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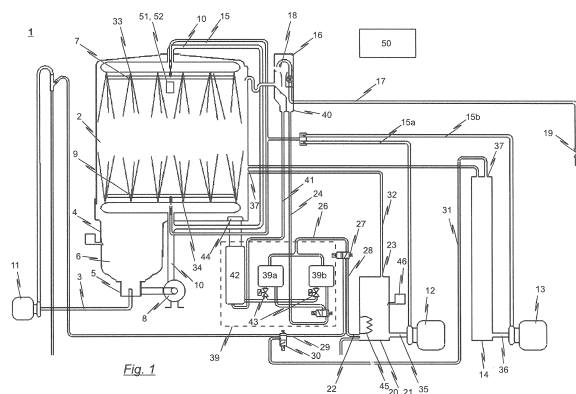
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(54) **DISHWASHER AND METHOD FOR CLEANING WASH WARE**

(57) The invention relates to a dishwasher (1) in the form of a programmable automatic machine, which has a programme control device (50) for carrying out at least one treatment programme, a treatment chamber (2) into which and from which wash ware can be manually inserted and removed, a tank (4) into which fluid from the treatment chamber (2) can flow off by gravity, and a washing system (33, 8, 34, 10) with a washing pump (8) and with a washing line system (10) for conveying washing fluid (6) during a washing phase out of the tank (4) through washing nozzles (33, 34) into the treatment chamber (2). In order to achieve an efficient treatment (cleaning and drying) of the wash ware, along with as low a consumption as possible of resources in terms of water, chemicals and, in particular, energy, there is provision, according to the invention, for the dishwasher (1) to have, furthermore, a wash-ware detector device (51) which is designed for detecting the type of wash ware to be treated, furthermore the programme control device (50) being designed to select a predetermined or determinable treatment programme for at least the washing phase automatically as a function of the detected type of wash ware to be treated and to set the process parameters associated with the selected treatment programme.



Description

[0001] The invention relates to a dishwasher and to a method for cleaning wash ware in a dishwasher.

[0002] The invention relates particularly to a method for cleaning wash ware in a dishwasher, in particular a commercial dishwasher, which is designed as a programmable automatic machine. The invention relates, furthermore, to a dishwasher, in particular a commercial dishwasher, in the form of a programmable automatic machine.

[0003] Manually loadable and unloadable dishwashers are programmable automatic machines. Programmable automatic machines (called box-type ware washers or else batch dishwashers) may be basket push-through dishwashers, also called hood-type ware washers, or front-loadable ware washers. Front loaders may be under-counter machines, top-counter machines or else free-standing front loaders.

[0004] Wash ware are, for example, plates, cups, pots, trays, cutlery, items of cutlery, glasses and kitchen utensils.

[0005] The publication EP 1 738 677 A2 discloses a domestic dishwasher which is designed for the following method sequence: a washing phase, during which washing fluid is sprayed by means of a pump out of a sump via spray nozzles into a washing chamber which is designed for receiving wash ware. Thereafter, washing fluid is pumped away, and the sump is filled with fresh water which is then conveyed by the same pump as that which previously conveyed the washing fluid to the same spray nozzles as the washing fluid. At the transition from the sump to the pump, there is a heater for heating the washing fluid, and, during the rinsing-clear phase, the rinse aid fluid may be heated or left unheated. After the rinsing-clear phase, a steam phase follows, in which fresh water is evaporated out of the sump by means of the heating and is conducted via the said spray nozzles into the treatment chamber. The steam phase may be followed by a drying phase in which the heated wash ware is dried.

[0006] Commercial dishwashers require water, detergent, rinse aid and energy for cleaning wash ware. The consumption of detergent and rinse aid is proportional to the water consumption per washing cycle. In the case of a constant water inflow temperature, this also applies to the heating energy which is required for heating the rinsing-clear water.

[0007] A commercial dishwasher, as a rule, has two water circuits which are completely separate from one another. These are a water circuit, which is responsible for washing and is executed with used water from the washing tank, and a fresh-water circuit, which is responsible for rinsing clear and uses fresh water from a boiler.

[0008] The main task of the rinsing-clear phase is to remove the washing fluid residues (lye) located on the wash ware. The rinsing-clear fluid (pure fresh water or fresh water mixed with rinse aid) sprayed during the rinsing-clear phase flows into the washing tank and therefore

also serves for regenerating the washing fluid. Before new rinsing-clear fluid is conducted into the washing tank during the rinsing-clear phase, the same quantity of washing fluid is pumped off from the washing tank.

[0009] In dishwashers which are designed in the form of a programmable automatic machine, the wash ware to be treated, such as, for example, dishes, pots, glasses, cutlery and other utensils to be cleaned, are treated during a plurality of treatment phases to be carried out in succession, such as, for example, washing phase or phases, rinsing-clear phase or phases and drying phase or phases. However, different types of wash ware require different treatment parameters for the individual process steps because of their use, their degree of soiling, their shape and the material. In present-day dishwashers designed as a programmable automatic machine, however, an automatic differentiation of the types of wash ware to be treated is, as a rule, not carried out, and therefore the conventional programmes often are designed to be a compromise such that they can be used for a plurality of different types of wash ware.

[0010] It is known that the programmable automatic dishwashers known from the prior art, such as, for example, under-counter dishwashers or hood-type dishwashers, may be equipped with a plurality of programmes. The individual programmes differ from one another mainly in the length of running time (cycle duration) of the treatment phases or, in the case of special programmes particularly for the treatment of drinking glasses, in the temperature parameters of the washing phase and of the rinsing-clear phase. In programmable automatic machines of this type, the operating personnel have the possibility, for example, of selecting a shorter programme for lightly soiled wash ware, such as, for example, drinking glasses, and a longer programme for more heavily or heavily soiled wash ware. In practice, however, because of inadequate training of the operating personnel, the possibility of manual programme selection is utilized only rarely, and therefore a programme preset at the factory is mainly employed for the treatment of the wash ware, irrespective of the type of wash ware.

[0011] If, in the treatment of the wash ware, a programme preset at the factory is employed, which, as a rule, is designed to be a compromise such that it can be used more or less efficiently for a plurality of types of wash ware, then, for example, lightly soiled crockery, such as, for example, drinking glasses, are washed for an uneconomically long time and at higher temperatures than would actually be required. On the other hand, there is the risk that, for example, wash ware with food residues which are relatively difficult to remove, such as, for example, cooking utensils and/or cutlery, are not cleaned sufficiently, and therefore, under certain circumstances, a plurality of washing runs or additional manual cleaning work are necessary.

[0012] The invention is intended to achieve the object of providing a dishwasher, in particular commercial dishwasher, which is designed as a programmable automatic

machine and which has a treatment chamber for receiving wash ware and which can provide good treatment results for all types of wash ware by the efficient utilization of resources (fresh water, chemicals and energy) during operation. Furthermore, the object is to be achieved of specifying a corresponding method for operating such a dishwasher designed as a programmable automatic machine.

