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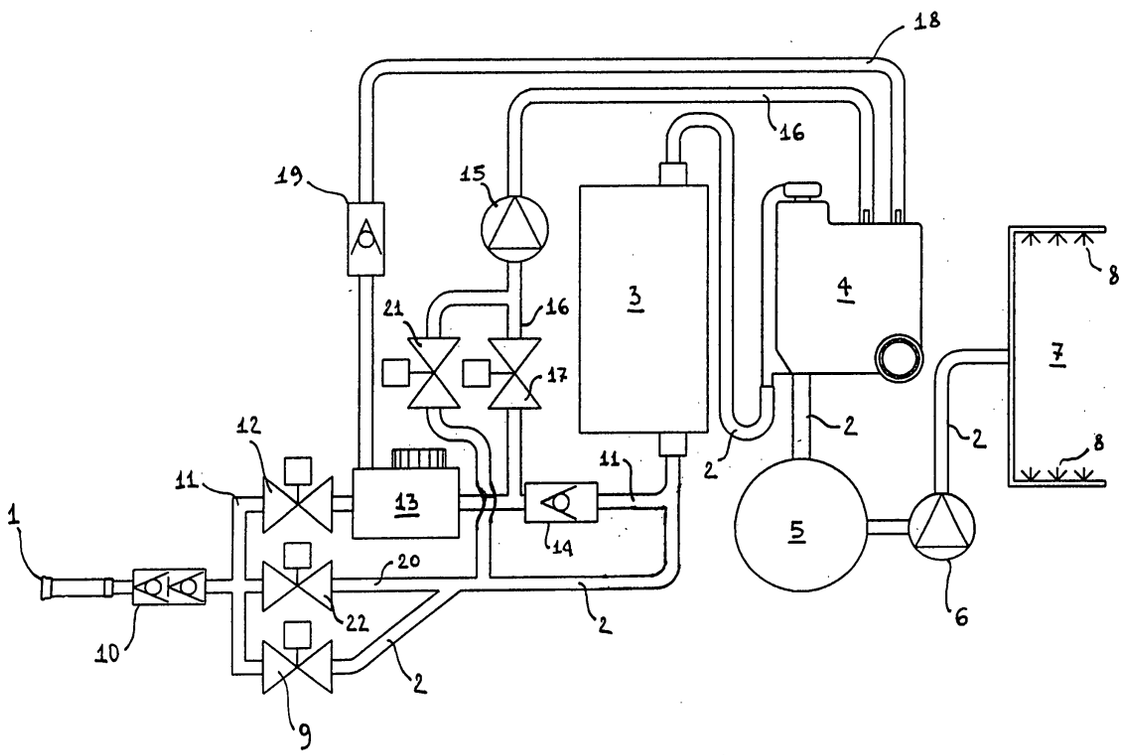
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(54) Automatic professional warewashing machine with improved water supply circuit

(57) The present invention refers to an automatic warewashing machine, in particular of the type intended for professional applications.

The machine according to the invention comprises at least a water inlet fitting (1) for the connection of said warewashing machine to the water supply, a device (3) containing water-softening resins, a separation chamber (4), a washing vessel (7), and a reservoir (13) for storing the salt required for regenerating said resins and restoring the efficiency thereof, said reservoir (13) being fluidly connected to said water-softener device (3) via a fluid regeneration circuit (11).

A basic feature of the invention is that said reservoir (13) is separate from said washing vessel (7), and is further connected fluidly to means (15) provided to empty it via a fluid emptying circuit (16).



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Description

[0001] The present invention refers to an automatic warewashing machine for professional, heavy-duty applications, provided with an improved water supply circuit, in particular of the type including means for softening the in-flowing supply water and a system for regenerating the water-softener means themselves.

