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(54) **Dishwashing machine with nebuliser and dish treatment method**

(57) A dishwashing machine (1) comprises a washing container closable through a port, a spraying device (4), a nebuliser device (9) adapted to nebulise at least part of the washing liquid and to convey such nebulised washing liquid in the washing container (2), a device for the heating (10) of the washing liquid, control means (12) for selecting a dish treatment program between a plurality of treatment programs comprising at least one washing program and at least one stand-by program with one or more nebulisation steps, during which nebulisation steps the nebuliser device (9) is actuated, and in which the heating device (10) is deactivated during the entire stand-by program.

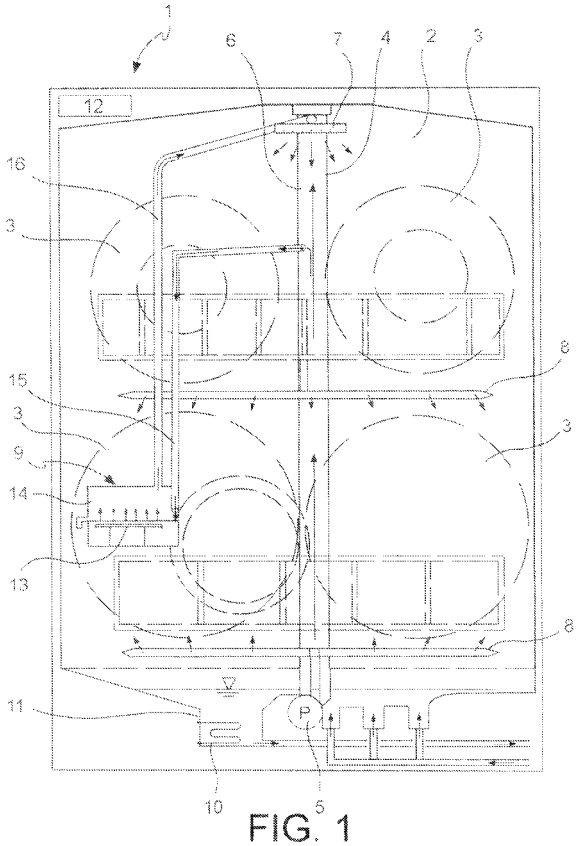

FIG. 1

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Description

[0001] The present invention relates to a dishwashing machine of the type comprising a washing container to receive dishes to be washed, a spraying device adapted to spray a non-nebulised washing liquid on the dishes arranged in the washing container, and a heating device (10) adapted to heat the washing liquid. Particularly, the present invention relates to a dishwashing machine provided with washing liquid nebulisation means.

[0002] The present invention further relates to a dish treatment method by means of a dishwashing machine.

[0003] During the washing cycles, the washing liquid is usually introduced in the washing container by means of spraying devices and, after the last washing cycle, a final rinsing step is performed, in which a brightener substance can be added to the washing liquid.

[0004] To the purposes of the washing result, it resulted to be advantageous to evenly spread a washing liquid containing detergent substances on the dish surfaces still before the washing cycle, and to make such washing liquid acting on the incrustations and impurities for a given period of time.

[0005] Therefore, in some known washing programs, at the beginning of the washing cycle, the dishes are wetted by a spraying device through a washing liquid previously mixed with a detergent.

[0006] Dishwashing machines with spraying devices are known, in which the washing liquid is distributed in the washing container by means of rotating sprayer arms. Due to the usually rectangular shape of the washing container, and the circular spray zone of the rotating sprayer arms, the washing liquid does not result to be evenly distributed in all the zones of the washing container.

[0007] Stationary spraying devices or nozzles are further known, the invariable spray directions of which cannot however ensure an even washing of all the dishes arranged in the washing container.

[0008] In other fields of the art, for example in medicine, in the chemistry, and environmental air conditioning, further auxiliary means for the nebulisation of liquids have been developed, for example aerosol mechanical generators, and particularly piezoelectric aerosol generators.

