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(54) A duct fan

(57) A duct fan has a single plate (18) connected at a first end thereof to a part (21) of a housing of the duct fan close to a first end wall and at an opposite second end thereof to a part (28) of the housing close to a second end wall. The single plate (18) extends laterally in a direction substantially perpendicularly to the axis of rotation of an impeller (6) of the duct fan for connecting to opposite lateral walls of the housing for forming a partition wall between a suction side room (11) and a pressure side room (16) of the housing. An outlet member (13) and an inlet member (8) of the housing have a circular cross-section for connecting the duct fan to ducts with a circular cross-section.

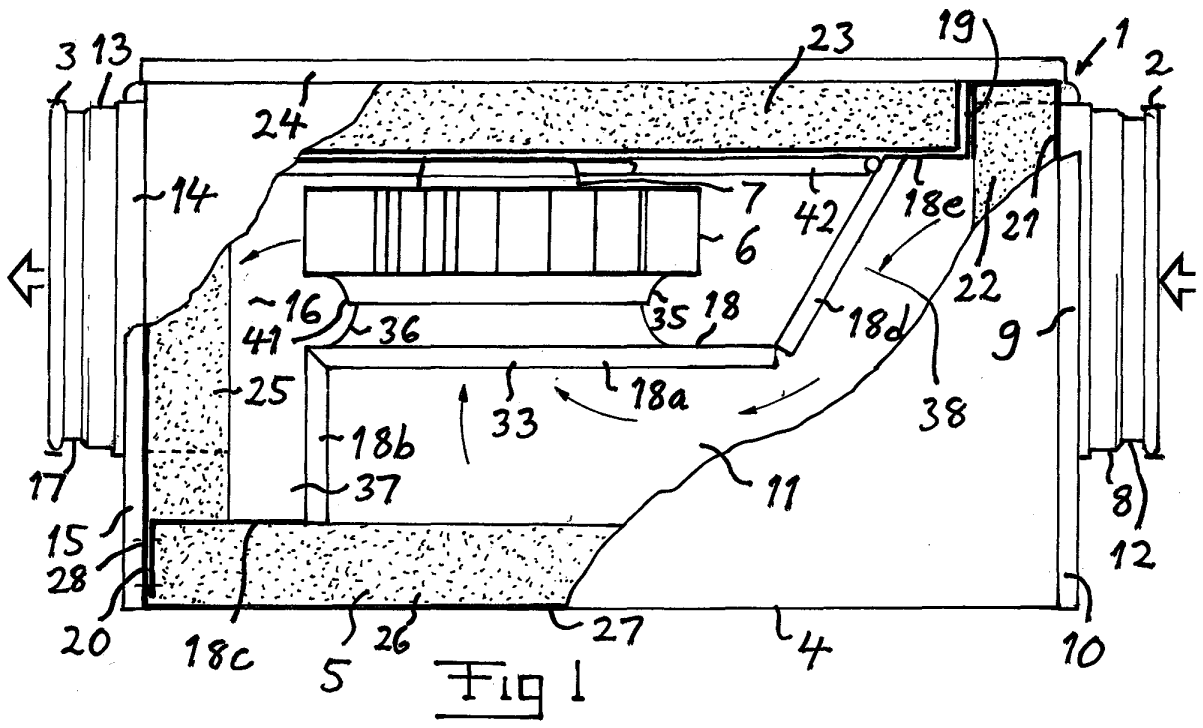

Fig 1

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Description

TECHNICAL FIELD OF THE INVENTION AND PRIOR ART

[0001] The present invention relates to a duct fan adapted to be arranged in a duct for transport of air between an upstream duct part and a downstream duct part according to the preamble of appended claim 1.

[0002] Accordingly, duct fans are fans installed in ducts for transport of air for forcing air through these ducts and they are sometimes also called "in line centrifugal fans". The ducts may be of any type in which it is a desire to transport air, such as ventilation ducts in any type of building, such as in dwelling houses, in industrial premises, in sport halls and the like, and air is here to be interpreted to include any gases or gas mixtures, such as air contaminated with any other gas, such as carbon monoxide.

[0003] The invention is particularly, but not exclusively, directed to insulated duct fans, which is the reason for predominantly discussing that type of duct fans in this disclosure. Insulated duct fans are for example used where it is important to eliminate or strongly reduce noise created by the operation of the fan member and in buildings or rooms where the risk of fires is high and the fireproofness is to be kept at a high level. Said insulating layer is normally substantially thicker than rigid plates that define the shape of the housing and form the external walls thereof, and it may for example typically have a thickness of 50 mm. The considerable thickness of the insulating layer makes it delicate to totally enclose the pressure side room of the fan containing the fan member for obtaining an optimum insulation thereof, which is the reason why such duct fans are not provided with any insulation of the pressure side room when the height thereof has to be kept at a low level. Moreover, problems with noises are mostly much greater in the suction side room and the duct connecting thereto.

[0004] Duct fans for transport of air in circular ducts were until now mostly so-called circular duct fans having an impeller with the axis of rotation substantially in parallel with direction of the main transport of air from the inlet to the outlet of the fan and when installed between an upstream duct part and a downstream duct part by that substantially in parallel with the extension of that duct in that region. However, such circular duct fans require comparatively much space in the direction perpendicular to said axis of rotation of the impeller, which often means in the vertical direction, since the ducts in question are often extending directly under or in ceilings of buildings. This means waste of space that may be utilised in a more efficient way. Furthermore, the pressure that may be obtained through such a circular duct fan in a duct is not as high as desired, at the same time as the noise level is rather high.

[0005] Duct fans of the type defined in the preamble of appended claim 1, i.e. having a radial impeller having the axis of rotation substantially perpendicular to the direction of the main transport of air from the inlet to the outlet, have for that sake been put on the market, inter alia through the present applicant. Such duct fans may be constructed with smaller dimensions in the transversal direction thereof, i.e. in the direction substantially perpendicular to the direction of the main transport of air from the inlet to the outlet, which in the practise means a lower height and less space demand in that context. Although such a duct fan is preferred with respect to a circular duct fan also with respect to obtainable pressure, noise level and efficiency, there is a desire to further improve the properties thereof.

[0006] Known duct fans of this type are for example so-called double-inlet fans including a fan member casing attached to a fan plate. However, this construction is rather complicated, which is also the case for duct fans of another known type having a worm plate with attachments for enclosing the impeller and a further fan plate ceiling member for restricting the pressure side of the fan with respect to the suction side thereof.

SUMMARY OF THE INVENTION

[0007] The object of the present invention is to provide a duct fan of the type defined in the introduction, which is improved with respect to such duct fans already known.

[0008] This object is according to the invention obtained by providing such a duct fan according to the appended claim 1.

[0009] This means that a duct fan of the type defined in the introduction adapted for connection to ducts having a circular cross-section and in which the interior of the fan is efficiently divided into the suction side room and the pressure side room being properly sealed with respect to each other is obtained.

[0010] According to an embodiment of the invention said single plate also forms a wall for connecting the suction side of said fan member to said suction side room. This means that only one single plate is needed for forming the wall for connecting the suction side of the fan member to the suction side room and to divide the interior of the fan into a suction side room and a pressure side room being properly sealed with respect to each other resulting in a saving of material as well as labour when producing the duct fan.

[0011] According to another embodiment of the invention said single plate is arranged to extend substantially diagonally through said housing from a first connecting location in the upper region of said first end wall to a second connecting location in the lower region of said second end wall, and the fan member is arranged in the pressure side room thus restricted by said single plate. This means a possibility to efficiently utilise the entire interior of the duct fan for air transport while forming a suction side room and a pressure side room having a volume and design advantageous for an efficient transport of air through the duct fan.

[0012] According to another embodiment of the inven-

tion said single plate is bent to have a first part forming a wall extending substantially in parallel with bottom and top walls of said housing for connecting the suction side of the fan member to said suction side room. Such a wall for connecting the suction side of the fan member to said suction side room is possible especially for a fan member with an impeller having blades curved backwards with respect to the rotation direction of the impeller arranged with the axis of rotation substantially perpendicular to said wall.

