(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 818 089 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
31.12.2014 Bulletin 2015/01

(51) Int Cl.:
A47L 15/24 *(2006.01)* ***A47L 15/42*** *(2006.01)*

(21) Application number: **14425076.8**

(22) Date of filing: **18.06.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **26.06.2013 IT VI20130162**

(71) Applicant: **ALI S.p.A.-div. DIHR**
20123 Milano (IT)

(72) Inventors:
- **Spinetti, Alberto**
  20123 Milano MI (IT)
- **Pasqualotto, Stefano**
  20123 Milano MI (IT)

(74) Representative: **Santi, Filippo et al**
Barzanò & Zanardo Roma S.p.A.
Via Piemonte 26
00187 Roma (IT)

(54) **Conveyor type dishwasher machine**

(57) A conveyor type dishwashing machine comprising a rinsing zone (R) of the dishes, at least one pre-rinsing zone (PR), at least one collection tank (VR1, VR2) arranged below at least one rinsing zone (R) and/or one pre-rinsing zone (PR), one or more washing zones (L1) of the dishes, equipped with respective washing tanks (V1), and a drying zone, in which water is evaporated from the dishes through a stream of hot air coming from the outside and conveyed in a zone where the dishes pass through; the collection tanks (VR1, VR2) and the washing tanks (V1) are communicating with each other through a decanting system and are filled with liquid one after the other, while a portion of liquid contained within at least one of the collection tanks (VR1, VR2) is sent to a heat exchanger (7) of the drying zone and from here into the pre-washing area (L2) or directly into the discharge conduit (SC) of the dishwashing machine.

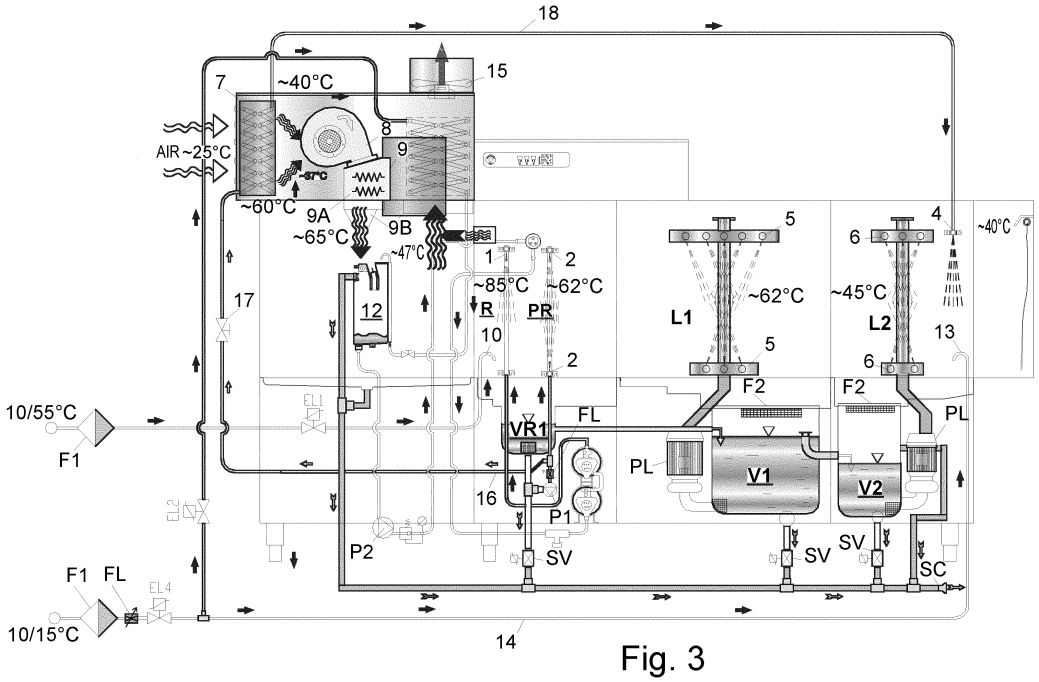

Fig. 3

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Description

[0001] The present invention generally relates to a conveyor type dishwashing machine (also known as a "tunnel dishwasher").

[0002] More particularly, the invention relates to a professional and/or industrial conveyor type dishwashing machine (to be used, for example, in restaurants, hotels, nursing homes, hospitals, etc.), in which the objects to be washed go through some areas sequentially, said areas being constituted by one or more pre-washing zones, one or more washing zones, one or more rinse zones and one or more drying zones.

[0003] The known professional dishwashers usually employ one or more washing nozzles, which are arranged within a washing chamber or tank and which are connected to some pumps for supplying the water coming from the water plant, one or more fixed, sliding or rotating baskets or shelves for placing the tools to be washed and one or more removable trays, which contain detergents, rinse agents and/or other cleaning and/or sanitizing agents.

