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(54) **Improved multistage rinsing module for tunnel dishwashers, and a tunnel dishwasher provided with such a module**

Verbessertes mehrstufiges Spülmodul für Tunnelgeschirrspüler und Tunnelgeschirrspüler mit solch einem Modul

Module de rinçage multi-étages amélioré pour lave-vaisselle tunnel et lave-vaisselle tunnel équipé d'un tel module

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Description

[0001] The present invention refers to a multistage rinsing module for tunnel dishwashers and to a tunnel dishwasher that is provided with such a module.

[0002] In particular, the present invention refers to a multistage rinsing module for tunnel dishwashers that is capable of carrying out a preliminary pre-rinsing cycle before the final rinsing of the dishes.

[0003] By the term "dishes" we mean plates, cutlery and glasses, as generally understood, but also saucepans, containers, kitchen utensils and other similar objects.

[0004] Furthermore, for the sake of simplicity, by the term "dishes" we shall also mean the mobile means which support the aforementioned dishes during their forward movement in the dishwasher.

[0005] In such a way also such supports shall be effectively washed and rinsed by the multistage rinsing module according to the present invention.

[0006] By the term "tunnel" machine we mean all those dishwashers in which the dishes are moved so as to go, in succession, through a plurality of operation steps such as the pre-washing, washing, pre-rinsing and final rinsing steps.

[0007] One example of a tunnel dishwasher of the known type is shown in figure 1 in which reference numerals 101, 102, 103 and 104 indicate the pre-washing station, the first and second washing stations and the rinsing station.

[0008] As visible the rinsing station 104 comprises two substations 105 and 106 inside of it for pre-rinsing and final rinsing, respectively.

[0009] In the case in which there are no problems of length of the machines, inside the rinsing station 104 downstream of the washing station 103 and immediately upstream of the pre-rinsing zone 105, a neutral zone 107 is provided, visible in figure 2, which is useful for draining the water "with detergent" from the dishes.

[0010] In other words, before the dishes enter the pre-rinsing zone 105 they stop, or transit, in such a draining zone 107 where, spontaneously by gravity, part of the water "with detergent" from the dishes is released.

[0011] Currently, it is the common goal of many manufacturers, as well as the purpose of the present invention, to study new solutions that are capable of reducing the consumption of water drawn from the net used in the final rinsing step of the dishes.

[0012] Indeed, advantageously, by decreasing the amount of water used there is also a corresponding substantial saving in terms of energy used for heating it, as well as a lower consumption of detergents and rinse aid.

[0013] A first solution proposed for such a purpose is described for example in patent EP1815779.

[0014] In such a patent it is foreseen for the water that is used for the pre-rinsing to be, at least partially, the same water used in the previous rinsing cycle.

[0015] Indeed in such machines there is a collection

tank of the water used for rinsing, or rather heated net water with rinse aid added to it, which is re-used in the preceding pre-rinsing step for removing most of the detergent from the dishes before their final rinsing, by means of "new" net water.

[0016] Such a method of re-using water in the pre-rinsing step that was previously used for rinsing allows to significantly reduce the consumption of water from the net and, therefore, also the consumption related to energy, detergent and rinse aid.

[0017] In parallel with the efforts aimed at reducing consumption of net water used for rinsing dishes, it is however necessary to safeguard the overall efficiency of the washing cycle.

[0018] For such a purpose EP1815779 has the drawback of conveying the solutions delivered by many nozzles, for example those for rinsing and those for pre-rinsing, in the same tank thus making the independent analysis of the various rinsing steps present in the dishwasher difficult.

[0019] Patent application WO10144307 indeed describes a tunnel machine of the type described above, or rather a machine that recycles the water previously used for rinsing in the pre-rinsing step of the following cycle, in which it is further provided for the sensors arranged actually inside the tank in which such water to be re-used is collected.

[0020] In particular, such sensors are connected to a control unit which controls a possible increase of detergent in the washing step, wherein said increase is a function of some parameters measured in the collection tank.

[0021] In WO10144307 there is no suggestion concerning using the values measured for controlling the delivery of the net water or of the pumps for supplying the nozzles.

[0022] DE4100164 discloses another example of a multistage tunnel dishwasher according to the prior art.

[0023] The purpose of the present invention is that of making a multistage rinsing module for tunnel dishwashers that is capable of solving, in a different manner with respect to the prior art, the problems relative to the decreasing of the consumption of net water without jeopardising the overall efficiency of the washing cycle.

[0024] These purposes according to the present invention are achieved by making a multistage rinsing module for tunnel dishwashers and a tunnel dishwasher provided with such a module as outlined in claims, 1 and 10, respectively.

[0025] Further characteristics of the invention are highlighted in the dependent claims.

[0026] The characteristics and the advantages of a multistage rinsing module for tunnel dishwashers according to the present invention shall become clearer from the following description, given as an example and not for limiting purposes, with reference to the attached schematic drawings, in which:

- figures 1 and 2 are schematic views of tunnel dish-

washers according to the prior art;

- figure 3 is a schematic view of a multistage rinsing module for tunnel dishwashers according to the present invention;
- figure 4 is a schematic view of a tunnel dishwasher that is provided with the multistage rinsing module of figure 3.

