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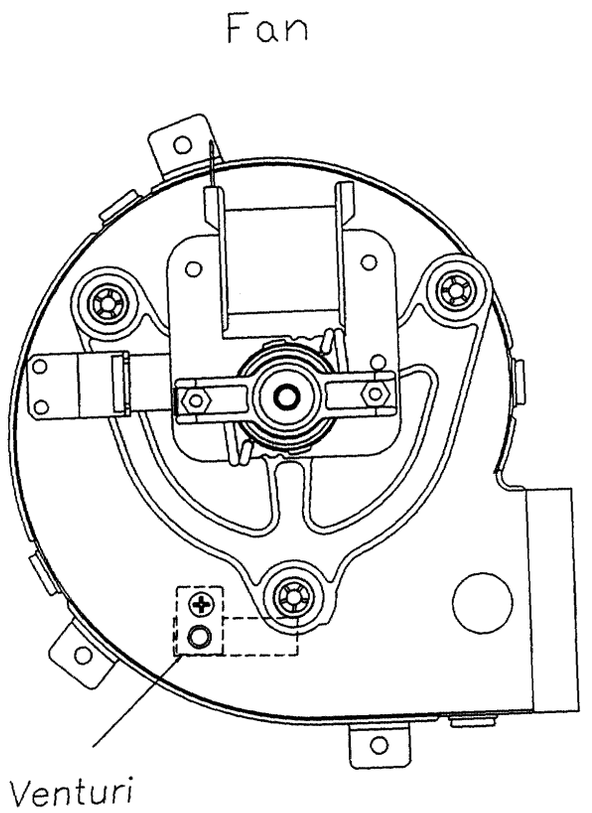
(54) Venturi

(57) In order to improve the performance of the flue gases exhaust from the tight chamber boiler, IABER S. p.A. uses a hooked pressure tube and a venturi tube, mounted inside the scroll.

The location of the venturi and pressure tubes within the fan scroll allow pressure detectors not be affected by the intake air flow, caused by the natural draught of the stack, when the boiler is off.

Also the venturi tube alone is useful to this purpose; actually, the solution providing for the only presence of the venturi tube allows a higher stability of the pressure signal reaching the pressure switch and assures that the boiler is shut-off in case of abnormal machine operation.



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Description

Purpose of the invention

[0001] Purpose of the invention is to improve the performance of the tight chamber boiler, passing the tests required by prEN483 standard for C5 configuration.

PrEN483.

[0002] Standard covering Type C (tight) boilers equipped with atmospheric burner, with rated thermal power equal to or less than 70 Kw.

[0003] This standard specifies the requirements and test methods for the construction, safety, performance, rational use of power, classification and marking of gas-fired boilers, designed for central heating.

C5 configuration.

[0004] C5 configuration is defined by prEN 483 as a system where a type C (tight) boiler is connected, through separate ducts, to two terminal units located in areas having a different pressure. In practice, the following two conditions occur:

- air intake on a wall and exhaust on the opposite wall (see drwg no.1)
- wall air intake and roof exhaust.

[0005] PrEn 483 states that the exhaust of flue gases for a boiler installed according to this configuration shall be submitted to a 2 mbar vacuum; under these conditions, the machine shall light regularly and the flame shall remain steady.

Present situation

[0006] IABER boilers are not able to pass this test. Pressure and venturi tubes are mounted inside the fan connector (see drwg. No. 2).

[0007] The pressure tube reads a static pressure while the venturi tube reads a vacuum, changing with the change of the air speed passing through it.

[0008] These two components are connected to a pressure switch (see drwg no. 3a) measuring any pressure change.

[0009] The pressure switch is an electromechanical device with a ON position at 100 +/-6 Pa and an OFF position at 72 +/-5 Pa.

[0010] Upon boiler's start-up, and for safety reasons, the software controlling the boiler operation checks the pressure switch position. Consent to boiler's start-up is granted only when the pressure switch is in the OFF position.

[0011] Under C5 configuration testing conditions, the 2 mbar vacuum applied to flue gases exhaust generate an air flow causing a pressure change within the boiler, thus bringing the pressure switch to the ON position. Therefore the software does not agree to the boiler's start-up.

Description of the solution.