[0013] According to another embodiment of the invention a part of said single plate forms a wall for connecting the suction side of the fan member to said suction side room and provides a nozzle from said suction side room opening into said fan member by a flange formed in said single plate. Such a flange may easily be formed by for example cold working of the plate for forming a collar-like nozzle thereby.

[0014] According to another embodiment of the invention said single plate is formed by a plate being substantially rectangular in a flat state thereof and being shaped. Thus, said single plate in the housing of the duct fan may easily be manufactured out of a flat, substantially rectangular plate.

[0015] According to another embodiment of the invention the impeller has blades curved backwards with respect to the rotation direction of the impeller. This makes the duct fan especially suited for higher air pressures, where it has a commercially interesting efficiency. This design of the impeller also facilitates cleaning of the impeller.

[0016] According to another embodiment of the invention, when viewing the housing in the direction of the axis of rotation of the impeller, the axis of rotation of the impeller is offset with respect to a straight line extending through said housing from the centre of the inlet opening to the centre of the outlet opening. Such an offset location of the impeller further improves the efficiency and the capacity of the fan.

[0017] According to another embodiment of the invention the impeller is so positioned in said pressure side room that lateral walls of the housing restricting the pressure side room jointly act as a shell surrounding the impeller while increasing the distance thereto in the direction of rotation of the impeller towards said outlet member. Thus, this position of the impeller means that the pressure side room forms itself a shell improving the efficiency and the capacity of a fan having an impeller with blades curved backwards.

[0018] According to another embodiment of the invention the duct fan comprises a further plate fixedly secured to at least one wall of the housing and extending in said pressure side room substantially in parallel with the top wall of the housing, and the impeller with motor is suspended in this further plate. This means that the motor and impeller may be very accurately positioned with respect to said housing with substantially no change of said position over the lifetime of the duct fan, so that the suction side of the duct fan may be connected to a wall connecting the suction side of the fan member to the suction side room with smaller tolerances than if the motor with impeller would instead be suspended in a lid pivoted with respect to the rest of the housing. Another advantage of having the motor suspended in such a plate is that the electrical cable thereto may be led through a fixed part of the housing, such as an end wall thereof.

[0019] According to another embodiment of the invention the duct fan is an insulated duct fan with walls defining said housing at least partially internally coated by an insulating layer of a material for sound or sound and fire insulating the fan with respect to the exterior. A duct fan of this type is particularly well suited to be used when there is a need to provide a sound or sound and fire insulation of the fan, since it may in spite of the thicker walls resulting from such insulating layers be made with a comparatively low demand on place.

[0020] According to another embodiment of the invention said single plate is connected at a first end thereof to a plate of said housing forming said first end wall and at an opposite second end thereof to a plate of the housing forming said second end wall through a respective connecting member extending through said insulating layer, which constitutes a preferred way to safely secure said single plate inside the housing.

[0021] According to another embodiment of the invention said single plate is bent to have a second part extending downwards for connecting to said second end wall plate.

[0022] According to another embodiment of the invention said single plate is bent to have a third part extending upwards at a distance to an insulating layer on said first end wall of the housing for reaching a top wall insulating layer of the housing at a distance to said first end wall insulating layer and a fourth part connecting to said third part and bent to extend further towards said first end wall for connecting to a plate of said housing forming said first end wall. The gap formed by said distance of said single plate through the insulating layer on said first end wall increases the cross-section area of the suction side room of the duct fan and the opening of the inlet member, which will also improve the efficiency and the capacity of the duct fan.

[0023] According to another embodiment of the invention said single plate is bent along the opposite borders thereof extending along an opposite said lateral housing wall each so as to form edge plate portions extending in parallel with the respective lateral wall insulating layer and bearing thereagainst. These edge plate portions of said single plate bearing by surfaces thereof against the insulating layer of the lateral walls of the duct fan housing are favourable for obtaining an efficiently sealed restriction of the suction side room with respect to the pressure side room along said lateral walls of the housing.

[0024] According to another embodiment of the invention the impeller with motor is suspended in a plate internally coated with a said insulating layer while forming at

least a part of the top wall of said housing and designed as a lid hinged with respect to the rest of the housing for enabling pivoting of this lid upwards for lifting the impeller with motor out of said housing for inspection, maintenance and/or cleaning.

[0025] According to another embodiment of the invention only walls of said housing defining said suction side room are internally coated with a said insulating layer. This type of insulated duct fan without insulation of the pressure side room may be made very compact while ensuring insulation where it is needed the most, i.e. in said suction side room.

[0026] According to another embodiment of the invention constituting a further development of the previous embodiment at least the bottom and opposite lateral walls of said suction side room are internally coated with a said insulating layer, which may result in a considerable sound insulation of the fan.

[0027] According to another embodiment of the invention, when viewing the housing in the direction of the axis of rotation of the impeller, said inlet member is offset with respect to a straight line extending through said housing at equal distances to the outer lateral limitations of the housing so as to be displaced towards a first such lateral limitation defined by a first lateral wall of the housing, and a second lateral wall defining said suction side room opposite to said first lateral wall is internally coated by a thicker insulating layer than the insulating layer on said first lateral wall. Such a thicker insulating layer on said second lateral wall made possible by said offset location of the inlet member is especially advantageous for obtaining a high degree of sound insulation, especially for lower frequencies, such as in the region of 100-500 Hz.

[0028] According to another embodiment of the invention said suction side room is prolonged in the direction opposite to the direction of the main transport of air from the inlet to the outlet of the housing by a part extending towards the inlet beyond the limitation of the pressure side room closest to said inlet by at least 20%, at least 50%, at least 100%, 100-300% or 100-200% of the longitudinal extension of said housing from the outlet member to said limitation of the pressure side room for forming a prolonged suction side room beyond said pressure side room limitation. Such a prolongation of an insulated said suction side room results in a duct fan with improved insulating properties in the part where it is really needed while keeping the height of the duct fan at a low level.

[0029] According to another embodiment of the invention constituting a further development of the previous embodiment said prolonged part of the suction side room has the top wall, the two lateral walls as well as the bottom thereof internally coated by a said insulating layer, which results in a very efficient insulation of said suction side room and by that of the duct fan.

[0030] According to another embodiment of the invention the top wall of said prolonged part of the suction side room is coated by an insulating layer being thicker than the insulating layer covering the bottom of said prolonged part. The top wall of the prolonged part may be made thick without influencing the height of the duct fan, since it is located beyond the pressure side room, so that the latter fact may be utilized for obtaining an improved insulation, especially with respect to noises of said lower frequencies.

[0031] According to another embodiment of the invention said thicker insulating layers coating said second lateral wall and said top wall are substantially equally thick, which may simplify the production of the duct fan.

[0032] According to another embodiment of the invention said thicker insulating layer has a thickness exceeding the thickness of said other insulating layer by at least 50% or by 75-125%. Such a thickness of the thicker insulating layer results in a remarkably improved insulation, especially sound insulation with respect to noises of lower frequencies. It is especially preferred to have said thicker insulating layer having a thickness exceeding the thickness of said other insulating layer by 100%.

[0033] Further advantages as well as advantageous features of the invention will appear from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] With reference to the appended drawings, below follows a specific description of insulated duct fans according to embodiments of the invention.