[0002] Existing automatic warewashing machines for professional applications, i.e. intended for use in food-service and mass catering operations, communities and the like, are largely known in the art to be usually provided of softening means for the inflowing supply water, in which said water softener means are capable of reducing the presence in the water of such scale-forming agents as, for example, calcium and magnesium salts, which could in the long run lead to scale forming in pipes and on the electric heating elements of the machine, thereby reducing the efficiency thereof. Materials used in such water softener means are subject to a gradual reduction in the capacity thereof of removing scale-forming salts from the water, so that they need to periodically undergo a regeneration process aimed at restoring the function and the efficiency thereof. The regeneration of water softener means is carried out automatically by the machine itself through an appropriately provided system which, under the control of a special programme, provides for a salt solution to be delivered into said water softener means. The amount of salt that is each time needed to complete a regeneration cycle is generally stored in a reservoir that the user/operator shall fill up periodically. Since such a reservoir is involved by a passage of water flowing therethrough during the regeneration cycle, it will therefore be found to be at least partially filled with water at the end of the same cycle. As a result, when the user/operator tries to open the reservoir in view of restoring the amount of salt in the same reservoir, the water contained therein flows out uncontrolled. In an effort to at least partially do away with such a problem, some prior-art warewashing machines for professional applications have the salt reservoir included within the same washing vessel, or tank, so that the water spilling from the reservoir is eventually collected by the conduit provided there to discharge washing liquor, detergents and aids used in the washing cycle. Solutions of this kind, however, have a major drawback in that the fluids and media put to work and operating in the washing vessel of the machine may then come into contact with the water supply system and pollute it just through the salt reservoir, for instance in the case that the latter has not been properly or correctly closed after a salt-re-filling operation carried out by the user or the operator. In addition, safety requirements which heavy-duty or professional warewashing machines are required to comply with in accordance with applying standard regulations as far as also their operation is concerned, such as those issued by the Water Research Centre in Great Britain, call for dangerous fluids rated as type-5 fluids in a scale of increasing dangerousness from 1 to 5, such as for instance the fluids put to work in the washing vessel, be effectively and by all means prevented from coming into contact with the fresh water flowing in from the water supply system. As a result, in order to enable warewashing machines incorporating the salt container in their washing vessel to duly comply with the applying regulations, the machines themselves must be isolated from the water supply system through an appropriate air separation chamber, generally known as "air-gap" or "air-break" in the art.

[0003] Such a chamber enables two or more conduits to be physically separated from each other, while anyway ensuring fluid transport from the upstream side to the downstream side of the same chamber. If the warewashing machine must on the one side be necessarily connected to a separation chamber of the above cited kind for due compliance to the applying regulations, on the other side such a connection implies the disadvantage of calling for an additional water pump to be used for installation between the air-gap and the warewashing machine in view of supplying the latter with water at the correct pressure value needed for working. The presence of such an additional pump is clearly disadvantageous, since it causes production costs to undesirably increase.

[0004] Also known in the art there are automatic warewashing machines for professional applications, which do not integrate in their structure any water softener arrangement and, therefore, any associated arrangement for the regeneration thereof, but are rather designed for connection to a separate water softener, which includes its own regeneration arrangement. This solution, however, has a drawback in that it calls for two distinct pieces of equipment to be used for the washing operations to be performed effectively, and it further requires the water softener itself to be selected in an appropriate, specific manner for the water flow rates requested by the warewashing machine to be duly taken into account, thereby contributing to a disadvantageous increase in the complexity of the whole installation, as well as in the purchase and set-up costs of the same.

[0005] It therefore is an object of the present invention to provide an automatic warewashing machine for professional applications, which does away with the above-described drawbacks and disadvantages of prior-art automatic warewashing machines of this kind. Within this general object, it is a purpose of the present invention is to provide an automatic warewashing machine for professional applications, which does not enable any direct contact between the fluid used for washing and the water supply system.

[0006] A further purpose of the present invention is to provide an automatic warewashing machine for professional applications, which is capable of operating with a simple connection to the water supply system, without requiring any connection to any further apparatus or piece of equipment.

[0007] Another purpose yet of the present invention is to provide an automatic warewashing machine for professional applications, which enables the regeneration arrangement to be restored without causing any water to be uncontrollably spilled.

[0008] According to the present invention, all these aims are reached in an automatic warewashing machine for professional applications, which incorporates the characteristics and features as recited in the appended claim 1. Features and advantages of the present invention will anyway be more readily understood from the description that is given below by way of non-limiting example with reference to the sole accompanying drawing, which is a schematical view of the main component parts of the water circuit of the automatic warewashing machine according to the present invention.