[0012] FIME fans type GR00680P, used for Basic boilers, incorporate the venturi tube (see drwg. No. 4) and the hooked pressure tube (see drwg. No. 5) into the scroll.

[0013] The venturi tube reads a pressure, which is lower than the static pressure present in the scroll and is proportional to the speed of flue gases at that point.

[0014] The choice of the pressure tube position (see drwg. No. 6) has been of the utmost importance; actually measurements are read by a pressure switch detecting pressure changes. The pressure switch reading shall be stable under normal operating conditions and shall decrease in abnormal operating conditions, in order to assure that the boiler is switched off.
The correct signal decrease depends upon the position of the venturi and hooked tubes inside the fan's scroll. Therefore, the location of the two pressure detectors is crucial and required long testing efforts.

[0015] The location of the venturi tube and of the hooked tube within the fan scroll, as shown by drawing no. 6, enables to pass C5 tests (as per standard prEN 483/1998), since pressure detectors are not affected by the air flow of the suction caused by the natural draught of the stack, when the boiler is off.

[0016] This represents a remarkable advantage as compared to the tubes inside the flue gases connection. Actually in this case, if a suction is imposed (as provided to pass C5 tests), the venturi tube, being at the center of the fluid vein, shall read a vacuum, thus making it difficult to pass the test. On the contrary, if it is located inside the fan scroll, the venturi tube is protected from the intake air flow thus allowing to pass the test.

[0017] Therefore, the venturi shall not be very sensitive to the flows imposed by simulating a suction when the boiler is off (test C5), but shall be highly sensitive to the speed changes of the fluid vein when the fan is operating, thus enabling the boiler to automatically shut-off, in case of either fan malfunctioning or incidental closure of the flue gases exhaust tube.

[0018] Actually, tests carried out prove that emissions remain below 2000 ppm CO, corrected before the boiler is put off by the action of the pressure switch and below 1000 ppm CO, corrected at re-start as provided by standard prEN483/1998. In addition to the above advantages, this solution allows a significant cost saving.

II.

Purpose of the invention.

[0019] Purpose of the invention is to improve the performance of the tight chamber boiler, passing the tests

required by prEN483 standard for C5 configuration.

PrEN483.

[0020] Standard covering Type C (tight) boilers equipped with atmospheric burner, with rated thermal power equal to or less than 70 Kw.

[0021] This standard specifies the requirements and test methods for the construction, safety, performance, rational use of power, classification and marking of gas-fired boiler, designed for central heating.

C5 configuration.

[0022] C5 configuration is defined by prEN 483 as a system where a type C (tight) boiler is connected, though separate ducts, to two terminal units located in areas having a different pressure. In practice, the following two conditions occur:

- air intake on a wall and exhaust on another wall (not on the opposite one) at different pressures (see drwg no.1)
- wall air intake and roof exhaust.

[0023] PrEn 483 states that the exhaust of flue gases for a boiler installed according to this configuration shall be submitted to a 2 mbar vacuum; under these conditions, the machine shall light regularly and the flame shall remain steady.

Present situation.

[0024] IABER boilers are not able to pass this test. Pressure and venturi tubes are mounted inside the fan connector (see drwg. No. 2).

[0025] The pressure tube reads a vacuum, changing with the change of the air speed passing through it.

[0026] These two components are connected to a pressure switch (see drwg no. 3) reading any pressure change.

[0027] The pressure switch is an electromechanical device with a ON position at 100 +/-6 Pa and an OFF position at 72 +/-5 Pa.

[0028] Upon boiler's start-up, and for safety reasons, the software controlling the boiler operation, checks the pressure switch position. Consent to boiler's start-up is granted only when the pressure switch is in the OFF position.

[0029] Under C5 configuration testing conditions, the 2 mbar vacuum applied to flue gases exhaust, generate an air flow causing a pressure change within the boiler, such as to bring the pressure switch to the ON position. Therefore the software does not agree to the boiler's start-up.

Description of the solution.

[0030] FIME fans type GR00680P, used for Basic boilers, incorporate the venturi tube into the scroll (see drwgs. Nos. 4 and 5).

[0031] The venturi tube reads the pressure intake proportionally to the speed of flue gases, at that point; the vacuum signal thus generated is then detected by the pressure switch. Therefore, it "perceives" a pressure change (PD) generated by two pressure signals coming from the venturi tube and from a static pressure tube (see drwg no. 3a).

