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

(11) **EP 2 541 144 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.01.2013 Bulletin 2013/01

(51) Int Cl.:
F23J 3/02 *(2006.01)*

(21) Application number: **11425168.9**

(22) Date of filing: **01.07.2011**

(84) Designated Contracting States:
AL 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 RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **Tecnoborgo S.p.A.**
29122 Piancenza (IT)

(72) Inventors:
- **Carretta, Gerardo**
  72020 Torchiarolo (Brindisi) (IT)
- **Mazzari, Claudio**
  29122 Piacenza (IT)

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

(54) Incinerator, particularly for waste-to-energy plants

(57) An incinerator, particularly for waste-to-energy plants, comprising at least one steam generator (1) that defines at least one combustion chamber (2), an evaporation section (3), a superheating section (4) and at least one economizer (5) in mutual sequence, comprising at least one catalyzing assembly (50) situated along the route of the gases generated by the combustion in the incinerator in a position having an operating temperature comprised substantially between 270°C and 310°C, where the route of the gases is defined between the superheating section (4) and the economizer (5).

Moreover, the catalyzing assembly (50) is provided with cleaning means (20) adapted to remove the ashes carried by the exhaust gases and which can accumulate in the ducts for conveying the exhaust gases of the catalyzing assembly (50).

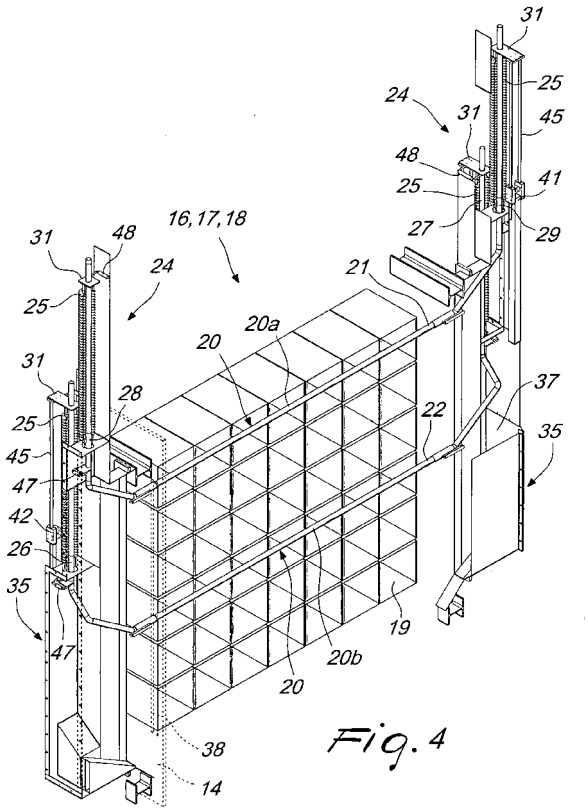


Fig. 4

EP 2 541 144 A1

Description

[0001] The present invention relates to an incinerator, particularly for waste-to-energy plants.

[0002] Incinerators are known for the disposal of urban waste, special waste similar to urban waste, sanitary waste and biological muds, which exploit the heat deriving from the combustion of the waste in order to produce electricity.

[0003] In such incinerators, which are commonly known as waste-to-energy plants, the treatment of waste in order to produce energy occurs according to the following steps.

[0004] In a first step, that of storage of the waste, the urban and similar wastes are accumulated in a special accumulation pit the environment of which is kept in partial vacuum in order to prevent the propagation of odors. The wastes, together with biological muds that have previously been dehydrated and sanitary waste that has previously been checked, in order to ensure it is free from radioactive waste, are introduced into special hoppers adapted to convey the waste to the furnaces.

[0005] Subsequently, in the furnaces, which are provided with inclined metal grilles that can be movable or fixed, the step is performed of burning the waste, which is fed by the presence of a forced air current necessary to supply the quantity of oxygen required to feed the combustion.

[0006] Thereafter comes the recovery of the heat that is released by the combustion. More precisely, the heat passes through the steam generator, located downstream of the furnace, and causes the vaporization at high pressure of water which is circulating in special pipe bundles that constitute the steam generator.

[0007] In this way superheated steam is obtained at high pressure, which is conveyed to a turbine that is coupled to an alternator, in such a way as to produce electricity.

[0008] With regard to the disposal of the dross deriving from the combustion, such dross falls from the metal grilles of the furnaces into a basin where it is cooled in a water bath and then conveniently recycled or directed to dumps to safeguard the environment.

[0009] Similarly, the exhaust gases of the combustion are also treated in order to prevent the emission of harmful substances into the atmosphere.

[0010] More precisely, the treatment of the exhaust gases involves the passage thereof through a filtering system for the abatement of dusts and of the pollutants contained, both chemical and solid.

[0011] Once the combustion exhaust gases have yielded their heat in the evaporation and superheating sections of the steam generator, they, still hot, are used to preheat the water supplying the steam generator.

[0012] In greater detail, the structure of the steam generator where this preheating of the water takes place is known as an economizer.

[0013] It should be emphasized that the treatment of the exhaust gases is nowadays of fundamental importance, and indeed in recent years many waste-to-energy plants, which had already been in operation for decades, have been upgraded with specific devices for treating exhaust gases.

[0014] Among these, the most commonly used device is advantageously of the "dry" type and involves several successive purification steps. In a first step, performed directly in the combustion chamber, an ammoniac solution (ammonia or urea) is injected for the abatement of nitrogen oxides (NOx) in nitrogen gas and water vapor.

[0015] This reduction is carried out in the combustion chamber since it requires temperatures comprised between 850°C and 1050°C.

[0016] During the passage of the exhaust gases into the steam generator, the heaviest dusts fall into accumulation cones under the steam generator and the exhaust gases created by the combustion pass through an electrostatic precipitator capable of retaining most of the dusts.

[0017] Downstream of the electrostatic precipitator the exhaust gases are additivised, in special reactors, with high surface area lime or sodium bicarbonate and activated charcoal in order to abate the acid components and the sulphur oxides, and in order to neutralize the dioxins and furans.

[0018] The exhaust gases then pass through bag filters in order to capture the residual sodium products and in order to abate the finer dusts still present, before being released into the atmosphere through a smokestack.

[0019] In this way, the solid residues extracted from the exhaust gases in the various steps of the treatment, for example dusts and ashes, are stored, partially recycled and then disposed of in appropriate dumps.

[0020] The incinerators of the known type are not devoid of drawbacks, including the fact that in the treatment of exhaust gases just described the ammoniac solution injected in the combustion chamber in order to reduce the nitrogen oxides (NOx) is even more harmful than the nitrogen oxides themselves, and therefore it is necessary to guarantee its complete use as a reagent for the chemical reaction of conversion of the nitrogen oxides into nitrogen gas and water vapor, and thus prevent the release thereof via the smokestack.

[0021] In order to reduce this hazard, the installation of an abatement system of the catalytic type for nitrogen oxides is often resorted to.

[0022] The presence of the catalyzer enables the reaction to take place at lower temperatures, preferably between 270°C and 310°C, and increases the yield of the reduction reaction, thus further reducing accordingly the emission of ammonia in the smokestack.

[0023] Notwithstanding this, even with the addition of an abatement system of the catalytic type for nitrogen oxides, conventional incinerators are not devoid of drawbacks, including the fact that the installation of the catalytic-type system in existing waste-to-energy plants is generally done downstream of the system for filtering the

exhaust gases, where the exhaust gases have a temperature generally comprised between 160°C and 170°C.

