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(54) Space heater of the ventilation type

(57) Space heater of the ventilation type, comprising a casing (11) and an exchanger body (12) which encloses a combustion chamber (13) and which is at least partially internal to the casing (11), this enclosing, below the exchanger body (12), a heating pre-chamber (14) for the air to be heated, which opens onto a heating chamber (15) arranged above it.

The heating chamber (15) is defined between the casing (11) and the exchanger body (12).

Means (16) for aspirating the air from the outside of the casing (11) into the heating pre-chamber (14) are provided, as well as a burner assembly (17), which is connected in a lower portion to the exchanger body (12) in order to be cooled by ventilation by the suction means (16).

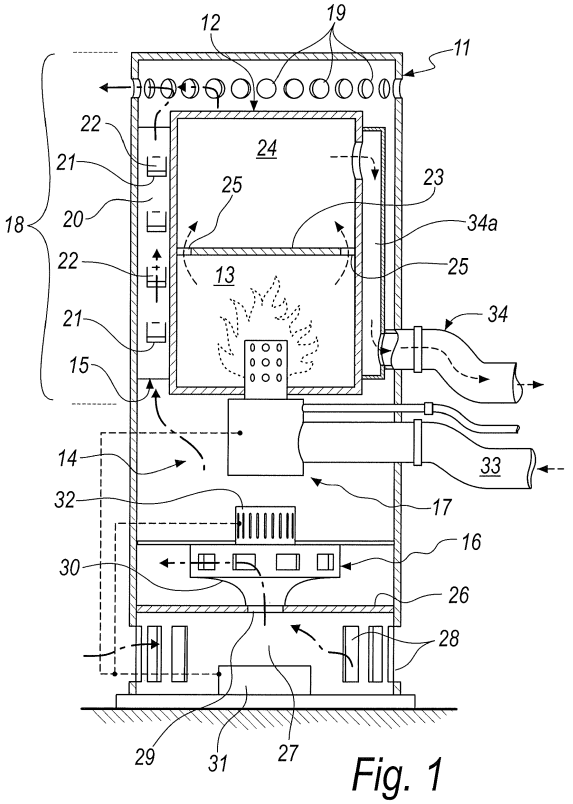

Fig. 1

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Description

[0001] The present invention relates to a space heater of the ventilation type.

[0002] Nowadays in the field of space heating, wall-mounted gas-powered fan coil units are known, which are constituted by a burner assembly facing toward a combustion chamber followed by a labyrinth-like heat exchange duct, adapted to the thermal dissipation of the heat of the gases produced by the combustion in outflow toward the exhaust.

[0003] Generally, the heat exchange duct and the combustion chamber are externally finned in order to boost the thermal exchange with the air that flows over them externally.

[0004] A fan is arranged outside the dissipator conduit and outside the combustion chamber, near the latter, in order to strike it with a flow of air drawn from the space to be heated and destined to be reintroduced back into the space after having flowed over the combustion chamber and the heat exchange duct, thus heating up.

[0005] The burner assembly, the combustion chamber, the heat exchange duct and the fan are enclosed in a casing provided with ventilation windows adapted to allow an easy aspiration and rejection of the air to be recirculated in the space to be heated.

[0006] The tension toward reducing the encumbrances of these devices, combined with the need to obtain a high heating power, has led persons skilled in the art to devise thin combustion chambers, in order to reduce the protrusion of the fan coil unit from the wall that supports it, and compact, labyrinth-like heat exchange ducts on the combustion chamber, in order to also contain the encumbrance crosswise to the wall supporting the device.

[0007] The fan is of the drum type, with vanes curved forward, in order to provide a high flow of air with a low pressure increase, thus exhibiting a reduced encumbrance compared to other types of fan.

[0008] Nowadays however the need to reduce the consumption of fuel is becoming increasingly urgent, including by increasing the efficiency of space heating devices.

