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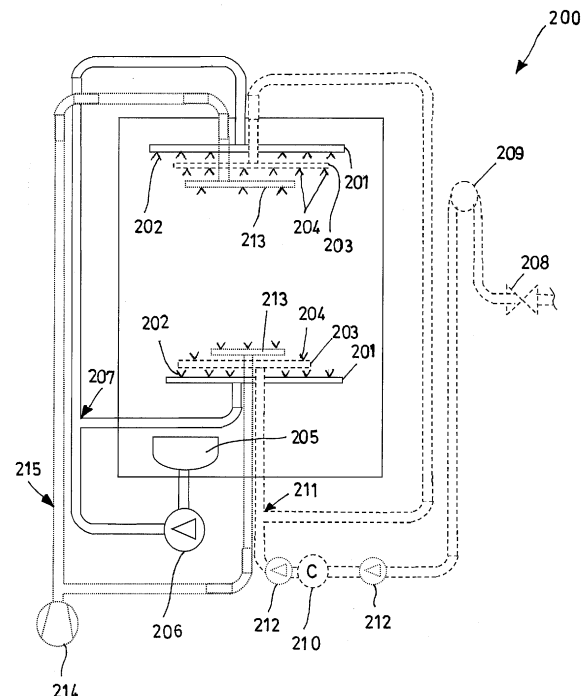
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(54) **METHOD FOR SANITIZING TABLEWARE HAVING LOW WATER CONSUMPTION AND RELATIVE CYCLE OR TUNNEL DISHWASHER**

(57) Cycle dishwasher comprising a plurality of nozzles (202, 204, 213) associated with at least one rotary or fixed arm (201, 203, 213), at least part of said nozzles (202, 204) being supplied through respective supply circuits with a liquid washing solution and a liquid rinsing solution; wherein the dishwasher (200) comprises a device (214) for supplying compressed air for at least part of said nozzles associated with at least a rotary or fixed arm (213) dedicated only to emitting compressed air, in such a way that they are supplied with compressed air in an intermediate time range between said liquid washing supply and said liquid rinsing supply.



**Fig.6**

## Description

**[0001]** The present invention refers to a method for sanitizing tableware in dishwashers for example for collective use of the tunnel or cycle type, wherein the rinsing step can be carried out directly with clean water or possibly preceded by one or more pre-rinsing steps.

**[0002]** The term "tableware" is meant to indicate both plates, cutlery and glasses, as is usually meant, but also pans, containers, trays, kitchen utensils and other similar objects.

**[0003]** Furthermore, for reasons of easy reading, the term "tableware" is also meant to indicate the means that support the aforementioned tableware during the sanitization process inside the dishwasher.

**[0004]** The term "sanitization" is meant to indicate the succession of washing and rinsing steps optionally with a drying step.

**[0005]** The term "cycle" dishwasher is meant to indicate dishwashers in which the tableware does not advance along a path but are sanitized remaining in the same environment.

**[0006]** Usually, there are at least two rotary or fixed arms, one for washing and one for rinsing, where the hydraulic circuits that supply them are separate; the mechanical configuration can, on the other hand, be devised in different shapes, typically with integral or juxtaposed washing/rinsing.

**[0007]** In the case of presence of a single arm the nozzles are separate on the same arm, with hydraulic circuits for washing/rinsing supply, again separate.

**[0008]** The term "tunnel" dishwasher is meant to indicate all dishwashers in which the tableware is moved along a path so as to pass in sequence through a plurality of work stations such as the washing station, where at least one wash and possibly a pre-wash takes place, and the rinsing station, where a final rinse necessarily takes place, possibly preceded by one or more pre-rinsing steps and/or by dripping areas, passive or active.

**[0009]** A schematic example of a cycle dishwasher 200 is illustrated in figure 1 highlighting a first pair of rotary or fixed arms 201 provided with a plurality of nozzles 202, supplied with a liquid washing solution and a second pair of rotary or fixed arms 203 also provided with a plurality of nozzles 204 supplied with a liquid rinsing solution. Every pair of arms is supplied from a respective supply circuit. The washing supply circuit comprises, in addition to the quoted arms, a recirculation tub 205 and a pump 206 and a first set of tubes 207 that connect the washing arms with the pump and the pump itself with the tub.

**[0010]** The rinsing supply circuit comprises, in addition to the quoted arms, a solenoid valve 208 that manages the supply of water from the water mains, a hydraulic nonreturn device 209 downstream of said valve and a boiler 210 downstream of said device. A second set of tubes 211 connects the boiler to such a second pair of arms.

**[0011]** Alternatively, the rinsing circuit can comprise a

pump 212 arranged upstream or downstream of the boiler adapted for carrying liquid under pressure to the nozzles.

**[0012]** Moreover, in the rinsing circuit upstream of the boiler there can be a device for treating the liquid (i.e. a softener).

**[0013]** An example of a known tunnel dishwasher is shown in figure 2 where reference numerals 101, 102, 103 and 104 the pre-washing, first washing and second washing and rinsing stations are indicated.

**[0014]** As can be seen, the rinsing station 104 comprises two sub-stations 105 and 106 inside it, for pre-rinsing and final rinsing, respectively.

**[0015]** As schematised, for a tunnel dishwasher, in order to reduce water consumption in the pre-rinsing step the solution collected in a tub previously used in the final rinsing step is fed.

**[0016]** Such a solution is described for example in patent ITMI20111324 that indeed refers to a tunnel dishwasher.

**[0017]** In such a patent, it is foreseen for the water to be used for pre-rinsing to be, at least in part, the same water used in the previous cycle for rinsing.

**[0018]** In such dishwashers, indeed, there is a tub for collecting the water used for rinsing, i.e. heated mains water possibly with added rinse agent, which is reused on the subsequent tableware in the pre-rinsing step to remove most of the detergent from the tableware before their final rinsing, by means of "new" mains water.

**[0019]** Such a method of re-use in pre-rinsing of the water used previously for rinsing makes it possible to substantially reduce the consumption of mains water and, therefore, also the connected consumption of energy, detergent and rinse aid.

