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(54) Ventilation device.

(57) A ventilation device comprising a cross-flow type heat exchanger mounted at a crossing point of an exhausted ambient air path and an intake air path. The device further comprises an intake resp. an exhaust air chamber situated upstream resp. downstream of the heat exchanger, said intake resp. exhaust air chamber having an output resp. an input plane extending substantially parallel to an input resp. an output plane of said heat exchanger.

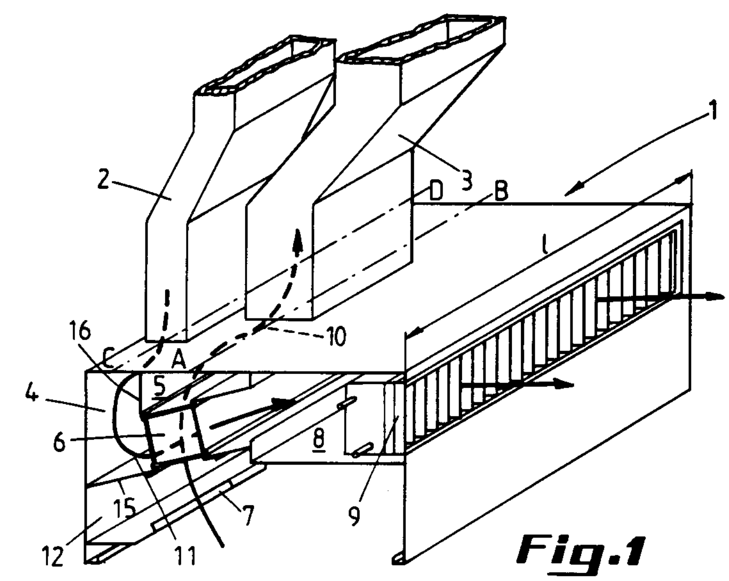

Fig.1

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The present invention relates to a ventilation device, in particular a kitchen hood, comprising :

- a suction opening for the input of ambient air to be removed out of a room and connected via a first air path to an exhaust duct for exhausting said removed ambient air ;
- an intake air duct connected via a second air path to an air discharge opening provided for the output of an intake air flow ;
- a heat exchanger mounted within said first and second air path and provided for extracting heat out of said ambient air and transferring it to said intake air ;
- an intake air chamber crossed by said second air path and situated upstream of said heat exchanger ;
- an exhaust air chamber crossed by said first air path and situated downstream of said heat exchanger

Such a ventilation device is known from the German Utility Model G 83 07 492.9. In the known ventilation device the first and second air path are situated beside each other when crossing the heat exchanger. The heat exchanger used in the known device is build up by a number of heat exchange modules, these subsequent modules being each time separated by channels for the conduction of the exhausted ambient air resp. the intake air. In order to separate the supplied fresh intake air from the ambient air, separation walls are provided over the whole device length. These separation walls form the border between the intake air chamber and the exhaust air chamber. Openings are further provided as well in the exhaust air chamber as in the intake air chamber in order to enable the ambient air resp. the intake air to reach the exhaust duct resp. the air discharge opening. By crossing the heat exchanger, heat is extracted from the ambient air and transferred to the intake air to heat up the latter. In such a manner heat is recuperated from the ambient air.

A drawback of the known ventilation device is that it has a rather complicated construction imposing a lot of constraints as well to the application of the exhaust duct and the intake air duct as to the track of the first and second air path. The channels between the subsequent modules and the openings in the exhaust and intake air chamber cause the stream of ambient air and intake air to be sharply bend at several times which substantially reduces the air flow within the device. The fact that first and second air path are situated beside one another when crossing the heat exchanger, substantially reduces the flexibility in mounting the exhaust and intake air duct.

It is an object of the present invention to realize a ventilation device having a less complicated construction enabling an improved air flux and a larger degree of freedom in application of the exhaust duct and intake air duct.

