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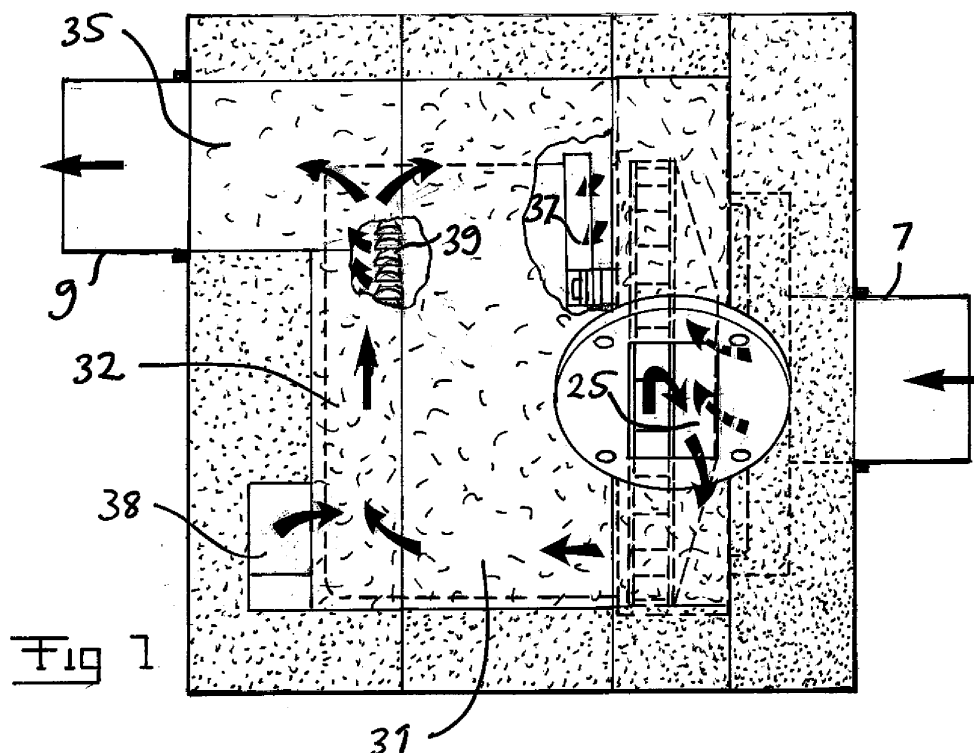
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(54) **An arrangement for transporting gases**

(57) An arrangement for transporting earth gases emanating from the soil from a space under a building to the atmosphere comprises a housing (6) having an inlet opening (7) configured to be connected to a pipe in fluid communication with said space and an outlet opening (9) configured to be connected to a pipe for exhausting said earth gases to the atmosphere. A fan unit (21) is

arranged inside the housing for generating a gas flow from the inlet to the outlet of the housing. The housing is filled by a block (15) of a compressible material with outer dimensions corresponding to the inner dimensions of the housing and provided with recesses for said fan unit (21) and members configured to define a flow path for said gases from the housing inlet to a fan casing inlet and from a fan casing outlet to the housing outlet.



Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to an arrangement for transporting earth gases emanating from the soil from a space under a building to the atmosphere.

[0002] It is particularly desired to obtain such transport of earth gases when these have a high content of radon, and the present invention is for that sake especially directed to such transport of earth gases containing radon for preventing this radon from entering the building and expose persons present therein to harmful radiation upon decay.

[0003] Radon is a link in the chain of decay of uranium-238 and occurs naturally in soil as the radio nuclide gas that dissipates by exposure of soil to the atmosphere. Studies have shown that the presence of radon gas may dramatically increase the risk of occurrence of lung cancer, which is the reason for limit values not to be exceeded in a building set by authorities, and this limit value is presently in Sweden set to be 200 bq for radon decay.

[0004] Radon gas permeates construction material as porous cement blocks or poured foundations which have become porous over time or which have cracked due to stress, so that radon can penetrate building structures at high concentrations. Thus, it will then be necessary to arrange an arrangement mentioned above for conducting radon containing earth gases directly to the atmosphere, so that said limit value is not reached.

BACKGROUND ART

[0005] The present invention relates more particularly to a said arrangement comprising:

- an air tight housing having an inlet opening configured to be connected to a pipe in fluid communication with said space and an outlet opening configured to be connected to a pipe for exhausting said earth gases to the atmosphere, and
- a fan unit arranged inside said housing and having on one hand a fan casing connected by an inlet to said housing inlet and by an outlet to said housing outlet and enclosing an impeller and on the other a motor configured to rotate said impeller for generating a gas flow through said housing from the inlet to the outlet thereof and by that transporting gases from said space to the atmosphere.

[0006] Such arrangements are known through for example SE 528 061 C2 and US 4 988 237. Although known such arrangements are sufficiently efficient in transporting earth gases emanating from the soil from a space under a building to the atmosphere for keeping the content of radon gas entering a building on a desired low level, there may be a desire to improve other properties of these arrangements.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide an arrangement of the type defined above being improved in at least some aspect with respect to such arrangements already known.