[0009] A use of these mechanical means to nebulise liquids is also known in relation to dishwashing machines. The very limited dimension of the single aerosol drops which can be generated by piezoelectric nebulisators allows a better penetration thereof in the incrustations and impurities, thus increasing the detergent effect of detergent substances dissolved in the nebulised washing liquid.

[0010] The publication EP 0 487 474 A1 discloses, for example, a dishwashing machine in which the washing liquid containing a detergent substance is nebulised in the washing container via an ultrasound generator.

[0011] With the aim of further improving an even distribution of the nebulised washing liquid, DE 10 2006 055 345 A1 proposes to combine the ultrasound nebuliser known from EP 0 487 474 A1 with a blower to forcedly convey the nebulised washing liquid in the washing container. Through this known solution, a better distribution of the liquid nebulised in the washing container is obtained. However, the provision of an electric blower involves high manufacturing costs, a reduction of the space available to contain the dishes to be washed, as well as an additional and undesired energy consumption.

[0012] Therefore, object of the present invention is to improve both the dishwashing machines and the known washing methods for the dishes, so as to improve the washing efficacy thereof and to reduce the water and electric power consumption thereof.

[0013] These and other objects are achieved by means of a dishwashing machine according to claim 1 and by a method for washing dishes in a dishwashing machine according to claim 14.

[0014] Advantageous embodiments are the object of the dependant claims.

[0015] According to the invention, a dishwashing machine is proposed, which comprises at least one washing container to receive dishes to be washed, a spraying device adapted to spray a washing liquid in the washing container to wet the dishes, a nebuliser device adapted to nebulise at least part of the washing liquid and to convey such nebulised washing liquid in the washing container, a washing liquid heating device and electronic control means so configured as to allow the selection of a dish treatment program amongst a plurality of treatment programs, wherein the plurality of treatment programs comprises at least one washing program with at least one washing step with heating of the washing liquid and introduction of the heated washing liquid in the washing container, **characterized in that** said treatment programs comprise at least one stand-by program with one or more nebulisation steps with introduction of nebulised washing liquid in the washing container, wherein during all the stand-by program, said heating device is deactivated.

[0016] Thanks to the stand-by program, the dishes awaiting to be washed are treated with a washing liquid cold aerosol, and in this manner are prepared and kept ready for a successive actual washing with hot washing liquid. This allows always awaiting for the completed filling of the dishwashing machine, independently from the type of soils and incrustation, before carrying out the washing program and subjecting the dishes awaiting to be washed to an optionally repeated pre-treatment by means of washing liquid aerosol so as to improve the washing program efficacy and to reduce the duration, the electric energy and water consumptions thereof.

[0017] In accordance with an embodiment, the nebuliser device comprises a piezoelectric aerosol generator capable of nebulising the washing liquid, during such stand-by program, with very low energy consumptions.

[0018] The dependant claims relates to advantageous embodiments of the invention.

[0019] In order to better understand the invention, and appreciate the advantage thereof, some embodiments thereof will be described below by way of non-limitative example, with reference to the annexed Figures, in which:

[0020] - Fig. 1 is a schematic front view of a dishwashing machine according to an embodiment of the invention;

[0021] - Fig. 1 is a schematic front view of a dishwashing machine in according to a second embodiment of the invention.

[0022] With reference to the annexed Figure, a dishwashing machine is generally indicated with the reference numeral

1. The dishwashing machine 1 comprises at least one washing container 2 adapted to receive dishes 3 to be washed and closable through a port (not shown). Within the dishwashing machine 1 a spraying device 4 is provided, for example, a pump 5 with a delivery tube 6, and one or more spraying nozzles 7 and/or spraying rotors 8. The spraying device 4 is configured to spray a non-nebulised washing liquid onto the dishes 3 arranged in the washing container 2. A nebuliser device 9 is further provided to nebulise at least part of the washing liquid with the aim of producing an aerosol flow and to convey such nebulised washing liquid (aerosol flow) onto the dishes 3 contained in the washing container 2. The dishwashing machine 1 further comprises a heating device adapted to heat the washing liquid, for example, an electric resistance 10 arranged in a washing liquid collection tank 11. The collection tank 11, preferably formed in a lower zone of the washing container 2 or under the washing container 2, is connected to the spraying device 4 and, optionally, to the nebulisation device 9 to allow that they withdraw the cold or heated washing liquid necessary for the treatment of the dishes.