[0032] In the previous solutions, the static pressure tube consisted of a straight tube (see drwg. No. 2) taking the signal from flue gases exhaust. Now the static pressure tube consists only of the positive tube of the pressure switch, reading the vacuum existing in the boiler's air box (see drwg. No. 3 and solution for Basic Boiler).

[0033] The minimum PD to be assured during boiler's operation is 120 Pa, in the worst conditions (i.e. tubes of the maximum width and operation at the maximum power).

[0034] Such PD could be generated by working both on the location of the venturi tube inside the scroll and on the diameter of the venturi groove, which is presently 4.6+/-0,1 mm.

[0035] Thanks to these adjustments, the venturi generates a vacuum signal of approx. 150 Pa.

[0036] Under these conditions, the second pressure sensor of the pressure switch perceives a vacuum of approx. 30 Pa.

[0037] The PD value detected by the pressure switch is therefore 120 Pa (150 Pa of the venturi - 30 Pa of the direct intake = 120 Pa).

[0038] The advantages of this solution are mainly reflected on a higher stability of the pressure signal.

[0039] The signal reaching the pressure switch shall be stable under the normal operating conditions and shall decrease in abnormal operating conditions, in order to assure that boiler goes off. The correct reduction of the signal is typical of the venturi positive action.

[0040] Moreover, the venturi location inside the fan scroll, as shown by drawing no. 5, enables to pass the C5 tests (as per standard prEN483/1998); actually in that position, it is not affected by the air flow caused by the natural draught of the stack, when the boiler is off.

[0041] This constitutes a remarkable advantage; actually , inside the fan scroll, the venturi is located in a position protected from the flow thus allowing to pass the C5 test (2 mbar vacuum suction).

[0042] Therefore, the venturi shall not be sensitive to the flows imposed by simulating a suction , when the boiler is off (C5 test), but shall be highly sensitive to the speed changes of the fluid vein when the fan is operating, thus enabling the boiler to automatically shut-off, in case of either fan malfunctioning or incidental closure of the flue gases exhaust.

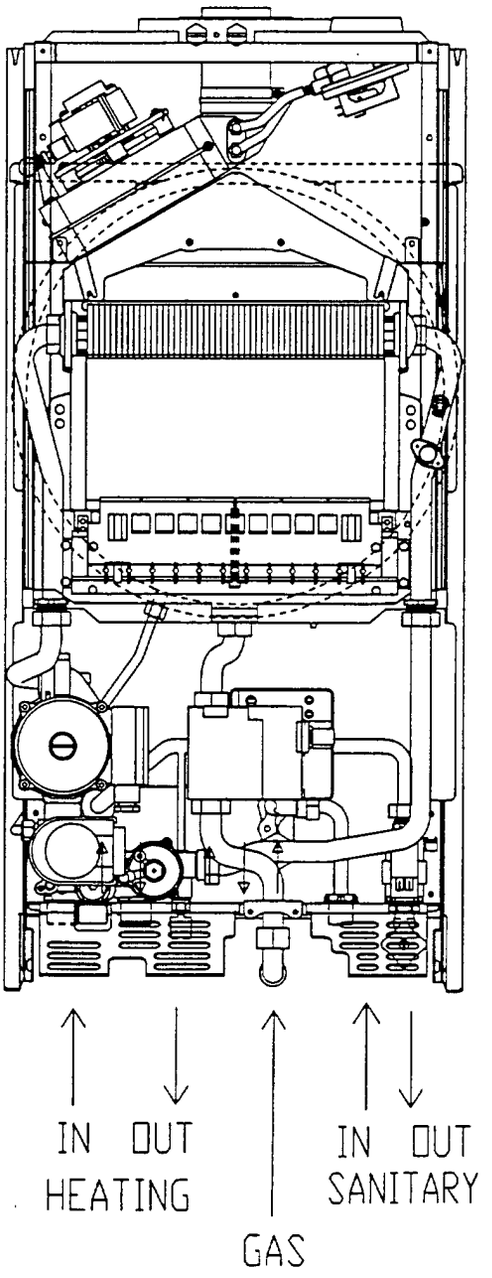
[0043] Tests carried out at the IABER R & D laboratory

prove that emissions remain below 2000 ppm CO, corrected before the boiler is put off by the action of the pressure switch, and below 1000 ppm CO, corrected at re-start, as provided by standard prEN 483/1998.