[0009] In the example of embodiment illustrated in the sole accompanying Figure, the warewashing machine according to the present invention comprises at least a main water inlet fitting 1 for the connection of the machine to the water supply. To this main water inlet fitting 1 there is connected a water supply circuit 2, which connects in series with each other an apparatus 3 containing water softening resins, generally referred to as "water softener", a separation chamber or air-break 4, a pump 6 for delivering water to a washing vessel 7 accommodating water spray means 8. Preferably, heating means 5 are provided upstream of the pump 6 for heating up the water. The above-cited water supply circuit 2 includes at least a valve 9, as well as, preferably, a check valve 10 adapted to prevent water being conveyed towards the warewashing machine from being able to flow back towards the water supply system. The water supply circuit 2 is involved in water passing therethrough during the normal operation of the warewashing machine, i.e. during the washing process taking place inside the washing vessel 7.

[0010] In order to be able to periodically carry out the process aimed at regenerating the water softener apparatus 3, the automatic warewashing machine for professional uses according to the present invention is provided with a regeneration water circuit 11 provided with at least a valve 12 that is capable of conveying a maximum flow rate which is lower than the flow rate of the valve 9 of the main water supply circuit 2. This regeneration water circuit 11 conveys water taken in from the water supply system towards a reservoir 13 provided for storing the salt intended for the regeneration of the effectiveness of the resins contained in said water softener apparatus 3. Inside said reservoir 13, which is separate from the washing vessel 7, the water mixes with the salt and the thus forming salt solution is conveyed from the portion of regeneration circuit 11 situated downstream of the reservoir 13 into the portion of main water supply circuit 2 situated upstream of the water softener apparatus 3. In this manner, the salt solution flows into the water softener apparatus 3, thereby starting the regeneration process of the resins. In the regeneration water circuit 11, which fluidly connects the water softener apparatus 3 with the reservoir 13, there is provided a first check valve 14 enabling flow to take place solely in the direction towards said water softener apparatus 3.

[0011] The process of regeneration of the water softener apparatus 3, as on the other hand the whole operation of the automatic warewashing machine according to the present invention, is controlled and carried out in a fully automatic manner; however, once such a process is concluded, the need arises for the user/operator to re-fill salt in the reservoir 13, so as to restore the necessary amount thereof and prepare the machine in view of the next regeneration process that it is due to carry out. Since the reservoir 13 is separate from the washing vessel 7 of the machine, in order to avoid that, when the reservoir 13 is re-filled with salt, water remaining in said reservoir after the regeneration process may spill out therefrom in an uncontrolled manner, the warewashing machine according to the present invention is made and arranged so that the reservoir 13 is further connected fluidly with means 15 for draining the same reservoir 13 through a proper emptying circuit 16. The draining operation is controlled and started automatically by the machine and it is performed prior to a signal being issued to tell the user/operator to restore the salt content in said reservoir 13. The above-cited reservoir emptying circuit 16 further connects the reservoir 13 with the separation chamber 4 ,and comprises first valve means 17 to enable or shut off water flow therethrough. In a preferable manner, said reservoir emptying circuit 16 is connected to the portion of the regeneration circuit 11 that is situated downstream of the reservoir 13. The above-cited means 15 for draining the reservoir 13 are preferably constituted by a vibration pump that is capable of drawing in water in which salt in a solid form is mixed.

[0012] During this draining operation carried out to empty the reservoir 13, the salt being removed from said reservoir will at least partly settle on the emptying means 15 themselves. Therefore, in order to be able to remove these deposits, the reservoir emptying circuit 16 is connected to flushing means 20 provided to rinse it. These flushing means 20 are constituted by a conduit conveying water in the chemical-physical conditions as delivered by said water supply system 4, and this conduit comprises second valve means 21 to start and cut off rinsing of said emptying circuit 16, as well as a valve 22 for adjusting the flow rate, the highest value of which is comprised between the highest flow-rate values of the valves 12 and 9 provided in the regeneration circuit 11 and the water supply circuit 2, respectively.

