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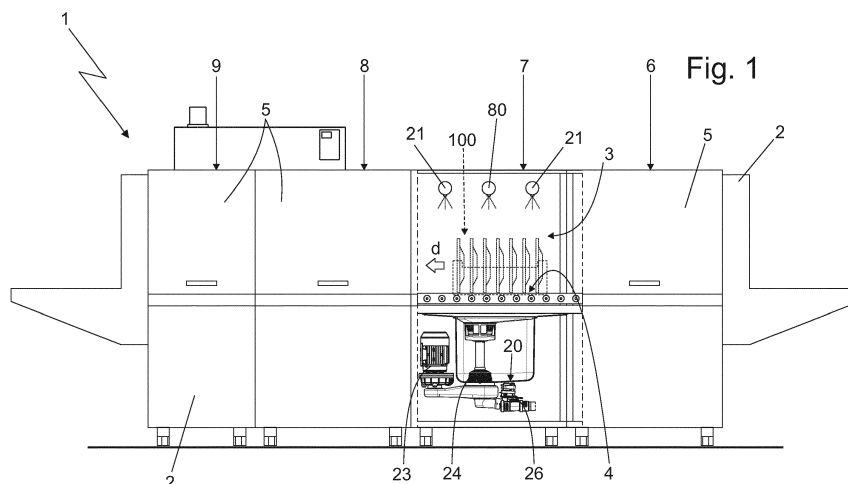
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(54) **OPERATING METHOD OF A PROFESSIONAL TUNNEL DISHWASHING MACHINE AND PROFESSIONAL TUNNEL DISHWASHING MACHINE IMPLEMENTING SUCH METHOD**

(57) Operating method of a professional tunnel dishwashing machine (1) comprising an outer casing (2) having a longitudinal horizontal pass-through tunnel (3), inspection doors (5) selectively openable to access corresponding sections of the tunnel and a linear conveyor (4) adapted to advance dish racks (100) along the tunnel; the tunnel having a washing station wherein first nozzles direct jets of washing liquid against the racks moving above a first collecting basin and a rinse station wherein

second nozzles direct jets of rinsing liquid against the racks moving above a second collecting basin; the method comprising the steps of producing/creating/preparing a descaling solution inside a tank communicating with the second nozzles and feeding the descaling solution also to auxiliary nozzles located inside the tunnel and orientated so as to direct corresponding jets of descaling solution against the inspection doors to remove the scale present on the inspection doors.



Description

[0001] The present invention relates to an operating method of a professional tunnel dishwashing machine and a professional tunnel dishwashing machine implementing such method.

[0002] In more detail, the present invention relates to an operating method of a professional tunnel dishwashing machine during the descaling procedure, to which the following description shall make explicit reference without thereby losing generality.

[0003] The term "professional" refers to the field of application in which such dishwashers are generally used, namely the professional catering sector, such as canteens, contract catering services, restaurants, etc. (not therefore for domestic use).

[0004] Hereinafter, the professional tunnel dishwashing machine can also be called simply dishwasher or tunnel dishwasher.

[0005] As is known, tunnel dishwashing machines are traditionally provided with an outer, rigid, box type casing substantially parallelepiped in shape, which is designed so as to rest firmly on the floor and is provided with a pass-through longitudinal tunnel extending horizontally along the entire length of the box casing; and a linear conveyor capable of slowly advancing a series of dish racks along the longitudinal tunnel, from one end of the dishwashing machine to the other.

[0006] Inside the longitudinal tunnel there are one or more prewashing stations, one or more washing stations, one rinsing station, and usually also one drying station, which are passed through in rapid succession by each dish rack as it advances along the longitudinal tunnel.

[0007] At the prewashing station, the dish rack is subject to a series of water jets, usually at room temperature, that serve to remove the coarsest dirt from the dishes. At the washing station, the dish rack is subject to a series of jets of water or detergent solution at a temperature of around 60°C, that serve to remove every trace of dirt from the dishes. Finally, at the rinsing station, the dish rack is subject to a series of jets of water or rinse aid solution at a temperature of around 80°C, which serve to remove any residue of detergent from the dishes and at the same time disinfect the dishes.

[0008] At the drying station, the dish rack is subject to a flow of hot air that is capable of drying/removing any drops of water or rinse aid solution remaining on the dishes.

[0009] The main drawback of this type of high-production dishwashing machine is limescale, which usually forms in large quantities during the normal operation of the machine and can often bring the machine to a complete halt. In fact, the nozzles that spray the water against the dish racks passing through the tunnel tend to block very easily.

[0010] Consequently, this type of dishwashing machine must be periodically inspected in order to identify and remove any limescale.

[0011] Most tunnel dishwashing machines are therefore provided with a series of side inspection doors, which allow the technician to gain access into the longitudinal tunnel in order to carry out normal maintenance operations.

[0012] Unfortunately, in some cases the limescale forms inside the machine very quickly and can even prevent, in a short space of time, the inspection doors of the dishwashing machine from being opened, with all the problems that this entails.

[0013] In order to reduce the formation of limescale, in the past the water used by the dishwashing machine was passed through an ionic-exchange water softener, capable of trapping the calcium ions, or was mixed with chemical products capable of reducing the hardness of the water.

[0014] Unfortunately, these solutions merely lengthen the time between two successive inspections of the dishwashing machine, are relatively expensive, and significantly increase the machine's operating costs.

[0015] European Patent EP2289385 describes a tunnel dishwashing machine equipped with a device that is capable, in a completely automatic way, of descaling the machine.

[0016] In more detail, this device is capable of releasing into the hydraulic circuit of the dishwashing machine a predetermined quantity of a descaling agent capable of dissolving and/or removing the limescale, and then of circulating the solution containing this descaling agent inside the machine in order to remove the limescale from the pumps, boiler, washing water collecting basins, and nozzles of the machine.

[0017] Clearly, as envisaged by regulations, the entire descaling procedure must be performed with no dish racks inside the tunnel.

[0018] Unfortunately, experimental tests have shown that the device described in European Patent Application EP2289385 is incapable of removing limescale from the areas of the dishwashing machine where there are inspection doors, with all of the problems that this entails.

[0019] DE102008005876 discloses a method for an automated self-cleaning of a continuous dishwasher for items to be cleaned with at least one rinsing zone, at least one clear rinsing zone and also a transporter. Items to be cleaned are conveyed in the direction of transportation via the transporter. The continuous dishwasher comprises at least one fine filter with a back-rinser on at least one storage tank and also at least one device for emptying each of the storage tanks. The continuous dishwasher automatically carries out a self-cleaning cycle in which cleaning liquid located in each of the storage tanks is used several times in succession in the various zones for cleaning thereof. The cleaning liquid is circulated by means of circulating pumps in the respective storage tanks and supplied to spraying systems, which are already present in the respective zones, or to separate nozzles or nozzle heads for wetting the inner side of the faces delimiting the respective zone.

[0020] The object of the present invention is to produce a professional tunnel dishwashing machine capable of removing the limescale that prevents the inspection doors of the machine from being opened.

[0021] In accordance with these objectives, according to the present invention an operating method is disclosed of a professional tunnel dishwashing machine as described in claim 1 and preferably, but not necessarily, in any of the claims that depend thereon.

[0022] In addition, according to the present invention, an operating method is also disclosed of a professional tunnel dishwashing machine that comprises: an outer casing that is provided with a longitudinal pass-through tunnel extending substantially horizontally through said casing; one or more inspection doors selectively openable to access corresponding sections of the longitudinal tunnel; and a linear conveyor adapted to advance a series of dish racks along said longitudinal tunnel; the longitudinal tunnel having inside at least one washing station wherein a first group of nozzles directs jets of washing liquid against the dish racks moving above a first collecting basin located on the bottom of the longitudinal tunnel; and at least one rinse station wherein a second group of nozzles directs jets of rinsing liquid against the dish racks moving above a second collecting basin located at the bottom of the longitudinal tunnel; said operating method comprising the step of producing/creating/ preparing a descaling solution inside a tank communicating with said second group of nozzles; and the step of feeding said descaling solution also to one or more auxiliary nozzles which are located inside the longitudinal tunnel and are orientated so as to direct corresponding jets of descaling solution against one or more of said inspection doors, so as to remove the scale present on the same inspection doors.

[0023] Optionally, the longitudinal tunnel of the dishwashing machine can have internally also at least one prewashing station, where a third group of nozzles directs jets of mains water against the dish racks moving above at least one third collecting basin located at the bottom of the longitudinal tunnel.

[0024] Preferably, but not necessarily, the above-mentioned operating method is additionally characterized in that it also comprises the step of heating the descaling solution directed towards said auxiliary nozzles.

[0025] Preferably, but not necessarily, the above-mentioned operating method is also characterized in that it also comprises the step of feeding the descaling solution accumulated in the first collecting basin to said first group of nozzles.

[0026] Preferably, but not necessarily, the above-mentioned operating method is additionally characterized in that it also comprises the step of heating the descaling solution before feeding it to said first group of nozzles.

[0027] Preferably, but not necessarily, the above-mentioned operating method is also characterized in that it comprises, after feeding the descaling solution to said first group of nozzles, also the step of emptying the col-

lecting basins so as to eliminate the descaling solution accumulated therein.

[0028] Preferably, but not necessarily, the above-mentioned operating method is also characterized by comprising, after feeding the descaling solution to said second group of nozzles, also the step of feeding clean water to the second group of nozzles so as to remove the residues of descaling solution.

[0029] Preferably, but not necessarily, the above-mentioned operating method is also characterized by comprising, after feeding descaling solution to said auxiliary nozzles, also the step of feeding clean water to the auxiliary nozzles so as to remove the residues of descaling solution from the inspection doors.