[0024] In order to achieve an optimal yield of the reaction to reduce the nitrogen oxides, an increase in the temperature of the exhaust gases is therefore required, of at least 50-100°C, in order to enable the catalytic-type system to function in the correct range of temperatures, with an inevitable waste of energy due to the increase in consumption of fuel necessary to raise the temperature.

[0025] Moreover, in the installation of the catalytic-type abatement systems for nitrogen oxides in existing waste-to-energy plants, difficulties arise, especially at the design phase, as a result of the major encumbrances of the catalytic-type systems, which, due to the size of the plant, reach considerable sizes.

[0026] A further drawback of conventional incinerators consists in that they have a major visual impact which is caused by the installation of the structures, considerable in size, adapted to contain such catalytic-type systems.

[0027] The aim of the present invention consists in providing an incinerator, particularly for waste-to-energy plants, that solves the above mentioned technical problems, that compensates for the drawbacks and that overcomes the limitations of the known art, by making it possible to efficiently abate the pollutants present in the exhaust gases from combustion.

[0028] Within this aim, an object of the invention is to provide un incinerator that makes it possible to limit the emission of ammonia to the smokestack thus avoiding energy waste.

[0029] Another object of the invention is to provide an incinerator that can ensure an efficient operation of the abatement systems of nitrogen oxides, even with easier maintenance operations.

[0030] Another object of the invention is to provide an incinerator the components of which can be used to upgrade incinerators with the installation of catalytic-type systems for the abatement of nitrogen oxides without leading to an increase in the encumbrances of the incinerator proper.

[0031] Another object of the invention consists in providing an incinerator that is capable of offering the widest guarantees of reliability and safety in use.

[0032] Another object of the invention consists in providing an incinerator that is easy to implement and economically competitive when compared to the known art.

[0033] This aim and these objects, as well as others which will become better apparent hereinafter, are achieved by an incinerator, particularly for waste-to-energy plants, comprising at least one steam generator, said at least one steam generator defining at least one combustion chamber, an evaporation section, a superheating section and at least one economizer in mutual sequence, characterized in that said steam generator comprises at least one catalyzing assembly situated along the route of the gases generated by the combustion in said incinerator in a position having an operating temperature comprised substantially between 270°C and 310°C, said route of the gases being defined between said superheating section and said economizer, and said at least one catalyzing assembly being provided with cleaning means adapted to remove the ashes carried by said exhaust gases and which can accumulate in the ducts for conveying the exhaust gases of said at least one catalyzing assembly.

[0034] Further characteristics and advantages of the invention will become better apparent from the description of a preferred, but not exclusive, embodiment of an incinerator, particularly for waste-to-energy plants, illustrated for the purposes of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a schematic side elevation view of an embodiment of a steam generator of an incinerator, particularly for waste-to-energy plants, according to the invention;

Figure 2 is an enlarged-scale detail of a portion, representing the economizer, of the incinerator shown in Figure 1;

Figure 3 is a perspective view of the economizer shown in Figure 2;

Figure 4 is a schematic perspective view from above of a portion of the catalyzing assembly inserted into the economizer shown in Figure 3 with the cleaning means located in the raised position;

Figure 5 is a schematic front elevation view of the portion of the catalyzing assembly shown in Figure 4;

Figure 6 is a schematic front elevation view of the portion of the catalyzing assembly shown in Figure 4 with the cleaning means located in the lowered position;

Figure 7 is a schematic side elevation view of the portion of the catalyzing assembly shown in Figure 6;

Figure 8 is a schematic perspective view of the portion of the catalyzing assembly shown in Figure 6.

[0035] With reference to the figures, the incinerator, particularly for waste-to-energy plants, comprises a steam generator, generally designated with the reference numeral 1 and defining inside it a combustion chamber 2 provided with grilles, an evaporation section 3 located immediately downstream of the combustion chamber 2, then a superheating section 4 and, downstream of the superheating section 4, an economizer 5.

[0036] The superheating section 4 and the economizer 5 define a chamber for the passage of the exhaust gases. The economizer 5 is located downstream of the superheating section 4, with respect to the direction of the route of the gases generated by combustion.

[0037] According to the invention, such chamber for the passage of the exhaust gases extends substantially horizontally, defining a substantially horizontal route of the gases.

[0038] Along the route of the gases several accumulation cones 7, 8, 9 are advantageously provided, which are located in a lower region of the chamber for the pas-

sage of the exhaust gases and are adapted to collect the ashes and the heavier dusts contained in the exhaust gases, which fall downward as a result of gravity.

[0039] In the embodiment disclosed, as clearly shown in Figures 1 and 2, the economizer 5 comprises four banks 10, 11, 12, 13 arranged in mutual series. Of these banks, some, designated with the reference numerals 10, 12, 13, contain pipe bundles 15 inside which the water supplying the steam generator circulates. The remaining bank, designated with the reference numeral 11, comprises at least one catalyzing assembly 50, advantageously of the selective catalytic reduction type.

[0040] The bank 11 containing the catalyzing assembly 50 is advantageously situated in a portion of the route of the gases that has a temperature substantially comprised between 270°C and 310°C, preferably equal to 300°C.

[0041] In the embodiment disclosed, the catalyzing assembly 50 comprises a plurality of catalytic packs 19, substantially cubic and organized in a plurality of catalyzing layers 16, 17, 18 arranged in mutual sequence in the main direction of travel of the exhaust gases along the route of the gases. Each catalyzing layer 16, 17, 18 occupies the entire cross-section of the chamber for the passage of the exhaust gases, defined by the containment walls 14 of the chamber for the passage of the exhaust gases.

[0042] Moreover, the catalyzing assembly 50 or each one of the catalyzing layers 16, 17 and 18 is provided with cleaning means 20 that are adapted to remove the ashes and dusts from the ducts for conveying the exhaust gases through each catalyzing assembly or layer.

[0043] The cleaning means 20 advantageously comprise one or more air nozzles 20a, 20b, blowing on the front wall of the catalyzing layers 16, 17, 18 in a direction that is substantially the same as the main direction of travel of the exhaust gases along the route of the gases.

[0044] More precisely, the air nozzles 20a, 20b that constitute the cleaning means 20 are movable crosswise with respect to the main direction of travel of the exhaust gases so as to affect substantially all of the surface of the front wall of the catalyzing layers 16, 17, 18.

[0045] With particular reference to Figures 4 to 7, the cleaning means 20 advantageously comprise a pair of air nozzles 20a, 20b for every front wall of the catalyzing layers 16, 17, 18, mutually parallel and each affecting at least one part, preferably half, of the surface of the front wall.

[0046] Conveniently, the air nozzles 20a, 20b are rigidly coupled to means of translational motion 24, which are adapted to the translational movement of the air nozzles 20a, 20b in a crosswise direction with respect to the main direction of the route of the gases, so as to affect the entire surface of the front wall of the catalyzing layers 16, 17, 18.

[0047] Each air nozzle 20a, 20b comprises a horizontal tubular element 21, 22 constituted by an inner tube and an outer tube fitted substantially concentrically over the inner tube, and two vertical tubular elements 26, 27 and 28, 29 respectively arranged one to the right and one to the left of the horizontal tubular element 21, 22 of each air nozzle 20a, 20b, and connected with the tubular element 21, 22, so that the passage of air between the horizontal tubular elements 21, 22 and the vertical tubular elements 26, 27 and 28, 29 is guaranteed. The vertical tubular elements 26, 27, 28 and 29 are in fact connected to air supply means.

