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

(11) **EP 2 189 745 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.05.2010 Bulletin 2010/21

(51) Int Cl.:
F28D 21/00 *(2006.01)* ***F28D 7/02*** *(2006.01)*

(21) Application number: **09176128.8**

(22) Date of filing: **16.11.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

(30) Priority: **24.11.2008 IT TV20080151**

(71) Applicants:
- **Eberle, Giorgio**
  31053 Pieve di Soligo (TV) (IT)
- **Mazzega, Massimo**
  31010 Fregona (TV) (IT)

(72) Inventors:
- **Eberle, Giorgio**
  31053 Pieve di Soligo (TV) (IT)
- **Mazzega, Massimo**
  31010 Fregona (TV) (IT)

(74) Representative: **Modiano, Micaela Nadia et al**
Modiano & Partners
Via Meravigli, 16
20123 Milano (IT)

(54) **Heat recovery device**

(57) A heat recovery device (1), particularly for reducing energy consumption in heating sanitary water for residential use or for industrial use by reducing the temperature of the combustion gases and of the particles dispersed by stacks of heating boilers. The device consists of a tubular element (2), which has an inlet (5) for the water drawn from the aqueduct, which flows along a coil of tubes (4) up to the exit (11) toward the heating boiler. The tubular element (2) also has an opening (15) for the inflow of the combustion gases that arrive from the heating boiler and exit through a second opening (24) after flowing around the coil that contains the water drawn from the aqueduct. The device thus allows savings in heating water for domestic and industrial uses and also allows a reduction in the emission of fine particles.

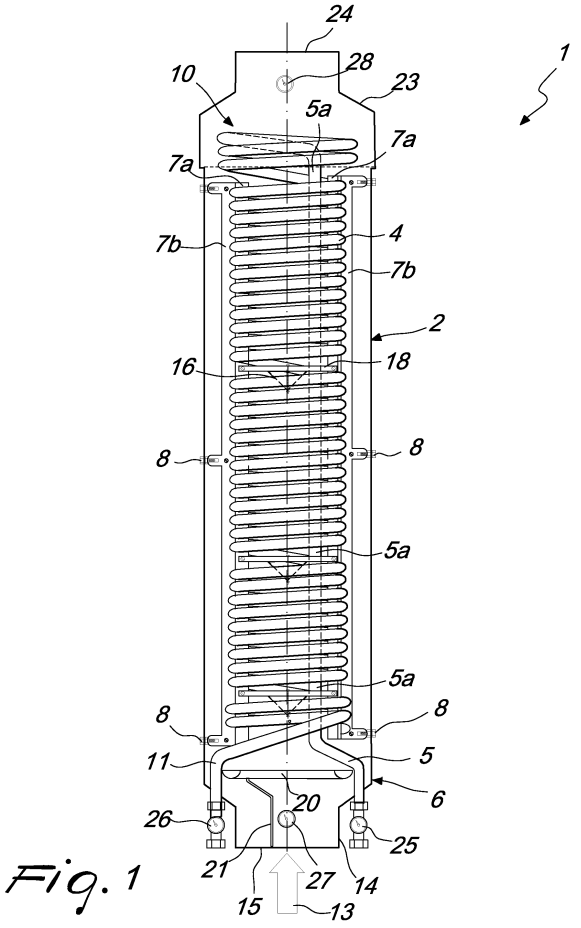

Fig. 1

EP 2 189 745 A1

Description

[0001] The present invention relates to a heat recovery device, particularly for stacks of boilers.

[0002] Currently it is known to heat water both for residential uses and for industrial uses by means of boilers.

[0003] These devices can be supplied especially with fuels which, by burning, emit combustion gases which are expelled from the flues.

[0004] In this last case, water heating occurs due to the heat generated by the combustion of the various fuels, which however release into the environment high-temperature combustion gases which are expelled from the flues, altering the surrounding bioclimate.

[0005] The use of these devices therefore requires energy and economic resources with high level for their operation, with the drawback of releasing into the environment a quantity of hot, high-temperature combustion gases that still have heat energy, which is lost.

[0006] Another drawback of this known method is that the high-temperature combustion gases disperse into the environment fine particles originating from combustion, which are very harmful to one's health.

[0007] The aim of the present invention is to solve the noted technical problems, eliminating the drawbacks of the cited background art, by providing a heat recovery device that allows reduction of the temperature at which the combustion gases of heating boilers are expelled from the flues, improving the thermal yield of the boilers.

[0008] Within this aim, an object of the invention is to provide a device that makes it possible to reduce, in heating boilers or other heat generators for heating water, the difference in temperature between the input water from the aqueduct and the desired value in output.

[0009] Another object is to provide a device that makes it possible to reduce the calories needed to heat the water up to the desired temperature in boilers or other heat generators.

[0010] Another object of the invention is to allow a reduction of the quantity of fine particles emitted by heating boilers into the surrounding environment.

[0011] Another object is to obtain a device that is effective, structurally simple, and can be provided at low cost.

[0012] This aim and these objects, as well as others that will become better apparent hereinafter, are achieved by a heat recovery device, **characterized in that** it comprises a tubular element, which is interposed between two ends of a stack or flue and is provided internally with at least one removable coil which has a first input connector which is connected to the aqueduct or to a well and a second output connector for sending the heated water toward devices that are adapted to heat it further or to accumulation tanks.

[0013] Further characteristics and advantages of the invention will become better apparent from the following detailed description of a particular but not exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a sectional view of a device according to the invention, arranged in a vertical position, suitable to allow the viewing of the components inside it and the hydraulic connections in the condition for use in countercurrent;

Figure 2 is a front view of the double-comb locking means;

Figure 3 is a perspective view of the diffuser cone and of its support;

Figure 4 is a plan view of the diffuser cone and of its support;

Figure 5 is a perspective view of of the heat recovery device with the cover uncoupled from the tubular element;

Figure 6 is a partially sectional schematic view of a possible application of the device;

Figure 7 is a schematic view of a possibility of application of the device with a plurality of modules in a cascade arrangement for serving heating boilers;

Figure 8 is a partially sectional schematic view of the device coupled to a tank for accumulating the heated water;

Figure 9 is a partially sectional view of the heat recovery device.

[0014] In the exemplary embodiments that follow, individual characteristics, given in relation to specific examples, may actually be interchanged with other different characteristics that exist in other exemplary embodiments.