[0035] In the drawings:

Fig 1 is a side elevation of an insulated duct fan according to a first embodiment of the invention with parts of the walls broken away for showing the interior of the housing of the fan,

Fig 2 is a view from above of the duct fan according to fig 1 with parts of the upper housing wall forming lid broken away,

Fig 3 is a perspective view of the duct fan according to fig 1 with parts of the interior thereof indicated by dashed lines for showing the internal construction of the duct fan,

Fig 4 is a view corresponding to Fig 1 of a duct fan according to a second embodiment of the invention,

Fig 5 is a perspective view of the duct fan according to Fig 4 with the top wall with insulation removed for showing the interior of the pressure side room thereof,

Fig 6 is a view corresponding to Fig 1 of a duct fan according to a third embodiment of the invention,

Fig 7 is a simplified view of the duct fan according to

Fig 6 from above with parts of the top wall broken away for showing the interior of the housing of the fan,

Fig 8 is a view from below of the duct fan according to Figs 6 and 7 with parts of the bottom broken away for showing the interior of the housing of the fan,

Fig 9 is a perspective view from below of the duct fan according to Figs 6-8 with the lateral walls, the bottom and the bottom insulating layer removed for especially illustrating the design of the rest of the insulating layers of the duct fan,

Fig 10 is a view corresponding to Fig 1 of a duct fan according to a fourth embodiment of the invention corresponding to that according to Fig 6 but without a prolongation of the suction side room, and

Fig 11 is a view corresponding to Fig 1 of a duct fan according to a fifth embodiment of the invention corresponding to that according to Fig 10 but without insulation.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0036] An insulated duct fan according to a first embodiment of the invention is illustrated in appended fig 1-3 and will now be described while simultaneously making reference to all these figures. The duct fan 1 is adapted to be arranged in a duct for transport of air between an upstream duct part 2 and a downstream duct part 3 schematically indicated in fig 1. These two duct parts 2, 3 are in this case in line (see fig 2), and a fan of this kind is also called an in line fan. The fan comprises a housing 4 preferably made of metal sheet plates and having substantially the shape of a rectangular parallelepiped. The walls of the housing so formed are internally coated by an insulating layer 5, which here has a thickness of about 50 mm, whereas the thickness of said metal sheet may be in the order of one or a few mm. The insulating layer is made of a material having superior sound or sound and fire insulating properties, for example rock wool coated by an air tight material. The housing 4 encloses a fan member in the form of an impeller 6 and a schematically indicated motor 7 for rotation thereof. An insulated duct fan of this type has typically an air flow of 0.10 m^3/sec - 1 m^3/sec, but the invention is not restricted to this range.

[0037] The duct fan also comprises an inlet member 8 defining an opening 9 in a first end wall 10 of the housing and adapted to connect a suction side room 11 of the housing to a said upstream duct part with a circular cross-section by means of a suitable connecting member 12 with a circular cross-section for sucking air in therefrom. The fan also comprises an outlet member 13 defining an opening 14 in a second end wall 15 of the housing opposite to said first end wall and adapted to connect a pressure side room 16 of the housing to a said downstream duct part with a circular cross-section by means of a suitable connecting member 17 with a circular cross-section for exhausting air thereto.

[0038] The duct fan comprises a single plate 18 which is shaped out of a substantially rectangular metal sheet. This single plate extends substantially diagonally through the housing from a first connection location 19 in the upper region of the first end wall 10 to a second connecting location 20 in the lower region of the second end wall 15 for dividing the interior of the housing into said suction side room 11 and said pressure side room 16. The single plate 18 is in the first connecting location 19 attached to a plate 21 of the first end wall 10 through a prolongation of this plate 21 extending around the insulating layer 22 on the first end wall by a part of the single plate 18 extending in between the insulating layer 23 arranged inside the top wall 24 of the housing and the insulating layer 22. The connection at the second connecting location 20 is obtained by a part of the single plate 18 extending in between the insulating layer 25 on said second end wall 15 and the insulating layer 26 located on top of the bottom wall 27 of the housing and downwards for connecting to a plate 28 of the second end wall 15. These two connections may for instance be done by riveting or any other suitable means or even obtained solely by bearing under or without pretension.

[0039] Said single plate 18 extends laterally in a direction substantially perpendicular to the axis of rotation of the impeller 6 and to the direction of the main transport of air from the inlet member 8 to the outlet member 13 for connecting to insulating layers 29, 30 on plates of opposite lateral walls 31, 32 of the housing. Said single plate 18 is for efficiently sealing against these insulating layers 29, 30 bent along the opposite borders thereof extending along an opposite lateral housing wall each so as to form edge plate portions 33 extending in parallel with a respective lateral wall insulating layer and bearing thereagainst. This means that said single plate 18 efficiently forms a partition wall between the suction side room 11 and the pressure side room 16. Thus, said insulating layers 29, 30 are to be considered to belong to said lateral walls, and said single plate 18 connects to such layers when present when it connects to opposite lateral walls of said housing 4.

[0040] Said single plate 18 is further bent to have a first part 18a forming a wall extending substantially in parallel with the bottom 27 and top wall 24 of the housing for connecting the suction side 35 of the fan member with said suction side room 11. This is more exactly done by a nozzle 36 made by shaping a flange out of said single plate 18.

[0041] The single plate 18 is also bent to have a second part 18b extending downwards at a distance to the insulating layer 25 on the second end wall of the housing for reaching the bottom wall insulating layer 26 at a distance

to the second end wall insulating layer 25 and a fifth part 18c connecting to the second part and bent to extend further towards the second end wall for connecting to the second end wall plate 28 at the location 20.

[0042] The single plate is further bent to have a third part 18d extending from said first part 18a upwards, here inclined, at a distance to the insulating layer 22 on the first end wall for reaching the top wall insulating layer 23 at a distance to the first end wall insulating layer 22 and a fourth part 18e connecting to the third part and bent to extend further towards said first end wall for connecting to the first end wall plate 21 at the location 19. The gaps 37 and 38 formed at the outlet and the inlet of the housing by said distances between the single plate 18 and the respective insulating layer increase the cross-section area of the pressure side room and the suction side room at the outlet and inlet, respectively, which under certain circumstances may result in an improved capacity of the duct fan. Said distances forming these gaps are in the present case about 20 mm for the gap 37 and about 70 mm for the gap 38.

[0043] The impeller 6 has blades 39 curved backwards with respect to the rotation direction of the impeller. This results in an increased efficiency of the fan member without any need of a shell. The impeller 6 is positioned in the pressure side room so that walls of this room jointly act as a shell for the impeller. This is achieved by arranging the impeller with the axis 40 of rotation thereof offset with respect to a straight line extending through the housing from the centre of the inlet opening 9 to the outlet opening 14. Thus this location improves the capacity, i.e. pressure/flow, of the duct fan according to the invention further. For an impeller of this type it will also be easier to clean the blades thereof upon maintenance of the duct fan.

[0044] Reference is now also made to Figs 4 and 5. A further plate 42 in the form of a so-called motor bridge, is by a bent over part 43 fixedly secured to a plate 28 of the second end wall and to said single plate while extending in the pressure side room substantially in parallel with the top wall of the housing. The impeller 6 with motor is suspended in this further plate, which means that the lid 24 may be pivoted upwardly for inspection of the interior of the housing without changing the position of the impeller with motor for that sake. It is also possible to lead the electrical cable through a fixed part of the housing when arranging the impeller with motor fixedly on such a motor bridge plate 42.

[0045] The impeller 6 with motor may also be suspended in the lid hinged with respect to the rest of the housing for enabling pivoting of this lid upwards for lifting the impeller with motor out of the housing for inspection, maintenance and/or cleaning (not shown). The impeller has lower circumferential portions 41 adapted to form a wrap-over with respect to the nozzle 36 with a small clearance when the lid is swung down for guiding substantially all air from the inlet room to the outlet room through the impeller.

[0046] Only those parts of other embodiments of the invention shown in Figs 4-11 differing from the embodiment according to Figs 1-3 will now be described, and parts corresponding to parts of the embodiment according to Figs 1-3 are in the Figures 4-11 provided with the same reference numerals.

[0047] The embodiment shown in Fig 4 differs from the embodiment according to Fig 1 by the fact that the first part 18a of the single plate extend towards the outlet to the insulating layer 25, so that there will be no gap between the second part 18b thereof and said insulating layer as in the embodiment according to Fig 1. Furthermore, it is shown how the plate is bent in the opposite direction for creating said edge plate portions 33 extending in parallel with a respective lateral wall insulating layer and bearing thereagainst. This way of bending especially said portions of the first part 18a upwardly facilitates the introduction of said single plate from above into the housing when assembling the duct fan. These edge portions may be formed by bending in the opposite direction to that shown in the Figures for any of the embodiments of the invention.

