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

(11) **EP 2 372 279 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.10.2011 Bulletin 2011/40

(51) Int Cl.:
F26B 13/10 *(2006.01)*

(21) Application number: **11425069.9**

(22) Date of filing: **22.03.2011**

(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

(30) Priority: **29.03.2010 IT FI20100054**

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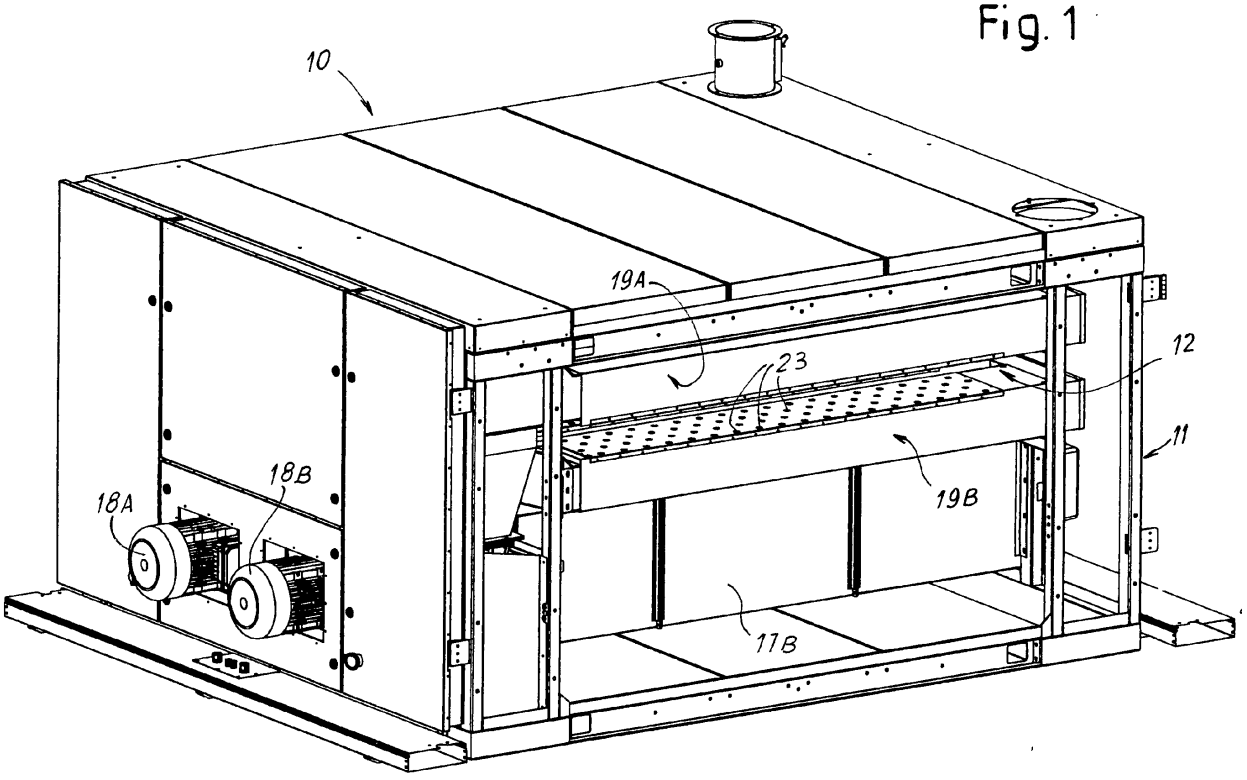
(54) **Heated air ejection structure for drying ovens for textile products**

(57) Air ejection structure (19A, 19B) for drying ovens for textile products, comprising a plurality of air ejection chambers (21), on which air ejection openings (23) are defined. Corresponding ends of the ejection chambers (21) are connected to a common first manifold (20) suitable to receive heated air. The opposite ends of the ejection chambers (21) are connected to each other, thus allowing a substantially uniform distribution of the air pressure between the chambers, also in the case of pressure variation in the first manifold.

Fig. 1



EP 2 372 279 A1

Description

Technical Field

[0001] The present invention relates to the field of the machines for producing and treating fabrics, and more in particular the object of the present invention is a heated air ejection structure for drying ovens for textile products such as fabrics, non-woven fabrics, staple fibers and products. A further object of the present invention is an oven using this ejection structure.

State of the Art

[0002] As it is well known, in the production or treatment of textile products there is often the need to eliminate the residual moisture on the product resulting from previous operating phases.

[0003] For this purpose, drying ovens are used that mostly provide for a drying tunnel, inside which a system is arranged for supporting and moving the fabric, such as a conveyor belt or a chain conveyor provided with needles.

[0004] To the tunnel, a heated air supply system is associated, providing for a pair of air supply channels that, with the aid of respective fans, convey the heated air from a heating area (where one or more burners are arranged) towards two ejection areas positioned respectively on the upper and lower part of the tunnel, where there are respective pluralities of outlet openings, directed respectively downwards and upwards, i.e. towards the fabric. The two air ejection areas provide a plurality of "sleeves" (that is tubular chambers), on a wall of which the heated air outlet openings are arranged. These sleeves are arranged in parallel and coplanar bank, with their own development, crosswise relative to the feeding direction of the conveyor belt and are spaced from each other. The ends of the sleeves of each ejection area are all connected, at a corresponding end, with a common manifold, which is in turn directly connected to the air discharge channel coming from the heating area; said sleeves are closed, at the opposite ends, by respective terminal walls. As a matter of fact said chambers are "blind chambers"

[0005] The space between the sleeves allows an optimal discharge of the heated and humid air from the tunnel area occupied by the conveyor belt.

[0006] This configuration of the air distribution area presents, however, some drawbacks, as the air distribution on the fabric in transit is poorly uniform with the conveyor belt when the speed of the fans is different from the design speed. Practically, if it is necessary to supply more or less air than the design air, for instance if the fabric is more humid or less humid relative to the value for which the plant has been dimensioned, the air distribution in the sleeves is unbalanced, as it cannot occupy all the sleeves with the same pressure, with consequent non-uniformity in longitudinal and cross direction relative to the exit of the openings. This non-uniformity of the air flow on the fabric leads to problems of dimensional stability and heterogeneous color of the fabric.