[0027] With reference to figures 3 and 4, reference numeral 10 shows one embodiment of a multistage rinsing module for tunnel dishwashers according to the present invention. Such a module or multistage rinsing station 10 comprises in succession from upstream to downstream following the movement of the dishes three independent zones: a draining zone 11 of the dishes full of detergent, a pre-rinsing zone 12 of the drained dishes and a final rinsing zone 13 of the drained and pre-rinsed dishes, respectively.

[0028] The final rinsing zone 13 is provided with rinsing nozzles 14 for delivering net water 15 and a pre-rinsing tank 18 for exclusively collecting the net water 15 delivered by the rinsing nozzles 14.

[0029] The pre-rinsing zone 12 is provided with pre-rinsing nozzles 16 for delivering the pre-rinsing solution 17 collected in the pre-rinsing tank 18.

[0030] The pre-rinsing solution 17 therefore consists of the net water 15 used in the preceding cycle during the rinsing step and the substances removed from the rinsed dishes.

[0031] The pre-rinsing zone 12 is also provided with a draining tank 21 for exclusively collecting the pre-rinsing solution 17 delivered by the pre-rinsing nozzles 16.

[0032] The draining solution 21 contained in the draining tank 21 thus consists of the pre-rinsing solution 17 used in the preceding cycle during the pre-rinsing step and the substances removed from the pre-rinsed dishes.

[0033] In the previous paragraph, like in the rest of the description, for the sake of clarity, the word "cycle" is used to indicate all the actions which are carried out in succession on the dishes from when they are introduced to when they come out from the machine.

[0034] However, it is worth clarifying that it is not an actual cycle but rather a series of operations that are carried out in succession, in different work stations or modules, on moving dishes.

[0035] In particular, according to the invention, the draining zone 11 is not a passive zone in which there is no forced rinsing action on the stopped or transiting dishes, but rather, contrary to the current state of the art, it is provided with draining nozzles 19 for delivering the previously described draining solution 20 collected in a draining tank 21.

[0036] In other words such draining nozzles 19 are configured so as to create a jet having speed, flow-rate, nebulization characteristics such as to generate the drawing of water with detergent present on the dishes, thus amplifying the draining effect which would otherwise occur only through gravity or by simple dilution.

[0037] Such a draining solution 21, as already mentioned, consists of the pre-rinsing solution 17 used in the preceding pre-rinsing cycle and of the substances removed from the pre-rinsed dishes.

[0038] The draining zone 11 is moreover provided with a discharge tank 31 for exclusively collecting the draining solution 20 delivered by the draining nozzles 19 and connected to the net 32 for discharging the discharge solution 30 collected in it.

[0039] As visible in figure 3, every zone 11, 12, 13 is made independent from the others by means of barrier elements 33, 34 placed between the tanks 18, 21, 31 so as to ensure that the solutions delivered by the nozzles of a particular zone are collected in a particular tank without mixing together, for example, the net water used with the pre-rinsing solution.

[0040] Such an embodiment offers an alternative solution to that described in EP18715779 in which the rinsing and pre-rinsing nozzles deliver net water and the pre-rinsing solution, respectively, in the same tank.

[0041] On the contrary, since the invention foresees independent separate tanks, it is possible to independently control the single zones of the rinsing station, thus being able to selectively act upon the net delivery or on the pumps 23, 24 according to the requirements, through suitable sensors.

[0042] Moreover, another special aspect of the invention consists in the fact that the discharge tank 31 in which the solution delivered by the draining nozzles 19 is collected does not foresee any return delivery to other nozzles but only the total or partial discharge to the net.

[0043] This, differently from what is foreseen in EP18715779 in which all the tanks make the collected solutions recirculate, is due to the fact that the action of the draining nozzles 19 is not suitable for obtaining a "dilution" of the solution present on the dishes, but an actual mechanical action that forces the draining through jets of solution at high speed and flow-rate.

[0044] In fact the flow-rate delivered by the draining nozzles 19 is greater than that of the remaining nozzles 16 and 14.

[0045] Therefore, since the mechanical action of forcing the draining occurs at high speed and flow-rate of the solution, according to the present invention it is not provided for the control of the discharge solution 31 collected in the discharge tank 30 since it is in fact intended only for being discharged and not for being re-used in the rinsing module.

[0046] On the contrary, since EP18715779 foresees the re-use of the solutions collected in all the tanks, the flow-rate delivered by the nozzles cannot be too high otherwise it is not possible to control the quality of the solutions and they cannot be used in the following cycle.

[0047] As shown, the module 10 also comprises warming means 22, such as a boiler, for warming the net water 15, a pre-rinsing pump 23 that is connected to the pre-rinsing tank 18 for the delivery of a pre-rinsing solution 17 under pressure to the pre-rinsing nozzles 16 and a

draining pump 24 connected to the draining tank 21 for the delivery in pressure of the draining solution 20 to the draining nozzles 19.

