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(54) **HEATING SYSTEM WITH RADIANT STRIPS**

(57) Heating system with radiant strips comprising a burner (5) housed in a containment structure (3) and provided with a combustion chamber (6) and with means (8) for supplying a fuel mixture and a ventilator (9), housed in the containment structure (3), provided with a fan (10) inserted in a recirculation duct (4) and operating in a suction fashion to force the carrier fluid (F) which traverses the radiant strips (2). The burner (5) is of premix type and comprises a conveniently cylindrical combustion head (12) provided with a metal mesh (13) on which the combustion occurs, and is extended into the combustion chamber (6) for at least the section (7') in which this traverses the recirculation duct (4). The supply means (8) of the burner (5) comprise a modulating blower (14) which suctions an adjustable flow, and an electropneumatic controlled valve (15), which is connected to a source of supply gas, and to the modulating blower (14) to which it is susceptible of sending a gas flow as a function of the air suctioned by the modulating blower (15), which are mixed together in the modulating blower (15) and injected by the latter in the combustion head (12) in order to obtain a flame on the cylindrical mesh (13) thereof.

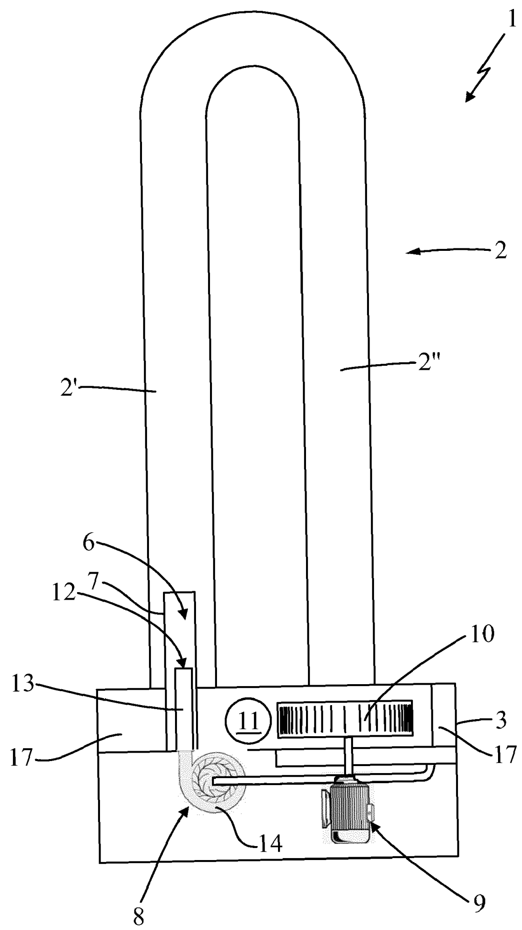

Fig. 1

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Description

Field of application

[0001] The present invention refers to a heating system with radiant strips, according to the preamble of the main independent claim No. 1.

[0002] The present system is intended to be employed in order to heat settings, generally of large size and in general of buildings, and more particularly of industrial and commercial buildings, such as sheds, warehouses, hangars, supermarkets, shopping malls or other buildings.

[0003] The system according to the invention is therefore inserted in the heat technology field, or in the technical field of production of heating systems.

State of the art

[0004] Heating systems with radiant strips have been known and used for some time, especially in industry. Such systems comprise one or more closed-loop radiant pipes adapted to be fixed to the ceiling or to a wall of a room that one wishes to heat and susceptible of being internally traversed by a heated carrier fluid constituted by exhaust gases as better explained hereinbelow, in order to heat the surrounding environment mainly by radiation.

[0005] The radiant strips are constituted by metal piping, generally made of aluminized steel, which are extended into the room to be heated with a length of several tens of meters, i.e. up to even 100-150 meters.

[0006] The radiant strip forms a closed loop defined by a delivery pipe and by a return pipe, connected to each other at the respective ends in order to obtain the closure of the loop and allow the recirculation of the carrier fluid at their interior, which in particular is constituted by exhaust gases.

[0007] The system also comprises a burner inserted in a combustion chamber, which can be partially housed inside an initial section of the delivery pipe of the radiant strip.

[0008] The burner is connected to first means for supplying fuel, in particular pressurized gas, and second means for supplying a comburent, in particular air for obtaining a mixture in the burner that produces a combustion reaction and produces hot fumes that are directly introduced into the loop of the radiant strip, heating the carrier fluid that flows therein and in turn constituted by previously-burned exhaust gas.

[0009] The system also comprises a ventilator operating in a suction fashion, which is arranged at the terminal section of the return pipe of the radiant strip, in proximity to the burner. The latter is in particular of the type at atmospheric pressure with multiflame Venturi tubes. The ventilator of the system described herein is adapted to suction the carrier fluid which traverses the delivery pipe and the return pipe of the radiant strip and to insufflate part of such carrier fluid laterally with respect to the burner in order to allow the recirculation thereof.

[0010] A fumes expulsion flue is also provided, preferably connected to the closed loop of the radiant strip at the connector close to the ventilator and to the burner, which expels that head part of the circulation carrier fluid which is substituted by new exhaust gases created in the burner.

[0011] The systems with radiant strips have a box-like containment body in which the following are housed: the burner with its combustion chamber, the ventilator for the circulation of the exhaust gases, the means for injecting air and gas into the combustion chamber and the connector between the delivery pipe and the return pipe with the derivation for the expulsion flue.

[0012] Preferably, the box-like containment body of the system is positioned in an external environment with respect to the environment to be heated.

[0013] In general, the systems with radiant strips employ two types of burners, i.e. suction air burners and blown air burners.

[0014] In the suction air burners, the air is suctioned in a natural manner by the fuel due to a duct that has a section narrowing at the tip in which the fuel is introduced. The comburent air coming from the external environment is generally suctioned into the burner due to the depression created by the pressurized jets of fuel gas within the burner and due to the depression created by the ventilator on the delivery pipe of the radiant strip associated with the burner. More in detail, the second means for supplying air comprise a chamber, communicating with the combustion chamber and with the external environment, through which the comburent air coming from the external environment is suctioned into the burner.

[0015] The blown air burners provide that the air is introduced into the burner in a forced manner, due to a ventilator placed upstream of the burner. The burner is in this case supplied with a mixture of fuel and comburent air which are mixed together at the nozzle of introduction into the burner; air and gas therefore reach the burner itself already mixed. The flame generated by such blown air burner is rather short, being extended over a limited volume.

[0016] Several examples of the aforesaid systems of known type are described in the documents DE 9103004, US 2009/042155, WO 2006/120717, EP 0391818 and EP 0248629.

[0017] The systems with radiant strips of known type which employ suction burners have various drawbacks.