[0008] This object is according to the invention obtained by providing such an arrangement in which said housing is filled by a block of a compressible material with outer dimensions corresponding to the inner dimensions of said housing and provided with recesses for said fan unit and members configured to define a flow path for said gases from said housing inlet to said fan casing inlet and from said fan casing outlet to said housing outlet.

[0009] A number of advantages are obtained by this new approach to fill the housing of such an arrangement by a block of such a material. One of them is that said flow path may be obtained by very simple means resulting in a reduction of production costs for the arrangement. Furthermore, the presence of such a block of compressible material in which the fan unit is embedded will automatically be positive for attempts to suppress noises emanating from the operation of the fan unit.

[0010] According to an embodiment of the invention said compressible material has a density exceeding 70 kg/m³, preferably being 80 kg/m³ - 200 kg/m³ and most preferred 90 kg/m³ - 150 kg/m³. The use of a compressible material having such a high density, which is much higher than of for instance common foamed plastic, gives this block a good mechanical stability making it possible to use it for supporting different components, here the components of the fan unit, which is also utilized in another embodiment of the invention discussed further below. This high density is also favourable for the ability of the material to absorb noises.

[0011] According to another embodiment of the invention said compressible material is porous, especially a foam material, which constitutes a favourable way of obtaining a block of said compressible material.

[0012] According to another embodiment of the invention said block of compressible material is formed by superimposed parallelepipedic layers of compressible material having the shape of a rectangular parallelepiped and provided with different cut-outs for together forming said recesses, which facilitates the production of the interior of said housing and by that lower the production costs thereof.

[0013] According to another embodiment of the invention said fan unit is floatingly arranged inside said housing by means fixed thereto being in engagement with portions of said compressible material block for holding the fan unit embedded in said compressible material. This means that vibrations possibly occurring from the operation of the fan unit may be efficiently absorbed by said block through the possibility of the fan unit to move inside said housing while compressing the material of said block, so that such vibrations will not result in any noise transferred to the walls of the housing or other parts of

the arrangement.

[0014] According to another embodiment of the invention said engagement means of the fan unit comprises at least one projection and said portions of said block comprises at least one cut-out in the block designed to receive said projection, which constitutes a simple way of obtaining adequate, well defined positioning of the fan unit inside the housing.

[0015] According to another embodiment of the invention said engagement means is fixed to said fan casing.

[0016] According to a further embodiment of the invention said motor is arranged outside the fan casing, and if the motor is then attached to said fan casing it is preferred to achieve this by resilient connecting members suspending the motor elastically with respect to the fan casing, so that vibrations from the motor may be substantially absorbed by said resilient connecting members.

[0017] According to another embodiment of the invention said members configured to define said flow path are formed by cut-outs made in said compressible material block, which means that these members will be obtained easily and to a low cost. The walls defining said flow path will then also automatically have a positive influence upon the noise suppressing ability of the flow path. This property may be further improved by having the member configured to define a flow path from the fan casing outlet to the housing outlet to comprise a channel portion designed for suppressing noise. This may be obtained by arranging the fan casing outlet and the housing outlet mutually nonaligned and mutually displaced for prolonging said channel portion.

[0018] The noise suppressing ability will according to another embodiment of the invention be further enhanced by the fact that the extension of the channel portion comprises at least one bend changing the air flow direction of more than 70°, and according to another embodiment of the invention said channel portion comprises at least two said bends, and a part downstream said two bends extends preferably substantially in parallel with and in the same direction as a channel part upstream said two bends, which has a further positive influence on said noise suppressing ability.

[0019] According to another embodiment of the invention applied to the case that the motor is arranged outside the fan casing said member configured to define a flow path from the outlet of the fan casing to the outlet of the housing has a first opening in fluid communication with the interior of a motor casing enclosing said motor for diverting a portion of exhaust gases from the fan casing into one end of said motor casing and upstream or downstream of said first opening a second opening in fluid communication with another end of said motor casing for receiving gases having passed the motor for cooling thereof. Thus, a part of the gas flow from said housing inlet to said housing outlet is used to obtain cooling of the motor arranged outside the main flow path through the housing, so that no further equipment is necessary

for obtaining efficient cooling of the motor. In case of a separate cooling media such equipment may necessitate a separate filter and other components increasing the production costs of the arrangement. Furthermore, the freedom of choosing locations of said housing could then also be restricted by having such a separate cooling equipment, especially if indoor air of the building is used as cooling media.

[0020] Further advantages as well as advantageous features of the invention will appear from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] With reference to the appended drawings, below follows a specific description of an embodiment of the invention cited as an example.

