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(54) **A roof fan**

(57) A roof fan (1) configured to be arranged on a roof (2) of a building for transport of air from an exhaust air channel (3) in the building to the exterior of the building comprises a housing (4) having inside thereof a fan member (11) in the form of an impeller (12) and a motor (14) for rotation thereof, a bottom (5) with an inlet opening

(15) configured to be connected to a said exhaust air channel for sucking air therefrom and outlet openings (16) only at two opposite sides (6,7) thereof surrounding said bottom. The fan has an arrangement allowing conversion of members (19,21) determining the direction of flow of air through the respective outlet opening (16).

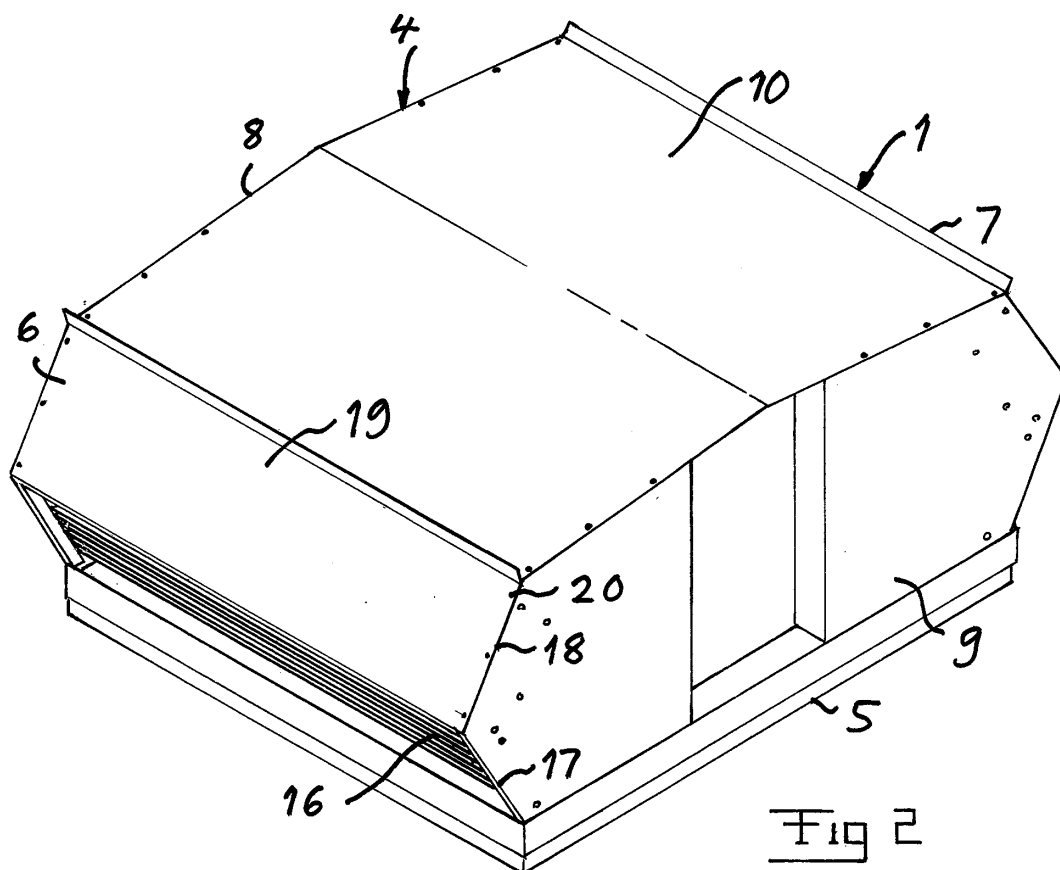


Fig 2

Description

TECHNICAL FIELD OF THE INVENTION AND PRIOR ART

[0001] The present invention relates to a roof fan configured to be arranged on a roof of a building for transport of air from an exhaust air channel in the building to the exterior of the building, said fan comprising a housing having inside thereof a fan member in the form of an impeller and a motor for rotation thereof, a bottom with an inlet opening configured to be connected to a said exhaust air channel for sucking air therefrom and at least one outlet opening for exhausting air to the exterior.

[0002] Such roof fans may be arranged on top of any type of roofs, such as horizontal roofs as well as inclining roofs. The expression "arranged on a roof of a building" is to be interpreted broadly as used here and covers both an arrangement of the roof fan directly onto a roof of a building and also an arrangement thereof on any member arranged on said roof, such as a platform or the like, for instance for adjusting the orientation of the roof fan. Thus, the bottom of the roof fan may extend horizontally or making an angle with a horizontal plane.

[0003] Such roof fans are used for ventilating purposes and may be arranged on the roof of any type of building, such as dwelling houses, industrial premises, schools and the like, and the capacity thereof may vary a lot depending upon the particular application. A roof fan do normally cause an airflow in said exhaust air channel of about 4 000 m³/hour, but quite other capacities are possible, such as 30 000 m³/hour, but there is principally no limits for such an airflow and it may well be much lower, such as a few m³/hour.

[0004] Such roof fans with many different designs are known, but they do all belong to one of two main types, namely a first type "exhausting horizontally" and a second type "exhausting vertically".

[0005] Which one of these types is chosen for a particular application is highly dependent upon the climate normally prevailing where the building is located.

[0006] In countries with a warmer climate, where the temperature does even in the winter stay above 0°C it is possible to use any of these two types, and a roof fan "exhausting horizontally" is then normally selected, since it may be better protected against rain than a roof fan of said second type, which has to open upwards. When a person skilled in this art speak about "exhausting horizontally" it means exhausting in a direction being close to the horizontal direction, but it may divert therefrom by several degrees, such as as much as 20°. The same apply for the use of "exhausting vertically" which means exhausting upwards away from the roof surface.

[0007] In countries where the climate is colder, i.e. where the temperature may fall below zero in the winter, roof fans of said second type have to be selected, since roof fans of the first type would there cause melting of snow on the roof and a formation of ice on the roof causing

problems, such as damage of the roof construction.

SUMMARY OF THE INVENTION

[0008] The object of the present invention is to provide a roof fan of the type defined in the introduction, which is improved in at least some aspect with respect to such roof fans already known.

[0009] This object is obtained by providing such a roof fan in which said housing is provided with outlet openings only at two opposite sides thereof surrounding said bottom, and which further comprises an arrangement configured to allow converting of members determining the direction of flow of air through the respective outlet opening to assume either of two positions, a first position of exhausting air substantially upwards with respect to said bottom and a second position of exhausting air substantially horizontally or downwards with respect to said bottom.