[0023] The dishwashing machine 1 further comprises control means, for example, an electronic control unit 12, so configured as to allow the selection of a dish treatment program amongst a plurality of treatment programs.

[0024] The plurality of treatment programs comprises at least one washing program with at least one washing step in which the heating device 10 is actuated so as to heat the washing liquid, and in which the spraying device 4 is actuated so as to insert the heated washing liquid in the washing container 2, or in other words, so as to spray the heated washing liquid onto the dishes 3 arranged in the washing container 2.

[0025] According to an aspect of the present invention, the treatment programs also comprise at least one stand-by program with one or more nebulisation steps, in which the nebuliser device 9 is actuated so as to introduce nebulised washing liquid in the washing container 2 (applying it on the dishes 3), and in which during the entire stand-by program, the heating device 10 remains deactivated.

[0026] In accordance with an embodiment, the control means 12 are configured so as to perform the nebulisation steps of the stand-by program in a time-independent manner from the carrying out of the washing steps of the washing programs.

[0027] Advantageously, the control means 12 are configured so as to deactivate also the spraying device 14 during the carrying out of the stand-by program.

[0028] Thanks to the stand-by program, the dishes awaiting to be washed are treated with a washing liquid cold aerosol, and in this manner are prepared and kept ready for a successive actual washing with hot washing liquid. This allows always awaiting for the complete filling of the dishwashing machine, independently from the soils and incrustation type, before carrying out the washing program and subjecting the dishes awaiting to washing to an optionally repeated pre-treatment through washing liquid aerosol, so as to improve the washing program efficacy and to reduce the duration, the electric energy and water consumptions thereof.

[0029] According to an embodiment, the control means are configured so that, during the nebulisation steps of the stand-by program, the nebuliser device 9 is automatically deactivated when the port is opened, and the nebuliser device 9 is automatically reactivated when the previously opened port is closed. Advantageously, this allows carrying out the treatment through washing liquid aerosol with a closed container, increasing the treatment efficacy and minimizing the escape of washing liquid aerosol into the surrounding environment.

[0030] The control means 12 can further comprise signalling means, for example, LCD, LED display, or the like, which indicate to the user the carrying out of a nebulisation step during the stand-by program. In this manner, the user who wants to load further dishes in the dishwashing machine, can decide whether to wait for the end of the treatment with washing liquid aerosol or to temporarily discontinue such treatment by opening the port.

[0031] According to an advantageous embodiment, the control means 12 are so configured as to actuate the nebulisation device 9, during the carrying out of the stand-by program, when the port has remained closed for a predetermined period of time, preferably from 2 to 10 minutes, still more preferably from 5 to 10 minutes, after the last opening thereof. In this manner, once the stand-by program has been selected and carried out, the soiled dishes arranged in the washing machine 1 are almost immediately subjected to a treatment via washing liquid aerosol but, at the same time, a repeated opening and closure of the port do not compromise the proper functioning of the stand-by program.

[0032] Preferably, the control means 12 are so configured as to actuate the nebulisation device 9 in a discontinuous manner during the carrying out of the stand-by program. Particularly, the control means 12 deactivate the nebulisation device 9 during a rest step between two consecutive nebulisation steps, in which such rest step

can have a duration of from 1 to 8 hours, preferably from 1 to 4 hours, still more preferably from 2 to 4 hours.

[0033] Experimental tests have shown that the treatment through washing liquid aerosol retains its action of incrustations desegregation and soils dissolution for the above-mentioned period of time. In this manner, a maximization of the effect of the treatment and a minimization of the energy consumptions necessary for the nebulisation can be obtained.