[0018] A first drawback lies in the fact that the exhaust gases expelled through the flue contain a high quantity of pollutants and in particular a high percentage of NO_x.

[0019] A second drawback lies in the fact that the mixture of gas and comburent air is not optimized for the different powers that the burner may be requested to deliver, with the result that the system has poor thermal efficiency.

[0020] In addition, with the current suction air burners there is often the risk that backfires are verified; indeed, if the suction ventilator which determines the fumes circulation does not create a sufficiently high depression for transmitting a suitable depression even to the start of the delivery pipe of the radiant strip, i.e. therefore even within the combustion chamber, then the burner is not able to suction the quantity of comburent air necessary for burning the fuel provided thereto, such that dangerous backfire phenomena can be verified, with the risk even of explosions.

[0021] In order to limit the risk that such phenomena can be verified, the known systems of the abovementioned type are equipped with a high power ventilator, capable of ensuring the creation within the delivery pipe of the radiant strip of a depression sufficient for ensuring the suction of sufficient quantities of comburent air. However, this involves greater costs for making the system, greater costs for the maintenance and operation of the heating system itself, and nearly no control on the quality of the combustion.

[0022] On the other hand, the systems with radiant strips of known type which have a blown air burner have the main drawback of requiring high production costs, since they must be equipped with a combustion chamber provided with optimal characteristics of resistance to thermal shock, to which the chamber itself is necessarily subjected during the operation of the system, and since they must be provided with a high power ventilator adapted to generate the necessary turbulence for ensuring the complete mixing of the fuel and of the comburent air which are sent to the head of the burner.

[0023] Also the systems with radiant strips with blown air burner expel, through the flue, gases containing a high percentage of NOx.

[0024] In addition, both the systems with radiant strips with suction air burner and those with blown air burner have, in the combustion unit, considerable thermal dispersions with heat which in part is dispersed in the external environment, where such unit is often situated, and which in part involves arranging heat insulation in order to prevent ruining the electronics, the valves and the other components for supplying the burner, which are housed within the same unit in a chamber alongside the burner.

[0025] In addition, both the systems with radiant strips with suction air burner and those with blown air burner generally have a single or double stage operation of the power, or with only one gas-side modulation since the application of a continuous and combined (air and gas) modulation of such burners is costly.

[0026] More recently, so-called premix burners have been introduced in the market which provide for a complete mixing of the comburent air and of the fuel gas in a ventilator that supplies the combustion head.

[0027] Such burners allow considerably reducing the NOx inflow, yet up to now they have not found application in the field of systems with radiant strips, since the high powers required by such systems would require a high volume - in which the flame is distributed and the heat is exchanged - which is incompatible with the normal size of the radiant strips. In addition, the combustion chamber and the delivery pipe that encloses it would be subjected to excessively high temperatures which would compromise the mechanical strength thereof, also in rather limited time periods.

Presentation of the invention

[0028] In this situation, therefore, the object of the present invention is to overcome the drawbacks of the abovementioned prior art, by providing a heating system with radiant strips which is able to drastically reduce the inflow of noxious gases, in particular the percentage of NOx with respect to the current systems with radiant strips.

[0029] A further object of the present invention is to provide a heating system with radiant strips, which is able to modulate the power delivered in a very extensive manner in accordance with the actual user requirements and in very brief time periods.

[0030] A further object of the present invention is to provide a heating system with radiant strips, which is safe and entirely reliable in operation.

[0031] A further object of the present invention is to provide a heating system with radiant strips, which is simple and inexpensive to obtain.

[0032] Another object of the present invention is to provide a heating system with radiant strips, which requires simple and inexpensive maintenance.

[0033] A further object of the present invention is to provide a heating system with radiant strips, which has low gas and electricity consumptions and therefore low operating costs.

Brief description of the drawings

[0034] The technical characteristics of the invention, according to the aforesaid objects, can be clearly found in the contents of the enclosed claims and the advantages thereof will be more evident in the following detailed description, made with reference to the enclosed drawings, which represent several merely exemplifying and non-limiting embodiments of the invention, in which:

- figure 1 shows a scheme of the heating system with radiant strips, object of the present invention;
- figure 2 shows a perspective view of a detail of the heating system with radiant strips, object of the present invention, relative to a containment structure of all its main members, with some parts removed in order to better illustrate other parts;
- figure 3 shows a first section view of the detail of the heating system with radiant strips of Fig. 2, made along a vertical plane;
- figure 4 shows a second section view of the detail of the heating system with radiant strips of Fig. 2, made along a horizontal plane;

- figure 5 shows a mechanical diagram for making the operation of a controlled valve for the supply means for the burner of the system, object of the present invention, dependent on the air flow that a modulating fan of the same system supplies;
- figure 6 shows a perspective view of a detail of the heating system with radiant strips, object of the present invention, in accordance with a first embodiment variant in which a heat exchanger is provided on the fumes flue which sends pre-heated air to the supply system;
- figure 7 shows a perspective view of a detail of the heating system with radiant strips, object of the present invention, in accordance with a second embodiment variant in which, also in this case, the heat exchanger is provided on the fumes flue which sends the pre-heated air to an interspace defined by a jacket, externally arranged with respect to the fumes recirculation duct;
- figure 8 shows a perspective view of a detail of the figure 7 where the connection between the pre-heated air exiting from the exchanger and the interspace of the jacket can be appreciated.

Detailed description

[0035] With reference to the enclosed drawings, reference number 1 indicates the heating system with radiant strips, object of the present invention.

[0036] The heating system 1, according to the invention, is intended to be employed for heating large-cubature settings, i.e. characterized by large surfaces and high heights, usually in industrial or commercial buildings, such as sheds, hangers, warehouses, supermarkets, shopping malls, cinemas or the like.

[0037] In particular, the system 1 according to the present invention is intended to be installed in the room that one wishes to heat at a distance from the ground and with an orientation that are suitably selected for ensuring the desired heating of a selected zone of the room.

[0038] The heating system 1, object of the present invention, comprises a loop of radiant strips 2, susceptible to be fixed to the ceiling or to a wall of a room to be heated, maintained suspended and spaced from the ground of the room itself, and adapted to be internally traversed by a carrier fluid F, in order to heat the room itself by radiation.

[0039] Of course, the radiant strips 2 of the system 1, rather than being fixed directly to the ceiling or to a wall, can also be fixed to beams or to columns or to poles associated therewith or to any structure susceptible to safely support the radiant strips 2 themselves and hence the system 1, without departing from the protective scope defined by the present patent.

[0040] The aforesaid radiant strips 2 are formed by metal pipes which are extended with a length of several tens of meters and in particular even up to 100-150 meters.