[0010] Most roof fans known so far exhaust air in "all directions", which means through all sides surrounding said bottom, i.e. all around the bottom. However, by in this way choosing a design restricting the exhaust of air to only two opposite sides of the housing a number of advantages may be obtained. The inventor has found out that the capacity of a roof fan may in fact be kept at the same level when exhausting through only two opposite sides of a housing as when exhausting in all directions. "All directions" is to be interpreted broadly and means blowing "all around" also covers the case of exhausting upwardly around an upper inner top wall of the fan.

[0011] The present inventor has also realised that the different requirements put on roof fans depending upon especially the climate on the location of the use thereof results in a need of keeping a high amount of components and fans in storage at the place of producing such fans and also keeping fans in storage for retailers. By designing a roof fan according to the present invention it is possible to address this problem and substantially reduce the requirement of storage space and also financial resources bound by keeping said high amount of components and fans in storage.

[0012] More particularly, one and the same roof fan may be converted from one of said two types mentioned above to the other. This means that the same components may be used for obtaining a roof fan of the type "exhausting horizontally" and of the type "exhausting vertically", which means that it is only necessary to keep one embodiment of a said roof fan in storage and still be able to provide a roof fan of any of said two types. This means that a retailer may change from one design to the other depending upon the demand of customers. Also the customer has the ability to change from one type to the other once the roof fan has been acquired.

[0013] However, the main advantage is that the production costs of such roof fans may be considerably reduced and the number of components to be kept in stor-

age for the producer will also decrease. Thus, the entire chain from producer to end customer will experience a simplification while still offering roof fans of both types.

[0014] According to an embodiment of the invention said arrangement comprises for each said outlet opening a member configured to cover a part of said side while leaving a part thereof open for airflow out of the housing, and this covering member is movable with respect to said housing between two positions for covering an upper and a lower part, respectively, of the respective said side of the housing in these positions. This constitutes an easy way of obtaining conversion of the roof fan between said two types, which is made possible thanks to the fact that outlet openings are only provided at two opposite sides of the housing of the roof fan.

[0015] According to another embodiment of the invention each said opposite side of the housing has a lower and an upper part extending from the bottom and a top of the housing, respectively, away from the other of said opposite sides, and said member is adapted to cover the lower part of said side in said first position and the upper part of said side in said second position, which means that the direction of exhausting of air from the roof fan may by very simple means be adjusted for changing between said first and said second position.

[0016] According to another embodiment of the invention exhausting air substantially upwards means exhausting in a direction making an angle of 20°-90°, such as 20°-80° or 30°-80°, and preferably 45°-60° with respect to said bottom.

[0017] According to another embodiment of the invention the roof fan comprises a grill for each outlet opening configured to be moved upon said conversion to cover the part of the respective side not covered by said covering member. Such a grill, grating or lattice may be suitable for protecting the interior of said housing, especially for preventing birds from entering the housing. The grill may then also be configured to guide air exhausted through said outlet opening substantially upwards or substantially horizontally or downwards depending upon the position of the covering member and by that the grill, so that the grill may be used to direct the flow of exhausting air properly.

[0018] According to another embodiment of the invention said grill and covering member are made in one part configured to be turned approximately 180° for obtaining said conversion, which is an easy way to obtain said conversion and also constitutes a simple and by that low cost solution to obtain said possibility of conversion, and this embodiment is especially suited for smaller roof fans.

[0019] The choice of a design of a roof fan having a housing with outlet openings only at two opposite sides thereof surrounding said bottom opens up for obtaining another advantage of a roof fan with respect to roof fans already known. This is obtained by another embodiment of the invention, in which said impeller and motor are suspended in a plate member fixed to two opposite sides of said housing having no said outlet opening. This

means a simple and reliable way of obtaining the suspension of impeller and motor, which is remarkably simplified by the possibility of doing this by fixing a said plate member in two opposite sides of the housing, which is not possible in most roof fans. This also means that a high stability of the impeller and motor in a direction substantially perpendicular to said two opposite sides having no said outlet opening may be obtained.

[0020] According to another embodiment of the invention said housing has a top side opposite to said bottom, and a sound insulating layer is arranged between said housing top side and said impeller with motor. Thus, by suspending the impeller and motor in this way a sound insulating layer may easily be arranged for substantially reducing the noise caused by a said roof fan.

[0021] According to another embodiment of the invention one side of said housing extending from the bottom and having no outlet opening is provided with an external recess for receiving an electronic control unit for the operation of said motor. Such a recess hiding and protecting a such electronic control unit in this way may be obtained thanks to the fact that the housing is provided with outlet openings only at two opposite sides thereof.

[0022] According to another embodiment of the invention the fan comprises a member configured to pivotally connect said housing to a said roof for allowing access to said exhaust air channel of the building, so that this may be cleaned when necessary.

[0023] This is according to another embodiment of the invention obtained by the fact that said connecting member comprises a frame configured to be fixed with respect to a said roof, and the entire housing is pivotally connected to said frame. This means that the dimensions of said frame may be adapted to the dimensions of a roof lead-through member allowing differently dimensioned roof fans to be connected to such a roof lead-through member. As an alternative, which constitutes another embodiment of the invention, said connecting member includes said bottom of the housing configured to be fixed to a said roof, and the rest of the housing is pivotally connected to said bottom. The first of these two alternatives is especially suited for larger roof fans and the second alternative for smaller roof fans, but the embodiments are not restricted to the size of the roof fan.

[0024] According to another embodiment of the invention the impeller has blades curved backwards with respect to the rotation direction of the impeller, and the axis of rotation of the impeller is substantially perpendicular to said housing bottom. Impellers having blades curved backwards are most suited for this type of roof fans, since they will work very efficient without any need of any particular guiding means, so that the impeller may be arranged in a space in said housing laterally delimited by lateral walls of the housing and opening directly into said outlet openings.

[0025] Further advantages as well as advantageous features of the invention will appear from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] With reference to the appended drawings, below follows a specific description of roof fans according to embodiments of the invention cited as examples.

