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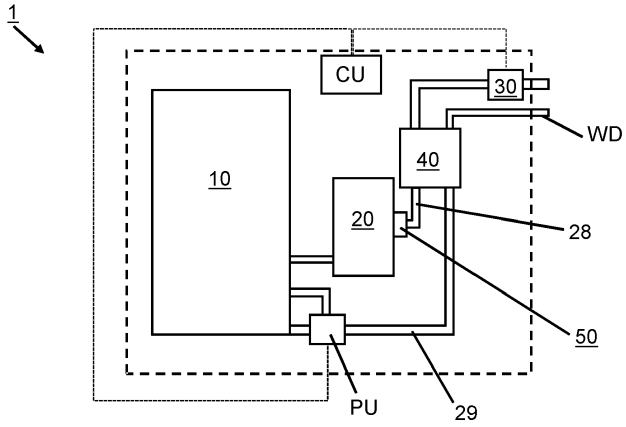
(54) INTERMEDIATE RINSE

(57) The present invention relates to a home appliance (1), in particular a dishwasher, a washing machine or the like, and a method for controlling said home appliance (1). The home appliance (1) comprises a water supply unit (30; 130; 230; 330; 430) including a water supply port (132; 232; 332; 432) configured to be connected to a water supply for supplying water, like fresh water, to the home appliance (1), a water reservoir (20; 120; 220; 320 420) for storing water to be supplied to the home appliance (1) by the water supply unit (30; 130; 230; 330; 430), a treatment space (10) for treating objects in the home appliance (1), like dishes or laundry, a heat exchanger (40; 140; 240; 340; 440) for exchanging heat between the water supplied to the reservoir (20; 120; 220; 320; 420) and the water discharged from the treatment space (10) by at least one pump unit (PU), a control unit (CU) for controlling the operation of the home appliance (1) and a bypass device (50; 150; 250; 350; 450) for bypassing water supplied by the water supply unit (30; 130; 230; 330; 430) past the reservoir (20; 120; 220; 320; 420) to the treatment space (10).

Fig. 1



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Description

[0001] The present invention relates to a home appliance, in particular a dishwasher, a washing machine or the like, which comprises a water supply unit including a water supply port for supplying water, like fresh water, to the home appliance, a water reservoir for storing water to be supplied to the home appliance by the water supply unit, a treatment space for treating objects in the home appliance, like dishes or laundry, at least one pump unit for circulating water inside the treatment space or for discharging water from the treatment space, and a control unit for controlling the operation of the home appliance. The present invention further relates to a method for controlling a home appliance.

[0002] In a known home appliance, like a dishwasher or a washing machine, items to be cleaned are accommodated in a treatment space to which water and a respective cleaning agent are supplied. The water for treating said items, like fresh or city water provided by a public water supply, is provided or temporarily stored in a water reservoir from which a respective amount is supplied in accordance with a selected cleaning program stored in a control unit of said home appliance. Fresh water usually has a temperature of about 10° to 15°C. Prior to supplying water to the treatment space, the water stored in the reservoir is usually warmed up by the ambient air to a temperature at least close to the temperature of the ambience. For further heating of the fresh water or process water to be used in a cleaning process, additional heating devices, like a heat exchanger or an electric heating device, may be provided. Said additional heating device may be arranged inside the reservoir or inside the treatment space.

[0003] During a cleaning process, the process water can be replaced several times. At least at some of each of these exchanges, it is necessary to heat the fresh water that replaces the discharged process water or greywater. Heating the fresh water for continuing the cleaning process and/or for carrying out a rinsing process requires a huge amount of energy.

[0004] However, a cleaning process may include rinsing processes, in which cold fresh water is guided into the treatment space, like for clear rinsing or for removing remains of process water or grey water from the treatment space. For executing such rinsing processes, a known home appliance is provided with a separate cold water rinsing arrangement, which requires additional components to be installed in said home appliance as well as additional construction space. In another known home appliance, the water already stored in the reservoir is used for a rinsing operation. In this case, when using the preheated water stored in the reservoir, the energy stored in said preheated water is lost, and additional energy has to be used up for heating the water next to be supplied to the reservoir.

[0005] Thus, it is an object of the present invention to provide a home appliance and a method for controlling a home appliance, in which the energy consumption as well as the construction and operation of the home appliance is optimized.

[0006] According to the present invention, there is provided a home appliance, in particular a dishwasher, a washing machine or the like. The home appliance comprises a water supply unit including a water supply port configured to be connected to a water supply for supplying water, like fresh water, to the home appliance, a water reservoir for storing water to be supplied to the home appliance by the water supply unit, a treatment space for treating objects in the home appliance, like dishes or laundry, a heat exchanger for exchanging heat between the water supplied to the reservoir and the water discharged from the treatment space, and a control unit for controlling the home appliance. In the inventive home appliance, a bypass device is provided, for bypassing water supplied by the water supply unit past the water reservoir to the treatment space.

[0007] This arrangement enables to supply cold fresh water to the treatment space. In particular, while bypassing cold fresh water by the water supply unit past the water reservoir to the treatment space, the preheated water stored in the reservoir has not be used and the energy stored in said preheated water may be saved. Furthermore, by providing a bypass device for bypassing the reservoir, a separate cold water supply arrangement for supplying cold fresh water to the treatment space may be omitted.

[0008] In order to control the amount of cold fresh water supplied to the treatment space, it is of advantage that the home appliance further includes means for determining the volume and/or the flow rate of the water supplied by the water supply unit.

[0009] It has to be understood, that said means for determining the volume and/or the flow rate of the water supplied by the water supply unit may be used for controlling the amount of cold fresh water supplied for said rinsing process as well as for controlling the amount of water to be preheated and stored to the reservoir.

[0010] The means for determining the volume and/or the flow rate of the water supplied by the water supply unit may include any suitable element or sensor. In a preferred embodiment, a flow meter is provided for determining the volume and/or the flow rate of the water supplied by the water supply unit. If no heated grey water is guided through the heat exchanger, the fresh water is also not heated.

[0011] The bypass device for bypassing the reservoir may be arranged at any suitable position. In an advantageous embodiment, the bypass device is arranged behind the heat exchanger, when referring to the flow direction of the fresh or process water, and in particular between the heat exchanger and the water reservoir. In this case, the water provided by the water supply unit may be guided such that it does not enter the reservoir, whereby mixing of cold fresh water and preheated water stored in the reservoir is prevented or at least minimized.

[0012] In another advantageous embodiment, the inventive home appliance further comprises a water supply pipe for supplying water from the heat exchanger to the reservoir. The bypass device can include a branch pipe branching off from the water supply pipe between the heat exchanger and the reservoir. This design enables the water supplied by the water supply unit to directly flow into the treatment space, without affecting the preheated water stored in the reservoir.

[0013] In order to further reduce the risk of the cold fresh water to affect the preheated water in the reservoir, e.g. by unintended backflow of water from the reservoir, the branch pipe branches off from the water supply pipe in a predefined distance upstream the reservoir. The risk of preheated water flowing back from the reservoir depends on the distance between the branch pipe and the reservoir. The greater said distance, the lower is the risk of unintended backflow of preheated water from the reservoir. However, said predetermined distance may further depend on the dimensions, like the diameter of the water supply pipe and/or the branch pipe. Accordingly, dependent on the dimension of the water supply pipe and the branch pipe, a distance may be selected, which reduces the risk of affecting the preheated water by said fresh water to a minimum.