**[0020]** In the case in which there are no problems of length of the dishwasher, inside the rinsing station 104 downstream of the washing station 103 and immediately upstream of the pre-rinsing area 105, a neutral area is foreseen 107, visible in figure 3, useful for dripping "detergent rich" water present at the tableware.

**[0021]** In other words, the tableware before accessing the pre-rinsing area 105 stops, or transits, in such a dripping area 107 where part of the "detergent rich" water present on the tableware is spontaneously released by gravity.

**[0022]** As can be seen in figure 4, it is currently known to equip the aforementioned dripping area with nozzles so that the dripping area 11 is not a passive area but instead is an active feeding area of a dripping solution 20 collected in a dripping tub 21.

**[0023]** In the example shown, such a dripping solution 21 comprises the pre-rinsing solution 17 used in the previous pre-rinsing cycle.

**[0024]** In such an example this active dripping removes part of the washing solution from the tableware.

**[0025]** Currently, it is also known to use compressed air in some treatment steps of tableware, in particular in steps of washing preparation, of drying after final rinsing

or mixing air with the washing or rinsing solutions to increase the mechanical dirt or detergent removal effect.

**[0026]** Starting from the various examples of the prior art described above, the purpose of the present invention is to make an alternative rinsing method with low water consumption both for tunnel dishwashers and for cycle dishwashers.

**[0027]** These purposes according to the present invention are accomplished by arranging a step of feeding compressed air onto the tableware between the washing and final rinsing steps, with the purpose of mechanically removing part of the washing solution (detergent rich water) present on the tableware itself, such a step of feeding compressed air being necessarily between the washing step and the rinsing step, but in any sequence with respect to possible intermediate pre-rinsing and/or dripping steps (passive and/or active).

**[0028]** In particular, in the case of cycle dishwashers such a step is temporally arranged between the washing step and the rinsing step, in tunnel dishwashers such a step is necessarily carried out in a step prior to final rinsing, typically in the dripping area, but possibly also with sequences of a different type, for example by arranging the feeding of compressed air between the pre-rinsing and the final rinsing, always and in any case in a step in which a solution containing detergent is present on the tableware, irrespective of the degree of dilution of the detergent itself.

**[0029]** According to an embodiment of the invention in cycle dishwashers the air supply nozzles can alternatively also be supply with liquid washing and/or rinsing solutions to obtain an active dripping making first air treatment and a second liquid treatment or vice-versa.

**[0030]** Advantageously, in this case the nozzles can also be the same ones for feeding air and liquids or it is possible to foresee two sets of distinct nozzles in which one can only be activated as a function of some washing parameters.

**[0031]** Between the washing and rinsing steps according to the present invention a forced dripping through an air jet is thus inserted that removes the detergent rich water.

**[0032]** Advantageously, by reducing the amount of detergent rich water present on the tableware a smaller amount of water will be needed for final rinsing, as a consequence allowing a reduction in consumption of detergents and energy.

**[0033]** One of the advantages of using the same nozzles for air and liquid is that in the first air feeding step the support arm for the nozzles, when it is of the rotary type, is able to be set in rotation without wasting water that in the first start-up steps of the arm does not reach the predetermined destinations.

**[0034]** In cycle dishwashers, moreover, the presence of an air jet in the dishwasher will additionally make it possible to remove the drops of detergent rich water present on the top of the dishwasher, which can fall onto the already rinsed tableware in a totally random manner.

**[0035]** The characteristics and advantages of a sanitization method for tunnel or cycle dishwashers according to the present invention will become clearer from the following description, given as an example and not for limiting purposes, referring to the attached schematic drawings, in which:

- figure 1 is a schematic view of a cycle dishwasher according to the prior art;
- figures 2, 3 and 4 are schematic views of tunnel dishwashers according to the prior art;
- figure 5 is a schematic view of a rinsing station for tunnel dishwashers according to the present invention;
- figure 6 is a schematic view of a cycle dishwasher according to an embodiment of the present invention;
- figure 7 is a schematic view of a cycle dishwasher according to a further embodiment of the present invention.

**[0036]** The invention refers to a method for sanitizing tableware thus comprising, in sequence, the steps of:

- a) washing the tableware through feeding of a washing solution from washing nozzles;
- b) pre-rinsing the washed tableware;
- c) rinsing the pre-rinsed tableware through feeding of a rinsing solution from rinsing nozzles.

Step b) of pre-rinsing can also be optional.

**[0037]** Of course, the term sanitization is meant to indicate the sequence of washing and rinsing steps of tableware.

**[0038]** According to the invention before the rinsing step, or in the case in which the pre-rinsing step of the washed tableware is present, during such a step or as an alternative to such a step or in addition to such a step, it is foreseen for there to be the step of feeding compressed air in the direction of the tableware.

**[0039]** Such a step thus replaces or integrates the steps of dripping and pre-rinsing with water.

**[0040]** Possibly, the pre-rinsing step can also comprise the step of feeding a pre-rinsing solution as well as air from the same nozzles, so as to carry out alternate air-liquid treatments on the washed tableware.

**[0041]** These steps of pre-rinsing with only air or alternately with air-liquid can carry out the first pre-rinsing, which can be followed by the established second pre-rinsing and the final rinsing or they can follow the pre-rinsing with water and precede the final rinsing.

**[0042]** In the embodiment of figures 1, 6 and 7 the cycle dishwasher has a first pair of rotary arms 201 provided with a plurality of nozzles 202, supplied with a liquid washing solution and a second pair of rotary arms 203 also provided with a plurality of nozzles 204 supplied with a liquid rinsing solution. Each pair of arms is supplied by a respective supply circuit. The washing supply circuit com-

prises, in addition to the aforementioned arms, a recirculation tub 205 and a pump 206 and a first set of tubes 207 that connect the washing arms with the pump and the pump itself with the tub.

[0043] Such a pair of arms is separated so as to have an upper arm close to the top of the dishwasher and one in the lower part. Alternatively, there can be just one arm (upper or lower) instead of a pair, and this can typically occur for example in specialised dishwashers for washing tableware of a particular type, for example machines commonly called "glasswashers" in which the upper washing arm is sometimes not present.