[0009] Another need that is becoming more and more of a priority is the need to reduce the pollutant substances introduced into the environment by the exhaust gases, by promoting a complete and correct combustion of the fuel/ oxidizer mixtures.

[0010] In particular, the tension toward preventing the formation of nitrogen oxides, represented by the chemical formula NO_x, goes against the consolidated practice of raising the combustion temperature, which is aimed at achieving a greater heat exchange for the same exchange surface of the combustion chamber and of the heat exchange duct.

[0011] These new needs are therefore in conflict with the consolidated design biases in the field of fan-based space heating devices.

[0012] The aim of the present invention is to provide an air-circulation space heating device that makes it possible to achieve thermal exchange efficiencies that are higher than the fan coil units known today.

[0013] Within this aim, an object of the invention is to provide a heating device that makes it possible to prevent the formation of nitrogen oxides.

[0014] Another object of the invention is to provide a heating device that exhibits a lower environmental impact than the fan coil units known today.

[0015] Another object of the invention is to provide a heating device that is quieter in operation than the fan coil units known today.

[0016] Another object of the invention is to provide a heating device that is longer lasting than the fan coil units known today.

[0017] Another object of the invention is to provide a heating device that is structurally simple and easy to use, and which can be implemented at low cost.

[0018] This aim, as well as these and other objects which will become better apparent hereinafter, are achieved by a space heater of the ventilation type, characterized in that it comprises a casing and an exchanger body which encloses a combustion chamber and is at least partially internal to said casing, said casing enclosing, below said exchanger body, a heating pre-chamber for the air to be heated, which opens onto a heating chamber arranged above it, said heating chamber being defined between said casing and said exchanger body, there being provided means for aspirating the air from the outside of said casing into said heating pre-chamber and a burner assembly, which is connected in a lower portion to said exchanger body in order to be cooled by ventilation by said suction means.

[0019] Further characteristics and advantages of the invention will become better apparent from the detailed description that follows of a preferred, but not exclusive, embodiment of the heating device according to the invention, which is illustrated for the purposes of non-limiting example in the accompanying drawings wherein:

Figure 1 is a view of a simplified diagram of a heating device, according to the invention;

Figure 2 is a partial view of a heating device, according to the invention;

Figure 3 is a view of a schematized detail of a heating device, according to a different embodiment of the invention.

[0020] With reference to the figures, the reference numeral 10 generally designates a space heater of the ventilation type, which, according to the invention, has a peculiarity in that it comprises a casing 11 and an exchanger body 12 that encloses a combustion chamber 13 by defining it internally.

[0021] The exchanger body 12 is inside the casing 11, this enclosing, below the exchanger body 12, a heating pre-chamber 14, for the air to be heated, which opens onto a heating chamber 15 for the air to be heated, arranged above it.

[0022] The heating chamber 15 is defined between the casing 11 and the exchanger body 12, means 16 being provided, preferably in the heating pre-chamber 14, for aspirating the air from the outside of the casing 11 into the heating pre-chamber 14 and a burner assembly 17, which is connected in a lower portion to the exchanger body 12 in order to be cooled by ventilation by the suction means 16.

[0023] Generally, according to the contingent requirements for implementing a heating device according to the invention, the exchanger body is at least partially inside the casing 11.

[0024] Advantageously, the casing 11 is substantially column-shaped and accommodates, in a portion thereof which is the upper one during use 18, the exchanger body 12, the heating chamber 15 being defined as an interspace between the upper portion 18 and the exchanger body 12.

[0025] The upper portion 18 is conveniently open in an upper portion, being conveniently provided with windows 19 to discharge the air that during use flows out of the heating chamber 15.

[0026] The exchanger body 12 is preferably surrounded by the upper portion 18 of the casing 11, the heating chamber 15 being annular with respect to the exchanger body 12.