[0014] It has to be understood that additional elements may be provided for preventing unintentional backflow from the reservoir, like a check valve arranged between the branch pipe and the reservoir.

[0015] In this embodiment, it is further of advantage that the water supply pipe terminates in the reservoir. This design enables the fresh water preheated in the heat exchanger to be directly guided into the reservoir, and the energy stored in said preheated water to be saved.

[0016] In a preferred embodiment, the inventive home appliance comprises a water supply pipe for supplying water from the heat exchanger to the reservoir, wherein the water supply pipe connects the water supply unit to the treatment space. In this embodiment, the bypass device includes a connection arrangement for connecting the reservoir to the water supply pipe. Said connection arrangement enables the water supplied by the water supply unit to be bypassed past the reservoir into the treatment space or to be supplied to the reservoir without any additional or separate piping, whereby no additional construction space is needed.

[0017] In this embodiment, it is of advantage that the connection arrangement includes flow reduction means. Said flow reduction means securely prevent the cold fresh water to be supplied to the treatment space from affecting the preheated water in the reservoir.

[0018] The flow reduction means may be of any suitable design which prevents an unintentional mixing of cold fresh water supplied to the treatment space with preheated water stored in the reservoir. Said flow reduction means may include specifically designed pipe portions, which e.g. include labyrinth portions, helical portions or zigzag-shaped portions, or pipe portions having a selected diameter, particularly, a reduced diameter compared with the diameter of the water supply pipe. Alternatively or additionally, said flow reduction means may include a mechanical element, like a flap, or a remote controlled valve, like an electrically/mechanically actuated valve. Said flow reduction means may prevent or at least reduce a flow of preheated water from the reservoir towards the treatment space during a rinsing process, in which cold fresh water is supplied to the treatment space.

[0019] In a further preferred embodiment of the inventive home appliance, a shut-off valve is arranged downstream the water reservoir. Dependent on the specific design of the home appliance, said shut-off valve may enable both the flow of water from the reservoir into the treatment space and the flow of cold fresh water into the treatment space.

[0020] The inventive home appliance may also include a further shut-off valve arranged in the water supply unit, for enabling or for stopping the flow of cold fresh water into the home appliance. Upon interaction with the shut-off valve downstream the reservoir, a defined flow of water, cold fresh water or preheated water, into the reservoir or the treatment space is enabled. In the inventive home appliance, when including a water supply pipe for supplying water from the heat exchanger to the reservoir, the bypass device may advantageously include an overflow unit. Advantageously, the overflow unit is adapted to allow a flow of water supplied by the water supply unit into the water reservoir or into the treatment space.

[0021] In this embodiment, the bypass device allows water supplied by the water supply unit to flow into the reservoir, particularly after being preheated in the heat exchanger, and, after a predetermined filling level is reached, the water further supplied by the water supply unit automatically flows into the treatment space. Thereby, the water stored in the reservoir is not affected by the water, like cold fresh water, further supplied by the water supply unit.

[0022] Said overflow unit may be arranged at any suitable position in the water supply pipe. However, it is preferred that the water supply pipe terminates in the overflow unit. In other words, the overflow unit is positioned at the downstream end of the water supply pipe. In this design, no additional piping, and thus no additional construction space, is needed. Moreover, said overflow unit may work automatically, without any additional control amount.

[0023] In an advantageous design, the overflow unit includes a float valve. Said float valve may be arranged such that it prevents a flow of water supplied by the waters supply unit into the reservoir, e.g. after a predetermined filling level has been reached. Alternatively, if it is desired to prioritize the filling of the reservoir, said float valve may be arranged such that a flow of water into the treatment space is prevented until a predetermined filling level of the reservoir is reached.

[0024] Further according to the present invention,

there is provided a method for controlling a home appliance, in particular, a dishwasher, a washing machine or the like. The home appliance comprises a water supply unit including a water supply port, configured to be connected to a water supply, for supplying water, like fresh water, to the home appliance, a water reservoir for storing water to be supplied to the home appliance by the water supply unit, a treatment space for treating objects in the home appliance, like dishes or laundry, a heat exchanger for exchanging heat between the water supplied to the reservoir and the water discharged from the treatment space and a control unit for controlling the operation of the home appliance. The method comprises the steps of supplying water to the reservoir by the water supply unit, exchanging heat between the water supplied to the reservoir and the water discharged from the treatment space by the heat exchanger. According to the present invention, the method further includes the step off bypassing water supplied by the water supply unit past the reservoir to the treatment space a bypass device, for executing a rinse process.

[0025] The inventive method further includes the step of determining the volume and/or the flow rate of the water supplied by the water supply unit, at least during the rinse process. The determination of the volume and/or the flow rate of the water supplied by the water supply unit may be realized in various ways. Preferably, the flow of water delivered by the water tap is metered by a respective flow meter.

[0026] The method according to the present invention may further include the step of interrupting the discharge of water from the treatment space during the rinse process. Thereby, water supplied via the heat exchanger and the water supply pipe to the treatment space, remains cold, for executing a defined step in the cleaning procedure, or a rinsing process.

[0027] The inventive method for controlling a home appliance provides all advantages explained in conjunction with the inventive home appliance.

[0028] Further advantages and preferred embodiments of the present invention will be described in the following together with the drawings listed below. The expressions "left", "right", "below" and "above" used in the following description refer to the drawings in an alignment such that the reference numbers and the notation of the figures used can be read in normal orientation.

[0029] In the drawings:

Fig. 1: is a general schematic view of the design of a home appliance according to the present invention;

Fig. 2: is a schematic view of a first embodiment of a home appliance according to the present invention;

Fig. 3 is a schematic view of a second embodiment of a home appliance according to the present invention;

Figs. 3a, 3b: are schematic views of flow reduction means of the bypass device according to the embodiment of Fig. 2;

Fig. 4: is a schematic view of a heat exchanger for use in a home appliance according to the present invention; and

Fig. 5: is a schematic cross-sectional view of a heat exchanger in a specific arrangement in the home appliance according to the present invention.

[0030] Fig. 1 schematically shows the principal design of a dishwasher 1 as an example for a home appliance in which the present invention is realized.

[0031] Dishwasher 1 comprises a treatment space 10, in which dishes to be cleaned may be placed. In treatment space 10, a spray arrangement (not shown) may be accommodated, a sump (not provided with a separate reference sign) arranged in the bottom region of treatment space 10, a pump unit PU coupled to said sump, which may include a discharge pump (not shown) for discharging grey water from dishwasher 1 and a circulation pump (not shown) for circulating water inside treatment space 10.

[0032] Dishwasher 1 further includes a reservoir 20 in which fresh or city water may be stored. Reservoir 20 is coupled to treatment space 10 by a respective fluid connection. A water supply unit 30 is provided for supplying fresh water to dishwasher 1. Water supply unit 30 is coupled to reservoir 20.

[0033] As can be further seen in Fig. 1, between reservoir 20 and water supply unit 30, a heat exchanger 40 is arranged such that fresh water entering heat exchanger 40 flows through a first flow path into reservoir 20 via a water supply pipe 28. A drain pipe 29 connects pump unit PU to a second flow path of heat exchanger 40, such that grey water discharged from treatment space 10 by pump unit PU flows through heat exchanger 40 to a water drain WD. Thereby, heat is exchanged between the grey water discharged from treatment space 10 and the fresh or process water supplied by water supply unit 30. Preferably, heat exchanger 40 is a counter flow heat exchanger, but may also be of any other suitable design.

