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(54) **Regulation system to control the speed of a fan delivering burner air**

(57) Burner comprising at least one fan (1) provided with a rotor (2) which takes comburent from at least one suction opening (3) and pumps it under pressure to a combustion duct (4), as well as with a differential manometer (9) connected to at least two probes (10, 11)

arranged in the comburent flow, said differential manometer (9) being connected also to means (5, 12; 21, 22) for adjusting the comburent flow toward the combustion duct (4) according to the pressure values detected by the differential manometer (9).

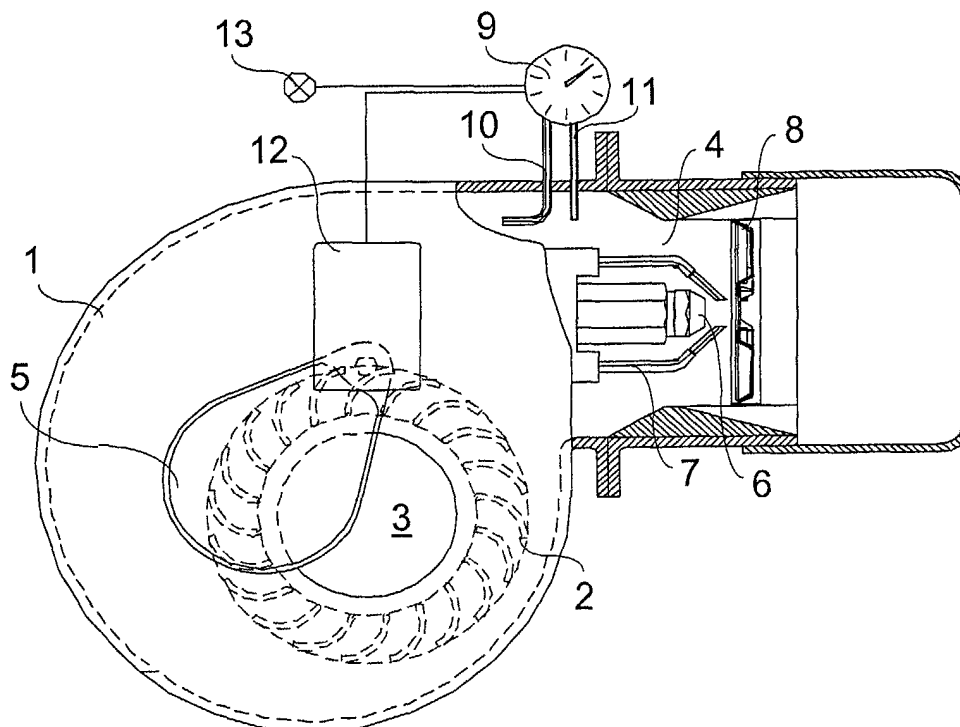


Fig. 1

Description

[0001] The present invention relates to a burner, and in particular to a burner with an automatic adjustment of the comburent flow for the combustible, which can be either gaseous or liquid.

[0002] In the known burners, the combustion is calibrated during the installation by manually adjusting the comburent flow blown into the combustion duct. However, during the use, some parts of the burner, for instance the fan, or ducts connected thereto, for instance the flue, are partially obstructed due to the combustion residues which can accumulate onto its inner walls, so as to worsen or compromise the working of the burner itself.

[0003] It is therefore an object of the present invention to provide a burner which is free from said disadvantages, i.e. a burner which correctly works also with the partially obstructed duct. Said object is achieved with a burner, the main features of which are disclosed in the first claim and other features are disclosed in the subsequent claims.

[0004] Thanks to the differential manostat made up of the differential manometer and of the means for adjusting the incoming comburent flow, the burner according to the present invention can automatically compensate pressure losses, if any, in the combustion duct, which are generally caused by dirt accumulations and combustion residues.

[0005] According to a particular advantageous aspects of the invention, the differential manometer can be connected to a thermal sensor for compensating changes, if any, of the oxygen amount in the comburent.