[0022] In the drawings:

- Fig 1 is a simplified view showing an arrangement according to the invention in use,
- Fig 2 is a perspective view of an arrangement according to an embodiment of the invention,
- Fig 3 is a view of a compressible material block arranged inside a housing of the arrangement according to Fig 2,
- Fig 4 is a perspective view of one layer of said compressible material block to be located closest to the inlet opening of the housing of the arrangement shown in Fig 2,
- Fig 5 is a side elevation view of the layer shown in Fig 4 with a fan unit of said arrangement partially received therein,
- Fig 6 is an exploded view of said compressible material block layers and fan unit arranged inside said housing,
- Fig 7 is a section view according to VII-VII in Fig 8 of the arrangement according to Fig 2, and
- Fig 8 is a perspective, partially sectioned view of the housing of the arrangement shown in Fig 2.

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

[0023] Fig 1 illustrates schematically how an arrangement 1 according to the invention may be located inside a building 2, such as in a cellar thereof, in a closet or the like. The arrangement is configured to transport earth gases emanating from the soil 3 from a space 4 under the building to the atmosphere 5 and has an airtight housing 6 having an inlet opening 7 configured to be connect-

ed to a pipe 8 in fluid communication with said space 4 and an outlet opening 9 configured to be connected to a pipe 10 for exhausting said earth gases to the atmosphere. It is also indicated how a filter 11 may be arranged upstream of the housing 6 for collecting particles drawn from said space 4 through the air flow for preventing them from entering the housing and causing disturbances of the function of the fan unit arranged therein.

[0024] Fig 2 illustrates the arrangement, and it is shown how an electronic control unit 12 is connected to the interior of the housing 6 for controlling the operation of a fan unit located therein and described further below and possibly also for monitoring the function of the fan unit by detecting parameters relating thereto, such as the number of revolutions of an impeller of the fan unit. A connector 13 for connecting the arrangement to an electric power supply and an on/off-switch are also visible.

[0025] Fig 3 illustrates the appearance of a block 15 of a compressible material designed to fill the housing 6, and opposite openings 16, 17 for connection to said housing inlet opening 7 and outlet opening 9, respectively, are shown. It appears that this block is formed by a number of superimposed parallelepipedic layers 18 of compressible material having the shape of a rectangular parallelepiped and provided with different cut-outs for together forming recesses inside said block for receiving a fan unit and members configured to define a flow path for gases from said housing inlet to a fan casing inlet and from a fan casing outlet to the housing outlet, which will be described further below.

[0026] The compressible material is porous and here a foam material with a high density for being a foam material, namely of about 100 kg/m³. Said layers 18 are here made by the material REGENOCELL[™] constituted by recycled porous fibrous material pressed together. This results in a compressible material having a good mechanical stability. The material will also be easy to cut for obtaining for example recesses therein and it will have a high sound absorbing capacity. In addition, it will be flame-retardant.

[0027] Fig 4 illustrates the appearance of the layer 18' of said block 15 to be arranged next to the inlet opening of the housing, and it appears that this layer is provided with said opening 16. This layer 18' has also a recess 19 designed to receive a bottom surface of a fan casing 20 of a fan unit 21 shown in Fig 5. The layer 18' has also a cut-out 22 designed to receive a projection 23 on said fan casing 20 for assisting said block to floatingly arrange said fan unit 21 inside the housing.

[0028] Said fan unit 21 has on one hand said fan casing 20 connected by an inlet 24 to the housing inlet 7 and by an outlet 25 to the housing outlet 9 and enclosing an impeller 26 and on the other a motor 27 received in a motor casing 28 configured rotate said impeller for generating a gas flow through the housing from the inlet to the outlet thereof and by that transporting gases from the space 4 to the atmosphere 5. It is illustrated how the motor casing 28 is attached to the fan casing 20 by resilient connecting members 29 suspending the motor 27, here an EC-motor of high efficiency, elastically with respect to the fan casing for absorbing vibrations resulting from the operation of the motor.

[0029] Figs 6 and 7 illustrate how cut-outs are made in said compressible material block layers for receiving the fan casing and the motor casing 28 of the fan unit 21 and other cut-outs made for defining said flow path for gases from the housing inlet to the fan casing inlet and from the fan casing outlet to the housing outlet. The flow path of gases from the fan casing outlet 25 to the housing outlet 9 will now be described while making reference to Figs 5-7.

[0030] Cut-outs 30 are made in said compressible material block layers for defining a first channel portion 31 extending from the fan casing outlet 25 substantially perpendicularly thereto and to the housing wall provided with a housing inlet. Said first channel portion 31 emerges into a second channel portion 32 realized through further cut-outs and connected to the first channel portion through a first bend 33 of 90°. The presence of this second channel portion 32 results in a prolongation of the flow path from the fan casing outlet to the housing outlet resulting in an efficient suppressing of noise from exhaust air from the fan. The second channel portion ends in a second bend 34 of 90° connecting it to a third channel portion 35 ending at the housing outlet 9 and extending substantially in parallel with and in the same direction as the first channel portion 31.

[0031] Furthermore, it appears from Figs 6 and 7 that the member configured to defined a flow path from the outlet of the fan casing to the outlet of the housing formed by the cut-outs resulting in the channel portions 31, 33 and 35 has a first opening 36 in fluid communication with the interior of the motor casing 28 for diverting a portion of exhaust gases from the fan casing into one end 37 of the motor casing and upstream of said first opening a second opening 38 in fluid communication with another end 39 of the motor casing for receiving gases having passed the motor for cooling of the motor. Accordingly, a minor part of the gases exhausted by the fan towards the housing outlet is by this recirculated for obtaining appropriate cooling of the motor.

