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

(11) EP 2 439 446 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.04.2012 Bulletin 2012/15

(21) Application number: **11184504.6**

(22) Date of filing: **10.10.2011**

(51) Int Cl.:
F23B 60/00 *(2006.01)* ***F23C 13/06*** *(2006.01)*
F23J 15/02 *(2006.01)* ***F23G 7/07*** *(2006.01)*
F24B 1/00 *(2006.01)* ***F23B 90/08*** *(2011.01)*
F23B 80/04 *(2006.01)*

(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

(30) Priority: **08.10.2010 IT UD20100183**
01.12.2010 IT UD20100222

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(54) Firebox

(57) A firebox (10) for a combustion apparatus, advantageously but not exclusively using biomass or biofuel, comprises a base structure (11) defining a combustion chamber (12) and a chimney (13) for the smoke, and has a door (16). The chimney (13) comprises at least a segment with a flue, cooperating with the combustion chamber (12), which is provided with a first pipe (19) and a second pipe (20) for the passage of the smoke. The first pipe (19) is associated with choking means (21) and said second pipe (20) is associated with filter means (23) located, according to the direction in which the smoke travels from the combustion chamber (12) toward the outside, before the first pipe (19) merges with the second pipe (20). The choking means (21) are associated, by means of connection means, to the position of the door (16), so that, with the door (16) open, the choking means (21) are in a position of opening the first pipe (19) and with the door (16) closed the choking means (21) are in a position of closing the first pipe (19).

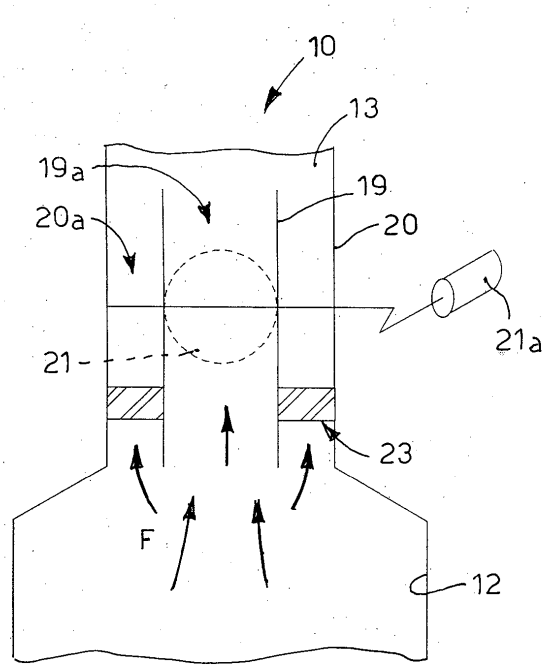

fig. 1a

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a firebox for an apparatus, advantageously, but not exclusively, using biomass or biofuel, of the type provided with a device to control the exit of smoke and fumes from a combustion chamber, when the door of the apparatus is in an open/closed condition. In particular the present invention concerns a firebox provided with filter means able to limit to a minimum the emission into the atmosphere of fine powders, carbon monoxide or other pollutants generated during combustion.

BACKGROUND OF THE INVENTION

[0002] A firebox is known for an apparatus for the combustion of biomass or biofuel in general, connected to a fireplace, a stove, a boiler or similar, having a base structure conformed to define at least a combustion chamber and a chimney for drawing the smoke. The combustion chamber is open at least on one side through a loading or access aperture, hereafter simply referred to as aperture, for example suitable to allow loading from outside the chamber and/or the start of combustion and/or inspection.

[0003] The aperture may sometimes be selectively closed by means of a door or other similar systems.

[0004] One drawback found in the state of the art is to guarantee, with the firebox functioning, that the chimney is open when the door is open, so as to prevent a considerable outlet of smoke from the aperture and thus prevent dangers for the operator. It must be remembered that opening the door during combustion often causes an intense outlet of powders and ash through the chimney.

[0005] It is known that, in the passage section of the chimney, a choking valve is provided, for example a butterfly, normally disposed in a segment of the chimney near the combustion chamber, which serves to choke the transit section of the chimney in order to adjust the free portion of the section on each occasion.

[0006] A kinematic device is known, for example from the Italian patent IT-B-1310551, which connects the door to the choking valve so that, when the door is in an open condition, the choking valve too is completely open, and then returns to the desired choking condition, once the door is closed.

[0007] It is also known to provide filter means, disposed in cooperation with the chimney, to reduce to a minimum the emissions into the atmosphere of fine powders, carbon monoxide or other pollutant elements.

[0008] It is also known to use, in cooperation with the chimney, a filter of the catalytic type, which, to perform at its best, must operate at temperatures comprised between 250°C and about 450°C.

[0009] Moreover, known filters require frequent maintenance interventions to clean and regenerate them, interventions which are normally complex and often require specialized personnel.

[0010] In particular, in applications where a choking valve is also provided, the filter is disposed along the chimney in suitable zones to obtain the functioning in the above temperature range. Very often these positions are difficult to access for operators, further complicating maintenance interventions.

[0011] One purpose of the present invention is to obtain a firebox-chimney system for biomass or biofuel in general, but not exclusively intended for this type of fuel, which is both simple and economic to produce.

[0012] Another purpose is to obtain a firebox-chimney system which allows both a desired and controlled choking of the section of the chimney, and a safe and controlled discharge of the smoke when the door is open.

[0013] It is also a purpose to make a more complete filtering of the smoke exiting from the chimney for the longest time possible.

[0014] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0015] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0016] In accordance with the above purposes, a firebox-chimney system according to the present invention comprises a base structure conformed to define at least a combustion chamber and a chimney for the smoke which is open, on one side, toward the combustion chamber and, on the other side, toward the outside environment. The combustion chamber is open on at least one side through an aperture which can be selectively closed by means of a door.

[0017] According to the present invention, the chimney comprises at least a segment of flue cooperating with the combustion chamber. The segment is provided with a first pipe and a second pipe for the passage of smoke.

[0018] The first pipe is associated with choking means so as to choke, in a desired and controlled manner on each occasion, the useful section for the smoke to pass, and the second pipe is associated with filter means located, according to the direction of the smoke from the combustion chamber toward the outside, before the first pipe merges with the second pipe.