A ventilation device according to the present invention is therefore characterised in that the heat exchanger is one of the cross-flow type located at a crossing point of said first and second air path, said intake resp. exhaust air chamber having an output resp. an input plane extending substantially parallel to an input resp. an output plane of said heat exchanger. The use of a cross-flow type heat exchanger enables the first and second air path to be crossed within the ventilation device, which renders the set-up of the device substantially less complicated. It is no longer needed to have the first and second air path besides each other when crossing the heat exchanger, which removes the constraint imposed in the location of the exhaust duct and the intake air duct. The fact that said input resp. output plane of said heat exhanger extends in parallel to the output resp. the input plane of the intake resp. exhaust air chamber enables an easy and thus considerable throughput of the intake resp. ambient air through the heat exchanger. The intake resp. ambient air can directly enter or exit the heat exchanger without being bent just in front resp. just at the output of the heat exchanger, thus avoiding perturbations at the input or output of the heat exchanger. The efficiency of the device is thus enhanced.

Preferably, the input plane of said heat exchanger has a length which is longer than the distance covered by the intake air flow while crossing said heat exchanger. A large entrance and output surface is thus provided for the intake resp. exhaust air.

A first preferred embodiment of a ventilation device according to the invention is characterised in that the heat exchanger is substantially rectangularly shaped. This enables a compact and efficient construction while at the same time satisfying the dimension constraints imposed on the heat exchanger.

A second preferred embodiment of a ventilation device according to the invention is characterised in that the heat exchanger is mounted inclined over an angle situated between 0 and 45° with respect to a plane wherein said section opening is located. This enables an easy removal for cleaning purpose of the heat exchanger without affecting the air stream within the device.

A third preferred embodiment of a ventilation device according to the invention is characterized in that it comprises an intake air chamber situated within said second air path between said intake air duct and said heat exchanger, said intake air chamber comprises a separation wall made of heat conductive material and separating said intake air chamber from an exhaust air collector situated downstream of said section opening in front of said heat exchanger, said separation wall being in line with the ambient air entrance of said heat exchanger. Since the separation wall is made of heat conductive material, it will extract heat from the ambient air, present in the exhaust air chamber. The heat thus accumulated in that wall will then be transferred to the intake air present in the intake air chamber thus favourably contributing to the heat exchanger.

Preferably, the ventilation device comprises a grease filter situated between said suction opening and said heat exchanger, said grease filter being inclined over an angle situated between 5-75° with respect to the ambient air entrance plane of said heat exchanger. The heat exchanger can thus be removed through the opening provided for the grease filter.

The invention will now be described in more details by referring to the annexed drawings showing an example of a ventilation device according to the invention. In the drawings :

Figure 1 shows a schematic view of a ventilation device according to the invention.

Figure 2 illustrates the air flow within the cross-flow type heat exchanger.

Figure 3 shows a cross-sectional view through a ventilation device according to the invention.

Figure 4 shows an alternative embodiment of a ventilation device according to the invention.

In the drawings, a same reference number is assigned to a same or an analogous element.

The ventilation device 1 illustrated in figure 1 comprises an intake air duct 2 and an exhaust duct 3. In figure 1, the intake and exhaust ducts are shown close to each other. They could however also be at a distance from each other since the exhaust resp. the intake duct can be applied at any place along the line AB resp. CD.

The intake air duct 2 flows into an intake air chamber 4, while an exhaust air chamber 5 is connected with said exhaust duct 3. The intake air chamber is delimited by the frame of the ventilation device and the separation walls 15 and 16 (figure 3). The separation wall 15 resp. 16 forms the separation between the intake air chamber and an exhaust air collector 12 resp. the exhaust air chamber 5.

A heat exchanger 6 is mounted between the exhaust air collector 12 and the exhaust chamber. The ambient air to be removed from the place where the ventilation device is placed enters the device via a suction opening 14 and is collected in the exhaust air collector 12. The collected ambient air then flows via the heat exchanger towards the exhausted chamber 5. The path along which the exhaust ambient air travels with the device is indicated by the arrow 10 and will be referred to as a first air path.

The intake air, preferably fresh air supplied from outside the room where the device is mounted, travels along a second air path indicated by the arrow 11. That second air path extends through the intake air chamber 4, the heat exchanger 6 and a further chamber 8 situated downstream of the heat exchanger towards an air discharge opening 9. In the embodiment shown in figure 1, the air discharge opening is applied in a sidewall of the ventilation device, outside the plane wherein the suction opening 14 is situated, and is provided for the output of the intake air flow into the room where the device is placed.

