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

(11) EP 1 243 865 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.09.2002 Bulletin 2002/39

(51) Int Cl.[7]: **F24F 13/22**

(21) Application number: **02425107.6**

(22) Date of filing: **27.02.2002**

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

(30) Priority: **20.03.2001 IT BS010033 U**

(71) Applicant: **ELETTROPLASTICA ELETTRODOMESTICI S.R.L.**
25060 Cellatica (BS) (IT)

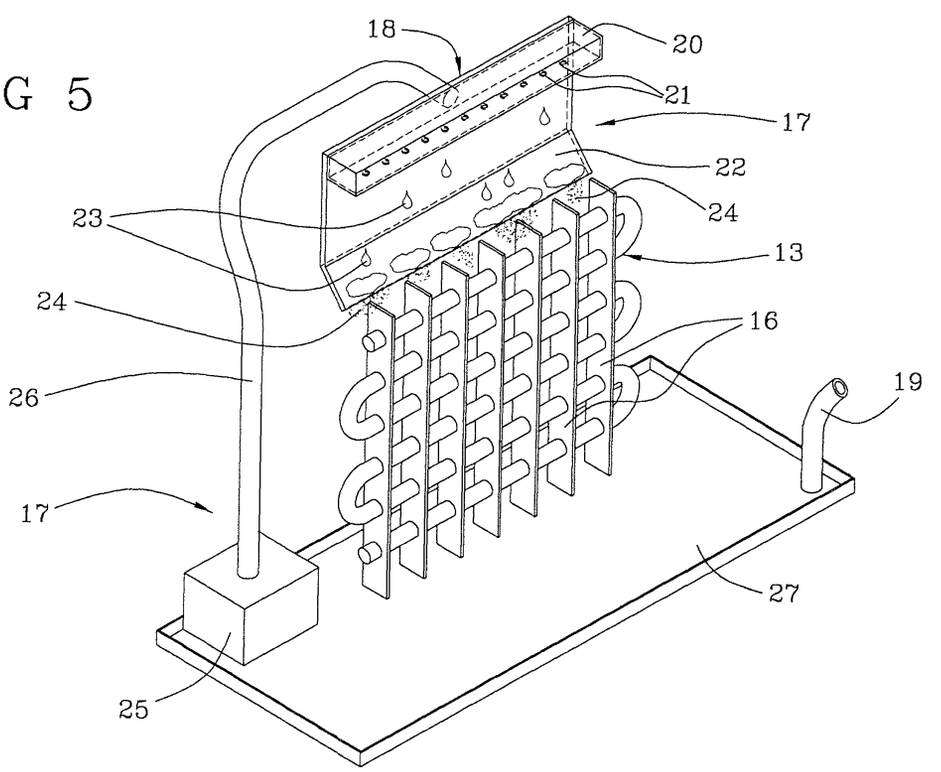
(72) Inventor: **Bottaro, Oreste**
38081 Bondo (Trento) (IT)

(74) Representative: **Ghioni, Carlo Raoul Maria**
c/o Bugnion S.p.A.,
Via Dante 17
25122 Brescia (IT)

(54) Device to drain the condensation water in air conditioners

(57) Device for draining condensation water for air conditioning units (1) comprising at least an internal unit (2) in which said condensation water is generated, and an external unit (3) equipped at least with a condenser (13) for the frigorific fluid and with a fan (15) generating a forced air flow through said condenser (13), characterized in that it comprises a conveyor (18) putting into fluid communication said internal unit (2) with said external unit (3) so as to convey the condensation water generated in said internal unit (2) onto said condenser (13) of said external unit (3). The conveyor (18) comprises at least a draining tube (19) for condensation water connecting the internal unit (2) with the external unit (3).

FIG 5



EP 1 243 865 A2

Description

[0001] The present invention relates to a device for draining condensation water in air conditioning units, particularly those used in residential, commercial or industrial buildings.

[0002] In particular, the invention relates to installation air conditioners, also known as stationary air conditioners, consisting of one or more internal units which are installed within the building, and of an external "motocondensing" unit installed outside the building. Such structure split up into one or more units is usually known in the field as "split system". In said known air conditioning systems the internal unit substantially comprises an evaporation battery for a frigorific fluid, a fan and an electric and/or electronic card for the control of the air conditioner, housed within a supporting casing. In the external unit, within a second supporting casing, are installed a compressor, a condensation battery for the frigorific fluid and a fan creating a forced ventilation through the condensation battery. The external and internal units are connected one to the other by means of a double tube (usually made of copper and passing through suitable holes made in the wall of the building) conveying the frigorific fluid, and of a multiple electrical connection. As is known, a certain amount of condensation water is generated within the internal unit, on the evaporation battery, because of the removal of the latent heat from inside the building. Therefore, such condensate should be collected within a suitable tank and then conveyed into a suitable flexible draining tube for discharging outside the water generated within the internal unit. In order to drain the condensation water generated within the internal unit, whose flow rate is of some liters per hour, some solutions have been put forth.