[0013] The solution according to the invention is distinguished in that, before the actual treatment (cleaning) of the wash ware, first the type of wash ware to be treated is detected with the aid of a suitable wash-ware detector device and a predetermined (e.g., predefined) or determinable (e.g., user definable) treatment programme for the treatment of the wash ware is selected automatically as a function of the detected type of wash ware by a programme control device. Subsequently, an automatic setting of the process parameters associated with the selected treatment programme takes place.

[0014] The treatment programme may be set during machine manufacture or may be set or modified by service personnel and/or machine operators/users in the field or on-site.

[0015] On the one hand, an automatic detection of the type of wash ware to be treated is possible due to the provision of the wash-ware detector device. On the other hand, with the aid of the programme control device, an optimal treatment programme for the treatment of the wash ware during at least one treatment phase is selected automatically for each detected type of wash ware, and the process parameters associated with the selected treatment programme are set. The selection and automatic setting of the process parameters preferably take place for at least one treatment phase (washing phase, rinsing-clear phase, drying phase). Since the process parameters applicable to the respective treatment phases can thereby be adapted to the type of wash ware to be treated, the consumption of fresh water, chemicals and energy can be optimized.

[0016] It is basically conceivable that the programme control device is designed for assigning each detected type of wash ware to a predetermined or determinable wash ware group likewise preferably before the actual treatment of the wash ware. Advantageously, for each wash ware group, there should, in turn, be a predetermined or determinable treatment programme, according to which the wash ware of the type of wash ware assigned to this wash ware group is to be treated during at least one of the treatment phases, such as, for example, during the washing phase, the rinsing-clear phase and/or the drying phase.

[0017] The treatment programme predetermined or determinable for each wash ware group is preferably a treatment programme which is adapted, on the one hand, to the consumption of fresh water, chemicals and energy and, on the other hand, to a sufficient cleaning result. The solution according to the invention therefore makes it possible that the process parameters of the dishwasher

are optimally adapted automatically to the respective type of wash ware to be treated, without the operating personnel having to take action and carry out a programme selection manually.

[0018] The "type of wash ware" is understood in the present context to mean the type of wash ware to be treated or to be cleaned. The type of wash ware depends particularly, for example, on the size, shape and/or material of the wash ware to be cleaned.

[0019] The invention is described below by means of preferred embodiments of the dishwasher according to the invention with reference to the drawings in which:

Fig. 1 shows diagrammatically a dishwasher designed in the form of a programmable automatic machine, according to a first embodiment of the invention; and

Fig. 2 shows diagrammatically a dishwasher designed in the form of a programmable automatic machine, according to a second embodiment of the invention.

[0020] The dishwasher 1 according to the invention has a treatment chamber 2 for cleaning wash ware, not illustrated in the drawings. Below the treatment chamber 2 is arranged a washing tank 4 in which fluid can flow back out of the cleaning chamber 2 by gravity. The washing tank 4 may be covered at the transition to the treatment chamber 2 with the aid of a screen, not illustrated in the drawings. The washing tank 4 contains washing fluid 6 which is usually water, to which, if appropriate, detergent can be supplied automatically in a controlled way by a detergent metering device, not illustrated in the drawings. The washing fluid 6 can be conveyed by a washing pump 8 via a washing line system 10 to washing nozzles 33 and 34 (e.g., nozzles that may be located in upper and lower rotatable wash arms) and be sprayed through these washing nozzles 33, 34 in the treatment chamber 2 onto the wash ware to be cleaned. The sprayed washing fluid 6 subsequently flows back into the washing tank 4. The lower end 5 of the washing tank 4 may have connected to it a discharge line 3 with an out-flow pump 11, in order, as required, to empty the washing tank 4.

[0021] In the embodiment, illustrated in Fig. 1, of the dishwasher 1 according to the invention, a first rinsing-clear pump 12 is connected with its suction side to an outlet 35 of a boiler 21. The boiler 21 has, furthermore, an inlet 22 which is connected to a fresh-water feed line 28 and via which either fresh water or fresh water with metered rinse aid is supplied to the boiler 21. In the boiler 21, the fluid (pure fresh water or fresh water with metered rinse aid) supplied via the inlet 22 is heated according to a stipulated process sequence. Via the first rinsing-clear pump 12 connected with its suction side to the boiler outlet 35, the rinsing-clear fluid heated in the boiler 21 may be supplied, for example during a fresh-water rinsing-clear phase, to rinsing-clear nozzles 7 and 9 (e.g., noz-

zles that may be located in upper and lower rotatable rinse arms) via a rinsing-clear line system 15, 15a. The rinsing-clear nozzles 7 and 9 are arranged in the treatment chamber 2, in order to spray the rinsing-clear fluid heated in the boiler 21 onto the wash ware in the treatment chamber 2.

[0022] It is, of course, also conceivable, however, that the boiler 21 is supplied via the inlet 22 and the fresh-water feed line 28 with pure fresh water, to which, after heating the boiler 21, rinse aid is metered with the aid of a rinse-aid metering device, not illustrated in the drawings.

[0023] In the embodiment, illustrated in Fig. 1, of the dishwasher 1 according to the invention, furthermore, a second rinsing-clear pump 13 is provided, which is connected with its suction side to a fresh-water container 14 and with its delivery side to a rinsing-clear line system 15, 15b. The rinsing-clear line system 15b extending from the delivery side of the second rinsing-clear pump 13 and the rinsing-clear line system 15a extending from the delivery side of the first rinsing-clear pump 12 merge into a common rinsing-clear line system 15. By means of the second rinsing-clear pump 13 connected to the fresh-water container 14, unheated rinsing-clear fluid can be conveyed to the rinsing-clear nozzles 7 and 9 arranged in the treatment chamber 2, in order, as required, to spray unheated rinsing-clear fluid onto the wash ware.

[0024] The fresh-water container 14 has an inlet 37 which is connected to a fresh-water feed line 31. Via this fresh-water feed line 31, either pure fresh water or fresh water with metered rinse aid is supplied to the fresh-water container 14. It is, of course, also conceivable, however, to arrange the already mentioned rinse-aid metering device, not illustrated explicitly in the drawings, downstream after the outlet 36 of the fresh-water container 14.

[0025] The washing nozzles 33, 34 and rinsing-clear nozzles 7, 9 are in each case preferably arranged above and below the wash-ware region and are directed towards the wash-ware region of the treatment chamber 2. In the embodiment, illustrated in Fig. 1, of the dishwasher 1 according to the invention, an upper washing-nozzle system and an upper rinsing-clear nozzle system, formed separately from this, and also a lower washing-nozzle system and a lower rinsing-clear nozzle system, formed separately from this, are provided. It would, of course, also be conceivable, however, to provide an upper and a lower washing-nozzle system which serves jointly for spraying washing fluid and for spraying rinsing-clear fluid. Also, the washing nozzles 33, 34 and/or the rinsing-clear nozzles 7, 9 may be arranged only at the top or only at the bottom, instead of at the bottom and at the top, or, instead or additionally, also one side of the treatment chamber 2 and be directed into the wash-ware region transversely with respect to the treatment chamber 2.