[0044] The rinsing supply circuit comprises, in addition to the quoted arms, a solenoid valve 208 that manages the supply of water from the mains, a hydraulic nonreturn device 209 downstream of said valve and a boiler 210 downstream of said device. A second set of tubes 211 connects the boiler to such a second pair of arms.

[0045] Alternatively, the rinsing circuit can comprise a pump 212 arranged upstream or downstream of the boiler adapted for carrying liquid under pressure to the nozzles.

[0046] Moreover, in the rinsing circuit upstream or downstream of the boiler there can be a liquid treatment device (i.e. a softener).

[0047] According to the present invention the cycle dishwasher is equipped with a device for supplying compressed air.

[0048] Such a device can comprise a third pair of rotary or fixed arms 213 dedicated only to emitting compressed air supplied by suitable compression means 214 of the air itself through a third set of tubes 215, as illustrated in figure 6.

[0049] Alternatively, the rinsing arms and/or the washing arms can be used to emit the compressed air, making the air circulate in the set of rinsing and/or washing tubes through respective three-way valves 216 adapted for connecting such tubes with the compression means 214, as illustrated in figure 7.

[0050] In general, it is possible to use the rinsing and/or washing arms and/or dedicated arms for the air according to any combination to emit compressed air.

[0051] Such compression means 214 can be made through a suitable dedicated compressor, or it is possible to use the motor means already existing in the dishwasher, like for example the motor of the washing pump, the motor of the rinsing pump, the motor of the discharge pump, the motor of the heat recovery or condensate system and the drying motor.

[0052] According to a further alternative of the present invention it is possible to use external compressed air feeding sources. Moreover, it is possible for there to be compressed air storage means, so as to be able to use compressed air at a later time after it is generated.

[0053] In the case of use of single nozzles for all emissions they are supplied with compressed air in an intermediate time range between said washing liquid supply and said rinsing liquid supply.

[0054] Advantageously, in such an embodiment the nozzles are oriented so that the supply of compressed air spontaneously generates the rotation of the rotary arm that supports them.

5 [0055] In a further embodiment for a cycle dishwasher, such a device comprises at least one arm or a pair of rotary or fixed arms dedicated to emitting washing solution, compressed air and rinsing solution in sequence.

10 [0056] Such a method also has an application in tunnel dishwashers that comprise at least one washing module and a rinsing module, which may or may not be multi-stage, for example, dishwashers in which there is no pre-rinsing area (or module) and dishwashers with simple pre-rinsing.

15 [0057] In such tunnel dishwashers the sending of air under pressure on the tableware is sent downstream of such a washing module. Advantageously, such air can be sent through a dedicated module for sending air under pressure, or it is possible to use an area of a pre-rinsing module, like for example a dripping area.

[0058] In the case of dishwashers with multi-stage rinsing module like the one illustrated in fig.5 there are three areas in sequence from upstream to downstream following the path of the tableware, respectively:

- a dripping area 11 of the tableware conveyed full of detergent exiting from the washing module,
- a pre-rinsing area 12 for the dripped tableware, and
- a final rinsing area 13 for the dripped and pre-rinsed tableware.

[0059] According to such a scheme, the final rinsing area 13 is equipped with rinsing nozzles 14 for feeding mains water 15; the pre-rinsing area 12 is equipped with pre-rinsing nozzles 16 for feeding a pre-rinsing solution 17 collected in a pre-rinsing tub 18. The pre-rinsing solution 17 comprises the mains water 15 used in the previous rinsing cycle and the substances removed from the rinsed tableware.

40 [0060] According to this embodiment of the invention, fig.5, the dripping area 11 is equipped with dripping nozzles 19 connected to a device for supplying compressed air 24' and thus such nozzles are used to send air under pressure.

45 [0061] According to a variant, the dripping nozzles are also connected to a dripping tub 21 for feeding a dripping solution 20 comprising the pre-rinsing solution 17 used in the previous pre-rinsing cycle and the substances removed from the pre-rinsed tableware. A valve 25 for selecting the air-dripping solution supply 20 to the dripping nozzles is provided.

50 [0062] In the tunnel embodiment it is possible to foresee heating means 22 of the mains water 15, a pre-rinsing pump 23 connected to the pre-rinsing tub 18 for sending the pre-rinsing solution 17 to the pre-rinsing nozzles 16 and a dripping pump 24 connected to the dripping tub 21 for sending the dripping solution 20 to the dripping nozzles when pressurised air is not being fed.

**[0063]** Reference numeral 16' furthermore shows a further pre-rinsing nozzle that can be supplied with air or liquid and can be activated according to some control parameters of the wash.

**[0064]** It has thus been seen that the rinsing method according to the present invention achieves the purposes highlighted earlier, offering clear advantages both for tunnel dishwashers and for cycle dishwashers.

**[0065]** Of course, all of the variants encompassed by the same inventive concept and all of the details that can replace technically equivalent elements form the object of the present invention.

## Claims

1. A method for sanitizing tableware comprising, in sequence, the steps of:

- a) washing tableware by feeding a washing solution through washing nozzles;
- b) rinsing tableware by feeding a rinsing solution through rinsing nozzles;

### characterised in that

between the two steps of washing and rinsing a step of feeding compressed air on the tableware is carried out.

2. A method according to claim 1, wherein the step of feeding compressed air is carried out necessarily between the washing step and the rinsing one but in any sequence with respect to any intermediate steps of pre-rinsing and/or dripping (passive and/or active) that precede the rinsing step.

3. A method according to claim 1 **characterised in that** said step of feeding compressed air is carried out together with the pre-rinsing step, wherein in addition to compressed air a pre-rinsing solution is fed, so as to perform alternating treatments with air and pre-rinsing liquid on the washed tableware.

4. A cycle dishwasher comprising a plurality of nozzles associated with at least a rotary or fixed arm, at least part of said nozzles being supplied through respective power supply circuits with a liquid washing solution and a liquid rinsing solution; **characterised in that** it comprises a device for supplying compressed air for at least part of said nozzles, in such a way that they are supplied with compressed air in an intermediate time range between said liquid washing supply and said liquid rinsing supply.