[0048] Each horizontal tubular element 21, 22 is provided on the outer tube with a plurality of radial holes mutually aligned along three lines substantially parallel to the axis of the tubes and directed so as to allow the outflow of air in the direction of the front wall of the catalytic layers 16, 17 and 18, substantially in the same direction of travel of the exhaust gases.

[0049] Between the outer tube and the inner tube of the horizontal tubular elements 21, 22 of the air nozzles 20a, 20b there is an interspace that constitutes an air distribution chamber, adapted to maintain a substantially constant pressure of the air in the interspace and thus an outflow of the air from the radial holes at a substantially homogeneous pressure.

[0050] More specifically, in the embodiment disclosed, as shown for the purposes of example in Figure 4, the means of translational motion 24 comprise a pair of actuators 41 and 42, advantageously of the pneumatic piston type, associated with the air nozzle 20a, and a pair of actuators 43 and 44 associated in a similar manner with the air nozzle 20b.

[0051] Each actuator 41, 42, 43, 44 comprises a movable piston-guide stem 45 oriented parallelly to the direction of translational motion of the air nozzles 20a, 20b. Each pair of movable stems 45 of each pair of actuators 41, 42, 43, 44 is kinematically connected to a pair of sliders 31. The vertical tubular elements 26, 27, 28 and 29, are rigidly coupled, and therefore integral in translational motion, to the sliders 31.

[0052] The vertical tubular elements 26, 27, 28 and 29 are advantageously provided with guide rollers 47, integral therewith, adapted to facilitate the vertical sliding thereof. Similarly, the sliders 31 are slidingly supported by guide rollers 48.

[0053] The means of translational motion 24 are overall located outside the economizer 5, i.e., outside the chamber for the passage of the exhaust gases.

[0054] The guide rollers 47 that support the vertical tubular elements 26, 27, 28 and 29 of the air nozzles 20a, 20b, as well as the vertical tubular elements proper, are contained in protection structures 35 located outside the economizer 5 and comprising sealing and thermally insulating means.

[0055] The actuators 41, 42, 43, 44, with the corresponding movable stems 45, the sliders 31 and the guide rollers 48 of the sliders 31 are located outside the protection structures 35. The protection structures 35 are adjacent to the lateral containment walls 14 of the economizer and comprise a space 37 that can be accessed

by operators for the purposes of maintenance of the cleaning means 20 and of the means of translational motion 24.

[0056] Each vertical tubular element 26, 27, 28 and 29 is partially contained in the protection structure 35. The portion of the vertical tubular element 26, 27, 28 and 29 that protrudes from the protection structure 35 following the movement of the air nozzles 20a, 20b is contained in a sealing bellows 25 for the exhaust gases.

[0057] The portions of the lateral containment walls 14 of the economizer 5, where the means of translational motion 24 and the protection structures 35 are located, have, at the horizontal tubular elements 21, 22 of the air nozzles 20a, 20b, slits 38 adapted to accommodate the air nozzles, thus allowing their vertical translational motion.

[0058] Each air nozzle 20a, 20b can be accessed from the protection structures 35 through portions that can be opened 39, such as, advantageously, sealing and thermally insulating doors.

[0059] Operation of the incinerator, particularly for waste-to-energy plants, is described below.

[0060] As mentioned previously, the economizer 5 comprises a substantially horizontal route of the gases, catalyzing layers 16, 17, 18 situated in a portion of the route of the gases that has a temperature comprised substantially between 270°C and 310°C, and means 20 for cleaning the catalyzing layers 16, 17, 18, adapted to remove the ashes from the ducts for conveying the exhaust gases.

[0061] The exhaust gases that pass through the catalyzing layers 16, 17, 18 are full of dusts and ashes which tend to clog the catalytic packs 19 of the catalyzing assembly 50 and thus reduce their efficiency.

[0062] Cleaning of the catalyzing assembly 50 occurs by way of air nozzles 20a, 20b which are provided with holes for the outflow of air in the direction of travel of the exhaust gases. By way of the translational motion of the air nozzles 20a, 20b crosswise to the direction of travel of the exhaust gases, the air jets uniformly affect the entire surface of the front wall of each catalyzing layer 16, 17, 18, thus facilitating the expulsion of dusts and ashes from each catalytic pack 19 of each catalyzing layer 16, 17, 18.

[0063] Dusts and ashes thus fall into the accumulation cone 9, downstream of the catalyzing assembly 50, as a result of gravity, without clogging the catalytic packs 19.

[0064] Considering the thickness of a catalytic pack 19, in the embodiment disclosed, every pair of air nozzles 20a, 20b is associated with a single catalyzing layer 16, 17, 18, in order to ensure that the power of the air jets is sufficient to drive ashes and dusts out from every catalytic pack 19 that constitutes the catalyzing layer 16, 17, 18.

[0065] In the embodiment disclosed each air nozzle 20a, 20b is translationally moved by a pair of synchronous actuators 41, 42, 43, 44.

[0066] The protection structures 35, by means of the opening doors 39, allow access by an operator to a space 37 from which it is possible to access the air nozzles 20a, 20b, thus allowing the removal of the horizontal tubular elements 21, 22, in order to carry out maintenance operations and the like.

[0067] In practice it has been found that the incinerator, particularly for waste-to-energy plants according to the present invention, achieves the intended aim and objects in that it makes it possible to abate the pollutants present in the exhaust gases of the combustion of waste.

[0068] Another advantage of the incinerator, according to the invention, consists in that it limits the emission of ammonia to the smokestack thus avoiding energy waste.

[0069] A further advantage of the incinerator, according to the invention, consists in that it ensures an efficient operation of the abatement systems of nitrogen oxides, even with easier maintenance operations.

[0070] Another advantage of the incinerator according to the invention consists in that it can be implemented by way of upgrading an incinerator with the installation of catalytic-type systems for the abatement of nitrogen oxides without leading to an increase in the encumbrances of the incinerator proper.

[0071] The incinerator, particularly for waste-to-energy plants, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0072] Moreover, all the details may be substituted by other, technically equivalent elements.

[0073] In practice the materials employed, provided they are compatible with the specific use, and the contingent dimensions and shapes, may be any according to requirements.

[0074] Where the technical features mentioned in any claim are followed by reference numerals and/or signs, those reference numerals and/or signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference numerals and/or signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference numerals and/or signs.

Claims

1. An incinerator, particularly for waste-to-energy plants, comprising at least one steam generator, said at least one steam generator (1) defining at least one combustion chamber (2), an evaporation section (3), a superheating section (4) and at least one economizer (5) in mutual sequence, **characterized in that** said steam generator (1) comprises at least one catalyzing assembly (50) situated along the route of the gases generated by the combustion in said incinerator in a position having an operating temperature substantially comprised between 270°C and 310°C, said route of the gases being defmed between said superheating section (4) and said economizer (5) and said at least one catalyzing assembly (50) being

provided with cleaning means (20) adapted to remove the ashes carried by said exhaust gases and which can accumulate in the ducts for conveying the exhaust gases of said at least one catalyzing assembly (50).

2. The incinerator according to claim 1, **characterized in that** said route of the gases is substantially horizontal.

3. The incinerator according to claim 1 or 2, **characterized in that** said operating temperature of said at least one catalyzing assembly (50) is substantially equal to 300°C.