[0019] The choking means are associated with the position of the door, so that when the door is open the choking means are automatically in a position to open the first pipe and when the door is closed the choking means are automatically in a position to close the first pipe.

[0020] In an advantageous form of embodiment, connection means are suitable to connect the door with the

choking means, so that when the door is open the choking means are automatically in the condition of maximum opening. In this condition the maximum drawing of the smoke through the chimney is guaranteed, avoiding peaks of powders and ash toward the chimney and the exit of the smoke through the aperture.

[0021] According to one form of embodiment, the connection means are at least partly kinematic.

[0022] According to another form of embodiment, the connection means are at least partly electric or electromechanical, so that the opening of the door drives a control and command circuit which governs the opening of the choking means of the chimney.

[0023] In another form of embodiment it can be provided that the connection means can at least be partly driven in a pneumatic mode.

[0024] In accordance with a first variant, the first pipe defines the proper channel for the passage of the smoke, while the second channel is placed around the first, that is, surrounding the first pipe, coaxially for example, to define a toric or circular space.

[0025] In accordance with a second variant, the first pipe is associated with the second pipe in the form of a by-pass, that is, one is extarnally adjacent to the other.

[0026] In accordance with a third variant, the first pipe and the second pipe are associated in proximity to the combustion chamber.

[0027] According to the invention, in the case of the first variant cited, the filter means are disposed inside the circular space.

[0028] In the case of the second variant, the filter means are present in the second pipe.

[0029] With the solution according to the third variant the filter means are found in an accessible position in proximity to the combustion chamber.

[0030] Advantageously, therefore, the filter means are in a zone where the temperature of the smoke always guarantees an operativeness between about 250°C and about 450°C, and they do not influence the functionality of the choking means.

[0031] Therefore on the one hand it is possible to provided quicker and simpler intervention steps with consequent reduction in maintenance costs, and on the other hand an optimum operativity of the filter means is guaranteed and the complete drawing of the smoke from the chimney is guaranteed when the door is open.

[0032] In one form of embodiment of the present invention, the filter means comprise a rapid attachment mechanism, for example of the snap-in type, the bayonet or other type, in order to promote the replacement or maintenance interventions.

[0033] In one form of embodiment, the snap-in attachment mechanism is made, with a first connection part, on the filter means, and with a second connection part, on an internal wall of the combustion chamber, in correspondence with the aperture of the chimney toward the combustion chamber.

[0034] The first connection part and the second connection part are configured to cooperate reciprocally on a common lying plane transverse to the direction defined by the path of the smoke along the first pipe and the second pipe. The first connection part is also suitable to cooperate tangentially in rotation with the second connection part to selectively pass from an axially released condition to a condition where it is axially engaged with the internal wall of the chamber.

[0035] In this way, the filter means can be selectively assembled and disassembled inside the circular space, intervening from inside the combustion chamber and acting on a simple snap-in attachment mechanism and performing a simple rotation operation and axial insertion/extraction, without the risk of damaging the filter by dropping it or through accidental knocks.

[0036] According to a variant, the snap-in attachment mechanism is of the bayonet type in which the first part comprises two fins which protrude laterally from the filter means, whereas the second part comprises two brackets attached to the internal wall and defining with the latter respective housing seatings for the fins of the filter means.

[0037] According to a variant, the brackets are made directly by shaping the internal wall of the combustion chamber.

[0038] Therefore the assembly of the filter means provides a first step of inserting the filter means inside the annular space, with the fins in a position angularly offset with respect to the brackets. Once a condition of complete insertion has been achieved, the filter means are rotated with respect to their median longitudinal axis, until the fins are taken inside the relative housing seatings.

[0039] With an inverse movement, that is, with a rotation and a subsequent axial extraction, the filter means are easily disassembled from the annular space.

[0040] This solution also allows the final user to intervene directly in operations to replace, regenerate and/or clean the tilter means, without needing the intervention of specialized personnel.

[0041] According to another variant, the snap-in attachment mechanism is of the elastic type, that is, with an elastic seal of the filter means when the latter are in position inside the annular space.

[0042] According to the invention, when the door opens a suitable control and command system drives the choking means which open the first pipe making the smoke, the powders and the ash pass through the first pipe, whereas when the door closes the choking means close the first pipe and the smoke, the powders and the ash transit, at least most of them, through the filter means.

[0043] According to a variant, the filter means are at least partly of the mechanic type.

[0044] According to another variant, the filter means are at least partly of the catalytic type,

[0045] According to a variant embodiment, the filter means are mechanical and/or mixed means, so that there are mechanical means located toward the flame and catalytic means located toward the exit of the chimney.

[0046] Moreover, in another variant the filter means are at least partly electrostatic.

[0047] In the case where the filter means are of the catalytic type, their position will be such that the temperature of the smoke which passes through the filter means maintain the filter means between about 250°C and about 450°C.

[0048] Positioning the filter means in proximity to the combustion chamber allows to provide quicker and simpler intervention steps, with consequent reduction in maintenance costs while an optimum operativity of the filter means is guaranteed, and also the complete drawing of the smoke from the chimney, when the door is open.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. la and lb respectively show two possible forms of embodiment of the present invention;
- fig. 2 shows a front view of a firebox according to the present invention;
- fig. 3 shows a section from III to III in fig. 2;
- fig. 4 shows a plane view of the firebox in fig.2;
- fig. 5 shows a section from V to V in fig. 2;
- fig. 6 shows a three-dimensional and partially sectioned view of an enlarged detail of the firebox in tig. 2, in a first operating condition;
- fig. 7 shows a three-dimensional and partially sectioned view of an enlarged detail of the firebox in fig. 2, in a second operating condition;
- fig. 8 shows a three-dimensional and partially sectioned view of an enlarged detail of the firebox in fig. 2, in a step of assembling/ disassembling the filter means.

[0050] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one form of embodiment can conveniently be incorporated into other forms of embodiment without further clarifications.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0051] With reference to the attached drawings, the number 10 indicates in its entirety a firebox for a chimney, a stove, a boiler or similar.

[0052] In the case of a chimney or a stove, given here as an example, the firebox 10 comprises a base structure, or frame 11, having a conformation such as to define a combustion chamber 12 and a chimney 13.

