



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**23.08.2000 Bulletin 2000/34**

(51) Int Cl.7: **A47L 15/42**

(21) Application number: **99830076.8**

(22) Date of filing: **15.02.1999**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE**  
Designated Extension States:  
**AL LT LV MK RO SI**

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(54) **A dishwasher with a radiant heater**

(57) A dishwasher comprises a washing chamber (3) formed in a machine body (2), a pump (12) for the washing water, means (9, 10) for spraying the washing water, a delivery duct (14) for putting the pump (12) into fluid communication with the spray means (9, 10), and

heating means (18, 19, 20, 21) disposed inside the washing chamber (3). Advantageously, a portion (15) of the delivery duct (14) is disposed inside the washing chamber and heating means are associated with the portion (15) of the delivery duct (14) in order to heat it.

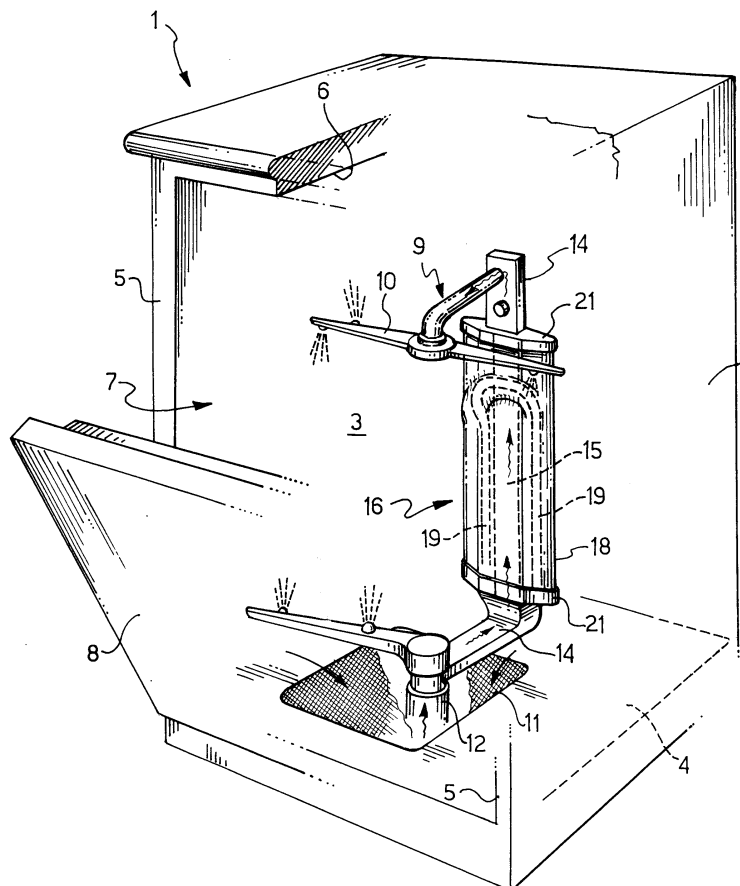


FIG.1

## Description

**[0001]** The present invention relates to a dishwasher comprising a washing chamber formed in a machine body, a pump for the washing water, means for spraying the washing water, a delivery pipe for putting the pump into fluid communication with the spray means, and heating means disposed inside the washing chamber.

**[0002]** As is known, dishwashers have heating means which are switched on both during washing, in order to heat the washing water, and during the subsequent crockery-drying stage.

**[0003]** The requirement to be satisfied is for a capability to heat the water during the washing stage and, in particular, to heat the air during the subsequent drying stage. In particular, there is a much-felt need to perform the drying stage whilst avoiding, as far as possible, the need to use motor-driven suction or pressure fans which lead to an increase in the cost of the dishwasher as well as increasing its structural complexity.

**[0004]** The aforesaid heating means are constituted, in most cases, by shielded electrical resistors which are disposed in a serpentine arrangement inside the washing chamber and, more precisely, in its base. It is appropriate to point out that, in order to supply the required amount of heat during washing and during the subsequent crockery-drying stage, it is necessary to use electrical resistors of considerable length. The resistors therefore extend over the greater part of the surface of the washing-chamber base.

**[0005]** The above-mentioned solution of arranging the electrical resistors in view, in the base of the washing chamber, has many disadvantages. First of all, the surfaces of the resistors pick up dirt particles which, once dried, produce undesirable odours. It should be borne in mind that it is not at all easy to clean the resistors.

**[0006]** Moreover, the considerable extent of the heating element inside the washing chamber has a barrier effect on the flow of washing water towards the underlying collection tray, creating imbalances in the recycling of the washing water under pressure.

