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

(11) EP 1 176 367 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
30.01.2002 Bulletin 2002/05

(51) Int Cl.[7]: **F24C 15/32**, F24C 3/12

(21) Application number: **01116786.3**

(22) Date of filing: **23.07.2001**

(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: **25.07.2000 IT VI000160**

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(54) Forced convection oven for food baking

(57) A forced convection oven for food baking including: a baking chamber (3) having internal heat exchanging means (2) formed by at least one wound pipe passed through by the discharged smoke of the burnt gas; a burner (4) provided with air/fuel mixing means whose head (41) faces the flame of said heat exchanger; ventilation means (46) suitable to ensure the necessary capacity of the burner of the air/fuel mixture. Said mixing means air/fuel are a mixer valve (43) ensuring a constant air/fuel ratio when the capacity varies and said capacity of said mixture is variable through the variation of the number of revolutions of the ventilation means, said variation being a function of the difference between the temperature (Ti) required to the oven and the detected temperature (Tf) of the chamber of said oven.

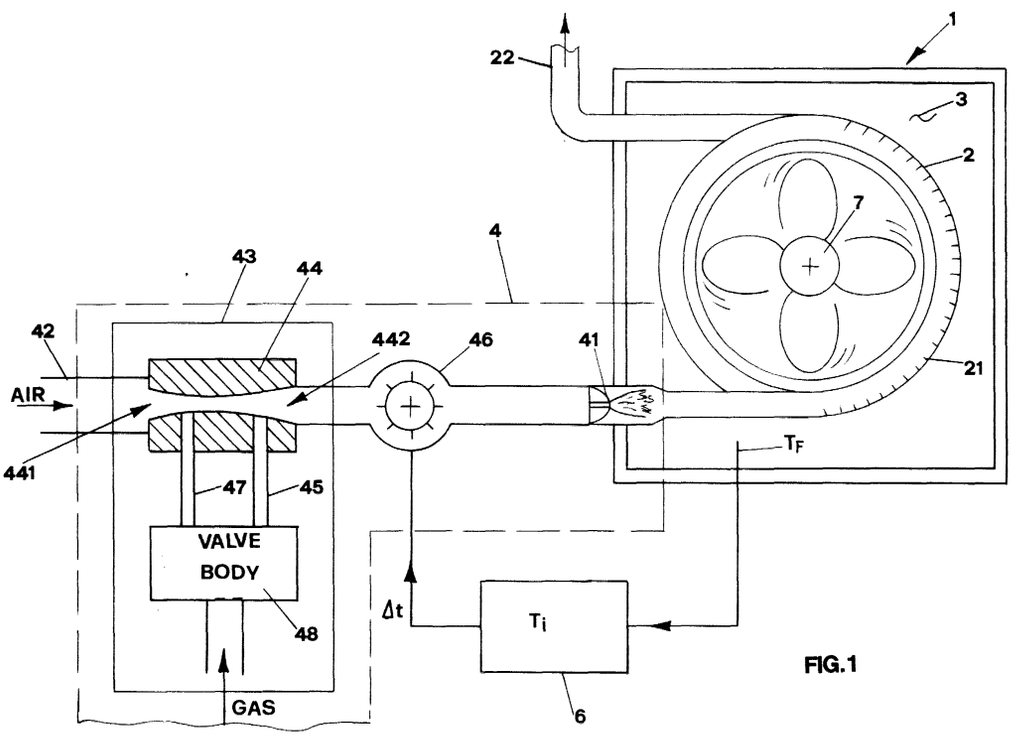

FIG.1

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Description

[0001] The invention concerns an oven for food baking of the forced convection type with the heat exchanger inside the baking chamber.

[0002] This kind of ovens contemplate that in the baking chamber there is a heat exchanger, generally a spiral-shaped wound pipe in which there are some gas circulating, produced by the combustion of a burner, generally a gas burner.

[0003] The burnt gas, that generally are pushed under overpressure inside this heat exchanger, give the heat to the baking chamber also with the help of a ventilator placed inside the baking chamber and more particularly in the cylindrical space defined by the spiral wound heat exchanger. In such a way the heat exchange is optimized.

[0004] In the ovens for food baking it is necessary to adjust the temperature that has to be different for the different kind of baking and for the different kind of food to be baked and that has to vary also in time, through rises and falls in temperature according to predetermined intervals.

[0005] Generally the variation of the heat amount exchanged in the baking chamber in this kind of ovens occurs by increasing or decreasing the gas amount that is sent to the burner. In fact the exhaust gas speed is generally constant inside the heat exchanger and is due to the overpressure produced by ventilators placed ahead of or below the heat exchanger.