[0048] Further warming means can also be foreseen acting on the solution contained in the draining tank 21 and/or in the pre-rinsing tank 18.

[0049] It is possible to foresee a further pre-rinsing nozzle 16' that is mobile between the pre-rinsing zone 12 and the draining zone 11.

[0050] As mentioned previously, the independence of the zones 11, 12 and 13 makes it possible to take care of the overall efficiency of the washing cycle with low consumption of net water.

[0051] For such a purpose, according to the present invention, a different retroactive control system is foreseen obtained with sensors for measuring the properties of the draining 21 and pre-rinsing 17 solutions.

[0052] Such sensors are indeed connected to a unit for controlling the delivery of the net water 15 and of the pumps 23, 24 so as to calibrate, cycle by cycle, the correct amount of net water to be used as well as the delivery flow of the nozzles 19 and 16.

[0053] For example, in the case in which there is an increase in the flow of dishes with detergent, with consequent increase of the provision of detergent and of other pollutants in the tanks 20 and/or 17, in order to ensure a correct rinsing, the control unit, when indicated by the aforementioned sensors, controls an increase of the amount of clean net water 15 so as to ensure a correct final rinsing.

[0054] On the other hand, when the movement of dishes with detergent decreases, with the consequent decrease in the flow of detergent present in the tanks 20 and/or 17, the control unit, when indicated by the aforementioned sensors, controls a decrease in the amount of clean net water 15 delivered for rinsing with relative saving in terms of energy consumption and rinse aid consumption.

[0055] In a complementary manner it can also be provided for a control of the forward movement of the dishes according to the values measured in the tanks 20 and/or 17.

[0056] As a control parameter it is possible to select at least one of the following indexes, or rather the Ph, the conductivity and/or turbidity of the draining 21 and pre-rinsing 17 solutions.

[0057] Furthermore, it can be foreseen for there to be means for controlling also the state of the net water 15 in inlet to the module 10, thus excluding variables due to the change over time of the characteristics of the net water.

[0058] Again, in order to ensure an effective rinsing, it can also be provided for level sensors of the solutions contained in the draining 21 and pre-rinsing 18 tanks connected to a unit for controlling further delivery of the net water 15 in the case in which the levels detected are below threshold values that have been determined *a priori* or that can be determined each time according to the

cases.

[0059] It is very simple to understand how a multistage rinsing module for tunnel dishwashers according to the present invention, object of the invention, operates.

[0060] During the pre-rinsing step 12 of the drained dishes a pre-rinsing solution 17 is used comprising the net water 15 used in the preceding rinsing cycle and the substances removed from the rinsed dishes.

[0061] During the draining step 11, an active step according to the present invention, a draining solution 20 is delivered comprising the pre-rinsing solution 17 used in the preceding pre-rinsing cycle and the substances removed from the pre-rinsed dishes.

[0062] It is clear how in such a way it is possible to reduce the amount of net water 15 to be used during the rinsing with consequent saving of energy.

[0063] Moreover, by means of pH sensors foreseen in the tanks 17, 20 it is possible to calibrate the aforementioned amount of net water 15 without jeopardising the overall efficiency of the washing cycle.

[0064] It has thus been seen that a multistage rinsing module for tunnel dishwashers according to the present invention achieves the purposes previously highlighted.

[0065] Indeed, the multistage rinsing module for tunnel dishwashers according to the present invention makes it possible to reduce the consumption of net water in the rinsing step without jeopardising the overall efficiency of the washing cycle by integrating an active step of the rinsing station into the natural draining step.

[0066] The multistage rinsing module for tunnel dishwashers according to the present invention and the tunnel dishwasher provided with such a module thus conceived may undergo numerous modifications and variants, all covered by the same inventive concept; moreover, all the details can be replaced by technically equivalent elements. In practice, the materials used, as well as their dimensions, may be any according to the technical requirements.

Claims

1. Multistage rinsing module (10) for tunnel dishwashers (100) of the type comprising in succession from upstream to downstream following the movement of the dishes three independent zones, respectively:

- a draining zone (11) of the dishes full of detergent supplied in said module (10),
- a pre-rinsing zone (12) of said drained dishes,
- a final rinsing zone (13) of said drained and pre-rinsed dishes; wherein
- said final rinsing zone (13) being provided with rinsing nozzles (14) for delivering net water (15);
- said pre-rinsing zone (12) being provided with pre-rinsing nozzles (16) for delivering a pre-rinsing solution (17); said pre-rinsing solution (17) consisting exclusively of the net water (15) de-