[0048] A duct fan according to a third embodiment of the invention is illustrated in Figs 6-9. This duct fan differs from the duct fan according to Fig 1 by the fact that only walls of the housing defining the suction side room are internally coated with an insulating layer, which means that this type of duct fan may be given a low height while still obtaining an efficient insulation where it is most often needed, i.e. in the suction part thereof. Furthermore, the suction side room 11 is prolonged in the direction opposite to the direction of the main transport of air from the inlet to the outlet of the housing by a part 11' extending towards the inlet beyond the limitation 44 of the pressure side room 16 closest to said inlet. This prolongation is at least 20% and preferably at least in the order of 100% of the longitudinal extension of the housing from the outlet member 13 to said limitation of the pressure side room, so that a prolonged suction side room is formed beyond the pressure side room limitation. Such a prolonged suction side room makes it possible to obtain excellent sound insulation properties, which will be explained below. It is seen how said single plate 18 here at a first end thereof connects to the top wall plate at a distance to the first end wall 10, but the definition "one single plate connected at a first end thereof to a part of said housing close to said first end wall" as used in the claims is to be interpreted to also cover this case.

[0049] It appears from Figs 7 and 8 that, when viewing the housing in the direction of rotation of the impeller, the inlet member 8 is offset with respect to a straight line extending through said housing at equal distances to the outer lateral limitations 45, 46 of the housing so as to be displaced towards a first such limitation 45 defined by a first lateral wall 32 of the housing. This makes it possible to internally coat a second lateral wall 31 defining said suction side room opposite to said first lateral wall by a thicker insulating layer 47 than the insulating layer 48 on

the first lateral wall.

[0050] It also appears from Figs 6 and 9 that it is possible to internally coat the top wall 24 of the housing by an insulating layer 49 being thicker than the insulating layer 50 covering the bottom 27 of the suction side room. In the present case the insulating layers 48 and 50 have a thickness of 50 mm, whereas the layers 47 and 49 have a thickness of 100 mm. These increased thicknesses of the insulating layers result in a reduction primarily of noises of lower frequencies, which has been shown when measuring noises of the octave bands around 125 Hz, 250 Hz and 500 Hz.

[0051] Furthermore, it is shown that the duct fan according to this embodiment is provided with a lid 51 pivoted upwards for obtaining access to the interior of the pressure side room. The impeller 6 with motor may be secured to this lid.

[0052] Fig 10 illustrates a duct fan according to a fourth embodiment of the invention corresponding to that according to Figs 6-9 except for the fact that it has no prolonged suction side room part, so that there is neither any insulating layer under any top wall of the suction side room. It is also shown how said single plate 18 is differently bent in the part thereof closest to the first end wall 10 for showing that the angle of the part 18e made to the part 18a may be arbitrarily chosen.

[0053] Finally, Fig 11 shows a duct fan according to a fifth embodiment of the invention, which differs from that according to Fig 10 by the fact that it has no insulating layers at all. This design is particularly advantageous in narrow rooms where little space is available and sound or fire insulation is not too important.

[0054] The invention is of course not in any way restricted to the embodiments thereof described above, but many possibilities to modifications thereof would be apparent for a person with ordinary skill in the art without departing from the basic idea of the invention as defined in the appended claims.

[0055] It is pointed out that the definitions top, bottom and lateral with respect to the walls of the housing is not to be interpreted as a requirement that a duct fan is to be arranged in operation thereof with these parts accordingly located, i.e. with the top wall at the top, but these definitions have been used for clearly defining the duct fan according to the invention and other orientations of these walls in operation of the fan are conceivable.

Claims

1. A duct fan adapted to be arranged in a duct for transport of air between an upstream duct part and a downstream duct part, said fan comprising a housing (4) having substantially the shape of a rectangular parallelepiped, said housing containing a fan member in the form of a radial impeller (6) having the axis of rotation substantially perpendicular to the direction of the main transport of air from an inlet to an outlet of the housing and a motor (7) for rotation thereof, an inlet member (8) defining an opening (9) in a first end wall (10) of the housing and adapted to connect a suction side room (11) of the housing to a said upstream duct part (3) for sucking air in therefrom, an outlet member (13) defining an opening (14) in a second end wall (15) of the housing opposite to said first end wall and adapted to connect a pressure side room (16) of said housing to a said downstream duct part (2) for exhausting air thereto and a member dividing the interior of said housing into a said suction side room and a pressure side room,
characterized **in that** said inlet member (8) and said outlet member (13) have a circular cross-section for connecting the duct fan to ducts with a circular cross-section, that said dividing member is formed by one single plate (18) connected at a first end thereof to a part of said housing close to said first end wall and at an opposite second end thereof to a part of the housing close to said second end wall and that said single plate extends laterally in a direction substantially perpendicularly to the axis of rotation of said impeller and to the direction of the main transport of air from said inlet member to said outlet member for connecting to opposite lateral walls (31, 32) of said housing for forming a partition wall between said suction side room (11) and said pressure side room (16).

2. A duct fan according to claim 1, ***characterized*** **in that** said single plate (18) also forms a wall (18a) for connecting the suction side of said fan member to said suction side room (11).

3. A duct fan according to claim 1 or 2, ***characterized*** **in that** said single plate (18) is arranged to extend substantially diagonally through said housing (4) from a first connecting location (19) in the upper region close to said first end wall (10) to a second connecting location (20) in the lower region close to said second end wall (15), and that the fan member (6) is arranged in the pressure side room (16) thus restricted by said single plate.

4. A duct fan according to claims 2 and 3, ***characterized*** **in that** said single plate (18) is bent to have a first part (18a) forming a wall extending substantially in parallel with bottom (27) and top (24) walls of said housing for connecting the suction side (35) of the fan member to said suction side room (11).

5. A duct fan according to any of the preceding claims, ***characterized*** **in that** a part (18a) of said single plate forms a wall for connecting the suction side (35) of the fan member (6, 7) to said suction side room (11) and provides a nozzle (36) from said suction side room opening into said fan member by a flange formed in said single plate (18).

6. A duct fan according to any of the preceding claims, ***characterized*** **in that** said single plate (18) is formed by a plate being substantially rectangular in a flat state thereof and being shaped.

7. A duct fan according to any of the preceding claims, ***characterized*** **in that** the impeller (6) has blades (39) curved backwards with respect to the rotation direction of the impeller.

8. A duct fan according to any of the preceding claims, ***characterized*** **in that**, when viewing the housing (4) in the direction of the axis of rotation (40) of the impeller (6), the axis of the rotation of the impeller is offset with respect to a straight line extending through said housing from the centre of the inlet opening (9) to the centre of the outlet opening (14).

9. A duct fan according to claim 8, **characterized in that** the impeller (6) is so positioned in said pressure side room (16) that lateral walls of the housing restricting the pressure side room jointly act as a shell surrounding the impeller while increasing the distance thereto in the direction of rotation of the impeller towards said outlet member (13).

10. A duct fan according to any of the preceding claims, ***characterized*** **in that** it comprises a further plate (42) fixedly secured to at least one wall (28) of the housing (4) and extending in said pressure side room (16) substantially in parallel with the top wall (24) of the housing, and that the impeller (6) with motor (7) is suspended in this further plate.

11. A duct fan according to any of the preceding claims, ***characterized*** **in that** it is an insulated duct fan with walls (10, 15, 24, 27, 31, 32) defining said housing at least partially internally coated by an insulating layer (22, 23, 25, 26, 29, 30, 47-50) of a material for sound or sound and fire insulating the fan with respect to the exterior.

12. A duct fan according to claim 11, ***characterized*** **in that** said single plate (18) is connected at a first end thereof to a plate (21) of said housing forming said first end wall (10) and at an opposite second end thereof to a plate (28) of the housing forming said second end wall (15) through a respective connecting member extending through said insulating layer.