[0006] The Italian patent IT 1220069 presents a gas-fed oven in which the heat exchanger that is inside the oven compartment is formed by a spiral wound pipe where circulates the exhaust smoke due to the combustion of a gas burner. Such smoke is speeded up through an ejector placed on the end side of the exhaust pipe that produces through a ventilator a draft carrying away the smoke on the outside producing a depression just next to the exhaust speeding up the exit of the smoke.

[0007] According to the European Patent EP 0 526 768 in the spiral wound exchanging means the speeding up of the smoke is obtained having just one ventilator ahead of the burner. The ventilator supplies an air overplus in a chamber for the air/fuel combustion so that the air overplus not used for the combustion is used to speed up the smoke exit.

[0008] One of the drawbacks of this kind of manufacture is that by varying the air coming in, the ratio of the air/gas mixture varies too and this bars the optimization of the combustion parameters.

[0009] The objet of the present invention is that of realizing a forced convection oven in which it is possible to increase or decrease the heat exchange inside the baking chamber also by increasing the speed of the exhaust gas of the combustion without affecting the quality of the combustion to be obtained.

[0010] What is essentially wanted is managing to keep optimal combustion parameters when the speed of the exhaust smoke varies.

[0011] Another objet that is intended by the invention is that of relating directly the increase or the decrease of temperature inside the chamber of the oven and the capacity of the air/fuel mixture that the burner is supplied with.

[0012] Another object of the invention is that of realizing the adjustment of the increasing or decreasing temperature inside the oven chamber, through simple and functional means.

[0013] Another object of the invention is that of realizing an oven with reliable and low-priced devices.

[0014] All the above-said objects and others that will be better underlined later on are achieved by a forced convection oven for food baking that according to claim one includes:

- a baking chamber having internal heat exchanging means formed by at least one wound pipe passed through by the discharged smoke of the burnt gas;
- a burner provided with air/fuel mixing means whose flame head faces the inlet of said heat exchanger;
- ventilation means suitable to ensure the necessary capacity of the burner of the air/fuel mixture, said oven being characterized in that said mixing means air/fuel are a mixer valve ensuring a constant air/fuel ratio when the capacity varies and in that the capacity of said mixture is variable through the variation of the number of revolutions of the ventilation means, said variation being a function of the difference between the temperature (Ti) required to the oven and the detected temperature (Tf) of the chamber of said oven.

[0015] Advantageously according to the invention the air/fuel mixing that is generally realized through methane, propane or the like occurs through a mixer valve ensuring a constant air/fuel ratio, more specifically according to a preferred embodiment the mixer valve ensures a constant 1:1 ratio.

[0016] The heat supply needed to reach a certain temperature is due to the increase in the capacity of the combustible mixture air/gas, said capacity being varied through the number of revolutions of at least one ventilator that is placed indifferently ahead of or below the mixer valve and that causes the variation of the capacity of the air/fuel mixture as a direct function of the number of revolutions.

[0017] According to a preferred embodiment of the invention an electronic gearcase that is reached by a signal proportional to the temperature detected in the oven chamber, emits a signal proportional to the difference between the predetermined set out temperature and the temperature detected in the oven chamber, in such a way to vary the number of revolutions of the ventilator. It is evident that in such a way the capacity of the air/fuel mixture increases through the increase of the number of revolutions and therefore, increasing the

burnt gas, the heat brought to the heat exchanger and consequently to the baking chamber increases too. By decreasing the number of revolutions of the ventilator, the capacity decreases and therefore the heat supplied to the baking chamber decreases too.

[0018] Further characteristics and details of the invention will better underlined during the description of two preferred embodiments of the invention given approximately but not restrictively and shown through the figures in the enclosed drawings where:

- figure 1 shows a plan of a special embodiment of the invention;
- fig. 2 is another version of fig. 1 plan.

[0019] Referring to the said figures and specifically in fig. 1 it can be observed that the forced convection oven marked with **1** has an internal heat exchanger marked with **2** that in the case of the example is spiral wound on the ideal generating lines of a cylinder, so that it leaves an internal cylindrical space to put a ventilator **7** suitable to increase the heat exchange with the baking chamber **3** used for the food baking.

[0020] The pipe **2** has an inlet **21** and an end side **22.** At the inlet **21** there is the head **41** of a burner marked with **4** as a whole, so that the combustion smoke after having passed through the inside of the pipe of the exchanger **2**, comes out trough the end side **22** and carry on through the smoke outlet stack not represented as a figure.