[0006] According to another particular advantageous aspects of the invention, the flow deviator can comprise a plurality of fins which prevent the obstruction of the openings for the comburent flow.

[0007] Finally, the burner according to the present invention can be provided with means suitable for signaling its anomalous working, so as to intervene before it suffers or causes malfunctions.

[0008] Further advantages and features of the burner according to the present invention will be clear to those skilled in the art from the following detailed and non-limiting description of two embodiments thereof with reference to the attached drawings, wherein:

- figure 1 shows a partially cross-sectioned side view of a first embodiment of the burner;
- figure 2 shows an exploded perspective view of the flow deviator of the burner of figure 1;
- figure 3 shows a front view of the flow deviator of figure 2;
- figure 4 shows a view cross-sectioned according to plane IV-IV of the flow deviator of figure 3; and
- figure 5 shows a cross-sectioned rear view of a second embodiment of the burner.

[0009] Referring to figure 1, it is seen that the burner according to the first embodiment of the invention comprises in a known way a fan 1 provided with a rotor 2 (shown with broken lines) which takes comburent, in particular air, from at least one suction opening 3 and pumps it under pressure to a combustion duct 4. The suction opening 3 can be provided with means for adjusting the comburent flow, for instance a shutter 5 suitable for partially closing said opening. At least one nozzle 6 for ejecting the combustible, as well as one or more electrodes 7 for its ignition are arranged in the combustion duct 4. The latter also comprises a flow deviator 8 provided with a plurality of fins for impressing a swirling motion to the comburent, so as to correctly mix it with the combustible.

[0010] According to the invention, a differential manometer 9, which can also be made up of a pair of single manometers mutually connected by means of electric and/or electronic devices, measures the comburent pressure by means of at least two probes 10, 11, the first of which has the free end turned toward the comburent flow, so as to measure the pressure increase due to the flow speed. In particular, the free end of probe 10 is arranged substantially parallel to the comburent flow, while the free end of probe 11 is arranged substantially perpendicular to the flow itself. The differential manometer 9 is further connected, directly or by means of intermediate devices, to an actuator 12, for example an electric motor, which is in turn mechanically connected to shutter 5. With this arrangement, the comburent flow coming from the suction opening 3 can be automatically adjusted according to the pressure values detected by the differential manometer 9, so that the combustion in duct 4 is always optimal.

[0011] The pressure values detected by the differential manometer 9 can be transmitted also to external signaling devices, for example a lamp 13 and/or a phone dialer, so as to signal anomalous working, if any, of the burner. The differential manometer 9 can further be connected, directly or through intermediate devices, to a thermal sensor (not visible in the figure) suitable for measuring the comburent temperature, so as to compensate changes, if any, of the oxygen amount contained therein, generally due to changes of its temperature, by acting on the means for adjusting the comburent flow.

[0012] In another embodiment of the invention, the differential manometer 9 can be connected not to motor 12, but to the motor (not visible in figure 1) of fan 1, so as to adjust the comburent pressure by changing the rotation speed of rotor 2. Nozzle 6 for the combustible can further be provided with a manometer (not visible in the figure) for measuring the combustible pressure before the ejection. If the value measured by the manometer exceeds a determined threshold pressure value, a partial or total obstruction of nozzle 6 is detected and signaled.

[0013] With reference to figures 2 to 4, it is seen that

in the present embodiment of the invention, the flow deviator 8 preferably comprises two propellers 14, 15, which are substantially circular-shaped and are arranged side by side and concentrically. The first propeller 14 comprises in a known way a first plurality of fins 16 suitable for deviating the comburent flow, while the second propeller 15 comprises a plurality of openings 17 adjacent to fins 16 of the first propeller 14, so as to let the comburent flow through, as well as second plurality of fins 18 arranged along the edge of openings 17 opposite to the edge close to the first fins 16. The second fins 18 prevent the comburent flow to lick the rear surface of the first propeller 14 after it has crossed openings 17 and has been deviated by the first fins 16, thus avoiding that particles, for example of dirt, can deposit onto said surface. Propellers 14, 15 are further provided with a central opening 19 through which the combustible ejected by nozzle 6 passes. In an alternative embodiment, propellers 14, 15 can be carried out in a single piece comprising fins 16 and 18.