[0053] The combustion chamber 12 is open toward the outside through a loading or inspection aperture 15; the aperture 15 can be selectively closed using a door 16, in this case with a guillotine movement.

[0054] The chimney 13 is open and on one side faces toward the combustion chamber 12 through an internal wall 17 and on the other side toward the external environment.

[0055] The chimney 13 comprises, at least in an initial part toward the combustion chamber 12, a first pipe 19 and a second pipe 20, which can be disposed one surrounding the other, advantageously coaxial to each other, (fig. 1a) or adjacent in a by-pass configuration, that is, not included one inside the other (fig. 1b): the first solution in which they are advantageously coaxial is preferred, also aesthetically.

[0056] The first pipe 19 defines its own channel 19a for the passage of smoke.

[0057] In some forms of embodiment, the first channel 19 has a reduced diameter compared to the second pipe 20.

[0058] The firebox 10 also comprises, a choking valve 21, for example a butterfly valve, disposed in cooperation with the channel 19a, so as to allow the selective variation of the useful section passage.

[0059] In some forms of embodiment, the choking valve 21 can be selectively driven using actuator means 21a.

[0060] Advantageously, connection means are suitable to connect the door 16 with the choking valve 21, so that when the door 16 is open, the choking valve 21 is in a condition of maximum opening.

[0061] In variant embodiments, the connection means which drive the choking valve 21 in connection to the door 16 can be a kinematism 22, as shown in fig. 2, connected to the door 16 and also having, or not, partial adjustment means.

[0062] According to another variant, the connection means which drive the choking valve 21 can be an electric, electromechanical or pneumatic system which provides an opening/closing sensor for the door 16 and in which, by means of a member, for example of the electric suction type, said sensor pilots the closing/opening of the choking valve 21.

[0063] The firebox 10 also comprises a filter 23, which is associated, or not, with a mechanical filter mean, for example a mesh.

[0064] The filter 23 is located, according to the direction of the smoke from the combustion chamber 12 toward the outside as shown by the arrows F in figs. la and 1b, before the first pipe 19 merges with the second pipe 20.

[0065] In Some forms of embodiment, the filter 23 is of the catalytic type. In this case, the filter 23 has an alveolar conformation, that is a honeycomb conformation.

[0066] Merely to give an example, the filter 23 is suitable to filter both the fine powders, for example PM1 and PM10, and also the volatile organic components, for ex-

ample OGC, and also to reduce the carbon monoxide (CO), all of which are generated during combustion.

[0067] According to the example embodiment, the filter 23 comprises a support ring 25 disposed externally, and from which two attachment fins 26 branch off radially and in diametrically opposite positions.

[0068] In a coordinated manner, on the internal wall 17 of the combustion chamber 12, the firebox 10 comprises two attachment brackets 27 which are able to define respective housing seatings suitable to couple the attachment fins 26. For example, the housing seatings are open laterally to allow a lateral insertion of the attachment fins 26 inside them. In this case, the attachment brackets 27 are in a position near to the opening zone of the drawing chimney 13 toward the chamber 12.

[0069] The attachment fins 26 and brackets 27 cooperate reciprocally on a common lying plane, transverse, advantageously perpendicular, with respect to the direction of travel of the smoke along the pipes 19, 20, in the example with respect to the median axis of the chimney 13.

[0070] Moreover, the fins 26 are configured to cooperate tangentially in rotation with the attachment brackets 27 in order to pass from a condition axially released from the internal wall 17 to a condition axially engaged, that is, constrained, to the internal wall 17 and vice versa.

[0071] Hereafter we will show the variant embodiment of the coaxial pipes 19, 20 (figs. la and 2-8), in which the second pipe 20 is located around the first pipe 19, so that a circular or toric space 20a for the passage of smoke is defined, distinct and separate from the channel 19a. It can also be provided that the pipes 19 and 20 are not coaxial with respect to each other, even though the second pipe 20 is located around or surrounding the first pipe 19.

[0072] In this variant embodiment, the filter 23 is configured to be housed in the toric space 20a, providing, to that end, a through aperture 23a, for example in a central position, in which the first pipe 19 (fig. la) is housed. For example, the filter 23 has a cylindrical shape and a cross section substantially equivalent to the cross section of the space 20a, so as to substantially occupy all the useful section for the passage of the smoke.

[0073] In the by-pass variant in fig. 1b, the filter 23 is instead solid and its position, cooperating with the whole section of the second pipe 20, intercepts all of the smoke or a part of it, depending on the condition of the choking valve 21, which possibly passes through the second pipe 20.

[0074] As schematically shown by the arrows L and R in fig. 8, the assembly or vice versa the dis-assembly of the filter 23, in the space 20a according to the variant in fig. la, or in cooperation with the whole section of the second pipe 20 as in the by-pass variant in fig. 1b, occurs by means of two movements, that is, one linear (arrow L) for the axial insertion of the filter 23 with respect to a longitudinal median axis of the chimney 13, and one rotational (arrow R), rotating the filter 23 with respect to the same median axis of the chimney 13, so as to cause the lateral insertion of the attachment fins 26 into the respective housing seatings and to determine the cooperation of the attachment fins 26 with the attachment brackets 27 in the axially engaged or constrained condition. With the inverse movement, the axially released condition of the filter 23 is obtained, for dis-assembly.

[0075] In particular, in the first variant of fig. 1a the filter 23 is thus correctly positioned inside the space 20a, as in the second variant of fig. 1b the filter 23 is correctly positioned inside the second pipe 20, carrying out, in each case, its functions of filtering the smoke coming from the combustion chamber 12.

[0076] In this same operating condition of the filter 23, the smoke can only pass through the space 20a, in the first variant, or through the second pipe 20 in the second variant, and then through the filter 23 in a closed condition of the choking valve 21, or both through the space 20a and through the channel 19a, in the first variant, or through the second pipe 20 and through the first pipe 19 in the second variant, in a open or semi-open condition of the choking valve 21.

[0077] It is clear that modifications and/or additions of parts may be made to the firebox 10 as described heretofore, without departing from the field and scope of the present invention.