[0027] The particular column shape, wherein the exchanger body 12 is central to the heating chamber 15 and inside the casing 11 so as to be, during use, conveniently completely surrounded by the air to be heated which flows over it, makes it possible to make the combustion chamber 13 wide so as to obtain a mixture of the gas combusting with the oxidizing air that is more effective than the devices known today, furthermore enabling the temperature of combustion to be kept relatively low so as to prevent or limit the formation of NO_x while still achieving high coefficients of thermal exchange between the exchanger body 12 and the air to be heated by means of the surface of the exchanger body 12 exposed thereto, which increases, virtuously, with the increase in size of the combustion chamber designed.

[0028] Furthermore, the high efficiency of the combustion thus achieved makes it possible to also limit the formation of carbon monoxide, represented by the chemical formula CO, to the advantage of the safety and low environmental impact of a heating device according to the invention.

[0029] Conveniently, the exchanger body 12 is provided with external fins 20 protruding into the heating chamber 15, in order to achieve a more efficient thermal exchange.

[0030] In particular, the fins 20 are preferably further provided with openings 21 and deflector flaps 22 adapted to impart to the air that flows over them a turbulent and vortical motion around the exchanger body 12.

[0031] The exchanger body 12 has an inner dividing wall 23 which defines

- the combustion chamber 13 in a lower portion, and
- in an upper portion, a recovery chamber 24 for the heat of the combustion gases, the internal wall 23 being open, preferably by having holes 25 in a peripheral region, in order to allow the passage of the combustion gases from the combustion chamber 13 to the heat recovery chamber 24.

[0032] The casing 11 conveniently has a bottom 26 which delimits, below the heating pre-chamber 14, a suction chamber 27, which is open perimetrically in order to draw air from the surrounding environment, for example by having perimetric slits 28.

[0033] The bottom 26 conveniently has a port 29 for the passage of air from the suction chamber 27 to the heating pre-chamber 14, the suction means 16 being connected to the port 29 in order to force the passage of air through it, during use.

[0034] Advantageously, the suction means 16 comprise a centrifugal fan 30 of the type with vanes curved backward, which furthermore is quieter than the drum fans used in the fan coil units known today.

[0035] In addition, a device 31 is conveniently provided for controlling the burner assembly 17 and the suction means 16, to which it is connected in order to modulate the heating thermal power produced by the heating device 10, selectively according to a predefined program or a command of an operator.

[0036] For this purpose, for example, the control device 31 can comprise an inverter to actuate the motor 32 of the centrifugal fan 30 in order to modulate its rotation torque as a function of the flow and pressure of air to be heated by passing through the heating chamber 15.

[0037] The control device 31 is preferably accommodated in the suction chamber 27 in order to be cooled by the air sucked through it during use.

[0038] The burner assembly 17 conveniently comprises a pre-mixer of combustible gas with combustion air, of a type that is known per se and not shown in the accompanying figures.

[0039] Furthermore, the burner assembly 17 is preferably connected hermetically to a duct 33 for aspirating the combustion air, and the exchanger body 12 is connected hermetically to a duct 34 for discharging the exhaust gases.

[0040] The discharge duct 34 conveniently has a heat-sink portion 34a that passes through the heating chamber 15.

[0041] In an embodiment of the invention, not shown in the accompanying figures, advantageously the exchanger body is provided with an internal set of fins which protrudes at least into the heat recovery chamber to exchange heat between the exhaust gases that flow therein and the air that flows in the heating chamber, during use.

[0042] Such set of fins can, according to the contingent requirements, for example extend vertically and helically in the heat recovery chamber.

[0043] In a different embodiment of the heating device

according to the invention, particularly adapted to be used outdoors or in spaces that are preferably ventilated, the discharge duct 34 conveniently comprises a terminal 35 that is open inside the casing 11, and specifically in the heating chamber 15.

[0044] More specifically, the terminal 35 conveniently extends in the opposite direction to the flow of the air being heated A in the heating chamber 15, illustrated for the purposes of non-limiting example in Figure 3 with an arrow with an undulating line.