5. A cycle dishwasher according to claim 4, comprising a washing supply circuit for these nozzles, a rinsing supply circuit for these nozzles and wherein said compressed air emitting device supply the air in at

least one of said supply circuits.

6. A cycle dishwasher according to claim 4, wherein said dishwasher has rinsing arms, washing arms and arms for the air that can be used to emit compressed air according to any combination thereof.

7. A cycle dishwasher according to claim 4, wherein said device comprises a pair of rotary or fixed arms adapted to emit compressed air and supplied by appropriate air compression means.

8. A cycle dishwasher according to claim 4, wherein said device comprises at least an arm or a pair of rotary or fixed arms adapted to emit, in sequence, the washing solution, compressed air and the rinsing solution.

9. A cycle dishwasher according to claim 4, wherein said device comprises a dedicated compressor, or motor means already present in the dishwasher are used to compress air, such as the motor of the washing pump, the motor of the rinsing pump, the motor of the discharge pump, the motor of the heat recovery or condensate system, the drying motor.

10. A cycle dishwasher according to claim 4, wherein said nozzles are oriented in such a way that said compressed air supply generates spontaneously the rotation of the rotary arm supporting them.

11. A cycle dishwasher according to claim 4, wherein said device uses external compressed air feeding sources.

12. A cycle dishwasher according to claim 4, wherein said device comprises compressed air storage means, in order to use compressed air later after its generation.

13. Tunnel dishwasher comprising at least a washing module and a rinsing module arranged downstream of said washing module, **characterised in that** it comprises an area to convey air under pressure on the tableware, arranged downstream of said washing module and upstream of said rinsing module.

14. Tunnel dishwasher according to claim 13, wherein said area to convey air is realized in a part of a pre-rinsing module.

15. Tunnel dishwasher according to claim 14, wherein said area to convey air under pressure corresponds to a dripping area of said pre-rinsing module.

16. Tunnel dishwasher according to claim 13, wherein said rinsing module is a multi-stage module (10), Fig. 5, of the type comprising three areas in sequence

from upstream to downstream along the path of the tableware, respectively:

- a dripping area (11) for the tableware conveyed in said module (10) full of detergent exiting from the washing module, 5
- a pre-rinsing area (12) for said dripped tableware, and
- a final rinsing area (13) for said dripped and pre-rinsed tableware; 10

said final rinsing area (13) being provided with rinsing nozzles (14) for feeding mains water (15),  
 said pre-rinsing area (12) being provided with pre-rinsing nozzles (16) for feeding a pre-rinsing solution (17) collected in a pre-rinsing tub (18), said pre-rinsing solution (17) comprising the mains water (15) used in the previous rinsing cycle and the substances removed from the rinsed tableware, 15  
 said dripping area (11) being provided with dripping nozzles (19); 20  
 said tunnel dishwasher being **characterised in that** it comprises a device (24') for supplying compressed air to said dripping nozzles. 25

17. Tunnel dishwasher according to claim 13 **characterised in that** said dripping nozzles are also connected to a dripping tub (21) for feeding a dripping solution (20) comprising said pre-rinsing solution (17) used in the previous pre-rinsing cycle and the substances removed from the pre-rinsed tableware; 30  
 a valve (25) for selecting the air-dripping solution supply (20) towards said dripping nozzles being provided. 35

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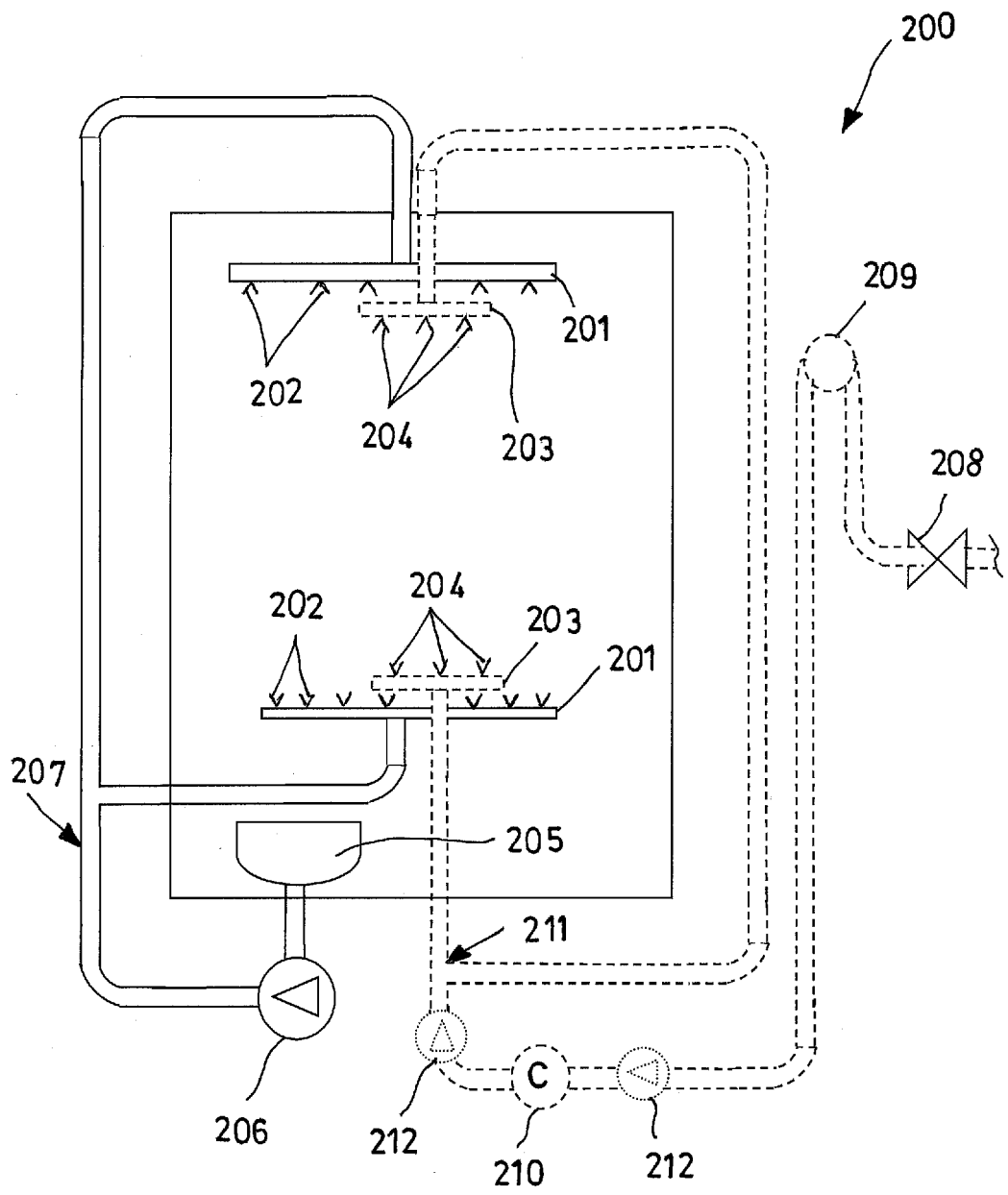


