly, provided that the principle of the invention is retained, the details of construction and the forms of embodiment can be varied widely from what has been described purely by way of example, without departure from the scope which has been claimed.

Claims

1. Water-softening device for electrical household appliances, comprising:

- a first tank (24) for containing substances with water-softening properties, having at least one inlet opening (26) for water to be softened and an outlet opening (28) for softened water,
 - a second salt-containing tank (30), having at least one water inlet opening (32) and an outlet opening (34) for a regenerating brine formed following the dissolution of the salt in the water,
 - a line (36) connecting the second tank (30) to the first tank (24) so that the brine formed in the second tank (30) can flow out towards the first tank (24),
 - a water supply line (10) having a branch-off point (18) into a first branch (20) supplying the first tank (24) and into a second branch (22) which leads to the inlet opening (32) of the second tank (30), and
 - a switching valve (38) with a shutter adapted to cause the water to flow into the first or second branch (20, 22),
- said device being **characterized in that** said valve (38) further comprises a passage (42) which puts into communication said water supply line (10) and said first branch (20) independ-

ently of the position of the shutter.

2. Device according to Claim 1, wherein the ratio between the flows of water in the first and second branches (20, 22) depends on the apertures of said passage (42) and of the valve seats (40a, 40b) with which said shutter (39) interacts. 5
3. Electrical household washing appliance comprising a water-softening device according to any one of the previous claims. 10