[0041] Advantageously, the aforesaid metal pipes are obtained starting from a continuous strip of metal material, e.g. of aluminized steel, which is formed as a spiral and fixed along the longitudinal edges thereof so as to make a tubular body, according to production processes that are *per se* known to the man skilled in the art of the field.

[0042] The system 1 illustrated in the enclosed figures and described in detail hereinbelow comprises a delivery pipe 2’ and a return pipe 2", connected together at the respective ends in order to define a closed loop and to allow the circulation of the carrier fluid F at its interior. Of course, the system 1 can comprise multiple radiant strips 2 without departing from the protective scope defined by the present patent.

[0043] The heating system 1 comprises a containment structure 3, preferably of box-like shape and metallic, e.g. made of steel, advantageously positioned in an external environment with respect to the setting to be heated, where instead the radiant strips 2 are placed.

[0044] Within the containment structure 3, a recirculation duct 4 is housed which places an initial section 3’ and a final section 3" of the loop of radiant strips 2 in mutual connection, and more precisely the initial section 3’ of the delivery pipe 2’ and the final section 3" of the return pipe 2" of the loop with radiant strips 2.

[0045] Therefore, the two delivery and return pipes 2’, 2" lead, with one end thereof, to the containment structure 3 while at the other end they are preferably connected, in a *per se* conventional manner, with a 180-degree connector or connector which has U-shaped form, or with multiple connectors with various extension, not illustrated in the enclosed figures since they are well-known to the man skilled in the art.

[0046] The system 1 therefore comprises a burner 5 housed in the containment structure 3 and provided with a combustion chamber 6 delimited by a cylindrical wall 7, which is extended passing into the recirculation duct 4, for a first section 7’, in which it is externally touched by the carrier fluid F and for a second section 7" with which it continues into the loop of radiant strips 2 starting from the initial section 3’ of the delivery pipe 2’.

[0047] The burner 5 also comprises, in a *per se* conventional manner, means 8 for supplying a fuel mixture, connected to the combustion chamber 6, in which the combustion of the fuel mixture takes place as well as the consequent generation of combustion products P susceptible of heating the carrier fluid F by mixing with it at the outlet of the combustion chamber 6.

[0048] Within the containment structure 3, a ventilator 9 is housed which is provided with a fan 10 inserted in the recirculation duct 4 and operating in a suction fashion to force the carrier fluid F into the loop of radiant strips 2, from the final section 2B to the initial section 2A. The fuel is advantageously in gaseous form and is constituted for example by methane or can be in liquefied form, and be for example constituted by LPG.

[0049] The part of exhaust gases suctioned by the ventilator 9, and not sent to the recirculation duct 4 towards the burner 5 to close the loop of the carrier fluid F, is sent to a flue 11 which is therefore pressurized.

[0050] In accordance with the idea underlying the present invention, the burner 5 is of premix type and comprises a cylindrical combustion head 12, which is provided with a metal mesh 13, on which the combustion occurs. The cylindrical combustion head 12 is extended into the combustion chamber 6 advantageously for at least the first section 7' of its wall 7, so as to uniformly heat it from the interior along its extension, which is externally and uniformly touched and cooled by the carrier fluid F which comes from the recirculation duct 4.

[0051] More in detail, the supply means 8 for the burner 5 comprise a modulating blower 14, which is driven by a variable speed motor (advantageously of brushless type), in order to suction an adjustable air flow, and a controlled valve 15, i.e. with proportional opening for the gas, which is connected on one side to a source of supply gas, and on the other side to the inlet of the modulating blower 14 in order to introduce a gas flow therein.

[0052] The supply means 8 for the burner draw a gas flow from the gas source through the controlled valve 15, as a function of the air suctioned by the modulating blower 14. The air flow and the gas flow are then closely mixed together within the modulating blower 14 in order to then be injected in mixture form in the combustion head 12, making a flame, advantageously radial, on its cylindrical mesh 13.

[0053] The controlled valve 15 is controlled to open and close, in an advantageously proportional manner, directly by the flow of air suctioned by the modulating blower 14 by means of control means.

[0054] Such control means can be pneumatic, mechanical or electronic.

[0055] For example, the controlled valve 15 can for such purpose have a proportional opening with pneumatic control, by receiving a pressure signal from the treated air flow or from the suction of the modulating blower 14.

[0056] Otherwise, the controlled valve can be mechanically controlled by a progressive actuation, which responds in a variable manner to the flow rate of air suctioned by the controlled valve.

[0057] Such control means - for making the opening of the valve 15 of the gas dependent on the flow rate of an air flow fed by the blower 14 - are well-known to the man skilled in the art of the field, are schematized in figure 5 and do not require further details due to the easy manufacture thereof.

[0058] An electronic control unit can likewise be provided which will control the speed of the modulating blower 14, for example as a function of the heat required by the users, and which will electronically detect the capacity of the modulating blower 14 in order to consequently adjust the valve 15, also possibly providing for optimizing the combustion parameters through the assumption of different parameters such as temperature, humidity or emissions at the flue 11.

[0059] Due to the present invention, the performances of a premix burner 5 in a heating system with radiant strips 1 are synergistically exploited, by providing for cooling the combustion chamber 6 - which otherwise would reach unacceptable temperatures in a configuration with radiant strips - through the recirculation flow of the coldest gases of the carrier F externally over the entire first section 7' of the wall 7 of the combustion chamber 6, which is correspondingly internally heated also by radiation from the cylindrical combustion head 12 of the burner 5.

[0060] The heating of the wall 7 of the combustion chamber also occurs by radiation by the metal mesh 13 of the cylindrical combustion head 12 of the burner 5, on which the combustion occurs. The flame on the mesh is very compact and preferably radial, and thus allows the mesh to radiate heat towards the wall 7.

[0061] Advantageously, moreover, in order to lengthen the flame, improving the stability thereof, the cylindrical combustion head 12 of the premix burner 5 is extended into the combustion chamber 6, going beyond its first section, traversing the initial section 2A of the loop of radiant strips 2 for a length L shorter than the second section 7", with which the combustion chamber 6 is extended into the delivery pipe 2'.

[0062] In accordance with a preferred characteristic of the present invention, a jacket 16 is provided, externally arranged with respect to the recirculation duct 4, with which it defines an interspace 17. The latter is in communication with the external environment by means of a first opening 18 and is in communication with the suction of the modulating blower by means of a first supply duct 19.

[0063] In this manner, the air suctioned by the modulating blower 14, through the first supply duct 19 and the interspace 17, is heated in contact with the recirculation duct 4, removing heat from the carrier fluid F so as to supply the modulating blower 14 with pre-heated air. Preferably, moreover, the air supply duct 19 comprises a chamber 20, which is provided with a wall 21 that separates it from the recirculation duct 4 and in which a second opening 22 is provided for the passage of a fraction F' of the flow of the carrier fluid F. The wall 21 is also provided with a third opening 25 in order to place the chamber 20 in communication with the interspace 17.