[0045] Furthermore, the terminal 35 has openings 36 that are covered by a deflector 37 that is adapted to deflect, in the same direction as the direction of flow of the air being heated A, the combustion gases B, illustrated for the purposes of example in Figure 3 with arrows with dotted lines.

[0046] In this way, the air being heated A, which flows over the deflector 37 externally, gives rise to a depression effect, known in the field of fluid dynamics as the Venturi effect, which sucks the gases B into the heating chamber 15.

[0047] Operation of a heating device 10, according to the invention, is the following.

[0048] The control device 31 commands the suction means 16 to draw air from the surrounding environment, passing through the slits 28, then the suction chamber 27 and the centrifugal fan 30, from which it is sucked through the port 29 and introduced into the heating pre-chamber 14 thus giving it a pressure that is adapted to determine the flow required for the programmed thermal heating power.

[0049] Furthermore, the control device actuates the burner assembly 17, adapting the flow of combustible gas and of oxidizing air to be introduced for combustion into the combustion chamber 13 to the aforementioned programmed thermal power.

[0050] The air to be heated, pressurized by the suction means 16, flows out of the heating pre-chamber 14 into the heating chamber 15 in which it acquires a turbulent and vortical motion by flowing over the exchanger body 12 and its fins 20, absorbing therefrom heat yielded thereto by the gases combusting in the combustion chamber 13 and by the exhaust gases which, from there, flow out through the heat recovery chamber 24 and the heat-sink portion 34a.

[0051] Figure 1 shows, for the purposes of non-limiting example

- the path of the air of the space to be heated in the heating device 10, with arrows with dash-dot lines, and
- the path of the products of the combustion in the heating device 10, with arrows with dotted lines.

[0052] In practice it has been found that the invention fully achieves the intended aim and objects by providing an air-circulation space heating device that makes it possible to achieve thermal exchange efficiencies that are higher than conventional fan coil units, while also making it possible to make the combustion chamber wider.

[0053] A heating device according to the invention makes it possible to prevent the formation of nitrogen oxides, by making it possible to keep the combustion temperature lower, for the same thermal power yielded to the air to be heated, than conventional devices.

[0054] And also, a heating device according to the invention exhibits a lower environmental impact than conventional fan coil units, by enabling a more complete combustion of the fuel, greater thermal efficiency and lower pollutant emissions.

[0055] Furthermore, a heating device according to the invention is quieter in operation than conventional fan coil units, by way of the ability to use fans with vanes curved forward exhibiting better aerodynamic efficiency.

[0056] What is more, a heating device according to the invention is longer lasting than conventional fan coil units, by enabling effective protection from superheating of both the control device and the sensitive components of the burner assembly which are cooled by the air to be heated, to the advantage of their durability and of the heat recovery efficiency of the heating device.

[0057] A heating device according to the invention is also structurally simple and easy to use, and can be made at low cost.

[0058] The invention, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims. Moreover, all the details may be substituted by other, technically equivalent elements.

[0059] In practice the materials employed, provided they are compatible with the specific use, and the contingent dimensions and shapes, may be any according to requirements and to the state of the art.

[0060] The disclosures in Italian Patent Application No. PD2010A000235 from which this application claims priority are incorporated herein by reference.

[0061] Where technical features mentioned in any claim are followed by reference signs, such reference signs have been inserted for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A space heater (10) of the ventilation type, **characterized in that** it comprises a casing (11) and an exchanger body (12) which encloses a combustion chamber (13) and which is at least partially internal to said casing (11), said casing (11) enclosing, below said exchanger body (12), a heating pre-chamber (14) for the air to be heated, which opens onto a heating chamber (15) arranged above it, said heating chamber (15) being defined between said casing

(11) and said exchanger body (12), there being provided means (16) for aspirating the air from the outside of said casing (11) into said heating pre-chamber (14) and a burner assembly (17), which is connected in a lower portion to said exchanger body (12) in order to be cooled by ventilation by said suction means (16).