In the alternative embodiment shown in figure 4, the air discharge opening 9 is situated on top of the device. The air discharge opening 9 is connected with an air duct 18. The latter embodiment enables to bring the intake air to a place removed from the one where the ventilation device 1 is mounted.

By crossing the heat exchanger, heat is extracted from the ambient air and transferred to the intake air in order to heat up the latter by means of heat recuperated from the removed ambient air.

The heat exchanger 6 is of the cross-flow type, as is illustrated in figure 2, and is located at the crossing point of the first 10 and second 11 air path. Cross-flow type heat exchanger signifies that by crossing the heat exchanger, the ambient air and the intake air crosses each other without interfering physically with each other. Such a heat exchanger is known as such and is for example commercialized by Heatex AB.

The heat exchanger extends over substantially the whole length of the ventilation device. The intake resp. output air chamber 4 resp. 5 has an output resp. input plane directly upstream resp. downstream the air entrance resp. output of the heat exchanger. The surface of that output resp. input plane extends substantially parallel to the intake air input resp. ambient air output of the heat exchanger. In such a manner, the intake resp. ambient air can directly stream into our out of the heat exchanger without being bent directly at the entrance or output of the heat exchanger. The latter substantially increases the throughput through the heat exchanger since large circulation facilities are thus provided.

The dimension of the heat exchanger is preferably chosen in such a manner that the length 1 of the intake air input plane is longer than the distance d covered by the intake air flow while crossing the heat exchanger.

The heat exchanger is therefore preferably dimensioned in such a manner that the ratio between the height h of the heat exchanger input surface for the intake air and the distance d covered by the intake air flow while crossing the heat exchanger is at least equal to one :

$$h/d \geqq 1$$

Preferably, the heat exchanger is rectangularly shaped which enables an easy and compact construction while at the same time satisfying the latter dimension constraints. The particular dimensioning of the heat exchanger combined with the use of a cross-flow type heat exchanger enables to provide, as well for the intake air as for the ambient air, a heat exchanger entrance surface which extends over substantially the whole length of the ventilation device. There is thus no need to canalize neither the intake air nor the ambient air towards a restricted input area of the heat exchanger to avoid interference. Further turbulence in the air stream which would reduce the through-put of the air circulating through the heat exchanger are avoided in such a manner. The fact that the heat exchanger can now be extended over the whole length of the device enables that for a given length of the device the heat exchanger is operative over the whole length thus enabling an increased efficiency with respect to a heat exchanger which extends only over a part of this given length due to construction constraints.

The heat exchanger is formed either by a single module or by a series of modules placed subsequent to each other. The latter is a preferred embodiment for a ventilation device having a length of 80 cm or more. Each module preferably has a length of 40 cm. The use of subsequent modules enables to more easily remove the different modules, for example for cleaning purposes.

The use of a cross-flow heat exchanger enables to substantially simplify the construction of the ventilation device, while at the same time improving its efficiency.

The separation wall 15 separating the intake air chamber 15 from the exhaust air collector 12 is preferably made of heat conductive material. The ambient air collected in the exhaust air collector enters into contact with that separation wall 15 and thus heats the wall up. Since the separation wall is made of heat conductive material, the heat thus extracted from the ambient air present in the exhaust air collected is transferred to the intake air chamber where it can heat up the intake air before the latter enters into the heat exchanger. The separation wall 15 thus also contributes to the heat transfer and improves in such a manner the heat transfer efficiency of the whole device. The fact that the separation wall 15 can be mounted so close to the exhaust air collector is due to the fact that a cross-flow type heat exchanger is used enabling crossing of the first and second air path so close to the place where the ambient air enters the device.

The heat exchanger 6 is mounted inclined over an angle α with respect to the plane wherein the suction opening 14 is located. The angle α is situated between 0 and 45°, preferably 30°. This enables to reduce the total height of the device and to increase the volume of the exhaust air collector 12. The latter improving the security of the device because it enables to provide a larger distance between a grease filter 7 situated at the entrance of the exhaust air collector and the ambient air entrance of the heat exchanger. In particular when the ventilation device is used as a kitchen hood, the greater the distance between the grease filter and the heat exchanger, the less the probability of grease particles to reach the heat exchanger.