[0027] In the drawings:

- Fig 1 is a very simplified view illustrating how a roof fan according to the invention may be arranged on a roof of a building,
- Fig 2 is a simplified perspective view from above of a roof fan according to a first embodiment of the invention with outlet covering members in a second position,
- Fig 3 is a view corresponding to Fig 2 with said outlet opening cover members in a first position,
- Fig 4 is a perspective view illustrating a grill used in the outlet openings of a roof fan according to Figs 2 and 3,
- Fig 5 is a perspective view illustrating the suspension of impeller with motor in a plate member in a roof fan according to the present invention,
- Fig 6 is a perspective view of a part of a roof fan according to Fig 2 and 3 with the top side and also a lateral wall of the housing removed for illustrating how the impeller with motor is suspended in the housing,
- Fig 7 is a perspective view of a roof fan according to said first embodiment of the invention with top side and a lateral wall removed for illustrating how the roof fan may be sound insulated and an electronic control unit may be arranged,
- Fig 8 is a perspective view of a roof fan according to a second embodiment of the invention illustrating how the housing of a roof fan according to a second embodiment of the invention may be pivotally connected to a roof,
- Fig 9 is a view corresponding to Fig 8 of a roof fan according to said first embodiment of the invention, and
- Fig 10 and 11 are views corresponding to Fig 2 of a roof fan according to said second embodiment of the invention with outlet

open covering members in two different positions.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0028] A roof fan 1 according to a first embodiment of the invention is very schematically illustrated in Fig 1, in which it is shown how this is arranged on a roof 2 of a building for transport of air from an exhaust air channel 3 connecting to different exhaust air members not shown inside the building to the exterior of the building. The roof fan 1 is in fact not arranged directly on the roof, but it is fixed to a roof lead-through member 2a. It is well possible that the roof fan is connected to only a short channel through the member 2a and no other exhaust air channel exists or that a plurality of exhaust air channels inside the building are connected to the member 2a. All these alternatives are intended to be covered by the wording of claim 1. The construction of this roof fan will now be described while making reference also to Figs 2-7.

[0029] The roof fan comprises a housing 4 having a bottom 5, the size of which being adapted to the size of the member 2a, two first opposite sides 6, 7 defined by walls extending from said bottom and two other, second opposite sides 8, 9 as well as a top side wall 10. A fan member 11 (see Fig 6) in the form of an impeller 12 having blades 13 curved backwards with respect to the rotation direction of the impeller and a motor 14 for rotation of the impeller is arranged inside the housing. The bottom 5 is provided with an inlet opening 15 (best seen in Fig 9) configured to be connected to a said exhaust air channel 3 for sucking air therefrom.

[0030] The housing is provided with outlet openings 16 for exhausting air to the exterior only at the two opposite first sides 6, 7 thereof, whereas the other two opposite sides 8, 9 are closed and have no outlet opening. The distance between said opposite sides 6, 7 and 8, 9 of the housing is adapted for obtaining a high efficiency of the fan member. The distance may not be too small with respect to the diameter of the impeller for obtaining an optimum capacity.

[0031] Each said first opposite side has a lower 17 and an upper 18 part extending from the bottom 5 and the top 10 of the housing, respectively, away from the other said opposite side. These two parts 17, 18 make an angle with each other of 90°-140°, preferably 100°-125°. Each said first opposite side is provided with a member 19 configured to cover a part of said side while leaving a part thereof open for airflow out of the housing. This member 19 is movably attached to the upper 18 or lower 17 part in the form of end surfaces of the respective part by screws 20 schematically indicated. This means that this member 19 may be moved from a first position, in which it covers the lower part 17 of said side and allow exhausting air substantially upwards with respect to the bottom 5, to a second position shown in Fig 2, in which it covers the upper part 18 of said side and causes exhausting of

air substantially horizontally or downwards with respect to said bottom. The first position is shown in Fig 3.

[0032] Fig 4 illustrates a grill 21 having fins or ribs 22 and configured to be moved upon said conversion to cover the part of the respective side not covered by the covering member 19. It is shown how this grill is also fixed by screws 23 to the lateral walls 8, 9. The fins 22 of the grill are configured to guide air exhausted through said outlet opening substantially upwards or substantially horizontally or downwards depending upon the position of said covering member 19 and by that the grill.

[0033] Figs 5 and 6 illustrate how the impeller 12 and motor 14 are suspended in a plate member 24 fixed to opposite sides 8, 9 of said housing having no said outlet opening. This is done by screws as indicated at 25, and opposite end surfaces 26 of the plate member are configured to bear against a part of the internal lateral wall of the respective side 8, 9 of the housing making the suspension of the impeller with motor very stable with respect to movement in the longitudinal direction of the plate member, i.e. from one of the sides 8, 9 to the other. Further screws 34 secure said end surfaces 26 of the plate to the respective lateral wall 8, 9 making said suspension stable in the transversal direction of the plate.

[0034] Furthermore, it is possible to arrange external recesses 27 in the sides 8, 9 of the housing having no outlet opening and use such an external recess for receiving and well protecting an electronic control unit 28 (see Fig 7) for the operation of the motor. This means that this unit may be protected when transported.

[0035] By the fact that outlet openings are only arranged on two opposite sides of the housing it will also be very easy to arrange a sound insulating layer 29a in a roof fan according to the invention by introducing this between said plate member and the top side wall 10 of the housing as well as a sound insulating layer 29b inside the respective lateral wall 8, 9 on both sides of said recess 27 for reducing noise coming from the operation of the fan member. Extra support members 30, 31 are for this sake fixed inside the housing for holding said insulating layer laterally. The arrangement of said sound insulating layer may reduce the level of said noise in the order of 4-5 dB.

[0036] The roof fan also comprises a member configured to pivotally connect the housing 4 to a roof (in fact a roof lead-through member) for allowing access to said exhaust air channel of the building, and two different ways of obtaining this are illustrated in Fig 8 and 9. Fig 8 illustrates how a connecting member 32 includes the bottom 5 of the housing configured to be fixed to a said roof lead-through member and by that onto a said roof, and the rest of the housing is pivotally connected to the bottom. Fig 9 illustrates how the connecting member comprises a frame 33 configured to be fixed to a said roof lead-through member, and the entire housing is pivotally connected to said frame.

[0037] Figs 10 and 11 illustrate a roof fan according to a second embodiment of the invention, in which the grill

21' has no guiding fins but only members there for forming an obstacle to items, such as birds, to enter into the housing. It is shown how this grill 21' may then be fixed to the housing by screws in the same way as the covering member 19. It is in this embodiment also possible, although not clearly shown in the figures, to make the grill 21' and covering member 19 in one part configured to be turned approximately 180° for obtaining said conversion between the position according to Fig 10 and the one according to Fig 11.

[0038] How a roof fan according to the embodiments described above may be converted from exhausting air substantially upwards to exhausting air substantially horizontally or downwards and conversely should appear from the above description but will nevertheless now be briefly explained.

[0039] When the roof fan is in the state shown in Fig 2 (see also Fig 9) and the covering member 19 covers the upper part of the side 6 in question and air is exhausted substantially horizontally or downwards a conversion to the state shown in Fig 3, in which air is exhausted upwards is carried out as follows: the covering member 19 is removed by releasing the screws 20 and the grill 21 is removed by releasing the corresponding screws 23. The covering member 19 is then secured to the lower part 17 by using the screws and the grill 21 is secured by using the screws 23 after having been turned 180° as shown in Fig 3. This procedure is carried out for both opposite sides 6, 7 of the housing.

[0040] For the embodiment shown in Fig 8, 10 and 11 converting between the two states is carried out in a similar way, and when the grill and the covering member is one and the same part the respective screws are removed and this entire part turned approximately 180° before fixing it to the housing by means of the screws again.