2. The heater according to claim 1, **characterized in that** said casing (11) is substantially column-shaped and accommodates, in a portion thereof which is the upper one during use (18), said exchanger body (12), said heating chamber (15) being defined as an interspace between said upper portion (18) and said exchanger body (12), said upper portion (18) being open in an upper region to discharge the air that during use flows out of said heating chamber (15).

3. The heater according to claim 2, **characterized in that** said exchanger body (12) is surrounded by said upper portion (18) of said casing (11), said heating chamber (15) being annular with respect to said exchanger body (12).

4. The heater according to one or more of the preceding claims, **characterized in that** said exchanger body (12) has external fins (20) which protrude into said heating chamber (15).

5. The heater according to claim 4, **characterized in that** said fins (20) have openings (21) and deflector flaps (22) which are adapted to impart to the air that flows over them a turbulent and vortical motion around said exchanger body (12).

6. The heater according to one or more of the preceding claims, **characterized in that** said exchanger body (12) has an internal dividing wall (23), which defines in a lower region said combustion chamber (13) and in an upper region a recovery chamber (24) for the heat of the combustion gases, said internal wall (23) being open in order to allow the passage of the combustion gases from said combustion chamber (13) to said heat recovery chamber (24).

7. The heater according to one or more of the preceding claims, **characterized in that** said casing (11) has a bottom (26) which delimits, below said heating pre-chamber (14), a suction chamber (27), which is open perimetrically in order to draw air from the surrounding environment, said bottom (26) having a port (29) for the passage of the air from said suction chamber (27) to said heating pre-chamber (14), said suction means (16) being connected to said port (29) in order to force the passage of air through it during use.

8. The heater according to one or more of the preceding claims, **characterized in that** said suction means (16) comprise a centrifugal fan (30) with vanes which are curved backward.

9. The heater according to one or more of the preceding claims, **characterized in that** it further comprises a device (31) for controlling said burner assembly (17) and said suction means (16) in order to modulate the heating thermal power produced by said heater, selectively according to a predefined program or a command of an operator.

10. The heater according to claim 9, **characterized in that** said control device (31) is accommodated in said suction chamber (27) in order to be cooled by the air aspirated through it during use.

11. The heater according to one or more of the preceding claims, **characterized in that** said burner assembly (17) comprises a pre-mixer of combustible gas with combustion air.

12. The heater according to one or more of the preceding claims, **characterized in that** said burner assembly (17) is connected hermetically to a duct (33) for aspirating the combustion air, said exchanger body (12) being connected hermetically to a duct (34) for the discharge of the exhaust gases.

13. The heater according to claim 12, **characterized in that** said discharge duct (34) has a heat-sink portion (34a) that passes through said heating chamber (15).

14. The heater according to one or more of the preceding claims, **characterized in that** said exchanger body (12) has an internal set of fins which protrudes at least into said heat recovery chamber (24) to exchange heat between the exhaust gases that flow therein and the air that flows in said heating chamber (15) during use.