[0004] As outlined in the diagram of figure 1 attached hereto, which shows a schematic drawing of a known conveyor type dishwashing machine, the potable water is loaded in the pre-washing tanks L2, in the washing tanks L1 and in the rinsing tanks R, starting from the rinsing zone R where the injector 10 is placed.

[0005] The water goes through the rinsing zone, the pre-rinsing tanks VR1, the washing tanks V1 and the pre-washing tanks V2 by means a decanting system. Practically, the injector 10 fills the pre-rinsing tank VR1 and when the water has reached a certain level within the pre-rinsing tank VR1 begins to fill the washing tank V1; when two or more washing tanks are provided, said washing tanks, being connected by means of said decanting system, are filled one after the other up to the cold pre-washing tank V2.

[0006] Similarly to the above mentioned loading of the different tanks, during the dishwasher operation, water decanting occurs in a direction opposite to the direction of transport of the dishes; said decanting phase allows for regenerating the washing tank V1 and the pre-washing tank V2 with the water introduced into the dishwasher in the rinsing zone R.

[0007] With reference to figures 1 and 2, which show two embodiments of a known dishwashing machine, the dishes that are put into the dishwasher firstly go through a cold pre-washing area or zone L2 having a washing tank V2, within which said dishes are wet, by means of the washing pump PL and the arms 6, with a recirculation liquid (water) at a temperature of about 45°C.

[0008] It is preferred to maintain said maximum value of temperature to avoid that food residues, as for example the cheese, stick to the dishes, then making it difficult to remove them; in fact, said pre-washing phase is performed when it is expected that the above mentioned food residues can remain on dishes. Following the above mentioned liquid decanting phase, the liquid (water) coming from the washing zones (for example L1), which is at a temperature above 45°C and which therefore raises the temperature of the liquid contained in the pre-washing tank V2, regularly flows into the cold pre-washing tank V2, which is equipped with a surface filter F2.

[0009] Therefore, according to the prior art, in order to keep the temperature to values lower than 45°C, low temperature water, which is supplied from the mains, is entered, for example through the injector 13, into the dishwasher by means of suitable mains filters F1, solenoid valves EL1, EL2, EL4, and flow switches FL.

[0010] Afterwards, the dishes are conveyed into one or more washing areas or zones L1, each equipped with a special tank V1 with a surface filter F2, where they are wet, through the washing pump PL and by means of the arms 5, with recirculation liquid (water) in which a cleansing substance is added; in the washing zones L1 the temperature of the liquid is always preferably greater than 50°C.

[0011] The dishes are then passed through a rinsing area or zone R, where the cleansing substance or detergent is removed; the rinsing phase takes place by wetting the dishes, by means of the pre-rinsing pump P1 and a possible rinsing pump (which can be a proportional-type pump) P2 (which takes water from an intermediate or break tank 12) and by means of the arms 2 of a first pre-rinsing phase, the possible arms 3 of a second pre-rinsing phase and the arms 1 of a final rinsing phase. The pre-rinsing arms 2, 3 are fed with a recirculation liquid coming from the tank VR1 of the pre-rinsing area PR, while the rinsing arms 1 are fed with mains water with added rinsing agent at a temperature of about 85°C.

[0012] It is also possible to perform a phase according to which the dishes are entered into a drying area or zone, whose purpose is to evaporate the water from the dishes through a stream of hot air also coming from the outside and conveyed into the drying zone by means of a fan 8 and a housing 9 equipped with heating elements or resistors 9a and a hopper 9b.

[0013] As described above, the liquid decanting steps which occur between the different tanks, while allowing to regenerate the contents of the washing tanks V1 and of the pre-washing tanks V2, involve the need to add detergent to an extent proportional to the amount of liquid which is fed into the tank; in any case, the right compromise between the need to regenerate the tanks V1, V2 and the need to save detergent is already achieved by providing to send, according to known embodiments, a portion of the liquid collected in the rinsing tank VR1 (at a temperature of about 60°C) into the pre-washing tank V2, through the nozzle 4 and without letting said liquid portion to enter into the washing tanks V1.

[0014] Furthermore, if the pre-washing area L2 is not present, the liquid is sent into the discharge conduit SC, possibly by means of the discharge valve SV or through a drain pump.

[0015] In any case, as previously mentioned, as a re-

sult of the liquid decanting steps which take place between the tanks, in order to allow the liquid to regenerate, the liquid coming from the washing tanks, at a temperature above 45°C in order to raise the temperature of the liquid contained in the pre-washing tank, continuously flows into the cold pre-washing tank.

[0016] Since, as mentioned, the pre-washing liquid has to maintain a temperature below 45°C, in order to make an efficient removal of food residues, low temperature water coming from the water mains is usually entered, through a special injector, into the pre-washing zone. The above procedure, however, causes a considerable consumption of water, which, combined with the significant consumption of electric energy which is necessary for supplying the drying system, determines an obvious drawback for an efficient use of the dishwashing machine.