Fig.1

Fig.2  
PRIOR ART

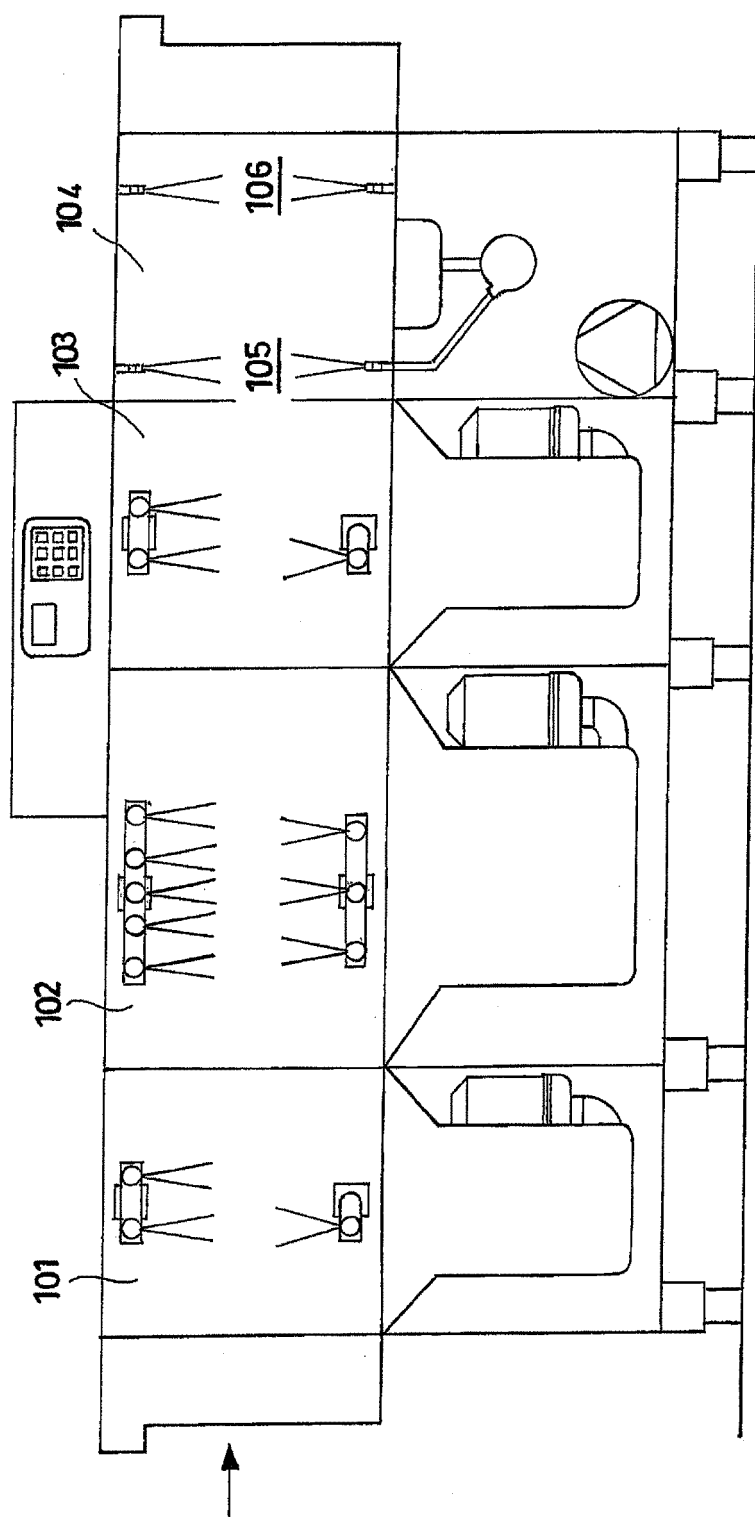




Fig.3