[0021] The burner unit **4** has the air inlet pipe **42** facing the mixer valve marked with **43** as a whole that, as it can be observed schematically in fig. 1, is formed substantially by a Venturi pipe **44** and by a proper valve body **48**.

[0022] The duct **45** supplies with the gas that is mixed with the air coming from the inlet **42** and that goes into the inlet **441** of the Venturi pipe **44.** The air/fuel mixture comes to the ventilator **46** that therefore speeds up the capacity of the air/gas mixture that comes to the head of the burner **41** priming the flame. When the ventilator **46** varies its speed, it can be understood how, increasing the number of revolutions the returning action of the air/gas mixture coming out from the opening **442** increases too, so that a depression is produced at the beginning in the Venturi pipe **44** that is perceived by the pipe **47** full of air that is connected to the valve body **48.** According to the known technics, such valve body **48** is such as it ensures that by the decrease of the air pressure, due to the increase of the capacity drawn by the ventilator **46,** an equal rise of the opening of the opening and closing valve is produced, so that the gas passing through the pipe **45** increases. Consequently the increase of the revolutions of the ventilator **46** corresponds to an increase of the capacity of the air/gas mixture with unchanged proportions between the air and the gas.

[0023] In order to relate the variations of the capacity of the ventilator **46** with the temperature of the oven, the chamber **3** of the oven **1** has a temperature sensor Tf, sending to an electronic gearcase **6** the temperature signal Tf that is compared with the previously set out and wanted temperature. The difference between the set out temperature Ti and the temperature Tf measured in the chamber, causes the emission of a signal ΔT coming out from the gearcase T6 and allows the variation of the number of revolutions of the ventilator **46,** in a way known by the skilled person, for example varying the electric frequency of the ventilator input. Of course if the temperature Tf is higher than the set out temperature Ti, the signal ΔT coming out from the gearcase **6** will lower the number of revolutions of the ventilator and therefore will produce a temporary overpressure in the duct **47** and consequently a decrease of the gas discharge in the duct **45** with a consequent reduction of the capacity of the fuel mixture.

[0024] The gearcase **6** can predict the setting out of the prearranged temperature for the oven baking, but also the possibility that some temperatures are reached within some time and kept during a certain interval, both rising and falling.

[0025] In such a way a perfect adjustment of the baking chamber is obtained by varying the number of revolutions of the ventilator **46,** entailing as it has been said before, a variation of the mixture capacity going to the burner head **41.** An equal effect can be obtained with a burner realized according to the plan in fig. 2, where the ventilator **46** is in this case placed ahead of the valve **43.** It is evident in fact that if in this case a signal delta T starts from the gearcase 6, due to the difference of detected temperature Tf compared to the set out temperature Ti, for example a signal requiring an increase of the capacity of the mixture air/gas, the ventilator **46,** increasing the number of revolutions, increases the air capacity in the duct **42.** By doing this in the duct **47** a temporary depression is produced, affecting the valve body **48,** and an increase of the capacity of the gas in the duct **45** is obtained through the mixture valve at a constant ratio that in the case of the example is a 1:1 ratio. Therefore at the outlet **442** of the Venturi pipe **44** an increase of the capacity of the air/fuel mixture is obtained, the ratio between the air and the fuel being constant anyhow. The same thing happens if the signal ΔT requires a decrease of the air/fuel mixture and a temperature fall and therefore a decrease of the number of revolutions of the ventilator 46.

[0026] As to the heat exchanger 2, it can be observed that it can be realized both spiral wound and through concentric pipes, one, two or more according to the need and the constructive advantages that these can have.

[0027] It has to be underlined that in fig. 1 and fig. 2 too the heat exchanger is provided also with swirling elements 21 increasing the intensity of the heat exchange to which the ventilator 7 contributes inside the cylindrical space produced by the heat exchanger.

Claims

1. Forced convection oven for food baking including:

   - a baking chamber (3) having internal heat exchanging means (2) formed by at least one wound pipe passed through by the discharged smoke of the burnt gas;
   - a burner (4) provided with air/fuel mixing means whose head (41) faces the flame of said heat exchanger;
   - ventilation means (46) suitable to ensure the necessary capacity of the burner of the air/fuel mixture,

   characterized in that said mixing means air/fuel are a mixer valve (43) ensuring a constant air/fuel ratio when the capacity varies and **in that** said capacity of said mixture is variable through the variation of the number of revolutions of the ventilation means, said variation being a function of the difference between the temperature (Ti) required to the oven and the detected temperature (Tf) of the chamber of said oven.