[0014] Finally, referring to figure 5, it is seen that in a second embodiment of the burner according to the present invention the differential manometer 9 can be connected by means of probes 10, 11 to a suction duct 20 arranged upstream the suction opening 3. The differential manometer 9 is further connected to a motor 21 mechanically connected to a shutter 22 arranged downstream rotor 2, so as to adjust the comburent flow in the combustion duct 4.

Claims

1. Burner comprising at least one fan (1) provided with a rotor (2) which takes comburent from at least one suction opening (3) and pumps it under pressure to a combustion duct (4), **characterized in that** a differential manometer (9) is connected to at least two probes (10, 11) arranged in the comburent flow, said differential manometer (9) being connected also to means (5, 12; 21, 22) for adjusting the comburent flow toward the combustion duct (4) according to the pressure values detected by the differential manometer (9).
2. Burner according to the previous claim, **characterized in that** the free end of a probe (10) is turned toward the comburent flow, so as to measure the pressure increase due to the flow speed.
3. Burner according to claim 2, **characterized in that** the free end of the first probe (10) is arranged substantially parallel to the comburent flow, while the free end of the second probe (11) is arranged substantially perpendicular to the flow itself.
4. Burner according to one of the previous claims, **characterized in that** the differential manometer (9) is connected to a thermal sensor suitable for measuring the comburent temperature, so as to compensate changes, if any, of the oxygen amount contained therein by acting on the means (5, 12; 21, 22) for adjusting the comburent flow toward the combustion duct (4).
5. Burner according to one of the previous claims, **characterized in that** the differential manometer (9) is connected to an actuator (12; 21), which is in turn mechanically connected to a shutter (5; 22) suitable for changing the comburent flow according to the values detected by the differential manometer (9).
6. Burner according to one of the previous claims, **characterized in that** the differential manometer (9) is connected to the motor of the fan (1) for changing the rotation speed of the rotor (2) according to the values detected by the differential manometer (9).
7. Burner according to one of the previous claims, **characterized in that** the differential manometer (9) is connected to external signaling devices (13).
8. Burner according to one of the previous claims, **characterized in that** the differential manometer (9) is connected to the combustion duct (4) by means of the probes (10, 11).
9. Burner according to one of claims 1 to 7, **characterized in that** the differential manometer (9) is connected by means of the probes (10, 11) to a suction duct (20) which is arranged upstream the suction opening (3).
10. Burner according to one of the previous claims, **characterized in that** a nozzle (6) for ejecting the combustible, which is provided with a manometer for measuring the combustible pressure before the ejection and signaling the exceeding a threshold pressure value, is arranged in the combustion duct (4).
11. Burner according to one of the previous claims, **characterized in that** a flow deviator (8) comprising a plurality of openings (17) adjacent to a first plurality of fins (16) suitable for deviating the comburent flow, as well as a second plurality of fins (18) arranged along the edge of the openings (17) opposite to the edge close to the fins (16) for preventing that the comburent flow licks the rear surface of the flow deviator (8), is arranged in the combustion duct (4).
12. Burner according to claim 11, **characterized in that** the flow deviator (8) comprises two propellers (14,

15) which are substantially circular-shaped and are arranged side by side and concentrically, wherein the first propeller (14) comprises the first plurality of fins (16), while the second propeller (15) comprises the plurality of openings (17) for the comburent flow, as well as the second plurality of openings (18).

13. Burner according to claim 12, **characterized in that** the propellers (14, 15) are provided with a central opening (19).