[0030] Preferably, but not necessarily, the above-mentioned operating method is additionally characterized by comprising also the step of feeding clean water to said first group of nozzles.

[0031] In an advantageous embodiment, the method also comprises the step of stopping the flow of descaling solution to the second group of nozzles and to the auxiliary nozzles when the descaling solution accumulated inside the collecting basins reaches a predetermined maximum level.

[0032] In an advantageous embodiment, the method also comprises the step of stopping the production/creation/preparation of the descaling solution when the descaling solution accumulated inside the collecting basins reaches a predetermined maximum level.

[0033] In an advantageous embodiment, the method also comprises the step of feeding the descaling solution accumulated in the first collecting basin to said first group of nozzles.

[0034] In an advantageous embodiment, the method also comprises the step of heating the descaling solution accumulated in the first collecting basin before feeding it to said first group of nozzles.

[0035] In an advantageous embodiment, the method also comprises, after feeding the descaling solution to the first group of nozzles, the step of emptying the collecting basins so as to eliminate the descaling solution accumulated inside the same collecting basins.

[0036] In an advantageous embodiment, the method also comprises, after emptying the collecting basins, the step of feeding clean water into said tank and/or to said second group of nozzles, so as to remove the residues of descaling solution.

[0037] In an advantageous embodiment, the method also comprises, after feeding clean water to said second group of nozzles, the step of feeding clean water to said auxiliary nozzles so as to remove the residues of descaling solution from the inspection doors.

[0038] In an advantageous embodiment, the method also comprises, after feeding the clean water to the auxiliary nozzles, the step of feeding clean water directly into the collecting basins.

[0039] In an advantageous embodiment, the method also comprises, after the level of clean water inside the

collecting basin has reached a predetermined level, the step of feeding the clean water accumulated into the first collecting basin to said first group of nozzles.

[0040] In an advantageous embodiment, the method also comprises, after feeding the clean water to said first group of nozzles, the step of emptying the collecting basins so as to eliminate the mixture of clean water and residues of descaling solution accumulated inside the same collecting basins.

[0041] The present invention will now be described with reference to the accompanying drawings that illustrate a non-limiting embodiment thereof, in which:

- Figure 1 is a schematic side view of a dishwashing machine made according to the teachings of the present invention, with parts cut away for clarity;
- Figure 2 is a front view of the dishwashing machine shown in Figure 1, with parts in section and parts cut away for clarity;
- Figure 3 is an axonometric view of the central segment of the dishwashing machine shown in Figure 1, sectioned along the centerline and with parts cut away for clarity;
- Figure 4 is a schematic view of the hydraulic circuit of the dishwashing machine shown in the preceding Figures, with parts cut away for clarity; and
- Figure 5 is a schematic view of a second embodiment of the hydraulic circuit of the dishwashing machine shown in Figure 1, with parts cut away for clarity.

[0042] With reference to Figures 1, 2, 3, and 4, number 1 shows as a whole a professional tunnel dishwashing machine that is capable of washing, and preferably quickly drying, the contents of a series of dish racks 100 that pass through the machine in succession and are specifically designed to contain plates, glasses, trays, cutlery, and/or other dishes.

[0043] The dishwashing machine 1 firstly comprises: an outer box casing 2, rigid and preferably substantially parallelepiped in shape, which is designed so as to rest firmly on the floor, and is equipped with a pass-through and preferably also substantially straight longitudinal tunnel 3, which extends substantially horizontally through the entire box casing 2; and a linear conveyor 4, preferably electrically operated, that is designed so as to be capable of advancing a series of dish racks 100 along the longitudinal tunnel 3, from one end of the dishwashing machine 1 to the other.

[0044] Inside the longitudinal tunnel 3, the dishwashing machine 1 has at least one washing station and one rinsing station, arranged one after the other in the direction of advance of the dish racks 100, so as to be passed through in succession by the dish racks 100 that the linear conveyor 4 moves forward along the longitudinal tunnel 3.

[0045] Preferably, the dishwashing machine 1 also has one or more prewashing stations, positioned along the longitudinal tunnel 3, upstream of the washing station.

[0046] In the prewashing station(s), the dish rack 100 and dishes contained therein are subject to a series of high-pressure jets of water, preferably at room temperature, that serve to remove the coarsest dirt from the dishes.

[0047] In the washing station, by contrast, the dish rack 100 and the dishes contained therein are subject to a series of high-pressure jets of washing liquid at a temperature preferably between 60°C and 70°C, that serve to remove all traces of dirt from the dishes.

[0048] Preferably, the washing liquid is a mixture of water and one or more detergent agents.

[0049] Lastly, in the rinsing station, the dish rack 100 and the dishes contained therein are subject to a series of high-pressure jets of rinsing liquid preferably at a temperature of between 70°C and 90°C, which serve to remove any residue of washing liquid from the dishes and at the same time disinfect the dishes.

[0050] Preferably, the rinsing liquid is a mixture of water and sanitizing chemical agents and/or rinse aid or other chemical agents capable of reducing the surface tension of the water, i.e. surfactants.

[0051] In other words, the dishwashing machine 1 is equipped with a series of groups of nozzles that are positioned one after the other within the longitudinal tunnel 3, and are capable of directing respectively, depending on their position inside the longitudinal tunnel 3, jets of water, jets of washing liquid or jets of rinse aid liquid against the dish racks 100 that are advancing inside the longitudinal tunnel 3; and with a series of supply lines capable of supplying/feeding the water, washing liquid, or rinsing liquid to the individual groups of nozzles at a predetermined pressure.

[0052] Inside the longitudinal tunnel 3, the dishwashing machine 1 additionally also comprises a series of collecting basins, which are located at the bottom of the longitudinal tunnel 3 one after the other, so as to be capable of separately collecting the water, washing water, and rinsing liquid that drip down from the dish racks 100 advancing inside the longitudinal tunnel 3.

[0053] Preferably, the dishwashing machine 1 also has, inside the longitudinal tunnel 3 and downstream of the rinsing station, a drying station where the dish rack 100 and the dishes contained therein are subject to a flow of hot air at a temperature preferably exceeding 100°C, which is capable of drying and/or rapidly removing any drops of rinsing liquid that may have remained on the dishes.

[0054] With reference to Figures 1 and 2, the dishwashing machine 1 is also provided with one or more inspection doors 5, which are preferably located along the same side of the box casing 2, and can be opened selectively so as to allow a person to access the corresponding sections of the longitudinal tunnel 3 in order to perform the usual inspection and/or maintenance operations.

[0055] In more detail, each inspection door 5 is preferably fixed in a vertically sliding manner on appropriate

guides present on the box casing 2, so as to be manually movable between a low position (see Figures 1 and 2) in which the inspection door 5 helps to form a side wall of the longitudinal tunnel 3, and a high position in which the inspection door 5 is located above the box casing 2 so as to allow a person to access the inside of the longitudinal tunnel 3.

[0056] In an alternative embodiment, each inspection door 5 can be fixed horizontally sliding on appropriate guides present on the box casing 2, or can be hinged to the frame of the box casing 2 so as to rotate like a flag about the axis of the hinges.

[0057] Furthermore, with reference to Figures 1, 2, and 3, in the example shown, the dishwashing machine 1 is preferably divided longitudinally into a series of independent sectional modules that are firmly coupled together so as to form the tunnel 3.

[0058] In more detail, the dishwashing machine 1 is preferably comprised of a prewashing module 6, a washing module 7, a rinsing module 8, and optionally also a drying module 9, which are aligned one after the other and are rigidly connected together. Preferably, the washing module 7 and the rinsing module 8 are also firmly connected together so as to form an easily transportable single group/block.

[0059] The prewashing module 6 forms a first section/segment of the longitudinal tunnel 3, and inside this first section/segment, the dish rack 100 and the dishes contained therein are subject to a series of jets of water, preferably at room temperature, that serve to remove the coarsest dirt from the dishes.

[0060] The washing module 7 forms a second section/segment of the longitudinal tunnel 3, and inside this second section/segment, the dish rack 100 and the dishes contained therein are subject to a series of jets of washing liquid at a temperature preferably between 60°C and 70°C, that serve to remove from the dishes every trace of dirt.

[0061] The rinsing module 8 forms a third section/segment of the longitudinal tunnel 3, and inside this third section/segment, the dish rack 100 and the dishes contained therein are subject to a series of jets of rinsing liquid at a temperature preferably between 70°C and 90°C, which serve to remove any residue of the washing liquid from the dishes and at the same time disinfect the dishes.

[0062] The drying module 9, optional as stated, forms a fourth and final section/segment of the longitudinal tunnel 3, and inside this fourth section/segment the dish rack 100 and the dishes contained therein are subject to a flow of hot air at a temperature preferably above 100°C, which is capable of drying and/or removing the drops of water and/or rinsing liquid that may have remained on the dishes.

[0063] In other words, the prewashing station is located inside the prewashing module 6, the washing station is located inside the washing module 7, the rinsing station is located inside the rinsing module 8, and the drying

station is located inside the rinsing module 9.

[0064] With reference to Figures 1 and 2, preferably each sectional module 6, 7, 8, and 9 of the dishwashing machine 1 is also provided with a respective inspection door 5, which allows the technician access to the segment of the longitudinal tunnel 3 delimited by said module.

[0065] Preferably, the linear conveyor 4 is also a roller conveyor or a twin chain conveyor, in both cases electrically operated.