[0017] An object of the present invention is therefore to overcome the above mentioned known drawbacks and, in particular, a primary object of the invention is to provide a conveyor type dishwashing machine, which allows for washing a wide variety of dishes with low consumptions of energy, water and cleansing agents. Another object of the present invention is to provide a conveyor type dishwashing machine, which is particularly efficient and reliable, as well as functioning in compliance with environmental and energy rules.

[0018] These and other objects, which will be more clear along the course of the description, are achieved by a conveyor type dishwashing machine with low consumptions of energy, water, detergents and rinsing agents, according to the attached claim 1; other technical features of the invention are set forth in more detail in the dependent claims.

[0019] Advantageously, the conveyor type dishwashing machine, which is the object of the present invention, allows to efficiently wash the dishes and has, at the same time, very low consumptions of water, electric energy and cleansing agents, with respect to the known conveyor type dishwashing machines which are still in use. Furthermore, the dishwashing machine according to the invention has a very low consumption of water and energy, with respect to the prior art, for equal loading and washing cycles, and still obtains a good washing result, thanks to the extended time action of the water and the cleansing agents or detergents.

[0020] The above aims and advantages, as well as other aims and advantages, will be more clear from the following description, which refers to preferred embodiments of the conveyor type dishwashing machine of the invention, and from the attached drawings, in which:

- figure 1 is a schematic view of a first embodiment of a conveyor type dishwashing machine, according to the prior art;
- figure 2 is a schematic view of a second embodiment of a conveyor type dishwashing machine, according to the prior art;
- figure 3 is a schematic view of a first embodiment of a conveyor type dishwashing machine, according to the present invention;
- figure 4 is a schematic view of another embodiment of a conveyor type dishwashing machine, according to the present invention.

[0021] Firstly, it should be noted that reference numbers that are used in figures 3 and 4 are the same reference numbers of figures 1 and 2 if referred to elements having the same structure and the same function.

[0022] With particular reference to figure 3, which refers to a first embodiment of the conveyor type dishwashing machine according to the present invention, said machine comprises:

- one or more rinsing zones R, where the final rinsing arms 1 are provided for wetting the dishes with clean water added to rinsing or cleansing agents, at a temperature of about 85°C, through the pump P2 and the injector 10, which, in a filling phase of the tanks, enter clean water from the water mains, at a temperature ranging between 5°C and 80°C, via the mains filter F1 and the solenoid valve EL1;
- one or more pre-rinsing zones PR, where the pre-rinsing arms 2 are provided for wetting the dishes with recirculation liquid (water + brighteners + detergent residues), at a temperature of about 62°C;
- a collection tank VR1, positioned below the rinsing zone R and the pre-rinsing zone PR and below the respective arms 1, 2;
- one or more washing zones L1, equipped with respective washing tanks V1 having a surface filter F2, where the washing arms 5 are provided for wetting the dishes with recirculation liquid which is added to a detergent, at a temperature higher than 50°C (and equal to about 62°C), and which comes from the respective tank V1 and sent to the arms 5 via a related pump PL;
- one or more pre-washing zones L2, equipped with a respective tank V2, where the dishes are wet, through the arms 6, with recirculation liquid coming from the tank V2 and sent to the arms 6 via a related pump PL, at a maximum temperature of 45°C;
- one or more drying zones for drying the dishes, which are eventually provided with a suction or blower 15, whose purpose is to evaporate the water from the dishes through a stream of hot air (at a temperature of about 65°C) coming from the outside and conveyed in the area where the dishes pass through, by means of a fan 8 and of a housing 9 equipped with heating elements or resistors 9a and and with a hopper 9b.

[0023] The water passes from the rinsing zones R into the different tanks VR1, V1 and V2 through a decanting system, so that said tanks being filled one after the other up to the pre-washing tank V2; in the same manner, dur-

ing operation of the dishwashing machine, a liquid decanting occurs in a direction opposite to the passage direction of the dishes, so as to regenerate the washing tank V1 and the pre-washing tank V2 with the water used during the rinsing phase.

[0024] According to an alternative embodiment of the dishwashing machine of the present invention (which is shown in the attached figure 4), it is possible to add a further pre-rinsing zone PR, with pre-rinsing arms 3 and a respective collection tank VR2, which uses, for rinsing the dishes, the pressure of the pump P1, which thus supplies simultaneously the pre-rinsing arms 2 and the pre-rinsing arms 3.

[0025] In this case, the additional pre-rinsing zone or area PR that uses the arms 3 can have an upstream subdivider or tap 11, which provides for delivering a determined amount of liquid to the arms 3; moreover, always using the above mentioned decanting system, the liquid which is contained into the tank VR2 (water + rinsing agents + detergent residues) may be added, in the washing tank V1, to the liquid coming from the tank VR1, as well as can be directly sent into the discharge conduit SC.