- livered by said rinsing nozzles (14) and the substances removed from the dishes,
 - said draining zone (11) being provided with draining nozzles (19) for delivering the draining solution (20); said draining solution (21) consisting exclusively of the pre-rinsing solution (17) delivered by said pre-rinsing nozzles (16) and the substances removed from the dishes;
characterised in that
 said draining nozzles (19) being configured so as to deliver said draining solution (20) at a flow-rate and a speed that are greater with respect to the pre-rinsing solution (17) and to the net water (15) delivered by said pre-rinsing nozzles (16) and by said rinsing nozzles (14).
2. Multistage rinsing module (10) according to claim 1 **characterised in that** it comprises means (22) for warming the net water (15), a pre-rinsing pump (23) for delivering said pre-rinsing solution (17) to said pre-rinsing nozzles (16) and a draining pump (24) for delivering said draining solution (20) to said draining nozzles (19).
 3. Multistage rinsing module (10) according to any one of the previous claims **characterised in that** it comprises a further pre-rinsing nozzle (16') mobile from said pre-rinsing zone (12) to said draining zone (11).
 4. Multistage rinsing module (10) according to any one of the previous claims **characterised in that** it comprises sensors for measuring the properties of said draining (21) and pre-rinsing (17) solutions connected to a unit for controlling both delivery of said net water (15) and advancing of said dishes in said module (10).
 5. Multistage rinsing module (10) according to claim 4 **characterised in that** said sensors are pH-reading sensors of said draining (21) and pre-rinsing (17) solutions.
 6. Multistage rinsing module (10) according to claim 4 **characterised in that** said sensors are reading sensors of the conductivity of said draining (21) and pre-rinsing (17) solutions.
 7. Multistage rinsing module (10) according to claim 4 **characterised in that** said sensors are reading sensors of the turbidity of said draining (21) and pre-rinsing (17) solutions.
 8. Tunnel dishwasher (100) comprising in succession from upstream to downstream following the movement of the dishes a pre-washing module (101), at least one washing module (102, 103) and a multistage rinsing module (10) according to any one of the previous claims.

Patentansprüche

1. Mehrstufiges Spülmodul (10) für Tunnelgeschirrspüler (100) des Typs, der hintereinander von stromaufwärts nach stromabwärts, entsprechend der Bewegung des Geschirrs, folgende drei unabhängige Bereiche umfasst:
 - einen Bereich zum Abtropfen (11) des Geschirrs, das mit dem im Modul (10) eingespeisten Spülmittel angefüllt ist,
 - einen Bereich zum Vorspülen (12) des abgetropften Geschirrs,
 - einen Bereich zum abschließenden Abspülen (13) des abgetropften und vorgespülten Geschirrs; wobei
 - der Bereich zum abschließenden Abspülen (13) mit Spüldüsen (14) zum Zuführen von Wasser (15) aus dem Netz versehen ist;
 - der Bereich zum Vorspülen (12) mit Vorspüldüsen (16) zum Zuführen einer Vorspüllösung (17) versehen ist; wobei die Vorspüllösung (17) ausschließlich aus dem von den Spüldüsen (14) zugeführten Wasser (15) aus dem Netz und den vom Geschirr entfernten Substanzen besteht,
 - der Bereich zum Abtropfen (11) mit Entleerungsstutzen (19) zum Zuführen der ablaufenden Lösung (20) versehen ist; wobei die ablaufende Lösung (21) ausschließlich aus der von den Vorspüldüsen (16) zugeführten Vorspüllösung (17) und den vom Geschirr entfernten Substanzen besteht;
- dadurch gekennzeichnet, dass**
 die Entleerungsstutzen (19) so ausgebildet sind, dass die ablaufende Lösung (20) bei einem Durchsatz und einer Geschwindigkeit zugeführt wird, die höher als die der Vorspüllösung (17) und die des Wassers (15) aus dem Netz sind, die von den Vorspüldüsen (16) und den Spüldüsen (14) zugeführt werden.
2. Mehrstufiges Spülmodul (10) nach Anspruch 1, **dadurch gekennzeichnet, dass** es Mittel (22) zum Erhitzen des Wassers (15) aus dem Netz, eine Vorspülpumpe (23) zum Zuführen der Vorspüllösung (17) in die Vorspüldüsen (16) und eine Entleerungspumpe (24) zum Zuführen der ablaufenden Lösung (20) in die Entleerungsstutzen (19) umfasst.
 3. Mehrstufiges Spülmodul (10) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** es eine weitere Vorspüldüse (16') umfasst, die von dem Vorspülbereich (12) zum Abtropfbereich (11) bewegt werden kann.
 4. Mehrstufiges Spülmodul (10) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet,**

dass es Sensoren zum Messen der Eigenschaften der ablaufenden Lösung (21) und der Vorspüllösung (17) umfasst, die mit einer Einheit zum Steuern sowohl der Zuführung des Wassers (15) aus dem Netz und des Vorschubs des Geschirrs in dem Modul (10) verbunden ist. 5