[0066] With reference to Figure 4, inside the section/segment of the longitudinal tunnel 3 corresponding to the prewashing station, i.e. to the inside of the prewashing module 6, the dishwashing machine 1 preferably comprises: a first collecting basin 10, which is located on the bottom of the tunnel 3 so as to be capable of collecting and accumulating the water that drips from the dish rack 100 momentarily passing through the prewashing station; and a first series of nozzles 11 that are located above the collecting basin 10, above and/or below the forward trajectory of the dish racks 100, and are oriented so as to direct the corresponding jets of water towards the dish rack 100 momentarily passing through the prewashing station.

[0067] In addition, the dishwashing machine 1 comprises also a first feed line 12 that is capable of feeding to the nozzles 11 the water previously accumulated in the collecting basin 10, preferably at a pressure of between 1.5 and 3 bar.

[0068] Preferably, the feed line 12 also comprises: a pump 13, preferably electrically operated, that is capable of drawing the water from the collecting basin 10 and feeding it to the nozzles 11, preferably at a pressure of between 1.5 and 3 bar; and optionally also a filtering unit (not visible in the Figures) that is located upstream of the suction port of the pump 13, and is designed to trap almost all of the solid contaminants in suspension in the water directed towards the pump 13, like pieces of food and suchlike.

[0069] In addition, the dishwashing machine 1 is preferably also provided with a first overflow manifold 15 that is capable of automatically conveying in a discharge pipe 16 the water that is contained inside the collecting basin 10 and that exceeds a predetermined maximum level; and/or with a first discharge valve, preferably electrically operated, that is interposed between the bottom of the collecting basin 10 and the discharge pipe 16, and is capable of placing the collecting basin 10 in direct communication with the discharge pipe 16 so as to enable the complete emptying of the collecting basin 10.

[0070] With reference to Figure 4, preferably the dishwashing machine 1, or rather the prewashing module 6, is also provided with a first level sensor 18 that is capable of determining the level of the water momentarily present in the collecting basin 10.

[0071] Optionally, the dishwashing machine 1, or rather the prewashing module 6, can additionally also comprise: a resistor or other auxiliary heating device (not

shown) that is located inside the collecting basin 10, and is capable of heating the prewashing liquid contained in the collecting basin 10; and preferably also an auxiliary temperature sensor (not shown) that is capable of determining the temperature of the rinsing liquid at that time contained in the collecting basin 10. Preferably, the auxiliary resistor and the auxiliary temperature sensor are used during the procedure for sanitizing and/or descaling the dishwashing machine 1.

[0072] With reference to Figures 1, 2, 3, and 4, inside the section/segment of the tunnel 3 corresponding to the washing station, i.e. inside the washing module 7, the dishwashing machine 1 preferably comprises: a second collecting basin 20 that is located at the bottom of the tunnel 3 so as to be capable of collecting and accumulating the washing liquid that drips from the dish rack 100 momentarily passing through the washing station; and a second series of nozzles 21 that are located above the collecting basin 20, above and/or below the forward trajectory of the dish racks 100, and are oriented so as to direct the corresponding jets of washing liquid towards the dish rack 100 momentarily passing through the washing station.

[0073] In addition, the dishwashing machine 1, or rather the washing module 7, also comprises a second supply line 22 that is capable of feeding to the nozzles 21 the washing liquid that has accumulated in the collecting basin 20, preferably at a pressure of between 1.5 and 3 bar.

[0074] Preferably, the supply line 22 also comprises: a pump 23, preferably electrically operated, that is capable of drawing the water from the collecting basin 20 and feeding it to the nozzles 21, preferably at a pressure of between 1.5 and 3 bar; and optionally also a filtering unit 24 that is positioned upstream of the suction port of the pump 23, and is designed to trap almost all of the solid contaminants in suspension in the washing liquid directed towards the pump 23, like pieces of food and suchlike.

[0075] In addition, the dishwashing machine 1, or rather the washing module 7, is preferably also provided with a second overflow manifold 25 that is capable of automatically conveying into the discharge pipe 16, the water that is contained inside the collecting basin 20 and exceeds a predetermined maximum level; and/or a second discharge valve 26, preferably electrically operated, that is interposed between the bottom of the collecting basin 20 and the discharge pipe 16, and is capable of placing the collecting basin 20 in direct communication with the discharge pipe 16 so as to enable the complete emptying of the collecting basin 20.

[0076] With reference to Figures 1, 2, 3, and 4, preferably the dishwashing machine 1, or rather the washing module 7, is also provided with at least one resistor or other heating device 27 that is preferably located inside the collecting basin 20, and is capable of heating the washing liquid contained in the collecting basin 20; and preferably also with a temperature sensor 28 that is capable of determining the temperature of the washing liquid at that moment contained in the collecting basin 20.

[0077] Preferably, the dishwashing machine 1, or rather the washing module 7, is also provided with a second level sensor 29 that is capable of determining the level of the washing liquid momentarily present in the collecting basin 20.

[0078] With reference to Figures 3 and 4, inside the section/segment of the tunnel 3 corresponding to the rinsing station, i.e. inside the rinsing module 8, the dishwashing machine 1 preferably comprises: a third and a fourth collecting basin 30 and 31 that are next to one another and are located on the bottom of the tunnel 3 one downstream of the other in the direction of advance d, so as to be capable of collecting and accumulating separately the rinsing liquid that drips from the dish rack 100 momentarily passing over the collecting basins 30 and 31; and a third series of nozzles 32 that are located above the collecting basin 31 closest to the outlet of the tunnel 3, above and/or below the forward trajectory of the dish racks 100, and are oriented so as to direct the corresponding jets of rinsing liquid toward the dish rack 100 momentarily passing over the collecting basin 31.

[0079] In addition, the dishwashing machine 1, or rather the rinsing module 8, also comprises a third supply line 33 that is capable of feeding the washing liquid to the nozzles 32 at a pressure preferably between 1.5 and 3 bar.

[0080] In more detail, the dishwashing machine 1, or rather the rinsing module 8, is preferably provided with a boiler 34 or other similar water-heating device that receives clean pressurized water preferably from the external water supply system, and is capable of heating such water to a predetermined temperature preferably exceeding 80°C. Preferably, the boiler 34 also incorporates a temperature sensor capable of measuring in real time the temperature of the fresh water momentarily contained inside said boiler 34.

[0081] In turn, the supply line 33 is capable of supplying/conveying the hot water from the boiler 34 to the nozzles 32 at a predetermined pressure preferably between 1.5 and 3 bar, optionally mixed at the same time with the hot water and rinse aid and/or other sanitizing and/or surfactant chemical agents.

[0082] In the example illustrated, in particular, the supply line 33 preferably comprises: a throttle valve, preferably electrically operated, that is capable of regulating, on command, the flow rate of the rinsing liquid, or rather the mixture of hot water and rinse aid and/or other sanitizing and/or surfactant chemical agents, directed towards the nozzles 32; and optionally also a flow meter 36 capable of measuring in real time the flow rate of the rinsing liquid directed towards the nozzles 32.

[0083] Still referring to Figures 3 and 4, preferably the dishwashing machine 1, or rather the rinsing module 8, additionally comprises: a bypass pipe 37 that connects the bottom of collecting basin 31 directly to the bottom of collecting basin 30; and a third overflow manifold 38 that is capable of automatically conveying into the bypass pipe 37 the rinsing liquid that is contained inside the col-

lecting basin 31 and exceeds a predetermined maximum level.

[0084] Preferably, the overflow manifold 38 is also capable of engaging in a manually removable and sealed manner into an intermediate well 39 that is located at the bottom of the collecting basin 31, and is in its turn configured so as to place, in the absence of the overflow manifold 38, the bottom of the collecting basin 31 and the mouth of the bypass pipe 37 in direct communication with the drainage pipe 16.

[0085] In addition, the dishwashing machine 1, or rather the rinsing module 8, preferably also comprises: a third discharge valve 40, preferably electrically operated, that is interposed between the bottom of the collecting basin 31 and the discharge pipe 16, and is capable of placing the collecting basin 31 in direct communication with the discharge pipe 16 so as to enable the complete emptying of the collecting basin 31.

[0086] With reference to Figure 3, preferably the dishwashing machine 1, or rather the rinsing module 8, is also provided with at least one resistor or other heating device 41 that is positioned inside the collecting basin 30, and is capable of heating the rinsing liquid contained in the collecting basin 30; and preferably also with a temperature sensor 42 that is capable of determining the temperature of the rinsing liquid at that moment contained in the collecting basin 30.

[0087] Preferably, the dishwashing machine 1, or rather the rinsing module 8, is also provided with a third level sensor 43 that is capable of determining the level of the rinsing liquid momentarily present in the collecting basin 30.

[0088] With reference to Figures 3 and 4, inside the section/segment of the tunnel 3 corresponding to the rinsing station, i.e. inside the rinsing module 8, the dishwashing machine 1 preferably also comprises a fourth series of nozzles 44 that are positioned above the boundary line between the collecting basins 30 and 31, above and/or below the forward trajectory of the dish racks 100, and are oriented so as to direct the corresponding jets of rinsing liquid towards the dish rack 100 momentarily straddling the collecting basins 30 and 31.

[0089] In addition, the dishwashing machine 1, or rather the rinsing module 8, also comprises a fourth supply line 45 that is capable of feeding the nozzles 44 with the washing liquid previously accumulated in the collecting basin 31, preferably at a pressure of between 1.5 and 3 bar.

[0090] Preferably, the supply line 45 also comprises: a pump 46, preferably electrically operated, that is capable of drawing the water from the collecting basin 31 and feeding it to the nozzles 44, preferably at a pressure of between 1.5 and 3 bar; and optionally also a filtering unit 47 that is positioned upstream of the suction port of the pump 46, and is designed to trap any solid contaminants in suspension in the rinsing liquid directed towards the pump 46.