[0026] In the embodiment, illustrated in Fig. 1, of the dishwasher 1 according to the invention, both the boiler 21 and the fresh-water container 14 are connected to a

non-return device 16 via fresh-water feed lines 24, 26, 28, 29 and 31. The non-return device 16 serves for preventing the situation where fresh water may be sucked back from the suction side of the first rinsing-clear pump 12 and/or the suction side of the second rinsing-clear pump 13 into a fresh-water feed line 17.

[0027] The non-return device 16 has an outlet 40 which is connected to a water softener device 39 via fresh-water feed lines 24 and 41. The water softener device 39 has, on the one hand, a salt container 42 connected to the fresh-water feed line 41 and, on the other hand, first and second water softeners 39a, 39b arranged parallel to one another. The two water softeners 39a, 39b arranged parallel to one another are connected to the outlet 40 of the non-return device 16 via corresponding fresh-water line system and the fresh-water feed line 24. The water softeners 39a, 39b of the water softener device 39 can be operated alternately by the suitable activation of valves 43, in order to soften the fresh water supplied to the boiler 21 via the fresh-water feed lines 26 and 28 and the fresh water supplied to the fresh-water container 14 via the fresh-water feed lines 26, 29 and 31.

[0028] The salt container 42 belonging to the water softener device 39 may contain a suitable salt or a suitable chemical. The salt or chemical serves, as required, for regenerating a water softener agent metered to the fresh water or a decomposition product occurring after metering. The salt container 42 can be topped up with the salt or the chemical from the treatment chamber 2 of the dishwasher 1 via a port closable by means of a lid 44.

[0029] In the illustrated preferred embodiment of the dishwasher 1 according to the invention, the boiler 21 has an integrated steam generator 20. A corresponding steam outlet 23 of the steam generator 20 is formed at the upper region of the boiler 21. The steam outlet 23 of the steam generator 20 is connected via a steam line 32, at a point 37 located above the washing tank 4, to the treatment chamber 2, in order, as required, to introduce into the latter the steam generated in the steam generator 20. The outlet port of the steam line 32 is preferably located between the upper nozzles 7, 33 and the lower nozzles 9, 34 of the washing line system 10 or of the rinsing-clear line system 15. However, other positions are, of course, also possible.

[0030] A heater 45 is located in the boiler 21 which serves not only for heating the rinsing-clear fluid, but also for generating steam. Furthermore, a level sensor 46, which, for example, controls a valve 19 of the fresh-water line 17, may be arranged in or on the boiler.

[0031] In the preferred embodiment, illustrated in Fig. 1, of the dishwasher 1 according to the invention, by the provision of the fresh-water container 14 and of the second rinsing-clear pump 13, it is selectively possible also to supply unheated rinsing-clear fluid to the rinsing-clear nozzles 7 and 9 via the rinsing-clear line system 15b and 15. It is therefore possible selectively to supply unheated or heated rinsing-clear fluid to the treatment chamber 2 by means of a suitable activation of, for example, the

rinsing-clear pumps 12, 13 and/or by means of a suitable activation of, for example, the valves 19, 27 and 30 arranged in the fresh-water feed lines to the fresh-water container 14 and the boiler 21.

[0032] A programme control device 50, illustrated merely diagrammatically in the drawings, serves for controlling at least one cleaning programme and is designed and connected to the controllable components of the dishwasher 1, such as, for example, to the valves 19, 27 and 30, to the washing pump 8, to the first rinsing-clear pump 12, to the second rinsing-clear pump 13 and/or to a heater control circuit (not illustrated explicitly) for controlling the heater 45, in order to implement a cleaning method (cleaning cycle) having the following steps (phases) to be carried out in succession:

1. A washing phase, in which washing fluid 6 is sprayed out of the washing tank 4 through the washing line system 10 into the treatment chamber 2 by means of the washing pump 8 and can then flow back from the treatment chamber 2 into the washing tank 4 by gravity;
2. A fresh-water rinsing-clear phase, in which heated or unheated fresh water or fresh water with metered rinse aid is sprayed as rinsing-clear fluid into the treatment chamber 2 by means of the first rinsing-clear pump 12 or the second rinsing-clear pump 13 and can then flow from the treatment chamber 2 into the washing tank 4 by gravity; and
3. (Optionally) a drying phase, in which drying air circulates within the treatment chamber 2.

[0033] In a preferred implementation of the programme control device 50, this is designed in such a way that it automatically activates the controllable components of the dishwasher 1 as a function of the detected type of wash ware, such that, after the fresh-water rinsing-clear phase, a steam rinsing-clear phase is carried out, in which steam is generated by means of the steam generator 20 connected at the fresh-water feed line 28 and is conducted into the treatment chamber 2.

[0034] The dishwasher 1 according to the invention, as illustrated, for example, in Fig. 1, is distinguished, inter alia, in that a wash-ware detector device 51, indicated merely diagrammatically in the drawings, is provided, which serves for detecting the type of wash ware received in the treatment chamber 2. The wash-ware detector device 51 is preferably arranged inside or outside the treatment chamber 2 in such a way that either the wash ware received in the treatment chamber 2 or a wash-ware basket inserted in the treatment chamber 2 comes within its detection range. The term "wash-ware detector device" used herein is to be understood as meaning any detection device which is designed for directly or indirectly detecting or determining the type of wash ware.

[0035] It is in this case conceivable, in particular, that the wash-ware detector device 51 has at least one detector assembly 52, by means of which the size, shape

and/or material of the wash ware to be treated in the dishwasher 1 can be detected. In one possible implementation of a wash-ware detector device 51 of this type, this has, for example, at least one preferably optically, inductively or capacitively operating detector assembly 52, so that, to identify the type of wash ware, the size, shape and/or material of the wash ware can be detected. However, other detector types may also be considered as a detector assembly 52, such as, for example, inductively operating sensors, light scanners, light barriers, laser scanners, 3D lasers, cameras, etc.

[0036] Alternatively or additionally to this, it is conceivable that the wash-ware detector device 51 has at least one detector assembly 52, by means of which the type of wash ware can be detected indirectly. This implementation is suitable particularly when the dishwasher 1 is designed in such a way that at least one wash-ware basket (not illustrated explicitly in the drawings), which receives the wash ware to be treated, can be inserted into the treatment chamber 2 of the dishwasher 1. In this case, the wash ware to be treated should preferably be sorted according to types of wash ware in such a way that only wash ware of a single type of wash ware is inserted in each wash-ware basket. Preferably, in this case, there is provision for each wash-ware basket to have an identification feature, such as, for example, an identification code, detectable by the detector assembly 52. The identification feature detected by the detector assembly 52 then delivers information on the type of wash ware received by the wash-ware basket.