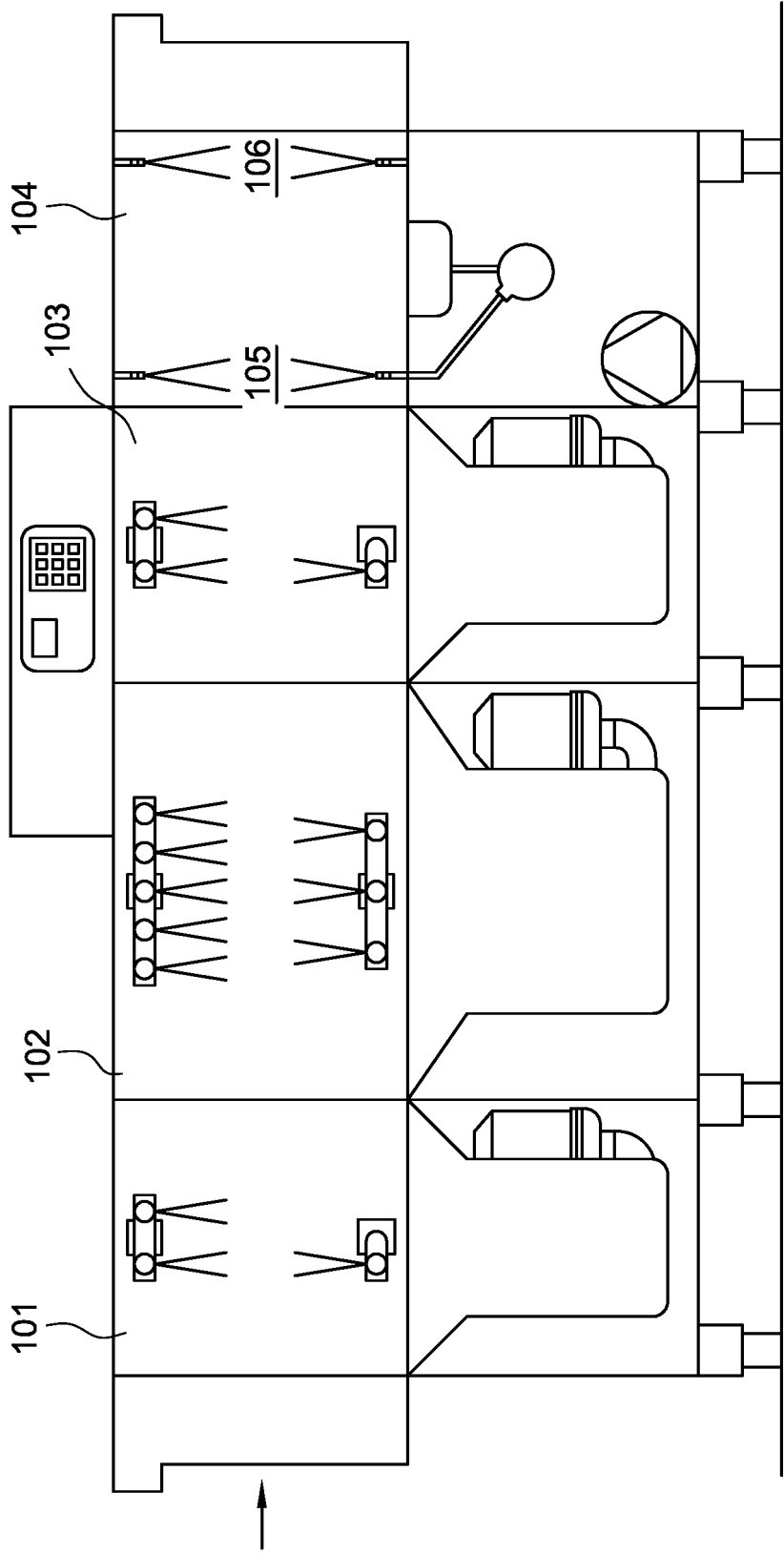
5. Mehrstufiges Spülmodul (10) nach Anspruch 4, **dadurch gekennzeichnet, dass** die Sensoren pH-Sensoren der ablaufenden Lösung (21) und der Vorspüllösung (17) sind. 10
6. Mehrstufiges Spülmodul (10) nach Anspruch 4, **dadurch gekennzeichnet, dass** die Sensoren Leitfähigkeitssensoren der ablaufenden Lösung (21) und der Vorspüllösung (17) sind. 15
7. Mehrstufiges Spülmodul (10) nach Anspruch 4, **dadurch gekennzeichnet, dass** die Sensoren Trübungssensoren der ablaufenden Lösung (21) und der Vorspüllösung (17) sind. 20
8. Tunnelgeschirrspüler (100) umfassend hintereinander von stromaufwärts nach stromabwärts, entsprechend der Bewegung des Geschirrs, ein Vorreinigungsmodul (101), mindestens ein Reinigungsmodul (102, 103) und ein mehrstufiges Spülmodul (10) nach einem der vorstehenden Ansprüche. 25

