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(54) Arrangement for partial recirculation of exhaust gases from heating boilers powered by gas or other fuels

(57) The aim of the present invention is to provide a method and device for partially recycling exhaust fumes (5) from the combustion chamber in a balanced flue boiler.
Suitable passages (8.1;8.2) are foreseen to connect the outlet flue (4) of the fumes (5) to the inlet flue (6) of the comburent air (7); said passages (8.1;8.2) being designed to take in part (5.1) of the fumes, that are then mixed with the comburent air (7) thus returning into the combustion chamber.
Inside the outlet flue (4) are positioned panels (9) in perforated or streched metal foil, electrostatically charged by well-known means, to filter and retain the suspended particles transported by the fumes (5).

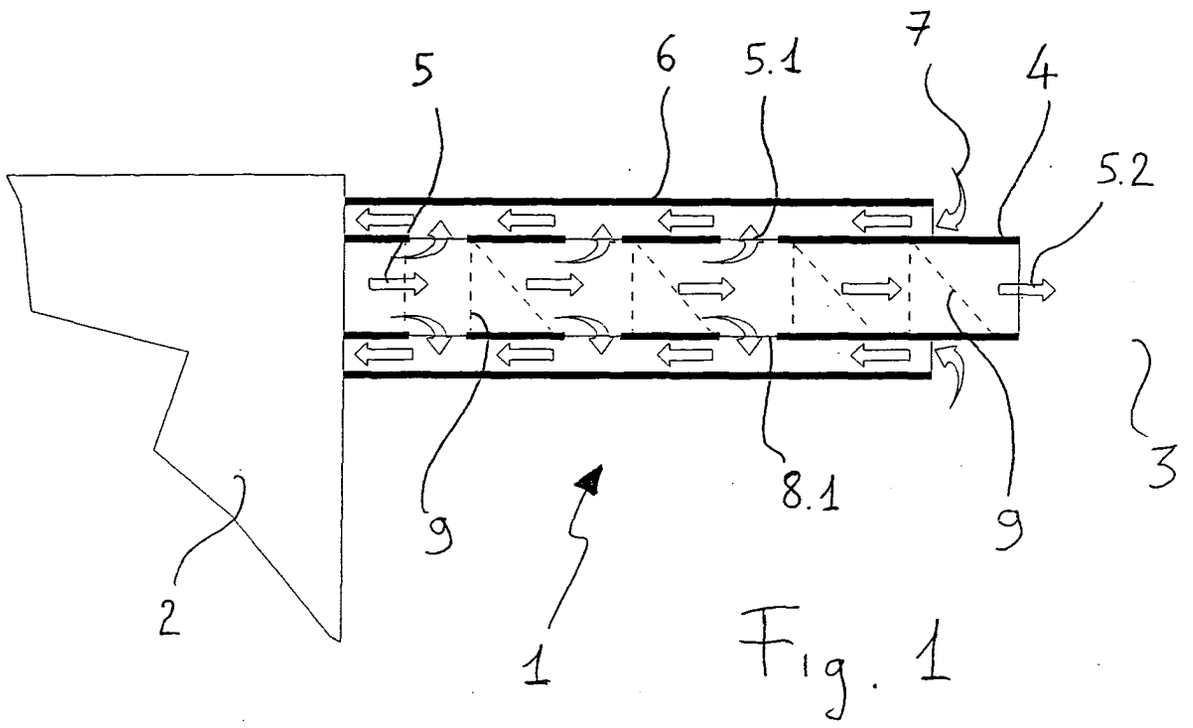

Fig. 1

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Description

[0001] The present invention aims at providing simple devices for reducing polluting exhaust fumes emitted by balanced flue boilers powered by any type of fuel, whether gaseous, liquid or solid.

[0002] Balanced flue boilers have been well known for many years. In these models, the comburent air is taken in from the exterior, and obviously the combustion gas (or fumes) is expelled to the exterior.