4. The incinerator according to claim 1, 2 or 3, **characterized in that** said cleaning means (20) comprise at least one air nozzle (20a, 20b) blowing air on the front wall of said at least one catalyzing assembly (50) in a direction that is substantially the same as the main direction of said exhaust gases along said route of the gases, said at least one air nozzle (20a, 20b) being movable crosswise with respect to said main direction for the cleaning of at least part of said front wall.

5. The incinerator according to claim 1 or 2 or 3, **characterized in that** said at least one catalyzing assembly (50) comprises a plurality of catalytic packs (19) organized in a plurality of catalyzing layers (16, 17, 18) arranged in mutual sequence in the main direction of said exhaust gases along said route of the gases, on the front wall of each one of said catalyzing layers (16, 17, 18), dedicated cleaning means (20) being provided for the cleaning of each one of said catalyzing layers (16, 17, 18).

6. The incinerator according to claim 5, **characterized in that** it comprises three of said catalyzing layers (16, 17, 18) mutually spaced apart.

7. The incinerator according to claim 5 or 6, **characterized in that** said cleaning means (20) comprise at least one air nozzle (20a, 20b) for each one of said catalyzing layers (16, 17, 18), blowing air on the front wall of said catalyzing layer (16, 17, 18) in a direction that is substantially the same as the main direction of said exhaust gases along said route of the gases, said at least one air nozzle (20a, 20b) being movable crosswise with respect to said main direction for the cleaning of at least part of said front wall.

8. The incinerator according to claim 4 or 7, **characterized in that** it comprises a plurality of air nozzles (20a, 20b) that are mutually parallel and each of which is adapted to clean part of said front wall, said air nozzles (20a, 20b) being mutually integral in translational motion.

9. The incinerator according to claim 8, **characterized in that** it comprises two air nozzles (20a, 20b) for each one of said front walls.

10. The incinerator according to claim 4 or 7 or 8 or 9, **characterized in that** each one of said air nozzles (20a, 20b) comprises an inner tube and an outer tube that is functionally connected to air supply means, fitted substantially concentrically over said inner tube and having a plurality of radial holes mutually aligned along at least one line that is substantially parallel to the axis of said tubes for the outflow of air in the direction of said front wall.

11. The incinerator according to claim 10, **characterized in that** it comprises an air distribution chamber defined in the interspace between said outer tube and said inner tube, said distribution chamber having a substantially constant pressure for the uniform outflow of air from said radial holes.

12. The incinerator according to one or more of claims 7 to 11, **characterized in that** it comprises means of translational motion (24) of each one of said air nozzles (20a, 20b) located outside said economizer (5).

13. The incinerator according to claim 12, **characterized in that** said means of translational motion (24) comprise at least one actuator (41, 42, 43, 44), said at least one actuator (41, 42, 43, 44) comprising a movable stem (45) oriented parallelly to the direction of translational motion of said at least one air nozzle (20a, 20b), for each one of said air nozzles (20a, 20b) at least one slider (31) being provided that is integral in translational motion with said air nozzle (20a, 20b), said slider (31) being kinematically connected to said means of translational motion (24) located outside said economizer (5).

14. The incinerator according to claim 13, **characterized in that** it comprises structures (35) for protecting said air nozzles (20a, 20b) comprising sealing and thermally insulating means for preventing outflows of exhaust gases from said route of the gases.

15. The incinerator according to claim 14, **characterized in that** each one of said air nozzles (20a, 20b) is accessible from said protection structures (35) for its removal from said economizer (5) for maintenance operations and the like.