Claims

1. Firebox for a combustion apparatus, advantageously but not exclusively using biomass or biofuel, comprising a base structure (11) defining a combustion chamber (12) and a chimney (13) for the smoke, a door (16) being present, **characterized in that** said chimney (13) comprises at least a segment with a flue, cooperating with the combustion chamber (12), said segment being provided with a first pipe (19) and a second pipe (20) for the passage of the smoke, said first pipe (19) being associated with choking means (21) and said second pipe (20) being associated with filter means (23) located, according to the direction in which the smoke travels from the combustion chamber (12) toward the outside, before the first pipe (19) merges with the second pipe (20), said choking means (21) being associated, by means of connection means, to the position of the door (16), so that, with the door (16) open, the choking means (21) are automatically in a position of opening the first pipe (19) and with the door (16) closed the choking means (21) are automatically in a position of closing the first pipe (19), a snap-in attachment mechanism being provided to associate said second pipe (20) to said filter means (23), comprising a first connection part (26) made on said filter means (23) and a second connection part (27) made on an internal wall (17) of the chamber (12), in correspondence with the aperture of the chimney (13)

toward said chamber (12), said first connection part (26) and said second connection part (27) being configured to reciprocally cooperate on a common lying plane transverse to the direction defined by the direction of travel of the smoke along the first pipe (19) and the second pipe (20), said first connection part (26) being suitable to cooperate tangentially in rotation with said second connection part (27) so as to selectively pass from an axially released condition to a condition axially engaged with said internal wall (17) of the chamber (12).

2. Firebox as in claim 1, ***characterized in that*** the connection means which associate the position of the door (16) to the position of the choking means (21) at least partly consist of a kinematic mechanism.

3. Firebox as in claim 2, ***characterized in that*** the connection means which associate the position of the door (16) to the position of the choking means (21) at least partly comprise electric or electromechanical detection and/or command means.

4. Firebox as in claim 2, **characterized in that** the connection means which associate the position of the door (16) to the position of the choking means (21) at least partly comprise pneumatic means.

5. Firebox as in any claim hereinbefore, **characterized in that** the filter means (23) comprise mechanical filter means.

6. Firebox as in any claim hereinbefore, **characterized in that** the filter means (23) comprises catalytic filter means.

7. Firebox as in any claim hereinbefore, **characterized in that** the filter means (23) comprise electrostatic filter means.

8. Firebox as in any claim hereinbefore, **characterized in that** it comprises a rapid attachment mechanism comprising a first part (26) made on said filter means (23) and a second part (27) made on an inside wall (17) of the combustion chamber (12), in correspondence with the aperture of the chimney (13) toward said chamber (12).

9. Firebox as in any claim hereinbefore, **characterized in that** said second pipe (20) is disposed coaxial and external to said first pipe (19), said first pipe (19) defining a channel (19a) for the passage of smoke and between said first pipe (19) and said second pipe (20) a circular space (20a) for the passage of smoke comes to be defined, said filter means (23) being provided inside said circular space (20a) and being cylindrical in shape with a cross section correlated to the cross section of said circular space (20a).

10. Firebox as in any claim hereinbefore, **characterized in that** the snap-in attachment mechanism is of the bayonet type and comprises two fins (26) protruding laterally to said filter means (23), and two brackets (27) associated with the internal wall (17) and defining therewith respective housing seatings for said fins (26).

11. Firebox as in claim 10, **characterized in that** the brackets (27) are fixed to the internal wall (17) of the combustion chamber (12).

12. Firebox as in claim 11, **characterized in that** the brackets (27) are directly made by shaping the internal wall (17) of the chamber (12).

13. Firebox as in any claim hereinbefore, **characterized in that** the choking means (21) are disposed transverse in the first pipe (19) so as to choke, in a desired manner, the useful passage section of the channel (19a).

14. Firebox as in any claim hereinbefore, **characterized in that** the connection means comprise a kinematic connection member (22) suitable to connect the door (16) with the choking means (21), so that an open condition of said door (16) corresponds to an open condition of said choking means (21).