[0003] For easy installation and other reasons such as the pre-heating of the comburent air using combustion gases through heat exchange in countercurrent, for example, the comburent air inlet flue is coaxial, and generally external to the exhaust fume flue. Hereafter the combination of these two co-axial flues for comburent air and fume expulsion will be referred to using the term "co-axial flues".

[0004] It is also a well-known fact that large efforts have been made to increase boiler heating efficiency as well as to reduce toxicity and the pollution levels of the emitted fumes.

[0005] Progress has been made in these directions using various devices, sometimes quite simple, but often very complex and costly, which act inside the combustion chamber during the combustion action itself, for example, by adjusting excess air and/or choosing appropriate shapes and materials for burners, while no interventions have been applied downstream of the combustion chamber so that the fumes are emitted into the external environment with the chemical composition and possible solid suspensions that have been produced in combustion, just as the comburent air used contains the same chemical composition found in the environment.

[0006] It is obvious that however sophisticated combustion control may be, it is impossible to generate fumes that are completely free of unburnt substances, or in the case of particular fuels, that are free of suspended particles.

[0007] The main aim of the present invention is to identify means able to modify the chemical composition of fumes downstream of the combustion chamber in order to reduce the concentration of unburnt gas.

[0008] A further aim of the present invention in a balanced flue boiler is to identify means able to destroy solid particle content in fumes downstream of the combustion chamber.

[0009] Another further aim of the present invention in a balanced flue boiler is to limit the installation of said means adapted for at least one of the aforesaid aims, within the co-axial flues.

[0010] These and other aims are attained through the means explained in the present description and in the appended claims that constitute an integral part of the basic description as well as the appended figures.

[0011] Figure 1 shows the co-axial flues of a balanced flue boiler containing a first embodiment of the device according to the invention.

[0012] Figure 2 shows the co-axial flues of a balanced flue boiler containing a second embodiment of the device according to the invention.

[0013] With reference to both figures, with 1 is identified the unit of the co-axial flues that connect the boiler 2 with the external environment 3.

[0014] The combustion products 5 (or fumes) pass through the fume expulsion flue 4 and are expelled into the external environment, while the comburent air 7 is sucked in through the air inlet flue 6.

[0015] It is well known that the circulation of the aeriform substances that pass to and from the boiler 2 is activated by a fan that, compared to the external environment 3, places the inlet flue 6 in a state of depression and the outlet flue 4 in a state of overpressure.

[0016] According to the present invention, it is foreseen that a part 5.1 of the fumes recirculate inside the combustion chamber. As stated previously, it is impossible to expel the fumes 5 from the combustion chamber completely free of unburnt gas such as carbon monoxide CO, or carbon dioxide CO2.

[0017] However, it has been discovered that by recirculating said part 5.1 of the fumes inside the combustion chamber, the part 5.2 of the same fumes expelled towards the exterior possess a lower level of unburnt gas, than fumes that are not sent for recirculation; therefore recirculation provides a lower pollution level than fumes that are not recirculated.

[0018] Moreover, said recirculation provides an improvement in energy performance, because more complete combustion permits greater utilization of the fuel calorific power, and because said part 5.1 of the recirculated fumes releases heat to the comburent air 7 instead of being lost in the environment.

[0019] To obtain said recirculation, it is sufficient to connect the outlet flue 4 with the inlet flue 6 through appropriate passages 8.1 or 8.2. Because of the relative pressures present, instead of being expelled towards the exterior 3, part of the fumes 5.1 pass from the outlet flue 4 to the inlet flue 6, to mix with the comburent air 7, returning in this manner into the combustion chamber.

[0020] With reference to figure 1, said appropriate passages 8.1 or 8.2 can be composed of a simple opening 8.1, performed in the wall that separates the outlet flue 4° from inlet flue 6.

[0021] With reference to figure 2, said appropriate passages 8.1 or 8.2 can alternatively be composed of ducts 8.2 of an appropriate shape to deflect the said part of the fumes 5.1 towards the interior of the inlet flue 6.