**[0007]** Lastly, but certainly not of least importance, the location of the heating elements close to the base of the tank is dangerous because of the burns which they may cause even to a proficient and careful user of the dishwasher. This is due to the residual temperature of the heating elements which remains high for a prolonged period of time after the completion of the operating cycle of the machine.

**[0008]** To prevent the aforementioned problems, it has been proposed to locate the heating means outside the washing chamber. However, this solution is not satisfactory, since it causes a greater loss of heat towards the exterior of the dishwasher and increases drying problems. With reference to this latter aspect, it should in fact be pointed out that the location of heating elements outside the washing chamber requires the use of motor-driven suction or pressure fans in order to elimi-

nate steam from the washing chamber.

**[0009]** The problem upon which the present invention is based is that of devising a dishwasher which has structural and functional characteristics such as to satisfy the aforementioned requirements and, at the same time, to prevent the problems referred to with reference to the dishwashers of the prior art.

**[0010]** This problem is solved by a dishwasher according to Claim 1.

**[0011]** Further characteristics and the advantages of the dishwasher according to the invention will become clear from the following description of some preferred embodiments thereof, given by way of non-limiting example with reference to the appended drawings, in which:

Figure 1 is a simplified perspective view of a dishwasher according to the invention,

Figure 2 is a lateral section of the radiant heater of the dishwasher of Figure 1,

Figure 3 is a partially-sectioned, perspective view of the radiant heater of the machine of Figure 1,

Figure 4 is a partially-sectioned, perspective view of a variant of the radiant heater of Figure 3,

Figure 5 is a lateral section of a further variant of the radiant heater of Figure 3, and

Figure 6 is a front view showing the radiant heater of Figure 5, in section.

**[0012]** With reference to Figures 1 to 3, a dishwasher according to the invention is generally indicated 1.

**[0013]** The dishwasher 1 comprises a machine body 2 inside which there is a washing chamber 3. The washing chamber 3 is defined by a base 4, by an upper wall 6, and by side walls 5. In wholly conventional manner, the washing chamber 3 and the body 2 of the dishwasher 1 have a front opening 7 in which there is a door 8, the opening of which affords access to the interior of the washing chamber 3 for the insertion or removal of the crockery.

**[0014]** The washing chamber houses removable baskets (not shown in the drawing) in which the crockery is placed.

**[0015]** The dishwasher 1 comprises means, disposed inside the washing chamber, for spraying washing water. In particular, the dishwasher 1 has upper spray means 9 disposed in the upper portion of the washing chamber 3, that is, close to the upper wall 6.

**[0016]** In the embodiment shown, the upper spray means 9 are constituted by rotary arms 10 having a plurality of nozzles through which the washing and rinsing water is supplied.

**[0017]** The washing water supplied by the spray means is collected by gravity in a collection tray 11 located beneath the base 4 of the washing chamber 3. For this purpose, the base 4 is shaped so as to direct the water towards the collection tray 11 and has suitable holes through which the water can pass.

**[0018]** The dishwasher 1 comprises a pump 12 which sends the washing or rinsing water, under pressure, through delivery ducts, to the spray means. According to the operating cycle provided for, the pump 12 may be supplied with water from the water mains or, alternatively, may draw water from the collection tank 11.

**[0019]** In the embodiment shown, the dishwasher 1 comprises a delivery duct 14 which puts the pump 12 into fluid communication with the upper spray means 9.

**[0020]** The delivery duct 14 comprises a portion 15 which extends vertically from the base 4, inside the washing chamber 3. For the reasons which will become clearer from the following description, it should be pointed out that the portion 15 of the delivery duct 14 extends close to a wall 5 of the washing chamber 3, more precisely, to the wall opposite the front opening 7.

**[0021]** The dishwasher 1 has heating means 16 which are located inside the washing chamber 3 and are associated with the portion 15 of the delivery duct 14 so as to heat it. As a result, the heating means 16 therefore extend close to the wall 5 of the washing chamber 3 opposite the front opening 7.

**[0022]** According to a preferred embodiment shown in Figure 3, the heating means comprise an outer casing 18 defining, around the aforesaid portion 15 of the delivery duct 14, a chamber in which the heating elements 19 extend.

**[0023]** This chamber defined by the outer casing 18 houses a thermally-conductive material, for example aluminium, which promotes the transmission of heat from the heating elements 19 to the portion 15 of the delivery duct 14 and to the outer casing 18.