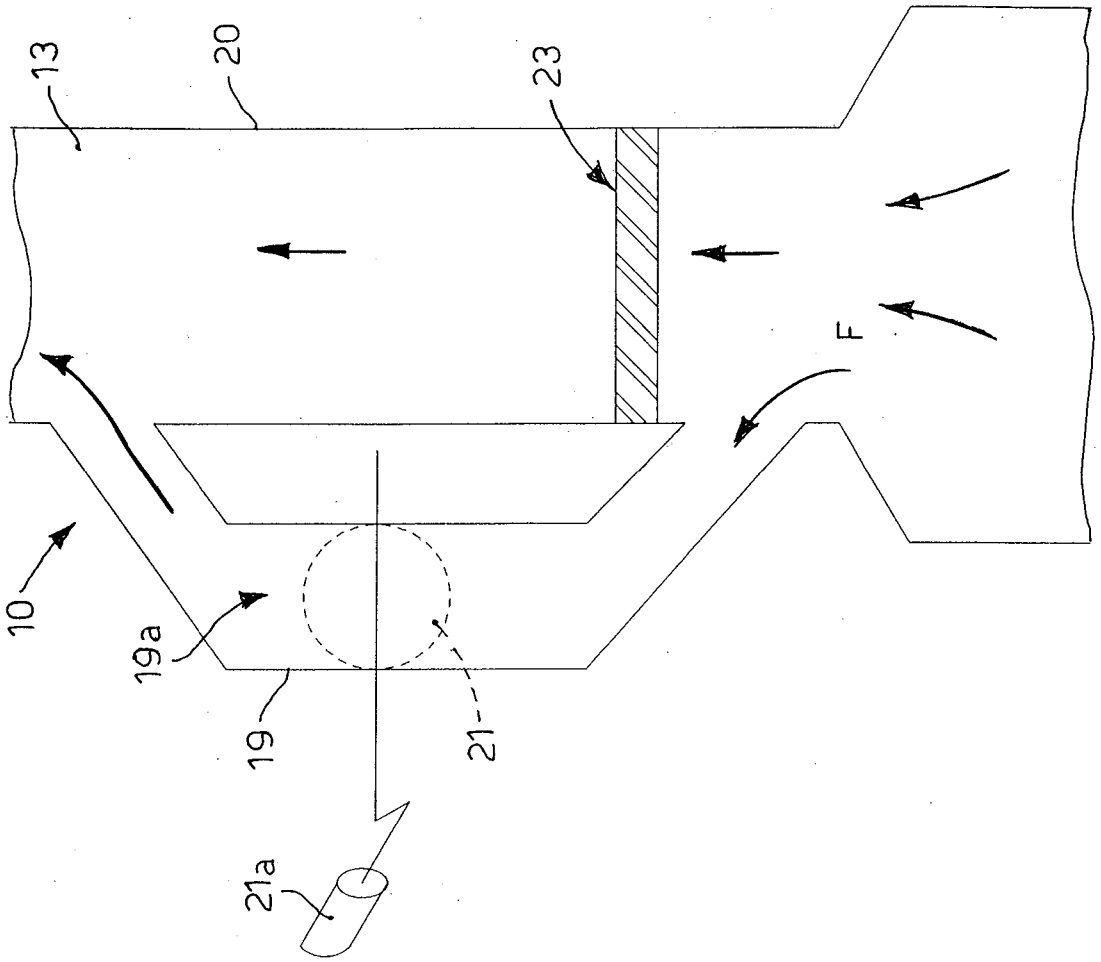

fig. 1b

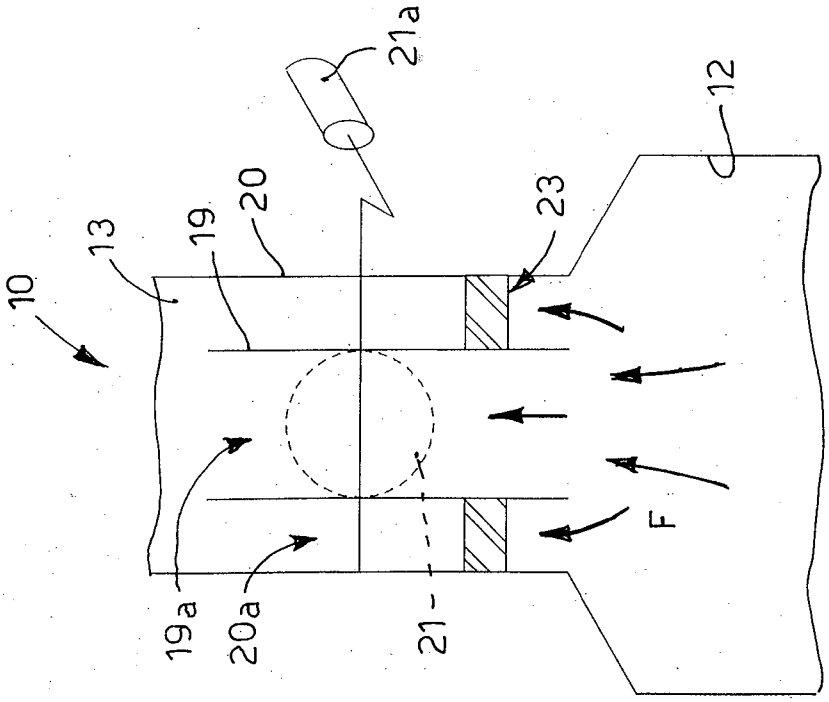

fig. 1a

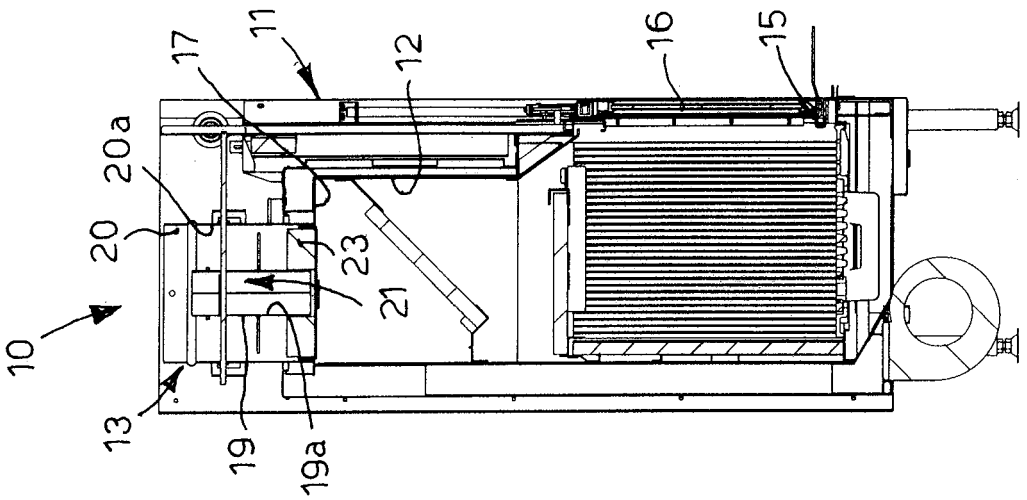

fig. 3

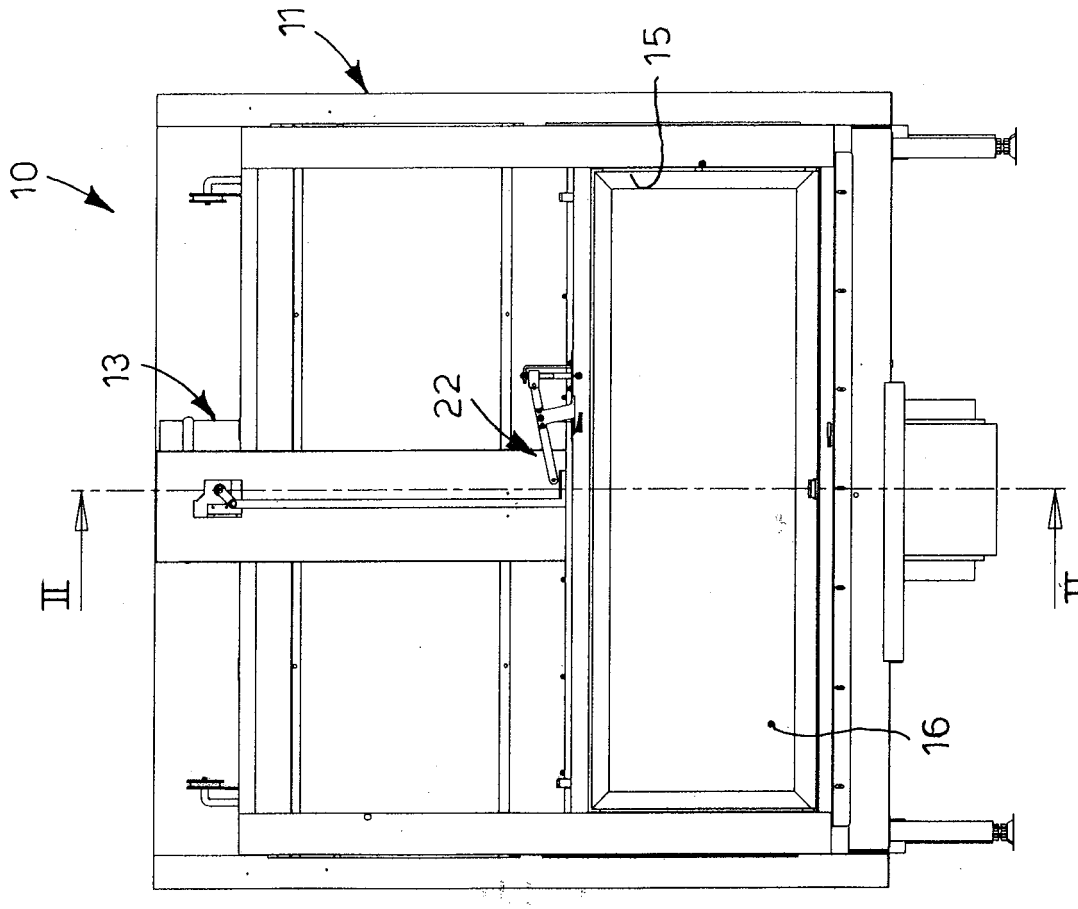

fig. 2

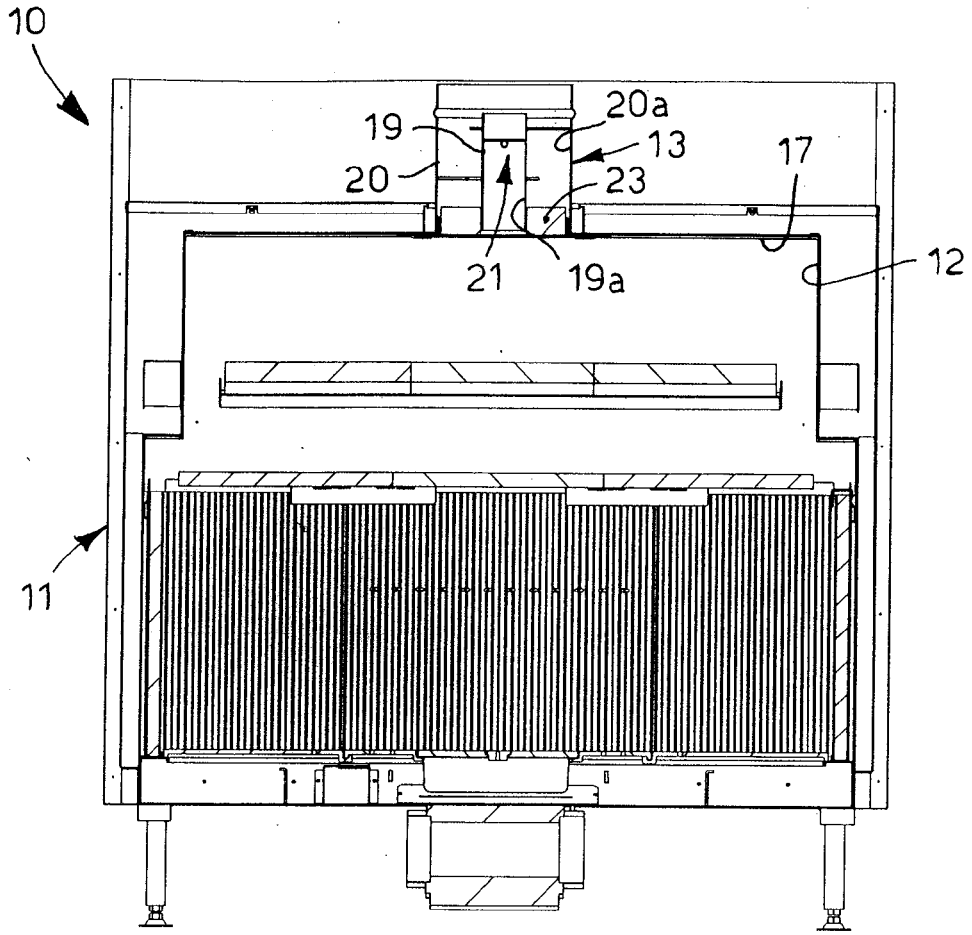

fig. 5