[0007] An example of drying oven which does not show a heated air ejection structure with ejection blind chambers is described in US4295284. The ejection chambers of said structure are fluidly connected at their opposite ends with two opposite common manifolds in turn both in fluid communication with two air supply channels that, with the aid of respective fans, convey the heated air from a heating area. The air entering in one manifold does not reach the other manifold as, the system is symmetrical (two opposite airflows enter the two manifolds, colliding in the middle of the ejection chambers) This configuration of oven is particularly expensive and subject to unbalance in the air distribution when there is an unwilled unbalance of the speed of the two fans connected to the two manifolds. As a matter of fact both the two manifolds are open on the ejection chambers and on air supply channels. A similar structure is described in DE970045 also.

Object and summary of the invention

[0008] The object of the present invention is to provide a heated air ejection structure for drying ovens for fabrics that solves the above mentioned drawbacks.

[0009] In particular, the main object of the present invention is to provide an ejection structure, and a corresponding drying oven for fabrics, providing particularly uniform flows of heated air on the fabric inside the oven.

[0010] These and other objects, that will be better described hereunder, are obtained through an ejection structure for drying ovens for textile products comprising a plurality of air ejection chambers or sleeves, on which the air ejection openings are defined; these ejection chambers or sleeves present opposite ends and corresponding ends of these ejection sleeves are opened onto a common first manifold designed to receive the heated air. According to the present invention, the opposite ends of these ejection chambers are connected one another, preferably through a common second manifold, thus allowing a substantially uniform distribution of air pressure between the sleeves, also in the case of change in the pressure of the first manifold. The air entering in the ejection chambers or sleeves from the first manifold distributes also in the space defined by said second manifold, being fluidly connected.

[0011] Preferably, said space or manifold is in fluid communication only with the ejection chambers.

[0012] The term "opening" substantially defines any type of aperture or pass, for example a hole, of limited dimensions that allows the ejection of a fluid.

[0013] The term "to connect" or "connection" is used with the meaning of "to fluidly connect" or "fluid connection", that is a connection which allows the passage of fluids (air or gas), like a typical connection between conduits.

[0014] A further object of the present invention is therefore a drying oven for textile products comprising a drying tunnel, inside which means are arranged for supporting the fabric to be dried, for instance a conveyor belt, and a heated air distribution system comprising air heating means and means (such as, preferably, one or more fans) for moving the heated air towards at least one air ejection area towards the conveyor belt, area where the above mentioned ejection structure is arranged.

[0015] As already said, the second manifold in the ejection structure, being fluidly opened in the ejection sleeves, allows to make the air pressure inside the ejection sleeves substantially uniform, thus allowing substantially equivalent speed characteristics of the air exiting from the openings, thus making the air flow on the fabric homogeneous, also following a change in the pressure and speed of the flow entering the first manifold due to the change of the air speed (obtained for example by varying the fan revolutions), i.e. an increase or a decrease in the air flow rate, to increase or decrease the fabric drying velocity. Practically, thanks to the second manifold there is an automatic re-balancing of the air pressure in the sleeves following an unbalance obtained by varying the air flow rate. Conversely, the ejection sleeves of the traditional type, being closed at one end (at these ends the sleeves are not in fluid communication with each other), were practically "insulated" in the part adjacent to the closed end, with a pressure value different both relative to the opposite end and relative to corresponding ends of adjacent sleeves. These drawbacks are solved by using the second manifold according to the invention.

[0016] It is advisable that the second manifold is formed by a space, onto which corresponding ends of the ejection sleeves exit, opposite to that fluidly connected with the first manifold. Preferably, this space can be substantially closed, i.e. it can communicate in a fluid manner only with the ejection chambers. Said space is provided with a number of apertures for air corresponding only (i.e. exactly) to the number of ejection chambers to which it is designed to be connected.

[0017] Preferably, the ejection chambers present an elongated development, i.e. the length of the chambers in the development direction is greater than the width of the chambers.

[0018] Preferably, with the ejection sleeves parallel to each other, it is advisable that the second manifold is arranged with its own development substantially orthogonal to the sleeves. The cross section of the second manifold is substantially constant along its own development, thus obtaining an optimal constant value of air pressure.

[0019] According to the preferred embodiment, the sleeves present a cross section (i.e. orthogonal to the axis of their own development) of substantially constant area.

[0020] In the preferred embodiment, the first manifold advantageously presents a cross section (i.e. orthogonal to the axis of its own development) decreasing from the area of connection to the heated air supply channel (of the drying oven to which the air ejection structure is to be associated) towards the farthest exits of the manifold, that are those connected to the more external ejection sleeves of the parallel and coplanar bank of sleeves (with more external sleeve of a bank, the first or the last sleeve of the bank is intended), thus allowing the creation of a substantially homogeneous pressure field in the entrance area of the sleeves. Preferably, the entrance to the first manifold, that is the area of connection to the supply channel (that is the area of the first manifold with greater cross section) is arranged about in correspondence to one of the two more external opposite ejection sleeves of the bank. The section of the first manifold practically decreases, preferably in a linear manner, from a more external sleeve of the battery (except for the area of connection of the supply channel to the manifold). With this configuration it is possible to obtain an optimal distribution of air pressure and speed also in correspondence of the first manifold.

[0021] In the preferred embodiment, the support means for the fabric are embodied by transferring means between the entrance and the exit of the tunnel, for instance a chain conveyor.

[0022] In a preferred embodiment again, the air distribution area with the sleeves and the openings is arranged above and/or below the means for transferring the fabric, with the openings directed so as to eject heated air downwards and/or upwards respectively. There are preferably two ejection areas, positioned respectively above and below the conveyor belt. It is advisable that these two distribution areas provide for air distribution structures substantially equal to one another, notwithstanding the obvious adjustments due to the different positioning thereof.

[0023] The invention further comprises the use of a manifold to fluidly connect the final ends of the ejection chambers (that, as previously mentioned, are obviously provided with ejection openings) of an air ejection structure for drying ovens for textile products. Obviously, final end is intended as the ends of the ejection chambers opposite to the ends closest to the air entrance area in the ejection structure, i.e., in the most of cases, the ends fluidly connected to a manifold for the connection to the heated air supply channel.