[0037] On the other hand, however, it is also conceivable that the detector assembly 52 is designed to detect the size and/or type of the at least one wash-ware basket receivable in the treatment chamber 2 of the dishwasher 1 and, on the basis of this information, to draw a conclusion as to the type of wash ware received by the wash-ware basket. In one possible implementation, there may, for example, be provision for carrying out the following sorting before the actual treatment of the wash ware in the dishwasher:

- plates manufactured from porcelain or a porcelain-like material are inserted into a wash-ware basket designed as a plate basket;
- cooking utensils manufactured from a metal, in particular from high-grade steel, are inserted into a wash-ware basket designed as a flat basket;
- cutlery or items of cutlery which are manufactured from metal, in particular from a high-grade steel, are inserted into a wash-ware basket designed as a cutlery basket; and
- drinking glasses manufactured from glass or a glass-like material are inserted into a wash-ware basket designed as a glass basket.

[0038] The remaining types of wash ware may in this case be inserted, for example, into a wash-ware basket designed as a plate basket. If such presorting is carried

out, it is conceivable, in one possible implementation of the wash-ware detector device 51, that this has a detector assembly 52 which is designed, for example, for detecting the type of wash-ware basket (plate basket, flat basket, cutlery basket, glass basket, etc.) inserted or to be inserted into the treatment chamber 2 and thus to determine indirectly the type of wash ware inserted into the treatment chamber 2 of the dishwasher 1. The type of wash-ware basket may be detected, for example, optically via the size, height and/or shape with the aid of the detector assembly 52. However, in this case, of course, the detection of another suitable identification feature of the wash-ware basket may also be considered.

[0039] As already mentioned, in the dishwasher 1 according to the present invention, furthermore, the programme control device 50, illustrated merely diagrammatically in the drawings, is provided. According to the invention, the programme control device 50 is designed to activate different activatable components of the dishwasher 1, such as, for example, the respective pumps and valves, according to a predetermined or determinable programme sequence, so that suitable process parameters can thereby be set during the individual treatment phases (washing phase, rinsing-clear phase and drying phase). The programme control device 50 is connected, in particular, via suitable communication connection to the wash-ware detector device 51, in order continuously or at predetermined times or events, preferably before the start of the washing cycle, to interrogate the type, detected by the wash-ware detector device 51, of wash ware received in the treatment chamber 2 of the dishwasher 1.

[0040] The programme control device 50 is designed, on the basis of the type of wash ware detected by the wash-ware detector device, to recognize automatically the wash ware to be treated. The programme control device 50 may preferably recognize automatically at least the following wash ware:

- plates manufactured from porcelain or a porcelain-like material;
- cups manufactured from porcelain or a porcelain-like material, glass or a glass-like material;
- bowls manufactured from porcelain or a porcelain-like material, glass or a glass-like material;
- trays or tray-like articles manufactured from a plastic material;
- containers, in particular GN containers, manufactured from a metal, in particular from high-grade steel;
- pots manufactured from a metal, in particular from high-grade steel;
- pans manufactured from a metal, in particular from high-grade steel;
- cutlery and items of cutlery manufactured from a metal, in particular from high-grade steel; and
- drinking glasses manufactured from glass or a glass-like material.

[0041] In the event that the programme control device 50 does not recognize the wash ware on the basis of the detected type of wash ware, the respective wash ware is identified as "other wash ware".

[0042] The solution according to the invention is distinguished not only, on the one hand, by the automatic detection of the type of wash ware to be treated and, on the other hand, by the automatic recognition of the wash ware to be treated, but also by the additional functionality of the programme control device 50, whereby this is designed for automatically selecting as a function of the detected type of wash ware a predetermined or determinable treatment programme, according to which the wash ware received in the treatment chamber 2 is to be treated during at least one treatment phase, and for setting the process parameters of the selected treatment programme by means of a corresponding activation of the activatable components of the dishwasher 1. For this purpose, it is basically conceivable that the programme control device 50 has, for example, a storage device, not illustrated explicitly in Fig. 1, to which the programme control device 50 can have access. In each case optimally adapted treatment programmes or corresponding process parameters for operating the dishwasher 1 are stored in this storage device for the individual types of wash ware which are in question.

[0043] The invention is based on the knowledge that the process parameters optimal for the individual treatment phases are dependant on the type of wash ware to be treated. The different types of wash ware require suitable treatment programmes, according to which the wash ware is to be treated, for example, during the washing phase, the fresh-water rinsing-clear phase and/or the drying phase. Thus, for example, only lightly soiled items of crockery, such as, for example, drinking glasses, in contrast to heavily soiled items of crockery with burnt-on food residues difficult to remove, such as, for example, cooking utensils, keeping-warm containers, baking moulds, etc., require, during the washing phase, only a relatively small quantity of washing fluid sprayed per unit time and only a relatively low nozzle pressure with which the washing fluid is sprayed. Furthermore, in comparison with heavily soiled items of crockery, only a shorter cycle duration of the washing phase is necessary for lightly soiled items of crockery.

[0044] On the other hand, the different types of wash ware also require coordinated treatment programmes for the fresh-water rinsing-clear phase which follows after the washing phase. An adaptation, carried out in terms of the type of wash ware, of the process parameters for the steam rinsing-clear phase and drying phase, to be carried out, if appropriate, after the fresh-water rinsing-clear phase, is also likewise conceivable.

[0045] As a result, an "over-treatment", particularly of only lightly soiled items of crockery, such as, for example, drinking glasses, can be efficiently prevented in a simple, but effective way, so that no more resources in terms of energy, water, chemicals, etc. than are necessary are

used during the process of cleaning (and, if appropriate, of drying) only lightly soiled items of crockery of this type.

[0046] The consumption of fresh water, which is sprayed in pure form, or mixed with further additives, onto the wash ware, for example, during the fresh-water rinsing-clear phase can also be reduced. As a result of the reduced fresh-water consumption of the dishwasher 1, the consumption of chemicals, in particular rinse aids and/or detergents, can also be reduced, without a variation in the chemical concentration of the respective fluid (washing fluid, rinsing-clear fluid) occurring. Owing to a lower fresh-water supply, the water quantity to be heated is lower, with the result that energy can be saved.

[0047] In this case, the invention is based on the knowledge that, in conventional dishwashers, the washing and rinsing-clear cycles of which proceed according to a programme preset at the factory, an over-treatment of the wash ware often takes place. It is frequently sufficient for an adequate washing and rinsing result simply to have, for example, a shorter cycle duration of the washing phase, a smaller quantity of washing fluid which is sprayed per unit time during the washing phase, a lower nozzle pressure with which the washing fluid is sprayed during the washing phase, a smaller quantity of rinsing-clear fluid which is sprayed overall during the fresh-water rinsing-clear phase, and/or a lower temperature of the fluid (washing fluid, rinsing-clear fluid) to be sprayed during the washing phase and fresh-water rinsing-clear phase.