[0034] Moreover, a control unit CU is provided for controlling the operation of dishwasher 1. Control unit CU is coupled via respective control wires (in Fig. 1 marked by broken lines) to the respective components of dishwasher 1, like pump unit PU and water supply unit 30, as explained in detail in the following.

[0035] As can be further seen in Fig. 1, dishwasher 1 is provided with a bypass device 50, which is arranged behind heat exchanger 40, when referring to the flow direction of the fresh or process water, and in particular between heat exchanger 40 and reservoir 20. Bypass

device 50 enables fresh water supplied by water supply unit 30 to be bypassed past reservoir 20 into treatment space 10, without affecting the preheated water stored in reservoir 20.

[0036] In the following, embodiments of dishwasher 1 are explained in detail. Where necessary, reference is made to the components shown in Fig.1, which are identical in all embodiments of dishwasher 1.

[0037] Fig. 2 shows a first embodiment of dishwasher 1 according to the present invention.

[0038] As it can be seen in Fig. 2, water supply unit 130 of dishwasher 1 includes a water supply port 132, a valve 134, e.g. in the form of a check valve for preventing backflow of water to a public water supply, or a control valve for setting a predefined flow rate, and a flow meter 136 as the means for determining the volume and/or the flow rate of the water supplied by water supply unit 130.

[0039] Heat exchanger 140 has a first flow path 142 with an inflow end 142a to which water supply unit 130 is coupled, and an outflow end 142b, via which water supplied by water supply unit 130 flows towards reservoir 120. Heat exchanger 140 has a second flow path 144 with an inflow end 144b that is coupled to the sump of treatment space 10 via pump unit PU (cf. Fig.1), and an outflow end 144a, via which gray water discharged from treatment space 10 flows to water drain WD.

[0040] Reservoir 120 has an inflow port 122 and an outflow port 124, both arranged in the bottom region of reservoir 120. Outflow port 124 is coupled to treatment space 10 via a respective tubing which includes a shut-off valve 126. Inflow port 122 of reservoir 120 is coupled to outflow end 142b of first flow path 142 of heat exchanger 140 by a water supply pipe 128, via which water supplied by water supply unit 130 is supplied to reservoir 120. Reservoir 120 may be filled with water supplied by water supply unit 130 up to a level WL, which is the maximum filling level of reservoir 120.

[0041] For controlling the operation of dishwasher 1, control unit CU, in which e.g. various cleaning programs may be stored, is, amongst others, connected via respective control wires to valve 134 and flow meter 136 of water supply unit 130, and to shut-off valve 126 downstream reservoir 120. It has to be understood that control unit CU is further connected to the other components of dishwasher 1, like pump unit PU or further sensors provided in dishwasher 1.

[0042] Dishwasher 1 further includes a bypass device 150 for bypassing water supplied by water supply unit 130 past reservoir 120 to treatment space 10.

[0043] Bypass device 150 according to the first embodiment includes a branch 152 arranged in water supply pipe 128 which connects heat exchanger 140 to reservoir 120. A branch pipe 154 branches off from water supply pipe 128 at branch 152. Branch pipe 154 extends substantially upwardly to a height which corresponds to the height of water level WL of reservoir 120. At the upper end of branch pipe 154, an inflow port 156 is arranged, which is connected to treatment space 10, such that water supplied by water supply unit 130 may flow via branch pipe 154 into treatment space 10 of dishwasher 1.

[0044] During a cleaning operation, like after a cleaning process in which warm water is used, said used warm grey water is discharged from treatment space 10 via heat exchanger 140 by pump unit PU. At the same time, cold fresh water is supplied to reservoir 120 via heat exchanger 140, whereby heat is exchanged between the grey water discharged from treatment space 10 and the fresh water supplied to reservoir 120. The preheated fresh water is stored in reservoir 120, which is filled up to its maximum level WL.

[0045] For executing a rinsing process or a cleaning process in which cold fresh water has to be used, cold fresh water supplied by water supply unit 130 is bypassed past reservoir 120 via bypass device 150.

[0046] For bypassing cold fresh water past reservoir 120, shut-off valve 126 is closed and valve 134 of water supply unit 130 is opened, such that cold fresh water may flow via first flow path 142 of heat exchanger 140, water supply pipe 128, branch pipe 154 and inflow port 156 into treatment space 10 of dishwasher 1. Due to the fact that inflow port 156 of bypass device 150 is positioned at the height of water level WL of reservoir 120, and that branch pipe 154 branches off from water supply pipe 128 at a position upstream reservoir 120, water supplied by water supply unit 130 does not flow into reservoir 120 but via branch pipe 154 and inflow port 156 into treatment space 10. Flow meter 136 determines the amount of water supplied to treatment space 10. After a predetermined amount of water is supplied to treatment space 10, control unit CU actuates valve 134 of water supply unit 130, which is shut off for stopping further water supply. It has to be understood that during executing a rinsing process or a cleaning process, in which cold fresh water is used, pump unit PU is switched off by control unit CU. Accordingly, no grey water is discharged from treatment space 10, such that no heat exchange may occur in heat exchanger 140. However, it is also possible to activate pump unit PU during the rinsing process or immediately before it ends, e.g. in order to discharge the used cold water together with possible remains from treatment space 10.

[0047] Fig. 3 shows a second embodiment of dishwasher 1 according to the present invention.

[0048] Also in this embodiment, water supply unit 230 of dishwasher 1 includes a water supply port 232, a valve 234, e.g. in the form of a check valve or a control valve, and a flow meter 236 as the means for determining the volume and/or the flow rate of the water supplied by water supply unit 230.

[0049] Heat exchanger 240 has a first flow path 242 to which water supply unit 230 is coupled, and via which water supplied by water supply unit 230 flows towards reservoir 220. Heat exchanger 240 has a second flow path 244 that is coupled to the sump of treatment space 10 via pump unit PU, and via which gray water discharged from treatment space 10 flows to water drain WD.

[0050] A water supply pipe 228 connects first flow path 242 of heat exchanger 240 to treatment space 10 of dishwasher 1. A shut-off valve 226 is provided at the downstream end of water supply pipe 228 for enabling or disabling supply of water via water supply pipe 228 to treatment space 10.

[0051] In the second embodiment of dishwasher 1, water reservoir 220 has a single inflow/outflow port 222 arranged in the bottom region of reservoir 220. Inflow/outflow port 222 of reservoir 220 is coupled to water supply pipe 228 upstream shut-off valve 226.

[0052] Dishwasher 1 according to the second embodiment includes a bypass device 250 for bypassing water supplied by water supply unit 230 past reservoir 220 to treatment space 10.

[0053] Bypass device 250 includes a connecting arrangement for connecting inflow/outflow port 222 of reservoir 220 to water supply pipe 228. Said connecting arrangement includes a branch 252 positioned upstream shut-off valve 226 in water supply pipe 228, and a branch pipe 254, which branches off from water supply pipe 228 at branch 252. Branch pipe 254 includes flow reduction means for reducing the flow of water through branch pipe 254.