[0003] A first method consists in taking the draining tube outside the building and then discharging water directly into the ground. This solution is quite simple to be carried out but disadvantageous because a large amount of water is going to be wasted outside the building. If the house is not provided with an adjacent garden or piece of ground, for instance within towns and cities, this feature cannot be taken into consideration since it causes the formation of troublesome water spots on the asphalt.

[0004] In a second known technique the draining tube is connected with a suitable water collection container placed outside the building. However, such solution disadvantageously requires periodical emptying operations of the container. Since dozens of liters of water can be produced in one day, such emptying operations should anyhow be carried out with a certain frequency, according to the container size.

[0005] A third known technique provides for the connection of the condensate draining tube directly with the water draining pipes of the building. This third solution disadvantageously requires complex and elaborate operations for the connection of the draining tube with said pipes during the installation of the air conditioning system. Such problem is particularly relevant in case of installation of air conditioners in old buildings, since often pipes are not close to the conditioner installation spot and it is therefore necessary to break a part of the building walls in order to carry out the connection of the draining tube. It should further be remembered that in order to enable the removal of condensate a certain inclination of the path of the draining tube as far as water pipes should anyhow be provided for.

[0006] In this situation the technical aim underlying the present invention is to provide for a device for draining condensation water for air conditioners which is able to substantially overcome the disadvantages mentioned above.

[0007] In particular, a technical aim of the present invention is to provide for a device for draining condensation water for air conditioners which allows to drain automatically and effectively condensation water generated within the internal unit of the air conditioner. Another aim of the present invention is to conceive a device for draining condensation water with a simple and fast installation. A further aim of the present invention is to provide for a device for draining condensation water which allows to "recover" part of the energy absorbed by the air conditioner in order to take latent heat from the ambient, thus increasing the effectiveness of the refrigerating cycle. A last aim of the present invention is to propose a device for draining condensation water which is simple and economic to be carried out.

[0008] These and other aims which will be further specified in the following description are substantially achieved with a device for draining condensation water for air conditioners comprising at least an internal unit in which condensation water is generated and an external unit equipped at least with a condenser for the frigorific fluid and with a fan generating a forced air flow through the condenser, characterized in that it comprises a conveyor which puts into fluid communication the internal unit and the external unit so to convey the condensation water generated in the internal unit onto the condenser of the external unit.

[0009] The conveyor advantageously comprises at least a draining tube for condensation water connecting the internal unit with the external unit. The conveyor preferably further comprises at least a pierced distributor operatively connected with the draining tube and arranged in the external unit on the condenser of the frigorific fluid, so as to distribute condensation water onto the condenser.

[0010] Further characteristics and advantages will be more evident in the detailed description of a preferred though not exclusive embodiment of a device for draining condensation water according to the present invention. Such description will be made in the following with reference to the attached drawings, provided to a mere indicative and therefore non limiting purpose, in which:

- figure 1 schematically represents an example of air conditioner installation according to the present invention;
- figure 2 is a front view of the inside of the external unit of an air conditioner installation according to the present invention;
- figure 3 shows a plan view of the inside of the unit of figure 2;
- figure 4 is a lateral view of the inside of the unit in figure 2;
- figure 5 is a perspective view of a device for draining condensation water applied to a condensation battery according to the present invention.

[0011] With reference to the attached drawings, an installation air conditioner of type known per se is globally indicated with reference number 1. As can be seen in figure 1 the air conditioner 1 substantially comprises an internal unit 2 and an external or motocondensing unit 3, both installed in a building. The internal unit is preferably mounted in a high position on a wall 4 of the building within an internal room to be conditioned 5 by means of suitable prop brackets. The external unit 3 is installed outside the building and is typically connected operatively with the internal unit 2 by means of a forth conveying tube 6 for the frigorific fluid from the internal unit 2 to the external unit 3, a back conveying tube 6' for the frigorific fluid from the external unit 3 to the internal unit, and a multiple electrical connection 7 to operatively connect the internal unit 2 with the external unit 3.

[0012] The internal unit 2 comprises a frame 8 housing at least an evaporation battery or evaporator 9 for the frigorific fluid and an electrofan 10 for generating a forced air flow through the evaporation battery 9, as well as control electric and/or electronic means 11, all being known elements schematically represented in figure 1.