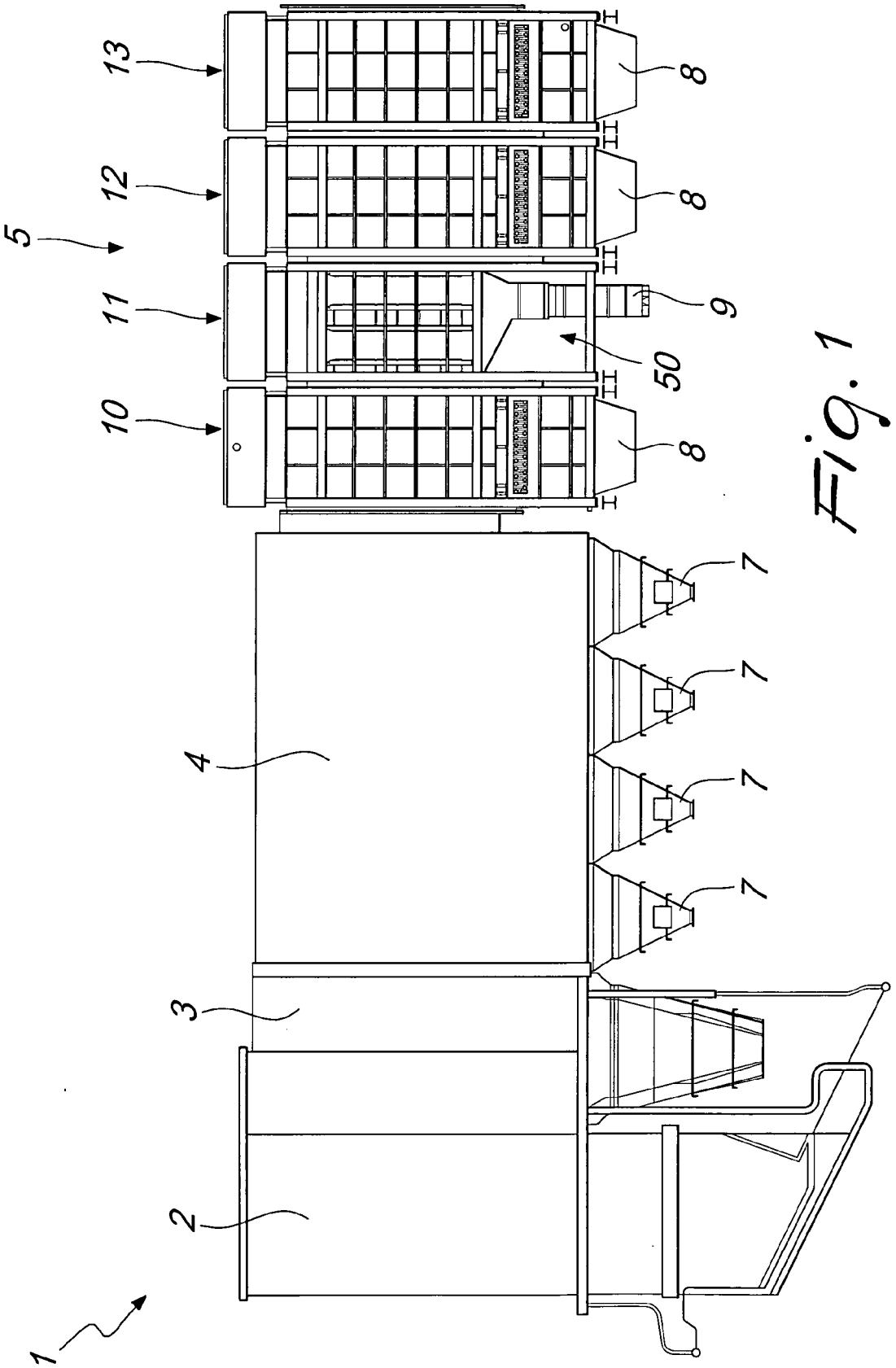


Fig. 1

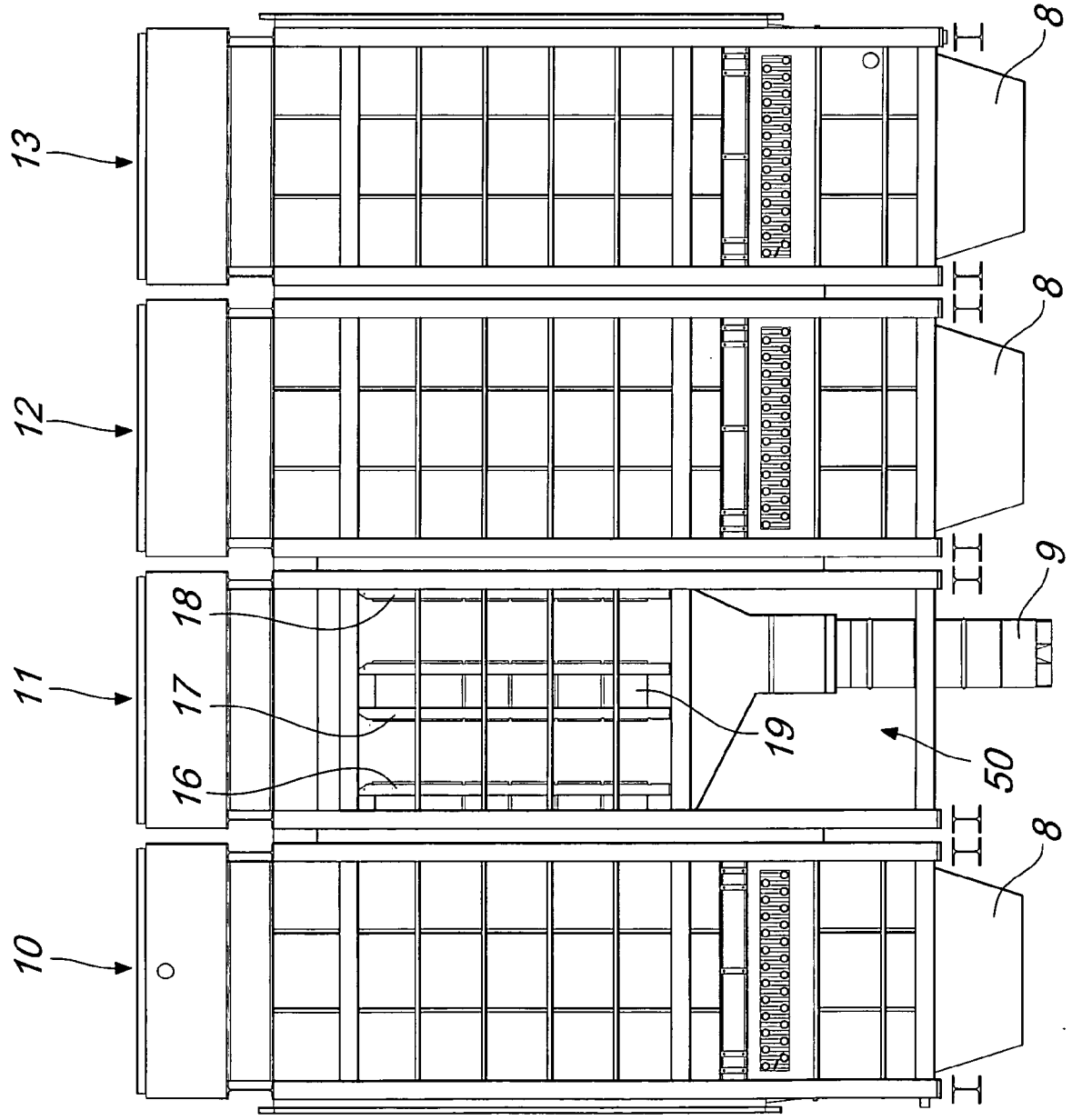


Fig. 2

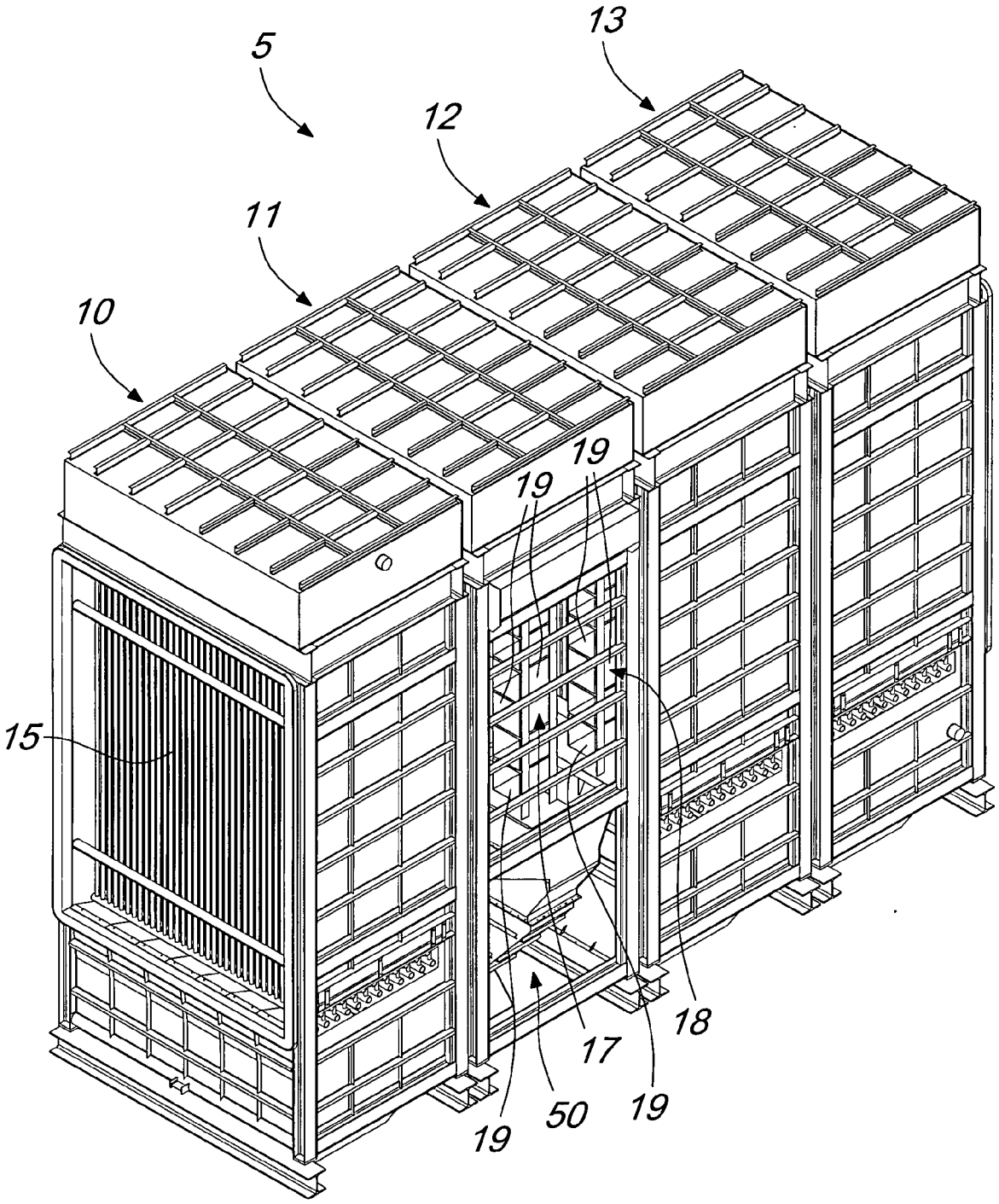


Fig. 3

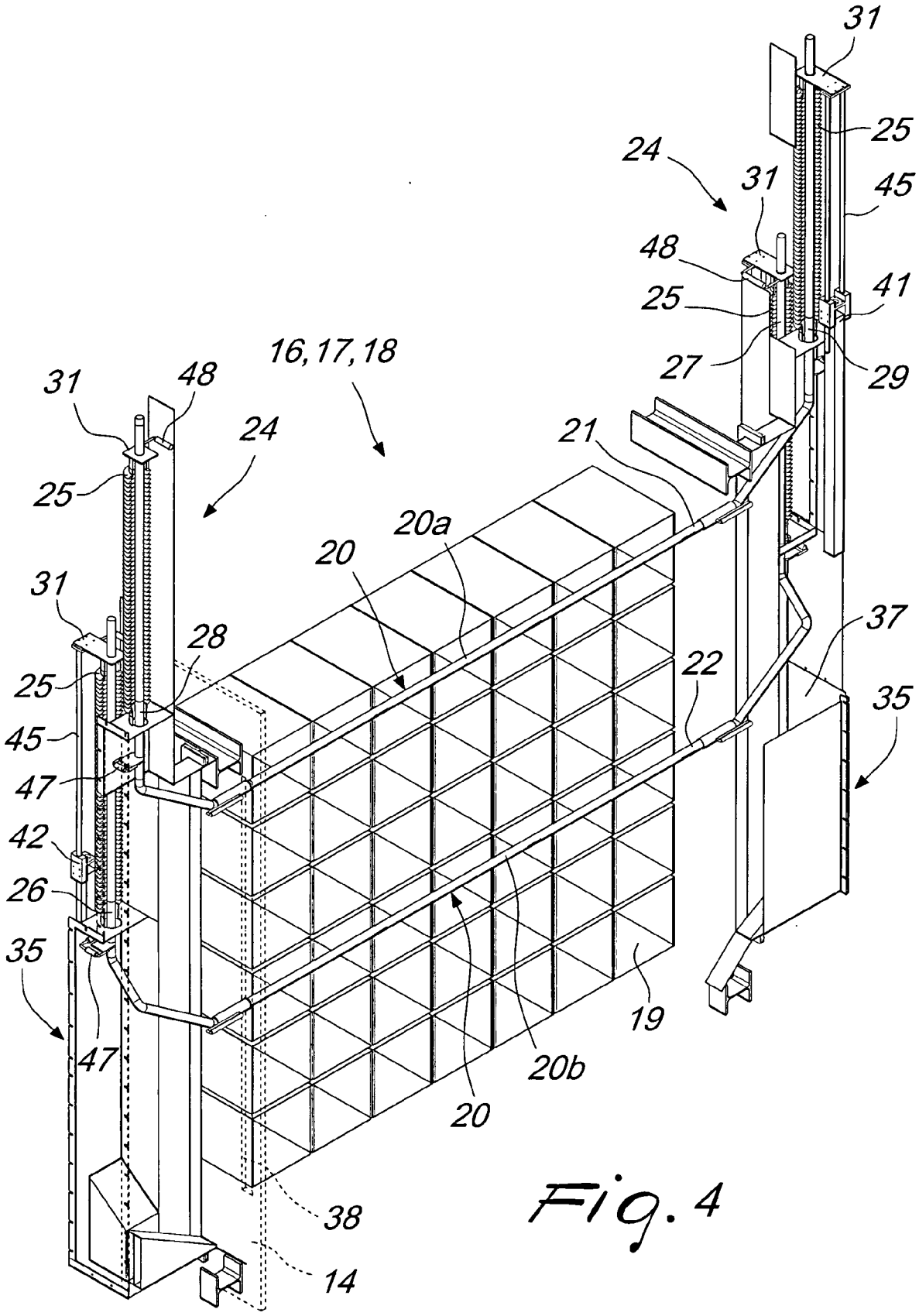

31
25
24
31
45
48
41
25
27
29
16,17,18
31
48