[0054] For controlling the operation of dishwasher 1, control unit CU is, amongst others, connected via respective control wires to valve 234 and flow meter 236 of water supply unit 230, and to shut-off valve 226 downstream reservoir 220.

[0055] As shown in Fig. 3a, bypass device 250 includes branch 252 and branch pipe 254 for connecting water supply pipe 228 to reservoir 220. In branch pipe 254, a flow reduction means in the form of a flap 255, as an example for mechanical flow reduction means, is arranged. Flap 255 has a size that is adapted to the cross section of branch pipe 254, and is pivotably arranged in branch pipe 254 about a joint 255a. Alternatively to flap 255, a shut-off valve, which e.g. can be actuated electrically, may be provided in branch pipe 254 as mechanical flow reduction means.

[0056] Flow reduction means may also be realized by a respective design of branch pipe 254, an example of which is shown in Fig. 3b. In this embodiment, branch pipe 254 is angled such that the flow of water is deviated. In addition, branch pipe 254 has a reduced diameter compared with the dimeter of water supply pipe 228.

[0057] For bypassing cold fresh water past reservoir 220, in order to execute a rinsing process or a cleaning process in which cold fresh water has to be used, shut-off valve 226, which is closed for preventing preheated water stored in reservoir 220 from flowing into treatment space 10, and valve 234 of water supply unit 230, which is also closed at this state, are opened at least approximately simultaneously by control unit CU. Accordingly, cold fresh water supplied by water supply unit 230 may flow via first flow path 242 of heat exchanger 240 and water supply pipe 228 into treatment space 10 of dishwasher 1. The cold fresh water bypasses reservoir 220 without affecting the preheated water therein. The flow reduction means prevent a flow of preheated water out of reservoir 220, or at least reduce such a flow of preheated water to a minimum. After the filling process of the treatment space 10 with cold fresh water is finished, shut-off valve 226 and valve 234 of water supply unit 230 are closed to stop any further supply of water to treatment space 10. Flow meter 236 determines the amount of water supplied to treatment space 10. After a predetermined amount of water is supplied to treatment space 10, said rinsing process or a cleaning process can start.

[0058] For supplying preheated water from reservoir 220 to treatment space 10, valve 234 of water supply unit 230 remains closed and shut-off valve 226 is opened.

[0059] To refill reservoir 220 with preheated fresh water, shut-off valve 226 is closed and valve 234 of water supply unit 230 is opened, such that cold fresh water may be supplied via heat exchanger 240 and water supply pipe 228 to reservoir 220. It has to be understood that in this case, pump unit PU is activated for supplying warm grey water from the sump of treatment space 10 via heat exchanger 240 to water drain WD, whereby heat is exchanged between the grey water and the cold fresh water.

[0060] Fig. 4 shows a third embodiment of dishwasher 1 according to the present invention.

[0061] As in the previously explained embodiments, also water supply unit 330 of dishwasher 1 according to the third embodiment includes a water supply port 332, a valve 334, e.g. in the form of a check valve or a control valve, and a flow meter 336 as the means for determining the volume and/or the flow rate of the water supplied by water supply unit 330.

[0062] Heat exchanger 340 has a first flow path 342 to which water supply unit 330 is coupled, and via which water supplied by water supply unit 330 flows towards reservoir 320. Heat exchanger 340 has a second flow path 344 that is coupled to the sump of treatment space 10 via pump unit PU, and via which gray water discharged from treatment space 10 flows to water drain WD.

[0063] In this embodiment of dishwasher 1, reservoir 320 has an outflow port 324 arranged in the bottom region of reservoir 320. A shut-off valve 326 is provided at outflow port 324 of reservoir 320 for enabling or disabling supply of water to treatment space 10.

[0064] A water supply pipe 328 connects first flow path 342 of heat exchanger 340 to reservoir 320 and to treatment space 10 of dishwasher 1.

[0065] In the third embodiment of dishwasher 1 a bypass device 350 for bypassing water supplied by water supply unit 330 past reservoir 320 to treatment space 10 is provided in the upper region of reservoir 320.

[0066] Bypass device 350 includes an overflow unit 360, in which water supply pipe 328 terminates, and which includes a cup-shaped body 362 arranged inside reservoir 320. Body 362 has an opening in its bottom region. Said opening forms inflow port 322, via which water is supplied to reservoir 320. An upper opening 364

of body 362 is connected to water supply pipe 328 as well as to an overflow pipe 366 which terminates in an inflow port 356 of bypass device 350. Inflow port 356 is connected to treatment space 10, via which water may flow into treatment space 10. As it can be seen in Fig. 4, the position or vertical height of inflow port 322 of reservoir 320 defines the maximum water level WL in reservoir 320.

[0067] For controlling its operation, also dishwasher 1 according to the third embodiment includes a control unit CU which is, amongst others, connected via respective control wires to valve 334 and flow meter 336 of water supply unit 330, and to shut-off valve 326 downstream reservoir 320.

[0068] In operation, fresh water, which has been preheated in heat exchanger 340 while exchanging heat with warm grey water discharged from treatment space 10 by pump unit PU, is supplied to reservoir 320 until water level WL is reached. The necessary amount of water to reach water level WL is determined by flow meter 336, upon a signal of which control unit CU opens and closes valve 334 of water supply unit 330. During this operation, shut-off valve 326 downstream reservoir 320 is closed.

[0069] For bypassing cold fresh water past reservoir 320, for executing a rinsing process or a cleaning process in which cold fresh water has to be used, shut-off valve 326 remains closed, and valve 334 of water supply unit 330, which is also closed at this state, is opened. Thereby, fresh water is supplied by water supply unit 330, and flows via water supply pipe 328 to bypass unit 350. Since reservoir 320 is filled with preheated water up to water level WL, inflow port 322 of reservoir 320 is closed by said water stored in reservoir 320. Accordingly, the water now supplied via water supply pipe 328 enters body 362 of overflow unit 360, and further flows via overflow pipe 366 and inflow port 356 of bypass device 350 into treatment space 10, without affecting the preheated water stored in reservoir 320. The amount of water supplied for executing the rinsing process is determined by flow meter 336 of water supply unit 330. After a predefined amount of water is supplied, valve 334 is closed by control unit CU.

[0070] For supplying preheated water from reservoir 320 to treatment space 10, valve 334 of water supply unit 330 remains closed and shut-off valve 326 is opened.

[0071] To refill reservoir 320 with preheated fresh water, shut-off valve 326 is closed and valve 334 of water supply unit 330 is opened. Accordingly, cold fresh water may be supplied via heat exchanger 340, in which heat is exchanged between the grey water and the cold fresh water, water supply pipe 328 and overflow unit 360 through inflow port 322 into reservoir 320. Reservoir 320 will be filled with preheated water up to level WL. Control unit CU controls valve 334 such that a predetermined amount of water is supplied to reservoir 320. It has to be understood that in this case, pump unit PU is activated for supplying warm grey water from the sump of treatment space 10 via heat exchanger 340 to water drain WD, whereby heat is exchanged between the grey water and the cold fresh water.

[0072] Fig. 5 shows a fourth embodiment of dishwasher 1 according to the present invention.

[0073] This embodiment is similar to dishwasher 1 according to the third embodiment, and includes a water supply unit 430 with a water supply port 432, a valve 434 and a flow meter 436, a heat exchanger 440 with a first flow path 442 to which water supply unit 430 is coupled, and via which water supplied by water supply unit 430 flows towards reservoir 420, and a second flow path 444 that is coupled to the sump of treatment space 10 via pump unit PU, for discharging gray water from treatment space 10 to water drain WD.