[0026] The liquid decanting phase between tanks VR1, VR2, V1, V2, while allowing to regenerate the washing tanks V1 and the pre-washing tanks V2, involve the need to add detergent to an extent proportional to the amount of the liquid which is fed into the tanks; therefore, in order to reach a compromise between the need to regenerate the tanks V1, V2 and to save detergent, a liquid portion contained in the tank VR1 (at a temperature of about 60°C) is sent into the pre-washing tank V2 through the injector 4, without said liquid is sent to the washing tanks V1.

[0027] Said liquid portion to be sent into the pre-washing tank V2 is carried out as follows: the pump P1, equipped with a relative flow switch FL, which feeds the pre-rinsing arms 2 (and possibly the additional arms 3), has a further supply branch or duct 16, possibly equipped with a restrictor 17, which is able to reduce the liquid amount suitable for regenerating the different washing tanks V1 and pre-washing tanks V2, by sending part of the liquid contained in the tank VR1 into the pre-washing area or zone L2 and, therefore, into the pre-washing tank V2, via the conduit 18 and the injector 4 (such a detergent saving system is known as "detergent economizer" or "ecodet"); furthermore, if the pre-washing area or zone L2 is not present, the liquid contained in the branch 16 and in the duct 18 is sent to the discharge conduit SC.

[0028] According to the present invention, the liquid in excess in pre-rinsing area PR, which comes from the collection tanks VR1 and/or VR2, depending on the configuration of the rinsing zone R, and which is sent into the branch 16, is used to pre-heat the incoming air in the dishes drying zone or area; therefore, the liquid in excess, before arriving into the duct 18, into the injector 4 or into the discharge conduit SC, is sent over a heat exchanger 7 and transfers the heat to the air (coming also from the outside and then conveyed to the fan 8 and heated by the resistors 9a), which is used for drying.

[0029] Therefore, in addition to the energy benefit due to the fact that the air is pre-heated, a reduction in temperature of the liquid that is sent into the duct 18 is also performed, so that when said liquid is sent into the pre-washing tank V2 (if said pre-washing tank V2 exists), through the injector 4, it does not increase the temperature of the liquid sprayed by the arms 6, thus avoiding the known cooling technique which is performed by means of the injector 13 and the duct or conduit 14 that is directly connected with the water mains at a temperature of about 5/15°C.

[0030] The fact that the liquid is at a temperature as low as possible in the pre-washing area L2 is a considerable advantage, as it avoids, as mentioned, the addition of cooling water and the connection of the pre-washing area L2 to the water mains.

[0031] The advantage is therefore double, as you get both a pre-heating of the incoming air in the drying zone and a reduction in temperature of the water which is sent sent in the discharge conduit SC or in the pre-washing area L2.

[0032] The above mentioned technical solution also allows to achieve many other advantages, such as to provide a soaking cold, entering the liquid coming from the heat exchanger 7 into the collection tank V2 of the pre-washing area L2 through the injector 4.

[0033] Moreover, the drying air taken from the outside, when it exits from the heat exchanger 7, is also dehumidified before being sucked by the fan 8.

[0034] Finally, the power of the resistors 9a can be significantly decreased, with respect to the prior art, since the air sucked by the fan 8 is already pre-heated.

[0035] Based on the foregoing, it is understood, therefore, that the conveyor type dishwashing machine according to the present invention achieves the objects and realizes the advantages which are previously mentioned.

[0036] Finally, it is clear that, during execution, the dishwashing machine according to the invention may be subjected to modifications and/or variations without departing from the scope of the appended claims, as well as it is clear that in the practical implementation of the invention, materials, shapes and dimensions of the technical details can be any, depending on requirements, and may be replaced with other technically equivalent.

[0037] Where the characteristics and techniques mentioned in the following claims are followed by reference numbers or signs, those reference signs have been introduced with the sole purpose of increasing the intelligibility of the claims themselves and, consequently, they do not have any limiting effect regarding the interpretation of each element, which is identified, only by way of example, by means of said reference signs.

Claims

1. A conveyor type or tunnel type dishwashing machine comprising

   - at least one rinsing zone (R), where one or more rinsing arms (1) are placed, which spray the dishes with water optionally added to rinsing agents,
   - at least one pre-rinsing zone (PR), where one or more pre-rinsing arms (2, 3) are placed, which spray the dishes with re-circulating liquid containing rinsing agents and detergent residues and by means of a first pump (PI),
   - at least one collection tank (VR1, VR2), which is placed below at least one of said rinsing and pre-rinsing arms (1, 2, 3),
   - one or more washing zones (L1), with respective one or more washing tanks (V1), where one or more washing arms (5) are placed, which spray the dishes with re-circulating liquid, coming from a respective washing tank (V1), which is added to detergent and which is sent to said washing arms (5) by means of a further respective pump (PL),
   - at least one drying zone, configured to evaporate water from the dishes through a flow of hot air coming from the outside and conveyed in a transition zone of said dishes,
   - said at least one collection tank (VR1, VR2) and said one or more washing tanks (V1) being connected one with each other through a decanting system, so that said tanks are filled with liquid one after the other, starting from said at least one collection tank (VR1, VR2) of said rinsing and pre-rinsing zones, **characterized in that** said first pump (PI), which is connected to said pre-rinsing arms (2, 3), has a first flow duct (16), equipped with at least one valve or throttle (17), inside of which a portion of liquid contained within said at least one collection tank (VR1, VR2) flows, said portion of liquid being sent to a heat exchanger (7) of the drying zone and from here inside a second flow duct (18), which flows in a pre-washing zone (L2) or in correspondence of a discharge conduit (SC) of said dishwashing machine.