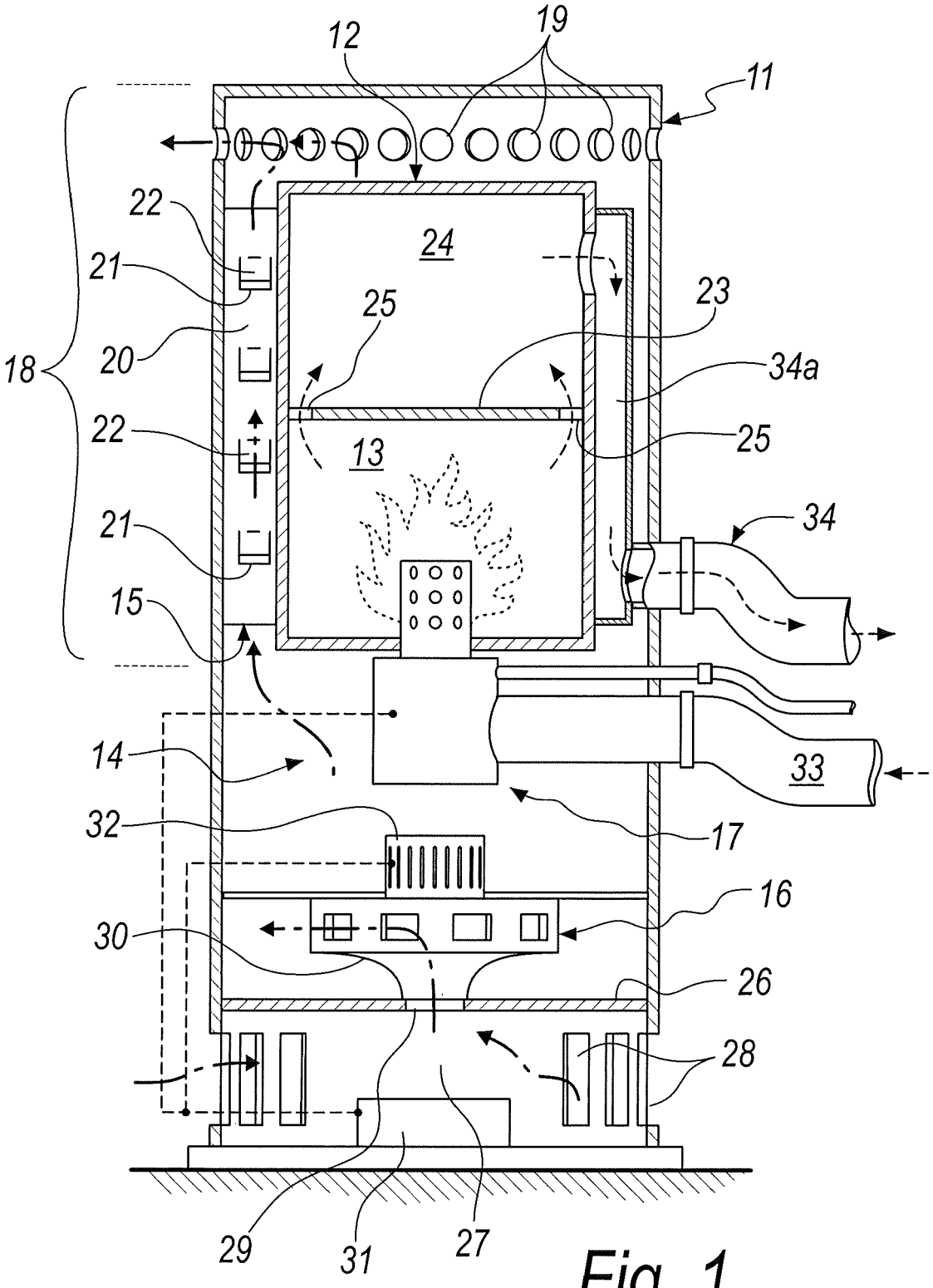
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Fig. 1