24
21
25
20a
20
31
28
37
25
22
45
35
47
42
26
35
47
19
20b
20
38
14

Fig. 4

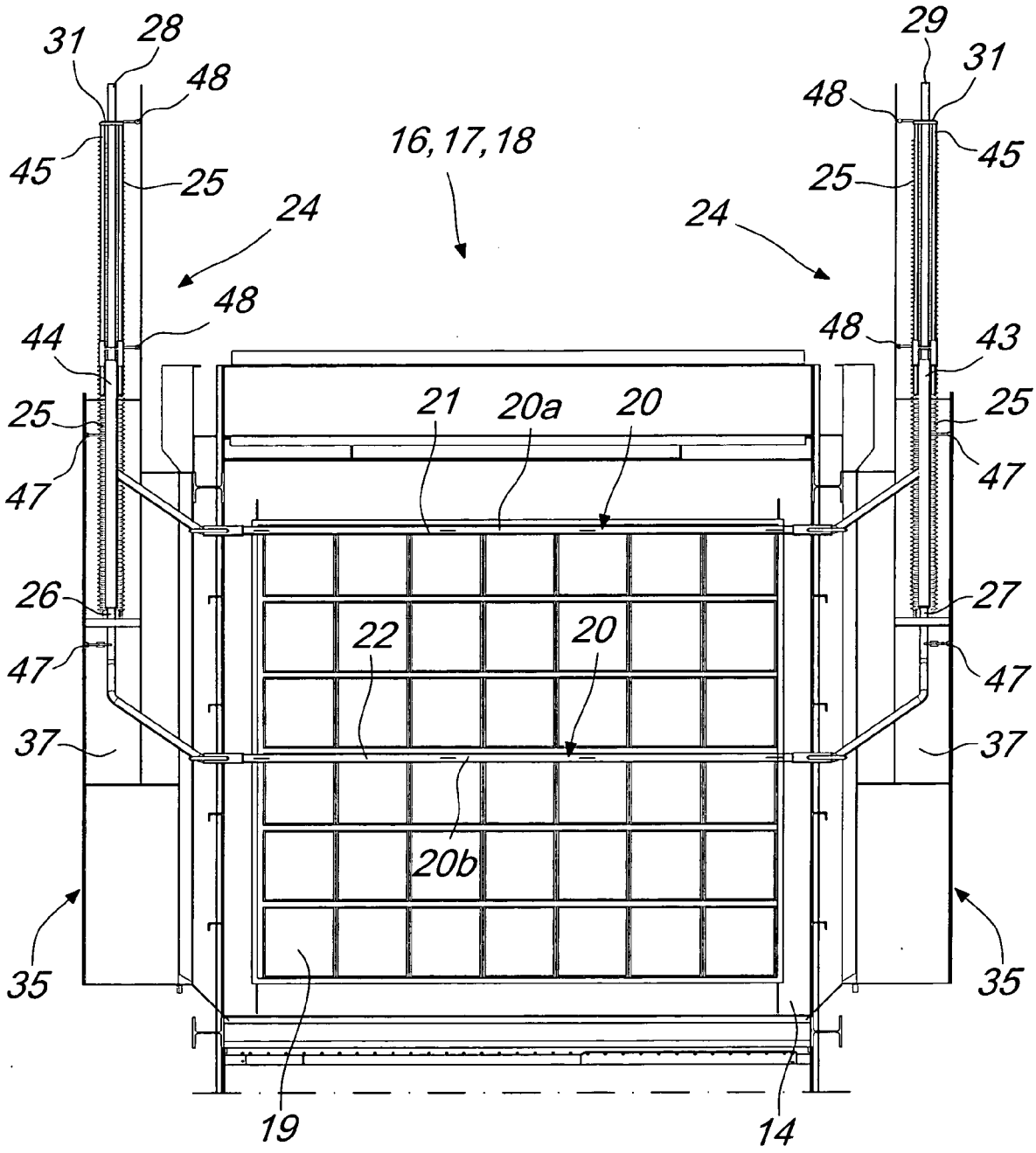

31
28
48
45
25
24
16, 17, 18
29
31
48
45
25
24
48
44
48
43
25
21
20a
20
25
47
47
26
27
22
20
47
47
37
37
20b
35
35
19
14