2. A dishwashing machine according to claim 1, **characterized in that** at least one pre-washing zone (L2) having a respective pre-washing tank (V2) where the dishes are wet is provided upstream of said at least one washing zone (L1), said dishes being wet or sprayed by means of one or more pre-washing arms (6), with recirculating liquid coming from said pre-washing tank (V2) and sent to said pre-washing arms (6) by means of said further respective pump (PL).

3. A dishwashing machine according to at least one of the preceding claims, **characterized in that** said second flow duct (18) has an end injector (4), placed inside said pre-washing zone (L2), so that said portion of liquid is directly injected inside said pre-washing tank (V2), without passages in the washing tanks (V1).

4. A dishwashing machine according to at least one of the preceding claims, **characterized in that** said portion of liquid flowing in said heat exchanger (7) gives up heat to the air coming from the outside, which is even conveyed to a fan (8) and heated by one or more resistors (9a) of said drying zone.

5. A dishwashing machine according to at least one of the preceding claims, **characterized in that** a liquid decanting phase occurs between said tanks (VR1, VR2, V1, V2) in a direction which is opposite to the direction of transport of the dishes, so as to regenerate the washing and pre-washing tanks (V1, V2) by means of water fed into the dishwashing machine in the rinsing zone (R).

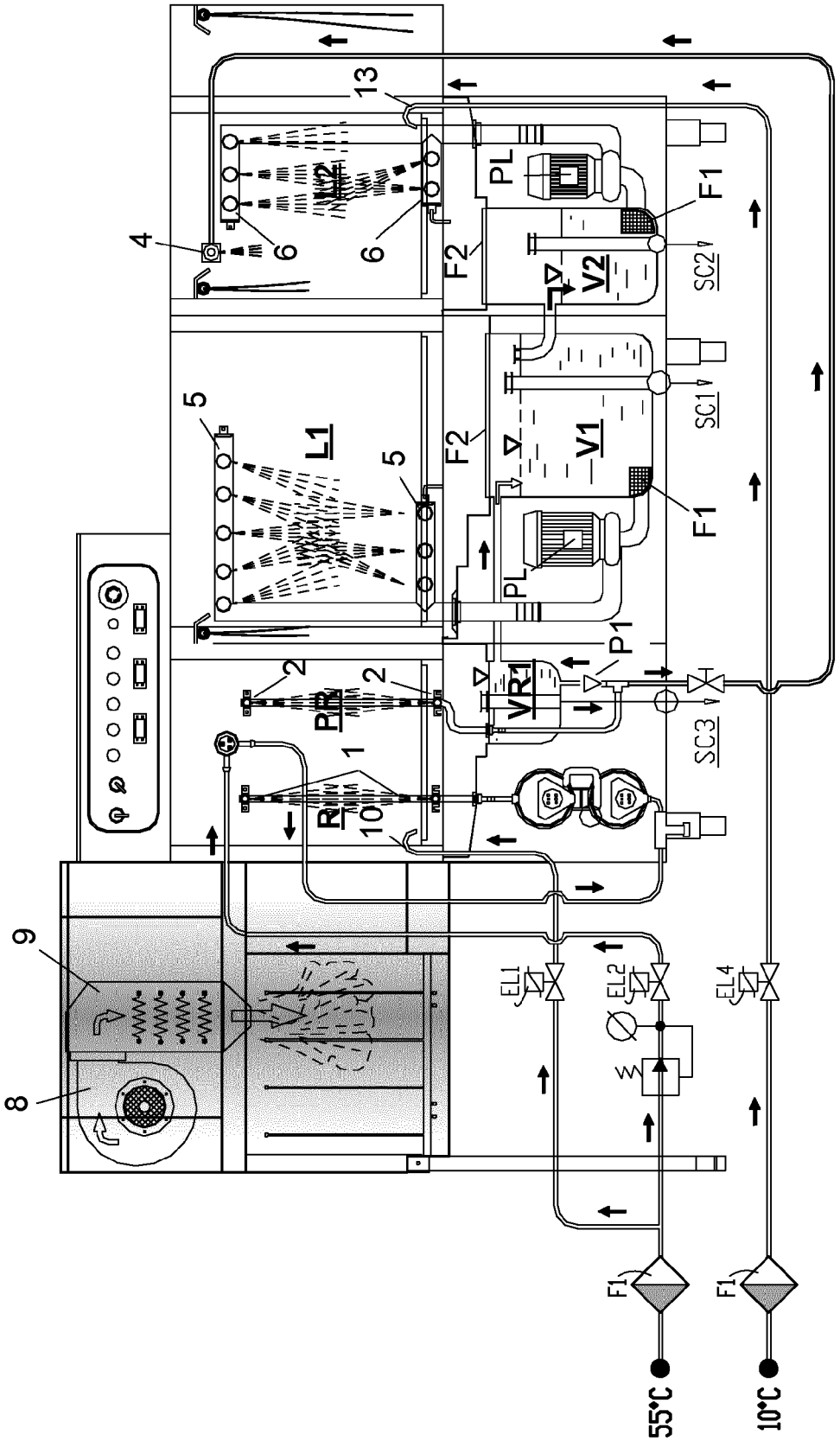
6. A dishwashing machine according to at least one of the preceding claims, **characterized in that** two pre-rinsing zones (PR) are provided, each of said pre-rinsing zones (PR) having one or more pre-rinsing arms (2, 3) and a respective collection tank (VR1, VR2) and each of said pre-rinsing zones (PR) using said first pump (PI).