[0034] In fact, thanks to the characteristics hereto described, all the dishes arranged in the dishwashing machine, which are awaiting for the complete filling thereof are subjected to at least one treatment with washing liquid aerosol after the port closure, but between a first nebulisation step and a successive nebulisation step of the same dishes (in the absence of further apertures and closures of the port), a rest step is provided, having a duration essentially corresponding to the duration of the actions of the first nebulisation step.

[0035] In accordance with an embodiment, the nebulisation steps of the stand-by program have a duration of from 1 minute to 1 hour, preferably from 5 minutes to 30 minutes, still more preferably from 5 minutes to 10 minutes.

[0036] With the aim of carrying out the nebulisation steps during the stand-by program, it is particularly advantageous to provide the nebuliser device 9 with a piezoelectric aerosol generator 13.

[0037] Such piezoelectric aerosol generator 13 can be arranged within a nebulisation container 14 connected through a supply tube 15 to the delivery duct 6 of the spraying device 4 and through a dispensing duct or port 16 within the washing container 2 (Fig. 1).

[0038] Alternatively, the nebulisation container 14 is connected through the supply tube 15 to a duct with air head directly connectable to the water network by the interposition of an electrovalve, for example, the supply duct of a water softener device.

[0039] According to an embodiment, the nebulisation device 9 dispensing duct 16 is connected to a sprayer nozzle 7 of the spraying device 4 so that the same sprayer nozzle 7 introduces both the sprays of non-nebulised washing liquid during the washing steps of the washing programs and the aerosol flow of nebulised washing liquid during the nebulisation steps of the stand-by program.

[0040] For further increasing the efficiency of treatment of the dishes "awaiting" by means of the washing liquid aerosol, a device can be provided within the machine 1 to receive a detergent substance and to bring such detergent substance to the washing liquid intended to be nebulised during the nebulisation steps of the stand-by program.

[0041] By means of the dishwashing machine 1 hereto described, it is possible to carry out a dish treatment method aimed at a water, electric energy, and detergent saving, for a given amount of washed dishes, and to improve the result of washing in the sense of a more complete removal of the food residues from the dishes.

[0042] Particularly, the method contemplates to arrange the dishes to be washed in the dishwashing machine, to await for the essentially complete filling of the dishwashing machine with dishes to be washed, and to wash the dishes only when the dishwashing machine results to be essentially filled with dishes, through heating washing liquid and spraying the heated washing liquid onto the dishes. When awaiting for the dishwashing machine to be filled, the method provides for nebulisation of washing liquid and the conveyance of the nebulised washing liquid onto the dishes, without heating the washing liquid.

[0043] Advantageously, the nebulisation of the washing liquid when awaiting for the filling of the dishwashing machine occurs in a time-independent manner from the carrying out of the washing of the dishes.

[0044] In accordance with an embodiment of the treatment method, the nebulisation is discontinued when the port is opened during the awaiting for the complete filling of the dishwashing machine and is resumed only after the closure of the port.

[0045] As already described in relation to the control device 12 of the dishwashing machine 1, in order to obtain the desired water, energy, and detergent savings, it is further advantageous to nebulise the washing liquid and to apply the nebulised washing liquid onto the dishes in an discontinuous manner when awaiting for the complete filling of the dishwashing machine.

[0046] Further advantageous aspects of the method for treating dishes have already been described in association with the description of the dishwashing machine 1 which is to be intended as an integrant part of the description of the treatment method which is the object of the present invention.

[0047] It shall be appreciated that to the dishwashing machine and the dish treatment method hereto described, those skilled in the art, with the aim of meeting contingent and specific needs, will be able to make further modifications and variations, all anyhow contained in the protection scope of the invention, as defined by the following claims.