[0013] As can be seen in figures 2, 3 and 4, the external unit 3 comprises a supporting casing 12 housing at least a condensation battery or condenser 13 for the frigorific fluid, a compressor 14 for the frigorific fluid operatively connected with the condenser 13, and a fan 15 generating a forced air flow through the condenser 13. The condenser 13 substantially consists of a radiator equipped with a plurality of cooling wings 16 promoting the heat exchange between the primary fluid, i.e. the frigorific fluid, and the secondary fluid, in this case the air blown by the fan 15.

[0014] The external unit 3 further comprises a series of conventional elements, such as the electric motor of the fan 15, an electronic unit control system and a plurality of connecting tubes, not shown in the attached figures for reasons of simplicity.

[0015] According to the present invention a device for draining condensation water has been generally indicated with reference number 17. The device 17 comprises a conveyor 18 for conveying the condensation water generated within the internal unit 2 from said internal unit 2 as far as the condenser 13 of the external unit 3. As can be seen in figure 1, the conveyor 18 comprises a draining tube 19 getting out of the internal unit 2 and into the external unit 3 so as to convey the condensation water generated within the internal unit 2 as far as the condenser 13. The conveyor 18 further comprises a distributor 18 which is operatively connected in an indirect way with the draining tube 19. The distributor 20 is equipped in its lower portion with a plurality of small holes 21 and is arranged within the external unit above and on the condenser 13 of the frigorific fluid, in order to distribute condensation water onto said condenser 13. The distributor 20 consists for instance of an elongated parallelepiped-shaped channel extending on the whole length of the condenser 13 so as to obtain a regular distribution of condensation water onto said condenser 13. Advantageously, the distributor 20 can be equipped in its lower portion with an inclined diffusion wall 22 arranged above the condenser 13 and below the holes 21 of the distributor 20. Such diffusion wall 22 breaks the water drops 23 coming from the holes 21 and allows to distribute onto the condenser 13 a uniform water film 24. It is thus possible to increase greatly the contact surface between the water and the condenser 13, thus promoting the evaporation of water and the subsequent cooling of the condenser 13.

[0016] As can be seen in figure 4, in the preferred embodiment the diffusion wall 22 is arranged on the air intake side within the condenser 13, and therefore on the side from which the forced air flow gets into the condenser, so that said forced air flow getting into the unit 3 draws the water film across the whole surface of the condenser 13. Thanks to this contrivance it is possible to further increase the contact surface between the water and the condenser 13. It should also be remembered that said forced air flow further promotes water evaporation.

[0017] The conveyor 18 further comprises a pump 25 operatively placed between the distributor 20 and the draining tube 19 and preferably housed within the casing 12. In an alternative embodiment it is possible to provide that some components of the conveyor 18, for instance the pump 25, are arranged outside the external unit 3.

[0018] The conveyor 18 further comprises a collection tank 27 arranged below the condenser 13 to collect the water distributed onto the condenser 13 by the distributor 20. Advantageously, in the preferred embodiment said tank 27 is obtained on the bottom of the casing 12. The pump 25 is suitably connected operatively with the collection tank 27 so as to convey again the water collected by the tank 27 to the distributor and to make it recirculate on the condenser 13 until its complete evaporation. As can be seen in figures 2 and 5, the draining tube 19 conveys the condensation water into the tank 27 from where the pump 25 sucks water and conveys it to the distributor 20 by means of a second tube 26. In the figures said second tube 26 is represented getting into the central area of the distributor 20, but it could

also get in on one of the ends of the distributor 20. Alternatively and on a wholly equivalent level the draining tube 19 can be connected directly with the pump 25 or with the distributor 20, instead of the tank 27. The external unit 3 is further advantageously equipped with a barrier 28 placed between the compressor 14 and the condenser 13 so as to protect the compressor 14 and the other internal components of the external unit 3 from the steam generated within the unit 3 by the device 17.

[0019] Figures 3 and 4 further show an arrow 29 indicating direction and sense of the forced air flow in the internal unit 3.

[0020] The working of an air conditioner according to the present invention, described above mainly from a structural point of view, is the following.

[0021] When the air conditioner 1 is switched on, the condensation water generated by the internal unit 2 is conveyed by means of the draining tube 19 and thanks to the inclination of said tube 19 as far as the tank 27 and then to the pump 25 within the external unit 3. The pump 25 pushes water into the distributor 20, from where water falls through the holes 21 onto the diffusion wall 22 and is then distributed uniformly onto the condenser 13. The air flow generated by the fan 15 passes through the condenser 13 and draws the water film onto the whole surface of said condenser 13. The water which does not evaporate in the first passage on the condenser 13 is collected in the tank 27 from where it is then sucked by the pump 25 and conveyed again to the distributor 20 for a new passage onto the condenser 13. It is thus possible to obtain a complete drainage by evaporation of the condensate generated in the internal unit 2, together with a drop of the operating temperature of the condenser 13 of the frigorific fluid within the external unit 3.

[0022] The invention has important advantages.