13. A duct fan according to claim 3 or 4 and any of the other preceding claims, ***characterized*** **in that** said single plate (18) is bent to have a second part (18b) extending downwards for connecting to said second end wall plate (28).

14. A duct fan according to any of claims 11 and 3, 4 or 13 and any of the other preceding claims, ***characterized*** **in that** said single plate (18) is bent to have a third part (18d) extending upwards at a distance to an insulating layer (22) on said first end wall (10) of the housing for reaching a top wall insulating layer (23) of the housing at a distance to said first end wall insulating layer and a fourth part (18e) connecting to said third part and bent to extend further towards said first end wall (10) for connecting to a plate (21) of said housing forming said first end wall.

15. A duct fan according claim 11 and any of the other preceding claims, ***characterized*** **in that** said single plate (18) is bent along the opposite borders thereof extending along an opposite said lateral housing wall (31, 32) each so as to form edge plate portions (33) extending in parallel with a respective lateral wall insulating layer (29, 30) and bearing thereagainst.

16. A duct fan according to claim 11 and any of claims 12-15 not dependent upon claim 10, ***characterized*** **in that** the impeller (6) with motor (7) is suspended in a plate (24) internally coated with a said insulating layer (23) while forming at least a part of the top wall of said housing (4) and designed as a lid hinged with respect to the rest of the housing for enabling pivoting of this lid upwards for lifting the impeller with motor out of said housing for inspection, maintenance and/or cleaning.

17. A duct fan according to claim 11, ***characterized*** **in that** only walls (24, 27, 31, 32) of said housing defining said suction side room (11, 11') are internally coated with a said insulating layer (47-50).

18. A duct fan according to claim 17, ***characterized*** **in that** at least the bottom (27) and opposite lateral walls (31, 32) of said suction side room are internally coated with a said insulating layer (47, 48, 50).

19. A duct fan according to claim 17 or 18, ***characterized*** **in that**, when viewing the housing (4) in the direction of the axis of rotation of the impeller (6), said inlet member is offset with respect to a straight line extending through said housing at equal distances to the outer lateral limitations (45, 46) of the housing so as to be displaced towards a first such lateral limitation (45) defined by a first lateral wall (32) of the housing, and that a second lateral wall (31) defining said suction side room (11, 11') opposite to said first lateral wall is internally coated by a thicker insulating layer (47) than the insulating layer (48) on said first lateral wall.

20. A duct fan according to any of claims 17-19, ***characterized*** **in that** said suction side room (11) is prolonged in the direction opposite to the direction of the main transport of air from the inlet to the outlet of the housing by a part (11') extending towards the

inlet beyond the limitation (44) of the pressure side room (16) closest to said inlet by at least 20%, at least 50%, at least 100%, 100-300% or 100-200% of the longitudinal extension of said housing from the outlet member (13) to said limitation (44) of the pressure side room for forming a prolonged suction side room beyond said pressure side room limitation.

21. A duct fan according to claim 20, ***characterized*** **in that** said prolonged part (11') of the suction side room has a top wall (24), the two lateral walls (31, 32) as well as the bottom (27) thereof internally coated by a said insulating layer (47-50).

22. A duct fan according to claim 21, ***characterized*** **in that** the top wall (24) of said prolonged part (11') of the suction side room is coated by an insulating layer (49) being thicker than the insulating layer (50) covering the bottom of said prolonged part.

23. A duct fan according to claims 19 and 22, ***characterized*** **in that** said thicker insulating layers (47, 49) coating said second lateral wall (31) and said top wall (24) are substantially equally thick.

24. A duct fan according to claim 19, 22 or 23, ***characterized*** **in that** said thicker insulating layer (47, 49) has a thickness exceeding the thickness of said other insulating layer (48, 50) by at least 50% or by 75-125%.

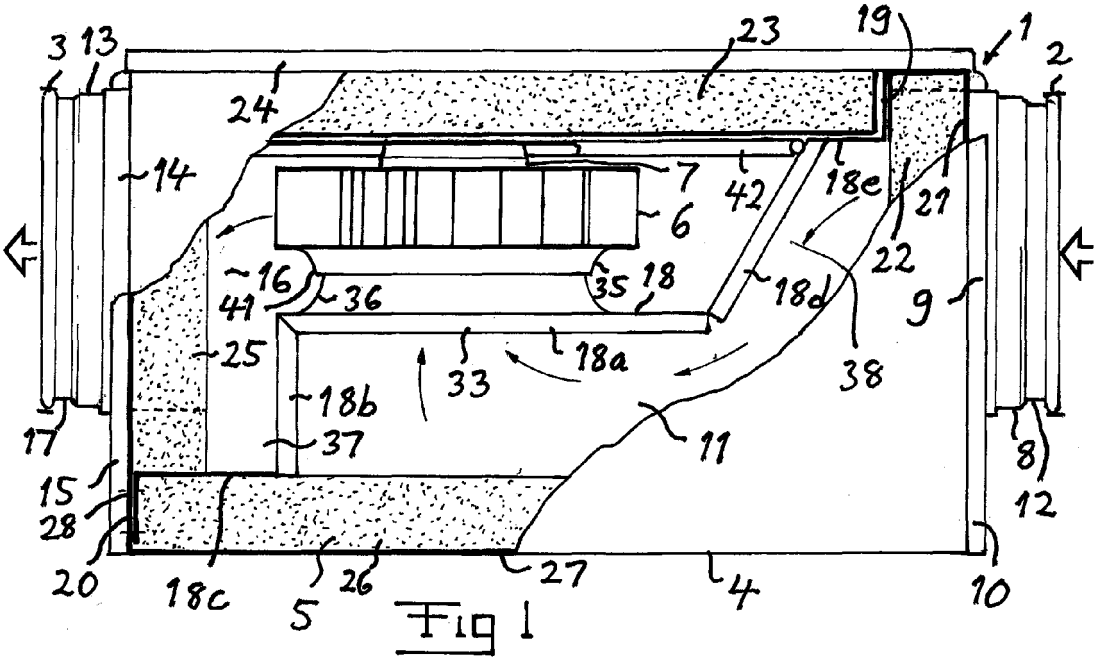
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Fig 1

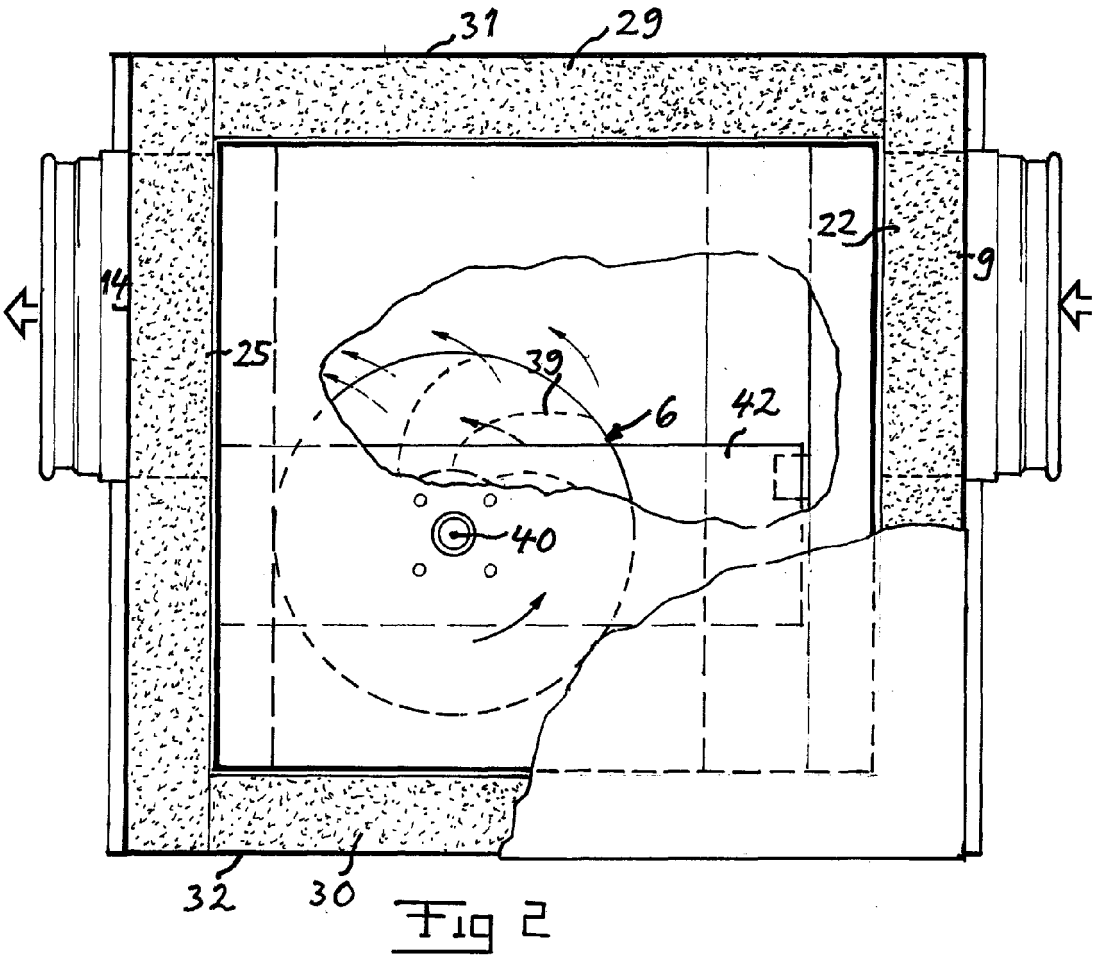
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Fig 2