PRIOR ART

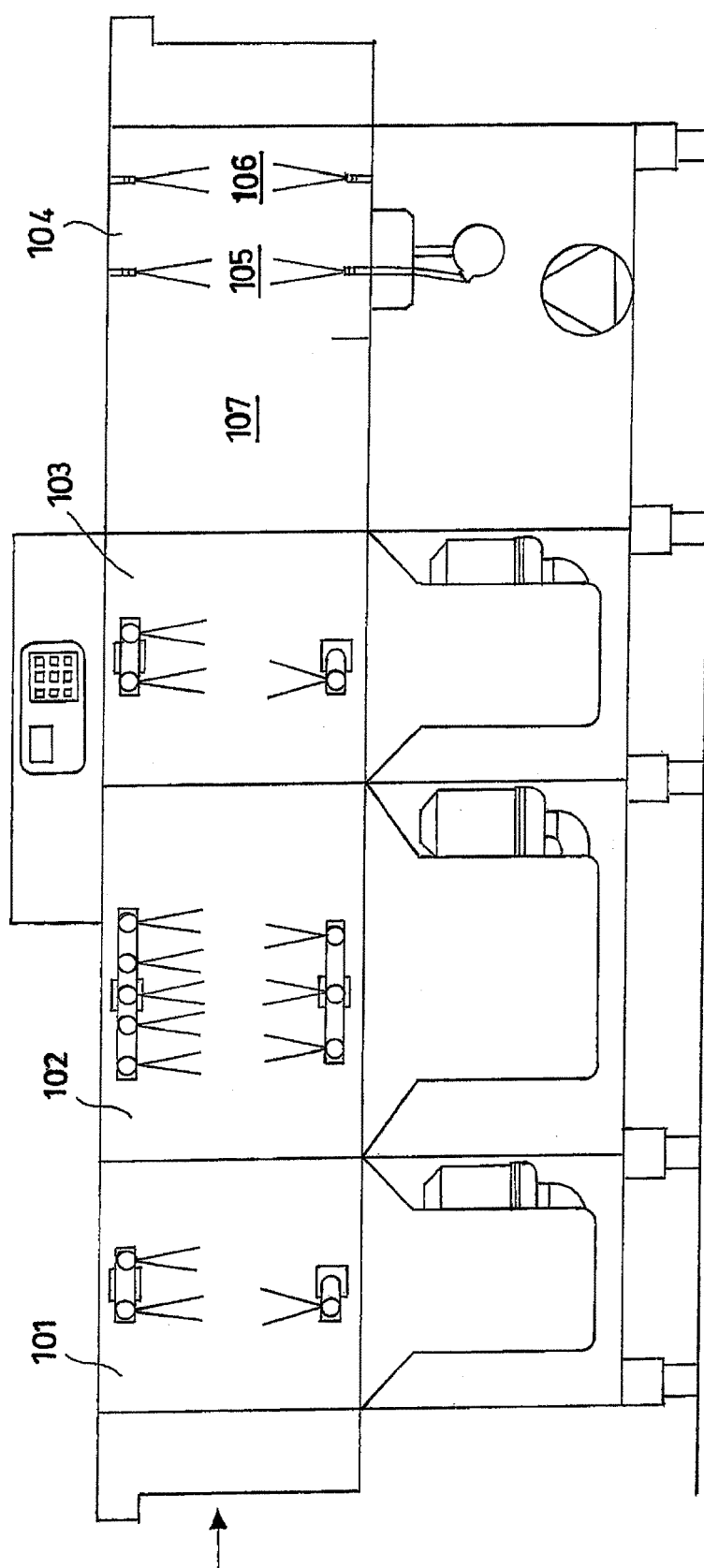


Fig.4

PRIOR ART