[0064] Such fraction F' of the flow of the carrier fluid F is constituted by exhaust gases, the exhaust gases having previously exited from the burner 6 hence with a much lower oxygen level than that of the external air.

[0065] The fraction F' of the flow of the carrier fluid F is therefore mixed in the chamber 20 with the ambient air coming from the first opening 18, further heating it and forming a mixture of air with oxygen level lower than that of the ambient air, and which supplies the modulating blower 14.

[0066] The low-oxygen mixture allows further reducing the NO_x generated in the combustion on the head 12 and subsequently emitted by the flue 11.

[0067] Advantageously, the fraction F' of the flow of the carrier fluid F is selected in a manner such that the mixture directed towards the modulating blower 14 has an oxygen percentage on the order of 15-18% rather than about 20.9% which external air would normally have.

[0068] The two abovementioned openings, i.e. the first opening 18 for the inlet of the ambient air and the second opening 22 for the inlet of the fraction F' of the flow of the carrier fluid F, can be adjusted by a gate valve (not illustrated) for reducing the passage of the ambient air and/or of the fraction F' of the flow of the carrier fluid F into the comburent fluid.

[0069] In accordance with an advantageous embodiment illustrated in figure 6, the system 1 also comprises a heat exchanger 26, which is associated with the flue 11 and receives the air from the external environment through at least one opening 27.

[0070] The air that enters into the exchanger 26 exchanges heat with the discharge fumes of the flue 11, being heated in order to supply the modulating blower 14 with pre-heated air through a second air supply duct 28. Due to the exchanger 26, the discharge fumes of the flue 11 are cooled, expelling colder fumes into the atmosphere with considerable energy savings, advantageously at a temperature lower than that of condensation for the recovery of the latent heat and hence of a considerably quantity of heat.

[0071] In accordance with an embodiment variant illustrated in figures 7 and 8, the pre-heated air exiting from the exchanger 26 is directed, by means of the second air supply duct 28, into the above-considered interspace 17, which encloses, or at least partly touches, the recirculation duct 4, and is in communication with the suction of the modulating blower 14 by means of the first supply duct 19. As already seen above, such first air supply duct 19 can also in this case comprise the chamber 20 which receives, from the second opening 22, a fraction F' of the flow of the carrier fluid F.

[0072] The containment structure 3 comprises a technical compartment 24, in which the ventilator 9 (or its motor) and the supply means 8 for the burner 5 are housed.

[0073] Such technical compartment 24 is separated from the recirculation duct 4 by a partitioning wall 23 which, if the drawing of the fraction F' of the carrier fluid F flow is provided, is partly defined by a wall of the chamber 20.

[0074] The cooling of the recirculation duct 4 through the air that traverses the interspace 17 allows decreasing or even eliminating the otherwise necessary insulation that separates it from the contiguous technical compartment 24, which is at a sufficiently low temperature for containing the ventilator 9 and the supply means 8 without ruining them.

[0075] In accordance with the above-described premix burner, the fuel and the comburent are mixed before combustion. Such technical solution allows very extensively modulating the delivered power, allowing an improved operating efficiency since the capacity to modulate the power and hence the heat supply allows satisfying the actual present needs of the users, reducing the turning on/off actions that are necessary with the burners that do not allow considerable modulation and which operate with insufficient or excessive power. The modulation of the flame of this burner allows varying the temperature of the fumes and hence of the carrier fluid as a function of the external temperature in order to optimize the performances. In addition, the flame of this burner assumes a compact geometry that maintains limited noise, which therefore also involves limited acoustic emission at the flue, with important advantages with regard to comfort.

[0076] The finding thus conceived therefore attains the preset objects.

Claims

1. Heating system with radiant strips, which comprises:

- at least one loop of radiant strips (2) susceptible to be fixed to the ceiling or to a wall of a room to be heated and adapted to be internally traversed by a heated carrier fluid (F), for heating said room by radiation;
- a containment structure (3);
- a recirculation duct (4) housed in said containment structure (3), susceptible to place an initial section (2A) and a final section (2B) of said loop of radiant strips (2) in mutual connection;
- a burner (5) of premix type, housed in said containment structure (3) and provided with:
    - a combustion chamber (6) delimited by a cylindrical wall (7) which is extended passing into said recirculation duct (4) for a first section (7') in which it is externally touched by said carrier fluid (F);
    - means (8) for supplying a fuel mixture connected to said combustion chamber (6) in which the combustion of said fuel mixture and the generation of combustion products susceptible to heat said carrier fluid (F) occurs;
    - a cylindrical combustion head (12);
- a ventilator (9), housed in said containment structure (3) provided with a fan (10) inserted in said recirculation duct (4) and operating in a suctioning fashion to force said carrier fluid (F) into said loop of radiant strips (2), from said final section (2B) to said initial section (2A);

characterized in that:

- said cylindrical wall (7) is extended for a second section (7") with which it continues into said loop of radiant strips (2) starting from its initial section (2A);

- the cylindrical combustion head (12) of said burner (5) is provided with a metal mesh (13) on which the combustion occurs, and it is extended into said combustion chamber (6) for at least the first section (7') of said cylindrical wall (7) thereof, so as to uniformly heat such first section (7') of the cylindrical wall which is externally and uniformly touched by the carrier fluid (F) of said recirculation duct (4);

- the means (8) for supplying said burner (5) comprise:

  - a modulating blower (14), which is driven by a variable speed motor, for suctioning an adjustable air flow,

  - a controlled valve (15), which is connectable to a source of supply gas, and is connected to said modulating blower (14) to which it is susceptible to send a gas flow as a function of the air suctioned by said modulating blower (14); the air flow and the gas flow being mixed together in said modulating blower (14) and injected by the latter in mixture form into said cylindrical combustion head (12) to obtain a flame on the cylindrical mesh (13) thereof.

2. Heating system according to claim 1, **characterized in that** the cylindrical combustion head (12) of said premix burner (5) is extended into said combustion chamber (6) beyond the first section (7') of the wall (7) thereof, traversing the initial section (2A) of said loop of radiant strips (2) for a length (L) shorter than the second section (7") of the wall (7) of said combustion chamber (6).

3. Heating system according to claim 1, **characterized in that** it comprises a jacket (16) arranged externally with respect to said recirculation duct (4), defining with the latter an interspace (17) in communication with the external environment by means of a first opening (18) and with the suction of said modulating blower (14) by means of a first supply duct (19), for supplying said modulating blower with pre-heated air.