[0041] The invention is of course not in any way restricted to the embodiments described above, but many possibilities to modification thereof would 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.

[0042] "Sides thereof surrounding said bottom" does not mean that said sides have to totally surround said bottom, which is clear from above. They only partially surround the bottom, but together with other sides they may do this totally.

Claims

1. A roof fan configured to be arranged on a roof (2) of a building for transport of air from an exhaust air channel (3) in the building to the exterior of the building, said fan comprising a housing (4) having inside thereof a fan member (11) in the form of an impeller (12) and a motor (14) for rotation thereof, a bottom (5) with an inlet opening (15) configured to be con-

- connected to a said exhaust air channel for sucking air therefrom and at least one outlet opening (16) for exhausting air to the exterior, said housing (4) being provided with outlet openings (16) only at two opposite sides (6, 7) thereof surrounding said bottom, **characterized in that** it further comprises an arrangement configured to allow converting of members (19, 21) determining the direction of flow of air through the respective outlet opening (16) to assume either of two positions, a first position of exhausting air substantially upwards with respect to said bottom and a second position of exhausting air substantially horizontally or downwards with respect to said bottom.
2. A roof fan according to claim 1, **characterized in that** said arrangement comprises for each said outlet opening (16) a member (19) configured to cover a part of said (6, 7) side while leaving a part thereof open for air flow out of the housing, and that this covering member is movable with respect to said housing (4) between two positions for covering an upper (18) and a lower (17) part, respectively, of the respective said side of the housing in these positions.
 3. A roof fan according to claim 2, **characterized in that** each said opposite side (6, 7) has a lower (17) and an upper (18) part extending from the bottom (5) and a top (10) of the housing (4), respectively, away from the other of said opposite sides, and that said member (19) is adapted to cover the lower (17) part of said side in said first position and the upper (18) part of said side in said second position.
 4. A roof fan according to any of the preceding claims, **characterized in that** exhausting air substantially upwards means exhausting in a direction making an angle of 20°-90°, such as 20°-80° or 30°-80°, and preferably 45°-60° with respect to said bottom (5).
 5. A roof fan according to any of the preceding claims, **characterized in that** it comprises a grill (21, 21') for each outlet opening (16) configured to be moved upon said conversion to cover the part of the respective side not covered by said covering member (19).
 6. A roof fan according to claim 5, **characterized in that** said grill (21') and covering member (19) is made in one part configured to be turned approximately 180° for obtaining said conversion.
 7. A roof fan according to claim 5 or 6, **characterized in that** said grill (21) is configured to guide air exhausted through said outlet opening (16) substantially upwards or substantially horizontally or downwards depending upon the position of said covering member and by that the grill.
 8. A roof fan according to any of the preceding claims, **characterized in that** said impeller (12) and motor (14) are suspended in a plate member (24) fixed to two opposite sides (8, 9) of said housing (4) having no said outlet opening.
 9. A roof fan according to claim 8, **characterized in that** said housing (4) has a top side (10) opposite to said bottom (5), and that a sound insulating layer (29a) is arranged between said housing top side (10) and said impeller (12) with motor (14).
 10. A roof fan according to any of the preceding claims, **characterized in that** one side (8) of said housing (4) extending from the bottom (5) and having no outlet opening is provided with an external recess (27) for receiving an electronic control unit (28) for the operation of said motor (14).
 11. A roof fan according to any of the preceding claims, **characterized in that** it comprises a member (32, 33) configured to pivotally connect said housing (4) to a said roof for allowing access to said exhaust air channel of the building.
 12. A roof fan according to claim 11, **characterized in that** said connecting member comprises a frame (33) configured to be fixed with respect to a said roof, and that the entire housing (4) is pivotally connected to said frame.
 13. A roof fan according to claim 11, **characterized in that** said connecting member (32) includes said bottom (5) of the housing (4) configured to be fixed to a said roof, and that the rest of the housing is pivotally connected to said bottom.
 14. A roof fan according to any of the preceding claims, **characterized in that** the impeller (12) has blades (13) curved backwards with respect to the rotation direction of the impeller, and that the axis of rotation of the impeller is substantially perpendicular to said housing bottom (5).