**[0024]** The above-mentioned chamber is preferably filled with a thermally-conductive material. In the embodiment shown, the chamber is filled with an aluminium casting 20 in which the heating elements 19 and the portion 15 of the delivery duct 14 are embedded. Alternatively, the chamber may be filled with thermally-conductive material, for example, in the form of small balls.

**[0025]** To enable the heat to spread effectively inside the washing chamber 3, the outer casing 18 is preferably made of a thermally-conductive material, for example, a metal. In view of the problems of encrustation and corrosion to which the outer casing 18 is exposed in the washing chamber 3, this casing may advantageously be made of stainless steel.

**[0026]** In this connection, it should be stressed that the entire surface of the outer casing 18 is in contact with the aluminium casting 20 so that, in operation, the entire surface of the outer casing 18 is at the same temperature.

**[0027]** To prevent corrosion of the aluminium casting 20, the two opposite head ends of the chamber defined by the outer casing 18 are closed by respective end elements 21.

**[0028]** In the embodiment shown, the heating elements 19 comprise shielded electrical resistors having tubular cross-sections and shaped so as to have a ser-

pentine arrangement. The ends of the electrical resistors advantageously project from the base 4 of the washing chamber 3 so that they can easily be supplied.

**[0029]** Purely by way of example, the electrical resistors used have a power of 15-20 W/cm<sup>2</sup> and their length, that is, the length of the serpentine arrangement, is determined in dependence on the thermal power required during the washing and drying stages.

**[0030]** According to the thermal power required during the various stages of operation of the dishwasher 1, instead of using a single electrical resistor, it is possible to use several electrical resistors to be switched on individually or simultaneously.

**[0031]** The outer casing 18 advantageously extends parallel to the aforementioned wall 5 of the washing chamber 3 so as to have a substantially flattened shape which reduces to the minimum the space which it occupies inside the washing chamber 3.

**[0032]** In this connection, it should be pointed out that, by suitably increasing the extent of the surface of the heating means, that is, of the outer casing 18, it is possible to increase the active radiant surface area, even during the drying stage.

**[0033]** The aforementioned flattened shape of the heating means prevents the above-mentioned problem of the barrier effect on the flow of washing water directed towards the collection tray mentioned with reference to dishwashers of the prior art.

**[0034]** The outer surface of the casing 18 is advantageously smooth so as to promote running of the water drops thereon. In this connection, it should be made clear that the water sprayed by the spray means forms a constant thin layer of water on the outer surface of the casing 18. The formation of this thin layer of water achieves the dual advantage of speeding up the recovery of the water in the underlying collection tray 11 and of further heating the washing water.

**[0035]** The outer casing 18 may be made of various materials, the use of epoxy resins, for example, being advantageous for some uses.

**[0036]** The delivery duct 14 is generally made of plastics material, since it suffices for only its portion 15 which is embedded in the aluminium casting 20 to be made of metal or other thermally-conductive material. The aforesaid portion 15 is preferably made of an corrosion-resistant material such as stainless steel.

**[0037]** The unit comprising the outer casing 18, the end elements 21, the heating elements 19, and the aluminium casting 20 forms an instantaneous radiant heater 16 which can heat the water contained in the portion 15 of the delivery duct 14. The radiant heater 16 also enables all of the heat produced by the heating elements 19 to be released into the washing chamber 3. The radiant heater 16 can consequently advantageously be used for generating all of the heat required during the crockery-drying stage.

**[0038]** In this connection, it should be pointed out that, by suitably increasing the surface area of the radiant

heater 16, that is, by increasing its thermal power, it is possible to dry the crockery without the need necessarily to provide for the presence of motor-driven suction or pressure fans.

**[0039]** Clearly, in a dishwasher 1 in which there is no provision for a crockery-drying stage, less thermal power is required from the radiant heater 16 which can consequently be smaller.

**[0040]** The location of the heating element close to the wall 5 of the washing chamber 3 opposite the front opening 7 is particularly advantageous. In fact, it prevents a user of the dishwasher 1 from having any contact with the element during the normal operations to insert crockery in the removable baskets of the washing chamber 3 or to remove crockery therefrom, avoiding the danger of burns.

**[0041]** The location of the heating elements inside the aluminium casting 20 prevents malodorous deposits from forming thereon and avoids exposure of the heating elements to surface attack by calcareous solutions which, over time, give rise to surface encrustation of the resistors. It need hardly be pointed out that such encrustations reduce the thermal efficiency of the resistors and cause known phenomena of local overheating of the heating element which compromises its useful life.