Another advantage of increasing the volume of the exhaust air collector 12 is that in such a manner space is provided for mounting a fire or heat detector even as fire extinguishing means within that collector 12. The exhaust air collector space being the one where the probability that a fire ignites being the largest, the presence of such a detector and fire extinguishing means in that collector space substantially improves the safety and reliability of the device.

The grease filter 7 is also inclined, over an angle β with respect to the suction opening 14. The angle β is situated between 5-75°, preferably 35°. The angles α and β are preferably different from one another and chosen in such a manner that the heat exchanger can pass through the grease filter opening when the latter is removed from the device. This enables an easy removing of the heat exchanger with no need to remove other parts of the ventilation device than the grease filter.

Depending on the overall dimension of the ventilation device, the angles α and β are chosen in such a manner as to enable a reduced overall length of the device while at the same time having a substantial volume for the exhaust air collector 12 and the intake air chamber 4.

When the ventilation device has also to be used as a heating device for the ambient air, the latter is provided with heating means (not shown) situated in front of the air discharge opening 9.

Claims

1. A ventilation device, in particular a kitchen hood, comprising :
   - a suction opening for the input of ambient air to be removed out of a room and connected via a first air path to an exhaust duct for exhausting said removed ambient air ;

- an intake air duct connected via a second air path to an air discharge opening provided for the output of an intake air flow ;
- a heat exchanger mounted within said first and second air path and provided for extracting heat out of said ambient air and transferring it to said intake air,
- an intake air chamber crossed by said second air path and situated upstream of said heat exchanger ;
- an exhaust air chamber crossed by said first air path and situated downstream of said heat exchanger characterised in that said heat exchanger is one of the cross-flow type located at a crossing point of said first and second air path, said intake resp. exhaust air chamber having an output resp. an input plane extending substantially parallel to an input resp. an output plane of said heat exchanger.

2. A ventilation device as claimed in claim 1, characterised in that the input plane of said heat exchanger has a length which is longer than the distance covered by the intake air flow while crossing said heat exchanger.

3. A ventilation device as claimed in claim 1 or 2, characterised in that said heat exchanger is substantially rectangularly shaped.

4. A ventilation device as claimed in claim 1, 2 or 3, characterised in that said heat exchanger is mounted inclined over an angle situated between 0 and 45° with respect to a plane wherein said section opening is located.

5. A ventilation device as claimed in anyone of the claims 1-4, characterised in that it comprises an intake air chamber situated within said second air path between said intake air duct and said heat exchanger, said intake air chamber comprises a separation wall made of heat conductive material and separating said intake air chamber from an exhaust air collector situated downstream of said section opening in front of said heat exchanger, said separation wall being in line with the ambient air entrance of said heat exchanger.

6. A ventilation device as claimed in anyone of the claims 1-5, and comprising a grease filter situated between said suction opening and said heat exchanger, said grease filter being inclined over an angle situated between 5-75° with respect to the ambient air entrance plane of said heat exchanger.