[0015] Moreover, it is noted that anything found to be already known during the patenting process is understood not to be claimed and to be the subject of a disclaimer.

[0016] The terms "lower", "top", "upper", "upwardly" and similar, are hereinafter used with reference to the position of the device and other parts as shown in the enclosed figures.

[0017] With reference to the figures, the reference numeral 1 designates a heat recovery device, which comprises a tubular element 2 which is hollow and cylindrical and is interposed between two ends of a flue 3 or stack.

[0018] The tubular element 2 is provided internally with at least one coil 4 of tubes which can be extracted and has a first connector 5, which is connected to the aqueduct or to a well, for the inflow of water; the first connector 5 is arranged proximately to a lower end 6 of the tubular element 2 and conveys, through a first vertical portion 5a that lies inside the coil 4, the water up to the top of the tubular element 2.

[0019] The coil of tubes 4 extends until it approximately skims the internal lateral surface of the tubular element 2, forming a series of circular turns, which are supported by a double-comb locking means 7 composed of two pairs of linear flanges 7a, 7b which are mutually opposite and have a series of seats for positioning and resting

portions of tube that constitute the coil 4.

[0020] The locking means 7, shown in Figure 2, is fixed to the tubular element 2 by means of screws 8, which pass through appropriately provided holes formed in said element and which, once unscrewed, allow the simultaneous extraction of the locking means 7 and of the coil 4 by means of a handle 9 that can be gripped by a user since it is arranged transversely to the upper end of the locking means 7.

[0021] Advantageously, the pipes of the coil 4 are of the non-rigid type, and have the particularity of contracting the coil 4 if the pressure of the fluid contained therein decreases.

[0022] The path of the coil 4 ends in a second output connector 11, which is arranged at the lower end 6 of the tubular element 2 and enters a first duct 12 for sending the heated water toward accumulation tanks 30 or toward devices that are adapted to heat it further, such as boilers 31 or heat generators.

[0023] The stream of combustion gases 13 that exit from the boiler 31 are conveyed into the flue 3, which engages the lower end 6 by means of a frustum-shaped portion that tapers along the vertical axis and ends with a third tubular connector 14, which has a circular cross-section and a first opening 15.

[0024] The stream of combustion gases 13 that enter from the first opening 15 is advantageously conveyed radially in the direction of the coil of tubes 4 by one or more diffuser cones 16, which preferably are three and are arranged along the central axis of the tubular element 2 in order to facilitate better heat exchange between the stream of the combustion gases 13 and the water that flows within the coil of tubes 4.

[0025] The diffuser cones 16, shown in Figure 3, are fixed to the locking means 7 by anchoring means 17 consisting of two rods 18, which are mutually connected in an X-shaped arrangement and have, at their ends, suitable holes 19 which act as seats for locking screws.

[0026] During heat exchange, therefore, the stream of combustion gases 13 is cooled, entailing the appearance of condensation, which is conveniently collected in a condensation recovery means 20 arranged at the lower end 6 in a region that is proximate to the first opening 15, the condensation recovery means 20 preferably having a concave tray-like shape provided with a drain tube 21.

[0027] The condensation that forms is collected by means of the drain tube 21 in a dust recovery tank 22, which can be inspected and opened for cleaning and is usually arranged below the tubular element 2.

[0028] These combustion gases, after passing through the tubular element 2, exit from an upper end 10, flowing inside a cover 23, which is removable and frustum-shaped and ends with a portion that tapers toward the upper part and is provided with a second opening 24.

[0029] The cover 23 is detachably engaged with the upper end 10 of the tubular element 2, for example with a coupling or a threaded closure (not shown in the figures) for allowing easy inspection of the inside of the tubular element 2.

[0030] Figure 3 shows how the heat recovery device is connected to the flue 3; in particular, it is shown how the flue 3 is engaged in the first opening 15 and continues after the outlet of the second opening 24.

[0031] Thermometers are placed for checking correct operation and efficiency of the heat recovery device: more precisely, there is a first thermometer 25, which is associated with the first connector 5 for the input of the water that arrives from the aqueduct, a second thermometer 26, which is associated with the second connector 11 at the exit of the water from the tubular element 2, a third thermometer 27 for measuring the temperature of the combustion gases that enter the device 1, which is associated with the third connector 14 of the lower end 6, and finally a fourth thermometer 28 for measuring the temperature of the combustion gases in output, which is placed on the cover 23.

[0032] The present heat recovery device can be simply arranged at the output of a boiler 31 and therefore serves a single residential use, as shown in Figure 6, or inserted in a plurality of modules in a cascade arrangement to serve a plurality of boilers 31, for example in condominiums as shown in Figure 7.

[0033] The operation of the device is as follows.

[0034] The boiler, by starting operation both to heat sanitary water and to heat rooms, burns fuel, thus emitting hot combustion gases which are directed to the flue 3.

[0035] The water that arrives from the aqueduct, at ambient temperature, is not routed directly to the boiler 31 but flows first inside the tubular element 2 interposed between two ends of the flue 3 and only then collects in the boiler 31.

[0036] When the hot water is demanded by the user, both residential and industrial, for example by opening a tap, the supply water from the aqueduct enters the first connector 5, where there is a first thermometer which measures its temperature, and subsequently begins to flow within the coil of tubes 4.

[0037] The demand for hot water starts the boiler 31, which emits combustion gases, which enter the flue 3 and pass through the first opening 15, skimming the coil of tubes 4.

[0038] The stream of combustion gases 13 is guided inside the tubular element 2 by the diffuser cones 16, which add to the stream of combustion gases 13, which previously was substantially vertical, a radial component, thus creating greater turbulence around the coil of tubes 4, thus increasing heat exchange.

[0039] The water, by flowing through the entire coil of tubes 4 in countercurrent, after being conveyed to the top of the tubular element 2 by means of the first connector 5, acquires heat from the combustion gases which reach the second output connector 11 at the lower end 6 with a higher temperature than that of the water that arrives from the aqueduct.

[0040] After flowing through the entire device, the water enters the boiler 31, thus requiring fewer calories for

further heating up to the desired temperature.

[0041] Moreover, the hot combustion gases at the output of the boiler 31 undergo cooling before they are introduced in the environment, leading to a suppression of emitted fine particles.