[0074] A water supply pipe 428 connects first flow path 442 of heat exchanger 440 to reservoir 420 and to treatment space 10 of dishwasher 1.

[0075] Similar to the third embodiment of dishwasher 1, reservoir 420 has an outflow port 424 arranged in the bottom region of reservoir 420 and a shut-off valve 426 provided at outflow port 424 for enabling or disabling supply of water from reservoir 420 to treatment space 10.

[0076] Also in this embodiment of dishwasher 1, a bypass device 450 for bypassing water supplied by water supply unit 430 past reservoir 420 to treatment space 10 is provided in the upper region of reservoir 420.

[0077] Bypass device 450 differs from bypass device 350 of the third embodiment by the design of overflow unit 460. Overflow unit 460 according to the fourth embodiment includes a float valve that has an approximately cylindrical valve body 462 arranged in the top region and inside reservoir 420. Valve body 462 has an opening in its bottom region, which forms inflow port 422, via which water is supplied to reservoir 420, and which defines the maximum water level WL in reservoir 420. Inside valve body 462, a valve element 462a in the form of a ball is arranged, which may move vertically up and down inside valve body 462. Valve body 462 includes a further opening 464 in the region of its upper end. The upper end of valve body 462 is connected to water supply pipe 428 as well as to an overflow pipe 466 which terminates in an inflow port 456 of bypass device 450. Inflow port 456 of bypass device 450 is connected to treatment space 10, such that water may flow via inflow port 456 into treatment space 10.

[0078] Also dishwasher 1 according to the fourth embodiment includes a control unit CU which is connected to valve 434 and flow meter 436 of water supply unit 430, and to shut-off valve 426 downstream reservoir 420 via respective control wires.

[0079] In operation, and similar to dishwasher 1 according to the third embodiment, fresh water, which has been preheated in heat exchanger 440 while exchanging heat with warm grey water discharged from treatment space 10, is supplied to reservoir 420 until water level WL is reached. The amount of water to reach water level WL is determined by flow meter 436, upon a signal of which control unit CU opens and closes valve 434 of water supply unit 430. During this operation, shut-off valve

426 is closed.

[0080] For bypassing cold fresh water past reservoir 420, for executing a rinsing process or a cleaning process in which cold fresh water has to be used, shut-off valve 426 remains closed, and valve 434 of water supply unit 430 is opened. Thereby, fresh water is supplied by water supply unit 430, and flows via water supply pipe 428 to bypass unit 450. Reservoir 420 is filled with preheated water up to water level WL. Thus, valve element or ball 462a in valve body 462 is lifted up by the water inside valve body 462, and closes opening 464 at the upper end of valve body 462, whereby any further flow of water from water supply pipe 428 into reservoir 420 is prevented. Accordingly, the water supplied by water supply unit 430 via water supply pipe 428 flows via overflow pipe 466 and inflow opening 456 into treatment space 10, without affecting the preheated water stored in reservoir 420.

[0081] The amount of fresh water supplied for executing the rinsing process is determined by flow meter 436 of water supply unit 430. After a predefined amount of water is supplied, valve 434 is closed by control unit CU.

[0082] Similar to dishwasher 1 according to the third embodiment, for supplying preheated water from reservoir 420 to treatment space 10, valve 434 of water supply unit 430 remains closed and shut-off valve 426 is opened. To refill reservoir 420 with preheated fresh water, shut-off valve 426 is closed and valve 434 of water supply unit 430 is opened, such that cold fresh water may be supplied via heat exchanger 440, in which heat is exchanged between the grey water and the cold fresh water, water supply pipe 428 and overflow unit 460 through inflow port 422 into reservoir 420. It has to be understood that in this case pump unit PU is activated for supplying warm grey water from the sump of treatment space 10 via heat exchanger 440 to water drain WD, whereby heat is exchanged between the grey water and the cold fresh water.

[0083] A home appliance according to the present invention has been explained above as being a dishwasher. However, the present invention may be realized in other home appliances, in which a cleaning process is executed, and in which cold fresh water is used for executing a rinsing process or a cleaning step.

[0084] Furthermore, the amount of water supplied by the water supply unit may be determined by a flow meter as the means for determining the volume and/or the flow rate of the water supplied by the water supply unit. Alternatively or additionally, sensors may be provided for determining the volume and/or the flow rate of the water supplied by the water supply unit. For example, a sensor may be provided in the reservoir, which detects the maximum water level and or a minimum water level, and which outputs a respective signal to the control unit.

Claims

1. A home appliance (1), in particular a dishwasher, a washing machine or the like, the home appliance (1) comprising:

   a water supply unit (30; 130; 230; 330; 430) including a water supply port (132; 232; 332; 432) configured to be connected to a water supply for supplying water, like fresh water, to the home appliance (1);
   a water reservoir (20; 120; 220; 320 420) for storing water to be supplied to the home appliance by the water supply unit (30; 130; 230; 330; 430);
   a treatment space (10) for treating objects in the home appliance (1), like dishes or laundry;
   a heat exchanger (40; 140; 240; 340; 440) for exchanging heat between the water supplied to the reservoir (20; 120; 220; 320; 420) and the water discharged from the treatment space (10) by at least one pump unit (PU);
   a control unit (CU) for controlling the operation of the home appliance (1); and
   a bypass device (50; 150; 250; 350; 450) for bypassing water supplied by the water supply unit (30; 130; 230; 330; 430) past the reservoir (20; 120; 220; 320; 420) to the treatment space (10).

2. The home appliance (1) according to claim 1, further including means (136; 236; 336; 436) for determining the volume and/or the flow rate of the water supplied by the water supply unit (30; 130; 230; 330; 430).

3. The home appliance (1) according to claim 1 or 2, wherein the bypass device (50; 150; 250; 350; 450) is arranged behind the heat exchanger (40; 140; 240; 340; 440), when referring to the flow direction of the water supplied by the water supply unit (30; 130; 230; 330; 430), and in particular between the heat exchanger (40; 140; 240; 340; 440) and the reservoir (20; 120; 220; 320; 420).

4. The home appliance (1) according to any of claims 1 to 3,

   further comprising a water supply pipe (28; 128) for supplying water from the heat exchanger (40; 140) to the reservoir (20; 120),
   wherein the bypass device includes a branch pipe (154) branching off from the water supply pipe (128) between the heat exchanger (40; 140) and the reservoir (20; 120).

5. The home appliance (1) according to claim 4, wherein the branch pipe (154) branches off from the water supply pipe (128) in a predefined distance upstream the reservoir (20; 120).

6. The home appliance (1) according to claim 4 or 5,

wherein the water supply pipe (128) terminates in the reservoir (20; 120).

7. The home appliance (1) according to claim 1 or 2,

further comprising a water supply pipe (228) for supplying water from the heat exchanger (40; 242) to the reservoir (20; 220),
wherein the water supply pipe (228) connects the water supply unit (30; 230) to the treatment space (10), and
wherein the bypass device (250) includes a connecting arrangement (252, 254) for connecting the reservoir (20; 220) to the water supply pipe (228).

8. The home appliance (1) according to claim 7,
wherein the connection arrangement (252, 254) includes flow reduction means (255).