[0024] The manifold according to the invention is preferably formed by a space provided with a number of openings corresponding to the number of ejection chambers to which it can be connected.

[0025] Further advantageous characteristics of the invention are indicated in the appended dependent claims and will be described in greater detail below with reference to some non limiting examples of embodiment of the invention.

Brief description of the drawings

[0026] The invention will be better understood by fol-

lowing the description below and the attached drawings, in which

- figure 1 is an axonometric view of a oven according to the invention, with the front panel of the casing removed so as to show the inside thereof;
- figure 2 represents a rear axonometric view of the oven of figure 1, wherein all the panels of the casing have been substantially removed, thus showing the frame and the inside of the casing;
- figure 3 is a 3/4 front axonometric view of the air ejection area, wherein the air ejection sleeves and the related manifolds are shown separately from the rest of the oven structure;
- figure 4 is a 3/4 rear axonometric view of the air ejection area, wherein the air ejection sleeves and the related first and second manifolds are shown separately from the rest of the oven structure, and wherein the second manifold is devoid of the end wall, to allow the vision inside the manifold itself;
- figure 5 is a schematic cross section of the oven according to the present invention;
- figure 6 is a plan section of a battery of sleeves as in the previous figures.

Detailed description of an embodiment of the invention

[0027] With reference to the previously cited figures, a drying oven for textile products and the like (i.e. fabrics, non-woven fabrics, fiber and staple products, etc) is indicated as a whole with number 10.

[0028] The oven 10 comprises a frame 11 formed by a base and by uprights and crossbars supporting the components and the lateral and upper panels forming the outer casing.

[0029] The oven 10 defines internally a drying tunnel 12, i.e. a room provided with an entrance and an exit defined on the front and back panel, across which the textile product to be dried is made pass.

[0030] Inside the tunnel 12 support means 13 are present for supporting the textile product, that are adequately embodied by a conveyor belt (schematized in dotted line only in figure 6, and omitted in the other figures, as it is of the known type) supporting and transferring the fabric from the tunnel entrance to the exit, according to a known method. The surface of the conveyor belt 13, on which the textile product rests, is adequately perforated in a through manner in vertical direction to allow the air passage.

[0031] Inside the oven there is a heated air distribution system of known structure, comprising heating means 14, constituted for example by a burner 15 arranged with the heating part inside a first environment 16 positioned in the initial part, or heat transfer means 16A, and two segments 17A, 17B of a duct, whose end parts correspond to the air ejection areas 18 on the conveyor belt 13, as it will be better described hereunder.

[0032] The burner 15 is leaned against a first flank of the oven. From the first environment 16, where there is the burner 15, the two duct segments 17A and 17B continue inside the oven, in the lower part thereof, towards the opposite flank of the oven, where they meet the housings for respective air moving means 18A and 18B, preferably fans (i.e. rotating members suitable to generate an air flow at the desired pressure, speed and flow rate).

[0033] The segments 17A and 17B of the duct develop from the fans 18A and 18B upwards, until they meet respective air ejection structures 19A and 19B arranged respectively above and below the conveyor belt 13, to define the air ejection area towards the conveyor belt.

[0034] Each ejection structure is substantially composed by the same components, and for the sake of brevity only the upper structure 19A will be described hereunder.

[0035] The ejection structure 19A is composed by a first manifold 20, practically constituted by a space 20A; on this space are defined a first aperture 20B, for the fluid connection to the respective duct segment 17A (that is the conduit supplying heated air to the ejection structure), and a plurality of second apertures 20C for the connection to respective ejection chambers 21, that can be also defined as ejecting sleeves (with the term manifold it is possible to indicate for example an element for connecting a conduit with a plurality of other conduits that preferably comprises a space provided with apertures for the connection to the various conduits).

[0036] In particular, these chambers 21 are each constituted by a tubular chamber, that in this example has rectangular section, fluidly connected at a first end to the above mentioned first manifold 20 and at the opposite second end to a second manifold 22, described below. The cross sections (i.e. orthogonal to the axis of development) of the ejection chambers 21 are of substantially constant area.

[0037] The bottom wall 21A of the chambers (in the case of chambers of the ejection structure 19B, i.e. of the lower structure, the wall is that constituting the ceiling of the chamber), i.e. the horizontal wall facing the conveyor belt 13, presents, substantially along its development, a series of ejection openings (or holes) 23 directed toward the belt, i.e. downwards.

[0038] Practically, each ejection structure 19A, 19B provides a "bank" (i.e. a series) of sleeves 21 parallel to and spaced from one another. In particular, the sleeves of each bank are at a same height, i.e. they are coplanar.

[0039] In this example, the entrance to the first manifold 20, that is the area of connection to the supply duct segment 17A, is arranged about in correspondence to one of the two more external opposite ejection chambers 21 of the bank. With external opposite ejection chambers 21 of the bank is intended the first or the last chamber of the series composing the linear bank of chambers. In this area of connection the first manifold 20 presents a constant cross section (i.e. orthogonal to the axis of its own development), while it is linearly decreasing as the manifold develops from that area towards the more external

opposite chamber of the bank, thus balancing the pressure field inside the manifold.

[0040] According to the present invention, the opposite ends of the ejection chambers relative to the first manifold 20 are fluidly connected to a common second manifold 22, constituted in this example by a tubular space 22A with rectangular cross section (i.e. orthogonal to the axis of its own development), constant along its own development. On a longitudinal side of this space 22A there is a plurality of apertures 22B connected to the respective chambers 21.

[0041] In this example, the length of this space is substantially equal to the overall width of the bank of ejection chambers 21.

[0042] Note that in this example said space 22A is a closed space, with the exception of the apertures 22B; therefore, in this example, said space can fluidly communicate only with the ejection chambers. As clearly visible, the number of the apertures on the space 22A for passage of air is equal to the number of the ejection chambers. It is evident that air can enter in said space 22A only from the ejection chambers 21 and can exit form said space only towards the same ejection chambers 21.