[0023] First of all, a device for draining condensation water for air conditioners according to the present invention enables an effective drainage of the condensation water generated by the internal unit, preventing its dispersion in the environment. Furthermore, a device for draining condensation water according to the present invention allows to simplify the installation of the air conditioner since it does not require any complex connections of the draining tube for condensation water with the draining system of the building. In the embodiment as mounting kit, with some elements placed outside the external unit, it is further possible to apply a device according to the present invention also to air conditioners which have already been installed. Advantageously, the invention further allows to recover part of the energy used by the air conditioner to remove the latent heat from inside the building, thanks to the evaporation of the condensation water on the condensation battery of the frigorific fluid in the external unit. It is thus possible to obtain a drop of the operating condensation temperature of the frigorific fluid and therefore an improvement of the efficiency of the refrigerating cycle. It should be pointed out that the invention therefore allows to save 10-15% of energy in terms of absorption of electric energy and to obtain a related increase of the absolute yield of the refrigerating cycle of the air conditioner. Finally, it should be noted that the invention is simple to be carried out and quite cheap.

[0024] The invention thus conceived can undergo several changes and variants, all falling within the framework of the inventive idea. Moreover, all details can be replaced by technically equivalent elements and any size can be used according to the various needs.

Claims

1. Device for draining condensation water for air conditioning units (1) comprising at least an internal unit (2) in which said condensation water is generated, and an external unit (3) equipped at least with a condenser (13) for the frigorific fluid and with a fan (15) generating a forced air flow through said condenser (13), **characterized in that** it comprises a conveyor (18) putting into fluid communication said internal unit (2) with said external unit (3) so as to convey the condensation water generated in said internal unit (2) onto said condenser (13) of said external unit (3).

2. Device according to claim 1 **characterized in that** said conveyor (18) comprises at least a draining tube (19) for condensation water, which connects said internal unit (2) with said external unit (3).

3. Device according to claim 2 **characterized in that** said conveyor (18) further comprises at least a pierced distributor (20) operatively connected with said draining tube (19) and arranged within said external unit (3) on said condenser (13) of the frigorific fluid, so as to distribute condensation water onto said condenser (13).

4. Device according to claim 3 **characterized in that** said distributor (20) has an elongated shape, is equipped in its lower portion with a plurality of small holes (21) and is arranged in a high position on said condenser (13) in order to distribute condensation water.

5. Device according to claims 3 or 4 **characterized in that** said distributor (20) is equipped with an inclined diffusion wall (22) placed in a high position on said condenser (13) and below the holes (21) of the distributor (20), so as to break the water drops (23) coming from said holes (21) and to distribute onto said condenser (13) a uniform water film (24).

6. Device according to claim 5 **characterized in that** said diffusion wall (22) is placed on the intake side

of said forced air flow within said condenser (13), so that said forced air flow draws the water film (24) across the surface of said condenser (13).

7. Device according to any of the claims 3 to 6 **characterized in that** said conveyor (18) further comprises a collection tank (27) placed below said condenser (13) so as to collect the water distributed onto the condenser (13) by the distributor (20), and a pump (25) operatively connected with said collection tank (27) and with said distributor (20), so as to convey condensation water back to said distributor (20).

8. Device according to claim 7 **characterized in that** said draining tube (19) is operatively connected with said collection tank (27).