Revendications

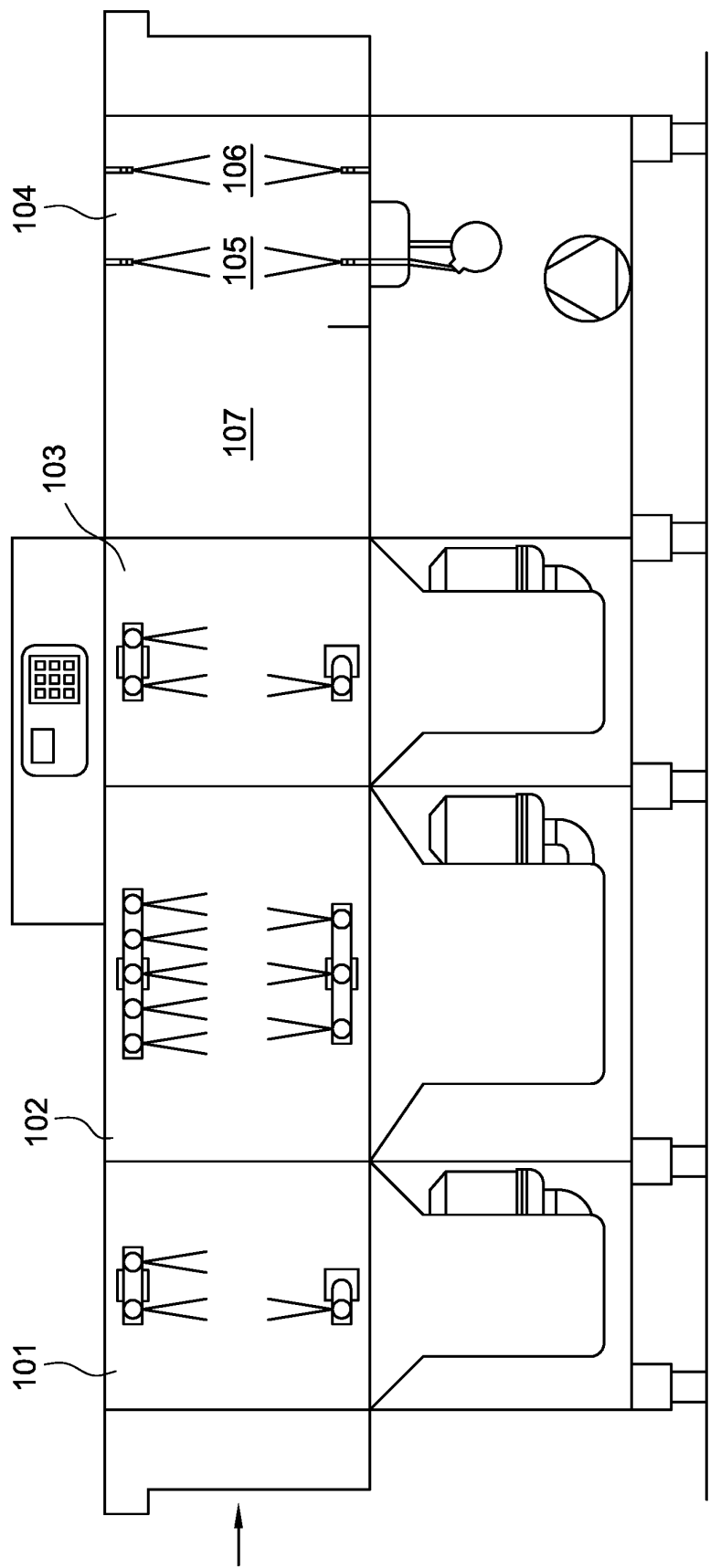
1. Module de rinçage multi-étages (10) pour lave-vaisselle tunnel (100) du type comprenant en succession, d'amont en aval suivant le mouvement de la vaisselle, trois zones indépendantes, respectivement : 30
 - une zone d'égouttage (11) de la vaisselle pleine de détergent alimentée dans ledit module (10), 40
 - une zone de pré-rinçage (12) de ladite vaisselle égouttée,
 - une zone de rinçage final (13) de ladite vaisselle égouttée et pré-rincée ; dans lequel 45
 - ladite zone de rinçage final (13) est équipée de buses de rinçage (14) pour distribuer de l'eau du réseau (15) ;
 - ladite zone de pré-rinçage (12) est équipée de buses de pré-rinçage (16) pour distribuer une solution de pré-rinçage (17) ; ladite solution de pré-rinçage (17) se composant exclusivement de l'eau du réseau (15) distribuée par lesdites buses de rinçage (14) et des substances retirées de la vaisselle, 50
 - ladite zone d'égouttage (11) est équipée de buses d'égouttage (19) pour distribuer la solution d'égouttage (20) ; ladite solution d'égoutta-

ge (21) se composant exclusivement de la solution de pré-rinçage (17) distribuée par lesdites buses de pré-rinçage (16) et des substances retirées de la vaisselle ; **caractérisé en ce que** lesdites buses d'égouttage (19) sont configurées de manière à distribuer ladite solution d'égouttage (20) à un débit et à une vitesse qui sont supérieures par rapport à la solution de pré-rinçage (17) et à l'eau du réseau (15) distribuée par lesdites buses de pré-rinçage (16) et par lesdites buses de rinçage (14).