Fig 1

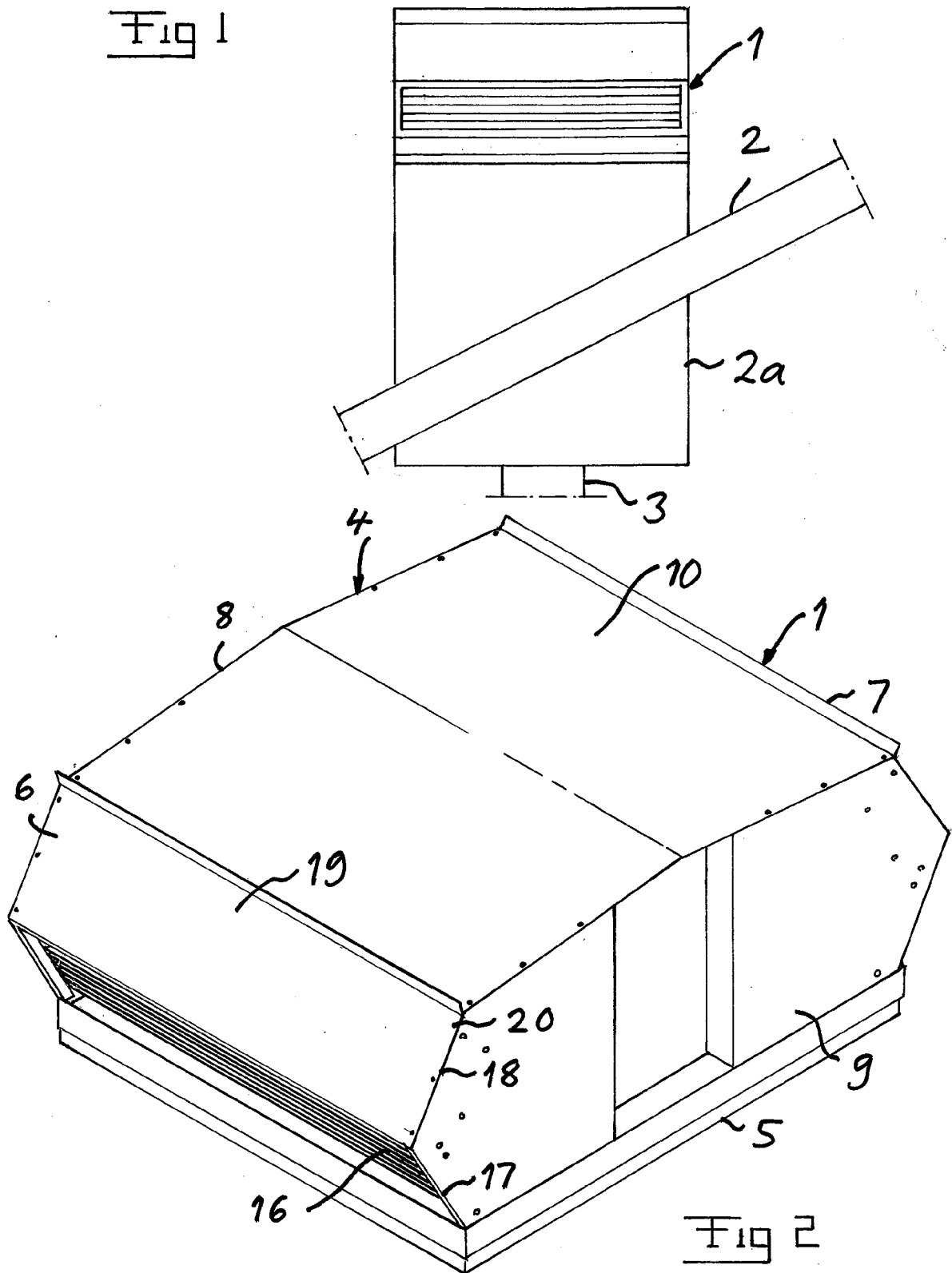
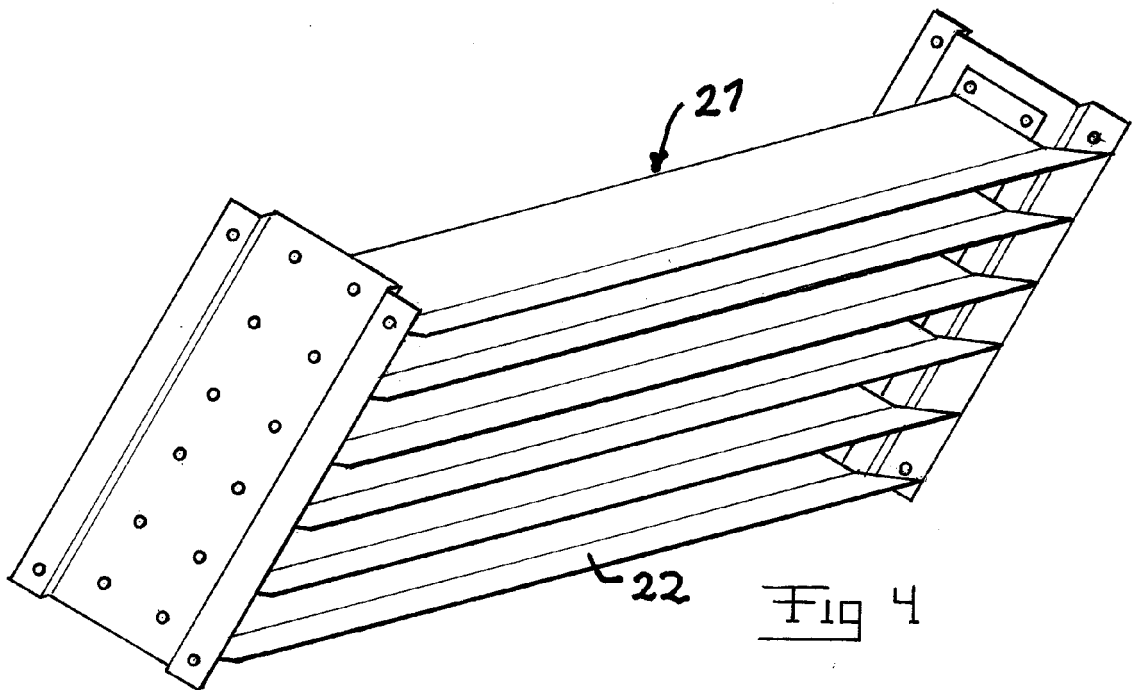
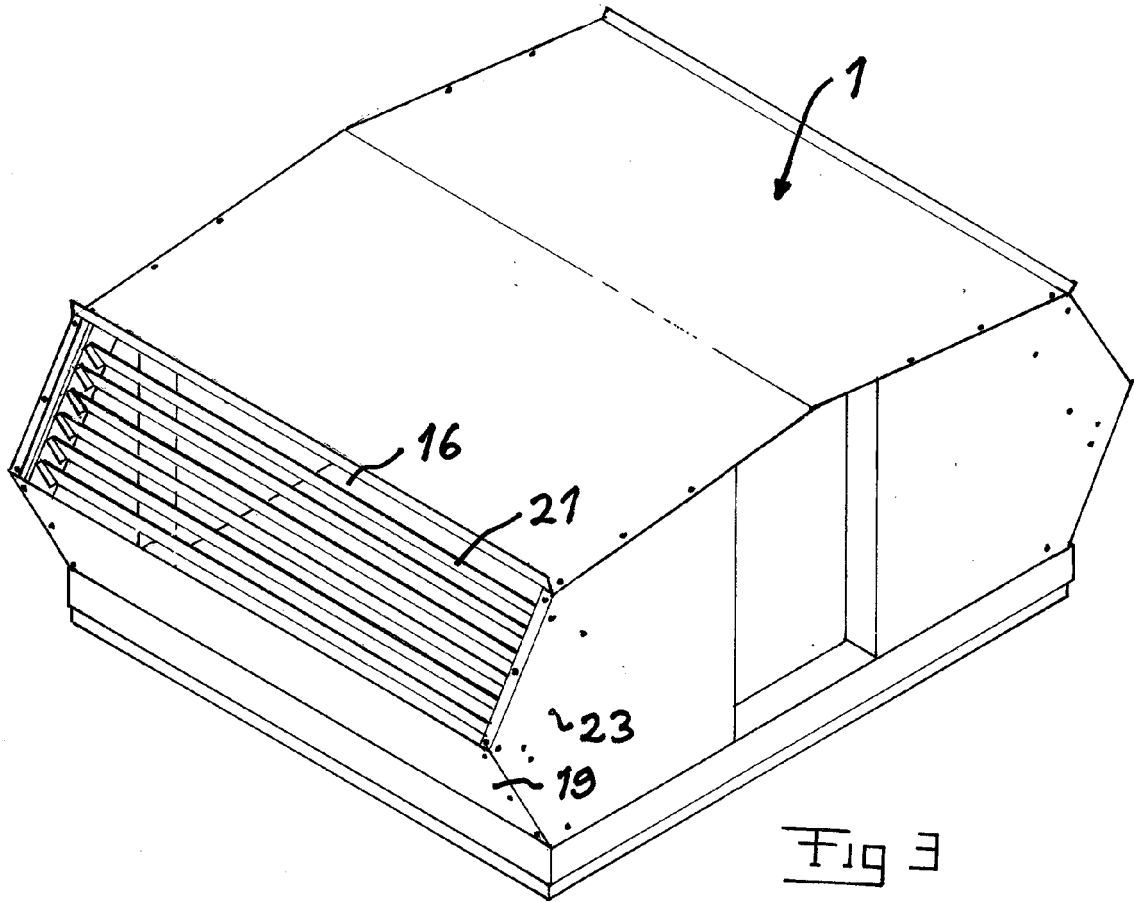


