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(54) **DEVICE FOR DISPLACEMENT VENTILATION INCLUDING FILTERS, SOUND ABSORBERS AND A FAN UNIT SUPPORTED IN A BLOCK OF SOUND ABSORBING MATERIAL.**

VORRICHTUNG ZUR VERDRÄNGUNGSVENTILATION MIT FILTERN, SCHALLDÄMPFERN UND EINER GEBLÄSEEINHEIT, DIE IN EINEM BLOCK AUS SCHALLABSORBIERENDEM MATERIAL GESTÜTZT WIRD

DISPOSITIF DE VENTILATION PAR DEPLACEMENT COMPRENANT DES FILTRES, DES ABSORBEURS DE SONS ET UN VENTILATEUR SUPPORTE DANS UN BLOC DE MATERIAU D'ABSORPTION DES SONS

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EP 1 504 226 B1

Description

Field of the invention

[0001] The invention relates to a displacement ventilation device according to the preamble of claim 1. Such a device is known from WO 93/04389.

Description of prior art

[0002] The principle of displacement ventilation is that air is introduced into a room through one or more low positioned air-supply means. The speed of the supply air through the supply surface of the air-supply means is set low resulting in a low degree of turbulence.

[0003] The supply air from the supply means is also somewhat sub-tempered, i.e. has somewhat lower temperature than the temperature of the air in the room, resulting in that the supply air, after having left the air supply means, floats out over the floor and fills the room with clean supply air from below. Used, somewhat warmer air containing i. a. particles and possibly unwanted composition of gases, will thereby be pressed up above the clean air and is typically discharged from the room through highly positioned discharge air means.

[0004] In previously known air supply means for displacement ventilation, wherein the supply air is supplied from a central ventilation system with air filters, a house comprising the means includes a conical air distributor and a permeable wall, through which the supply air is flowing with low speed into the room intended to be ventilated.

[0005] The previously known air supply means for displacement ventilation functions well but its construction brings along certain limitations as to its flexibility. WO 93/09389 discloses a ventilation and filter module wherein a fan is disposed in an end wall in connection with an air infare.

The aim and most important features of the invention

[0006] It is an aim of the invention to provide a device for displacement ventilation making possible greater flexibility than what is the case in devices according to the prior art.

[0007] This aim is achieved in a device as mentioned above through the features of the characterising portion of claim 1.

[0008] Hereby it is provided a device with possibilities of simple efficient and quick adaptation to different applications, wherein the device for air circulation allows possibility of having a lower controlled temperature of the supply air as well as a lower central supply air flow contributing to reduced energy consumption, reduced dimensions of the central system with it's fans and channels.

[0009] Further, it allows a greater freedom in adjusting the so called comfort distance from the device according to the invention, since, according to the definition of displacement ventilation, according to the above, it is presupposed that the supply air is held somewhat cooler than the air being present in the room. In order to avoid noise problems in connection with air circulation, sound absorbers are arranged at the inlet of the fan unit as well as at the outlet according to the invention. Hereby the inlet sound, which is generally most disturbing, as well as noise at the outlet is reduced. By having the fan unit being supported inside a block of sound-absorbing material, it is effectively avoided that vibrations from the fan unit are transmitted as body sounds to the framework of the device and further on to parts of the building.

[0010] It is particularly preferred that the circulation air is filtered through a circulation air filter before the inlet to the fan unit. Hereby it is achieved that the circulated air is purified before the passage of the fan unit and the sound absorbers which is a considerable advantage. In particular it may also be ensured that a circulation air filter is adapted to the conditions and expected impurities prevailing in the particular room whereas the filter-housing per se is essentially adapted to the conditions prevailing in the supply air.

[0011] The block for supporting the fan unit is connected to the inlet sound absorber and in particular said block is an integral part of the inlet sound absorber. This measure enhances provisions for sound-absorbing and reduces risk of leaking noise.

[0012] When the centrifugal fan has two axially opposite directed inlets, there is a possibility of achieving low air velocity in separate channels inside the inlet sound absorber as well as a possibility of advantageous extension of the sound absorber in a lateral direction at the same time as the device is compact in directions perpendicular to this direction.