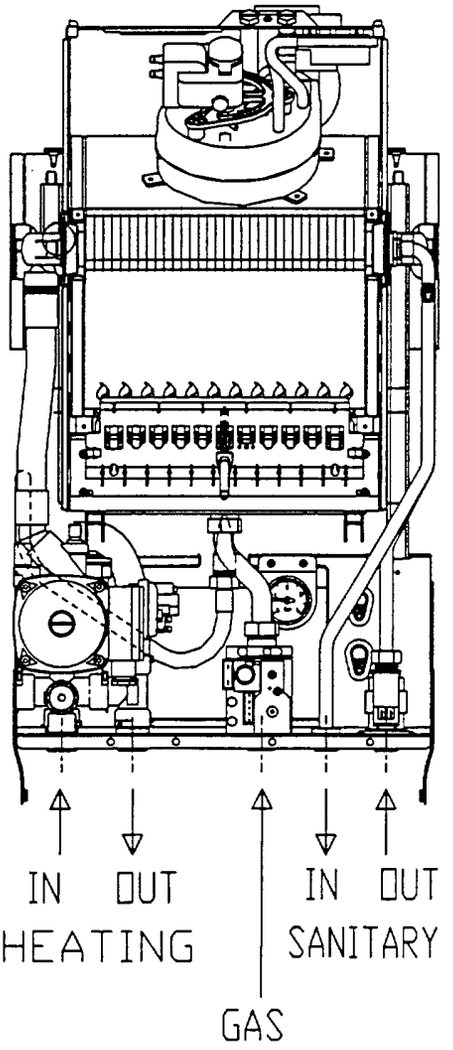
Claims

1. New position for pressure tubes
2. New position for hooked tube
3. New corrected re-start
4. New diameter of the venturi groove
5. Presence of a second sensor