Fig 2



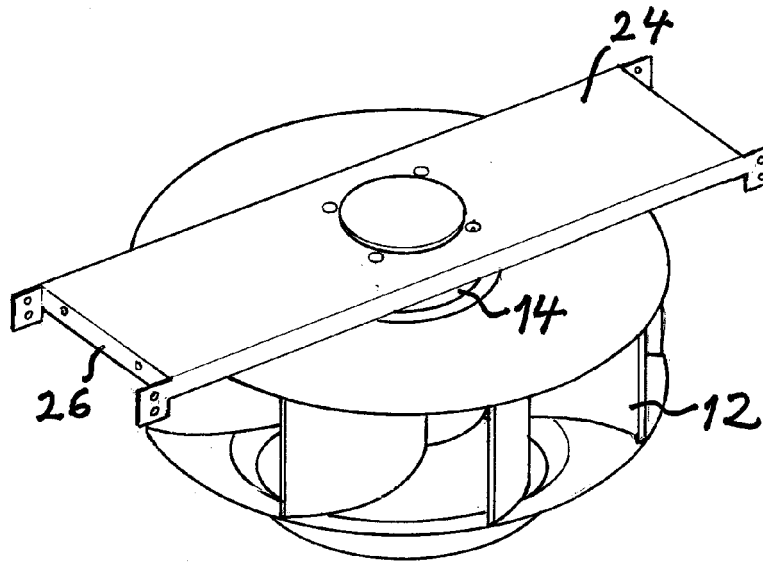


Fig 5

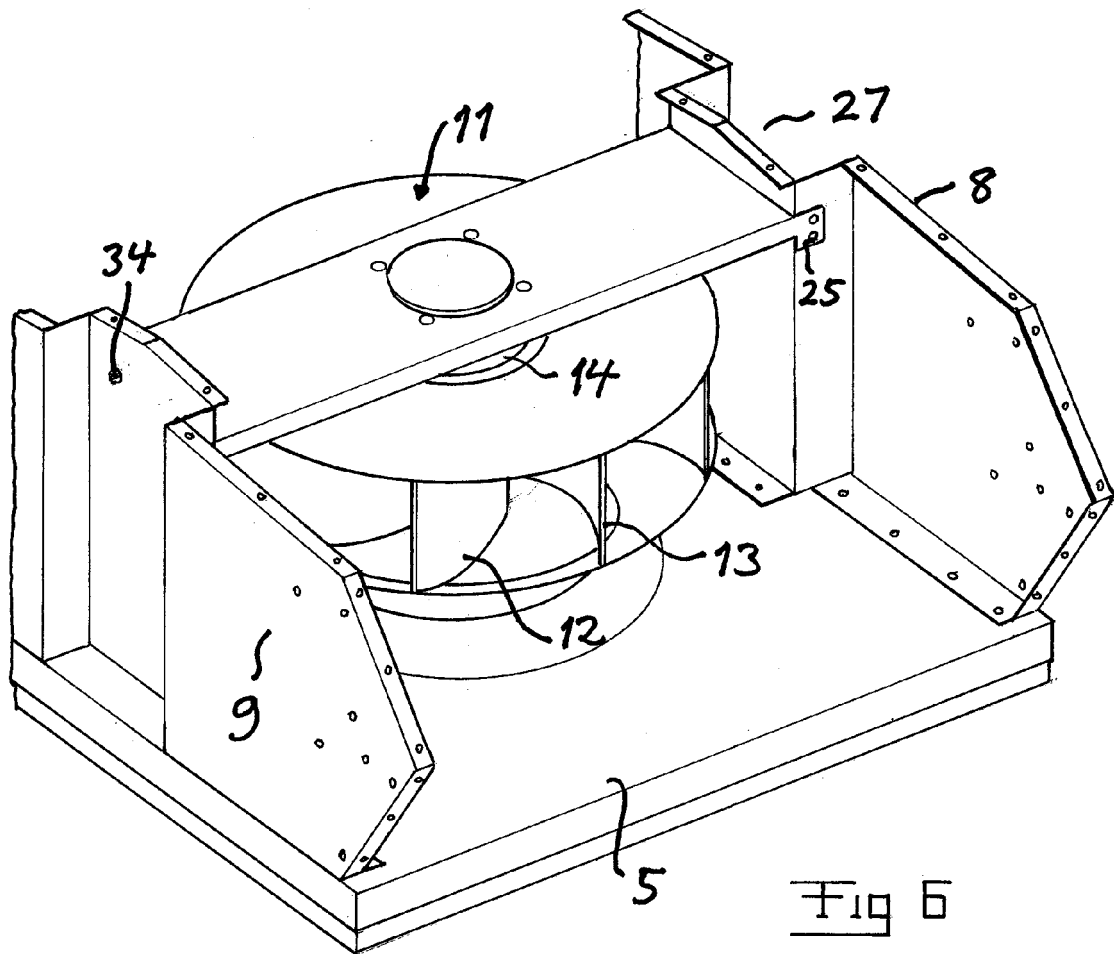
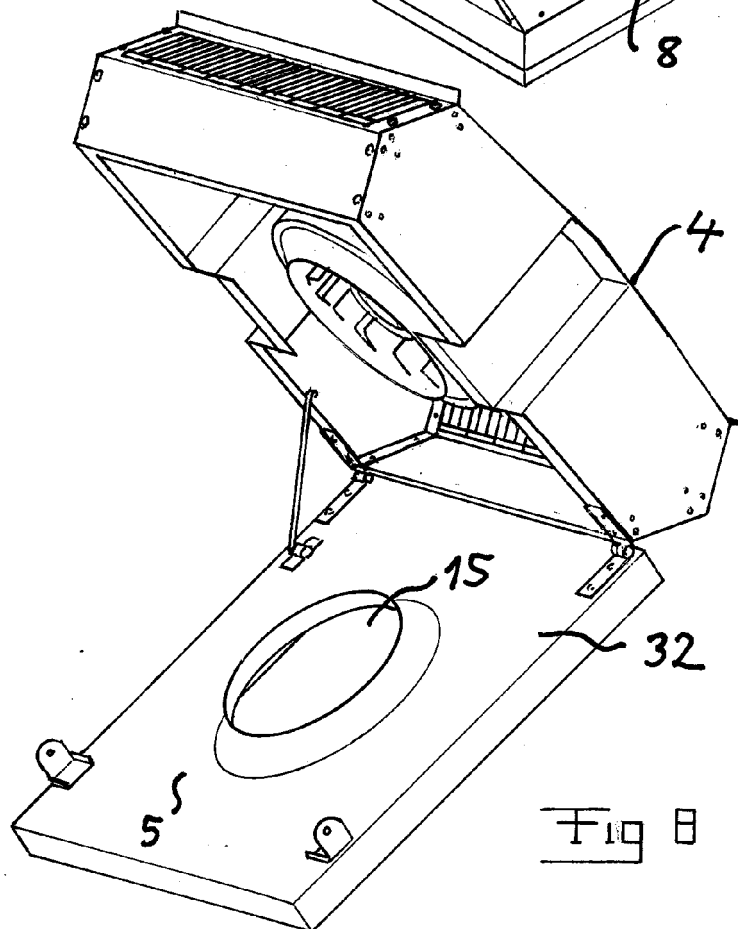