[0091] Preferably, the supply line 45 also includes a

second flow meter 48 capable of measuring in real time the flow rate of the rinsing liquid directed towards the nozzles 44.

[0092] With reference to Figures 3 and 4, inside the section/segment of the tunnel 3 corresponding to the rinsing station, i.e. inside the rinsing module 8, the dishwashing machine 1 preferably also comprises a fifth series of nozzles 50 that are located above the collecting basin 30, above and/or below the forward trajectory of the dish racks 100, and are oriented so as to direct the corresponding jets of rinsing liquid towards the dish rack 100 momentarily passing over the collecting basin 30.

[0093] In addition, the dishwashing machine 1, or rather the rinsing module 8, also comprises a fifth supply line 51 that is capable of sending to the nozzles 50 and preferably also directly to the collecting basin 31 the rinsing liquid previously accumulated in the collecting basin 30, preferably at a pressure of between 1.5 and 3 bar.

[0094] Preferably, the supply line 51 is also designed/configured so as to divide the flow of the prewashing liquid from the collecting basin 30 in a predetermined way between the nozzles 50 and the collecting basin 31.

[0095] With reference to Figures 3 and 4, preferably the supply line 51 also comprises: a pump 52, preferably electrically operated, that is capable of drawing the water from the collecting basin 30 and feeding it to the nozzles 50, preferably at a pressure of between 1.5 and 3 bar; and optionally also a filtering unit 53 that is located upstream of the suction port of the pump 52, and is designed to trap any solid contaminants in suspension in the rinsing liquid directed towards the pump 52.

[0096] Preferably, the supply line 51 also includes a terminal outlet 54 that is preferably positioned on the side wall of the collecting basin 31, preferably below the maximum level guaranteed by the overflow manifold 38, and is designed so as to be capable of expelling/conveying the rinsing liquid originating from the pump 52 unidirectionally directly into the collecting basin 31.

[0097] In a different embodiment, however, the supply line 51 may comprise, instead of the outlet 54, a non-return valve or suchlike, that is positioned on the pipe that carries the rinsing liquid from the pump 52 to the collecting basin 31, so as to prevent the return of the rinsing liquid back to the pump 52.

[0098] With reference to Figures 3 and 4, preferably, the dishwashing machine 1, or rather the rinsing module 8, also comprises a transfer line 55 capable of continuously moving part of the rinsing water from the collecting basin 30 to the collecting basin 20.

[0099] Furthermore, the transfer line 55 preferably comprises: a pump 56, preferably electrically operated, that is capable of drawing the water from the collecting basin 30 and feeding it directly into the collecting basin 20, preferably at a pressure of between 1.5 and 3 bar; and optionally also a filtering unit that is located upstream of the suction port of the pump 56, and is designed to trap any solid contaminants in suspension in the rinsing liquid directed towards the pump 56.

[0100] In the example shown, in particular, the filtering unit 53 is preferably positioned so as to close off a well made in the bottom of the collecting basin 30, and the suction ports of the pumps 52 and 56 preferably communicate directly with this well downstream of the filtering unit 53, so as to share said filtering unit 53.

[0101] Preferably the transfer line 55 also includes a terminal outlet 57 that is preferably located on the side wall of the collecting basin 20, preferably below the maximum level guaranteed by the overflow manifold 25, and is designed so as to be capable of expelling/conveying the rinsing water originating from the pump 56 unidirectionally directly into the collecting basin 20.

[0102] In a different embodiment, however, the transfer line 55 can comprise, instead of the terminal outlet 57, a non-return valve or suchlike, which is located on the pipe that carries the rinsing liquid from the pump 56 to the collecting basin 20, so as to prevent the return of the rinsing liquid back towards the pump 56.

[0103] With reference to Figure 4, preferably the dishwashing machine 1, or rather the rinsing module 8, also comprises: a non-pressurized main tank 60 that receives fresh water directly from the external water supply system 200; and a supply pump 61, preferably electrically operated, that is capable of drawing the water directly from the tank 60 and feeding it to the boiler 34 at a predetermined pressure, preferably between 1.5 and 3 bar.

[0104] In more detail, the non-pressurized tank 60 is connected to the external water supply system 200 by a water-inlet line 62, that preferably includes a water-inlet valve, preferably electrically operated, which is capable of regulating the flow of fresh water towards the non-pressurized tank 60.

[0105] Preferably, the dishwashing machine 1, or rather the rinsing module 8, is also provided with a fourth overflow manifold 64 that is capable of automatically conveying into the discharge pipe 16 the water that is contained inside the non-pressurized tank 60 and exceeds a predetermined maximum level; and/or with a fourth temperature sensor 65 capable of determining the temperature of the water momentarily contained in the non-pressurized tank 60; and/or with a fourth level sensor 66 that is capable of measuring the level of the water momentarily contained in the non-pressurized tank 60.

[0106] With reference to Figure 4, preferably the dishwashing machine 1, or rather the rinsing module 8, is also provided with a recirculation line 68 that is capable of diverting/conveying part of the flow of water exiting the pump 61 back into the non-pressurized tank 60, and that preferably comprises a flow reducer 69 of a known type.

[0107] Preferably, the dishwashing machine 1, or rather the rinsing module 8, also comprises: a non-return valve 70 that is located on the pipe that connects the pump 61 to the boiler 34, preferably downstream of the recirculation line 68, and is capable of allowing the unidirectional flow of the water in the direction of the boiler 34; and optionally also an energy recovery device 71, that is preferably located on the pipe that connects the

pump 61 to the boiler 34, downstream of the non-return valve 70, and is capable of preheating the water directed towards the boiler 34.

[0108] In more detail, the energy recovery device 71 is preferably designed so as to be capable of transferring thermal energy (i.e. heat) from the hot air that has previously been used to dry the dishes in the drying station, to the cold water directed towards the boiler 34.

[0109] In the example illustrated, in particular, the energy recovery device 71 preferably includes a circuit with an electrically operated heat pump, or a simple air/liquid heat exchanger that has been passed through at the same time by the cold water directed towards the boiler 34 and by the hot air that has previously been used to dry the dishes in the drying station.

[0110] The energy recovery device 71 is a component already widely known in the sector of industrial dishwashing machines and so will not be described in further detail.

[0111] Preferably, the dishwashing machine 1, or rather the rinsing module 8, is also provided with a fifth temperature sensor 72 that is located between the energy recovery device 71 and the boiler 34, and is capable of determining the temperature of the water entering the boiler 34.

[0112] With reference to Figure 4, the dishwashing machine 1 preferably also comprises: a small auxiliary tank 75, preferably hermetically sealed, that is capable of containing a quantity of descaling agent, preferably sufficient to perform a plurality of descaling cycles in the dishwashing machine 1; and, preferably, also a metering pump 76, preferably electrically controlled, that is capable of transferring on command a predetermined dose of descaling agent from the auxiliary tank 75 to the non-pressurized tank 60.

[0113] In the example shown, in particular, the metering pump 76 is preferably a peristaltic pump.

[0114] With reference to Figures 1, 3, and 4, the dishwashing machine 1 additionally comprises: one or more auxiliary nozzles 80 that are located inside the longitudinal tunnel 3, at the inspection door(s) 5, and are oriented so as to direct the corresponding jets of liquid towards the immediately adjacent inspection door(s) 5; and an auxiliary supply line 81 that is capable of feeding descaling solution into the auxiliary nozzles 80 at a predetermined pressure, preferably between 1.5 and 3 bar.

[0115] In more detail, the auxiliary supply line 81 preferably branches from the pipe that connects the pump 61 to the boiler 34, preferably between the non-return valve 70 and the delivery line of the pump 61, and preferably also includes a delivery valve 82, preferably electrically operated, that is capable of regulating the flow of descaling liquid directed to the auxiliary nozzles 80.

[0116] In the example illustrated, in particular, the dishwashing machine 1 is preferably provided with a plurality of auxiliary nozzles 80 each of which is preferably located on the roof of the longitudinal tunnel 3, facing an inspection door 5, and oriented so as to direct its own jet of descaling solution towards said inspection door 5.

[0117] In more detail, the auxiliary nozzles 80 are preferably located at the inspection door(s) 5 of the washing station, at the inspection door(s) 5 of the prewashing station, and at the inspection door(s) 5 of the rinsing station.

[0118] With reference to Figure 4, preferably the dishwashing machine 1 finally also includes a secondary water inlet line 85 that is connected or can be connected to the external water supply system 200 or to a general external source of hot water, and is designed to be capable of selectively and independently conveying a flow of clean and preferably also hot water towards the collecting basin 10 and/or the collecting basin 20 and/or the collecting basin 30.

[0119] In more detail, the secondary water inlet line 85 is preferably provided with a series of branches that terminate, respectively, in the collecting basin 10 and/or in the collecting basin 20 and/or in the collecting basin 30, and preferably also includes a series of water inlet valves 86, preferably electrically operated, each of which is located on a respective branch so as to be capable of regulating the flow of clean water directed towards the corresponding collecting basin 10, 20, or 30.

[0120] Preferably the secondary water inlet line 85 additionally comprises, at the end of each branch, a respective terminal outlet 87 that is preferably located on the side wall of collecting basin 10, 20, or 30, preferably below the maximum level guaranteed by the overflow manifold 15 or 25, and is designed so as to be capable of expelling/conveying the clean water unidirectionally directly into the collecting basin 10, 20, or 30.