[0022] As far as the scrubbing of the suspended particles in the fumes 5 is concerned, both figures 1 and 2 show that panels 9 are appropriately positioned and maintained inside the outlet flue 4, in a manner so that the fumes 5 can be filtered through the panels.

[0023] Said panels 9 can be composed of suitable perforated metal foil, or a well known type obtained through so-called micro-stretching, composed of sheets

that have been previously subject to multiple cutting into regular rows, followed by stretching to obtain a type of net or mesh. Said panels 9 are preferably maintained by suitable means at a potential which is different from that of the fumes 5 and the suspended particles transported by the fumes, so that the panels will attract and collect the particles through electrostatic attraction; methods and means for attracting particles using electrostatic attraction are well known and do not require further description.

[0024] Naturally said panels 9 must be cleaned regularly to remove all impurities attached; for this reason it is foreseen that the panels can be removed from the outlet flue 4 for cleaning, or alternatively, at least one part of the outlet flue 4 in which the panels 9 are mounted can be removed.

[0025] The advantages of the present invention are obvious: with the application of suitable means described previously, or other equivalent means, it is possible to scrub fumes 5 of any chemical type, and to reduce unburnt substances of physical type while retaining the transported powder particles. Moreover, it is possible to improve the thermal efficiency of the boilers on which the invention is applied, because of the improved utilization of the heating power of the combustible, as well as the fact that part of the thermal energy of the fumes is released to heat the comburent air.

[0026] A further advantage consists in the fact all the aforesaid means according to the present invention are enclosed within the unit formed by the co-axial flues 1.

Claims

1. Method for scrubbing exhaust fumes (5) from the combustion chamber of a balanced flue boiler consisting of the recirculation of part (5.1.) of said fumes (5) inside the combustion chamber, mixing said fumes with the comburent air (7).

2. Method for scrubbing exhaust fumes (5) according to the previous claim,
characterised in that
the method also foresees the filtration of suspended particles transported by said fumes (5).

3. Method for scrubbing exhaust fumes (5) according to any of the previous claims,
characterised in that
the method also foresees electrostatic attraction of the particles transported by said fumes (5).

4. Device for the scrubbing of exhaust fumes (5) from the combustion chamber of a balanced flue boiler
characterised in that
said device foresees suitable passages (8.1; 8.2) that connect the outlet flue (4) for the expulsion of said fumes (5) with the inlet flue (6) of the comburent air (7), said passages (8.1; 8.2) being designed to take in part (5.1) of the fumes, that are then mixed with the comburent air (7).

5. Device for the scrubbing of fumes (5) according to the previous claim
characterised in that
said passages (8.1; 8.2) are openings (8.1) performed in the wall that separates the outlet flue (4) of said fumes (5) and the inlet flue (6) of the comburent air (7).

6. Device for the scrubbing of fumes (5) according to claim 4
characterised in that
said passages (8.1; 8.2) are ducts (8.2) realised in the most appropriate shape and adapted to deflect part (5.1) of said fumes (5) inside the inlet flue (6) of the comburent air (7).

7. Device for the scrubbing of fumes (5) according to any of the previous claims from 4 to 6
characterised in that
said device foresees means (9) positioned inside the outlet flue (4) of said fumes (5) adapted to filter and retain the suspended particles transported by said fumes (5).

8. Device for the scrubbing of fumes (5) according to the previous claim
characterised in that
said means (9) are composed of panels realised in perforated or stretched metal foil of various types.

9. Device for the scrubbing of fumes (5) according to the previous claim
characterised in that
said perforated or stretched foil (9) is electrostatically charged with means well known in the art, in the most suitable manner to attract and retain said suspended particles transported by said fumes (5).

10. Device for the scrubbing of fumes (5) according to any of the previous claims from 7 to 9
characterised in that
said means (9) adapted to filter and retain the suspended particles transported by said fumes (5) can be removed for cleaning.