[0043] The air entering in the space 22A from the apertures 22B is the air, with the exception of the air exited from the openings 23, entering the ejection chambers from the first manifold 20, that is the air coming from the supply duct segment 17A. The apertures 22B coincide with the opposite ends of the ejection chambers.

[0044] It is clear that the second manifold 22 can be manufactured as a piece that has to be fixed to the ejection chambers 21 or can be manufactured as a single piece integral with one or more chambers.

[0045] Operation of the oven is as follows.

[0046] The textile product to be dried is arranged on the conveyor belt 13 moving forward in the tunnel 12 of the oven according to the direction indicated by the arrow F shown in figure 2. The air is heated by the burner 15 and moved by the fans 18A, 18B along the two segments 17A and 17B of air supply duct towards the respective ejection structures 19A and 19B arranged above and below the conveyor belt. The heated air enters the ejection chambers 21 and exits towards the conveyor belt 13 through the ejection openings 23, investing the textile product and drying it. Part of the ejected air is preferably recovered inside the air supply system, in correspondence of the heat transfer area 16A where there is the burner, while the remaining air exits from the oven.

[0047] Observing in detail the operation of the ejection structures 19A, 19B, the air entering the ejection chambers 21 from the first manifold 20 distributes also in the second manifold 22, as it is communicating in a fluid manner. The pressure field in the chambers is substantially uniform on all the bank, i.e. with a substantially constant pressure value (constant means a pressure value varying locally in a negligible manner relative to the uniformity requirements of the ejection structure) thanks to, the fact that the ends of the chambers opposite to those of air entrance have been put into fluid communication by means of a common space. It should be noted that by varying the number of fan revolutions, i.e. varying the flow rate necessary for drying, there is no pressure unbalance inside the chambers, and therefore the uniformity of the pressure field, and therefore the speed and rate of the flow exiting from the openings, is guaranteed at any speed value of the fans, to advantage of the fabric final quality.

[0048] It is understood that what illustrated purely represents possible non-limiting embodiments of the present invention, which may vary in forms and arrangements without departing from the scope of the concept on which the invention is based. Any reference numbers in the appended claims are provided for the sole purpose of facilitating the reading thereof in the light of the description hereinbefore and the accompanying drawings and do not in any way limit the scope of protection of the present invention.

Claims

1. A drying oven air ejection structure (19A, 19B) for drying textile products, comprising a plurality of air ejection chambers (21) on which air ejection openings,(23) are defined, each of said air ejection chambers (21) presenting a first end and a second opposite end, corresponding first ends of said ejection chambers (21) being fluidly connected to a common first manifold (20) designed to receive heated air, **characterized in that** the opposite second ends of said ejection chambers (21) are fluidly connected to each other through a common space (22A) which is in fluid communication with said ejection chambers (21) such that the air entering said ejection chambers (21) from said first manifold (20) distributes also in said space (22A), thus allowing a substantially uniform distribution of the air pressure between the chambers, also in the case of pressure variation in the first manifold.

2. A structure as claimed in claim 1, **characterized in that** said space (22A) is defined by a second manifold (22) to which said second opposite ends of the ejection chambers are fluidly connected, such that the air entering said ejection chambers (21) from said first manifold (20) distributes also in the second manifold (22).

3. A structure as claimed in claim 2, **characterized in that** said second manifold (22) is fluidly connected only with said ejection chambers (21).

4. A structure as claimed in claim 2, **characterized in that** said space (22A) is provided with a number of apertures (22B) corresponding exactly to the number of ejection chambers (21) to which is fluidly

connected.

5. A structure as claimed in claim 2 or 3, **characterized in that** said second manifold (22) comprises a tubular space (22A), on which exit said corresponding ends of the ejection chambers (21), opposite to those connected to the first manifold (20).

6. A structure as claimed in claim 2 or 3 or 5, **characterized in that** said second manifold (22) presents constant cross section along its own development.

7. A structure as claimed in one or more of the previous claims, **characterized in that** each ejection chamber (21) presents substantially constant cross section along its own development.

8. A structure as claimed in one or more of the preceding claims, **characterized in that** said ejection chambers (21) are parallel and spaced from each other, said second manifold (22) being arranged with its own development substantially orthogonal to said chambers (21).

9. A structure as claimed in one or more of the previous claims, **characterized in that** said first manifold (20) presents a cross section decreasing from the area of fluid connection to the heated air supply duct (17A, 17B) of the oven to which the structure is to be associated, towards the farthest exits of the first manifold (20), that are those fluidly connected to the more external ejection chambers (21) of the parallel and coplanar bank of chambers (21).

10. A structure as claimed in claim 9, **characterized in that** the area of connection of the first manifold (20) to the heated air supply duct (17A, 17B), that is the area of the first manifold (20) with greater cross section, is arranged about in correspondence to one of the two more external opposite ejection chambers (21) of the chamber pack; the section of the first manifold being so decreasing, preferably in a linear manner, from said more external chamberof the bank, except for the area of fluid connection of the supply duct to the manifold.

11. A structure as claimed in one or more of the preceding claims, **characterized in that** the length of said second manifold is substantially equal to the overall length of the battery of said ejection chambers (21).

12. Use of a manifold (22) to fluidly connect the final ends of ejection chambers (21) of an air ejection structure (19A, 19B) for drying ovens for drying textile products, said final ends corresponding to the ends of said ejection chambers (21) opposite to the ends closest to the entrance area (20B) of the air in the ejection structure (19A, 19B), the air entering said ejection chambers (21) from said entrance area (20B) distributes also in said manifold (22).

13. A use, as claimed in claim 12, **characterized in that** said manifold (22) is constituted by a space (22A) provided with a number of apertures (22B) corresponding to the number of ejection chambers (21) to which it is designed to be connected.

14. Drying oven for textile products, comprising a drying tunnel (12), inside which support means (13) are arranged for the textile product to be dried and a heated air distribution system (14, 17, 18, 19) comprising air heating means (14) and means (18A, 18B) for moving the heated air toward at least one ejection structure (19A, 19B) as claimed in one or more of the claims from 1 to 11.