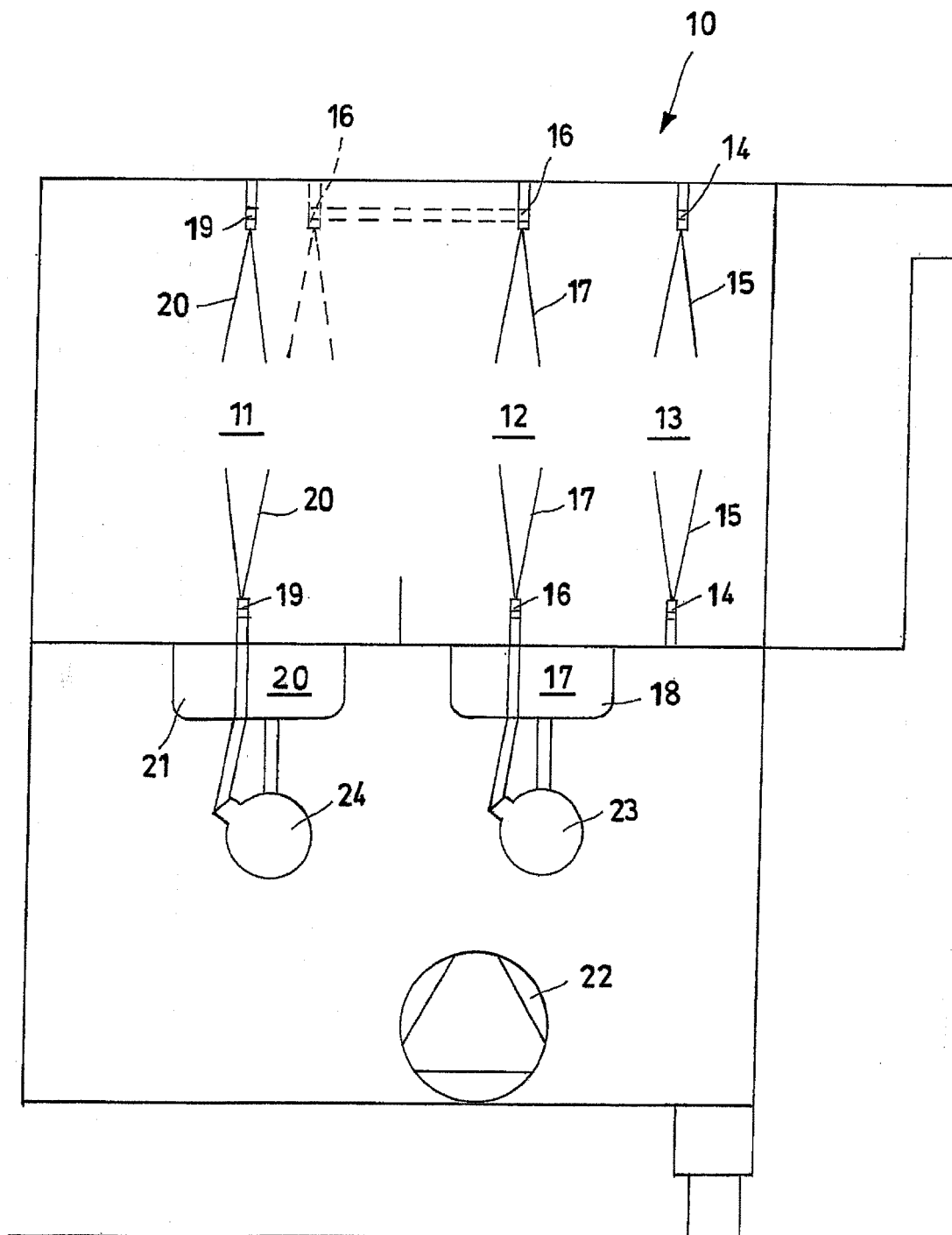
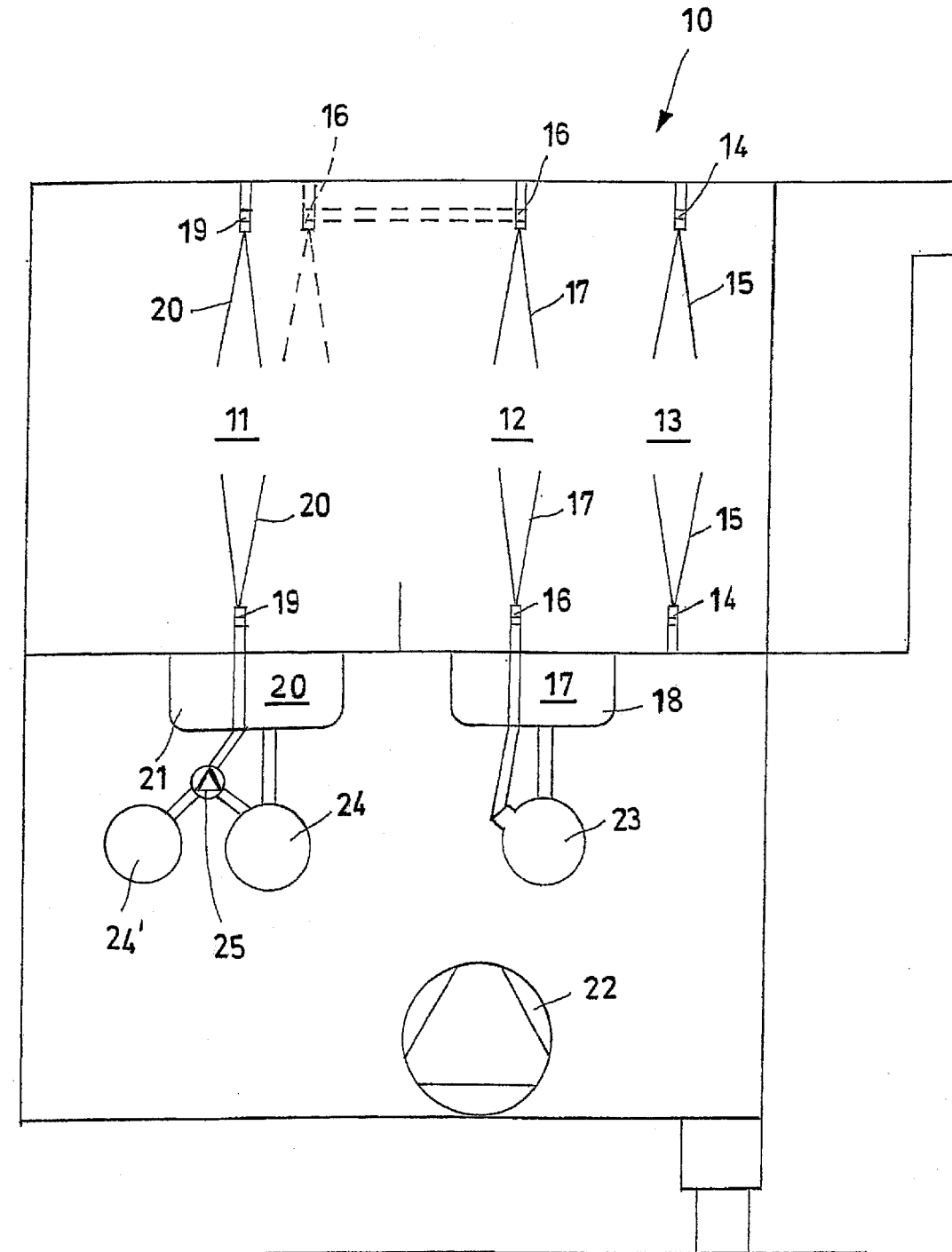