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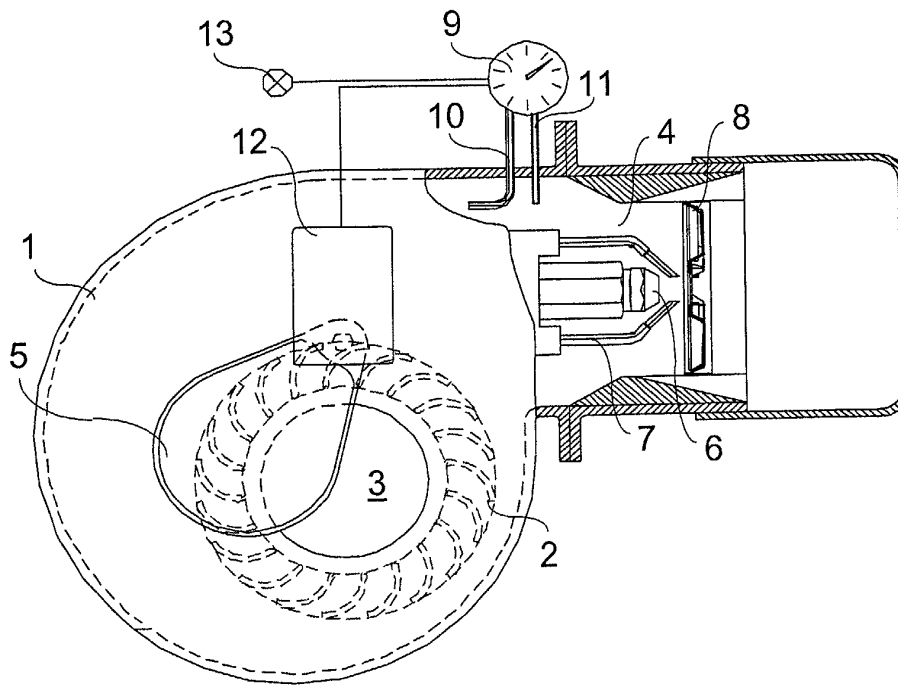