2. Module de rinçage multi-étages (10) selon la revendication 1, **caractérisé en ce qu'il** comprend des moyens (22) pour chauffer l'eau du réseau (15), une pompe de pré-rinçage (23) pour distribuer ladite solution de pré-rinçage (17) auxdites buses de pré-rinçage (16) et une pompe d'égouttage (24) pour distribuer ladite solution d'égouttage (20) auxdites buses d'égouttage (19).
3. Module de rinçage multi-étages (10) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comprend une autre buse de pré-rinçage (16') mobile de ladite zone de pré-rinçage (12) à ladite zone d'égouttage (11).
4. Module de rinçage multi-étages (10) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comprend des capteurs pour mesurer les propriétés desdites solutions d'égouttage (21) et de pré-rinçage (17), connectés à une unité pour commander à la fois la distribution de ladite eau du réseau (15) et la progression en avant de ladite vaisselle dans ledit module (10). 30
5. Module de rinçage multi-étages (10) selon la revendication 4, **caractérisé en ce que** lesdits capteurs sont des capteurs de mesure de pH desdites solutions d'égouttage (21) et de pré-rinçage (17).
6. Module de rinçage multi-étages (10) selon la revendication 4, **caractérisé en ce que** lesdits capteurs sont des capteurs de mesure de la conductivité desdites solutions d'égouttage (21) et de pré-rinçage (17).
7. Module de rinçage multi-étages (10) selon la revendication 4, **caractérisé en ce que** lesdits capteurs sont des capteurs de mesure de la turbidité desdites solutions d'égouttage (21) et de pré-rinçage (17).
8. Lave-vaisselle tunnel (100) comprenant en succession, d'amont en aval suivant le mouvement de la vaisselle, un module de pré-lavage (101), au moins un module de lavage (102, 103) et ledit module de rinçage multi-étages (10) selon l'une quelconque des revendications précédentes. 55