[0042] Condensation caused by heat exchange can in fact form inside the tubular element 2 and, by descending in countercurrent with respect to the stream of combustion gases 13, captures the fine particles, collecting in the condensation recovery means 20.

[0043] The generated condensation, which contains the impurities of the combustion of the gases, descends from the condensation recovery means 20 through the drain tube 21 down to the particle recovery tank 22, which can be inspected and opened for cleaning.

[0044] During heat exchange, in addition to condensation, impurities can form which can deposit on the outer surface of the coil of tubes 4, thus reducing heat conductivity between the tubes and the stream of combustion gases 13.

[0045] However, these impurities are removed whenever the boiler demands water, for example when the user opens a hot water tap, because the pressure inside the tube decreases and the tube reacts by compressing axially.

[0046] The axial movement, caused by the contraction of the coil of tubes 4, upon the variation of the pressure of the fluid inside it, leads to the breakup and fragmentation of the impurities that might form on the pipes, such impurities descending by gravity toward the condensation recovery means 20.

[0047] If the user demands only heating of the rooms, the stream of hot combustion gases 13 heats the water that is present inside the coil of tubes 4, making it available at a higher temperature for subsequent use.

[0048] One possible arrangement of the heat recovery device can provide for the presence of the accumulation tank 30, which is arranged so as to receive the water in output from the tubular element 2 before it is conveyed into the boiler 31.

[0049] The accumulation tank 30 has a fifth thermometer 38 for measuring the temperature of the water contained therein.

[0050] In this case, a second duct 29, which is connected to the second connector 11 for the outflow of the water from the tubular element 2, is connected to the lower region of the accumulation tank 30, and a circulation pump 32 is inserted in the second duct 29.

[0051] The accumulation tank 30 further has a third delivery duct 33, which is arranged in the upper region; the third duct 33 continues by splitting into a fourth duct 34 for entering the boiler and a fifth duct 35 which ends with a first redirection valve 36, which is arranged in the pipe of the aqueduct 37, which in turn is connected to the first connector 5 of the tubular element 2.

[0052] For allowing the formation of a closed circuit between the accumulation tank 30 and the device 1, there is a second redirection valve 40, which intercepts the fourth duct 34 and the fifth duct 35.

[0053] For the use of sanitary water, operation is as described earlier; the accumulation tank 30 receives water at a higher temperature than the water of the aqueduct if the heating system is in operation.

[0054] If instead the boiler operates only for room heating, the first redirection valve 36 is activated automatically, preventing the inflow of the water of the aqueduct in the tubular element 2, and simultaneously the circulation pump 32 is started, allowing the water of the accumulation tank 30 to flow within the tubular element 2, circulating within the closed circuit formed between the accumulation tank 30 and the device 1, in turn being heated and being thus ready for any subsequent use.

[0055] The device can also be inserted horizontally and can thus adapt to any arrangement of the flue 3.

[0056] The device that has just been described has a heat exchange in countercurrent, but it is also possible to achieve heat exchange in equicurrent if this is more favorable for operating reasons.

[0057] This last case requires the swapping of the connections between the intake and the delivery.

[0058] The device therefore makes it possible to recover the heat of the stream of combustion gases by heating the sanitary water before it enters the boiler, reducing considerably the difference in temperature between the water that arrives from the aqueduct or well and the temperature desired by the user.

[0059] It has thus been found that the invention has achieved the intended aim and objects, a device having been devised which makes it possible to reduce energy consumption and reduce emissions of fine particles generated by combustion in order to obtain hot water to be used for industrial or civil purposes.

[0060] Of course, the materials used, as well as the dimensions that constitute the individual components of the invention, may be more pertinent according to specific requirements.

[0061] The various means for performing certain different functions need not certainly coexist only in the illustrated embodiment but can be present per se in many embodiments, including those that are not illustrated.

[0062] The characteristics indicated as advantageous, convenient or the like may also be omitted or replaced with equivalents.

[0063] The disclosures in Italian Patent Application No. TV2008A000151 from which this application claims priority are incorporated herein by reference.

[0064] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A heat recovery device (1), **characterized in that** it comprises a tubular element (2), which is interposed between two ends of a stack or flue (3) and is provided internally with at least one removable coil (4) which has a first input connector (5) which is connected to the aqueduct or to a well and a second output connector (11) for sending the heated water to devices that are suitable to heat it further or to accumulation tanks (30).

2. The device according to claim 1, **characterized in that** said first connector (5), arranged proximately to a lower end (6) of said tubular element (2), conveys, through a first vertical portion (5a) which is inside said coil (4), the water of the aqueduct or of the well to the top of said tubular element (2), said coil of tubes (4) extending so as to approximately skim the internal lateral surface of said tubular element (2), so as to form a series of circular turns, which are supported by a double-comb locking means (7).

3. The device according to claims 1 and 2, **characterized in that** said double-comb locking means (7) is composed of two pairs of linear flanges (7a, 7b), which are mutually opposite and have a series of seats for the positioning and resting of portions of tube that constitute said coil of tubes (4), said locking means (7) being fixed to said tubular element (2) by means of screws (8), which pass through appropriately provided holes formed in said tubular element (2), said screws (8), once unscrewed, allowing the simultaneous extraction of said locking means (7) and of said coil (4) by means of a handle (9) that can be gripped by a user and is arranged transversely to the upper end of said locking means (7).

4. The device according to one or more of the preceding claims, **characterized in that** said tubes of said coil (4) are of the non-rigid type, said coil (4) being able to contract if the pressure of the fluid contained therein decreases and to expand when the pressure increases.

5. The device according to claims 1 and 4, **characterized in that** said cylindrical and hollow tubular element (2) has, at said lower end (6), a portion that tapers along the vertical axis and is frustum-shaped for connection to said flue (3), said lower end (6) terminating in a third tubular connector (14), which has a circular cross-section and a first opening (15), said tubular element (2) being arranged at the outlet of one or more boilers (31) or inserted in a plurality of modules in a cascade arrangement to serve said one or more boilers (31), as in condominiums.

6. The device according to claims 1 and 5, **characterized in that** in said tubular element (2) there are one or more diffuser cones (16), preferably three and arranged along the central axis of said tubular element (2), for facilitating better heat exchange between the stream of combustion gases (13) and the water that flows inside said coil of tubes (4), said diffuser cones (16) being fixed to said locking means (7) by anchoring means (17) consisting of two rods (18), which are mutually connected in an X-shaped arrangement, said two rods (18) having, at their ends, appropriately provided holes (19) for accommodating locking screws.