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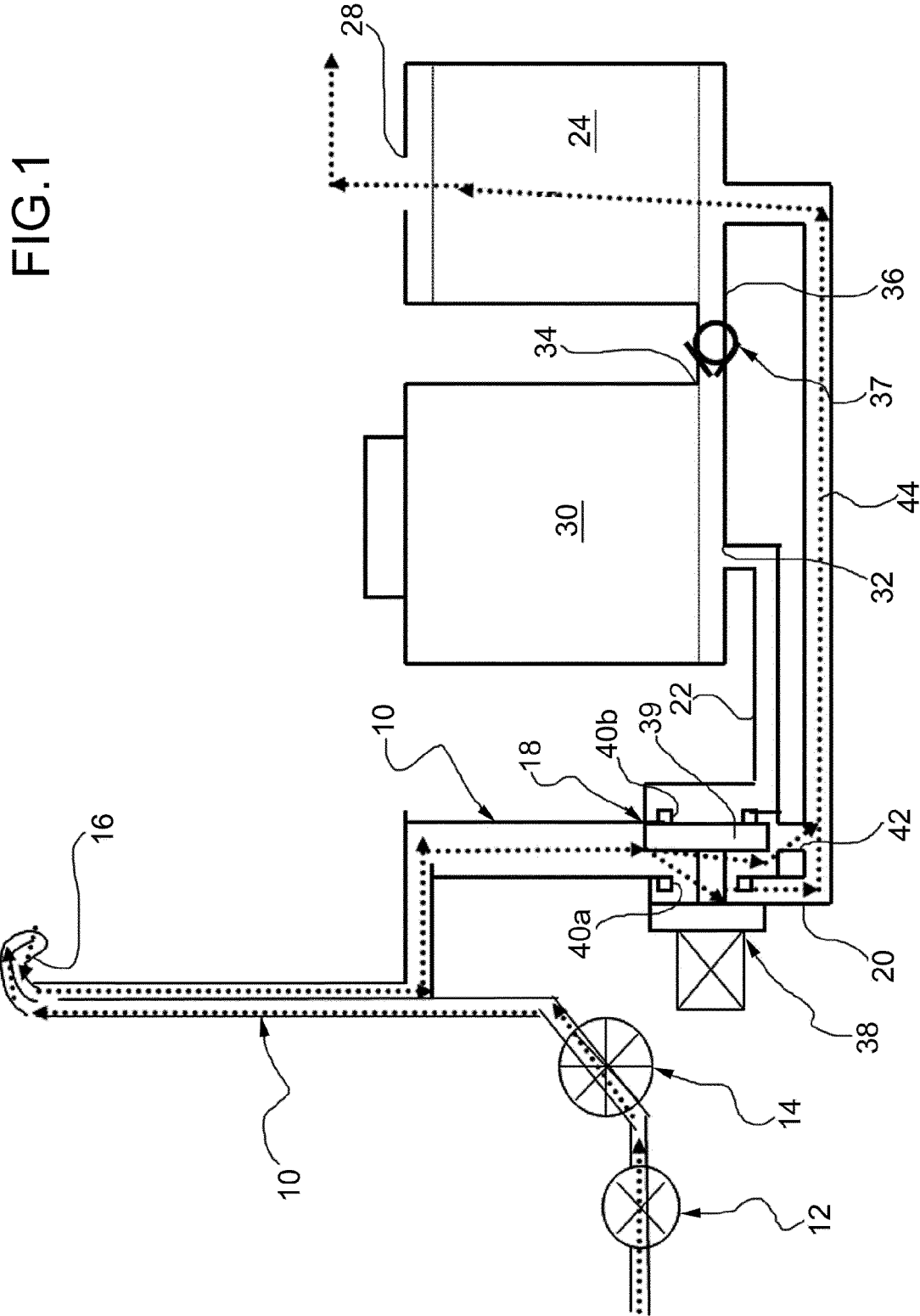
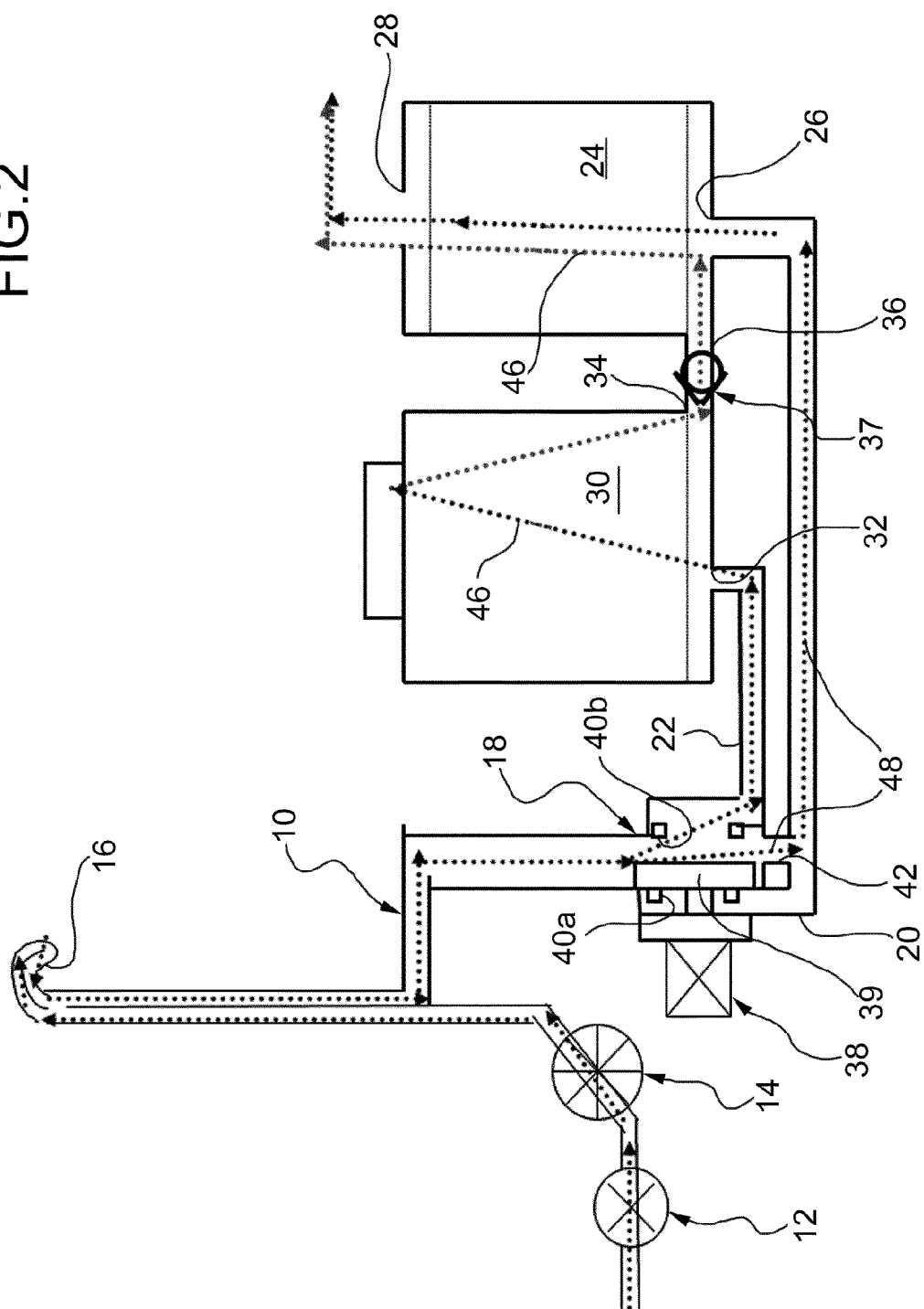


FIG. 2





EUROPEAN SEARCH REPORT

Application Number
EP 12 18 1443

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 September 2012	Examiner Martin Gonzalez, G
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	

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 12 18 1443

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
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