[0121] In an alternative embodiment, however, the secondary water inlet line 85 could comprise, instead of the terminal outlets 87, non-return valves or suchlike, each of which is located on the pipe that carries the clean water towards the collecting basin 10, 20, or 30.

[0122] Preferably, the secondary water inlet line 85 finally also comprises a measuring device 86 that is capable of measuring the temperature and/or flow of the clean water that flows along the secondary water inlet line 85, directed towards the collecting basin 10 and/or 20 and/or 30.

[0123] The general operation of the dishwashing machine 1 during washing of the dishes can be easily deduced from that described above and so does not require further explanation.

[0124] When it is necessary to remove scale, however, from the dishwashing machine 1, assuming that the dishwashing machine 1 also includes at least one pre-washing station, the electronic control unit (not shown) of the dishwashing machine 1 implements the following procedure.

[0125] Firstly, the procedure for descaling the dishwashing machine 1 involves completely emptying the collecting basins 10, 20, 30, and 31 present at the bottom of the longitudinal tunnel 3 in order to eliminate the waste water or other liquids previously accumulated inside said collecting basins 10, 20, 30, and 31.

[0126] In order to empty the collecting basins 10, 20,

30, and 31, the electronic control unit of the dishwashing machine 1 preferably momentarily opens the discharge valves 17, 26, and 40, so as to cause any wastewater present in the collecting basins 10, 20, 30, and 31 to flow rapidly into the discharge pipe 16.

[0127] At the same time or after emptying the collecting basins 10, 20, 30, and 31, the procedure for descaling the dishwashing machine 1 involves producing/creating/preparing, inside the main non-pressurized tank 60, a descaling solution formed of water and descaling agent in predetermined percentages.

[0128] In order to produce/create/prepare said descaling solution, the electronic control unit of the dishwashing machine 1 preferably activates the metering pump 76 so as to transfer the correct quantity of descaling agent from the auxiliary tank 75 to the main tank 60, where the descaling agent mixes with the water from the external water supply system.

[0129] When the descaling solution is ready for use, the procedure for descaling the dishwashing machine 1 involves feeding the descaling solution to the nozzles 32 of the rinsing station.

[0130] Optionally, the procedure for descaling the dishwashing machine 1 involves heating the descaling solution directed to the nozzles 32 of the rinsing station to a predetermined temperature, preferably between 50°C and 100°C.

[0131] In order to feed the descaling solution to the nozzles 32 of the rinsing station, the electronic control unit of the dishwashing machine 1 preferably activates the feed pump 61 so as to push the descaling solution from the main tank 60 towards the boiler 34 and then along the supply line 33 until the nozzles 32.

[0132] Preferably, the electronic control unit of the dishwashing machine 1 also activates the boiler 34 and/or the energy recovery device 71 so as to heat the descaling solution before it reaches the nozzles 32 of the rinsing station.

[0133] The descaling solution that exits the nozzles 32 collects in the collecting basin 31 below, until reaching the level of the mouth of the overflow manifold 38. Once it has entered the overflow manifold 38, the descaling solution flows along the bypass pipe 37 until reaching and accumulating inside the collecting basin 30 of the rinsing station.

[0134] Preferably, when the descaling solution reaches a predetermined level inside the collecting basin 30, the electronic control unit of the dishwashing machine 1 additionally also activates the pump 46 so as to feed the descaling solution also to the intermediate nozzles 44 of the rinsing station.

[0135] Preferably, at the same time or after starting the pump 46, the electronic control unit of the dishwashing machine 1 also activates the pump 52 so as to feed the descaling solution also to the nozzles 50 of the rinsing station.

[0136] When the descaling solution reaches a predetermined level inside the collecting basin 30 and prefer-

ably also after feeding the descaling solution to the nozzles 44 and/or 50 of the rinsing station, preferably the procedure for descaling the dishwashing machine 1 also involves slowly transferring part of the descaling solution from the collecting basin 30 of the rinsing station to the collecting basin 20 of the washing station.

[0137] In more detail, at the same time or after starting the pump 46 and/or 52, the electronic control unit of the dishwashing machine 1 preferably also activates the pump 56 so as to slowly transfer part of the descaling solution from the collecting basin 30 of the rinsing station to the collecting basin 20 of the washing station.

[0138] At the same time as, or after feeding the descaling solution to the nozzles 32, 44, and/or 50 of the rinsing station, the procedure for descaling the dishwashing machine 1 additionally involves feeding the descaling solution also to the auxiliary nozzles 80 that spray the descaling solution towards/against the inspection doors 5 of the machine, so as to remove any scale that would prevent the inspection doors 5 from opening.

[0139] In order to feed the descaling solution to the auxiliary nozzles 80, the electronic control unit of the dishwashing machine 1 preferably opens the delivery valve 82, so that the pump 61 can pump part of the descaling solution also along the pipes of the auxiliary supply line 81, up to the nozzles 80 that spray the descaling solution against the inspection doors 5 of the machine.

[0140] Since the auxiliary supply line 81 branches off the pipe that connects the pump 61 to the boiler 34, upstream of the boiler 34 and the energy recovery device 71, the descaling solution directed towards the auxiliary nozzles is at room temperature.

[0141] After having sprayed the inspection doors 5 of the machine, the descaling solution coming from the auxiliary nozzles 80 flows and accumulates inside the collecting basins 10, 20, 30, and 31 below.

[0142] The auxiliary supply line 81 is then capable of conveying the descaling solution directly to the collecting basins 10, 20, and optionally 30 and/or 31, straddling the boiler 34.

[0143] When the descaling solution reaches a predetermined maximum level inside the collecting basins 10 and 20, the procedure for descaling the dishwashing machine 1 involves interrupting the flow of descaling solution to the nozzles 32, 44, and/or 50 of the rinsing station and also to the auxiliary nozzles 80 directed towards the inspection doors 5 of the machine. In addition, the procedure for descaling the dishwashing machine 1 preferably also involves interrupting more or less at the same time the production/ creation/preparation of the descaling solution.

[0144] In order to interrupt the production/creation/preparation of the descaling solution and the flow of descaling solution to the nozzles 32, 44, and/or 50 of the rinsing station and to the auxiliary nozzles 80, the electronic control unit of the dishwashing machine 1 preferably deactivates the pumps 61 and 76.

[0145] At the same time or immediately after having

interrupted the production/creation/preparation of the descaling solution to the nozzles 32, 44, and/or 50 of the rinsing station and to the auxiliary nozzles 80, the procedure for descaling the dishwashing machine 1 preferably involves feeding to the nozzles 21 of the washing station and to the nozzles 11 of the prewashing station the descaling solution that has accumulated in the corresponding collecting basins 20 and 10.

[0146] Preferably, the procedure for descaling the dishwashing machine 1 also involves feeding the descaling solution to the nozzles 21 and to the nozzles 11 for a first predetermined period of time, preferably between 1 and 20 minutes. In order to feed the descaling solution to the nozzles 21 and 11, the electronic control unit of the dishwashing machine 1 preferably activates the pump 23 of the washing station and the pump 13 of the prewashing station. Optionally, the electronic control unit of the dishwashing machine 1 can also activate the pump 56 of the transfer line 55.

[0147] Before or at the same time as feeding the descaling solution to the nozzles 21 of the washing station and to the nozzles 11 of the prewashing station, preferably the procedure for descaling the dishwashing machine 1 also involves heating the descaling solution accumulated in the collecting basins 10, 20, and 30 to a predetermined temperature, preferably between 50°C and 100°C.

[0148] In order to heat the descaling solution accumulated in the collecting basins 10, 20, and 30, the electronic control unit of the dishwashing machine 1 preferably activates the resistors 27 and 41.

[0149] After the above-mentioned period of time has elapsed, the descaling procedure of the dishwashing machine 1 preferably involves interrupting the feed of descaling solution to all of the nozzles and again emptying the collecting basins 10, 20, 30, and 31, so as to remove the descaling solution accumulated inside the various basins.

[0150] In order to again empty the collecting basins 10, 20, 30, and 31, the electronic control unit of the dishwashing machine 1 preferably reopens the discharge valves 17, 26, and 40, so as to cause the descaling solution contained therein to flow rapidly into the discharge pipe 16.

[0151] After the second emptying of the collecting basins 10, 20, 30, and 31, the descaling procedure of the dishwashing machine 1 advantageously involves feeding clean water to the main tanks 60 and to the nozzles 32 of the rinsing station in order to remove the residues of descaling solution from the pipes.

[0152] The mixture of water and descaling solution that exits the nozzles 32, falls into the collecting basin 31 of the rinsing station and then flows directly into the discharge pipe 16 through the discharge valve 40.

[0153] In more detail, the electronic control unit of the dishwashing machine 1 preferably opens the water-inlet valve 63 in order to fill the non-pressurized main tank 60 with clean water, and then activates the supply pump 61

so as to feed clean water to the boiler 34 and then to the supply line 33, up to the nozzles 32.

[0154] At the same time or after feeding clean water to the nozzles 32 of the rinsing station, the procedure for descaling the dishwashing machine 1 preferably involves feeding clean water also to the auxiliary nozzles 80 directed towards the inspection doors 5 of the machine, in order to remove the residues of descaling solution from the inspection doors 5.

[0155] The mixture of water and descaling solution that exits the auxiliary nozzles 80 falls into the collecting basins 10, 20, 30, and 31 and from there flows directly into the discharge pipe 16 through the discharge valves 17, 26, and 40.

[0156] In order to feed clean water to the auxiliary nozzles 80, the electronic control unit of the dishwashing machine 1 preferably reopens the delivery valve 82 of the auxiliary supply line 81 so that the pump 61 can feed clean water also to the auxiliary nozzles 80.