7. The device according to claims 1 and 6, **characterized in that** in said tubular element (2) there is, in the region proximate to said first opening (15), a means for recovering condensation (20), said condensation recovery means (20) preferably having a tray-like concave shape, said condensation recovery means (20) having a drain tube (21), which is connected to a particle recovery tank (22), of the type that can be inspected and opened for cleaning, which is arranged below said tubular element (2).

8. The device according to one or more of the preceding claims, **characterized in that** it comprises a cover (23), which is engaged detachably with an upper end (10) of said tubular element (2), said cover (23) having a frustum-like shape which terminates in a portion that tapers toward the upper part and is provided with a second opening (24).

9. The device according to one or more of the preceding claims, **characterized in that** it comprises a first thermometer (25), which is associated with said first connector (5) for the inflow of water that arrives from the aqueduct or from a well, a second thermometer (26), which is associated with said second connector (11) at the outlet of the water of said tubular element (2), a third thermometer (27), which is associated with the third connector (14) of said lower end (6), and finally a fourth thermometer (28) for measuring the temperature of the combustion gases in output, which is arranged on said upper end (10).

10. The device according to one or more of the preceding claims, **characterized in that** it comprises said accumulation tank (30) arranged so as to receive the water in output from said tubular element (2) before it is conveyed into said one or more boilers (31), a second duct (29) being provided which is connected to said second connector (11) for the outflow of the water from said tubular element (2) and connected to the lower region of said accumulation tank (30), a circulation pump (32) being inserted in said second duct (29), a third duct (33) also being provided for delivery in output from the upper region of said accumulation tank (30), said third duct (33) continuing

and splitting into a fourth duct (34) for entering the boiler and a fifth duct (35) which terminates in a first redirection valve (36) which is arranged in the pipe of the aqueduct (37) that is connected to said first connector (5) of said tubular element (2), in order to allow the formation of a closed circuit between said accumulation tank (30) and said device (1), a second redirection valve (40) being provided, which intercepts said fourth and fifth ducts (34, 35).

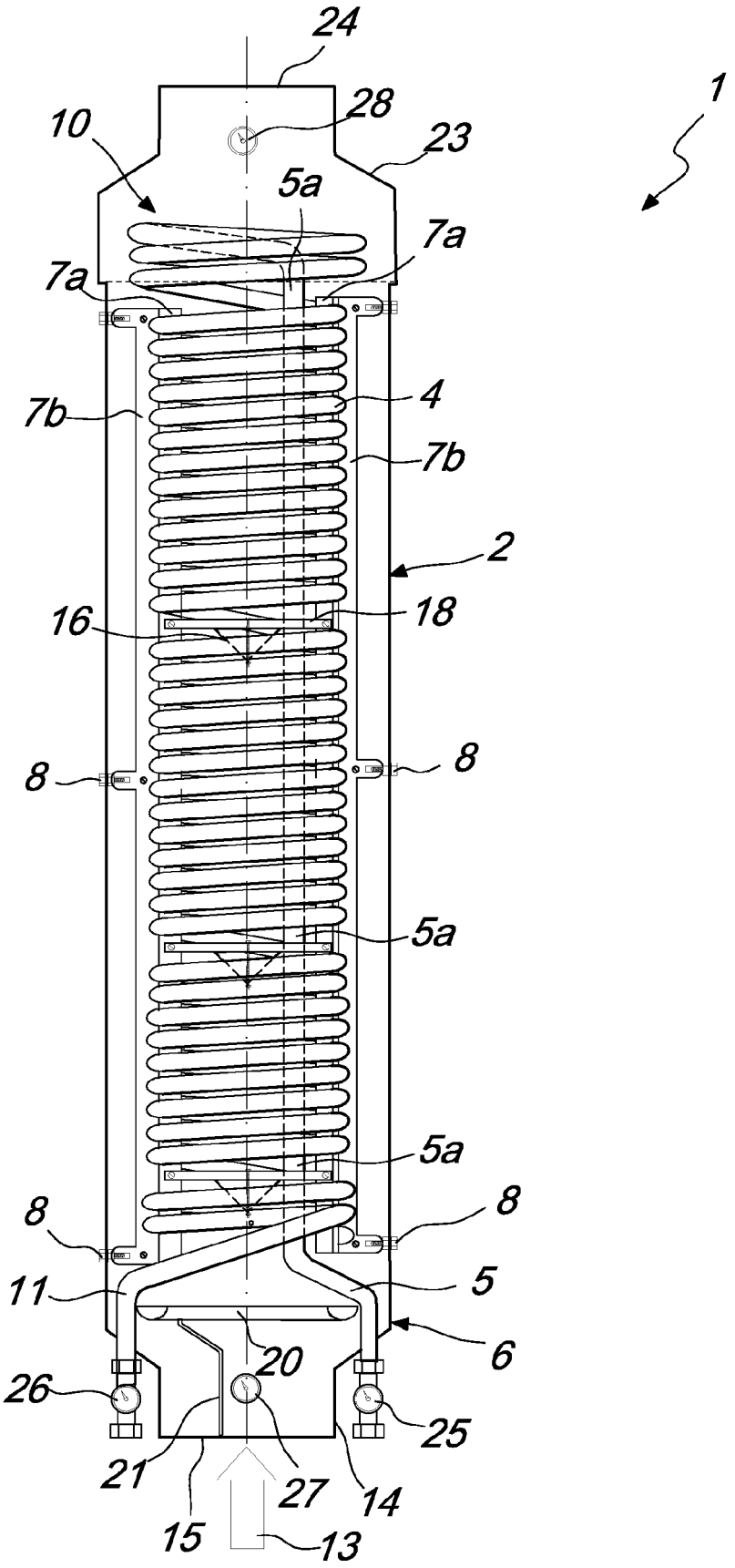
24
1
10
28
23
5a
7a
7a
7b
4
7b
2
16
18
8
8
5a
5a
8
8
11
5
6
20
26
25
21
27
14
15
13