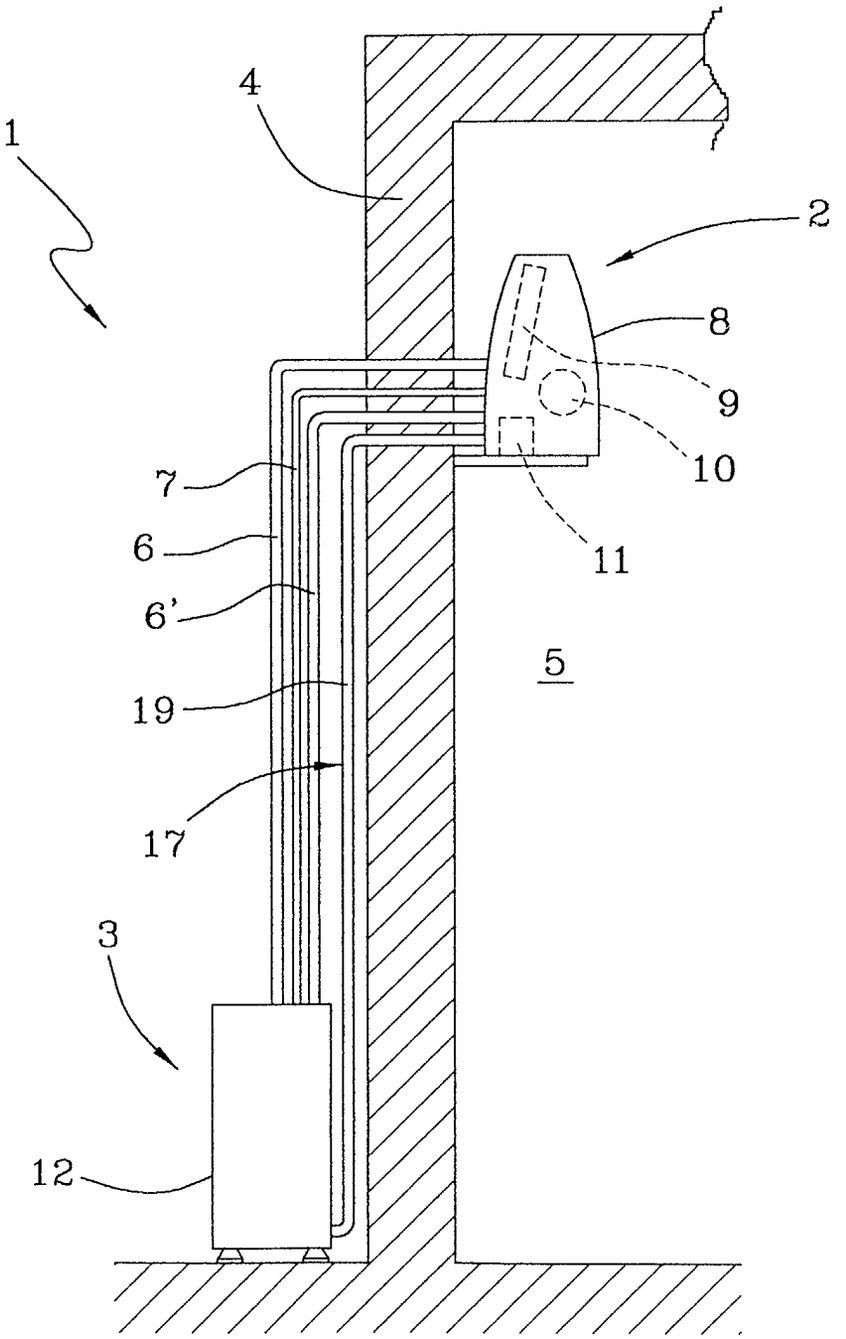
9. Device according to claims 7 or 8 **characterized in that** at least said pump (25) is placed outside said external unit (3).

10. Device according to claims 7 or 8 **characterized in that** said pump (25) is placed within said external unit (3).

11. Air conditioning unit comprising:

an internal unit (2) equipped at least with an evaporator (9) for a frigorific fluid, and with an electrofan (10) generating a forced air flow through the evaporator (9), said forced air flow generating condensation water on said evaporator (9);
an external unit (3) equipped at least with a condenser (13) for the frigorific fluid, with a compressor (14) for the frigorific fluid connected with said condenser (13), and with a fan (15) generating a forced air flow through said condenser (13); and
a forth conveying tube (6) for the frigorific fluid from said internal unit (2) to said external unit (3), a back conveying tube (6') for the frigorific fluid from said external unit (3) to said internal unit (2), and an electrical connection (7) so as to operatively connect said internal unit (2) with said external unit (3), **characterized in that** it further comprises a device (17) according to any of the claims 1 to 10.