[0157] After having completed the cleaning of the auxiliary nozzles 80 of the corresponding auxiliary supply line 81, the procedure for descaling the dishwashing machine 1 involves feeding clean water directly into the collecting basins 10, 20, 30, and 31.

[0158] In order to send clean water directly into the collecting basins 10, 20, 30, and 31, the electronic control unit of the dishwashing machine 1 preferably first closes the discharge valves 17, 26, and 40, and then opens the water-inlet valves 86 of the secondary water inlet line 85.

[0159] After the level of clean water inside the collecting basins 10, 20, 30, and 31 has reached a predetermined value, the descaling procedure of the dishwashing machine 1 preferably involves feeding to the nozzles 21 of the washing station and to the nozzles 11 of the pre-washing station the clean water that has accumulated in the corresponding collecting basins 20 and 10.

[0160] Preferably, the procedure for descaling the dishwashing machine 1 also involves feeding the clean water of the collecting basins 10 and 20 to the nozzles 11 and 21 for a second predetermined period of time, preferably between 1 and 30 minutes, so as to remove the residues of descaling solution from supply line 12 and from supply line 22.

[0161] In more detail, when the clean water has reached the predetermined level in the collecting basins 10, 20, 30, and 31, the electronic control unit of the dishwashing machine 1 preferably reactivates the pumps 13, 23, 46, 52, and 56 for a time preferably between 1 and 30 minutes.

[0162] The mixture of water and descaling solution that exits the nozzles 11, 21, 44, and 50 falls and accumulates in the collecting basins 10, 20, 30, and 31.

[0163] After having removed the residues of descaling solution from the hydraulic circuit of the machine, the procedure for descaling the dishwashing machine 1 involves preferably emptying for the third time the collecting basins 10, 20, 30, and 31, so as to eliminate the mixture of water and descaling solution contained therein.

[0164] In more detail, once the above-mentioned washing time has elapsed, the electronic control unit of the dishwashing machine 1 preferably deactivates the pumps 13, 23, 46, 52, and 56 and reopens the discharge valves 17, 26, and 40 so as to cause the mixture of water and descaling solution contained therein to flow into the discharge pipe 16.

[0165] At this point, the descaling procedure preferably ends and the dishwashing machine 1 can resume normal washing of the dishes placed in the dish racks 100.

[0166] The advantages deriving from using the above-described descaling procedure are considerable.

[0167] Firstly, the above-described descaling procedure allows removal even of the scale that forms at the inspection doors 5 of the machine and that in the long term could hinder or prevent the normal opening thereof.

[0168] In addition, the above-described descaling procedure is performed completely automatically by the dishwashing machine 1, thus enormously simplifying the cleaning and maintenance operations for which the personnel who supervise the normal operation of the machine are responsible.

[0169] Lastly, the above-described descaling procedure minimizes the use of clean water during the removal of the residues of descaling solution, with the reduction in water consumption and operating costs that this entails.

[0170] Finally, it is clear that modifications and variations can be made to the above-described dishwashing machine 1 and to the operating method of the dishwashing machine 1 without departing from the scope of the invention.

[0171] For example, the dishwashing machine 1 could be devoid of the auxiliary nozzle(s) arranged inside the longitudinal tunnel 3, at the inspection door(s) of the rinsing station. The inspection door(s) 5 located at the rinsing station would not then be bathed/sprayed by the descaling solution during the above-described descaling procedure.

[0172] Furthermore, with reference to Figure 5, in a different embodiment of the dishwashing machine 1, instead of branching off from the pipe that connects the pump 61 to the boiler 34, the auxiliary supply line 81 branches off from the supply line 33 of the rinsing station, preferably downstream of the throttle valve 35.

[0173] In this case, the procedure for descaling the dishwashing machine 1 also involves heating the descaling solution before delivering it to the auxiliary nozzles 80 that spray the descaling solution towards/against the inspection doors 5 of the machine.

[0174] In more detail, in this embodiment, the electronic control unit of the dishwashing machine 1 preferably activates the energy recovery device 71 and/or the boiler 34 at the same time as the pump 61, so as to heat to a predetermined temperature the descaling solution that flows towards the nozzles 32 of the rinsing station and the auxiliary nozzles 80. Preferably, the predetermined temperature is also higher than 60°C.

[0175] The heating of the descaling solution improves the efficacy of the descaling solution in the removal of limescale.

[0176] Experimental tests have shown that the descaling action of the descaling solution increases as the temperature of the solution increases.

[0177] Furthermore, in another less sophisticated embodiment, not shown, the dishwashing machine 1 could comprise, instead of the collecting basins 30 and 31, one basin for collecting the rinsing liquid, obviously located inside the section/segment of the tunnel 3 corresponding to the rinsing station.

[0178] In this embodiment, the dishwashing machine 1 is obviously devoid of the bypass pipe 37, and the transfer line 55 is capable of continuously moving part of the rinsing liquid from the single collecting basin of the rinsing station to the collecting basin 20 of the washing station.

[0179] Lastly, in this embodiment, the dishwashing machine 1 would be devoid of the nozzles 44 and/or 50 and of the relative supply lines 45 and/or 51.

Claims

1. An operating method of a professional tunnel dishwashing machine (1) comprising: an outer casing (2) which is provided with a pass-through longitudinal tunnel (3) extending substantially horizontally through the same casing (2); one or more inspection doors (5) selectively openable to access a corresponding stretch of the longitudinal tunnel (3); and a linear conveyer (4) adapted to advance a series of dish racks (100) along said longitudinal tunnel (3); the longitudinal tunnel (3) having inside at last one washing station wherein a first group of nozzles (21) directs jets of washing liquid against the dish racks (100) moving above a first collecting basin (20) located on the bottom of the longitudinal tunnel (3); and at least one rinse station wherein a second group of nozzles (32, 44, 50) directs jets of rinsing liquid against the dish racks (100) moving above a second collecting basin (30, 31) located at the bottom of the longitudinal tunnel (3); the operating method comprising the step of producing/ creating/preparing a descaling solution inside a tank (60) communicating with said second group of nozzles (32, 44, 50), and the step of feeding said descaling solution to said second group of nozzles (32, 44, 50). said operating method being **characterised by** comprising the step of feeding said descaling solution also to one or more auxiliary nozzles (80) which are located inside of the longitudinal tunnel (3) and are orientated so as to direct corresponding jets of descaling solution against one or more of said inspection doors (5), so as to remove the scale present on the same inspection doors (5).

2. Operating method of a washing machine according to Claim 1, **characterised by** additionally comprising the step of stopping the flow of descaling solution to the second group of nozzles (32, 44, 50) and to the auxiliary nozzles (80) when the descaling solution accumulated inside the collecting basins (20, 30, 31) reaches a predetermined maximum level.

3. Operating method of a washing machine according to Claim 1 or 2, **characterised by** additionally comprising the step of stopping the production/creation/preparation of the descaling solution when the descaling solution accumulated inside the collecting basins (20, 30, 31) reaches a predetermined maximum level.

4. Operating method of a washing machine according to any one of the preceding claims, **characterised by** additionally comprising the step of feeding the descaling solution accumulated in the first collecting basin (20) to said first group of nozzles (21).

5. Operating method of a washing machine according to Claim 4, **characterised by** additionally comprising the step of heating the descaling solution accumulated in the first collecting basin (20) before feeding it to said first group of nozzles (21).

6. Operating method of a washing machine according to Claim 4 or 5, **characterised by** comprising, after feeding the descaling solution to the first group of nozzles (21), also the step of emptying the collecting basins (20, 30, 31) so as to eliminate the descaling solution accumulated inside the same collecting basins (20, 30, 31).

7. Operating method of a washing machine according to Claim 6, **characterised by** comprising, after the emptying of said collecting basins (20, 30, 31), also the step of feeding clean water into said tank (60) and/or to said second group of nozzles (32, 44, 50), so as to remove the residues of the descaling solution.

8. Operating method of a washing machine according to any one of the preceding claims, **characterised by** comprising, after said step of feeding said descaling solution also to one or more auxiliary nozzles (80), the step of feeding clean water to said auxiliary nozzles (80) so as to remove the residues of the descaling solution from said inspection doors (5).

9. Operating method of a washing machine according to any one of the preceding claims, **characterised by** additionally comprising the step of heating up the descaling solution directed towards said auxiliary nozzles (80).

10. Operating method of a washing machine according to any one of the preceding claims, **characterised by** additionally comprising, before the step of feeding the descaling solution to said second group of nozzles (32, 44, 50), also the step of emptying said collecting basins (20, 30, 31) so as to eliminate any liquid previously accumulated inside the same collecting basins (20, 30, 31).