Claims

1. A dishwashing machine (1), comprising:

- at least one washing container (2) adapted to receive dishes (3) to be washed, and closable through a port;
- a spraying device (4) adapted to spray a non-nebulised washing liquid onto the dishes (3) arranged in the washing container (2);
- a nebuliser device (9) adapted to nebulise at least part of the washing liquid and to convey such nebulised washing liquid in the washing container (2);
- a heating device (10) adapted to heat the wash-

ing liquid;
- control means (12) so configured as to allow the selection of a dish treatment program amongst a plurality of treatment programs,

wherein said plurality of treatment programs comprises at least one washing program with at least one washing step, during which washing step said heating device (10) is actuated so as to heat the washing liquid, and said spraying device (4) is actuated so as to spray said heated washing liquid onto the dishes (3) in the washing container (2),
characterized in that said treatment programs comprise at least one stand-by program with one or more nebulisation steps, during which nebulisation steps said nebuliser device (9) is actuated so as to introduce nebulised washing liquid in the washing container (2), and wherein said heating device (10) is deactivated during the entire stand-by program.

2. The dishwashing machine (1) according to claim 1, wherein said control means (12) are configured so as to control the carrying out of said one or more nebulisation steps of the stand-by program in a manner time-independent from the carrying out of the washing steps in said washing programs.

3. The dishwashing machine (1) according to claim 1 or 2, wherein said control means (12) are configured so as to deactivate said spraying device (4) during the carrying out of said stand-by program.

4. The dishwashing machine (1) according to claim 1, 2 or 3, wherein said control means (12) are configured so that, during said nebulisation steps of the stand-by program,

- said nebuliser device (9) is automatically deactivated when said port is opened; and
- said nebuliser device (9) is automatically reactivated when the port is closed.

5. The dishwashing machine (1) according to any one of the preceding claims, wherein said control means (12) comprise signalling means which indicate to the user the carrying out of a nebulisation step during the stand-by program.

6. The dishwashing machine (1) according to any one of the preceding claims, wherein said control means (12) are configured so as to actuate said nebulisation device (9), during the carrying out of the stand-by program, if said port has remained closed for a predetermined period of time after the last opening thereof.

7. The dishwashing machine (1) according to any one of the preceding claims, wherein said control means (12) are so configured as to actuate said nebulisation device (9) in a discontinuous manner during the carrying out of the stand-by program.

8. The dishwashing machine (1) according to the preceding claim, wherein during the carrying out of the stand-by program, said control means (12) deactivate the nebulisation device (9) during a rest step between two consecutive nebulisation steps.

9. The dishwashing machine (1) according to the preceding claim, wherein said rest step has a duration of from 1 to 8 hours, preferably from 1 to 4 hours, still more preferably from 2 to 4 hours.

10. The dishwashing machine (1) according to any one of the preceding claims, wherein said nebulisation steps of the stand-by program have a duration of from 1 minute to 1 hour, preferably from 5 minutes to 30 minutes, still more preferably from 5 minutes to 10 minutes.

11. The dishwashing machine (1) according to any one of the preceding claims, wherein said nebuliser device (9) comprises a piezoelectric aerosol generator (13).

12. The dishwashing machine (1) according to the preceding claim, wherein said piezoelectric aerosol generator (13) is arranged within a nebulisation container (14) connected via a supply tube (15) to a delivery duct (6) of the spraying device (4) and via a dispensing duct or port (16) within the washing container (2).

13. The dishwashing machine (1) according to the preceding claim, wherein said dispensing duct (16) of the nebulisation device (9) is connected to a sprayer nozzle (7) of the spraying device (4) so that the same sprayer nozzle (7) introduces both the sprays of non-nebulised washing liquid during the washing steps of the washing programs and the washing aerosol flow nebulised during the nebulisation steps of the stand-by program.

14. The dishwashing machine (1) according to any one of the preceding claims, comprising a device to receive a detergent substance, and means to add said detergent substance to the washing liquid intended to be nebulised during said nebulisation steps of said stand-by program.

15. A dish treatment method by means of a dishwashing machine, comprising the steps of:

- arranging dishes to be washed in the dishwashing machine;
- awaiting for the essentially complete filling of

the dishwashing machine with dishes to be washed;
- a dishwashing machine essentially filled with dishes, washing the dishes, heating washing liquid, and spraying the heated washing liquid onto the dishes;
- while awaiting for the filling of the dishwashing machine, nebulising washing liquid and conveying the nebulised washing liquid onto the dishes, without heating the washing liquid when awaiting for the washing.