2. Oven according to claim 1) **characterized in that** said mixer valve (43) ensures a 1:1 air/fuel ratio.

3. Oven according to claim 1) or 2) **characterized in that** it has an electronic gearcase (6) reached by a signal (Tf) as a function of the temperature (Ti) detected in the oven chamber, said signal being compared with the set out required temperature (Ti), the difference between said temperatures producing an output signal from the gearcase suitable to vary the revolutions of the ventilation means (46).

4. Oven according to any of the preceding claims **characterized in that** said ventilation means are formed by a ventilator placed between said mixer valve (43) and said mixing head (41).

5. Oven according to any of the claims from 1) to 3) **characterized in that** said ventilation means are formed by a ventilator placed ahead of said mixer valve (43).

6. Oven according to any of the preceding claims **characterized in that** said heat exchanging means are formed by one or more pipes (2) that are spiral wound on the generating lines of an ideal cylinder.

7. Oven according to any of the preceding claims **characterized in that** said one or more pipes have internal swirling elements (21).

8. Oven according to any of the preceding claims **characterized in that** the ventilation means in order to increase the heat exchange between the heat exchanger and the oven walls are formed by a ventilator (7) placed inside the substantially cylindrical hole created by said at least one spiral wound pipe.

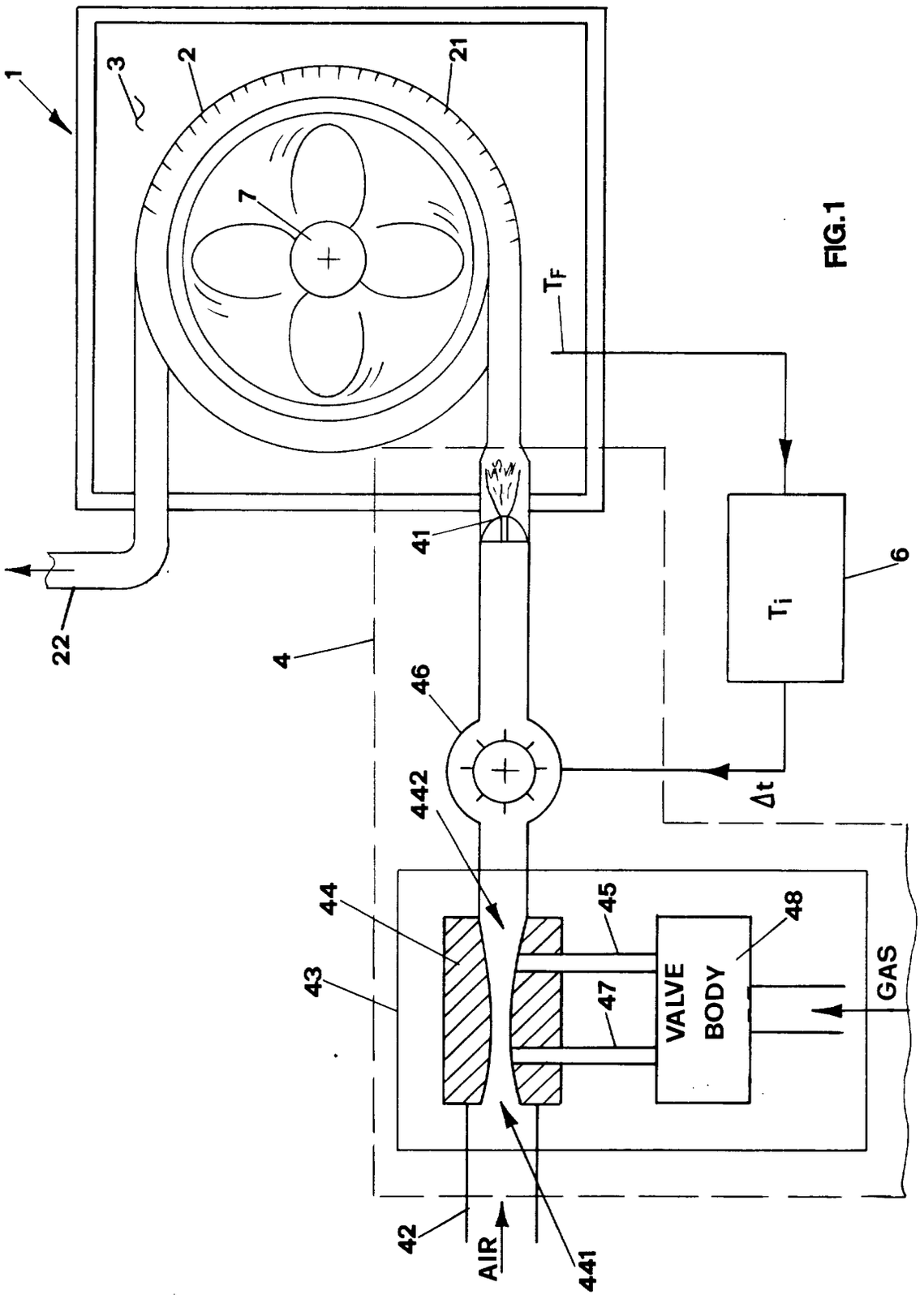
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FIG.1