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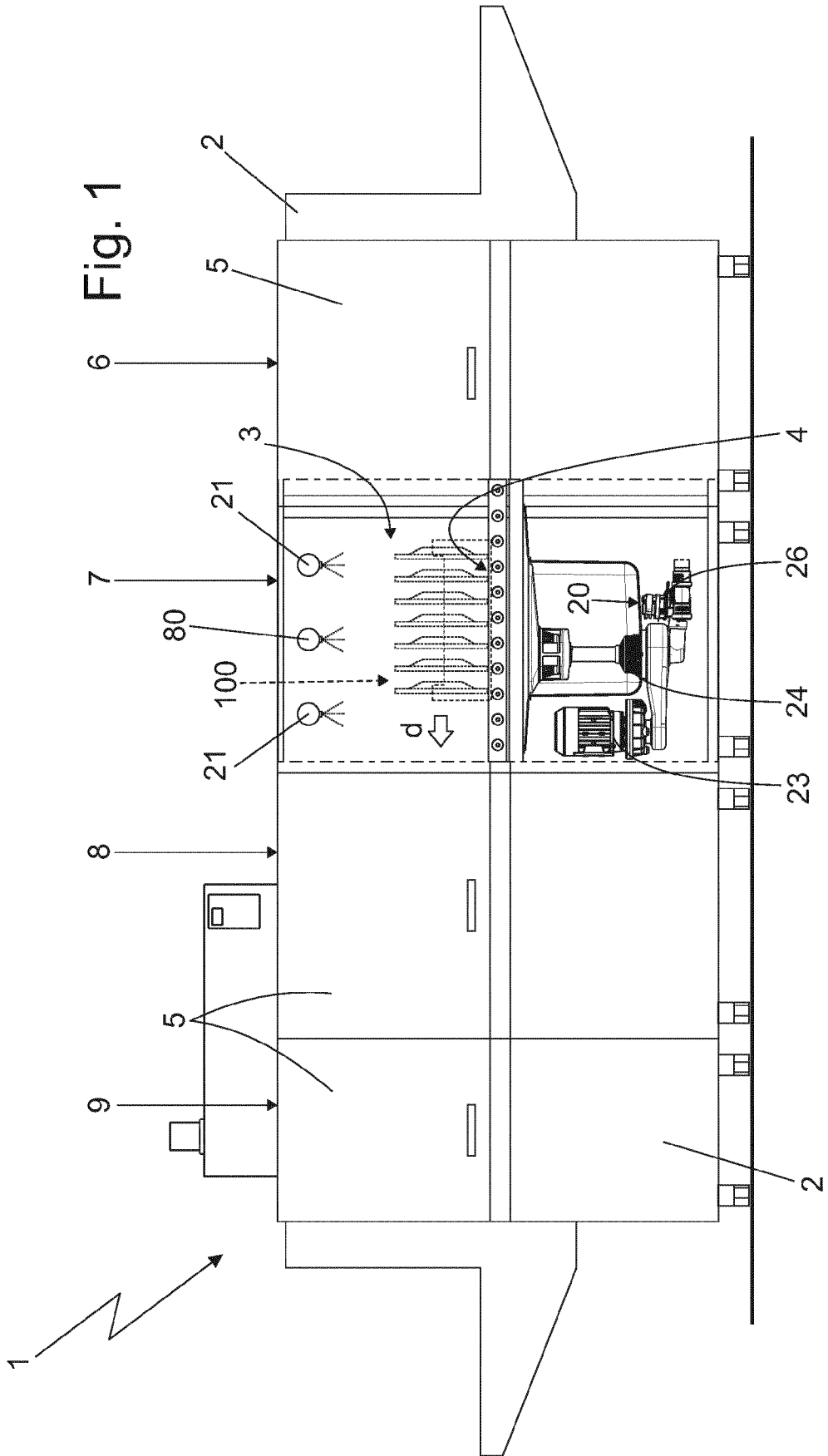
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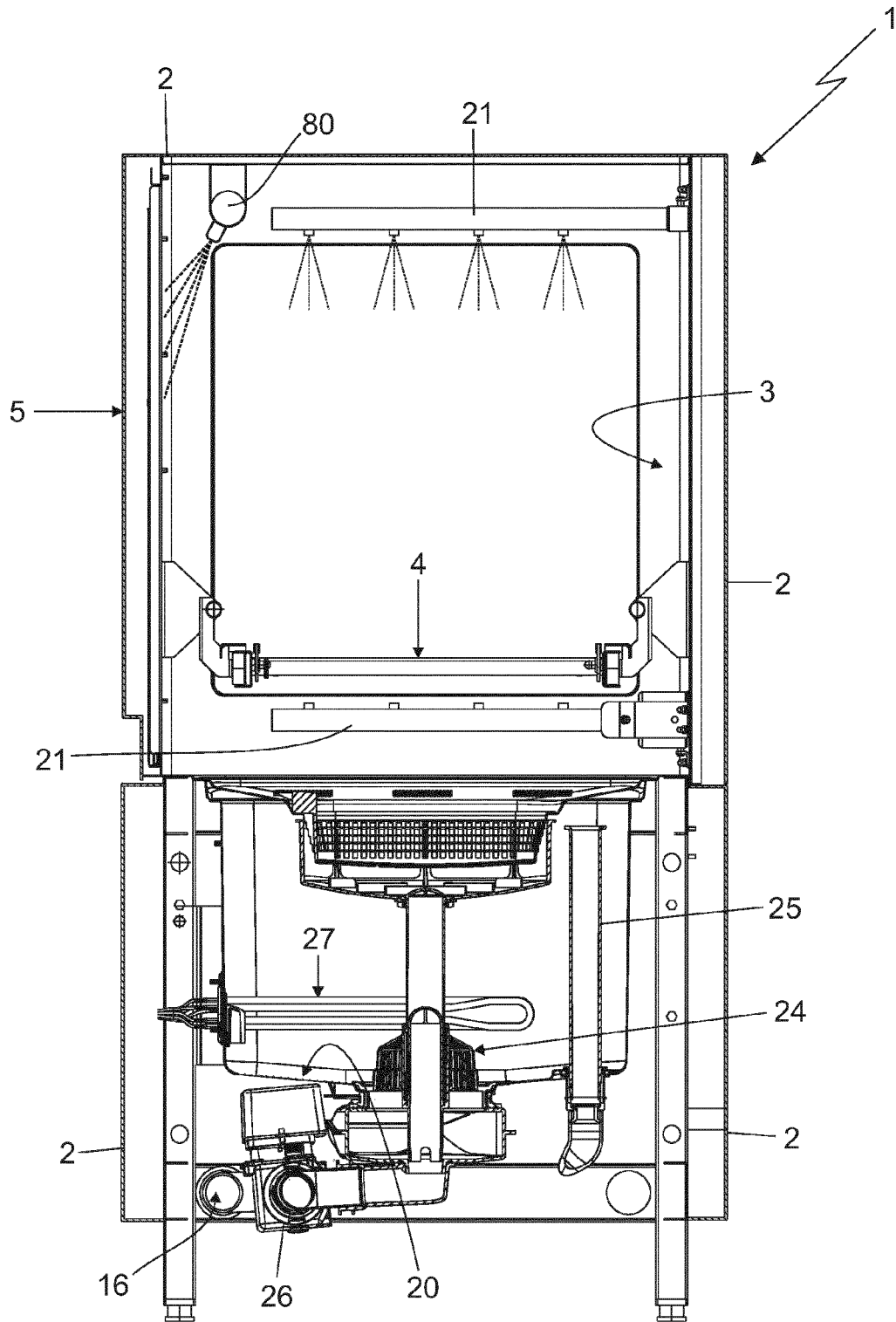