16. The method according to claim 15, comprising the step of carrying out the washing liquid nebulisation when awaiting for the filling in a manner time-independent from the carrying out of the washing of the dishes.

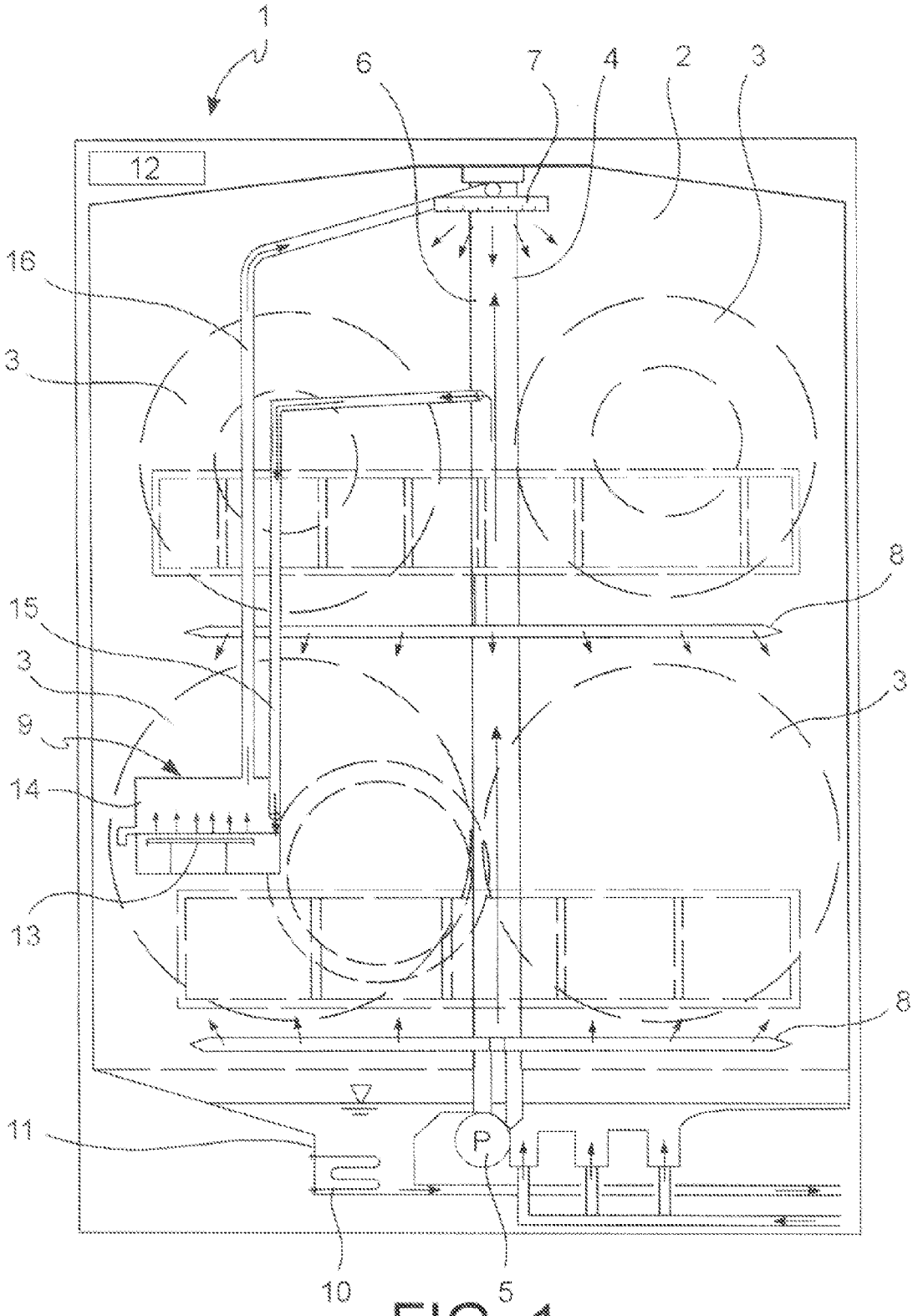

FIG. 1