[0048] According to the invention, therefore, the programme control device 50 is designed in such a way that this automatically activates the washing pump 8 as a function of the detected type of wash ware, in such a way that at least one of the parameters given below is adapted to the detected type of wash ware for the washing phase:

- the cycle duration of the washing phase;
- the quantity of washing fluid sprayed per unit time during the washing phase; and
- the pressure with which the washing fluid is sprayed during the washing phase.

[0049] In a preferred implementation of the solution according to the invention, there is provision for the programme control device 50 to be designed to set the washing pressure, that is to say the nozzle pressure with which the washing fluid is sprayed onto the wash ware during the washing phase, at a low value of, for example, 0.2 bar when the type of wash ware detected is plates manufactured from porcelain or porcelain-like material, drinking glasses manufactured from glass or a glass-like material or "other wash ware". In the case of these types of wash ware, the programme control device 50 preferably also sets the quantity of washing fluid sprayed per unit time during the washing phase to a low value of, for example, 120 l/min.

[0050] For the remaining types of wash ware, that is to say for containers, in particular GN containers, pots,

pans, cutlery and items of cutlery, manufactured from metal, in particular from high-grade steel, the nozzle pressure is preferably set automatically to a high value of, for example, 0.4 bar and the quantity of washing fluid sprayed per unit time during the washing phase is also set at a high value of, for example, 180 l/min.

[0051] If plates manufactured from porcelain or a porcelain-like material or drinking glasses manufactured from glass or a glass-like material or "other wash ware" are treated during the washing phase, the cycle duration of the washing phase should be reduced automatically, as compared with the treatment of the other types of wash ware, by the programme control device 50.

[0052] All the above- and below-mentioned numerical values are to be considered purely by way of example and, in particular, not to be judged as a restriction of the invention.

[0053] As already indicated, the dishwasher 1 according to the embodiment illustrated in Fig. 1 also has, in addition to the washing system, a fresh-water rinsing-clear system which has a first and a second rinsing-clear pump 12, 13 and a rinsing-clear line system 15a, 15b, in order to convey rinsing-clear fluid out of the fresh-water container 14 or boiler 21 through rinsing-clear nozzles 7, 9 into the treatment chamber 2 during the fresh-water rinsing-clear phase. There is provision particularly preferably for the programme control device 50 to be designed to select a predetermined or determinable treatment programme for the fresh-water rinsing-clear phase automatically as a function of the detected type of wash ware and likewise automatically to set the process parameters associated with the selected treatment programme. Settable process parameters which may be considered are, for example, in particular the cycle duration of the rinsing-clear phase, the quantity of rinsing-clear fluid to be sprayed overall during the rinsing-clear phase and/or the temperature of the rinsing-clear fluid to be sprayed during the rinsing-clear phase.

[0054] In a preferred implementation of the solution according to the invention, the programme control device 50 is designed to set the quantity of rinsing-clear fluid to be sprayed overall during the fresh-water rinsing-clear phase to a reduced value of, for example, 1.5 litres per unit area of size 500 mm × 500 mm, enclosed by the wall of the treatment chamber 2, as seen in a top view of the treatment chamber, and the temperature of the rinsing-clear fluid to be sprayed during the fresh-water rinsing-clear phase to a high value of, for example, at least 80°C when plates manufactured from porcelain or porcelain-like material, containers, in particular GN containers, pots, pans, cutlery and items of cutlery, manufactured from metal, in particular from high-grade steel, or "other wash ware" are to be treated.

[0055] If, by contrast, drinking glasses manufactured from glass or a glass-like material are detected as the type of wash ware, the programme control device 50 automatically sets the quantity of rinsing-clear fluid to be sprayed during the fresh-water rinsing-clear phase to an

increased value of, for example, higher than 2.5 litres per unit area of size 500 mm × 500 mm, enclosed by the wall of the treatment chamber 2, as seen in a top view of the treatment chamber. The temperature of the rinsing-clear fluid to be sprayed during the fresh-water rinsing-clear phase is in this case preferably set to a reduced value of, for example, at least 63°C.

[0056] Preferably, furthermore, the dishwasher 1 has the already mentioned steam rinsing-clear system 22, 32 which, in particular, also comprises the steam generator 20. As illustrated in the drawings, the steam generator 20 is connected to the fresh-water feed line 28 and is designed for generating steam. The generated steam is conducted via the steam line 32 into the treatment chamber 2 during the steam rinsing-clear phase. In this case, preferably, the programme control device 50 is designed to switch on the steam rinsing-clear system 22, 32 automatically, as a function of the detected type of wash ware, after the expiry of the fresh-water rinsing-clear phase for a predetermined or determinable duration.

[0057] In a preferred implementation of the solution according to the invention, the programme control device 50 is designed to switch on the steam rinsing-clear system 22, 32 automatically only when plates manufactured from porcelain or porcelain-like material, containers, in particular GN containers, pots, pans, cutlery and items of cutlery, manufactured from metal, in particular from high-grade steel, or "other wash ware" are detected as the type of wash ware.

[0058] After the steam rinsing-clear phase, a condensation and drip phase can then be carried out, which will last for the defined time and in which the steam conducted into the treatment chamber 2 of the dishwasher 1 during the steam rinsing-clear phase can at least partially condense on the wash-ware surfaces, drip off and flow into the washing tank 4 by gravity. This optionally provided condensation and drip phase lasts preferably for about 10 to 60 seconds, and even more preferably for about 20 to 30 seconds.

[0059] In this preferred development, therefore, there is provision for the above-described fresh-water rinsing-clear phase to be carried out with a reduced fresh-water quantity of, for example, 1.5 litres, as a function of the detected type of wash ware, after the standard washing phase. After this fresh-water rinsing-clear phase, there takes place, likewise as a function of the detected type of wash ware, the steam rinsing-clear phase in which, with the aid of the steam introduced into the treatment chamber of the dishwasher, the washing fluid residues still remaining on the wash-ware surfaces after the fresh-water rinsing-clear phase are rinsed off completely. In this steam rinsing-clear phase, overall, a fresh-water quantity of about 0.05 to 0.25 litres, and preferably a fresh-water quantity of about 0.10 to 0.15 litres, is used in steam form.

[0060] The fresh-water quantities given herein always relate to a dishwasher in the form of a programmable automatic machine, the treatment chamber 2 of which is

designed for a wash-ware basket of standard size 500 mm × 500 mm, so that a unit area of the size 500 mm × 500 mm is enclosed by the wall of the treatment chamber 2, as seen in a top view of the treatment chamber.

[0061] In a particularly preferred development of the dishwasher 1 according to the invention, there is provision for this to have, furthermore, a drying system, not illustrated explicitly in the drawings, with a drying blower. The drying blower serves for causing a drying-air stream to circulate in the treatment chamber 2 of the dishwasher 1 during a drying phase to be carried out after the fresh-water or steam rinsing-clear phase.

[0062] In conventional dishwashers which have a drying system of this type, an over-treatment of the wash ware often takes place even during the drying phase. It is frequently sufficient for an adequate drying result simply to have a lower volume flow of drying air circulating per unit time in the drying zone, a lower temperature of the drying air and/or a lower cycle duration of the drying phase.