[0013] It is highly preferred that the outlet sound absorber includes one portion for redirection of the flow essentially 180°. This allows a particularly compact arrangement of the device according to the invention since the filter-housing may be positioned in front of the outlet sound absorber and being supplied with circulating air from its one end whereas supply air is supplied through the other end of the filter-housing. This results in a preferred mixture of supply air and circulation air inside the filter-housing and in general advantageous flow-properties for the device as a supply air means. In particular it is an advantage to provide a bifurcation in the area of the connection of the outlet sound absorber to the filter-housing since this allows low velocity at the inlet of the filter-housing and excellent mixing.

[0014] It is advantageous to produce the sound absorbers from a synthetic foam material having open cells and an essentially air-tight surface layer on their external surfaces. Hereby a very good sound-absorbing effect is achieved. For clarity it should be noted that air channels being inside the parts of the sound absorbers are not lined with any air-tight layer, but that the open cells of the foam material are open towards these channels.

[0015] By the device having a modular body consisting of a rear portion (such as a rear plate), and at right angle thereto supporting planes fastenable thereto, simple production and assembling of air supply means according to the invention is achieved. In particular, and at occasions, the supporting planes may be comprised of plates having through-going short tubular portions adjoining to sound-absorbing parts positioned at either side of the supporting planes for fixing the sound-absorbing parts and simplifying drawing of channels in connection with and through said supporting planes.

[0016] Further advantages of the invention will be evident from the following detailed description.

Brief description of drawings

[0017] The invention will now be described in more detail with reference to the annexed drawings, wherein:

Fig. 1 shows, in a disassembled view, a device for displacement ventilation according to the invention,

Fig. 2 shows a modular filter-housing for use in a device according to the invention,

Fig. 3 shows another modular filter-housing for use in a device according to the invention,

Fig. 4 shows in detail an inlet sound absorber for the device in Fig. 1,

Fig. 5 shows a first portion of an outlet sound absorber of the device in Fig. 1,

Fig. 6 shows a second portion of the outlet sound absorber for use in a device according to Fig. 1, and

Fig. 7 shows diagrammatically the construction of a supporting body of a device according to the invention.

Description of embodiments

[0018] The displacement ventilation device 1 in Fig. 1 is connected to a support air conduit 2 belonging to a central support air system. The support air conduit 2 is connected to a modular filter-housing 3 which on its front side has a filter, over a supply air connection 4.

[0019] The displacement ventilation device 1 besides the filter-housing 3 also comprises a circulation housing 5 which is provided with a circulation air filter. The circulation housing 5 is over two circulating conduits 7 connected to a block for carrying a fan unit 6, over an inlet sound absorber 8 which is intended to absorb inlet noise emanating from the operation of the fan unit 6.

[0020] The outlet from the fan unit 6 goes through a channel which is drawn through an outlet sound absorber 9a, 9b, consisting of a first portion including a first connection portion 10 for connection to the fan unit and a second connection portion 11 for connection to the filter-housing 3.

[0021] Circulation air from the fan unit 6 is thus lead through the channel in the first portion 9a of the outlet sound absorber, further through the second portion 9b of the outlet sound absorber, where the flow is redirected essentially 180° so as to connect to the filter-housing 3 at an end opposite the end for the supply air connection 4.

[0022] The device 1 comprises a body consisting of a rear portion 12, essentially consisting of a plate bent to 90° for adapting to a corner of a room. Onto this rear portion 12 a number of supporting planes 13, 14, 15 and 16 are fastenable through snap action or in a corresponding manner such that they are positioned essentially at a right angle against the two main parts of the rear portion 12. The supporting planes 13-16 support the circulation housing 5, the inlet connection to the inlet sound absorber 8 comprises interface between the block of the fan unit and the outlet sound absorber and comprises the interface between the two parts 9a, 9b of the outlet sound absorber, respectively, and simultaneously support connections for the filter-housing 3.

[0023] The bottom supporting plane 16 may be arranged to support control equipment included in the device.

[0024] A cover 17 comprised of a perforated plate having provision for passage of air is arranged to cover the filter-housing 3 and the circulation housing 5. At a bottom end of the device 1, there is arranged a rounded, recessed cap 18. The fan unit block is covered with a lid 19 provided with an inner sound isolation (not shown).

[0025] The design of the displacement ventilation device 1 is very compact with the described construction and allows the inclusion of several functions at a limited area while maintaining great flexibility and highly modularised construction.