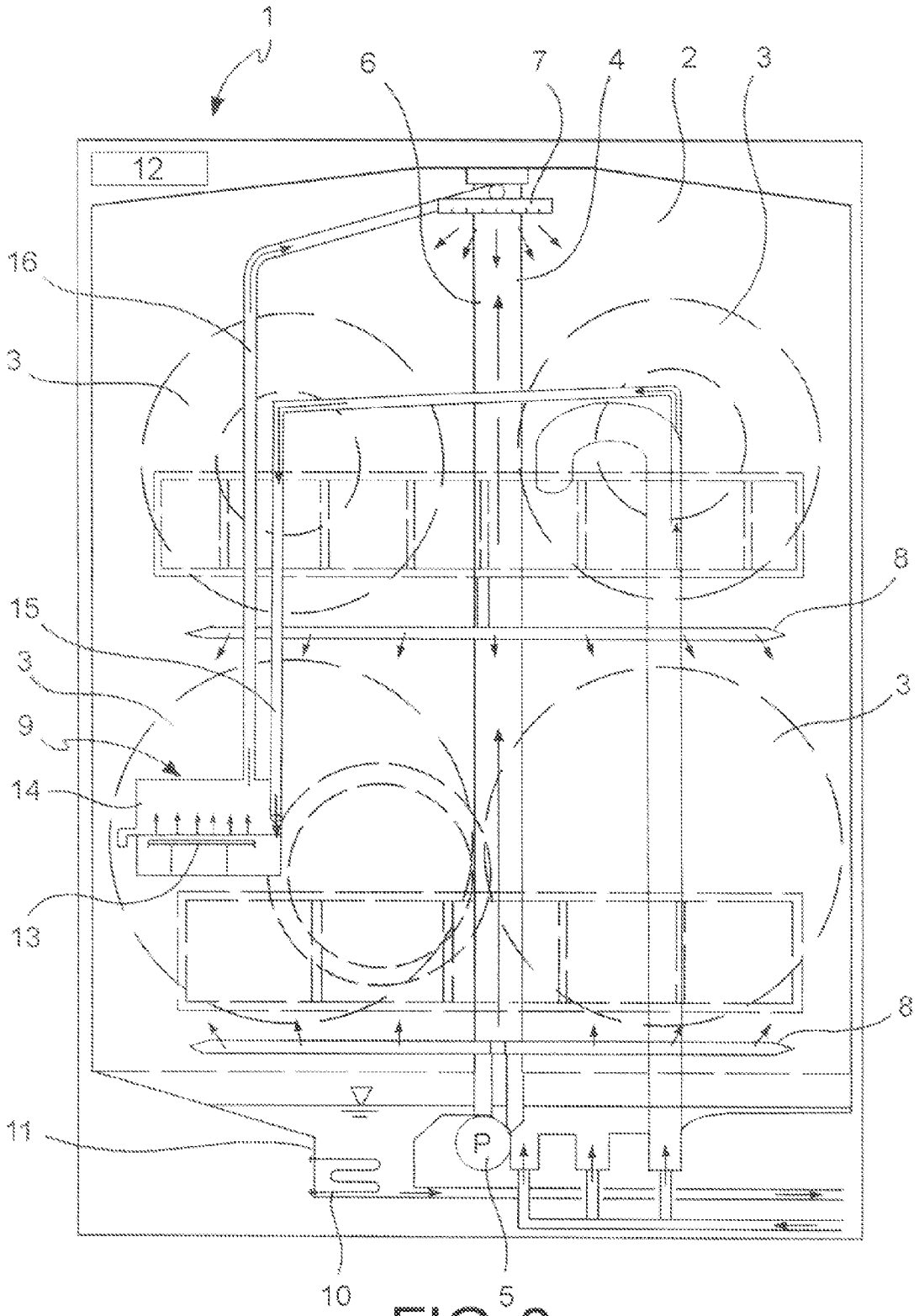

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 08 42 5795

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 May 2009	Lodato, Alessandra

CATEGORY OF CITED DOCUMENTS

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