FIG 1



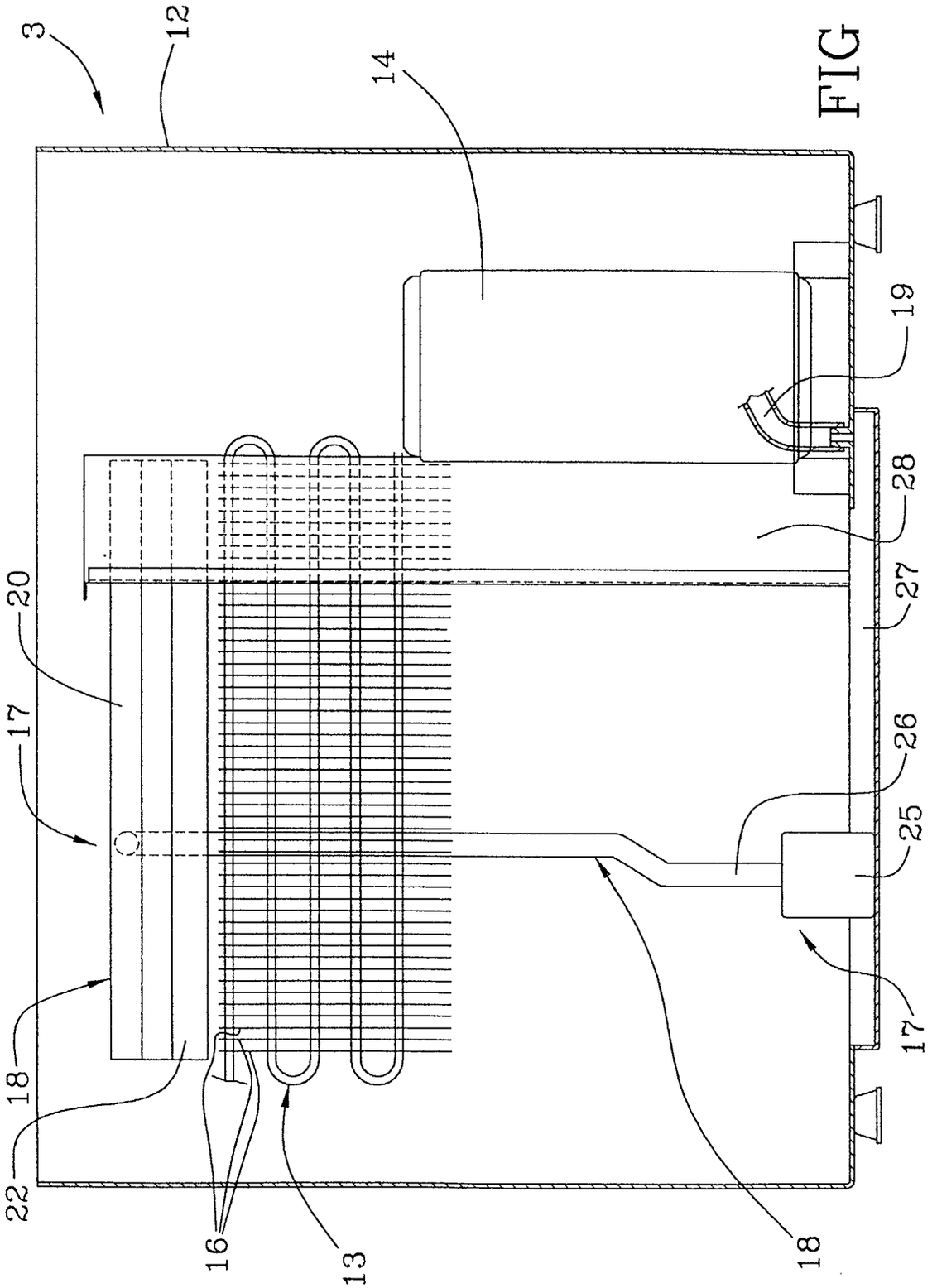


FIG 2