[0063] If, as already indicated before, for specific types of wash ware the fresh-water rinsing-clear phase is followed automatically by the steam rinsing-clear phase, then, to dry this type of wash ware, use may be made of the knowledge that a large part of the energy required for evaporation drying comes from the energy stored with hot steam during the steam rinsing-clear phase. Accordingly, in a preferred development of the solution according to the invention, there is provision for the programme control device 50 to set automatically so that the cycle duration of the drying phase is set at an increased value of, for example, 180 seconds solely in the case of the detection of drinking glasses manufactured from glass or a glass-like material, in which the steam rinsing-clear phase is not carried out. Likewise, in this case, the volume flow of drying air circulating per unit time during the drying phase should have an increased value. For the remaining types of wash ware, in which the steam rinsing-clear phase is preferably carried out, a reduced cycle duration of, for example, 120 seconds and a reduced volume flow of drying air circulating per unit time are sufficient.

[0064] So that, in the selection of the optimal programme parameters to be adopted during the individual treatment phases, the different aspects applicable to the respective types of wash ware can be taken into account, the programme control device 50 used in the dishwasher 1 according to the invention is preferably designed to the effect of classifying each individual type of wash ware detected with the aid of the wash-ware detector device 51 in a predetermined wash ware group. Each wash ware group is assigned a determined treatment programme, according to which the types of wash ware assigned to a specific wash ware group are treated during the individual treatment phases.

[0065] So that the different types of wash ware can therefore be taken into account in the selection of the optimal process parameters, in a preferred implementation of the dishwasher 1 according to the invention with

the programme control device 50 the following assignments are carried out:

- plates manufactured from porcelain or a porcelain-like material are assigned to a first wash ware group;
- utensils manufactured from metal, in particular from high-grade steel and cutlery or items of cutlery manufactured from metal, in particular from high-grade steel, are assigned to a second wash ware group;
- drinking glasses manufactured from glass or a glass-like material are assigned to a third wash ware group; and
- the wash ware which has been recognized as "other wash ware" is assigned to a fourth wash ware group.

[0066] Fig. 2 illustrates diagrammatically a dishwasher 1, in particular a commercial dishwasher, in the form of a programmable automatic machine, according to the second preferred embodiment of the solution according to the invention. In contrast to the first embodiment illustrated in Fig. 1, the dishwasher 1 illustrated in Fig. 2 has no fresh-water container and therefore also no second rinsing-clear pump, via which, as illustrated in Fig. 1, unheated rinsing-clear fluid can be supplied to the rinsing-clear nozzles via a rinsing-clear line system. The dishwasher 1 illustrated in Fig. 2 is otherwise structurally and functionally identical to the dishwasher described with reference to Fig. 1. It is, of course, conceivable that the heater 45 of the boiler 21 or of the steam generator 20 can be appropriately activated via the heater control circuit (not illustrated explicitly) in order to provide rinsing-clear fluid heated to a greater or lesser extent.

[0067] The invention is not restricted to the embodiments of the dishwasher 1 which are shown by way of example in the drawings. On the contrary, the invention arises from an overall consideration by a person skilled in the art of the patent claims and of the description of the exemplary embodiments.

[0068] In particular, it is conceivable that the dishwasher 1 has, furthermore, a detergent metering device for metering detergent into the washing fluid. The programme control device 50 should in this case particularly preferably be designed to set, as a function of the type of wash ware to be treated, the quantity of detergent metered into the washing fluid. In particular, it is conceivable that, when a type of wash ware assigned to the second wash ware group is detected, an increased quantity of detergent is metered, while, in the case of the other wash ware groups, a standard value is selected for the quantity of metered detergent.

[0069] Alternatively or additionally, it is conceivable, furthermore, that the dishwasher 1 has a rinse-aid metering device for metering rinse aid into the rinsing-clear fluid, the programme control device 50 preferably being designed to set, as a function of the type of wash ware to be treated, the quantity of rinse aid metered. In this case, in particular, it is conceivable that, when wash ware assigned to the first wash ware group is detected, the

quantity of metered rinse aid is reduced automatically, in comparison with the other wash ware groups.

[0070] Finally, in a preferred development of the method according to the invention, it is conceivable that, as a function of the detected type of wash ware, steam soaking is carried out automatically before the washing phase, in which steam is generated by means of the generator 20 and is conducted into the treatment chamber 2. This steam soaking phase is to be employed optionally, in particular, in the treatment of wash ware which is assigned to the second wash ware group.

[0071] It is likewise conceivable that the dishwasher 1 according to the invention has a detergent direct-spraying system, in order to spray detergent directly during the washing phase onto the wash ware inserted into the treatment chamber 2. This detergent direct-spraying system can preferably be activated by the programme control device 50 as a function of the detected type of wash ware. It is in this case appropriate for the programme control device 50 to be designed to switch on the detergent direct-spraying system during the washing phase when a type of wash ware assigned to the second wash ware group is detected.

[0072] The solution according to the invention allows an automatic detection of the type of wash ware to be treated and an automatic setting of programme parameters optimally adapted to the type of wash ware. In this case, there is provision for the programme control device 50 selectively to select automatically and correspondingly determine the process parameters which are optimal in terms of the type of wash ware, in order to afford the operating personnel basically the possibility of being able to set or vary manually the process parameters applicable to the individual treatment phases.

Claims

1. Method for cleaning wash ware in a dishwasher (1), in particular in a commercial dishwasher, which is designed as a programmable automatic machine and has a treatment chamber (2) for receiving the wash ware to be treated, wherein the method has the following method steps to be carried out in succession:

- i) the type of wash ware to be treated is detected;
- ii) a treatment programme for the treatment of the wash ware is selected as a function of the detected type of wash ware; and
- iii) the process parameters associated with the selected treatment programme are set automatically,

characterized in that

each detected type of wash ware is assigned to a predetermined or determinable wash ware group before the actual treatment of the wash ware, wherein,

for each wash ware group is a predetermined or determinable treatment programme, according to which the wash ware of the type of wash ware assigned to this wash ware group is to be treated during at least one of the treatment phases.

2. Method according to claim 1, which has, furthermore, the following programme-controlled method step to be carried out after the method step iii):

iv) a washing phase, in which washing fluid (6) is sprayed out of a tank (4) by means of a washing pump (8) through a washing line system (10) into the treatment chamber (2) and can flow back from the treatment chamber (2) into the tank (4) by gravity, wherein the cycle duration of the washing phase is set automatically as a function of the detected type of wash ware; and/or the quantity of washing fluid to be sprayed per unit time during the washing phase is set automatically as a function of the detected type of wash ware; and/or in that the nozzle pressure with which the washing fluid is to be sprayed during the washing phase is set automatically as a function of the detected type of wash ware.