**[0042]** Figure 4 shows a variant of the radiant heater 16. In this embodiment, the radiant heater has no outer casing 18, the casting 22 of thermally-conductive material being exposed directly to the atmosphere of the washing chamber 3. In this embodiment also, the heating elements 19 and the portion 15 of the delivery duct 14 are embedded in a protected position inside the casting 22 of thermally-conductive material.

**[0043]** Figures 5 and 6 show a different variant of the radiant heater of the dishwasher 1. This embodiment is simpler and less expensive than the previous embodiments, being particularly suitable for the production of more economical dishwashers or those in which there is no provision for the additional stage for drying the crockery by means of resistors supplied dry. In this case, the outer casing of the radiant heater is constituted directly by a portion 23 of the delivery duct 14 which extends vertically from the base 4, inside the washing chamber 3. As can be seen from Figure 6, the portion 23 has a larger surface area than the rest of the delivery duct 14 and is shaped so as to have a substantially flattened shape.

**[0044]** The heating elements 19 extend inside the above-mentioned portion 23 of the delivery duct 14 so as to be in direct contact with the washing water.

**[0045]** As can be appreciated from the foregoing description, the dishwasher according to the invention satisfies the above-mentioned requirements and prevents the problems referred to with reference to the dishwashers of the prior art.

**[0046]** Naturally, in order to satisfy contingent and specific requirements, an expert in the art may apply to the above-described dishwasher many modifications

and variations all of which, however, are included within the scope of protection of the invention as defined by the following claims.

## Claims

1. A dishwasher comprising a washing chamber (3) formed in a machine body (2), a pump (12) for the washing water, means (9, 10) for spraying the washing water, a delivery duct (14) for putting the pump (12) into fluid communication with the spray means (9, 10), and heating means (18, 19, 20, 21) disposed inside the washing chamber (3), characterised in that at least a portion (15) of the delivery duct (14) is disposed inside the washing chamber (3) and the heating means are associated with said portion (15) of the delivery duct (14) in order to heat it.
2. A dishwasher according to Claim 1, in which the heating means comprise an outer casing (18) defining a chamber around said portion (15) of the delivery duct (14), heating elements (19) being fitted in the chamber.
3. A dishwasher according to Claim 2, in which the chamber contains a thermally-conductive material for promoting the transmission of heat from the heating elements (19) to said portion (15) of the delivery duct (14) and to the outer casing (18).
4. A dishwasher according to Claim 3, in which the chamber is filled by a casting (20) of thermally-conductive material, the heating elements (19) and said portion (15) of the delivery duct (14) being embedded in the casting (20).
5. A dishwasher according to Claim 3 or Claim 4, in which the thermally-conductive material is aluminium.
6. A dishwasher according to Claim 2, in which the outer casing (18) is made of metal.
7. A dishwasher according to Claim 6, in which the outer casing (18) is made of stainless steel.
8. A dishwasher according to Claim 2, in which the outer casing (18) is made of epoxy resin.
9. A dishwasher according to Claim 1, in which the heating means comprise heating elements disposed close to said portion (15) of the delivery duct (14), the heating elements (18) and said portion (15) of the delivery duct (14) being embedded in a casting (20) of thermally-conductive material.