9. The home appliance (1) according to any of claims 1 to 8,
wherein a shut-off valve (26; 126; 226; 326; 426) is arranged downstream the reservoir (20; 120; 220; 320; 420).

10. The home appliance (1) according to any of claims 1 to 3,

further comprising a water supply pipe (328, 428) for supplying water from the heat exchanger (40; 340; 440) to the reservoir (20; 320; 420),
wherein the bypass device (350; 450) includes an overflow unit.

11. The home appliance (1) according to claim 10,
wherein the overflow unit (360; 460) is adapted to allow a flow of water supplied by the water supply unit (30; 330; 430) into the reservoir (20; 320; 420) or into the treatment space (10).

12. The home appliance (1) according to any of claims 1 to 3,
wherein the overflow unit (460) includes a float valve (462; 462a).

13. A method for controlling a home appliance (1), in particular a dishwasher, a washing machine or the like, the home appliance (1) comprising a water supply unit (30; 130; 230; 330; 430) including a water supply port (132; 232; 332; 432), configured to be connected to a water supply, for supplying water, like fresh water, to the home appliance (1), a water reservoir (20; 120; 220; 320; 420) for storing water to be supplied to the home appliance (1) by the water supply unit (30; 130; 230; 330; 430), a treatment space (10) for treating objects in the home appliance (1), like dishes or laundry, a heat exchanger (40; 140; 240; 340; 440) for exchanging heat between the water supplied to the reservoir (20; 120; 220; 320; 420) and the water discharged from the treatment space (10) by at least one pump unit (PU), and a control unit (CU) for controlling the operation of the home appliance (1), the method comprising the steps of:

supplying water to the reservoir (20; 120; 220; 320; 420) by the water supply unit (30; 130; 230; 330; 430);
exchanging heat between the water supplied to the reservoir (20; 120; 220; 320; 420) and the water discharged from the treatment space (10) by the heat exchanger (40; 140; 240; 340; 440); and
bypassing water supplied by the water supply unit (30; 130; 230; 330; 430) past the reservoir (20; 120; 220; 320; 420) to the treatment space (10) by a bypass device (50; 150; 250; 350; 450), for executing a rinse process.

14. The method according to claim 13,
further including the step of determining the volume and/or the flow rate of the water supplied by the water supply unit (30; 130; 230; 330; 430), at least during the heat exchange process or the bypassing process.

15. The method according to claim 13 or 14,
further including the step of interrupting the discharge of water from the treatment space (10) during the rinse process.

Fig. 1

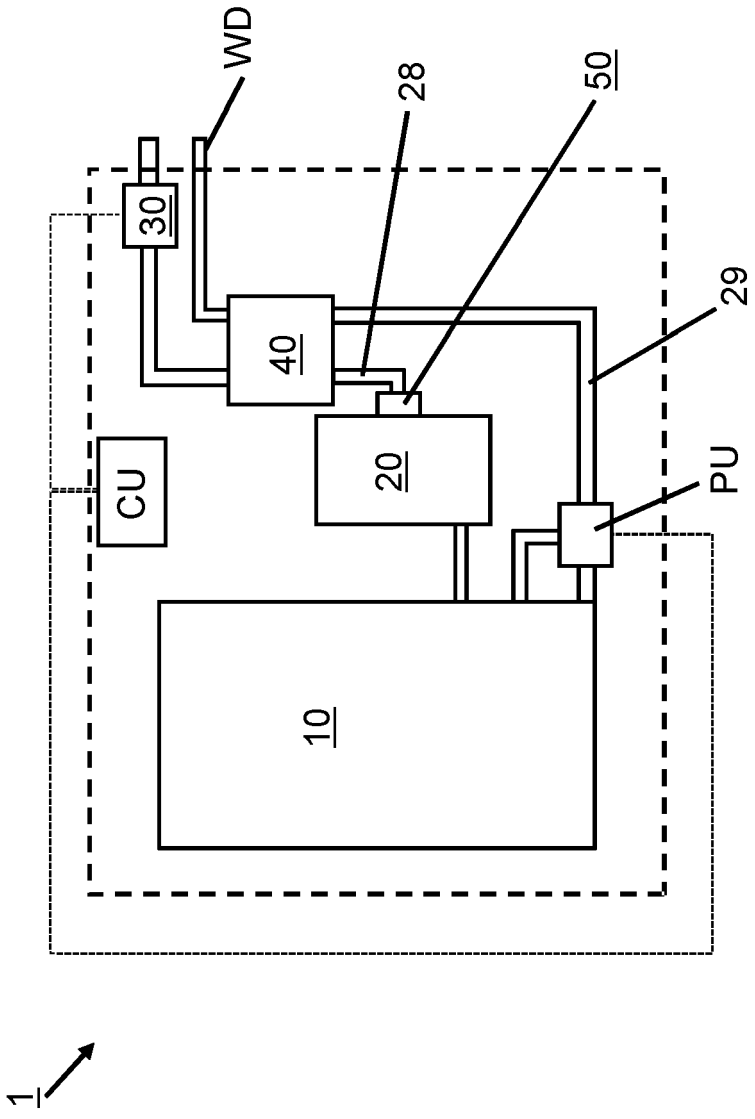

Fig. 2

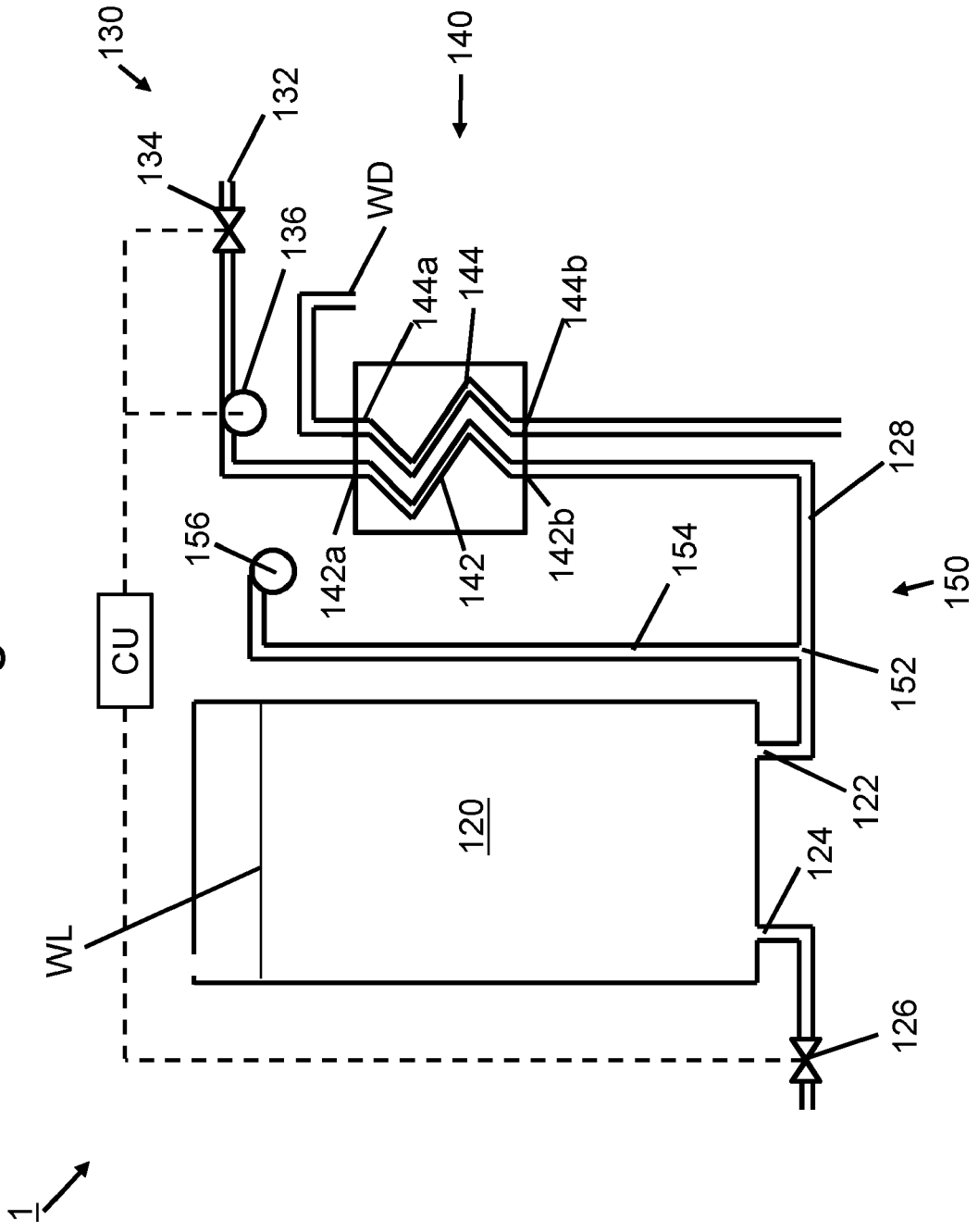
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Fig. 3