3. Method according to claim 2, wherein before method step iv), as a function of the detected type of wash ware a steam soaking is carried out automatically, in which steam is generated by means of a steam generator (20) connected to a fresh-water feed line (28) and is conducted into the treatment chamber (2).

4. Method according to claims 2 or 3, which has, furthermore, the following programme-controlled method step to be carried out after the method step iv):

v) a fresh-water rinsing-clear phase, in which rinsing-clear fluid is sprayed out of a rinsing-clear fluid supply device (14, 21) by means of at least one rinsing-clear pump (12, 13) through a rinsing-clear line system (15) into the treatment chamber (2) and can flow from the treatment chamber (2) into the tank (4) by gravity, wherein the cycle duration of the fresh-water rinsing-clear phase is set automatically as a function of the detected type of wash ware; and/or wherein a quantity of rinsing-clear fluid to be sprayed during the fresh-water rinsing-clear phase is set automatically as a function of the detected type of wash ware; and/or wherein the temperature of the rinsing-clear fluid to be sprayed during the fresh-water rinsing-clear phase is set automatically as a function of the detected type of wash ware.

5. Method according to claim 4, wherein as a function of the detected type of wash

ware, a steam rinsing-clear phase following after the fresh-water rinsing-clear phase is carried out automatically, in which steam is generated by means of a steam generator (20) connected to a freshwater feed line (28) and is conducted into the treatment chamber (2).

6. Method according to one of claims 2 to 5, which has, furthermore, the following programme-controlled method step to be carried out after the method step iv):

vi) a drying phase, in which drying air circulates within the treatment chamber (2), wherein the cycle duration of the drying phase is set automatically as a function of the detected type of wash ware; and/or in that the temperature of the drying air circulating in the treatment chamber (2) during the drying phase is set automatically as a function of the detected type of wash ware; and/or in that the volume flow of the drying air circulating in the treatment chamber (2) during the drying phase is set automatically as a function of the detected type of wash ware.

7. Method according to one of claims 1 to 6 wherein the treatment programme is a stored treatment programme that is either predetermined or user-determinable.

8. Dishwasher (1) in the form of a programmable automatic machine for carrying out the method according to one of the preceding claims, in particular commercial dishwasher, the dishwasher having the following:

- a programme control device (50) for carrying out at least one treatment programme;
- a treatment chamber (2) into which and from which wash ware can be manually inserted and removed;
- a tank (4) into which fluid from the treatment chamber (2) can flow off by gravity; and
- a washing system (33, 8, 34, 10) with a washing pump (8) and with a washing line system (10) for conveying washing fluid (6) during a washing phase out of the tank (4) through washing nozzles (33, 34) into the treatment chamber (2),

wherein a wash-ware detector device (51) is provided, which is designed for detecting the type of wash ware to be treated,

the wash-ware detector device (51) having at least one preferably optically operating detector assembly (52) which is designed to detect the size of the wash ware to be treated and/or which is designed to detect the shape of the wash ware to be treated, and further having at least one preferably inductively or capac-

itively operating detector assembly (52) which is designed to detect the material of the wash ware to be treated; wherein the programme control device (50) is designed to select a predetermined or determinable treatment programme for the washing phase automatically as a function of the detected type of wash ware and for setting the process parameters associated with the selected treatment programme; and wherein the programme control device (50) is designed for assigning each detected type of wash ware to a predetermined or determinable wash ware group before the actual treatment of the wash ware, wherein, for each wash ware group is a predetermined or determinable treatment programme, according to which the wash ware of the type of wash ware assigned to this wash ware group is to be treated during at least one of the treatment phases.

9. Dishwasher according to claim 8, wherein the programme control device (50) is designed to set the cycle duration of the washing phase automatically as a function of the detected type of wash ware; and/or wherein the programme control device (50) is designed to set automatically as a function of the detected type of wash ware the quantity of washing fluid to be sprayed per unit time during the washing phase; and/or wherein the programme control device (50) is designed to set automatically as a function of the detected type of wash ware the nozzle pressure with which the washing fluid is to be sprayed during the washing phase.

10. Dishwasher according to claim 8 or 9, which has, furthermore, the following:

- a fresh-water rinsing-clear system (12, 13, 15a, 15b, 7, 9) with at least one rinsing-clear pump (12, 13) and with at least one rinsing-clear line system (15a, 125b) for conveying rinsing-clear fluid during a fresh-water rinsing-clear phase out of a freshwater supply device (14, 21) through rinsing-clear nozzles (7, 9) into the treatment chamber (2),

wherein the programme control device (50) is designed to select a predetermined or determinable treatment programme for the fresh-water rinsing clear phase automatically as a function of the detected type of wash ware and to set the process parameters associated with the selected treatment programme.

11. Dishwasher according to claim 10, wherein the programme control device (50) is designed to set the cycle duration of the fresh-water rinsing-clear phase automatically as a function of the

detected type of wash ware; and/or wherein the programme control device (50) is designed to set automatically as a function of the detected type of wash ware a quantity of rinsing-clear fluid to be sprayed during the fresh-water rinsing-clear phase; and/or wherein the programme control device (50) is designed to set automatically as a function of the detected type of wash ware the temperature of the rinsing clear fluid to be sprayed during the fresh-water rinsing-clear phase.

12. Dishwasher according to claim 10 or 11, which has, furthermore, the following:

- a steam rinsing-clear system (20, 32) with a steam generator (20), connected to a fresh-water feed line (28), for generating steam and for conducting the steam via a steam line (32) into the treatment chamber (2) during a steam rinsing-clear phase selectively following after the fresh-water rinsing-clear phase,

wherein the programme control device (50) is designed to switch on the steam rinsing-clear system (20, 32) automatically for a predetermined or determinable cycle duration, as a function of the detected type of wash ware, after the expiry of the fresh-water rinsing-clear phase.

13. Dishwasher according to one of claims 8 to 12, which has, furthermore, the following:

- a drying system with a drying blower for generating a drying-air stream circulating in the treatment chamber (2) during a drying phase,

wherein the programme control device (50) is designed to select a predetermined or determinable treatment programme for the drying phase automatically as a function of the detected type of wash ware and to set the process parameters associated with the selected treatment programme.