15. A drying oven as claimed in claim 14, **characterized by** comprising two ejection structures (19A, 19B) arranged at the top and at the bottom of said support means (13) of the textile product to be dried, said support means being preferably embodied in a conveyor belt with through holes for the air; said ejection chambers of said structures (19A, 19B) being transverse to the forward direction of said conveyor belt.

Fig. 1

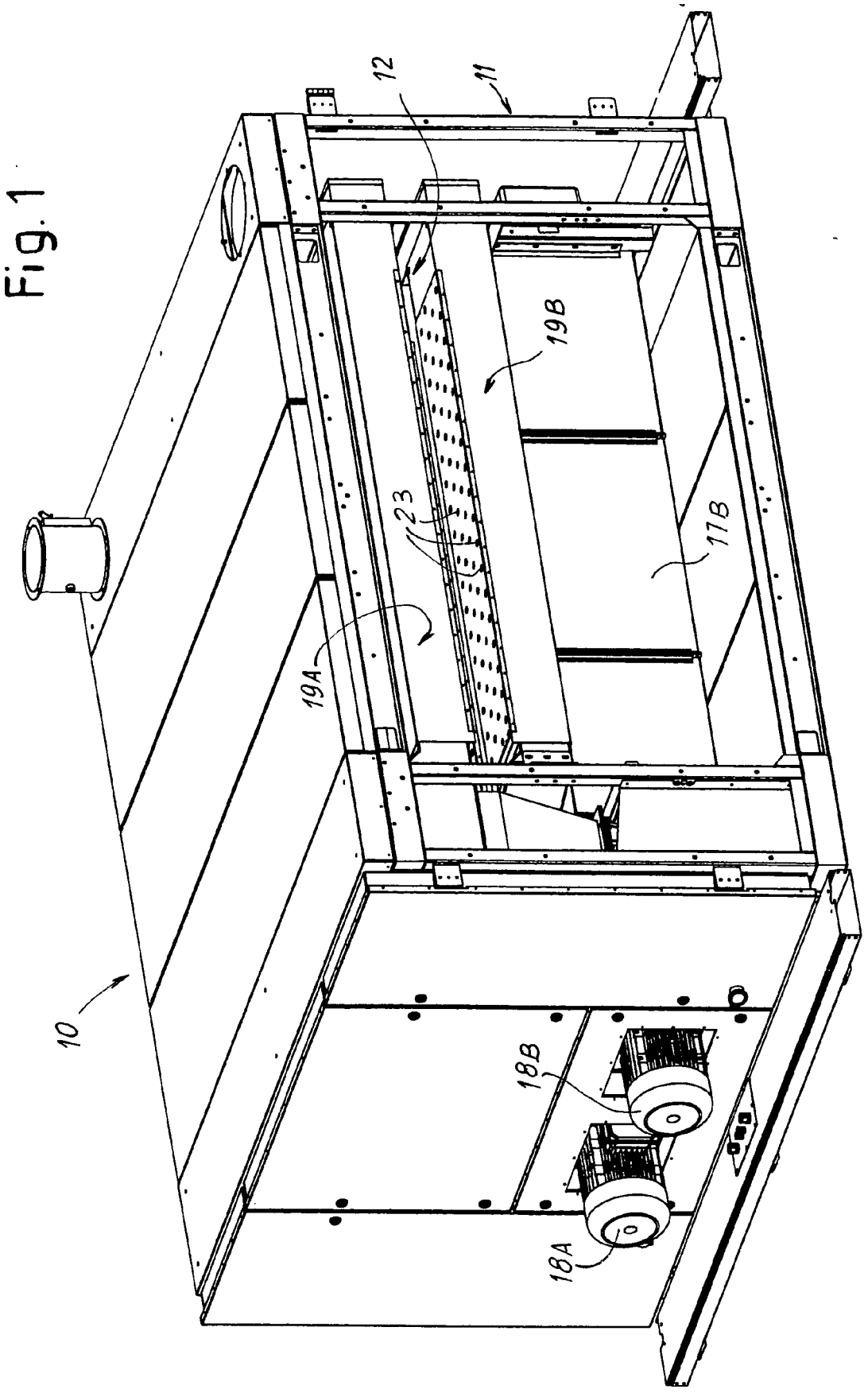


Fig.2

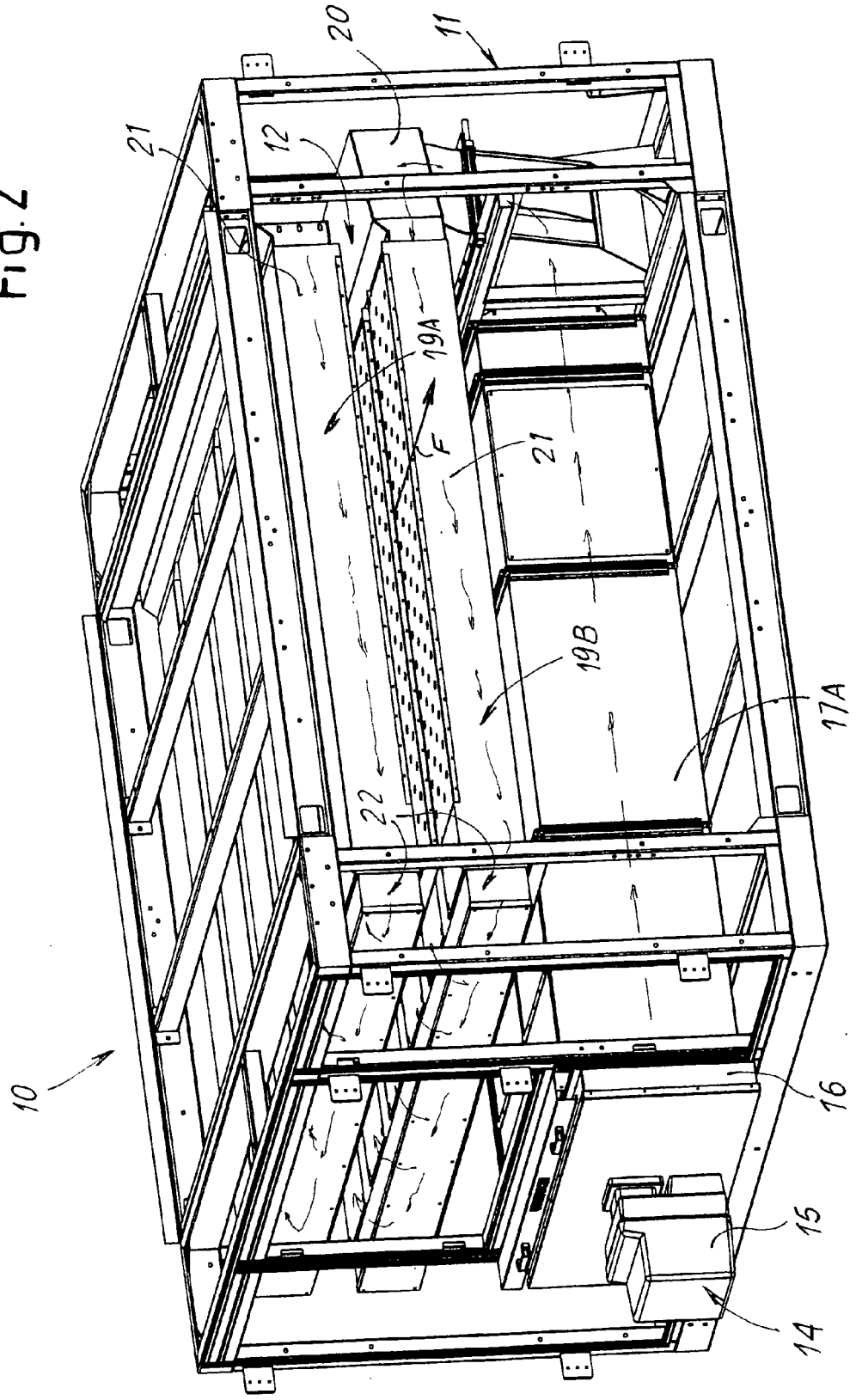