[0013] In order to prevent the reservoir 13 from finding itself operating at some inappropriate pressure, a pressure compensation circuit 18 connects the separation chamber 4 with the reservoir 13. A second check valve 19 is installed in said pressure compensation circuit 18, so as flow is actually allowed to solely take place towards said reservoir 13.

[0014] Fully apparent from the above description is therefore the ability of the present invention to effectively reach the afore cited aims and advantages: in fact, it provides an automatic warewashing machine for professional applications which does away with any possibility for washing liquor to come into contact with the water supply system. It has been furthermore demonstrated how the automatic warewashing machine according to the present invention is actually capable of working with a simple connection to the water supply system, without requiring any further connection to other apparatuses or devices. It has been finally ascertained that the automatic warewashing machine according to the present invention enables the water-softener regeneration arrangement to be restored in its condition without causing water to be spilled in an uncontrolled manner.

[0015] It should of course be noticed that the materials, as well as the shapes and the sizing of the individual component parts of the machine according to the present invention may each time be selected so as to more appropriately meet the particular requirements or suit the particular application, without departing from the scope of the present invention.

[0016] It will furthermore be appreciated that the various parts and items constituting the machine according to the present invention shall not necessarily be embodied in the sole manner as described above, but can rather be inherently provided in many other embodiments and variants thereof, again without departing from the scope of the present invention.

Claims

1. Automatic warewashing machine, in particular of the type intended for professional applications, comprising:

   - at least a water inlet fitting (1) for the connection of said warewashing machine to the water supply,
   - a device (3) containing water-softening resins,
   - a separation chamber (4),
   - a washing vessel (7),
   - a reservoir (13) for storing the salt required for regenerating said resins and restoring the efficiency thereof, said reservoir (13) being fluidly connected to said water-softener device (3) via a fluid regeneration circuit (11), **characterized in that** said reservoir (13) is separate from said washing vessel (7), and is further connected fluidly to means (15) provided to empty it via a fluid emptying circuit (16).

2. Automatic warewashing machine according to claim 1, **characterized in that** said fluid emptying circuit (16) fluidly connects said reservoir (13) with said separation chamber (4).

3. Automatic warewashing machine according to claim 1 or 2, **characterized in that** said fluid emptying circuit (16) comprises first valve means (17) to enable or shut off fluid flow therethrough.

4. Automatic warewashing machine according to any of the preceding claims or a combination thereof, **characterized in that** said reservoir emptying means (15) are constituted by a vibration pump.

5. Automatic warewashing machine according to any of the preceding claims or a combination thereof, **characterized in that** said fluid emptying circuit (16) is connected to flushing means (20) for rinsing it.