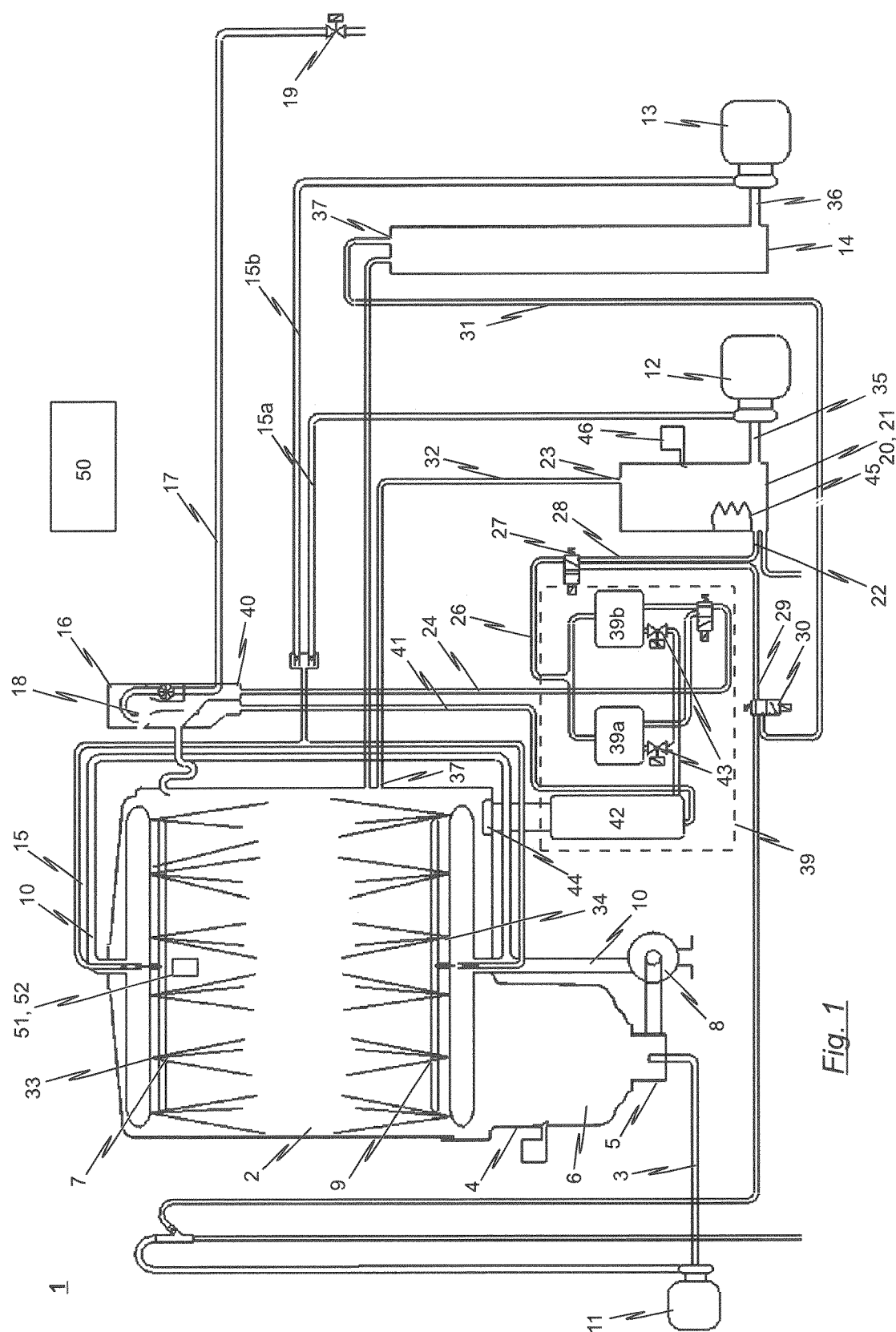


Fig. 1

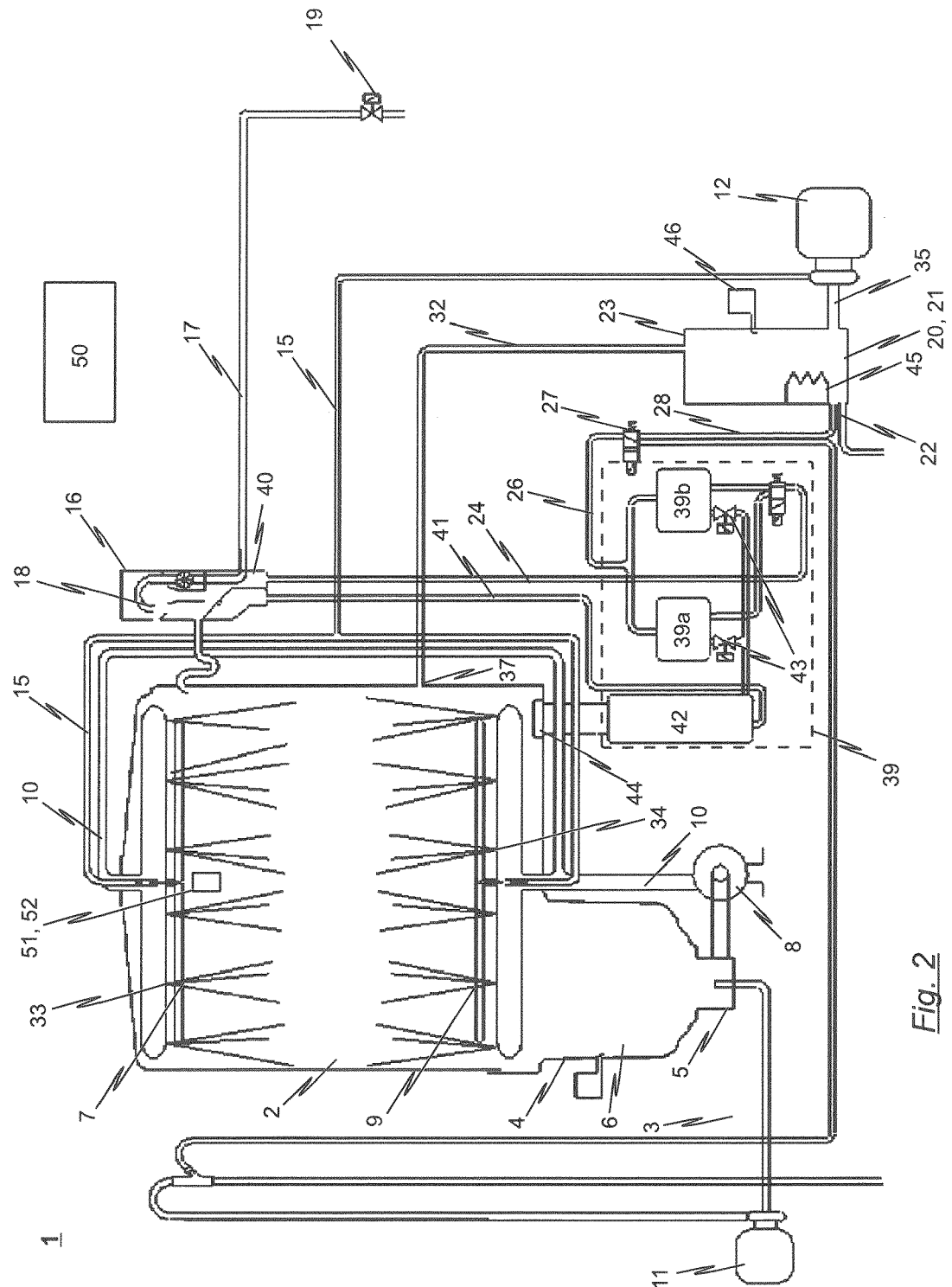


Fig. 2



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