4. Heating system according to claim 3, **characterized in that** said first supply duct (19), comprises a chamber (20) provided with a wall (21) for separation from said recirculation duct (4) and in which at least one second opening (22) is provided for the passage of a fraction (F') of carrier fluid (F), which is mixed in said chamber (20) with the ambient air coming from said first opening (18), forming a low-oxygen mixture that supplies said modulating blower (14).

5. Heating system according to claim 4, **characterized in that** said first and/or second opening (18, 22) have a gate valve associated therewith for reducing the passage of the ambient air and/or of the fraction (F') of the flow of said carrier fluid (F).

6. Heating system according to any one of the preceding claims, **characterized in that** it comprises an electronic control unit connected to said modulating blower (14) and to said controlled valve (15) and susceptible to control the flow rate of the mixture to be injected into the burner (6) and the air/gas ratio of said mixture.

7. Heating system according to any one of the preceding claims, **characterized in that** the motor of said modulating blower (14) is of brushless type.

8. Heating system according to any one of the preceding claims, **characterized in that** the controlled valve (15) of said means (8) for supplying said burner (6) is a pneumatic control valve receiving the pressure signal from the air flow treated by said modulating blower (14).

9. Heating system according to any one of the preceding claims, **characterized in that** the metal mesh (13) of the cylindrical combustion head (12) of said burner (5), on which combustion occurs, heats the wall (7) of said combustion chamber (6) by radiation.

10. Heating system according to any one of the preceding claims, **characterized in that** said containment structure (3) comprises a partitioning wall (23) which separates the recirculation duct (4) from a technical compartment (24), in which said ventilator (9) and said means (8) for supplying said burner (5) are housed.

11. Heating system according to any one of the preceding claims, **characterized in that** it comprises at least one heat exchanger (26), which is associated with said flue (11), receives air from the external environment through at least one opening (27), and supplies said modulating blower (14) with pre-heated air in said exchanger (26) through at least one second supply duct (28).

12. Heating system according to claim 11 and any one of claims 3, 4 or 5, **characterized in that** the air pre-heated in said exchanger (26) is directed by said second supply duct (28) into said interspace (17).

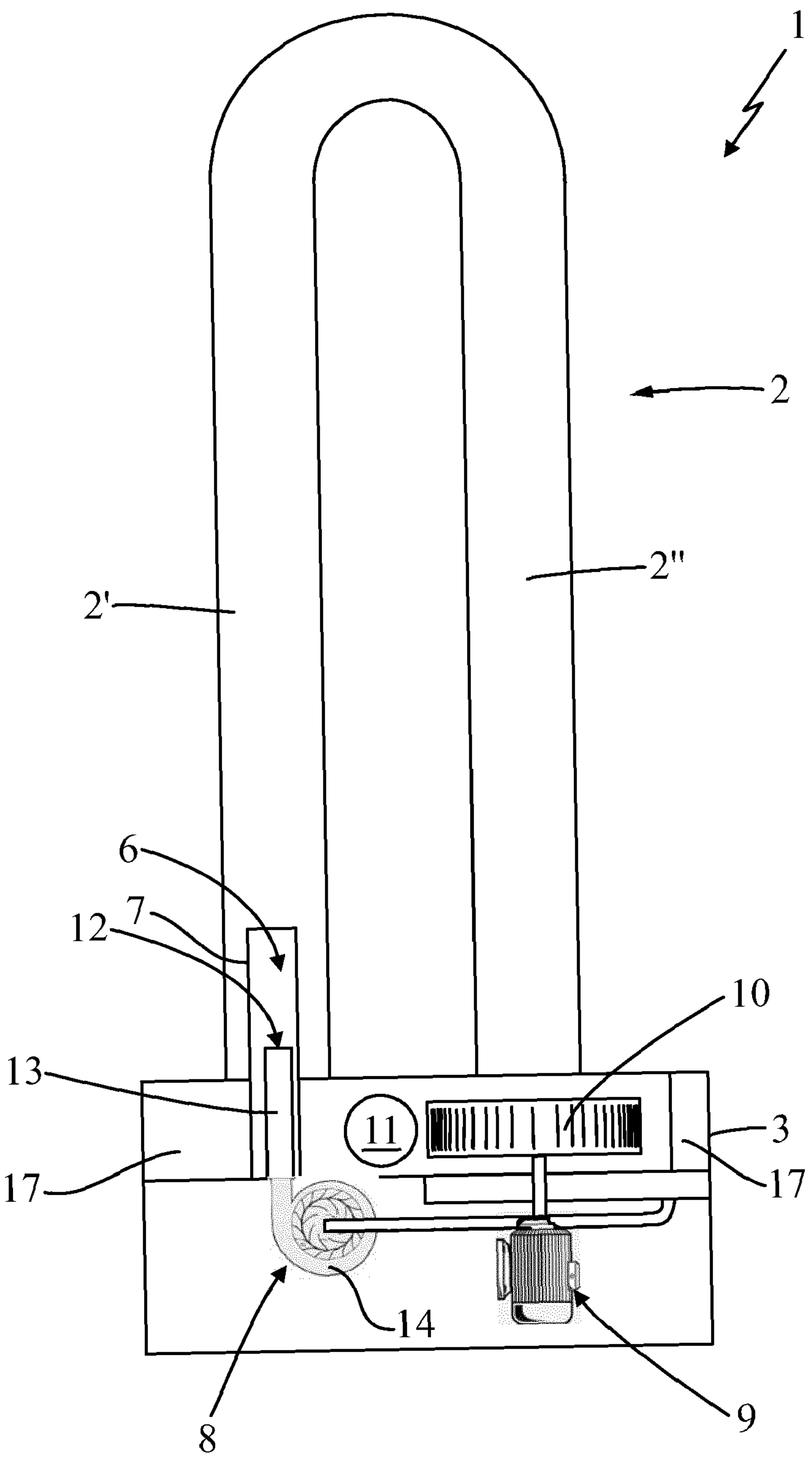
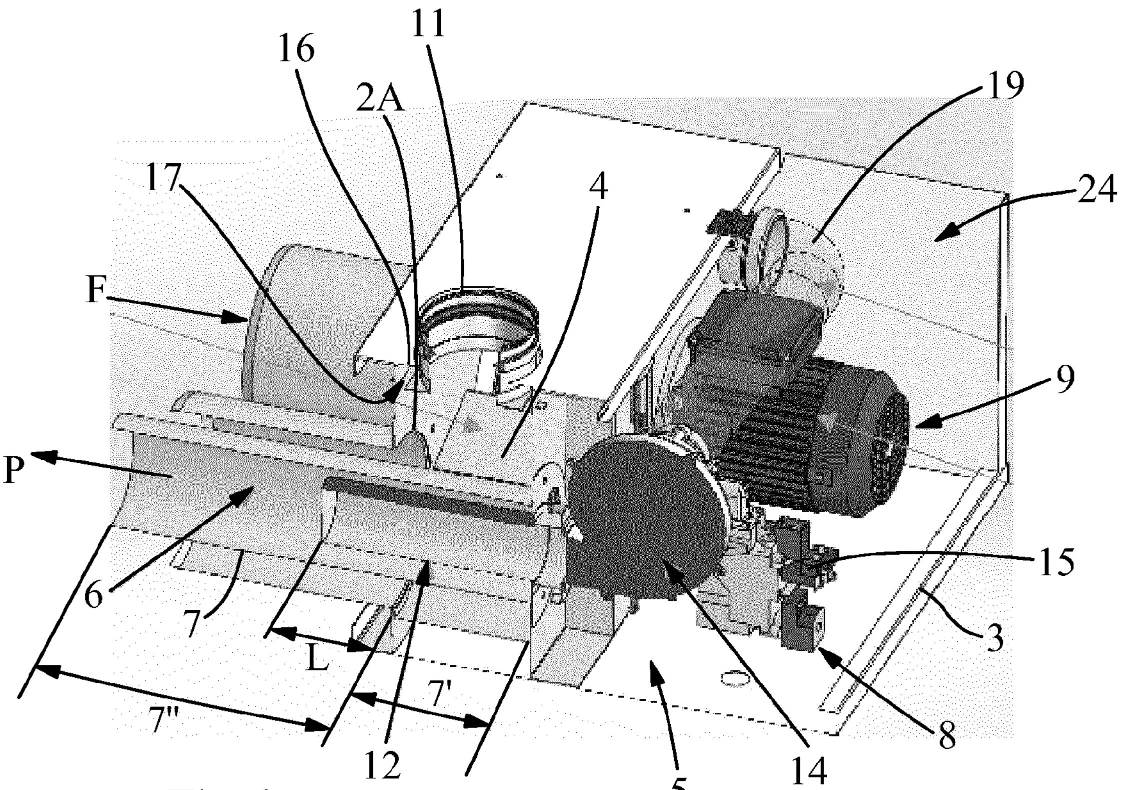