10. A dishwasher according to Claim 1, in which the heating means comprise heating elements (19) extending inside said portion (15) of the delivery duct (14), which is positioned inside the washing chamber (3). 5
11. A dishwasher according to Claim 2, Claim 9 or Claim 10, in which said portion (15) of the delivery duct (14) is made of metal. 10
12. A dishwasher according to Claim 2, Claim 9 or Claim 10, in which the heating elements (19) comprise at least one electrical resistor extending in a serpentine arrangement. 15
13. A dishwasher according to Claim 12, in which the ends of the at least one serpentine electrical resistor project from the base (4) of the washing chamber (3). 20
14. A dishwasher according to Claim 1, in which the heating means have a substantially flattened shape.
15. A dishwasher according to Claim 1, in which the heating means are positioned close to a wall (5) of the washing chamber (3). 25
16. A dishwasher according to Claim 15, in which the washing chamber (3) comprises a front opening (7) and the heating means are positioned close to the wall of the washing chamber (3) opposite the front opening (7). 30
17. A dishwasher according to Claim 1, in which the means (9, 10) for spraying the washing water are located in the upper portion of the washing chamber (3), and in which the delivery duct (14) extends vertically from the base (4) of the washing chamber (3), close to a wall (5) thereof. 35  
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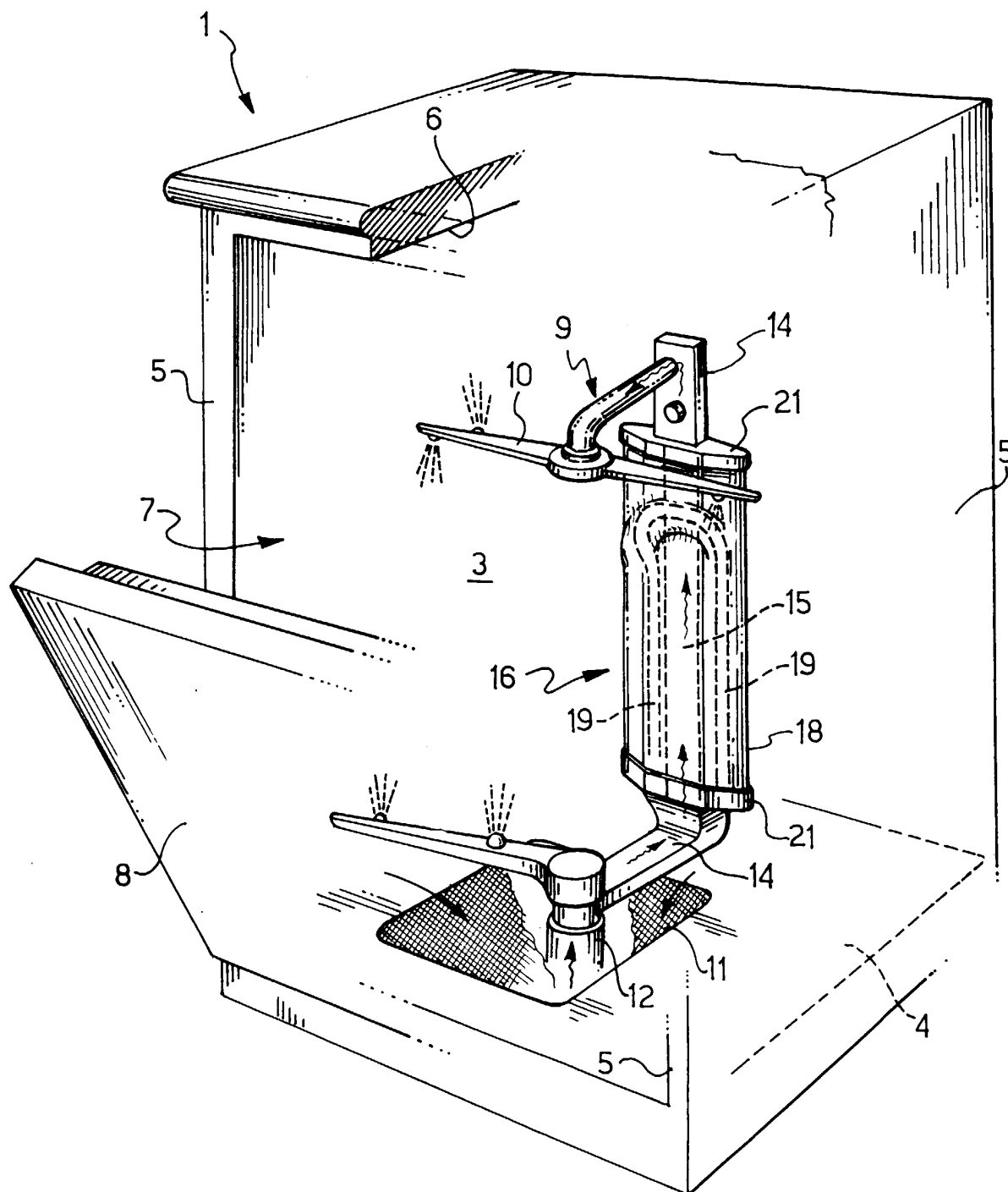