[0032] The invention is of course not in any way restricted to the embodiment thereof described above, but many possibilities to modifications thereof will be apparent to a person with ordinary skill in the art without departing from the scope of the invention as defined in the appended claims.

Claims

1. An arrangement for transporting earth gases emanating from the soil (3) from a space (4) under a building (2) to the atmosphere, said arrangement comprising:

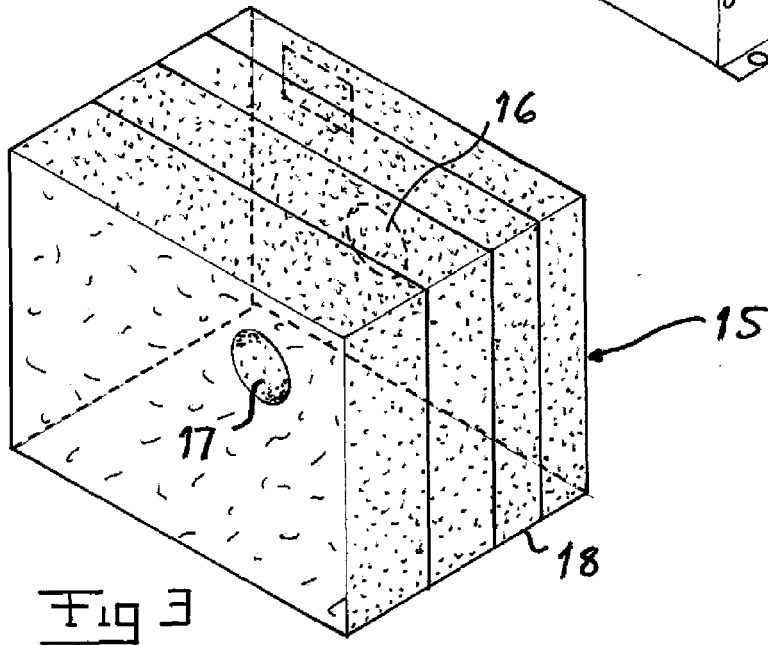
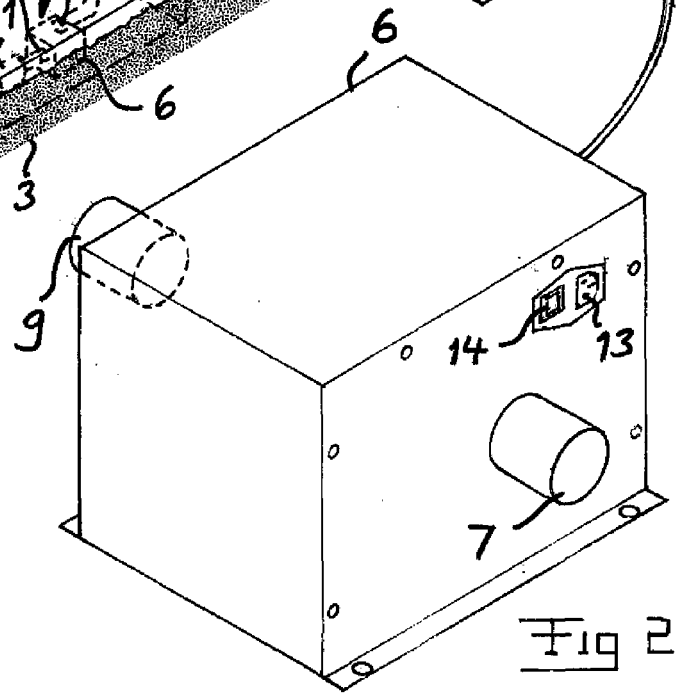
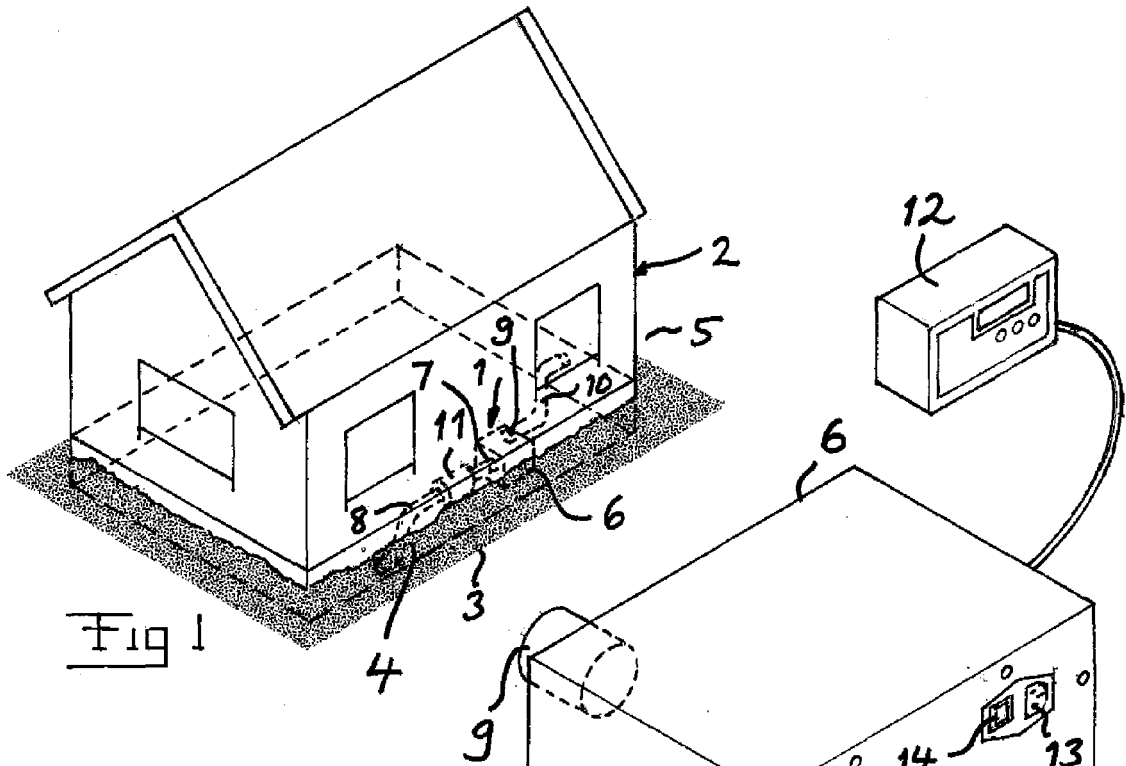
- an air tight housing (6) having an inlet opening (7) configured to be connected to a pipe (8) in fluid communication with said space and an outlet opening (9) configured to be connected to a pipe (10) for exhausting said earth gases to the atmosphere, and
- a fan unit (21) arranged inside said housing and having on one hand a fan casing (20) connected by an inlet (24) to said housing inlet and by an outlet (25) to said housing outlet and enclosing an impeller (26) and on the other a motor (27) configured to rotate said impeller for generating a gas flow through said housing from the inlet to the outlet thereof and by that transporting gases from said space to the atmosphere,