Fig. 1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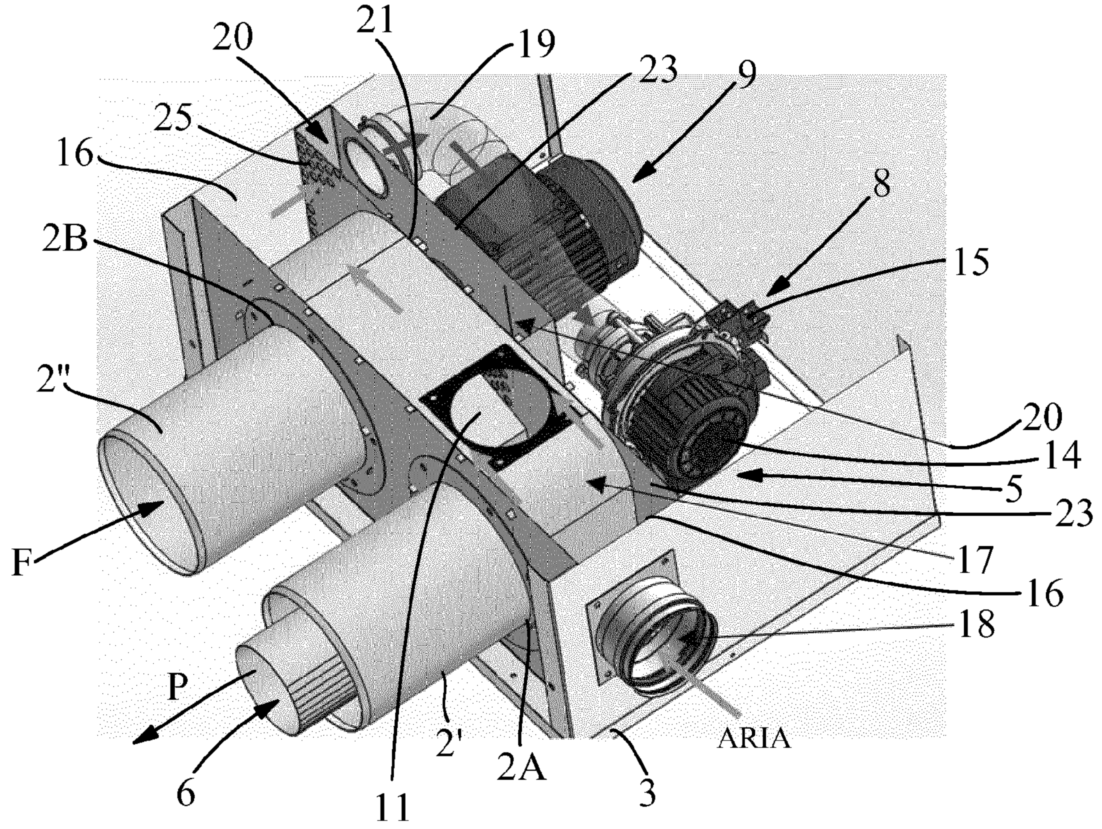
14
5