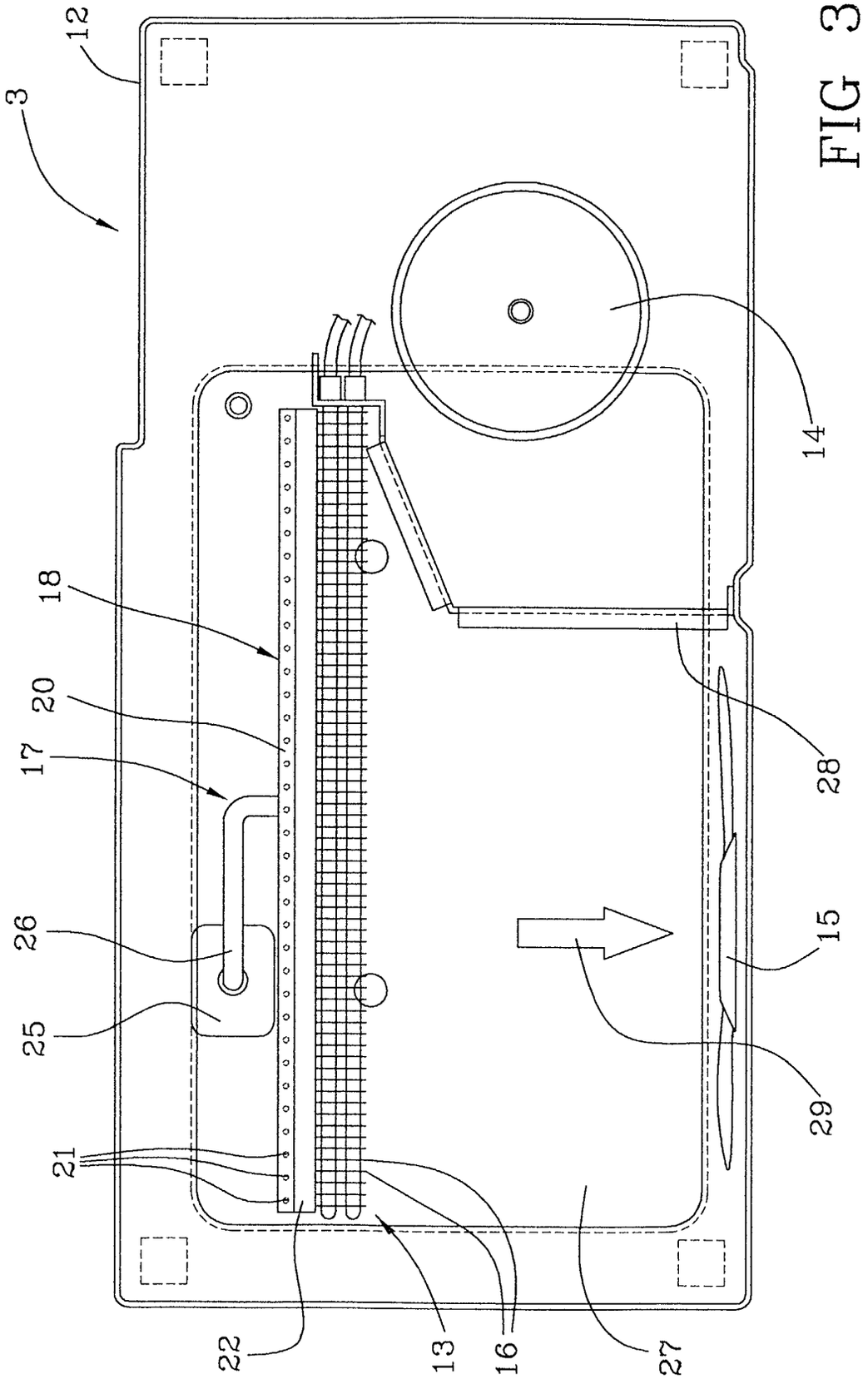
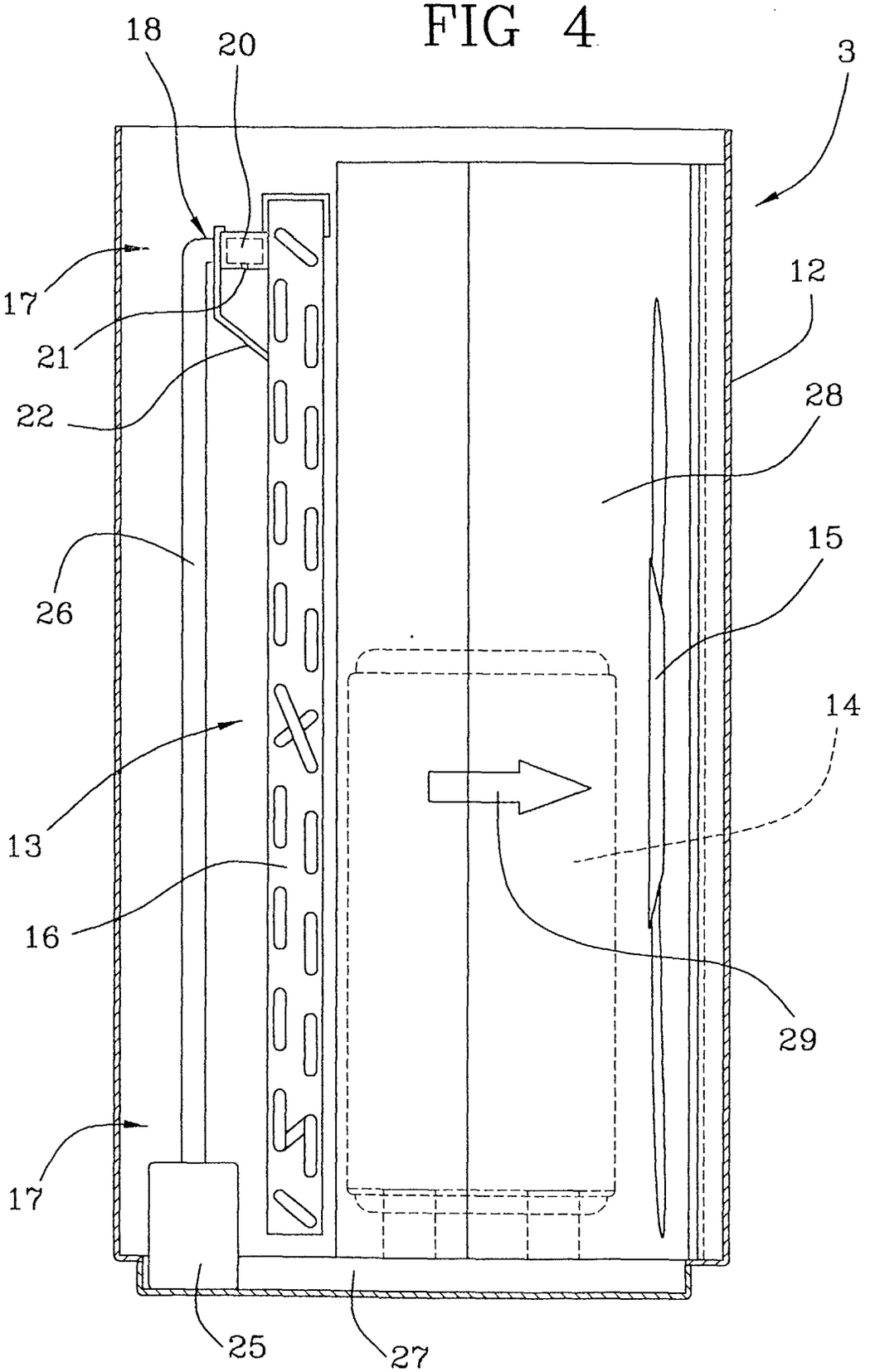