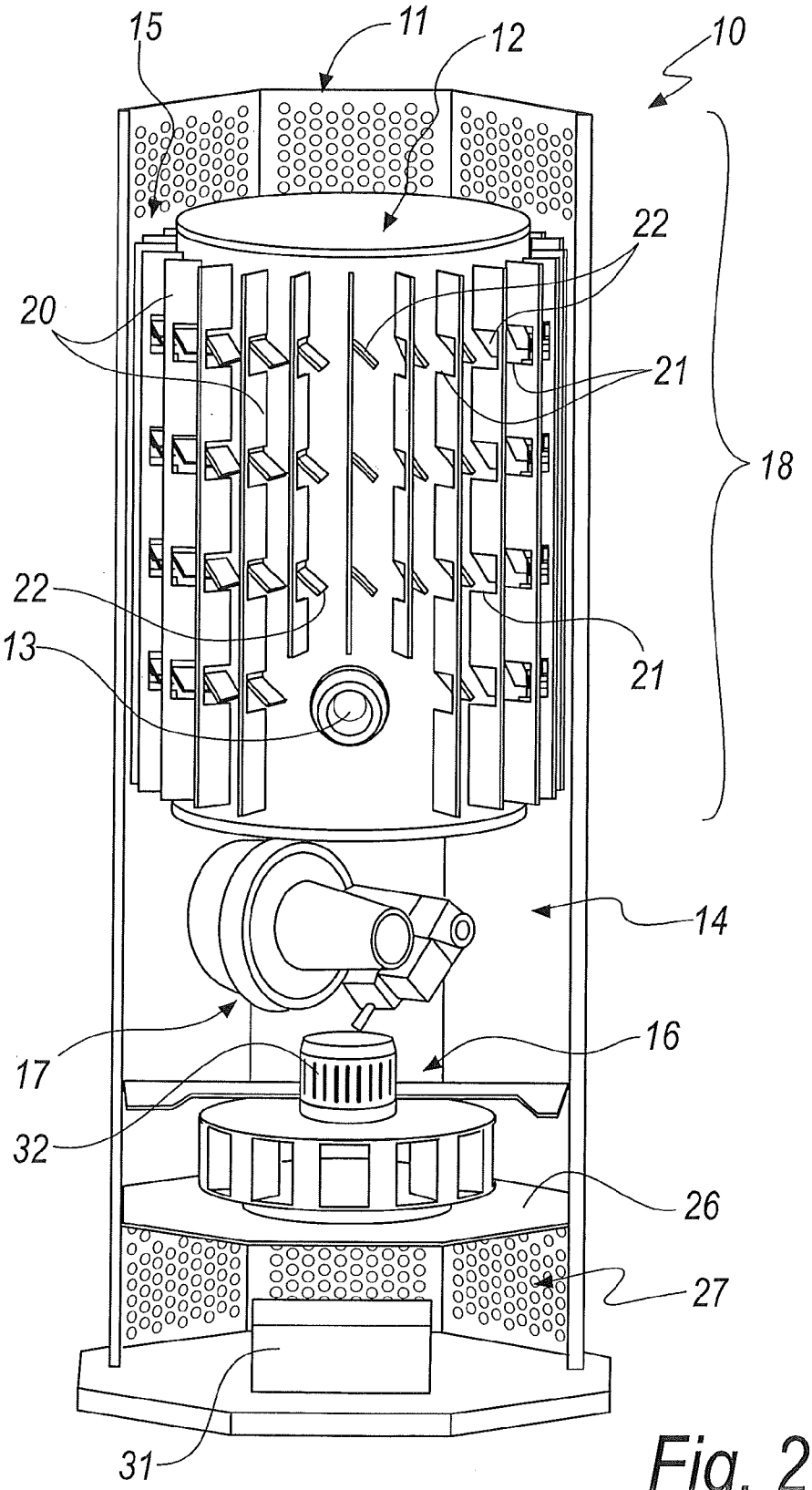

Fig. 2

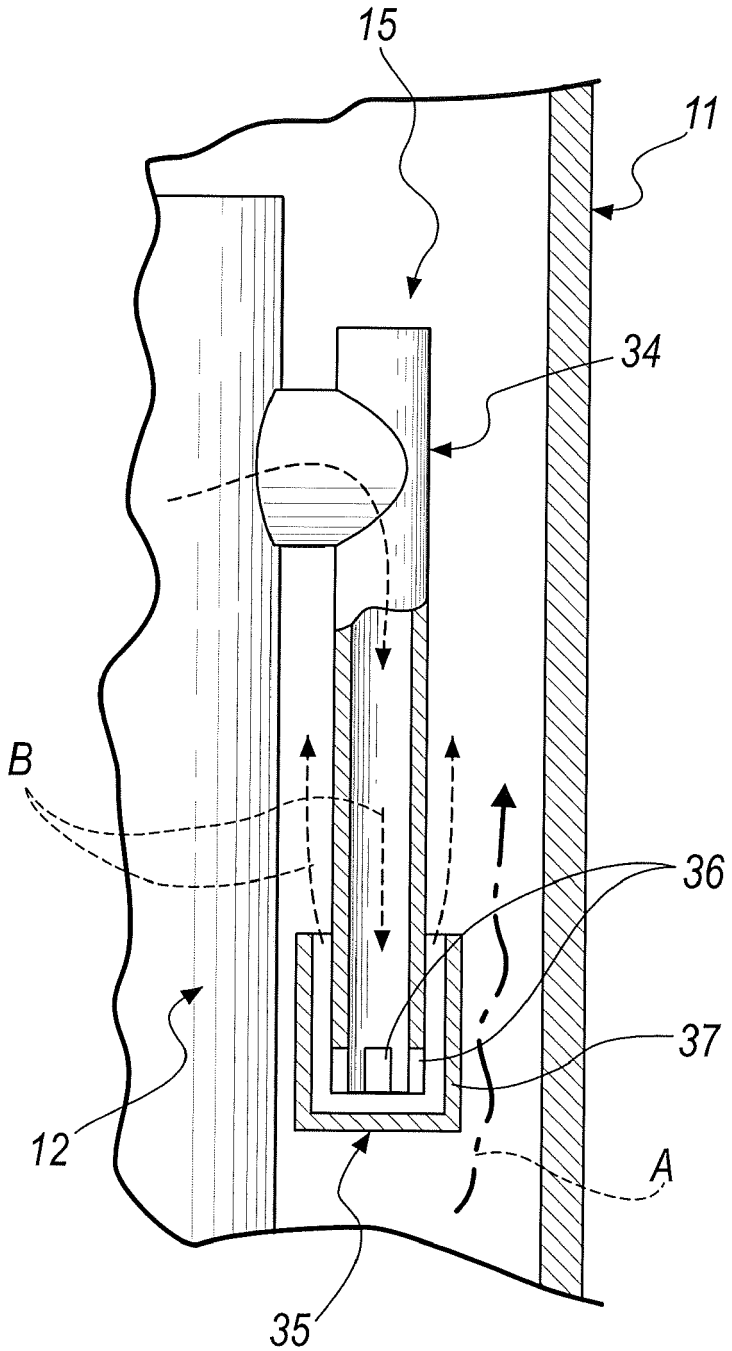

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 11 17 4684

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 735 152 A (DRAGONAIR LTD) 17 August 1955 (1955-08-17) * page 1, line 67 - page 4, line 10 * * page 4, lines 60-69 * * figures 1,2,3,9 *	1-4,6,8, 9,12 10,14	INV. F24H3/06
X	FR 1 312 844 A (M. LUDWIG HUBERT) 21 December 1962 (1962-12-21) * page 2, line 93 - page 5, line 27 * * figures 1-3 *	1-9,12, 13	
X	US 4 275 705 A (SCHAUS ORLAND O ET AL) 30 June 1981 (1981-06-30) * column 3, line 57 - column 8, line 7 * * figures 1,2 *	1,2,6,8, 9,11-13	
Y	US 6 318 358 B1 (GATLEY JR WILLIAM STUART [US]) 20 November 2001 (2001-11-20) * column 1, lines 40-46 * * column 2, lines 57-60 * * column 5, lines 60-65 *	10	
Y	GB 1 366 922 A (STUKLEY P A R) 18 September 1974 (1974-09-18) * page 2, lines 19-23 * * page 1, lines 87-90 * * figures 3-4 *	14	TECHNICAL FIELDS SEARCHED (IPC) F24H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 September 2011	Schwaller, Vincent

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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27-09-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 735152 A	17-08-1955	NONE	
FR 1312844 A	21-12-1962	NONE	
US 4275705 A	30-06-1981	CA 1108499 A1	08-09-1981
US 6318358 B1	20-11-2001	US 2002014233 A1	07-02-2002
GB 1366922 A	18-09-1974	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- IT PD20100235 A **[0060]**