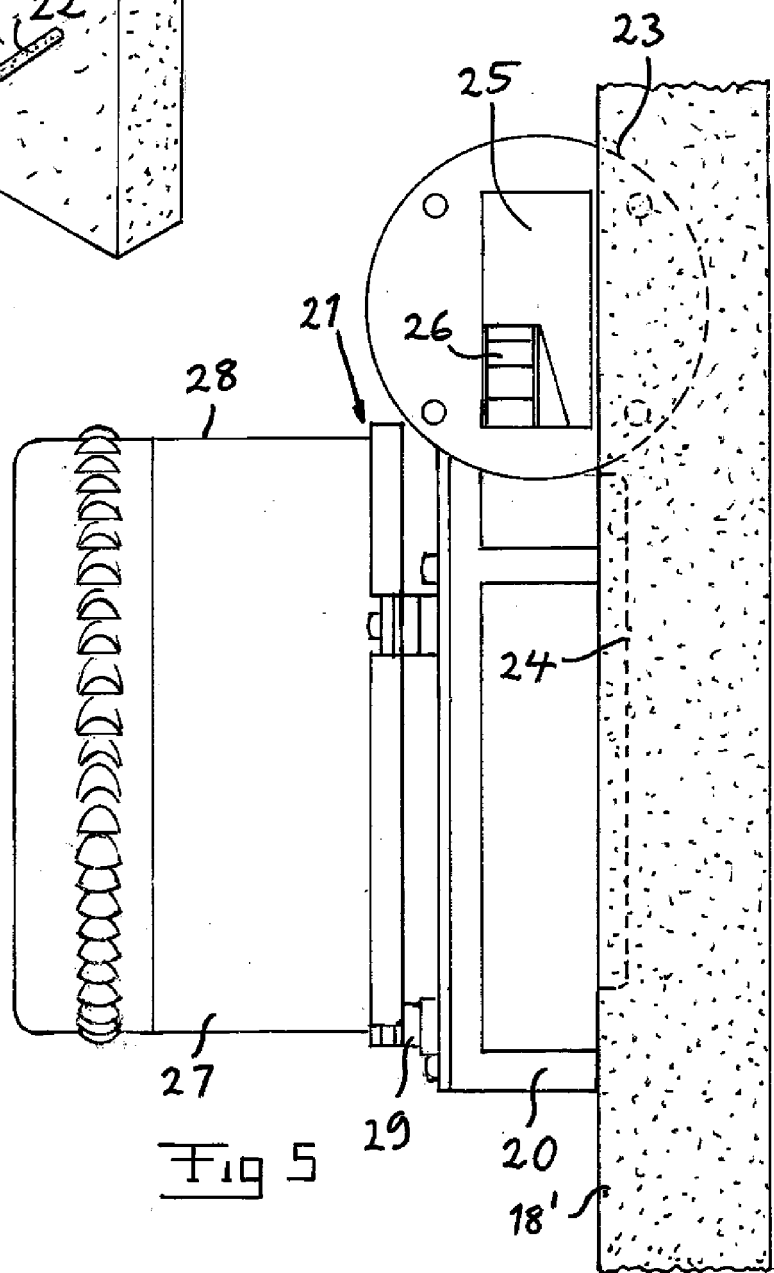
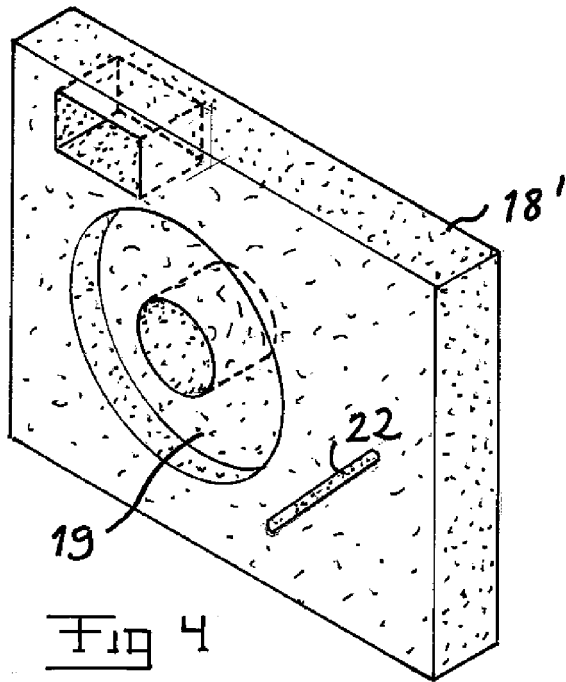
characterized in that said housing (6) is filled by a block (15) of a compressible material with outer dimensions corresponding to the inner dimensions of said housing and provided with recesses (19) for said fan unit and members configured to define a flow path for said gases from said housing inlet to said fan casing inlet and from said fan casing outlet to said housing outlet.