Fig. 3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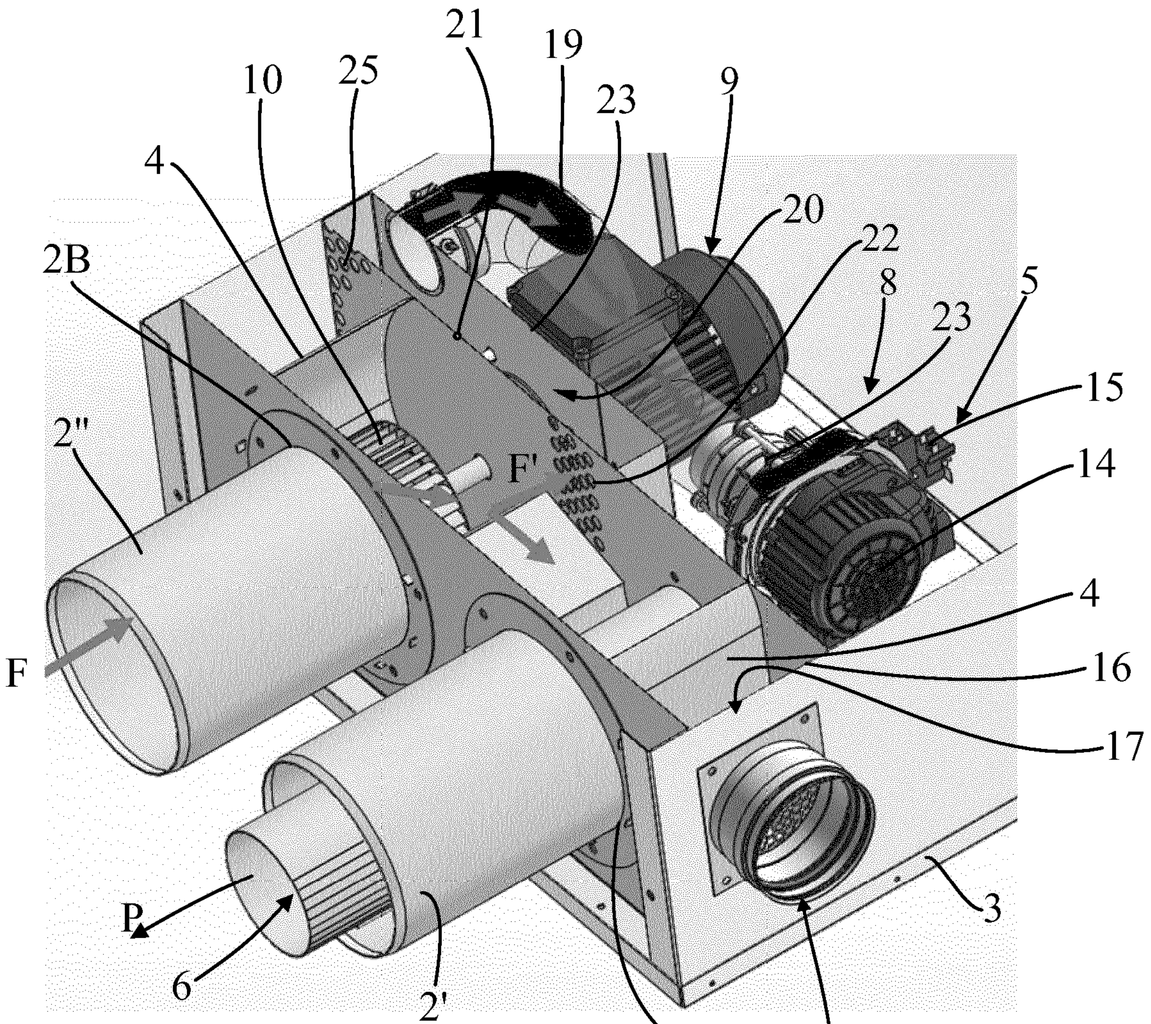
20
19
23
9
25
16
8
2B
15
2"
20
14
5
23
F
17
16
18
P
ARIA
2'
6
2A
11
3

Fig. 2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4
20
2B
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8
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2''
15
F'
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F
16
17
3
P
6
2'
2A
18