7. A dishwashing machine according to at least one of the preceding claims, **characterized in that** at least one first pre-rinsing zone (PR) has an upstream tap (11), able to determine the amount of liquid to be sent to the pre-rinsing arms (3) of said first zone.

8. A dishwashing machine according to at least one of the preceding claims, **characterized in that** at least one of said collection tanks (VR1, VR2) communicates with said washing tanks (V1).

9. A dishwashing machine according to at least one of the preceding claims, **characterized in that** at least one of said collection tanks (VR1, VR2) is directly connected to a discharge conduit (SC) of the dishwashing machine.

10. A dishwashing machine according to at least one of the preceding claims, **characterized in that** said fan (8) of the drying zone is connected to a housing or casing (9), equipped with said resistors (9a), and to a hopper (9b), said drying zone also comprising at least one fumes and/or one suction or blower (15).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R2
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Fig. 1

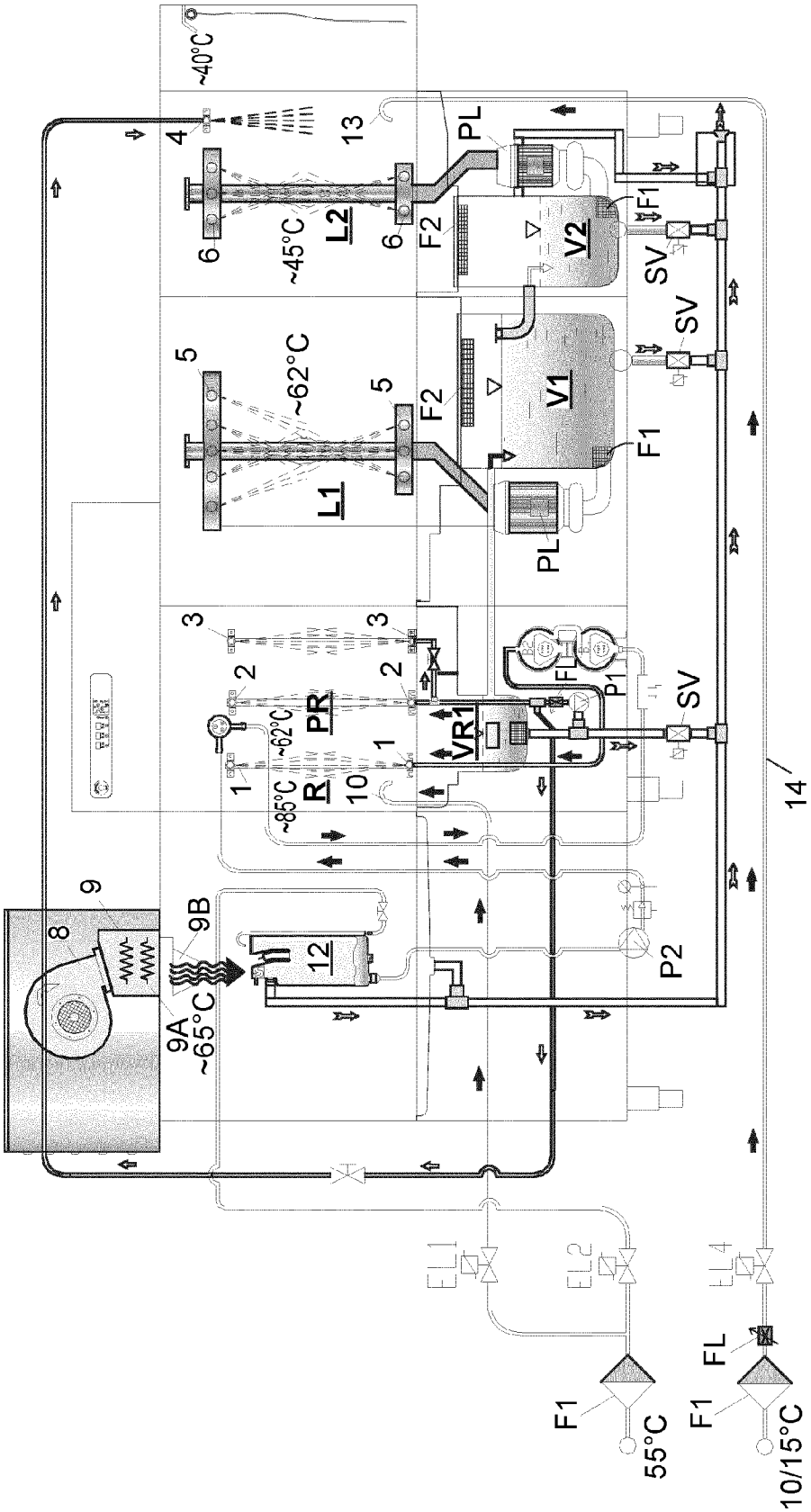
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Fig. 2