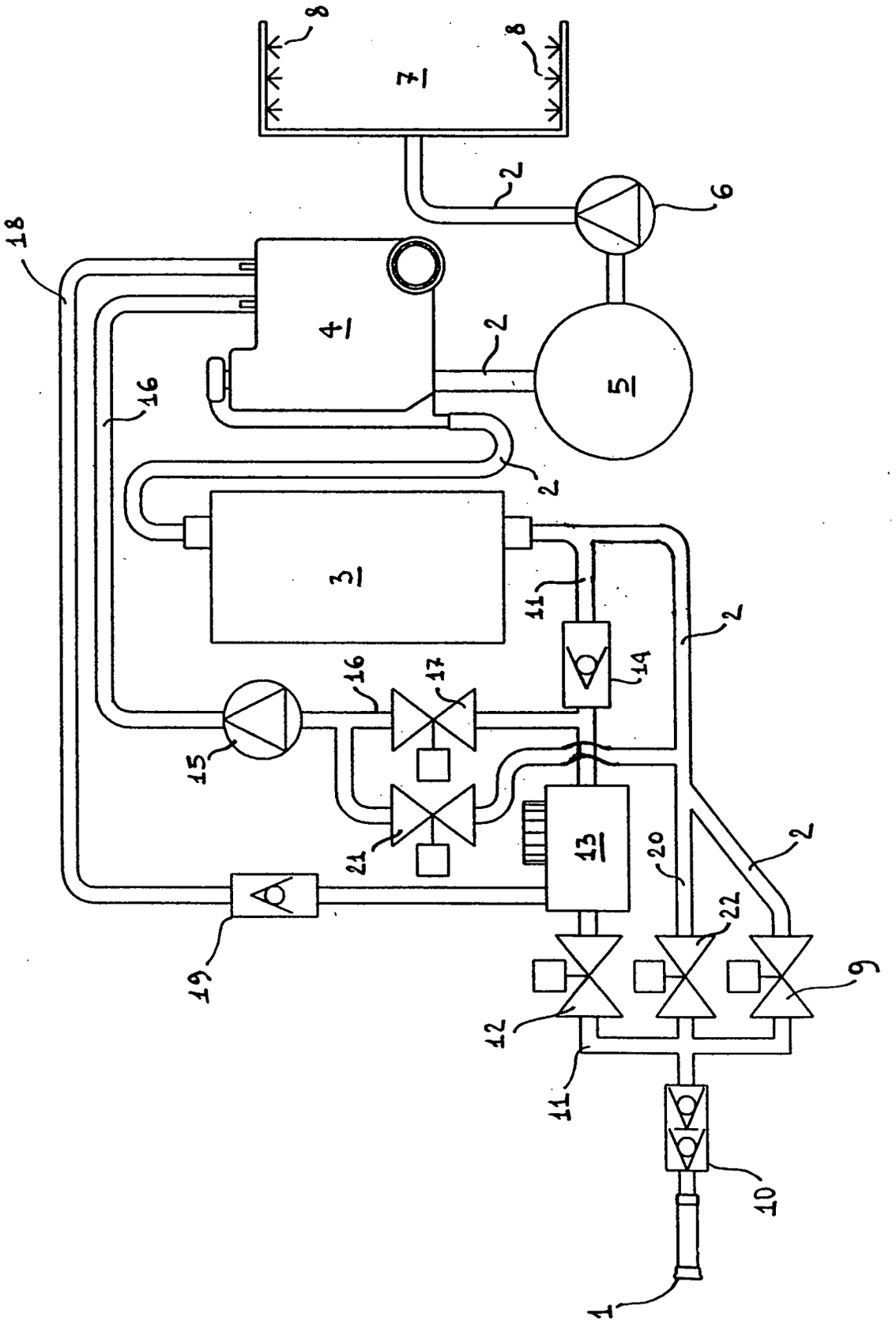
6. Automatic warewashing machine according to claim 5, **characterized in that** said flushing means (20) are constituted by a conduit conveying water in the chemical-physical conditions as delivered by said water supply system, said conduit comprising second valve means (21) to start and cut off rinsing of said emptying circuit (16).

7. Automatic warewashing machine according to any of the preceding claims or a combination thereof, **characterized in that** in said regeneration circuit (11), between said reservoir (13) and said water softener (3), there is connected a first check valve (14) enabling flow to take place solely in the direction towards said water-softener device (3).

8. Automatic warewashing machine according to any of the preceding claims or a combination thereof, **characterized in that** said reservoir (13) and said at least a separation chamber (4) are further connected with each other by a pressure compensation circuit (18).

9. Automatic warewashing machine according to claim 5, **characterized in that** said pressure compensation circuit (18) comprises a second check valve (19) enabling flow to solely take place towards said reservoir (13).

10. Automatic warewashing machine according to any of the preceding claims or a combination thereof, **characterized by** what has been described and illustrated in and with reference to the accompanying drawing.


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PARTIAL EUROPEAN SEARCH REPORT

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number EP 03 02 9545

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
Munich	26 May 2004	Papadimitriou, S

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
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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 (P04C07)

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INCOMPLETE SEARCH SHEET C

Application Number
EP 03 02 9545

Claim(s) not searched:
10

Reason for the limitation of the search:

The subject-matter of claim 10 is not in compliance with the provisions of Rule 29(6) EPC.

European Patent Office

PARTIAL EUROPEAN SEARCH REPORT

Application Number
EP 03 02 9545

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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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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