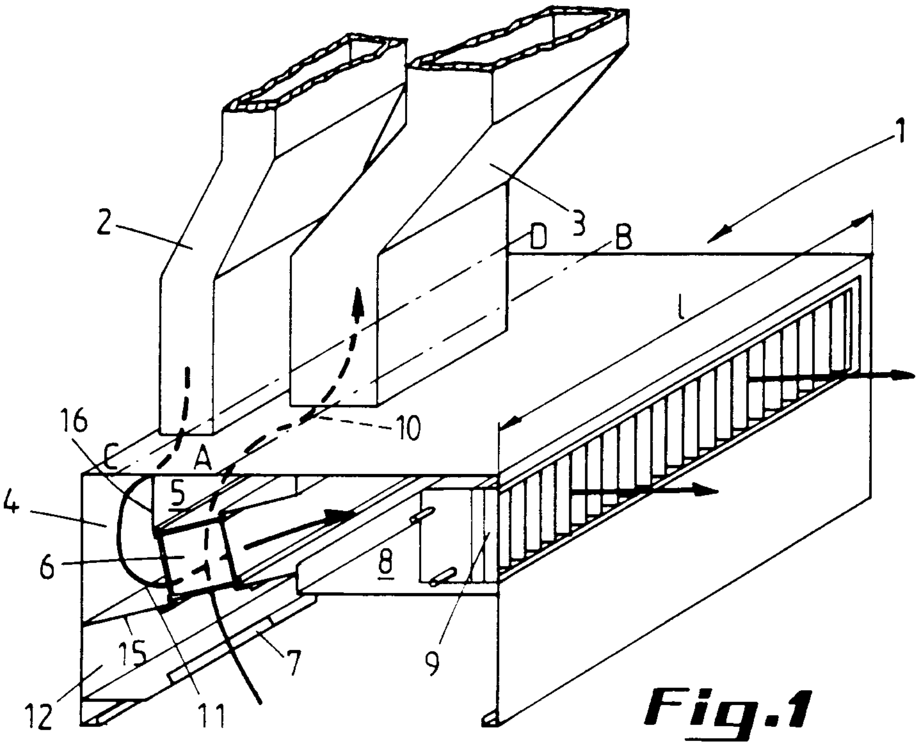

Fig.1

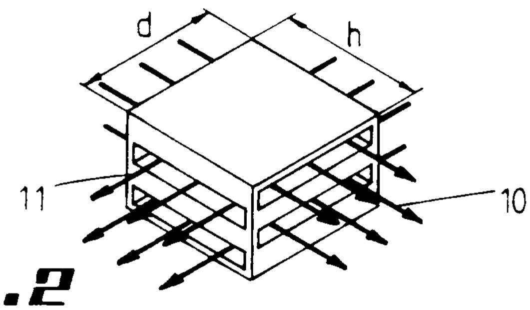

Fig.2

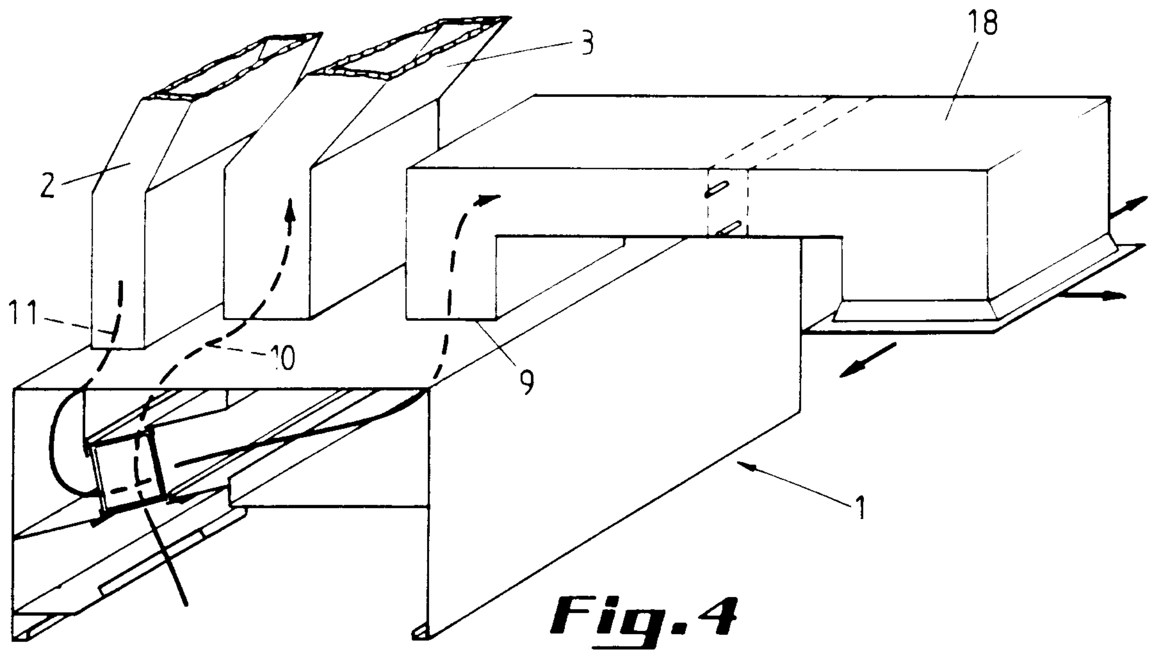

Fig.4

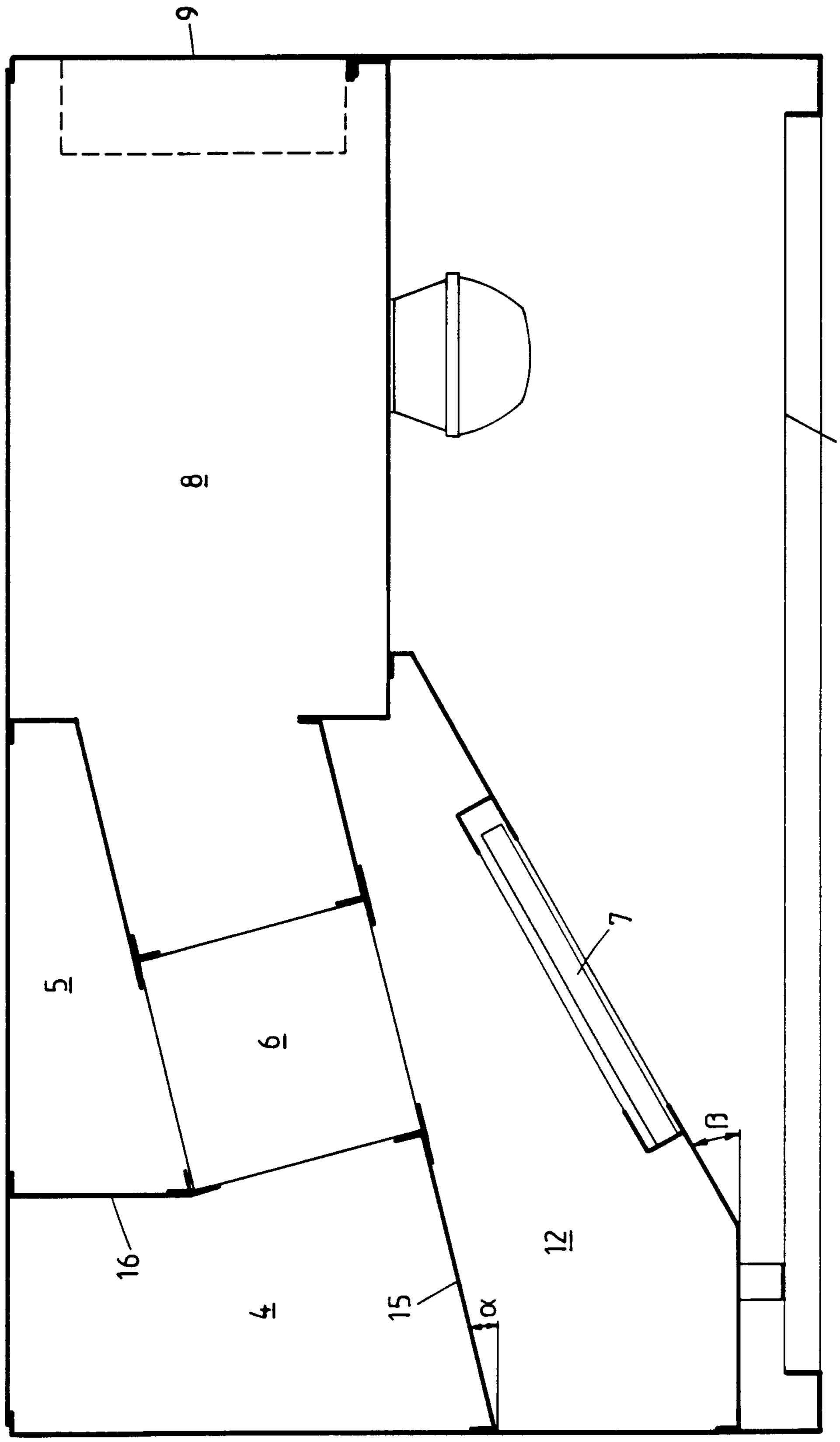

Fig.3

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EUROPEAN SEARCH REPORT

Application Number
EP 94 87 0024

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-4 171 722 (HUGGINS) * the whole document * ---	1,3	F24C15/20
X	EP-A-0 284 142 (LE PAIR BEHEER) * column 3, line 35 - column 4, line 11; figures * ---	1,3,4	
A	US-A-4 175 614 (HUGGINS) * abstract * ---	1	
A	FR-A-2 372 394 (ILMAR METS) * claims; figures * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 July 1994	Vanheusden, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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