PRIOR ART
Fig. 1



PRIOR ART
Fig. 2

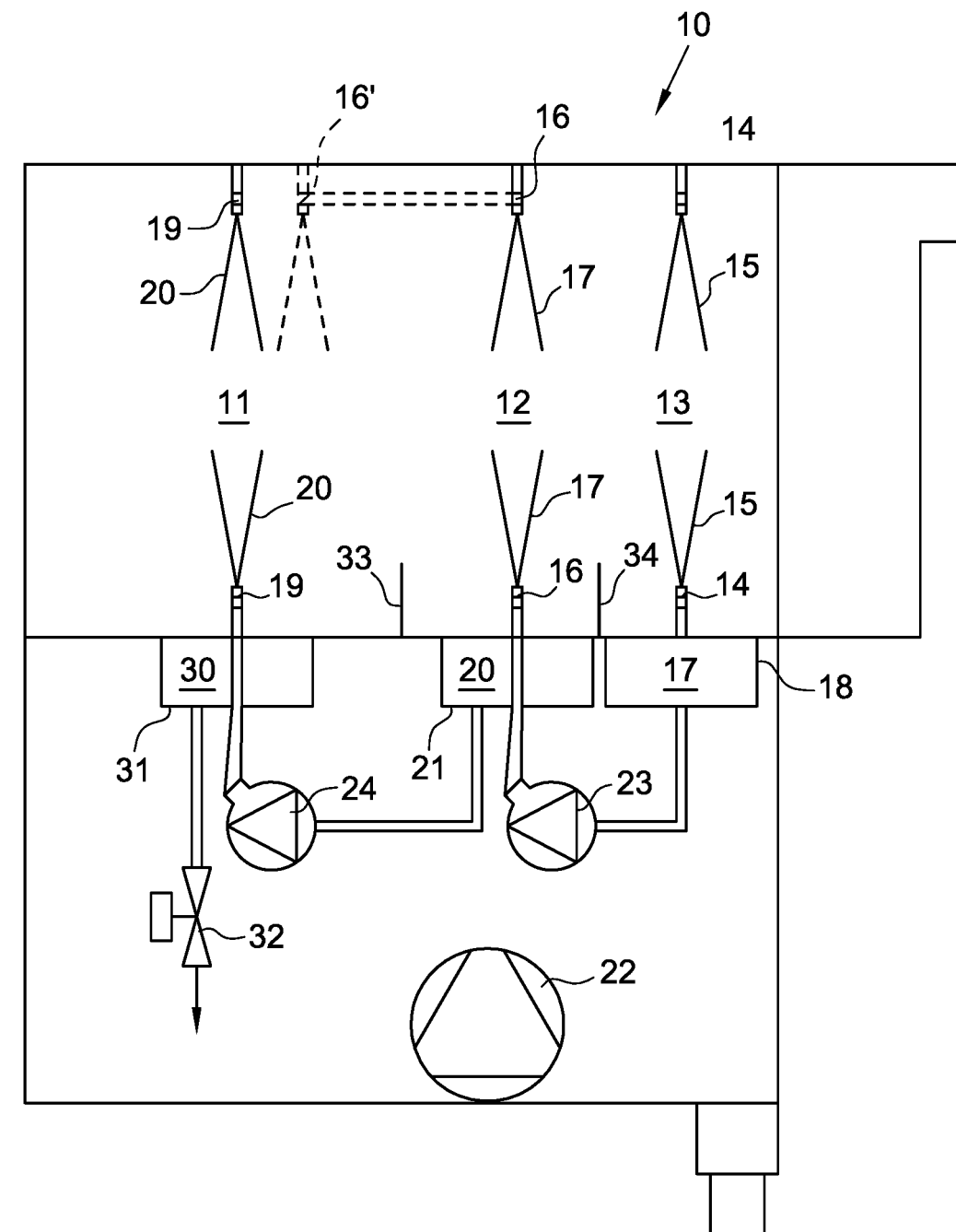


Fig. 3

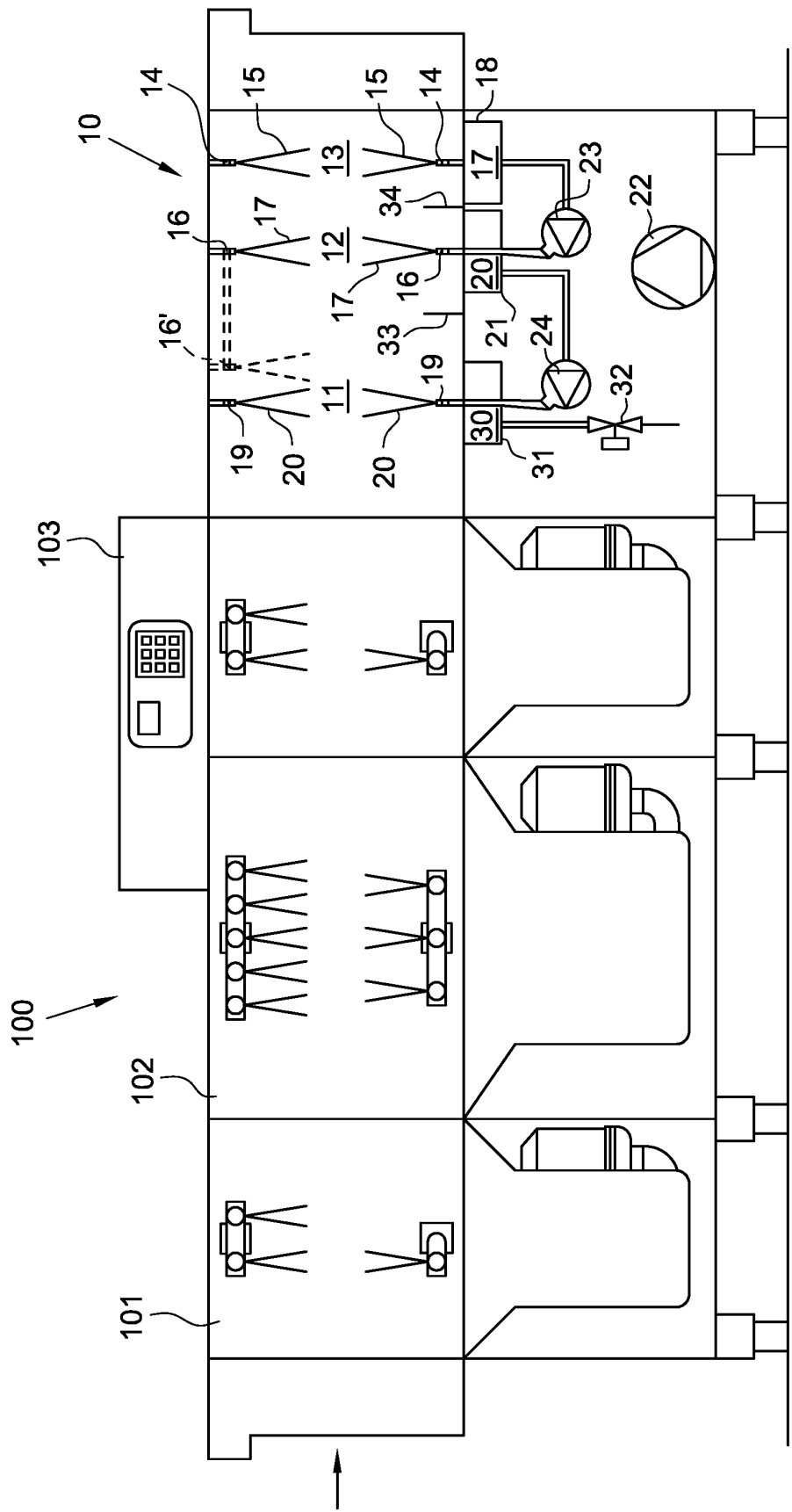


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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