FIG 3

FIG 4



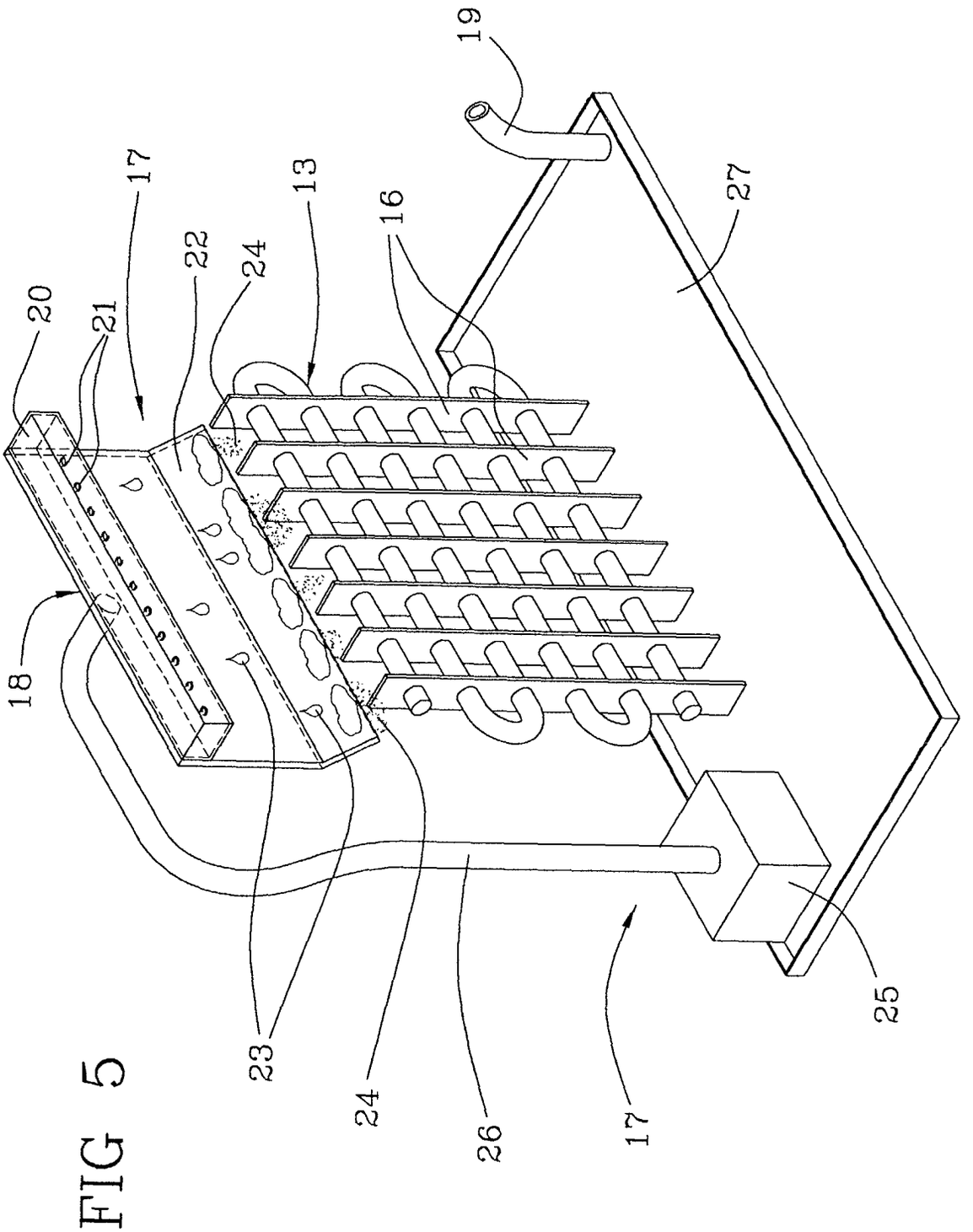


FIG 5