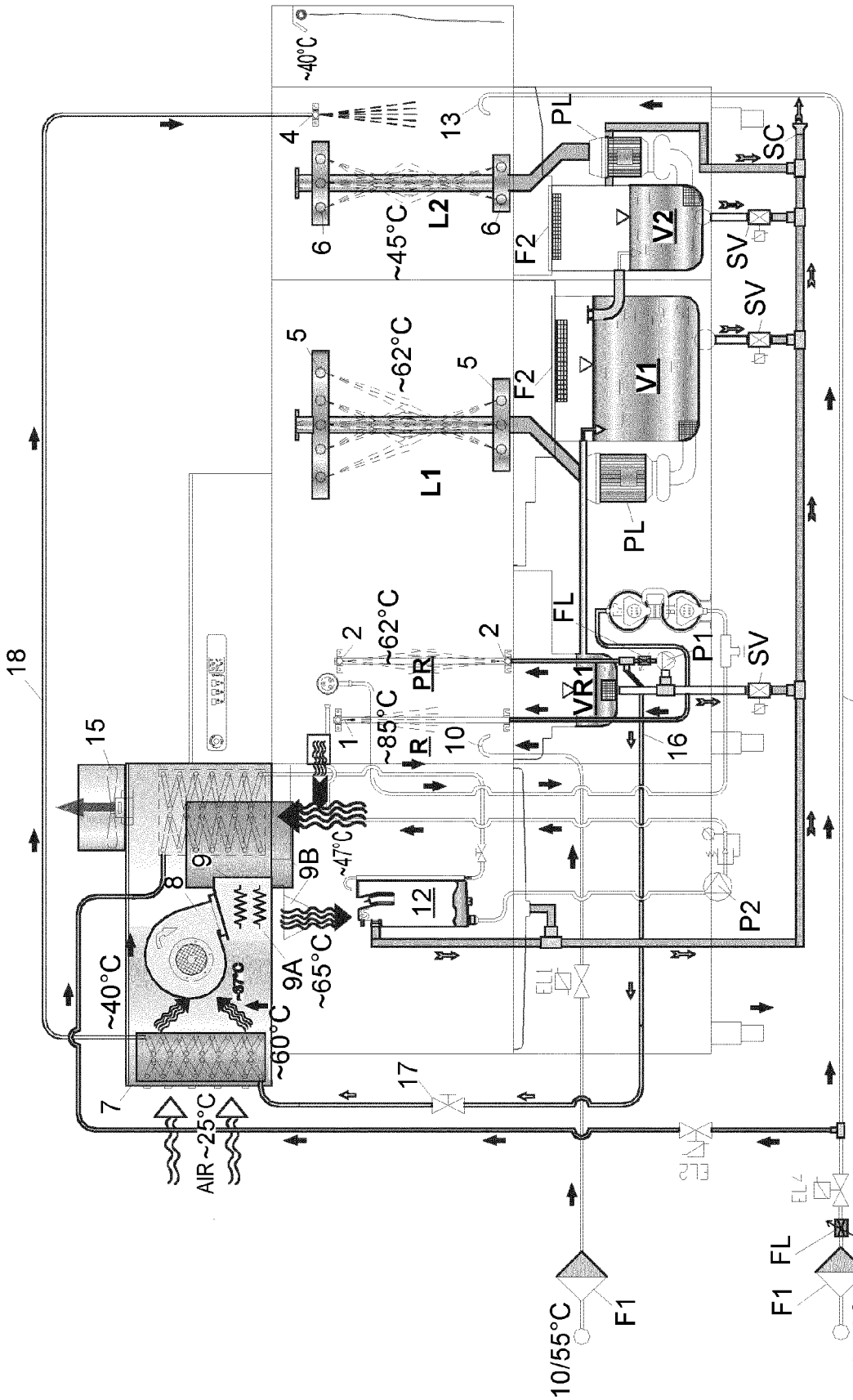
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Fig. 3