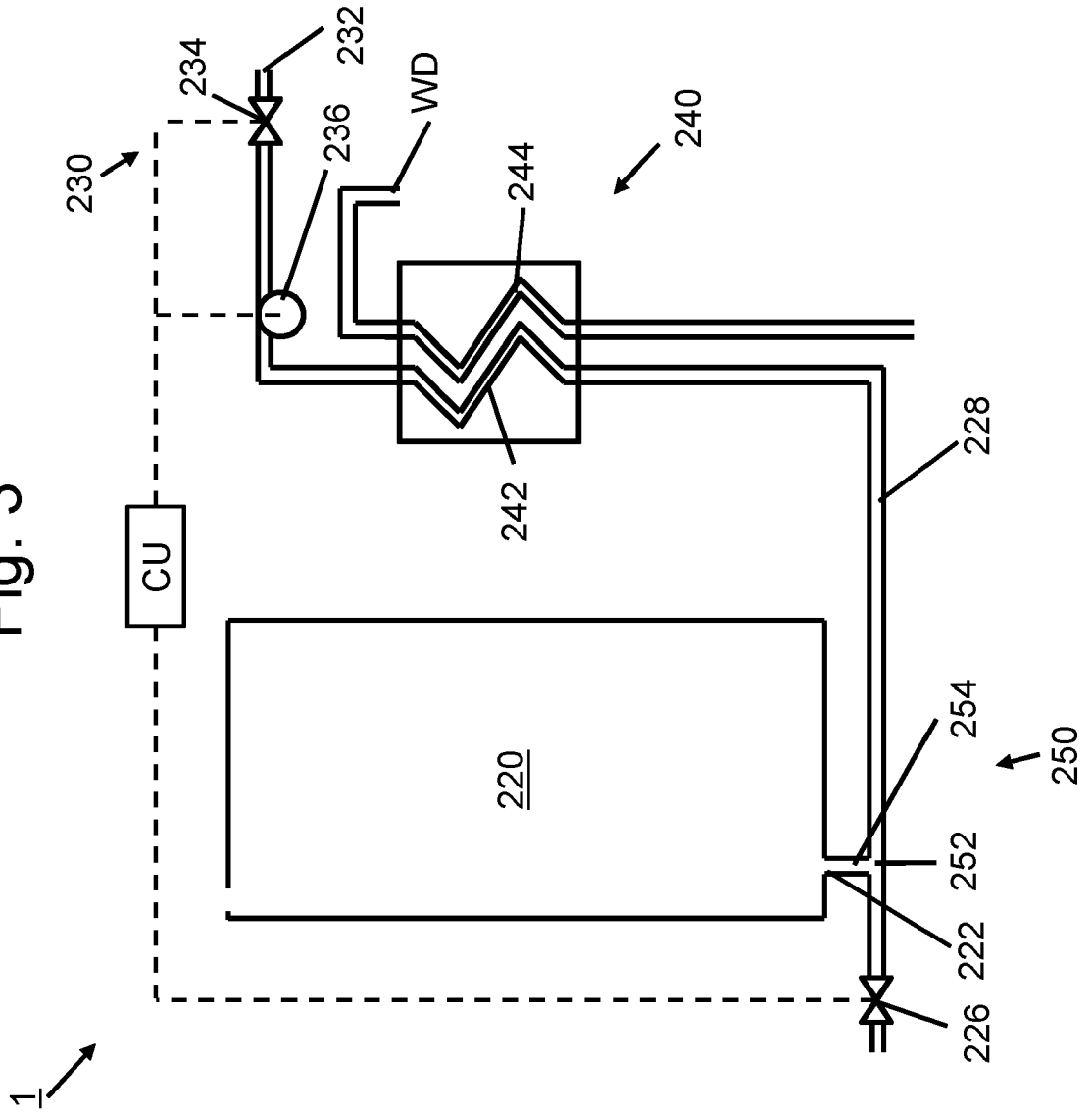

Fig. 3a

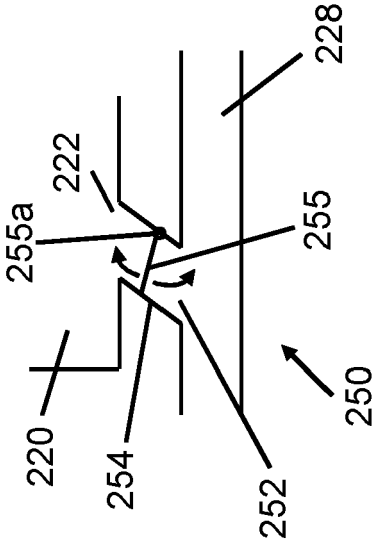

Fig. 3b

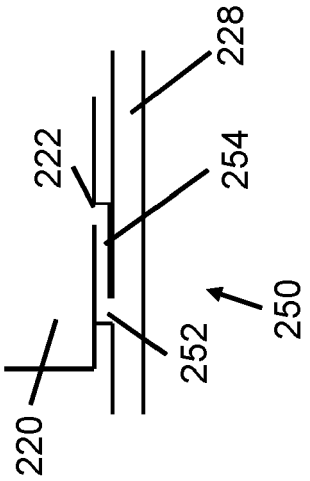

Fig. 4

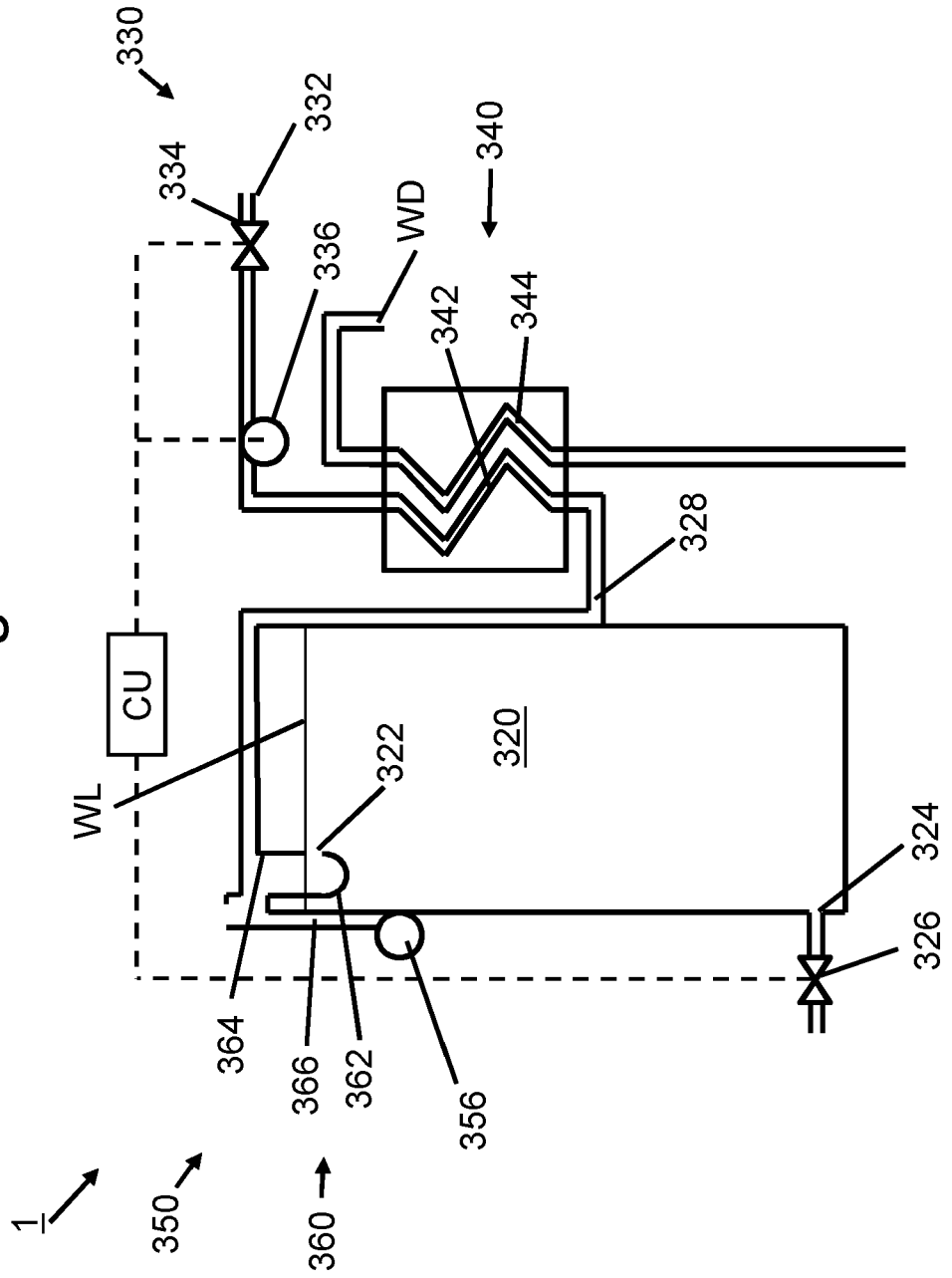
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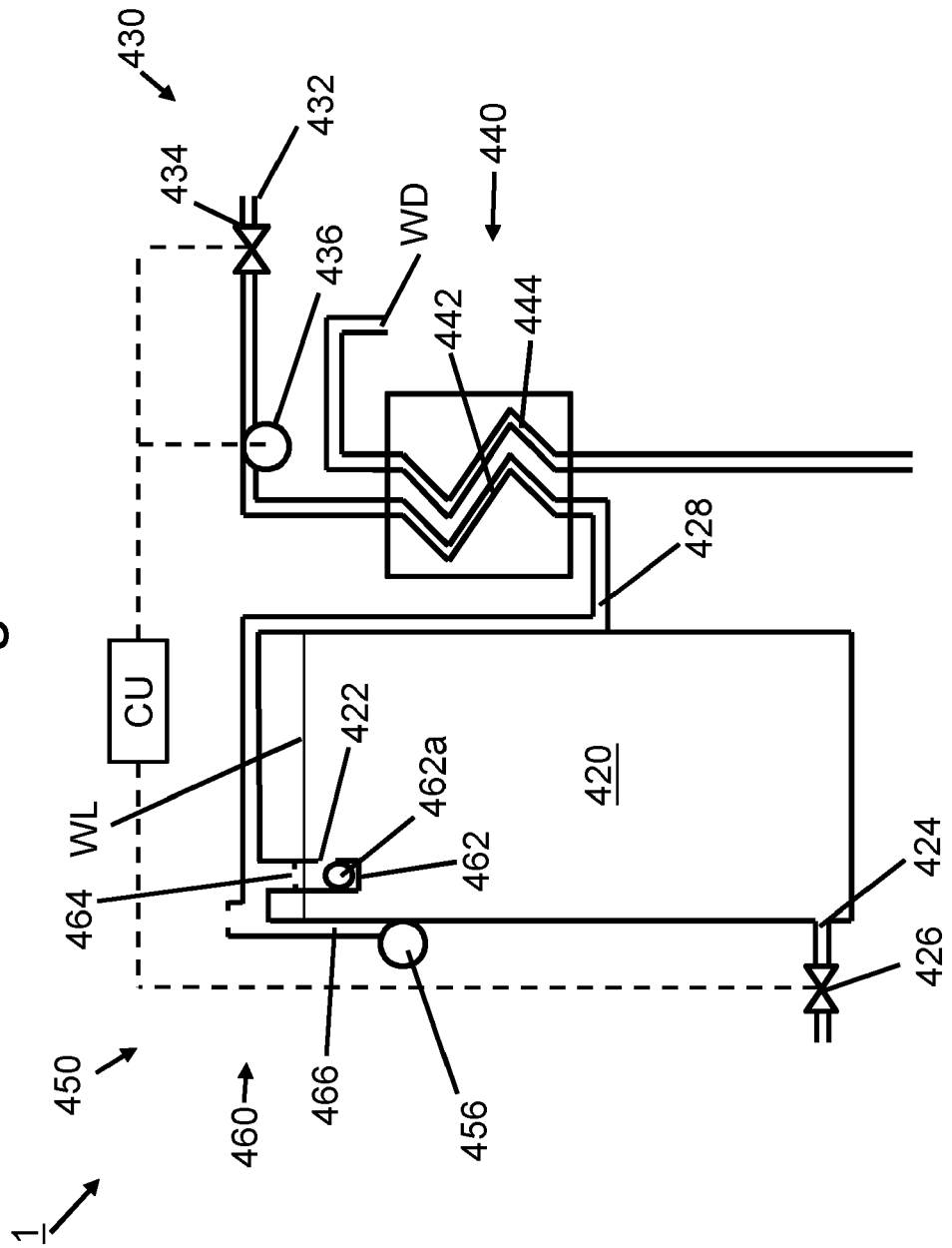
Fig. 5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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 3762

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A47L
D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 January 2024	Prosig, Christina

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15-01-2024

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