Fig.5



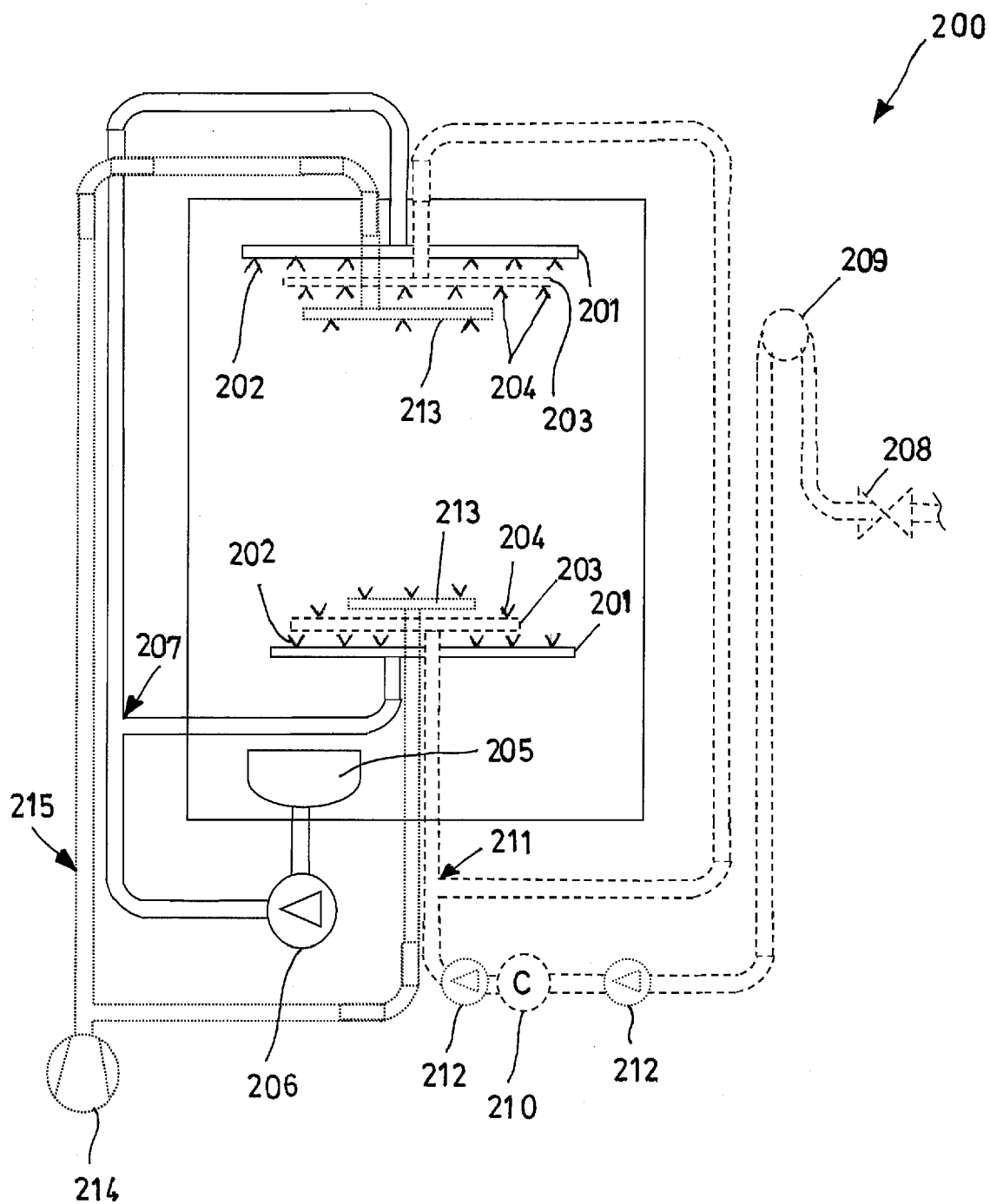


Fig.6

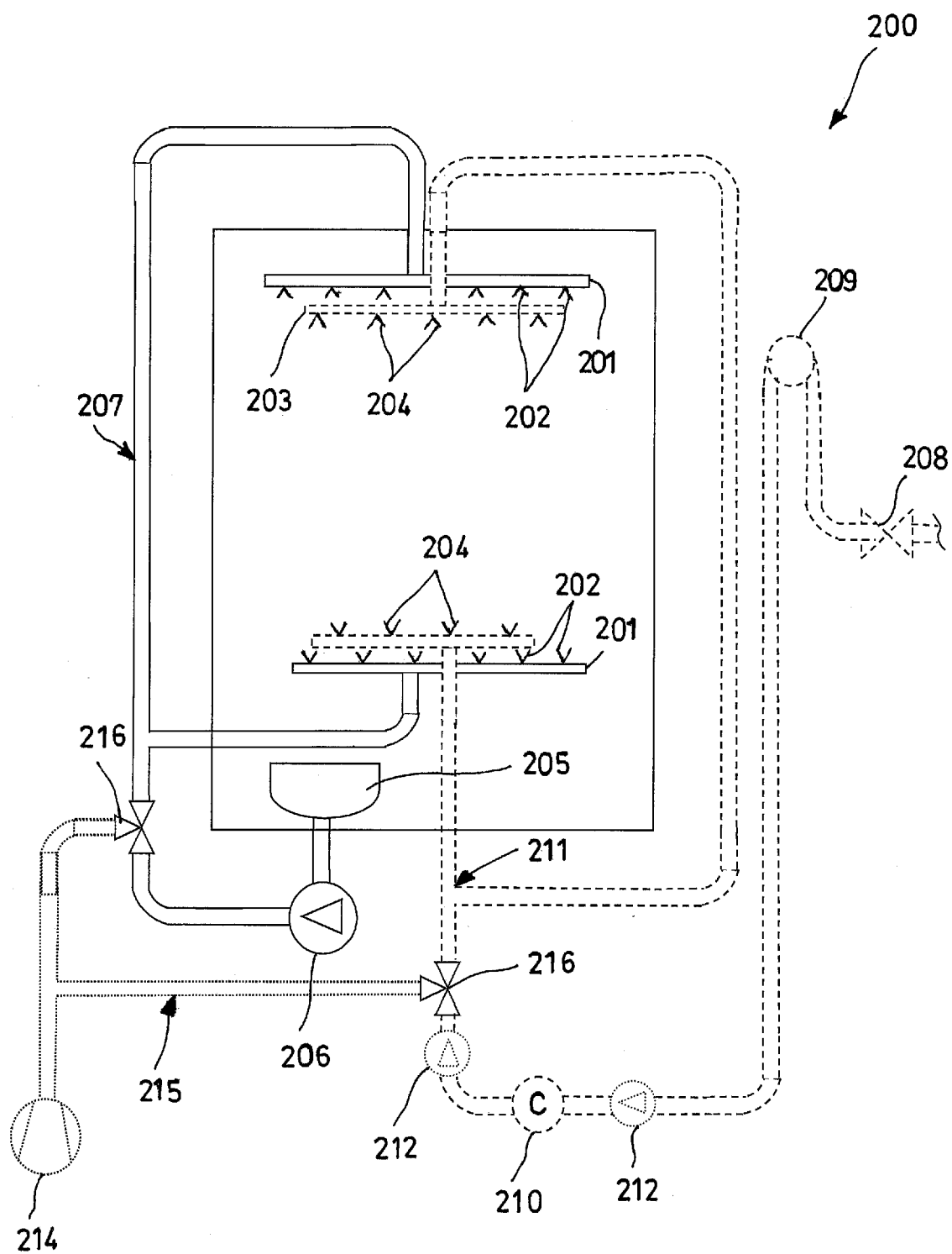


Fig.7



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