Fig. 2

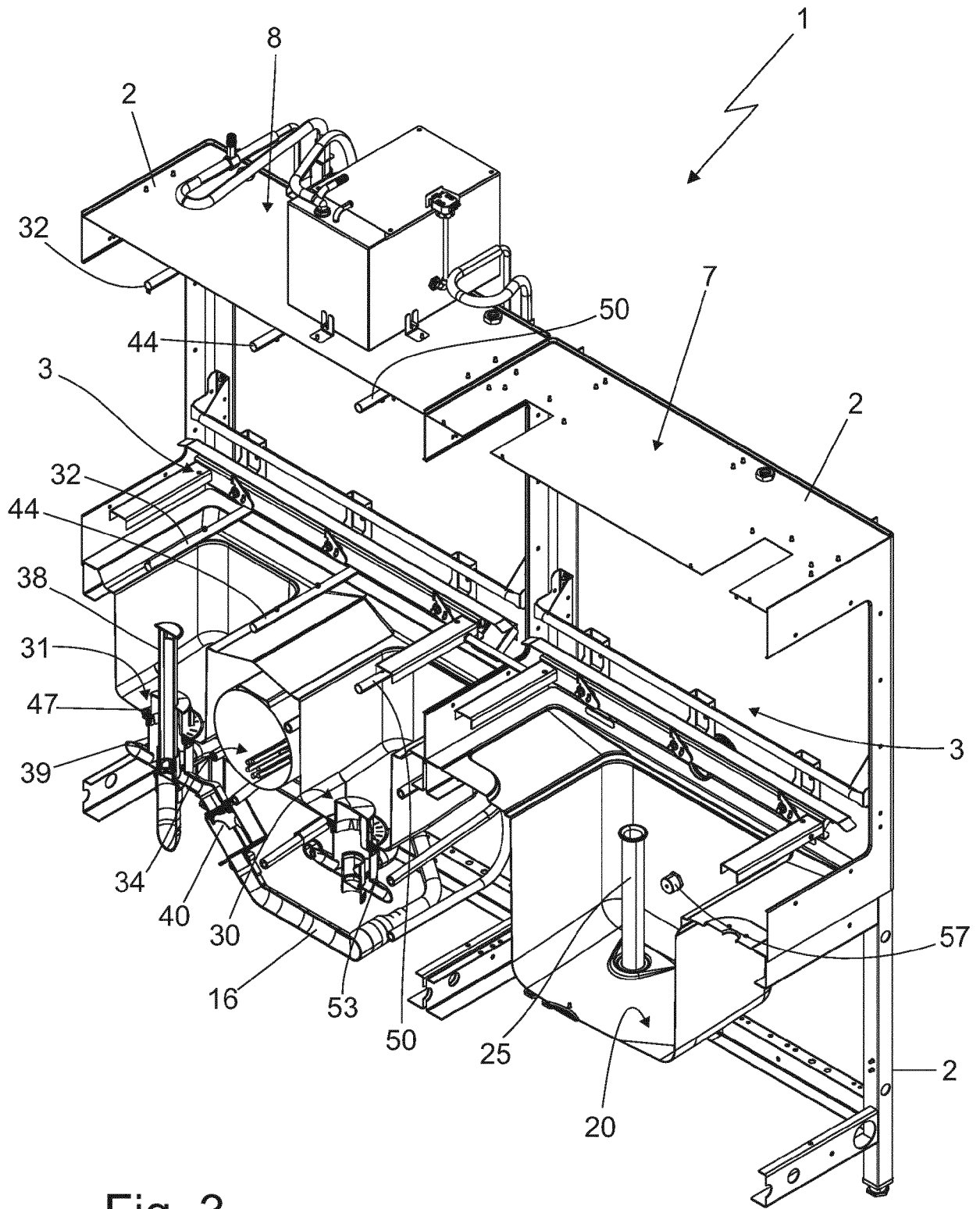
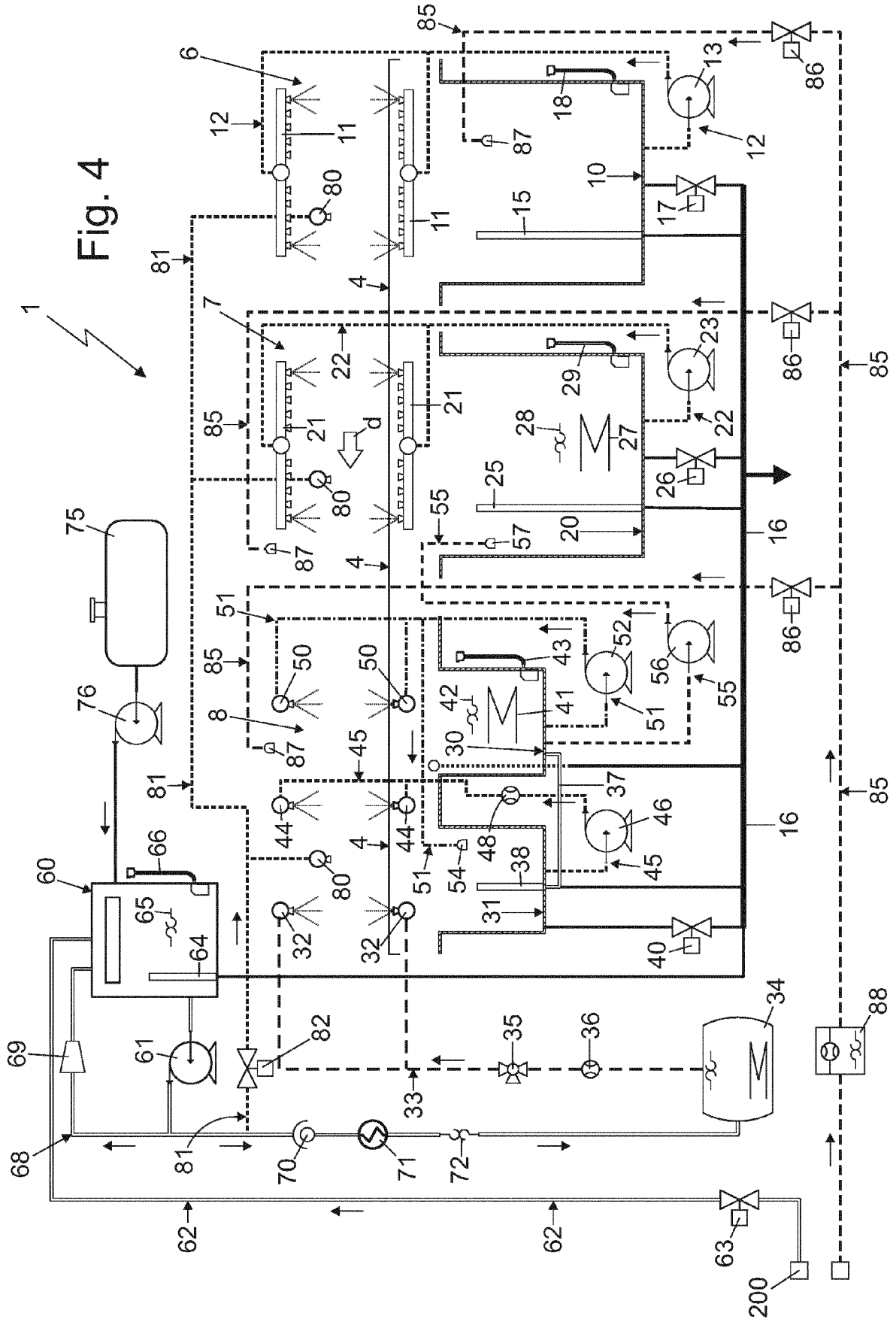


Fig. 3



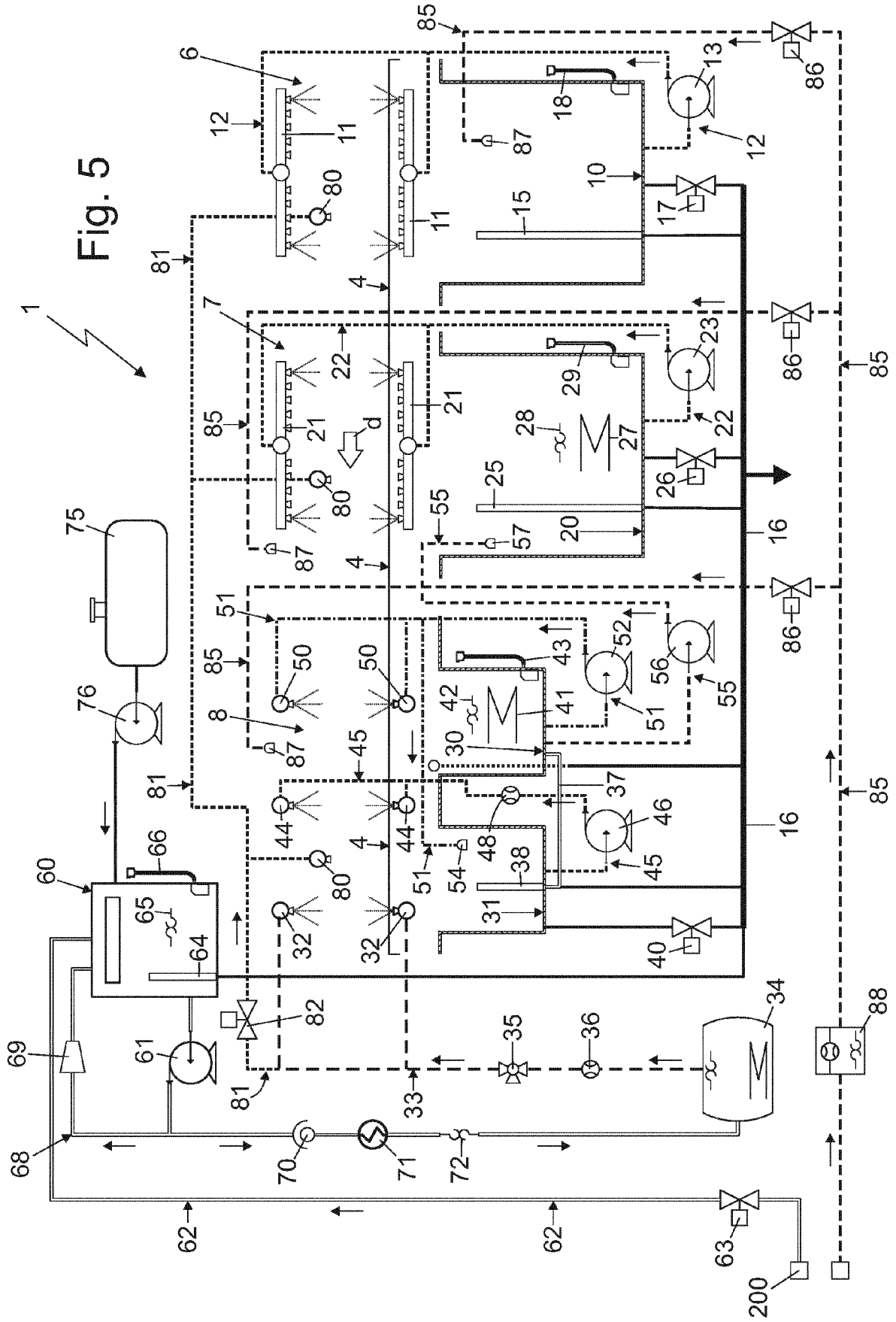


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 18 17 8613

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	DE 10 2008 005876 B3 (MEIKO MASCHINENBAU GMBH & CO [DE]) 30 April 2009 (2009-04-30) * page 3, paragraph 10 * * page 5, paragraph 24 - paragraph 25 * * page 6, paragraphs 33,34,37 * * page 7, paragraph 42 - page 8, paragraph 49; figures 1,2a,2b,3 *	1-10	INV. A47L15/24 A47L15/00 A47L15/42
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A	DE 10 2011 081246 A1 (PREMARK FEG LLC [US]) 21 February 2013 (2013-02-21) * page 7, paragraph 54 - paragraph 58; figures 1,3,4 *	1-10	
A	DE 195 15 025 A1 (PREMARK FEG CORP [US]) 31 October 1996 (1996-10-31) * the whole document *	1-10	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 August 2018	Examiner Lodato, Alessandra
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 18 17 8613

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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