11. Device for the scrubbing of fumes (5) according to any of the previous claims from 4 to 10
characterised in that
said device is positioned inside the unit formed by the co-axial flues (1), said co-axial flues (1) being composed of the outlet flue (4) of said fumes (5) and the inlet flue (6) of the comburent air (7).

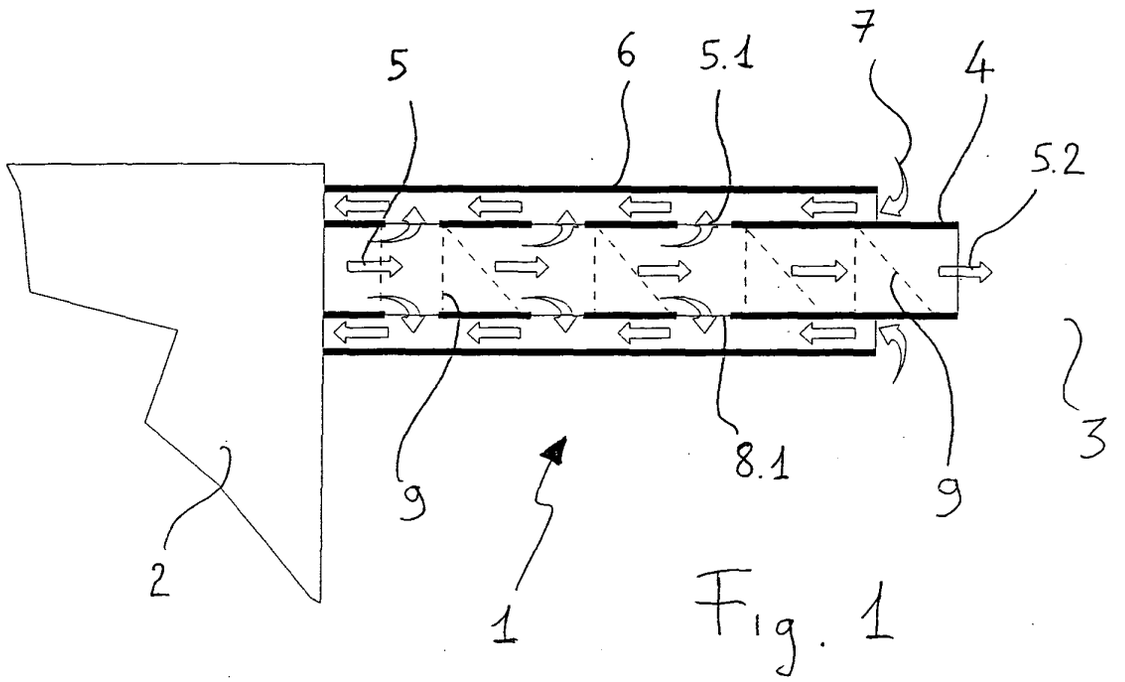

Fig. 1

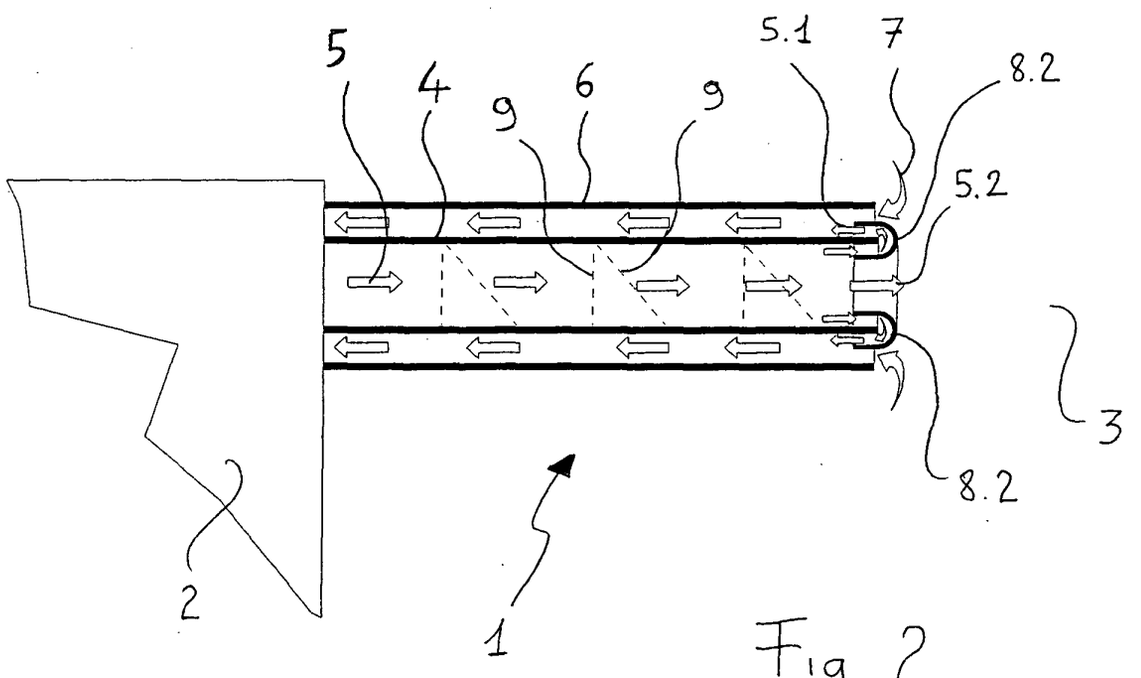

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 03 01 7442

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 634 610 A (MEULINK & GROL BV) 18 January 1995 (1995-01-18) * column 1, line 25 - column 2, line 2; figure 1 *	1	B01D53/34 F23L17/04 F23C9/06 F23C9/08 B03C3/00
X	EP 0 153 046 A (CARVER & CO ENG) 28 August 1985 (1985-08-28) * page 21, line 15-19 *	1,4,5	
A	US 4 411 204 A (HAMILTON THOMAS B) 25 October 1983 (1983-10-25) * figures 1,2 *	1-4,6,7, 10	
A	EP 0 244 569 A (LENTJES BWE ENERGIETECHNIK GMB) 11 November 1987 (1987-11-11) * claims 1,3; figure 1 *	1-4,6,7, 9,10	
A	US 3 668 836 A (RICHARDSON HARRY L ET AL) 13 June 1972 (1972-06-13) * figures 1-4 *	2,3,7-9	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B01D
F23L
F23C