Fig. 5

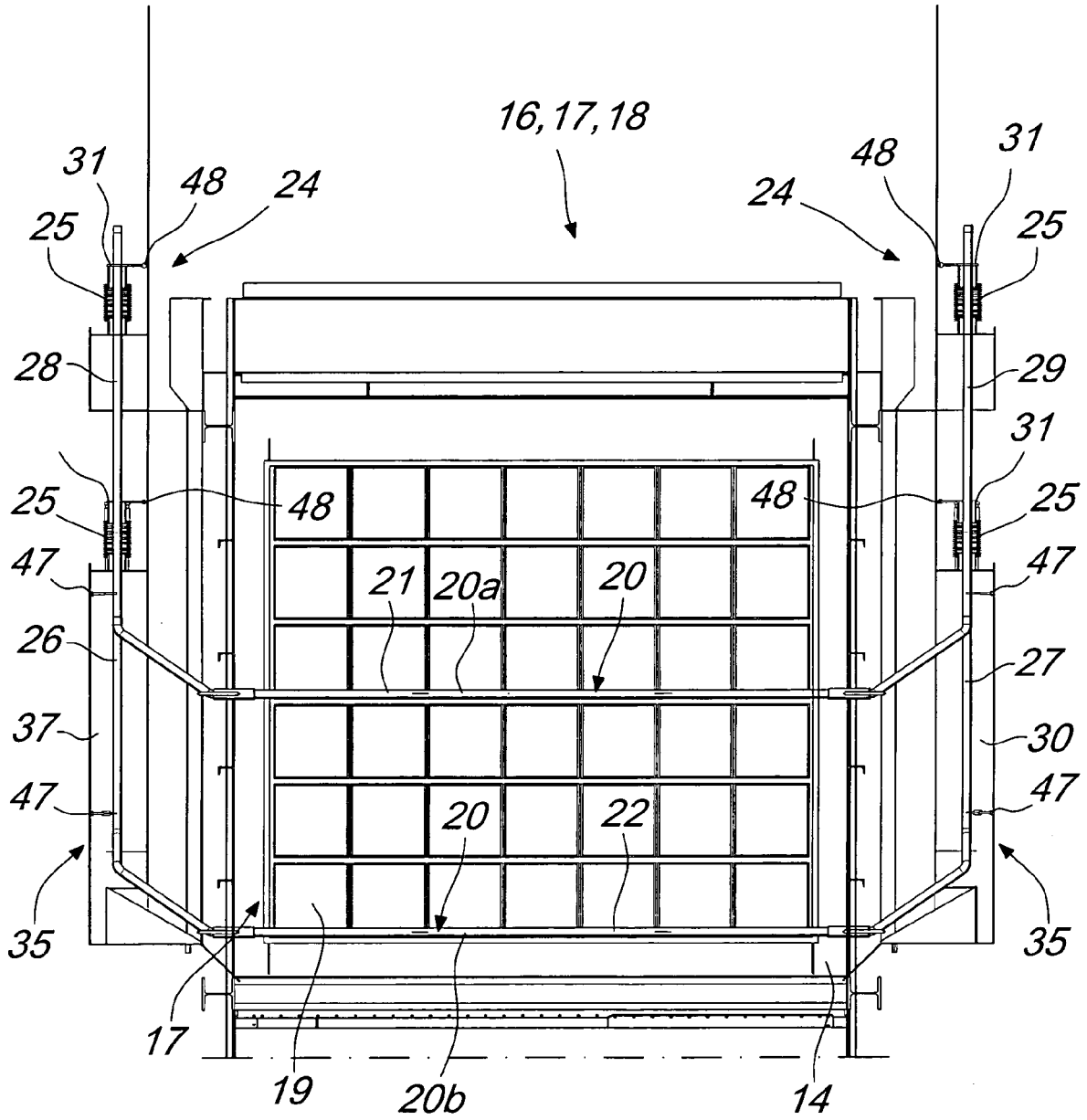

16,17,18
31
48
24
25
28
29
48
21
20a
20
26
27
37
30
47
22
35
17
19
20b
14

Fig. 6

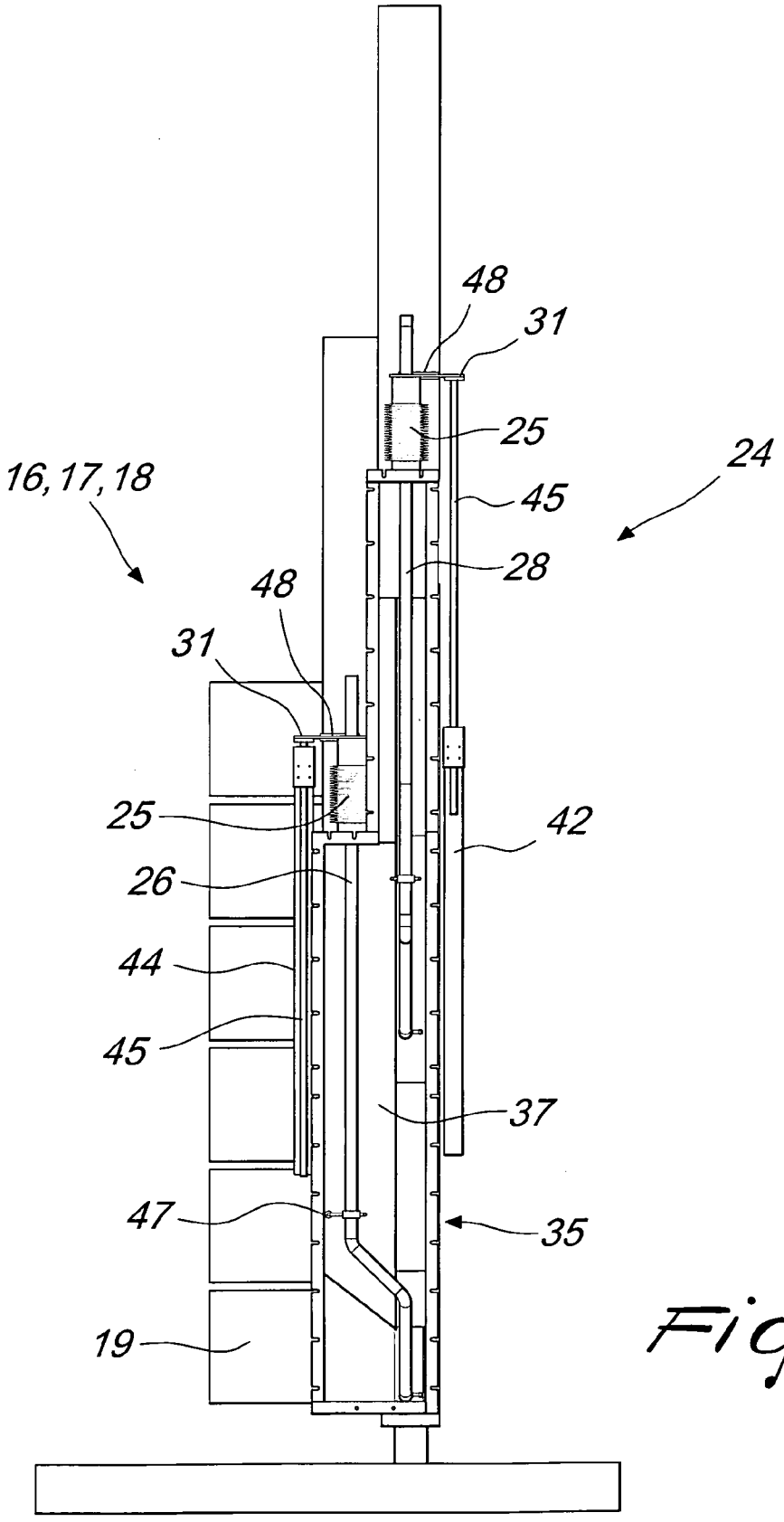


Fig. 7

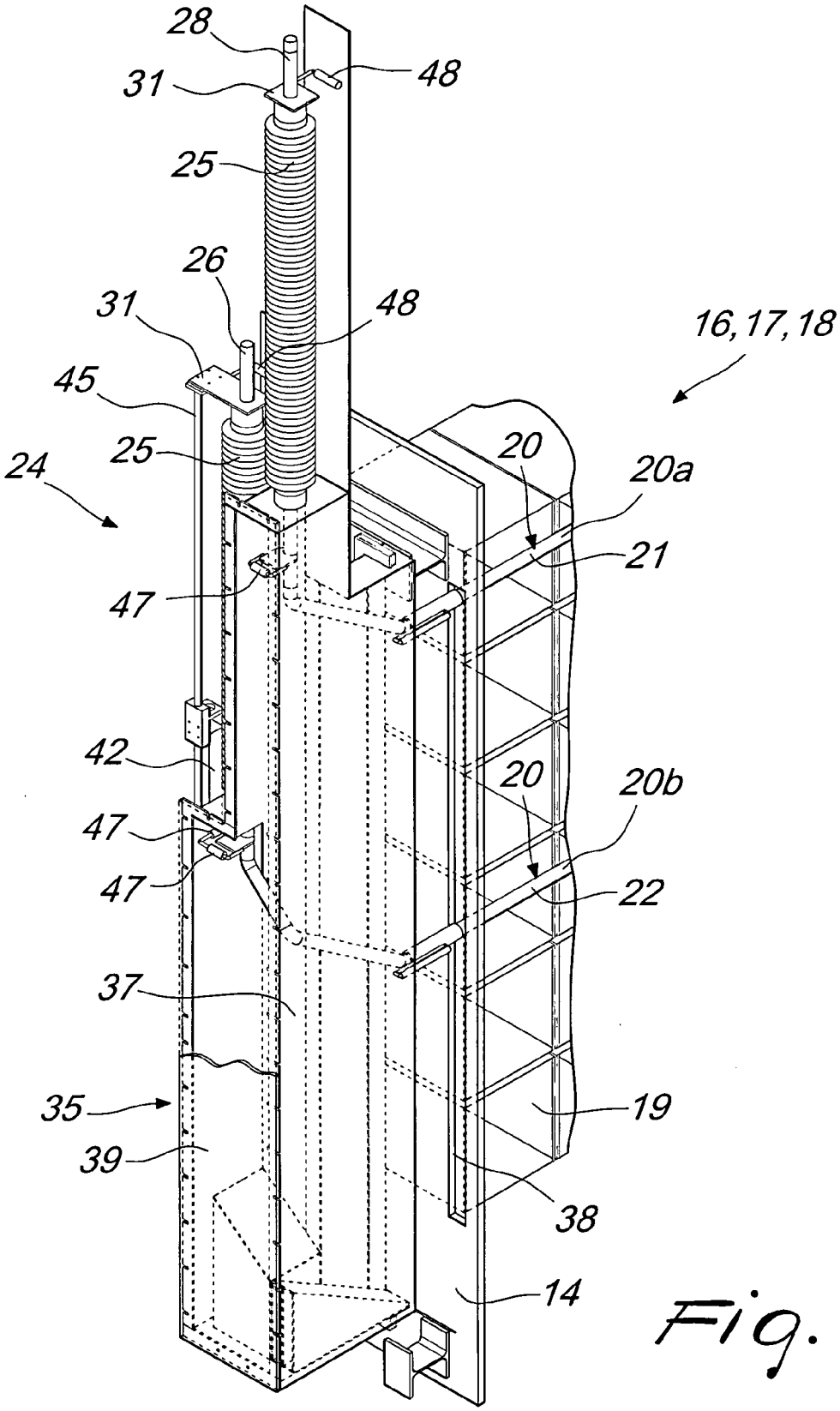

28
31
48
25
26
31
48
16,17,18
45
25
24
20
20a
21
47
42
20
20b
47
47
22
37
35
19
39
38
14

Fig. 8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 42 5168

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	WO 95/27554 A1 (AHLSTROEM OY [FI]) 19 October 1995 (1995-10-19) * page 8, line 5 - page 11, line 24; figure 1 *	1,3 2,4-15	INV. F23J3/02
Y A	EP 0 745 807 A1 (ABB MANAGEMENT AG [CH] ASEA BROWN BOVERI [CH]) 4 December 1996 (1996-12-04) * abstract; claim 1; figures 3,4 *	2 1	
Y	DE 10 2005 030633 A1 (GUENTNER GMBH HANS [DE]) 4 January 2007 (2007-01-04) * the whole document *	4-15	

TECHNICAL FIELDS SEARCHED (IPC)

F23J
F28G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 December 2011	Munteh, Louis

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

3

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 42 5168

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.

09-12-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9527554 A1	19-10-1995	AT 183942 T	15-09-1999
		CA 2186369 A1	19-10-1995
		CZ 9602977 A3	12-03-1997
		DE 69511854 D1	07-10-1999
		DE 69511854 T2	17-02-2000
		DK 755299 T3	27-03-2000
		EP 0755299 A1	29-01-1997
		JP H09509474 A	22-09-1997
		PL 316785 A1	17-02-1997
		US 5465690 A	14-11-1995
		WO 9527554 A1	19-10-1995
EP 0745807 A1	04-12-1996	AT 182207 T	15-07-1999
		AU 704982 B2	13-05-1999
		AU 5459396 A	12-12-1996
		CZ 9601537 A3	11-12-1996
		DE 59506386 D1	19-08-1999
		DK 745807 T3	21-02-2000
		EP 0745807 A1	04-12-1996
		ES 2136267 T3	16-11-1999
		JP 8327009 A	10-12-1996
		PL 314258 A1	09-12-1996
		US 5775266 A	07-07-1998
DE 102005030633 A1	04-01-2007	DE 102005030633 A1	04-01-2007
		DE 202005021540 U1	02-10-2008

EPO FORM P0459

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