Fig.3

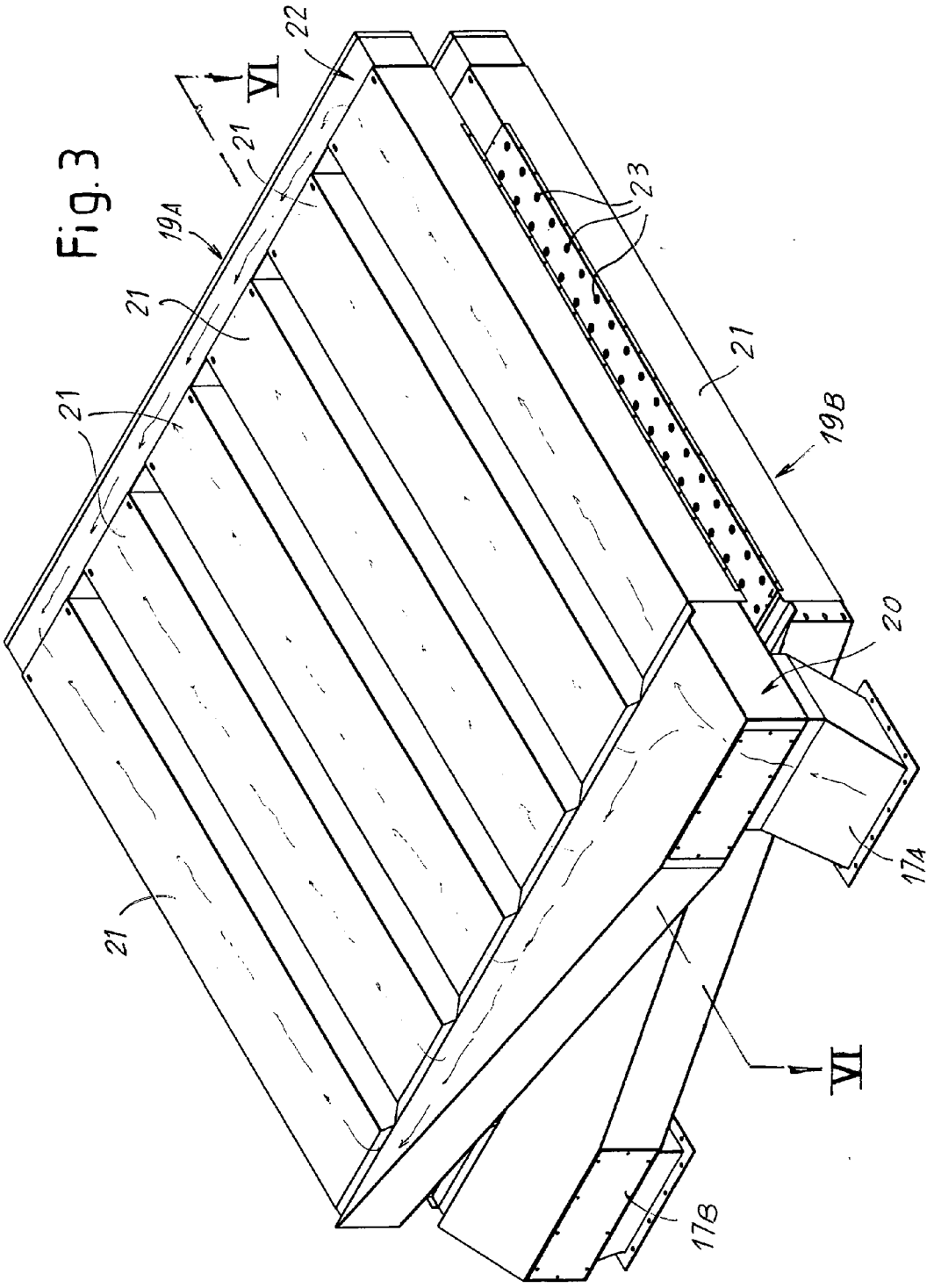


Fig. 4

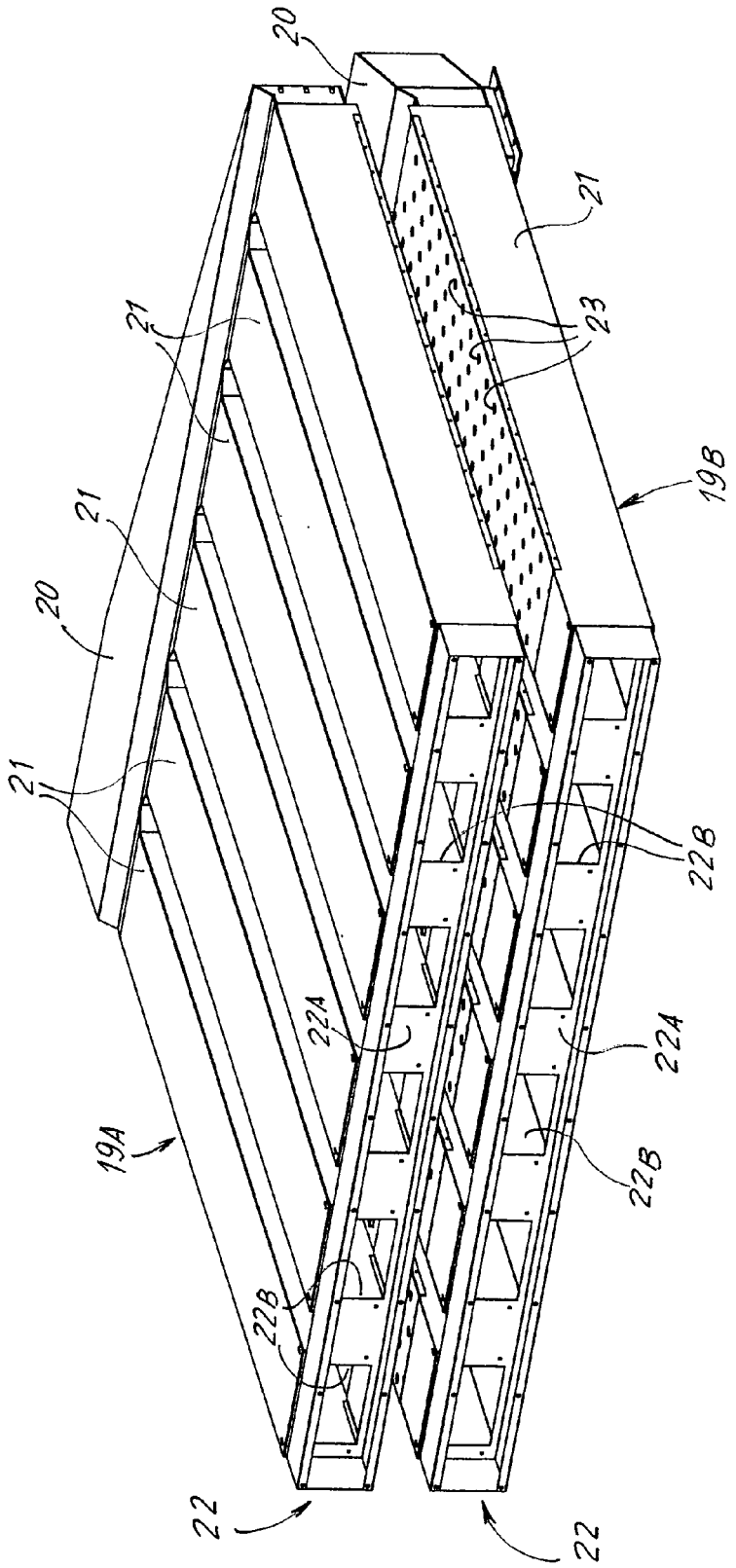


Fig.5

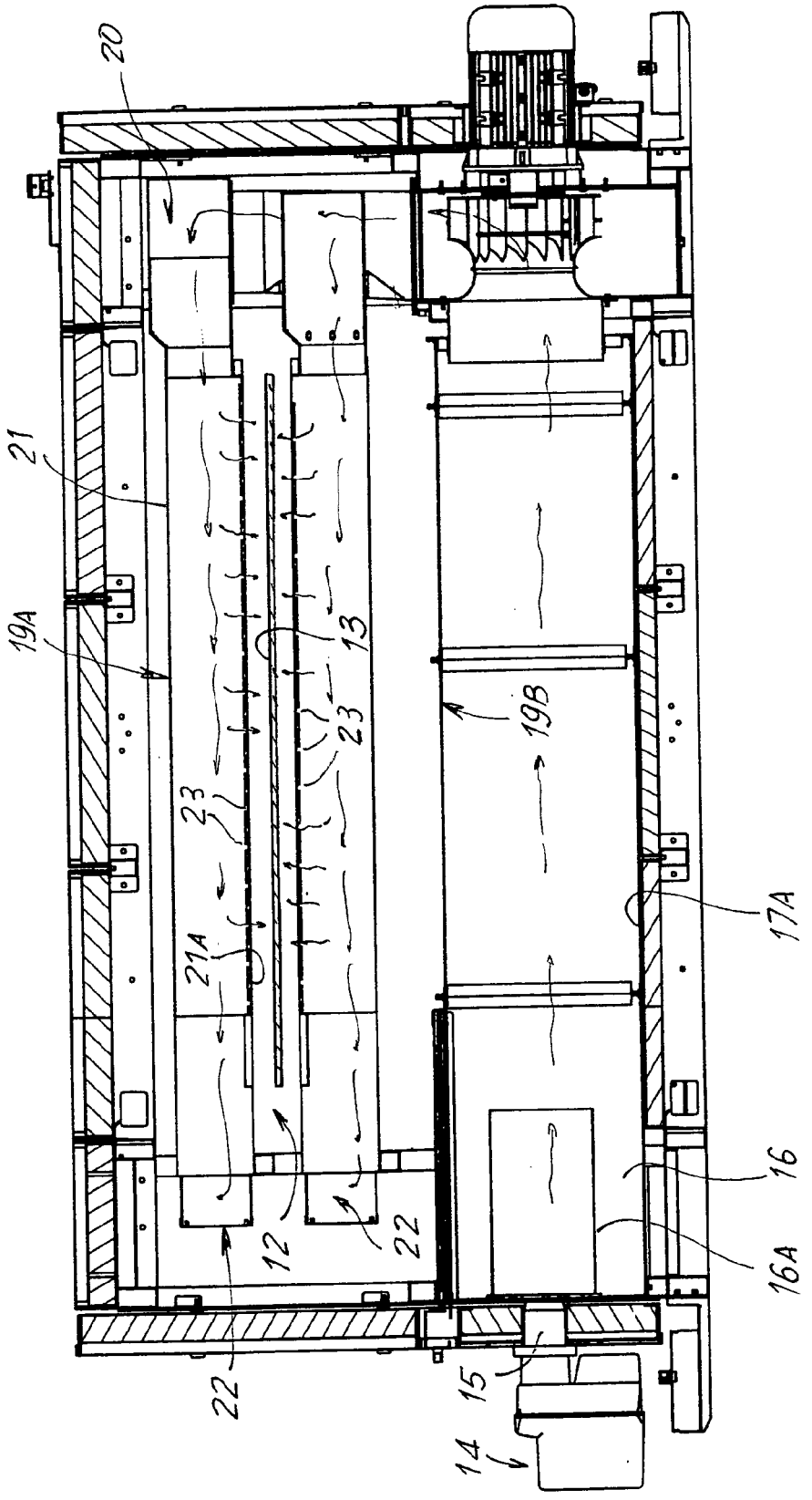
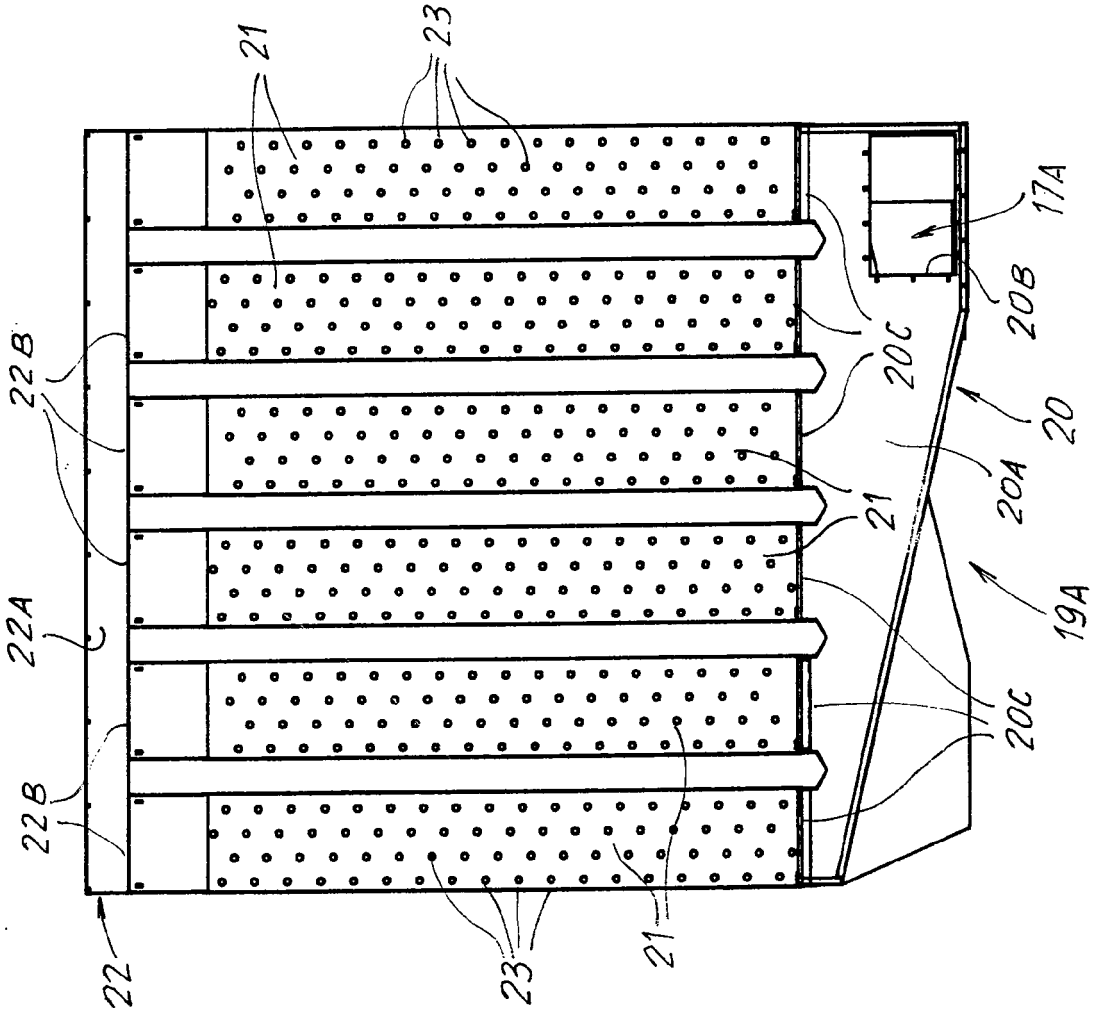


Fig.6



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EUROPEAN SEARCH REPORT

Application Number
EP 11 42 5069

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 4 295 284 A (WITKIN PHILIP M) 20 October 1981 (1981-10-20) * column 3, lines 5-54; figures 1,4 *	1-15	INV. F26B13/10
A	DE 970 045 C (SVENSKA FLAEKTFABRIKEN AB) 14 August 1958 (1958-08-14) * page 3, lines 40-52; claims 1,4; figure 4 *	1-15	
A	EP 0 284 710 A2 (REGGIANI MACCHINE SPA [IT]) 5 October 1988 (1988-10-05) * the whole document *	1-15	
A	US 4 094 077 A (SCHRADER ALFONS ET AL) 13 June 1978 (1978-06-13) * the whole document *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

F26B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 May 2011	Bichi, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 42 5069

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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27-05-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4295284 A	20-10-1981	NONE	
DE 970045 C	14-08-1958	NONE	
EP 0284710 A2	05-10-1988	IT 1202721 B	09-02-1989
US 4094077 A	13-06-1978	CA 1068105 A1	18-12-1979
		DE 2544590 A1	14-04-1977

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

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Patent documents cited in the description

- US 4295284 A **[0007]**
- DE 970045 **[0007]**