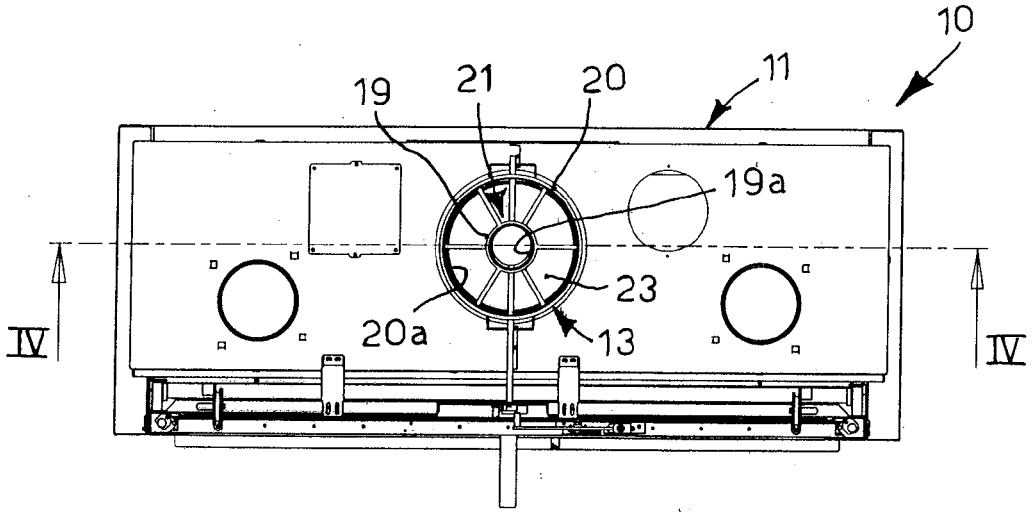

fig. 4

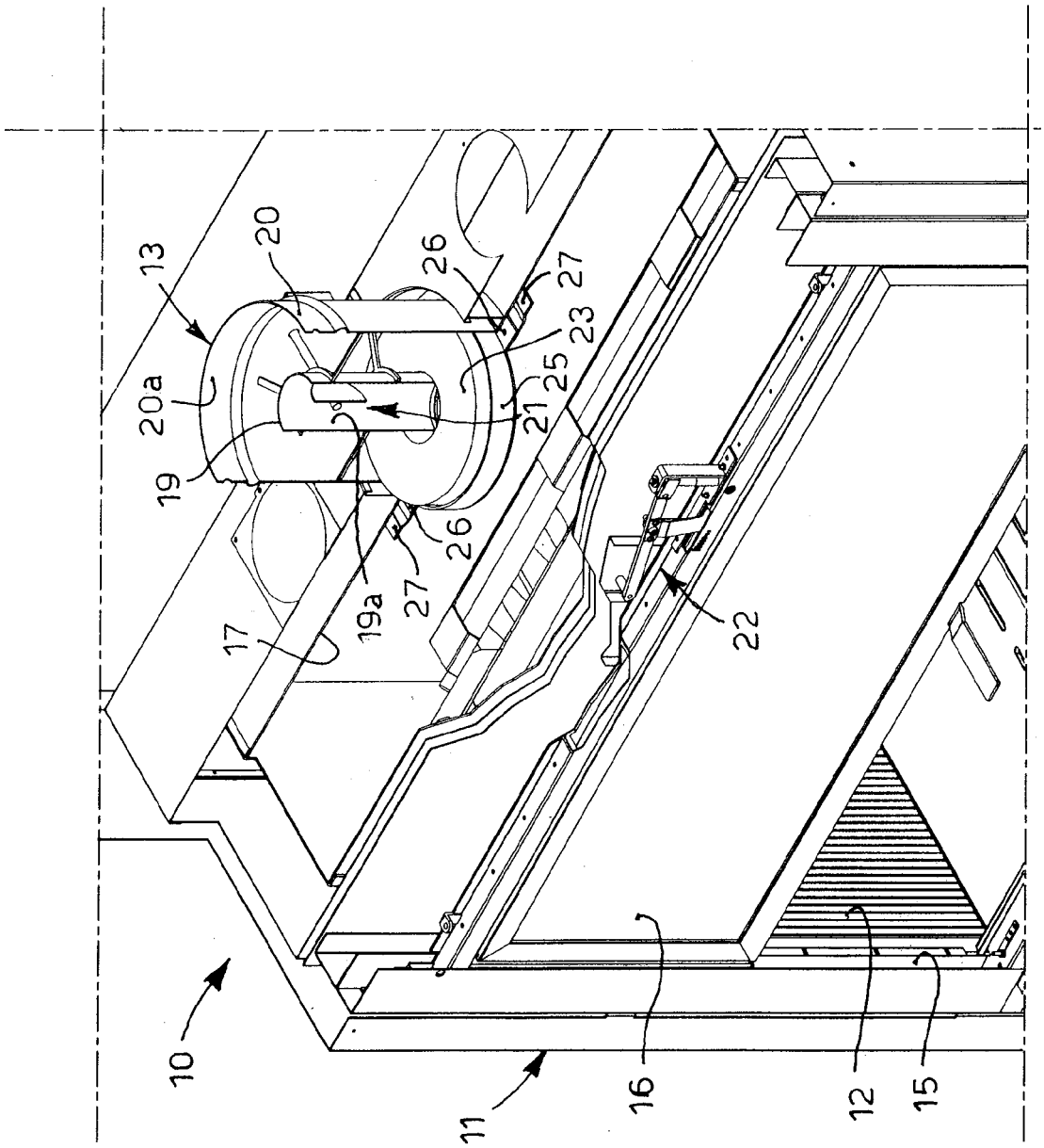

fig.6

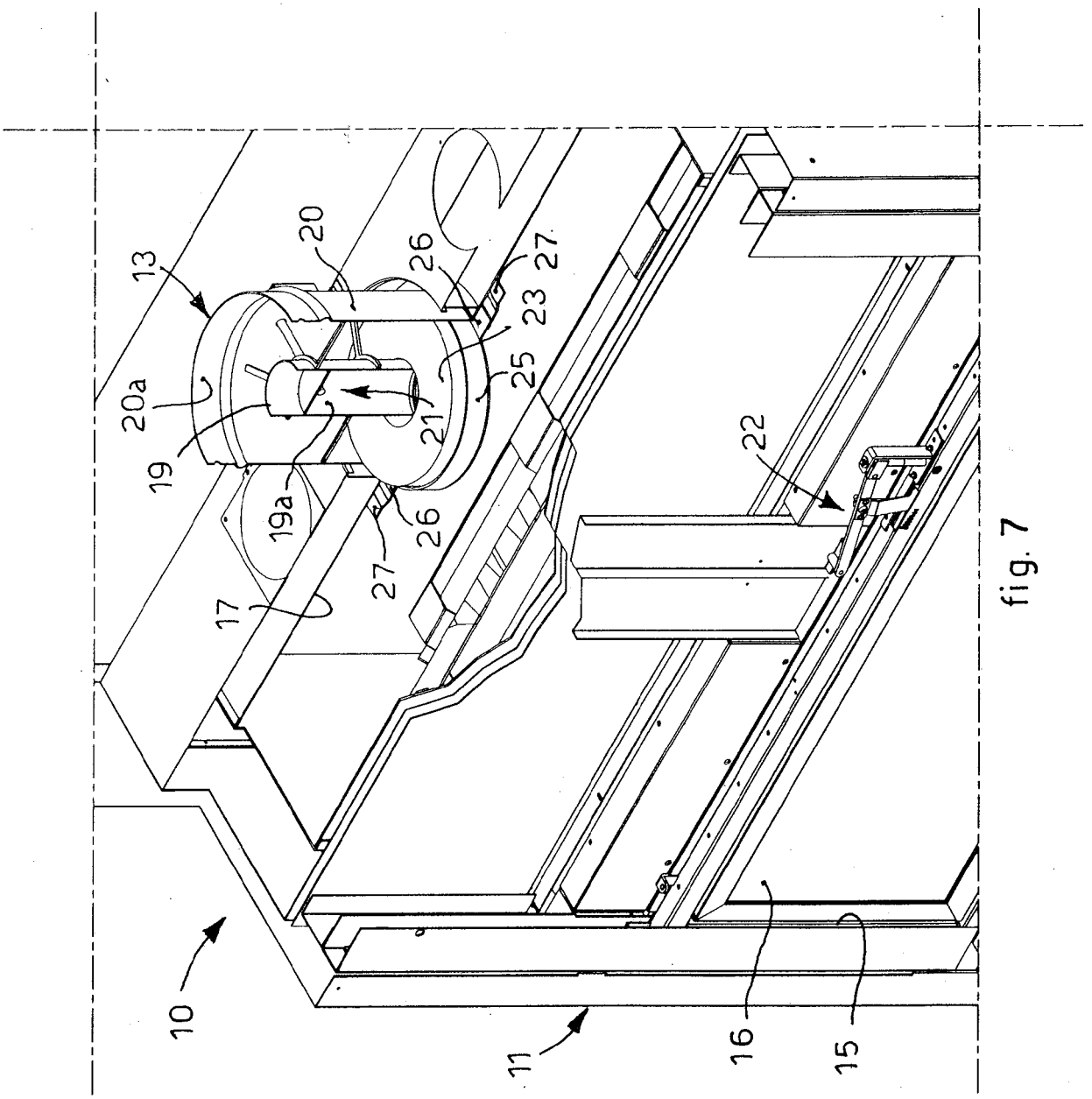

fig. 7

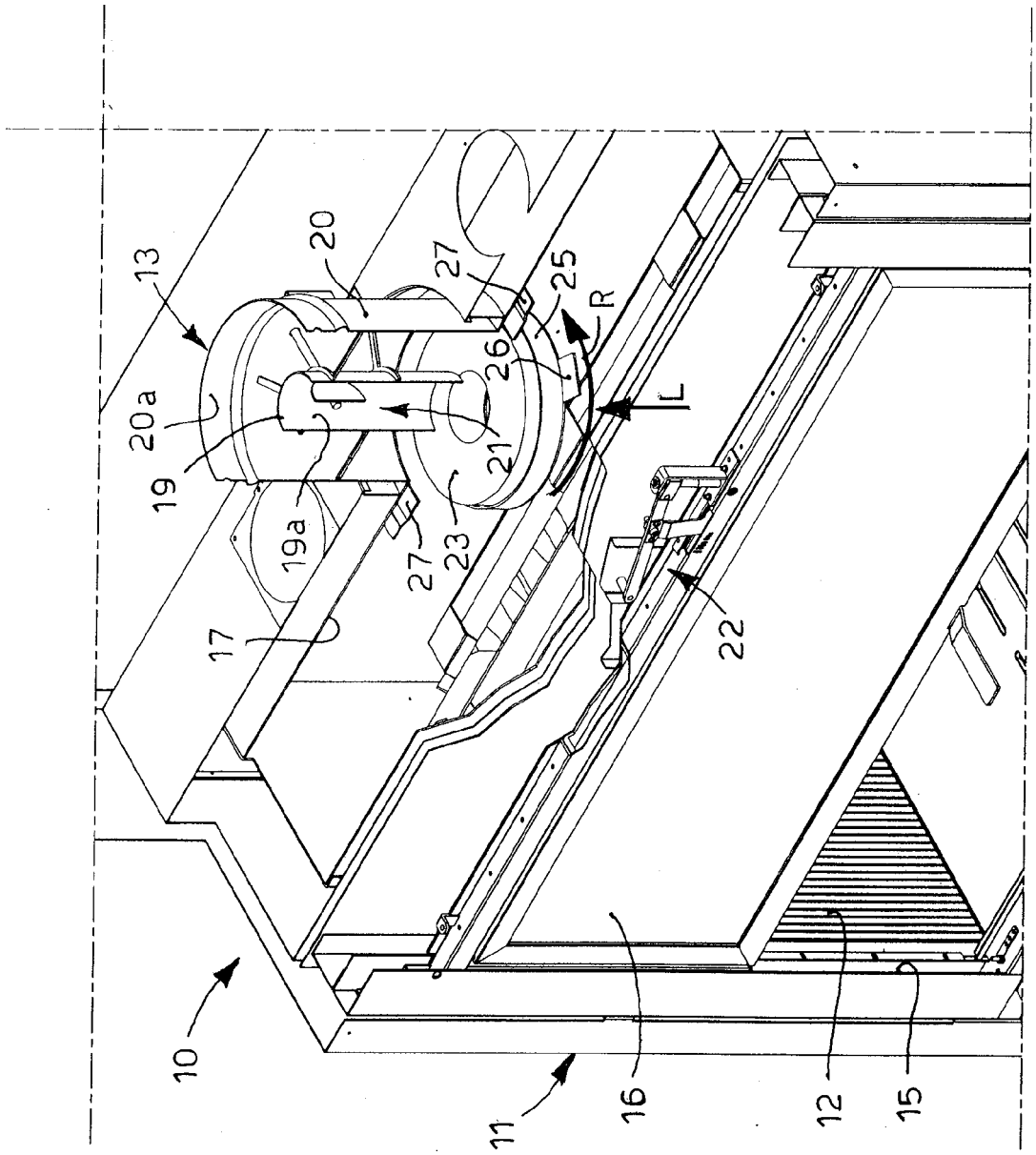

fig.8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 18 4504

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 0 375 470 A1 (CHEMINEES PHILIPPE SOCIETE ANO [FR]) 27 June 1990 (1990-06-27) * column 4, line 38 - line 45 * * column 5, line 7 - line 19 * * column 8, line 11 - line 55 * * figure 4 *	1-14	INV. F23B60/00 F23C13/06 F23J15/02 F23G7/07 F24B1/00 F23B90/08 F23B80/04
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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EUROPEAN SEARCH REPORT

Application Number
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