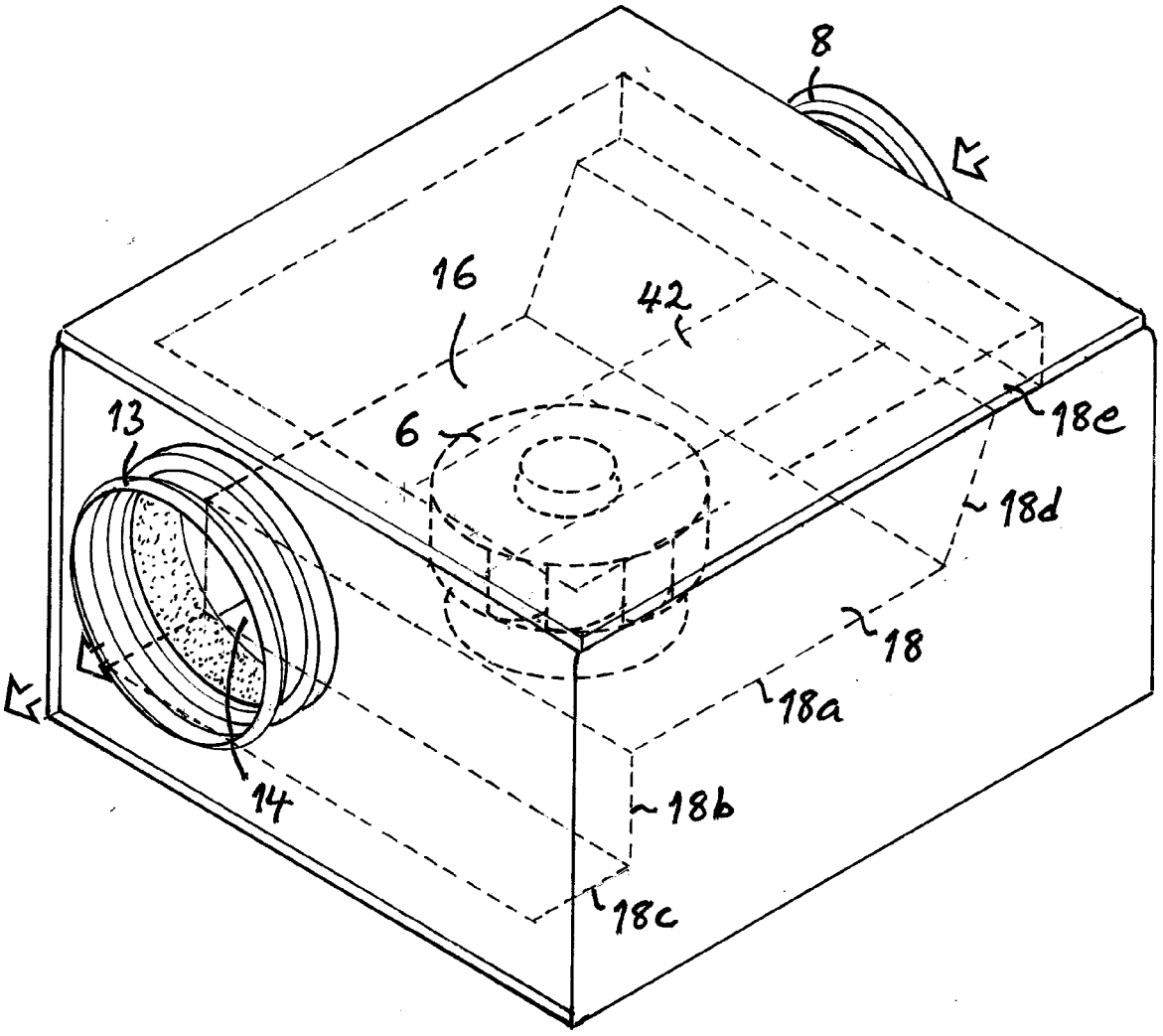

Fig 3

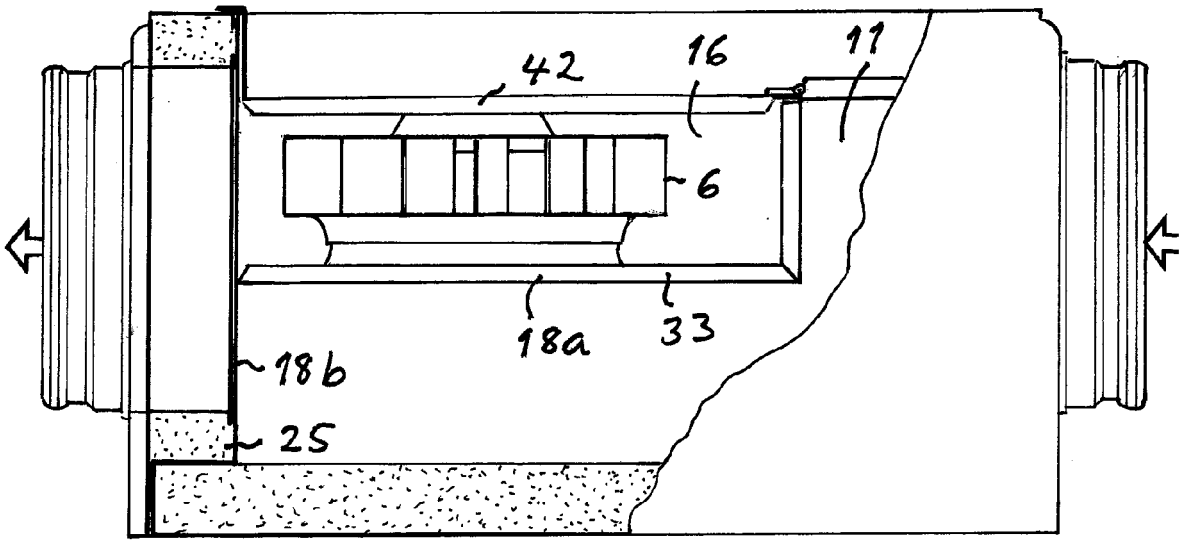

Fig 4

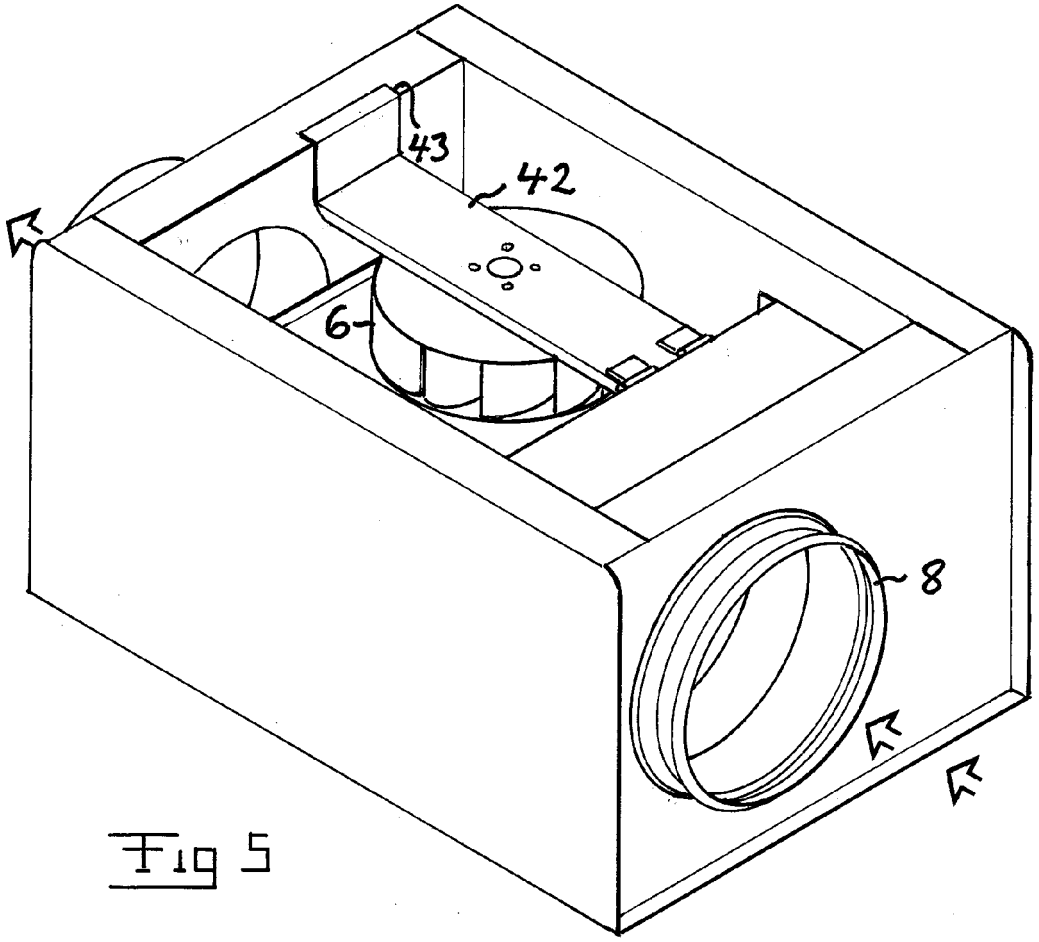

Fig 5

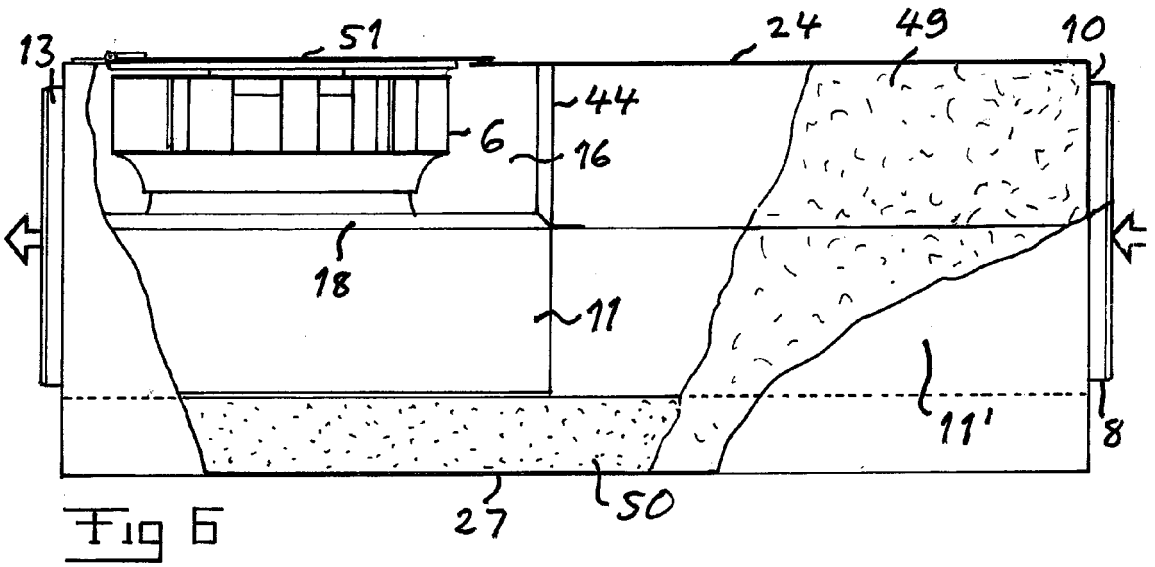

Fig 6

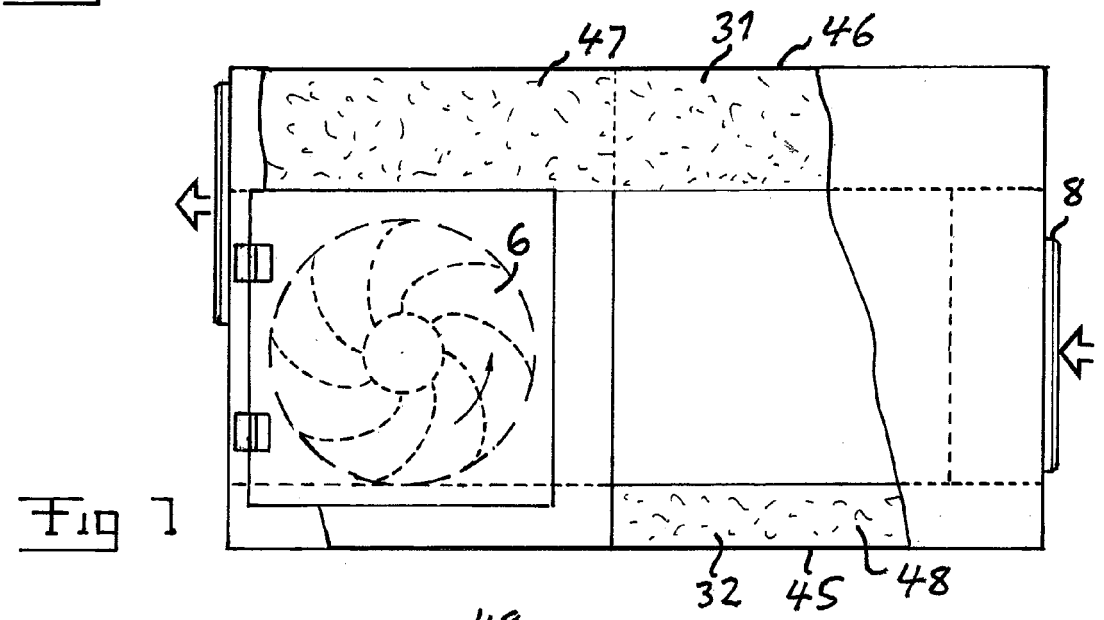

Fig 7

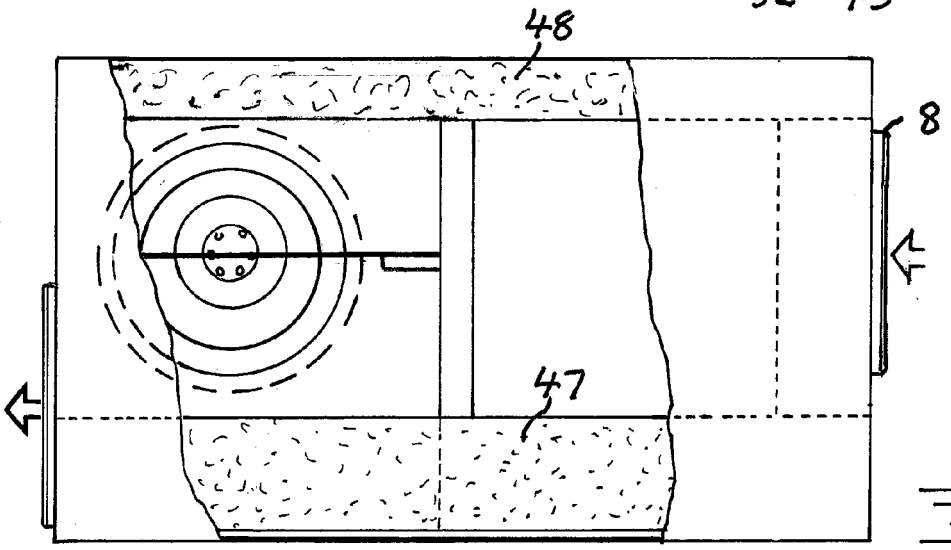

Fig 8

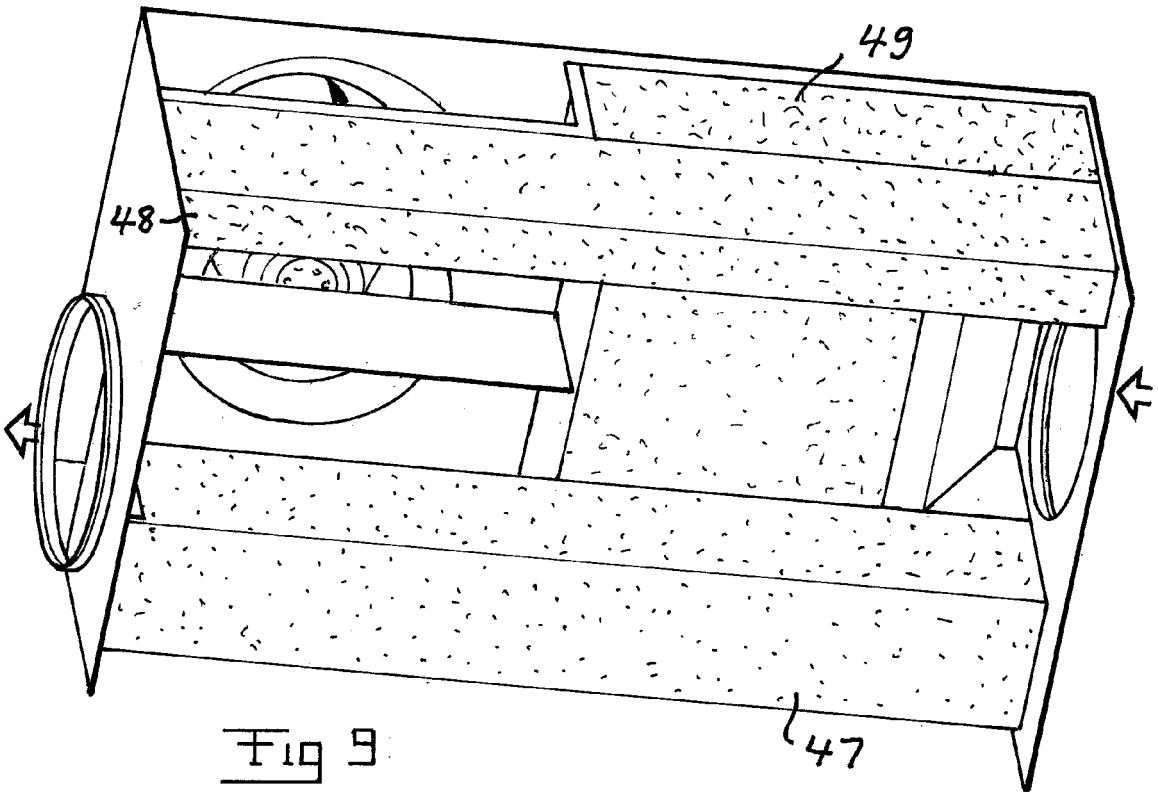

Fig 9

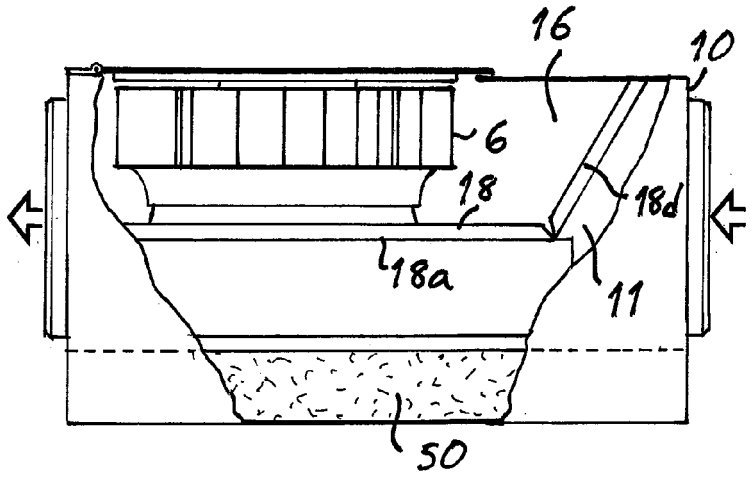

Fig 10

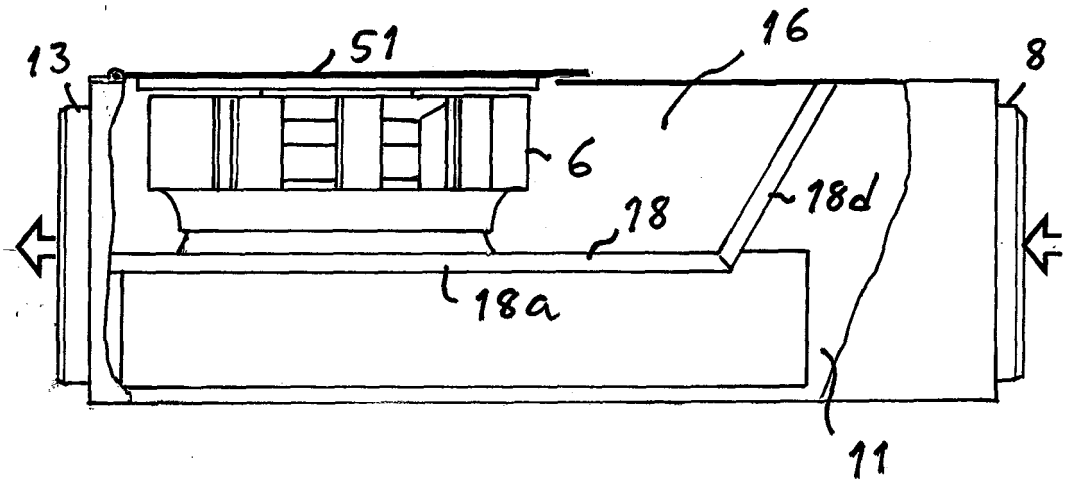

Fig 11

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 10 3516

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 657 451 A (OESTBERG HANS [SE]) 17 May 2006 (2006-05-17)	1-8,12	INV. F04D29/42
A	* paragraph [0020] - paragraph [0022]; figure 2 *	17,19,20	ADD.
X	* paragraphs [0024], [0034] *	11,13, 14,18	F24F13/20

X	FR 2 710 700 A1 (ABB FLAKT [FR]) 7 April 1995 (1995-04-07) * page 5, line 24 - page 6, line 15; figure 1 *	1,2,6	
X	* page 7, line 8 - line 27; figure 1 * * page 8, line 30 - page 9, line 6; figure 3c *	8	

X	FR 2 271 425 A1 (FIMEC [FR]) 12 December 1975 (1975-12-12)	1,2,6	
A	* page 2, line 14 - line 28 * * page 3, line 4 - line 7; figure 2 *	5,9	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 August 2007	DI GIORGIO, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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