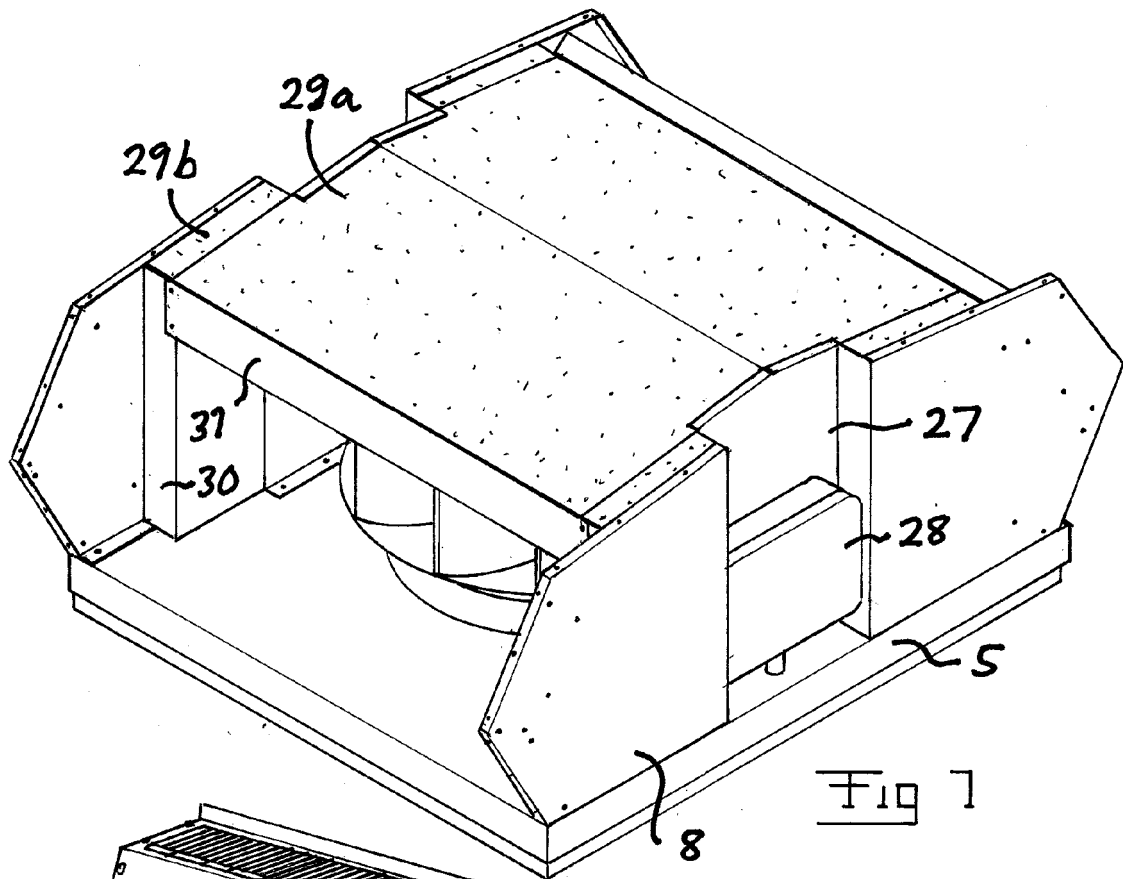
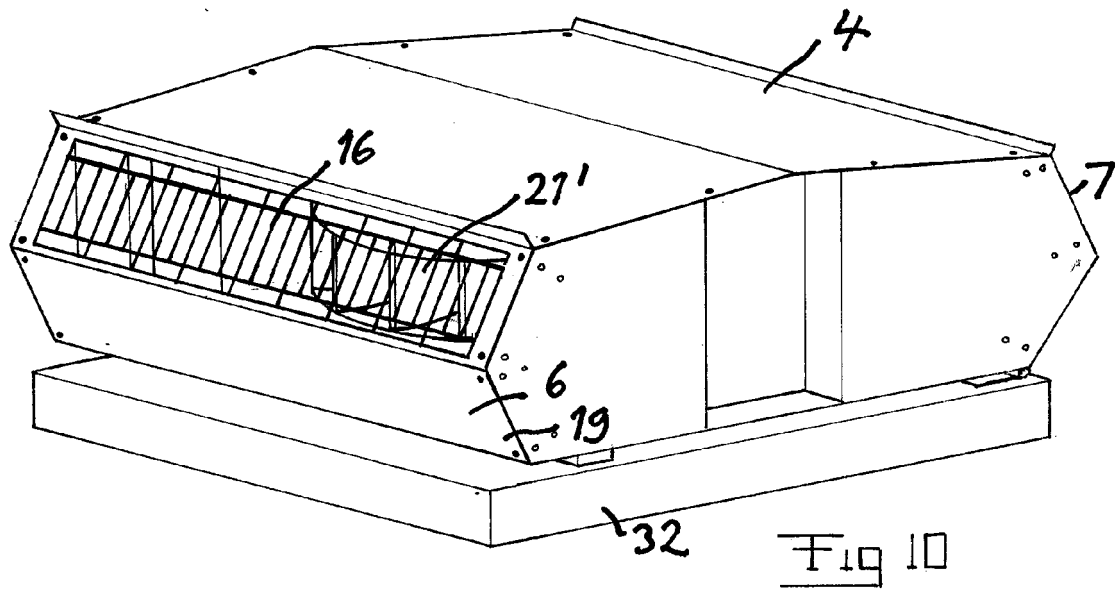
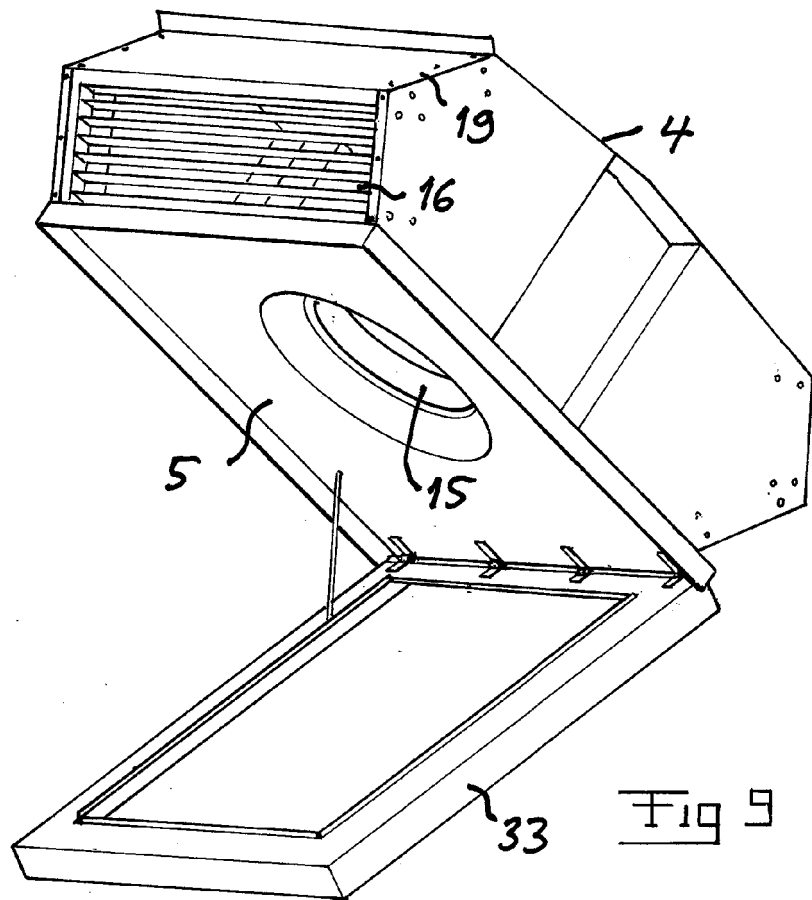
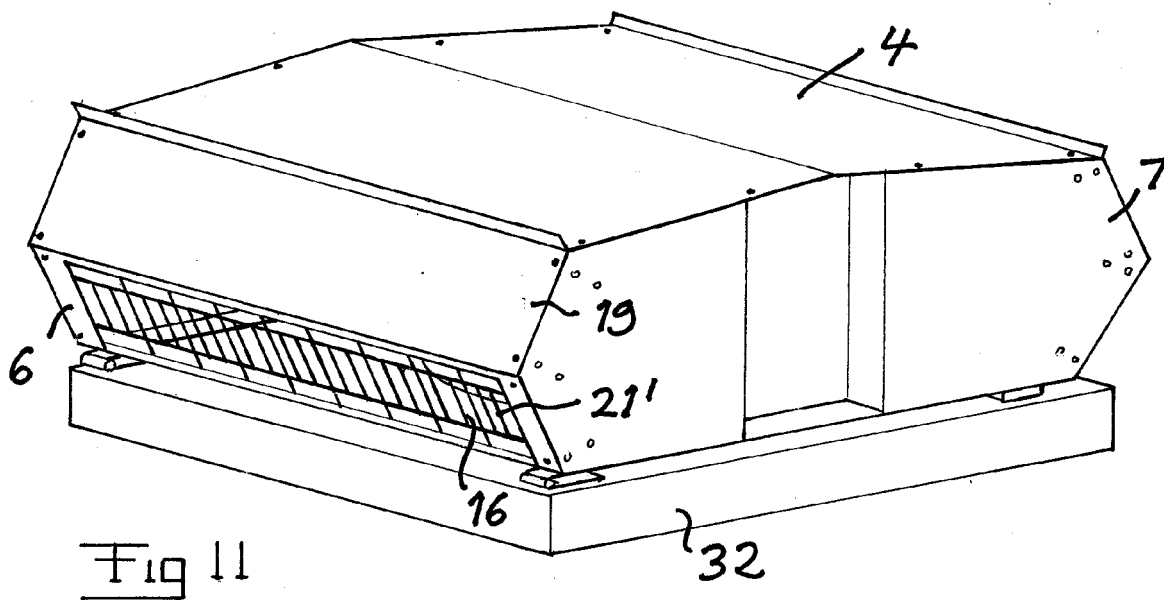