Fig. 1

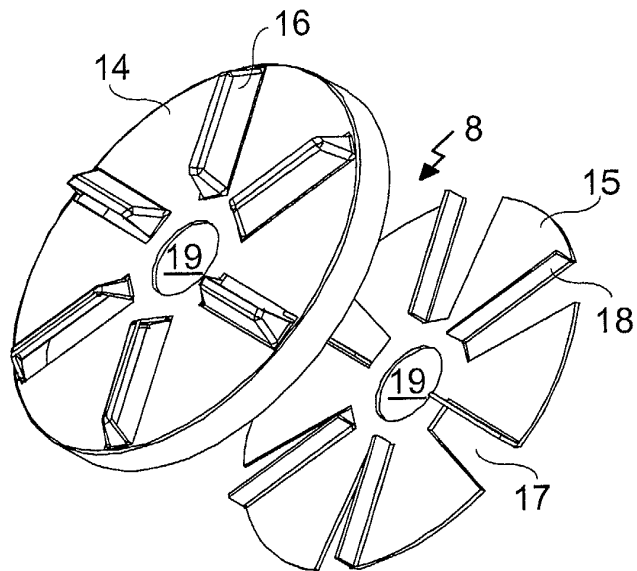
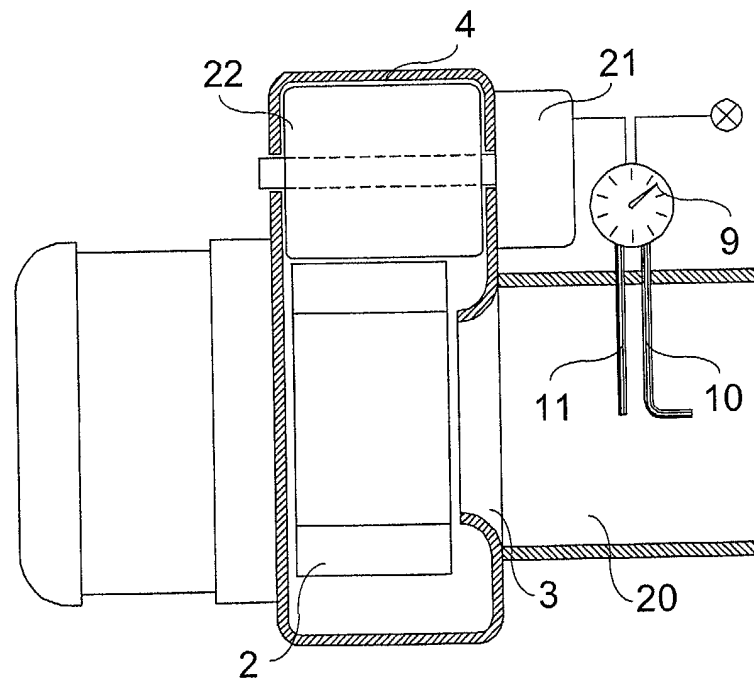
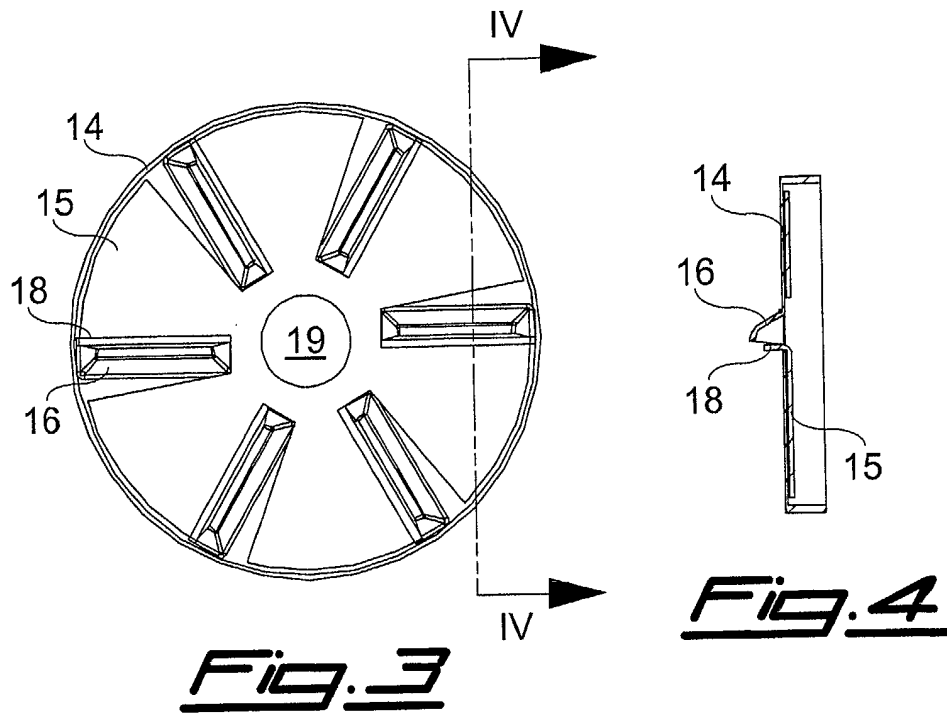


Fig. 2





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EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5298

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 November 2002	Examiner Mougey, M
CATEGORY OF CITED DOCUMENTS 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 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			

EPO FORM 1503 03 82 (P04C01)



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EUROPEAN SEARCH REPORT

Application Number
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Place of search THE HAGUE		Date of completion of the search 21 November 2002	Examiner Mougey, M
CATEGORY OF CITED DOCUMENTS 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 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			

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
1-9, 11-13
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 02 42 5298

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-9

These claims deal with the use of a differential pressure measurement of the air flow to maintain the fuel air ratio in a correct range, even in case of clogging of the exhaust pipe.

2. Claim : 10

This claim deals with the measurement of the fuel pressure before ejection at the nozzle in order to stop the fuel delivery in case of nozzle clogging.

3. Claims: 11-13

These claims deal with the design of fan blades.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 42 5298

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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