FIG.1

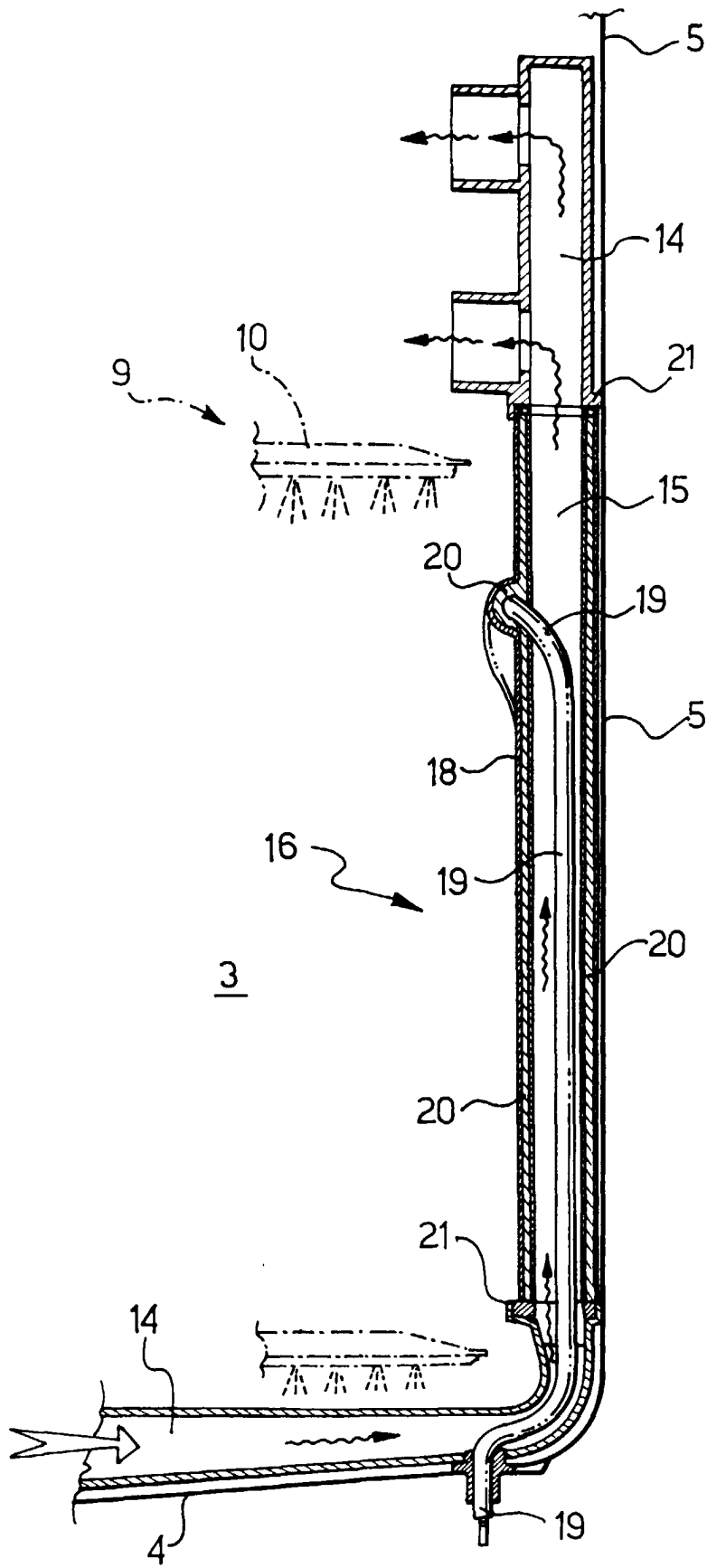


FIG.2

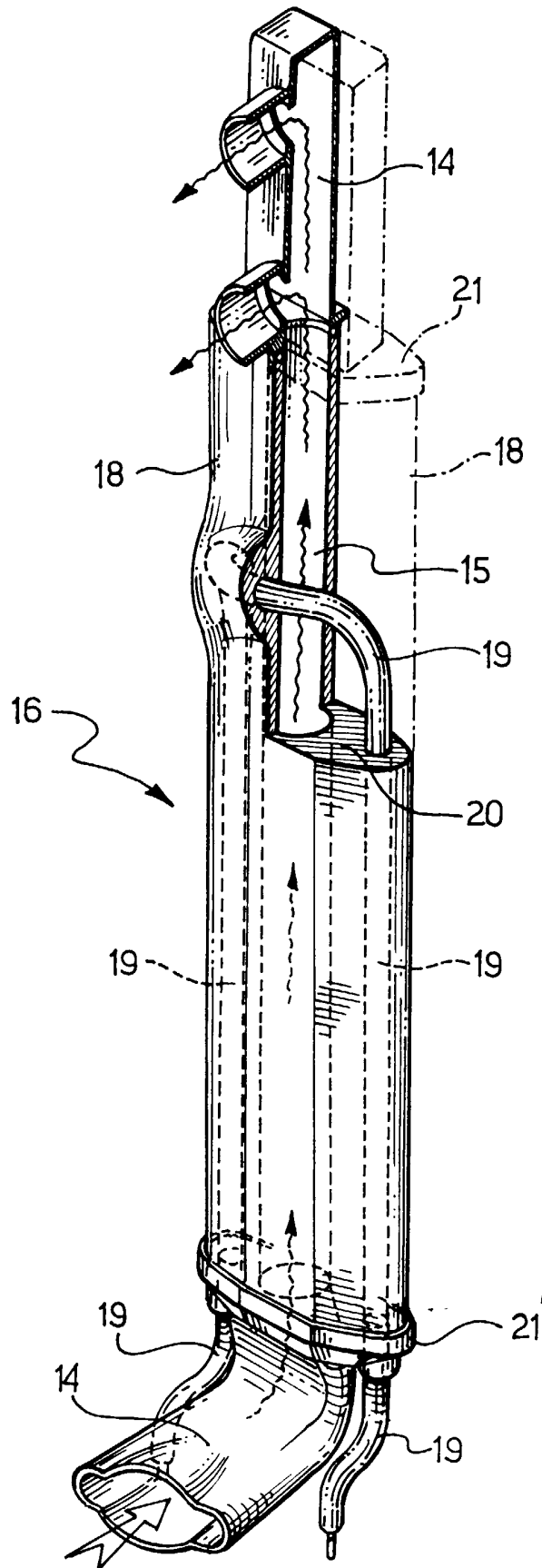
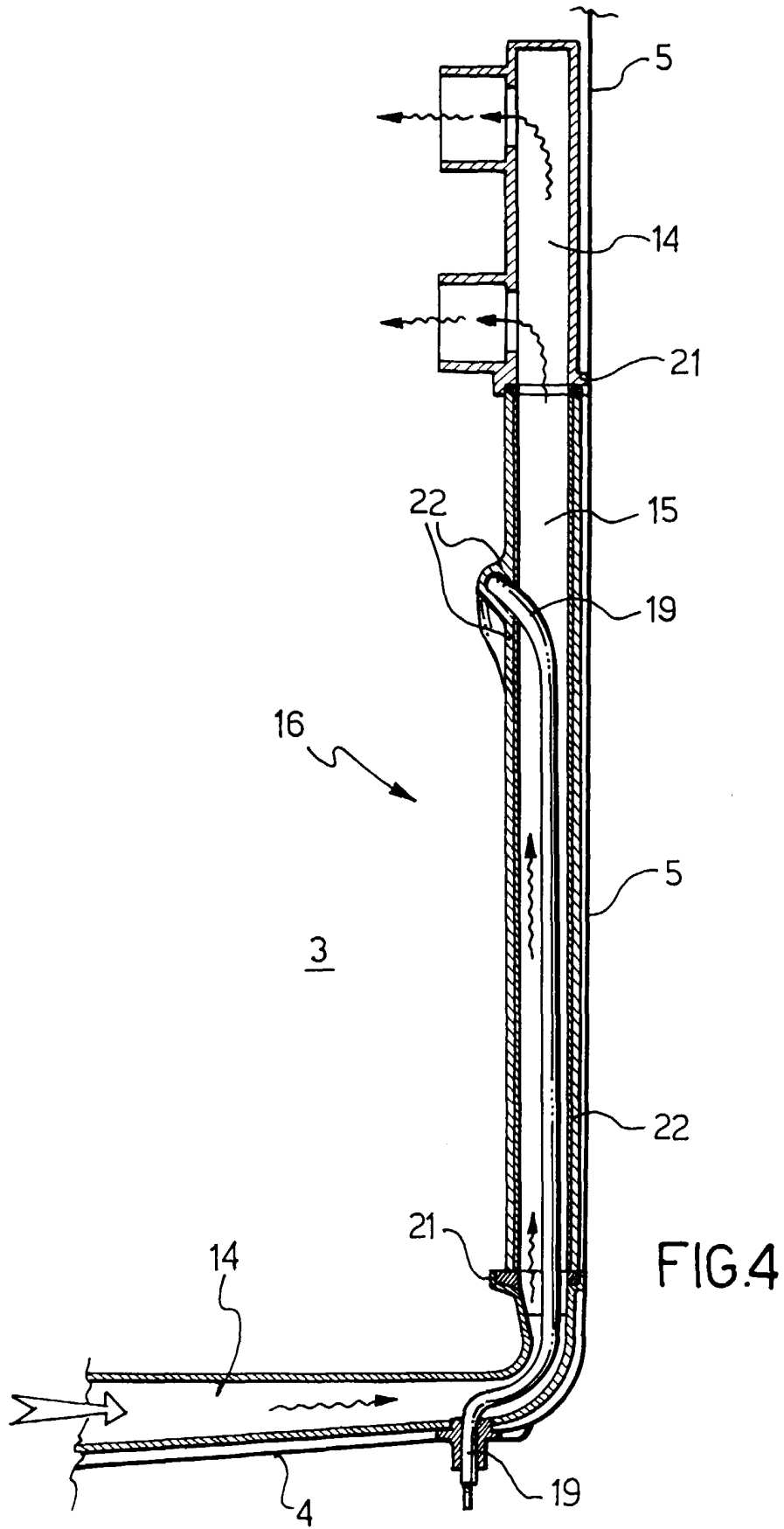
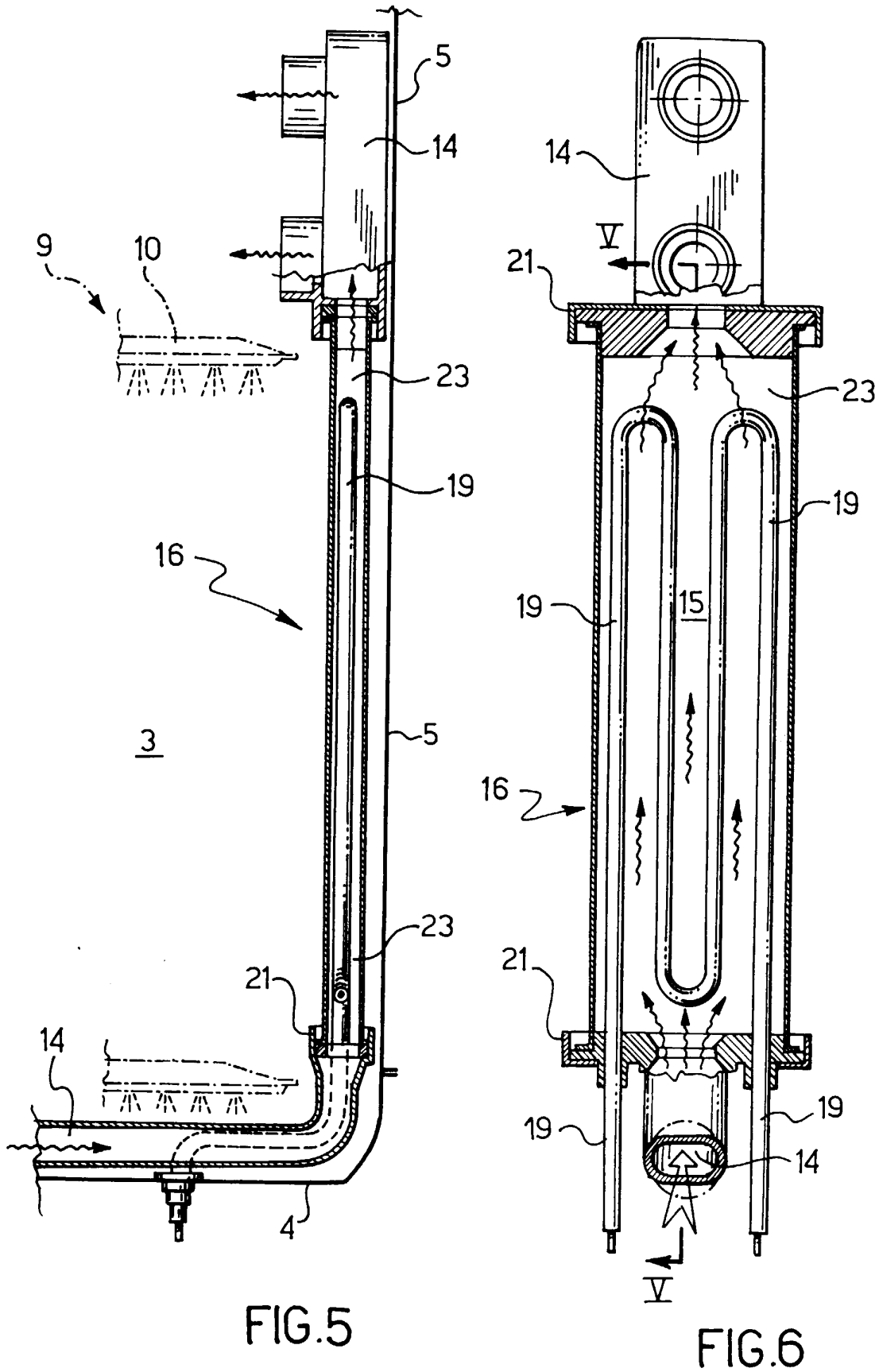


FIG.3









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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
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The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	5 July 1999	Norman, P	
CATEGORY OF CITED DOCUMENTS		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	
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			

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT  
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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  
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