Fig 6









EUROPEAN SEARCH REPORT

Application Number
EP 08 17 0376

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 1 512 294 A (FRIEDLING G [CH]) 1 June 1978 (1978-06-01) * column 4, line 7 - line 36; figures 1,7 *	1,4,8-14	INV. F04D25/10 F04D25/14 F04D29/42 F24F7/02
A	GB 2 213 926 A (GEBHARDT GMBH WILHELM [DE]) 23 August 1989 (1989-08-23) * page 15, paragraph 4; claims 14-16; figures 14,15 *	1	
A	US 3 946 648 A (SCHNEIDER HEINRICH) 30 March 1976 (1976-03-30) * column 4, line 22 - line 27; figures 1,2 *	1	
A	JP 58 020998 A (SHIMIZU CONSTRUCTION CO LTD) 7 February 1983 (1983-02-07) * abstract; figures 2,3 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			F04D F24F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 17 April 2009	Examiner de Martino, Marcello
CATEGORY OF CITED DOCUMENTS		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	
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			

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EPO FORM 1503 03.82 (P04C01)

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

EP 08 17 0376

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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17-04-2009

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
GB 1512294	A	01-06-1978	AT	354595 B	10-01-1979
			BE	836622 A1	15-06-1976
			CH	591632 A5	30-09-1977
			DE	2556022 A1	24-06-1976
			FR	2295270 A1	16-07-1976
			IT	1051622 B	20-05-1981
			SE	425119 B	30-08-1982
			SE	7514111 A	17-06-1976

GB 2213926	A	23-08-1989	CH	669431 A5	15-03-1989
			DE	3438710 A1	24-04-1986
			ES	8703608 A1	01-05-1987
			FR	2572139 A1	25-04-1986
			GB	2165938 A	23-04-1986
			IT	1200727 B	27-01-1989
			JP	61114036 A	31-05-1986
			NL	8502388 A	16-05-1986
			SE	460224 B	18-09-1989
			SE	8503636 A	24-04-1986
			US	4768424 A	06-09-1988
			ZA	8506475 A	30-04-1986

US 3946648	A	30-03-1976	DE	2209301 B1	05-07-1973
			GB	1424719 A	11-02-1976
			SE	392749 B	18-04-1977

JP 58020998	A	07-02-1983	JP	1382117 C	09-06-1987
			JP	61047998 B	22-10-1986