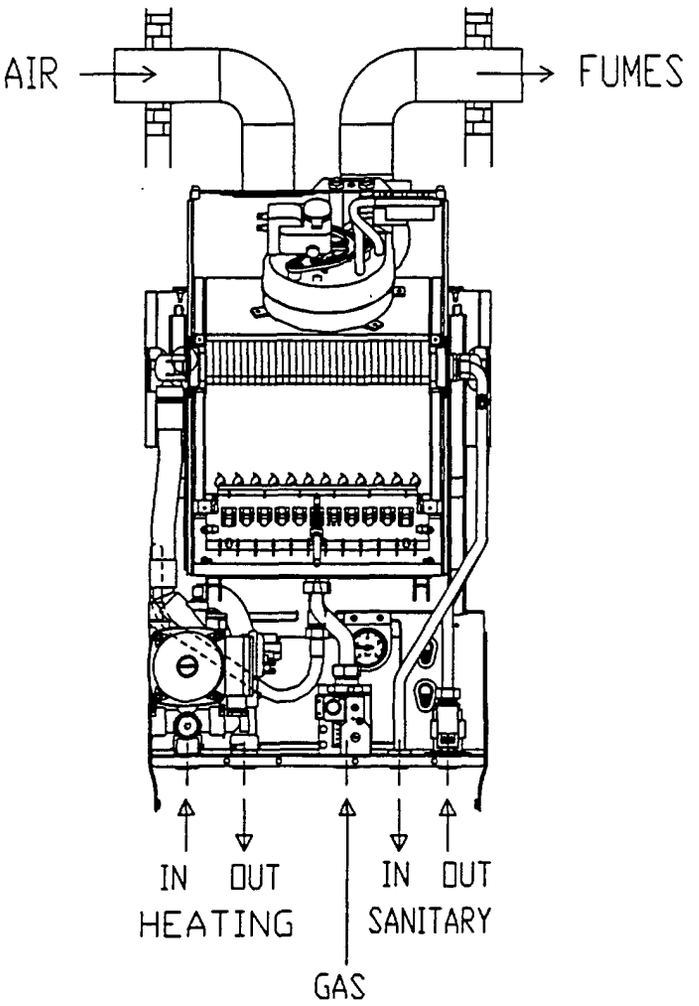
Standard Solution

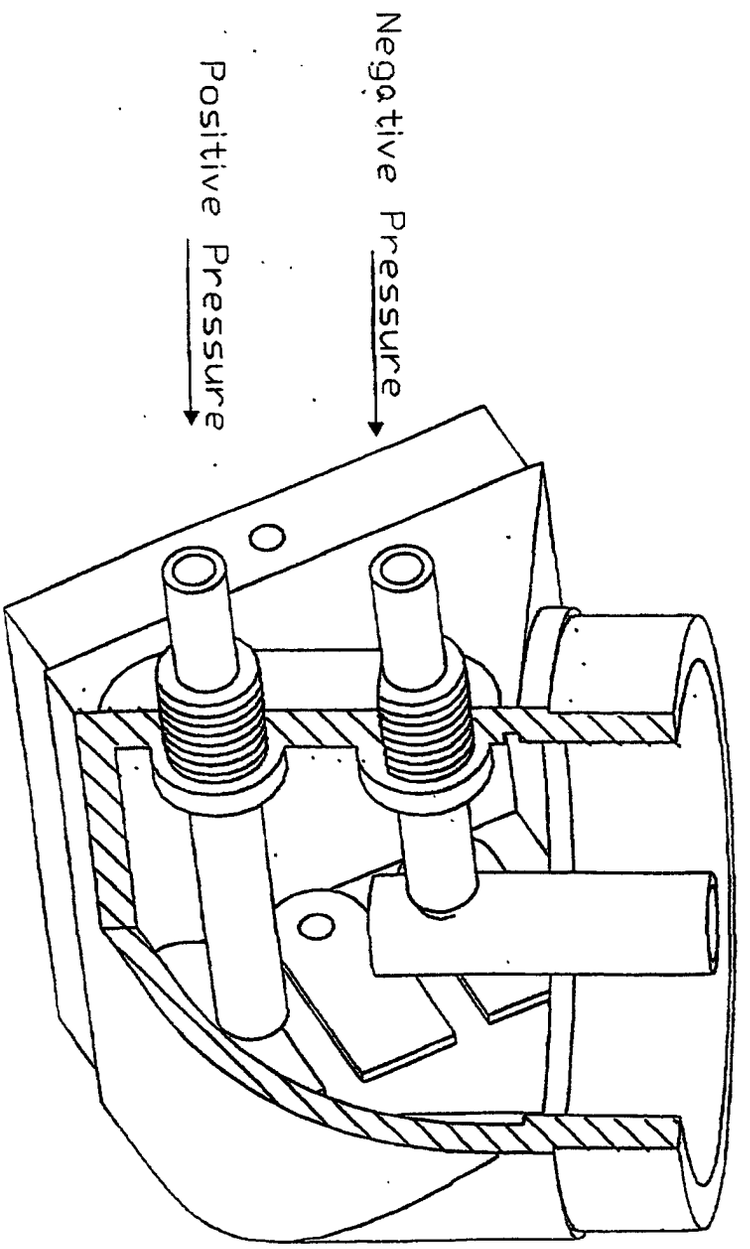


Basic Solution

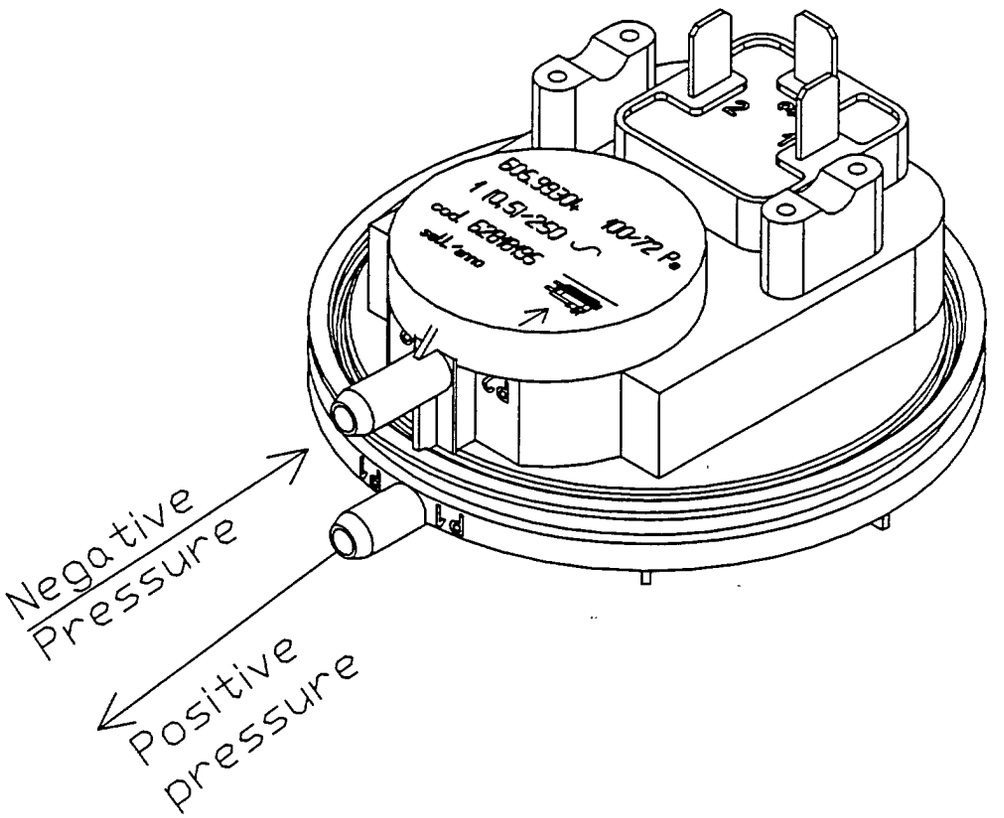


Separate Pipe

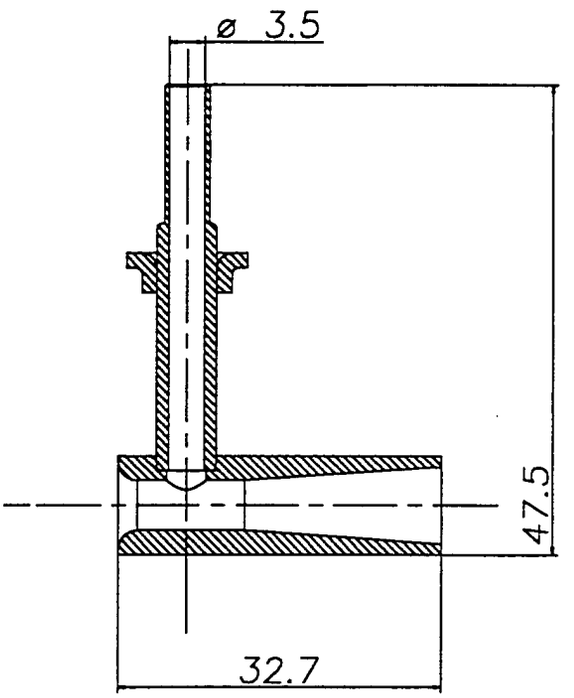



Negative Pressure
Positive Pressure

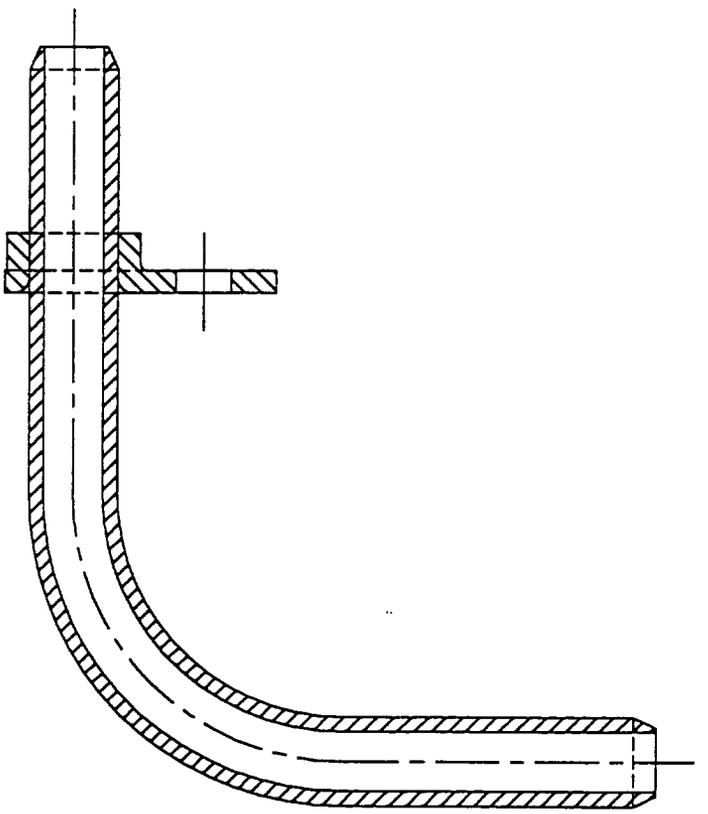
Differential pressure switch



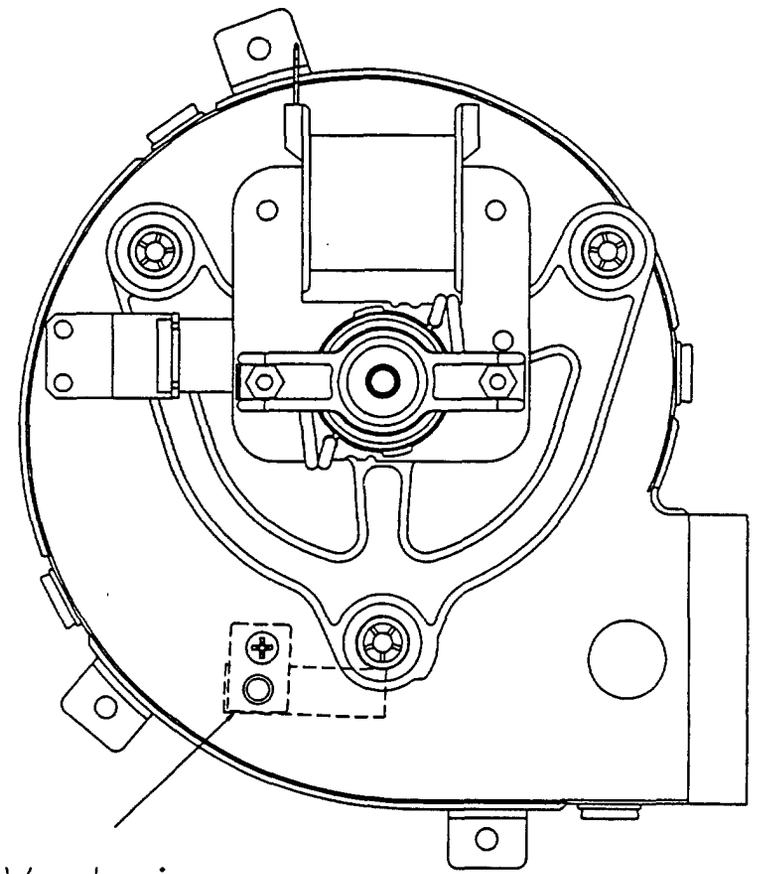
Venturi's Pipe



Pressure capture



Fan



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EUROPEAN SEARCH REPORT

Application Number
EP 00 20 0751

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)
A	EP 0 909 922 A (IABER SPA) 21 April 1999 (1999-04-21) * abstract *	1-5	F23N5/18
A	EP 0 790 465 A (BOSCH GMBH ROBERT) 20 August 1997 (1997-08-20) * abstract *	1-5	
A	EP 0 818 656 A (RBL SPA) 14 January 1998 (1998-01-14) * abstract *	1-5	
A	US 5 520 533 A (VROLIJK ENNO) 28 May 1996 (1996-05-28) * abstract *	1-5	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F23N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 August 2000	Van Gestel, H

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 20 0751

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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15-08-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0909922 A	21-04-1999	NONE	
EP 0790465 A	20-08-1997	DE 19605380 A	21-08-1997
		TR 9700070 A	21-08-1997
EP 0818656 A	14-01-1998	IT VI960115 A	12-01-1998
US 5520533 A	28-05-1996	EP 0644377 A	22-03-1995
		CA 2132124 A	17-03-1995
		DE 59304310 D	28-11-1996

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