2. An arrangement according to claim 1, **characterized in that** said compressible material has a density exceeding 70 kg/m^3 , preferably being $80 \text{ kg/m}^3 - 200 \text{ kg/m}^3$ and most preferred $90 \text{ kg/m}^3 - 150 \text{ kg/m}^3$.
3. An arrangement according to claim 1 or 2, **characterized in that** said compressible material is porous, especially a foam material.
4. An arrangement according to any of the preceding claims, **characterized in that** said block (15) of compressible material is formed by superimposed parallelepipedic layers (18) of compressible material having the shape of a rectangular parallelepiped and provided with different cut-outs for together forming said recesses.
5. An arrangement according to any of the preceding claims, **characterized in that** said fan unit (21) is floatingly arranged inside said housing (6) by means (23) fixed thereto being in engagement with portions (22) of said compressible material block (15) for holding the fan unit embedded in said compressible material.
6. An arrangement according to claim 5, **characterized in that** said engagement means of the fan unit (21) comprises at least one projection (23) and said portions of said block comprises at least one cut-out (22) in the block designed to receive said projection.
7. An arrangement according to claim 5 or 6, **characterized in that** said engagement means (23) is fixed

to said fan casing (20).

8. An arrangement according to any of the preceding claims, **characterized in that** said motor (27) is arranged outside the fan casing (20).
9. An arrangement according to claim 8, **characterized in that** said motor (27) is attached to said fan casing (20), preferably by resilient connecting members (29) suspending the motor elastically with respect to the fan casing.
10. An arrangement according to any of the preceding claims, **characterized in that** said members configured to define said flow path are formed by cut-outs (16, 17, 30) made in said compressible material block (15).
11. An arrangement according to claim 10, **characterized in that** said member configured to define a flow path from the fan casing outlet (25) to the housing outlet (9) comprises a channel portion (31, 32, 35) designed for suppressing noise.
12. An arrangement according to claim 11, **characterized in that** said fan casing outlet (25) and said housing outlet (9) are mutually non-aligned and mutually displaced for prolonging said channel portion.
13. An arrangement according to claim 11 or 12, **characterized in that** the extension of said channel portion comprises at least one bend (33, 34) changing the air flow direction of more than 70° .
14. An arrangement according to claim 13, **characterized in that** said channel portion comprises at least two said bends (33, 34), and that a part (35) downstream said two bends extends preferably substantially in parallel with and in the same direction as a channel part (31) upstream said two bends.
15. An arrangement according to claim 8 or claim 8 and any of the other preceding claims, **characterized in that** said member configured to define a flow path from the outlet (25) of the fan casing (20) to the outlet (9) of the housing (6) has a first opening (36) in fluid communication with the interior of a motor casing (28) enclosing said motor (27) for diverting a portion of exhaust gases from the fan casing into one end (37) of said motor casing and upstream or downstream of said first opening a second opening (38) in fluid communication with another end (39) of said motor casing for receiving gases having passed the motor for cooling thereof.