Fig. 1

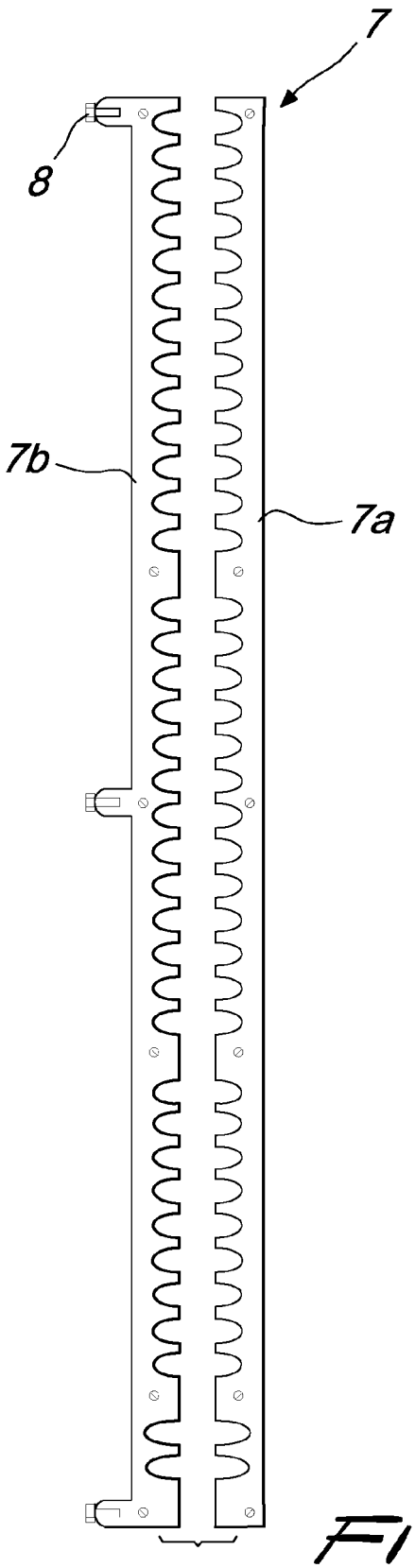

Fig. 2

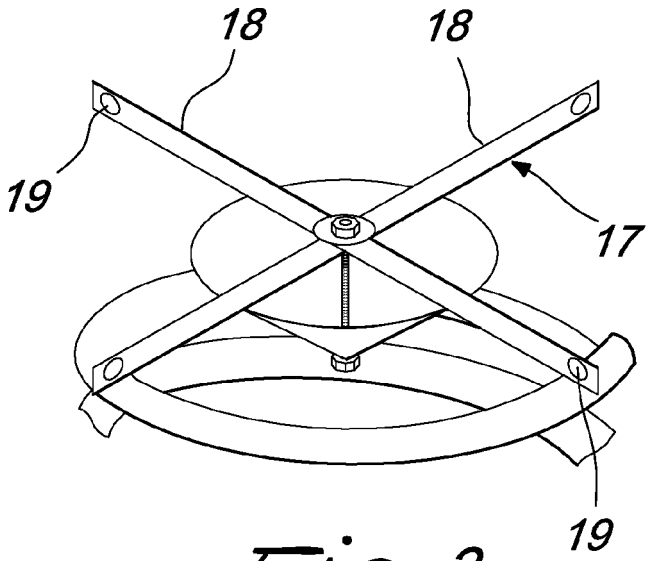

Fig. 3

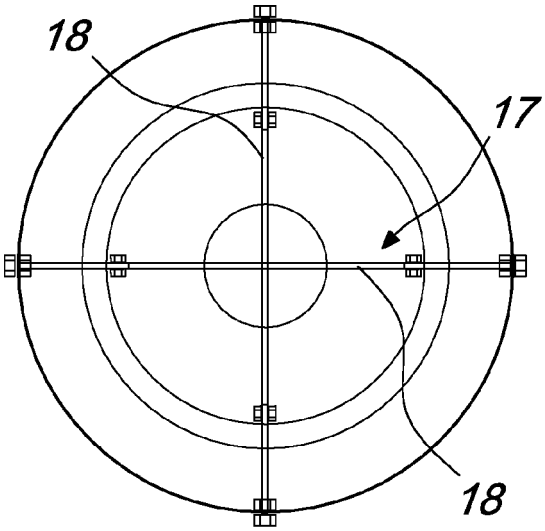

Fig. 4

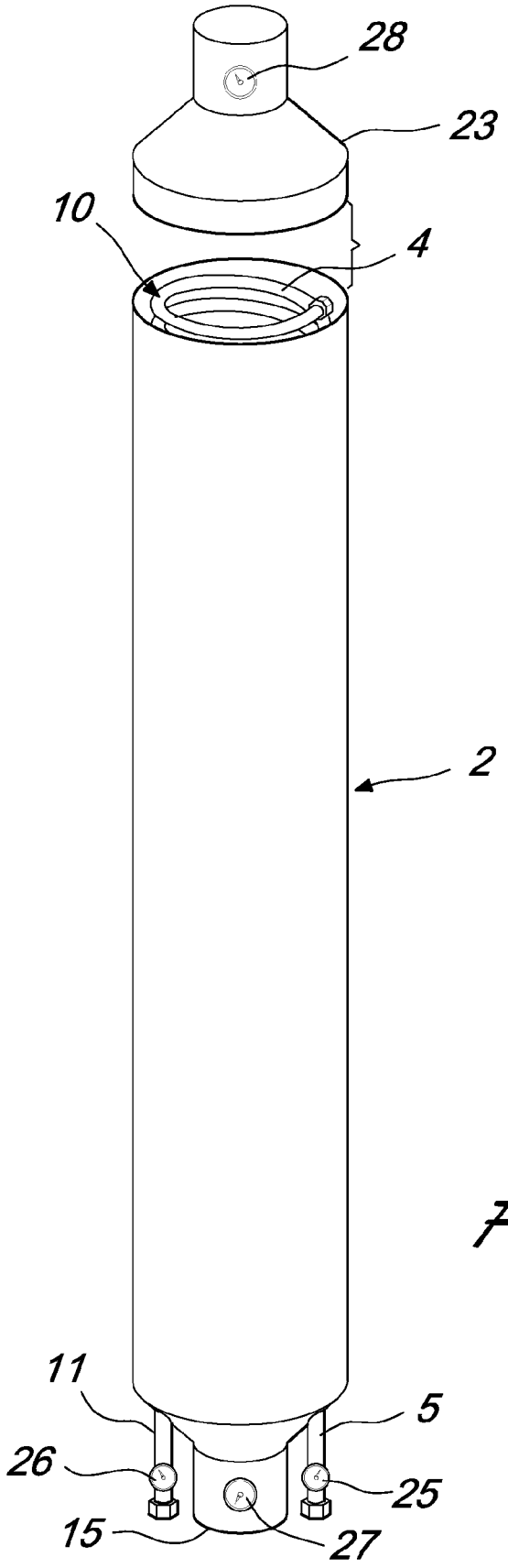

Fig. 5

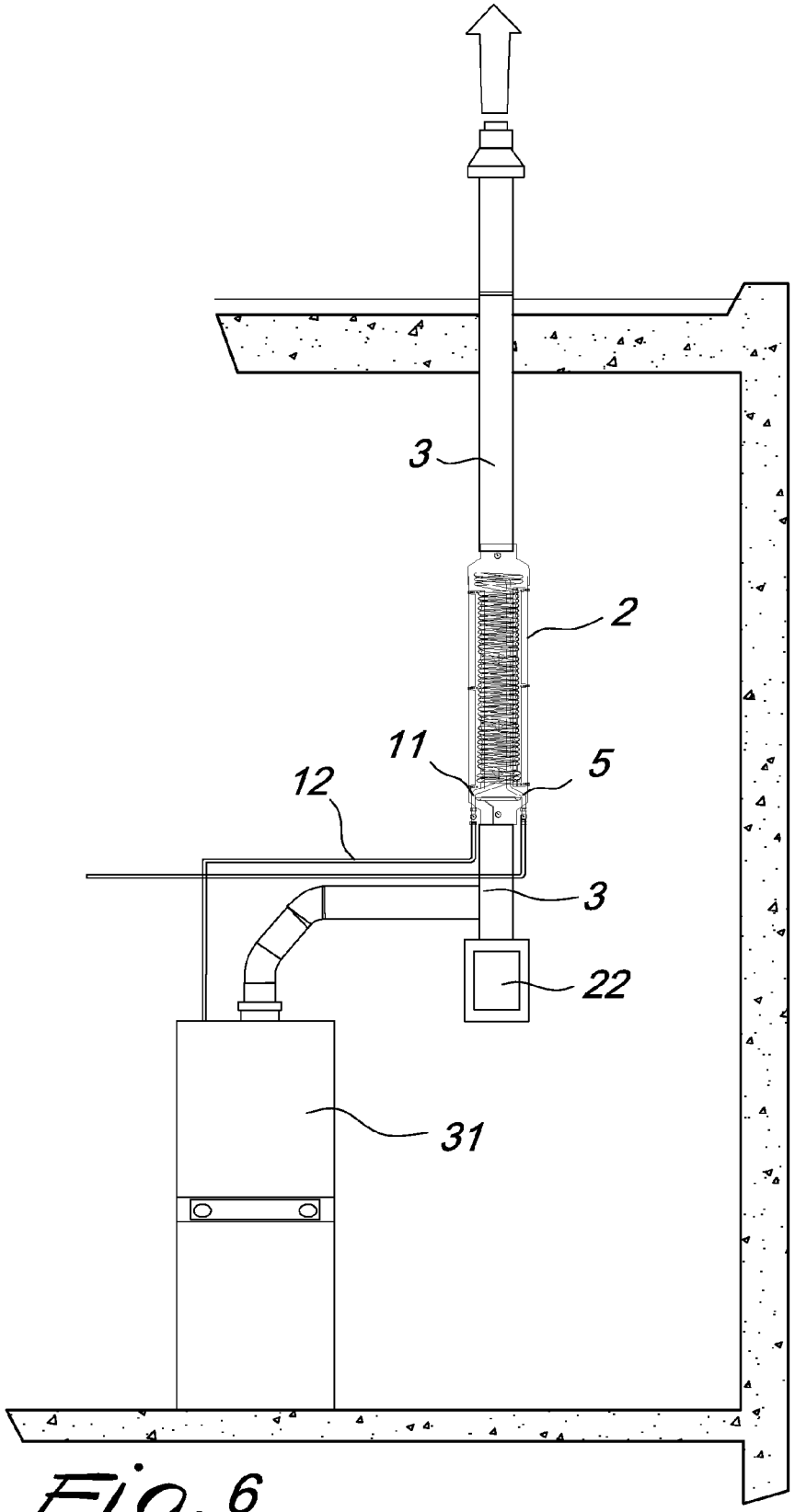

Fig. 6

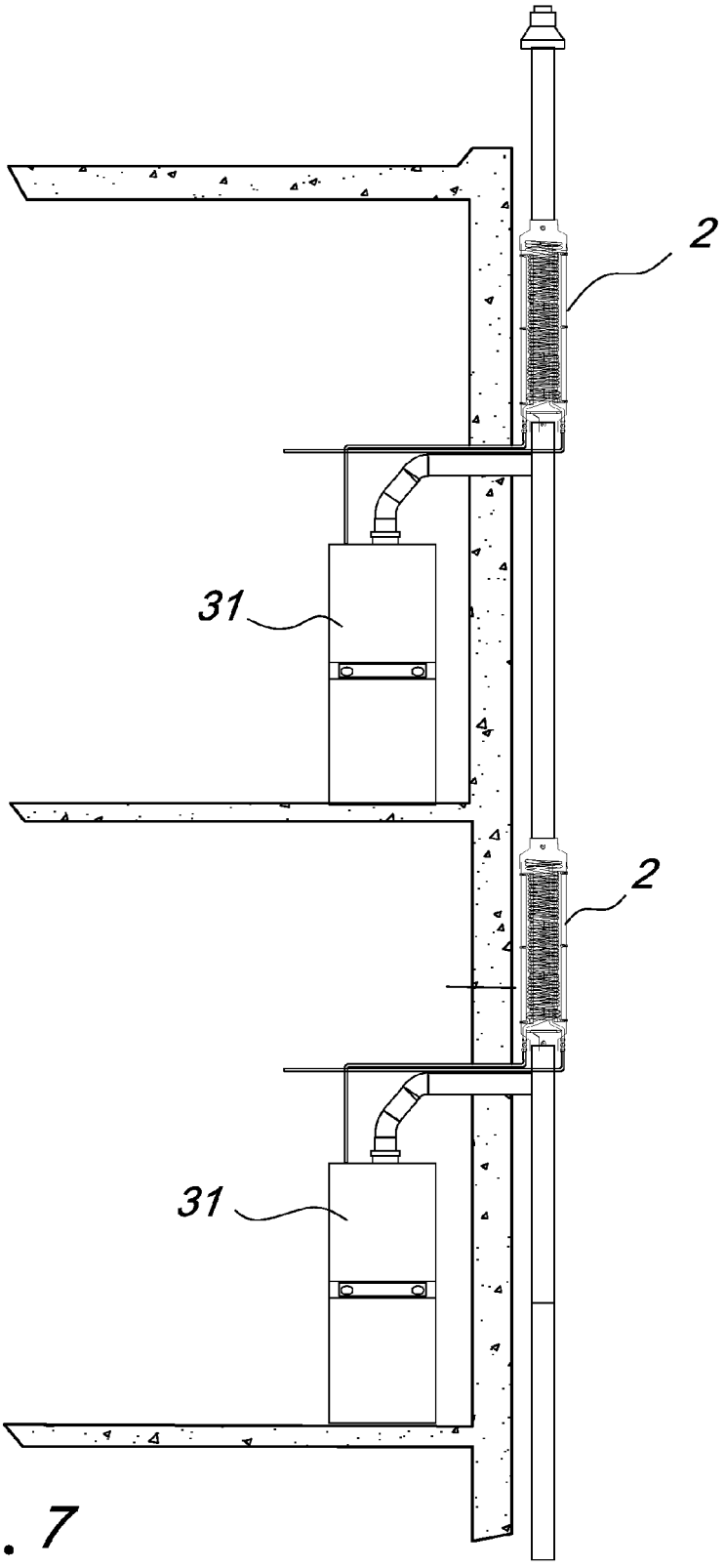

Fig. 1

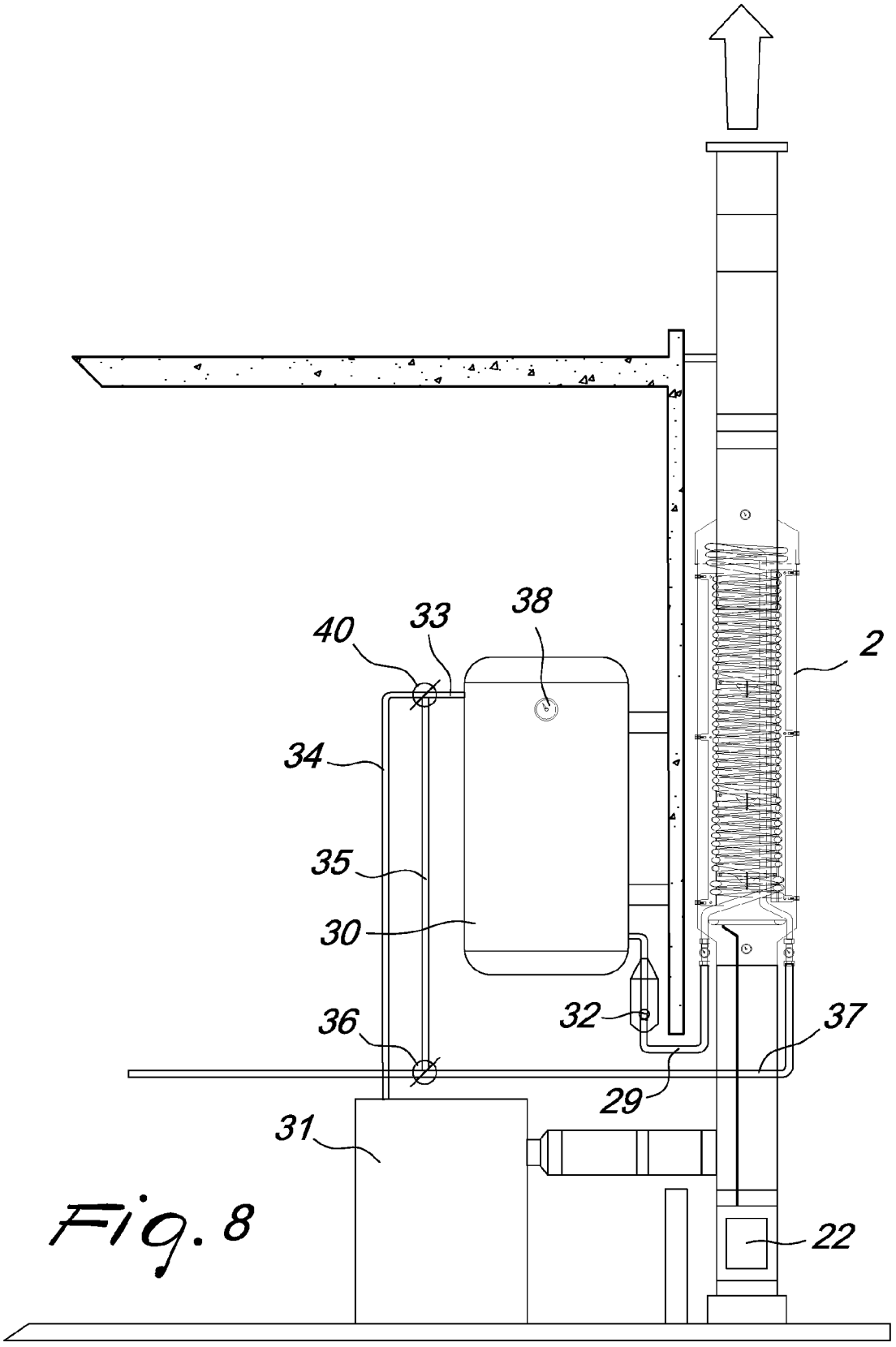

Fig. 8

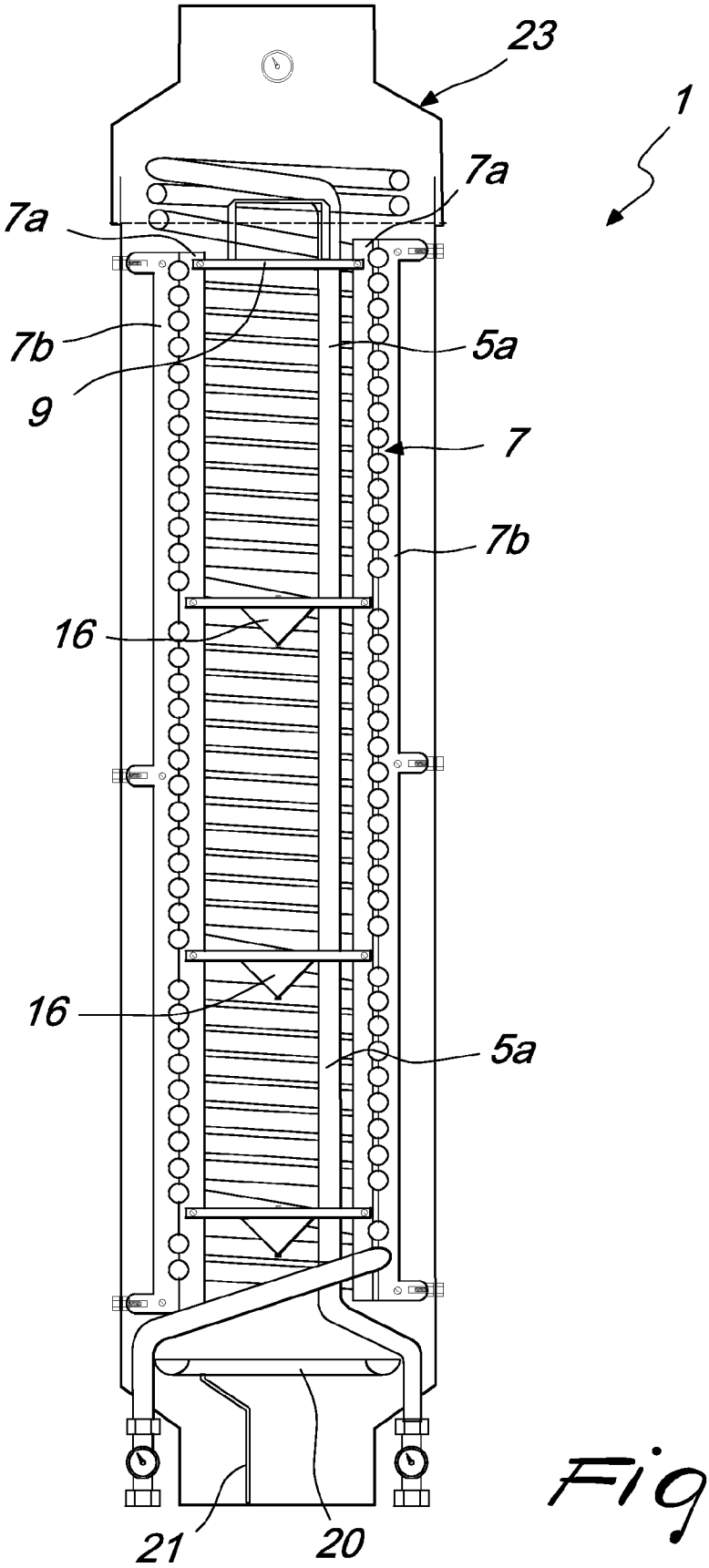

Fig. 9

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 09 17 6128

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	EP 0 351 247 A (DAWSON ROBERTS E [BS]) 17 January 1990 (1990-01-17) * page 5, line 64 - page 6, line 31 * * page 9, line 63 - page 10, line 24; figures 1-10,19 *	1 2 3-10	INV. F28D21/00 F28D7/02
Y	US 685 835 A (GROH) 5 November 1901 (1901-11-05) * page 1, line 50 - line 84; figure 1 *	2	