Fig. 4

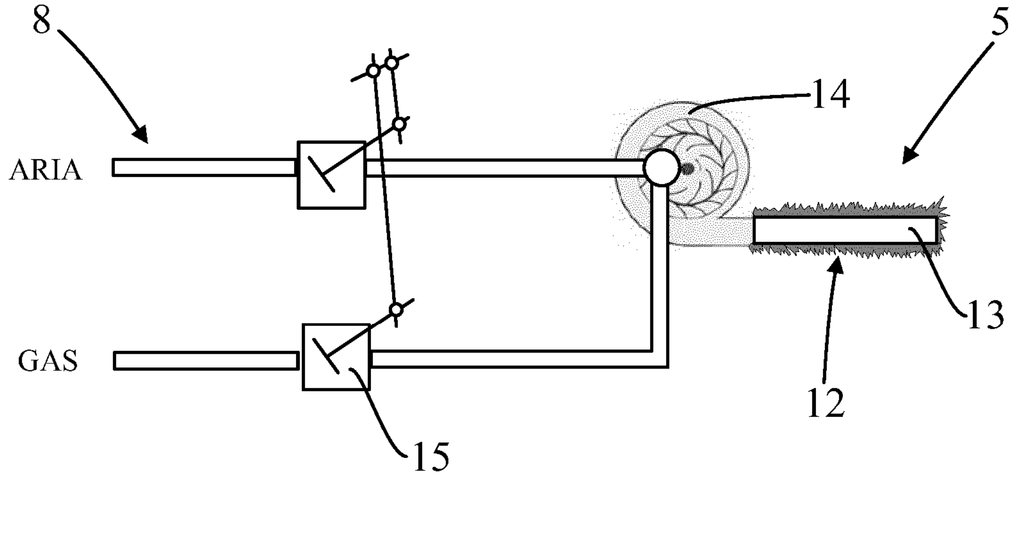
8
5
14
ARIA
13
GAS
12
15

Fig. 5

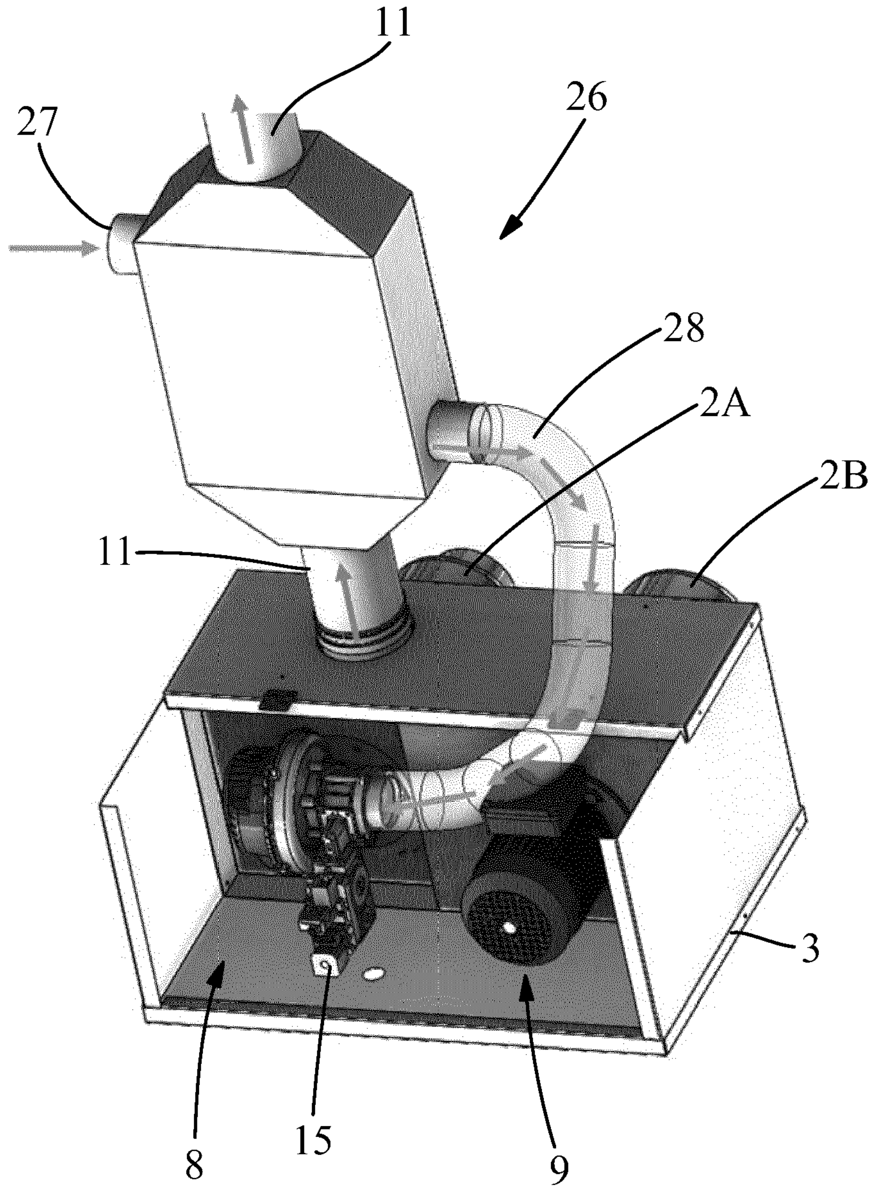

Fig. 6

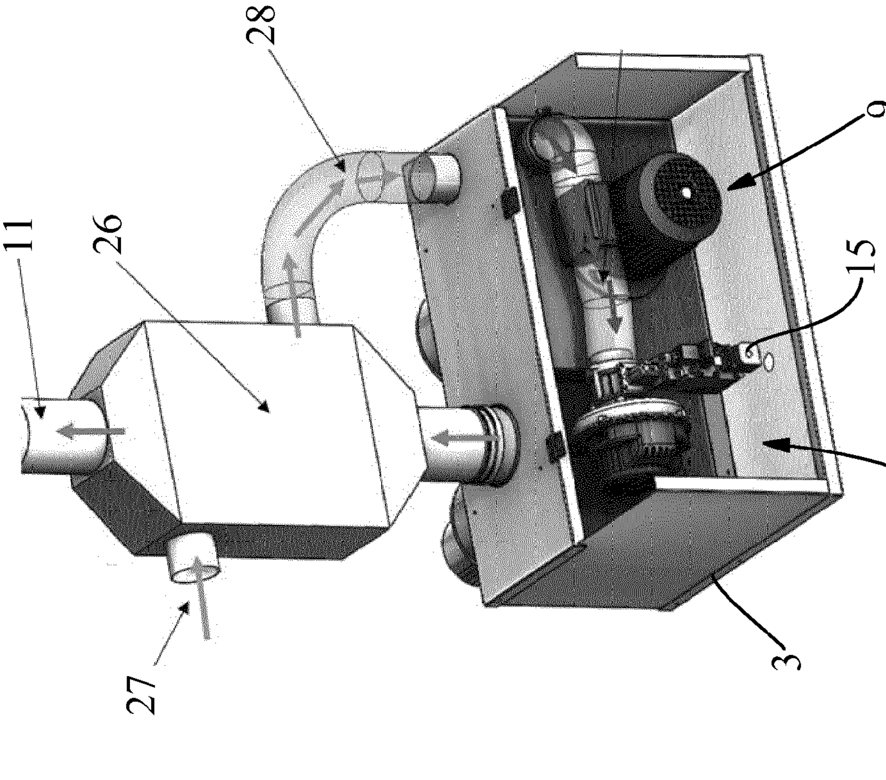

Fig. 7

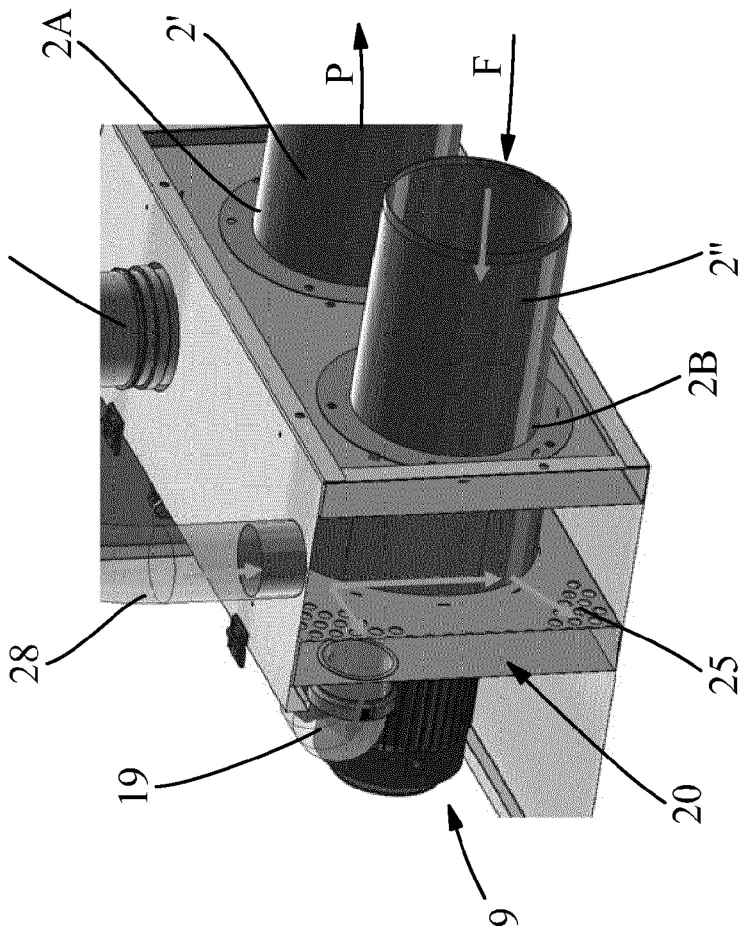

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 17 20 7170

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A	DE 91 03 004 U1 (PENDEWR STRAHLUNGSHEIZUNG, DE) 13 June 1991 (1991-06-13) * page 5 - page 12; figure 1 * -----	1-12	INV. F24D5/08 F23D14/02 F23D14/14 F23C3/00
A	US 2009/042155 A1 (TURNER GLYN WILFRED [GB] ET AL) 12 February 2009 (2009-02-12) * paragraph [0015] - paragraph [0025]; figures 1-2 * -----	1-12	
A	WO 2006/120717 A1 (SYSTEMA S P A [IT]; PALLARO OSCAR [IT]) 16 November 2006 (2006-11-16) * paragraph [0029] - paragraph [0065]; figures 1-2 * -----	1-12	
A	EP 0 391 818 A1 (GAZ IND SA [FR]) 10 October 1990 (1990-10-10) * column 2, line 24 - column 6, line 9; figures 1-2 * -----	1-12	TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	11 May 2018	Ast, Gabor

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