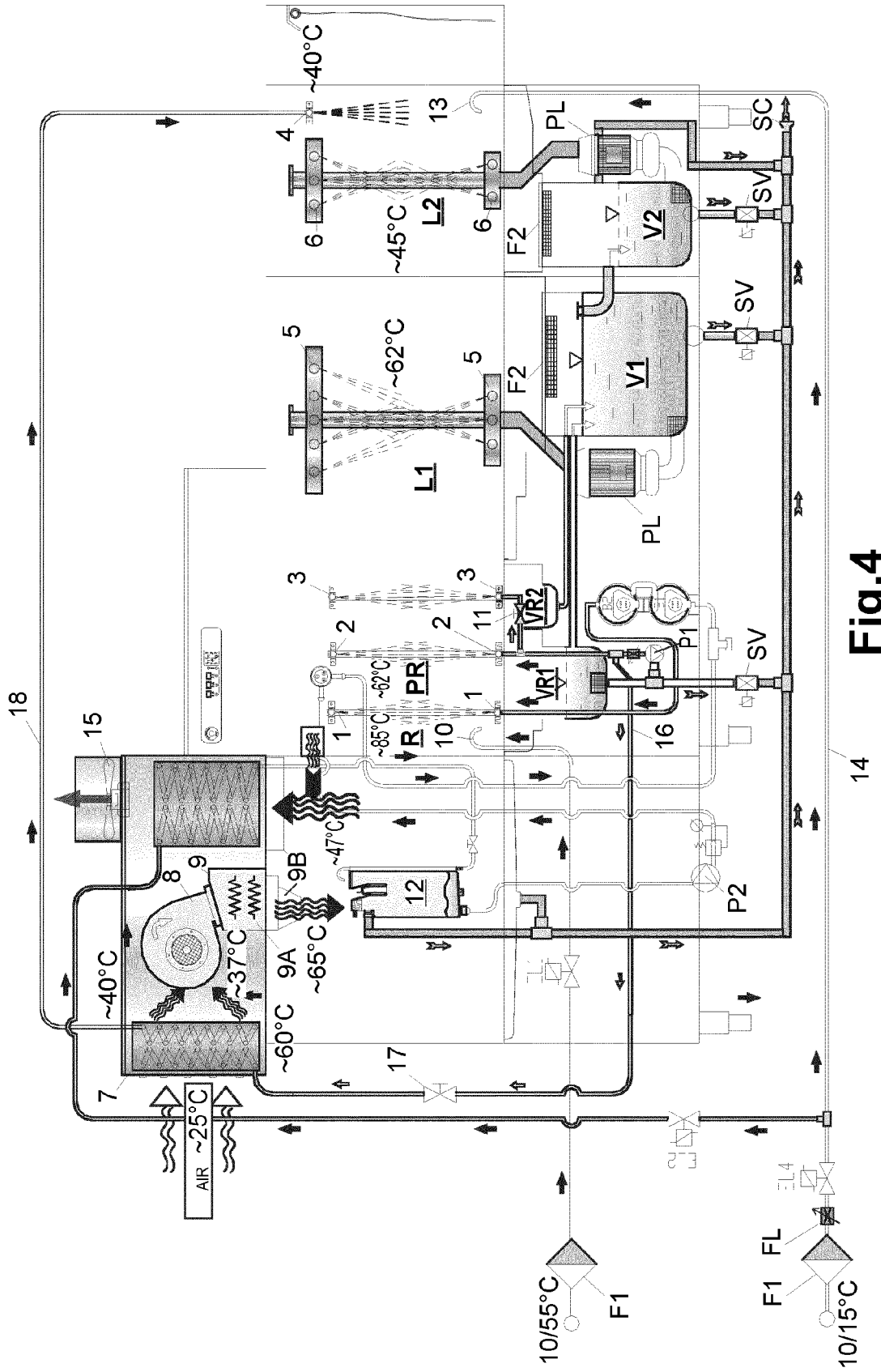
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Fig.4

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EUROPEAN SEARCH REPORT

Application Number
EP 14 42 5076

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 10 2011 083179 A1 (PREMARK FEG LLC [US]) 7 February 2013 (2013-02-07) * the whole document *	1-10	INV. A47L15/24 A47L15/42
A	DE 10 2007 006787 A1 (MEIKO MASCHINENBAU GMBH & CO [DE]) 14 August 2008 (2008-08-14) * the whole document *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 September 2014	Jezierski, Krzysztof

CATEGORY OF CITED DOCUMENTS

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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