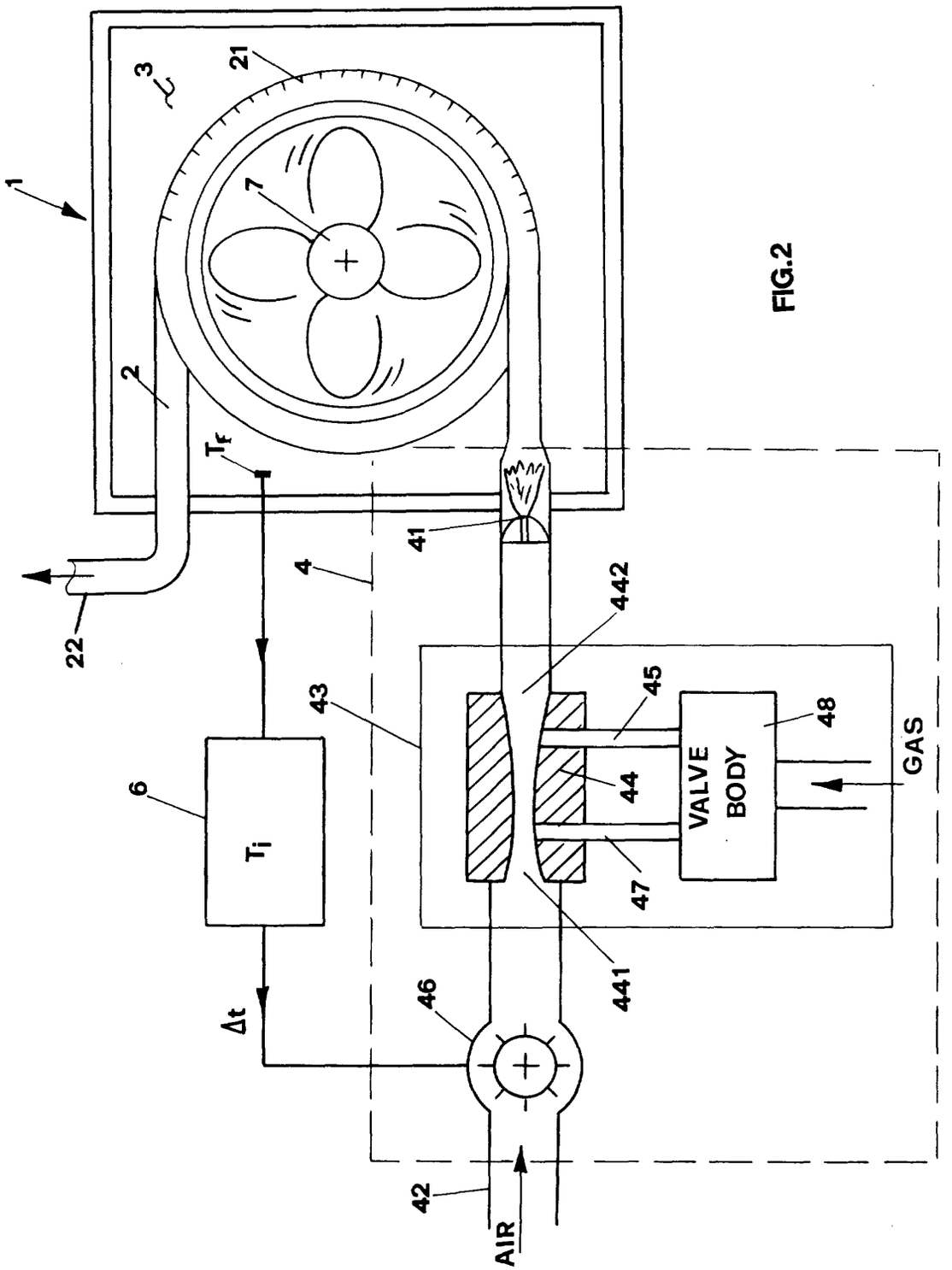
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FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 01 11 6786

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	16 November 2001	MARZANO MONTERO.., M

CATEGORY OF CITED DOCUMENTS

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