X A	DE 31 46 877 A1 (GEIGER LUDWIG) 1 June 1983 (1983-06-01) * page 10, line 13 - page 17, line 17; figures 1-3 *	1 2-3	
A	US 1 841 361 A (BULKELEY CLAUDE A) 19 January 1932 (1932-01-19) * page 2, line 74 - line 91; figure 2 *	1-3	
A	US 2002/189798 A1 (JACOBS SIDNEY [US]) 19 December 2002 (2002-12-19) * paragraph [0047]; figure 2 *	1-3	TECHNICAL FIELDS SEARCHED (IPC) F28D
A	US 4 498 524 A (JACOBSEN ORVAL E [US]) 12 February 1985 (1985-02-12) * column 3, line 35 - column 5, line 43; figures 1-4 *	1-5,9	
A	US 2 521 462 A (KINZELMANN HARRY X) 5 September 1950 (1950-09-05) * column 1, line 60 - column 3, line 30; figures 1,2 *	1-2,10	
A	US 2 252 046 A (STEELE WILLIAM L) 12 August 1941 (1941-08-12) * page 1, right-hand column, line 22 - page 2, left-hand column, line 61; figure 1 *	1-2	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 March 2010	Beltzung, Francis

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)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 09 17 6128

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 4 043 014 A (WILSON JOHN C) 23 August 1977 (1977-08-23) * column 1, line 51 - column 2, line 26; figures 1A,3 *	1-2,9	
A	US 4 175 518 A (REAMES CEDRIC TED A JR [US]) 27 November 1979 (1979-11-27) * column 1, line 49 - column 2, line 65; figure 1 *	1-2	
A	US 4 143 816 A (SKADELAND DAVID A) 13 March 1979 (1979-03-13) * column 2, line 3 - column 6, line 23; figures 1-4 *	1,10	
A	US 3 231 016 A (CAMPBELL STEWART JAMES ET AL) 25 January 1966 (1966-01-25) * column 1, line 9 - column 4, line 39; figures 1,2,8,9 *	1-3	
A	DE 29 41 989 A1 (LUECKE HANNS W) 7 May 1981 (1981-05-07) * page 4, line 33 - page 6, line 13; figures 1-4 *	1-2	TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 March 2010	Beltzung, Francis

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

1 EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 17 6128

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-03-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0351247 A	17-01-1990	NONE	
US 685835 A		NONE	
DE 3146877 A1	01-06-1983	NONE	
US 1841361 A	19-01-1932	NONE	
US 2002189798 A1	19-12-2002	NONE	
US 4498524 A	12-02-1985	NONE	
US 2521462 A	05-09-1950	NONE	
US 2252046 A	12-08-1941	NONE	
US 4043014 A	23-08-1977	NONE	
US 4175518 A	27-11-1979	NONE	
US 4143816 A	13-03-1979	NONE	
US 3231016 A	25-01-1966	GB 1072904 A	21-06-1967
DE 2941989 A1	07-05-1981	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- IT TV20080151 A **[0063]**