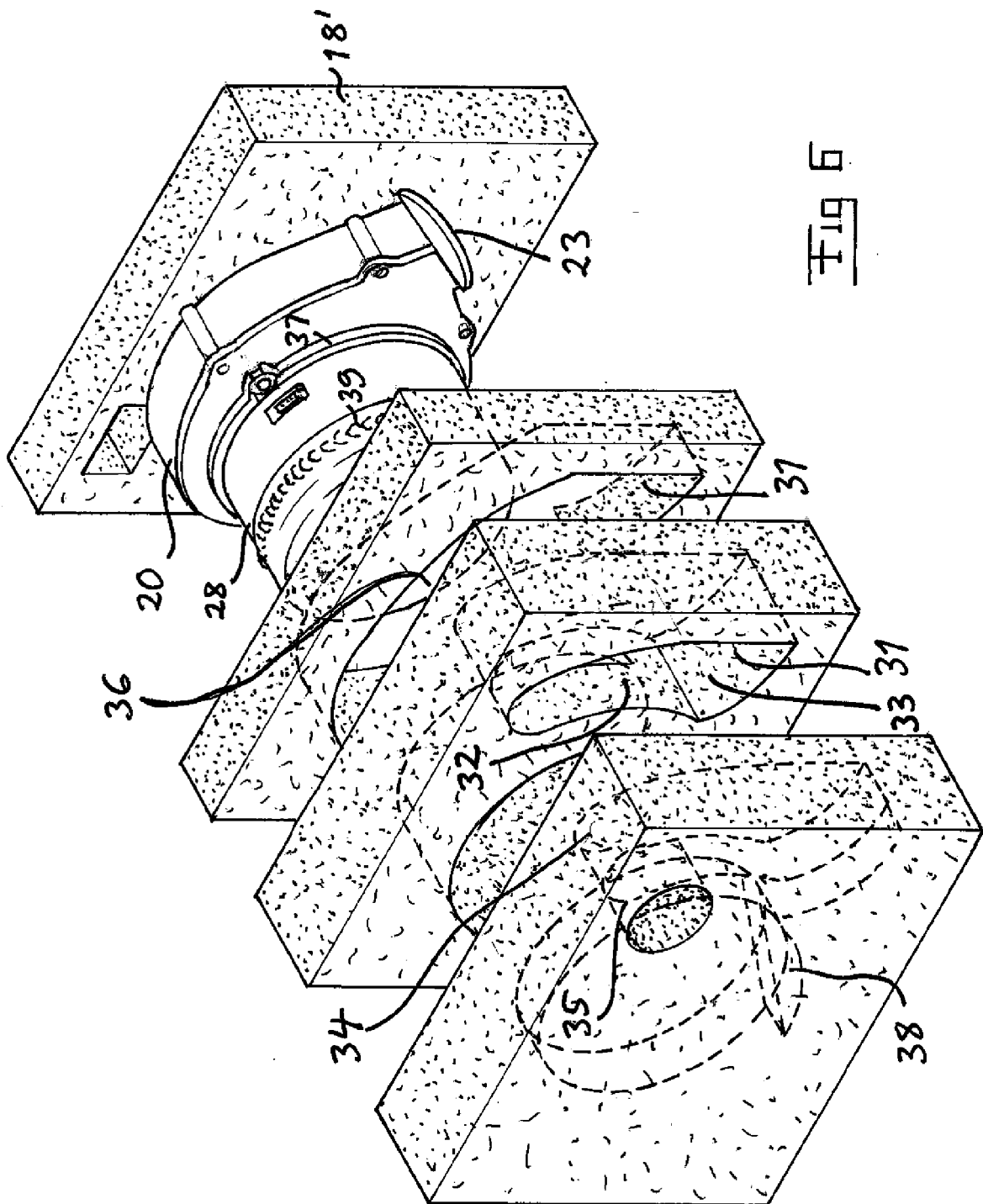
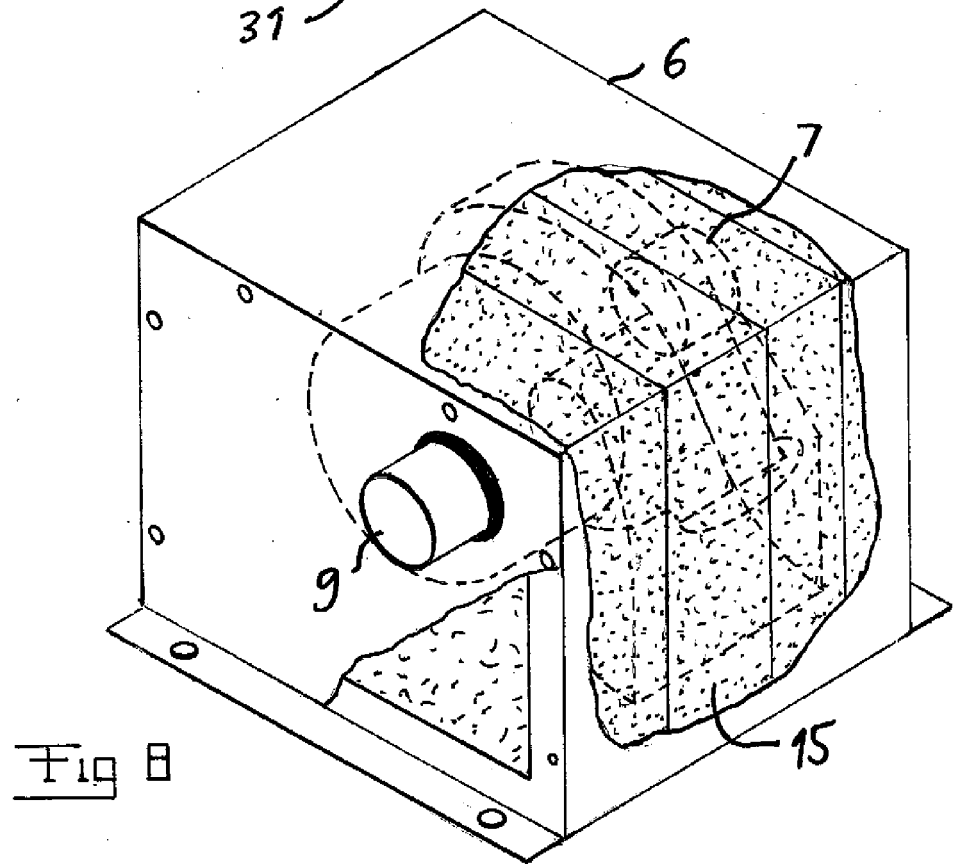
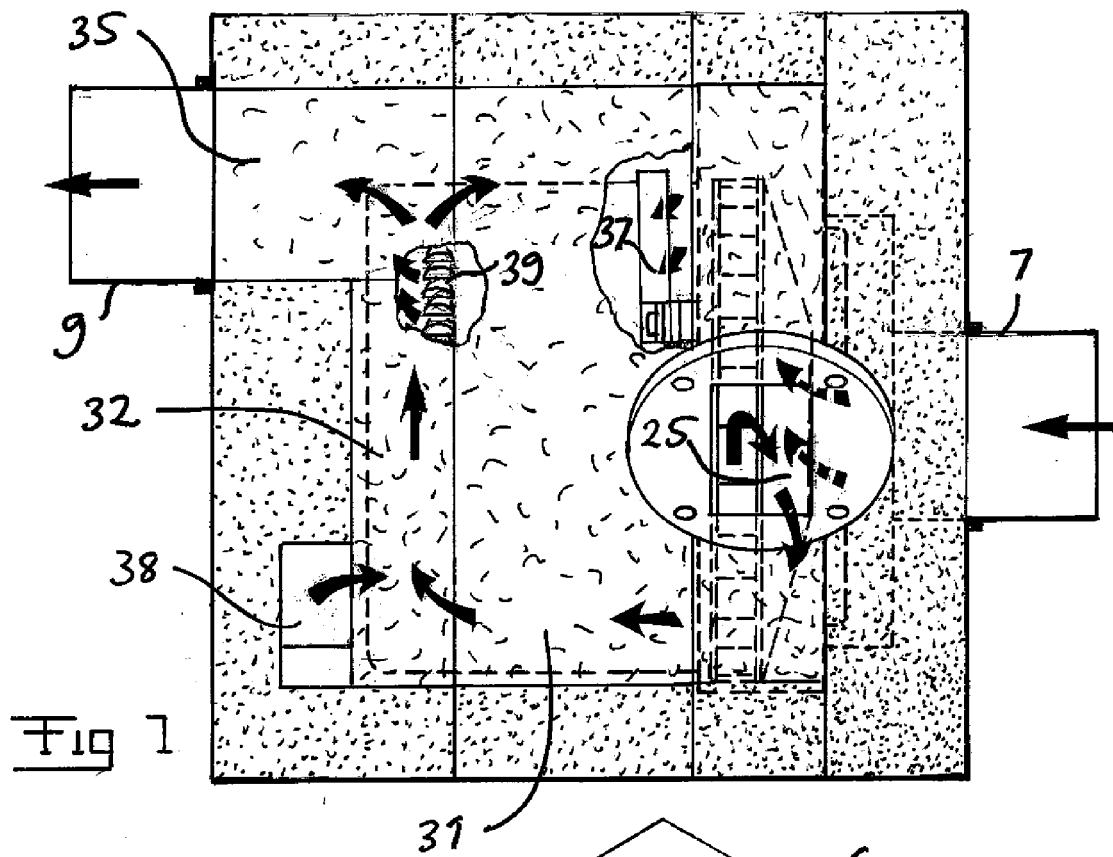


Fig 6





EUROPEAN SEARCH REPORT

Application Number
EP 09 16 5879

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			E02D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 August 2009	Examiner Geiger, Harald
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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 16 5879

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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REFERENCES CITED IN THE DESCRIPTION

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