B03C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	27 November 2003	de Biasio, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 01 7442

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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27-11-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0634610 A	18-01-1995	NL 9301246 A	01-02-1995
		EP 0634610 A1	18-01-1995
EP 0153046 A	28-08-1985	AT 41992 T	15-04-1989
		DE 3569285 D1	11-05-1989
		DE 3580483 D1	13-12-1990
		EP 0153046 A2	28-08-1985
		EP 0222221 A1	20-05-1987
		GB 2153989 A ,B	29-08-1985
		GB 2154314 A ,B	04-09-1985
		HK 32889 A	28-04-1989
		HK 42589 A	09-06-1989
		SG 12389 G	07-07-1989
		SG 31188 G	30-09-1988
US 4411204 A	25-10-1983	CA 1188931 A1	18-06-1985
		DE 3269238 D1	27-03-1986
		EP 0081114 A2	15-06-1983
		ES 8400816 A1	01-02-1984
		IN 159615 A1	30-05-1987
		JP 58106319 A	24-06-1983
EP 0244569 A	11-11-1987	DE 3615125 A1	05-11-1987
		AT 52323 T	15-05-1990
		EP 0244569 A2	11-11-1987
US 3668836 A	13-06-1972	BE 761889 A1	22-07-1971
		DE 2103022 A1	29-07-1971
		FR 2077612 A7	29-10-1971
		NL 7100925 A	26-07-1971

EPO FORM P0459

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