[0026] The filter-housing 3 and the circulation housing 5 are simply replaceable when they have fulfilled their function, by removing the cover 17, covering the supply air conduit 2, removing the filter-housing 3 and the circulation housing 5 after sealing inlet and outlet, respectively, and sealing the filter front with the aid of a covering sheet or the like and subsequently positioning of new modules.

[0027] In Fig. 2 the filter-housing 3 is shown in an enlarged scale with connections 4 and 20, respectively. The filter-housing 3 is designed as a closed bladder and is preferably produced from a plastic material such as polycarbonate in two halves, which are sealingly connected to each other over an encircling flange. 21 indicates three filter portions with effective filters being sealingly inserted inside the filter-housing 3.

[0028] Fig. 3 shows the circulation housing 5 which has only one filter portion 22 and two connections 23, which in this case function as outlets from the circulation housing 5.

[0029] It should be noted here that the device according to the invention can be easily supplemented with a discharge air module, which in that case is preferably positioned above the circulation housing 5 in Fig. 1 and is connected over its outlet or outlets, preferably corresponding to the outlets 23 in Fig. 3, to at least one central discharge air channel.

[0030] In Fig. 4, the inlet sound absorber 8 is shown, which in this case is integral with a block for supporting the fan unit 6. This block comprises the lower portion of the sound absorber in Fig. 4 and includes a seat 30 for the fan unit 6. The fan unit 6 includes a centrifugal fan with, as seen in the figure, downwardly directed outlet. Air is drawn through air channels 24 into the inside of the seat 30 of the fan unit 6, whereafter the air is pressed, as is usual in a centrifugal fan, out from the fan block through the outlet 31.

[0031] The fan unit 6 is in the figure shown in a position where, for clarity reasons, it is removed from its seat 30. The fan unit 6 includes a motor (not shown), a centrifugal fan which is open in two axial directions for intake from both the axial directions of the fan and a downwardly directed outlet. Fastening of the fan unit inside the seat 30 is easiest through pressing-in of the unit, which in the inserted position is held through the friction from the elastically adjoining portions of the seat.

[0032] In Fig. 5 the first part 9a of the outlet sound absorber is shown in an enlarged scale. The air channel 25 starts with a portion 25 which has a square section, so as to essentially correspond in its shape to the outlet 31 (Fig. 4) and in the inside of the portion 9a change into a circular section.

[0033] The second part 9b of the outlet sound absorber is shown in Fig. 6, wherein the inlet hole 26 for this portion is shown, which comprises an extension of the channel 25 of the portion 9a in Fig. 5. In the inside of the portion 9b the channel 26 bifurcates into two channels 27 and 28 in the second connection portion 11 of the outlet sound absorber. The flow is thus in operation redirected so that a redirection of essentially 180° of the flow is obtained.

[0034] It is preferred that all parts comprising sound absorbers in the device according to the invention are comprised of complete parts in a synthetic foam material having open cells. On the outside the whole elements of the sound absorbers are surface-covered so as to form an air-tight external layer which provides a clear and effective damping effect. Suitable materials for use in the sound-absorbing portions is polyurethane foam, and the surface-covering could be a suitable synthetic lacquer, such as a polymeric surface-layer. It is however not excluded that the sound absorbers are comprised of more parts or fewer parts. In principle one single integral element could be used, which thus would include sound absorbers for inlet and outlet as well as the seat of the fan unit.

[0035] In Fig. 7 the support body of the device is shown in more detail having the rear portion 12 being comprised essentially of a plate which is bent into a 90° angle and four supporting planes. The supporting planes are provided with a number of holes 29 corresponding to the present use, whereby the hole or holes in each supporting plane corresponds to the use in question. As is indicated above, it is preferred that a pipe part is inserted into each hole (not shown here) for connection to an adjoining sound-absorbing portion or filter housing.

[0036] Connection of the supporting planes to the rear portion 22 is accomplished in a suitable manner such as through a cut-out tongue into a downwardly bent edge-portion 32 on the supporting plane 13 which rests in a pocket-like protrusion 31 having an opening 33 in the rear portion 12.

[0037] It should be noted that other forms of devices according to the invention than quarter-circular, that is for positioning in a corner, may be contemplated. In other shapes, such as semi-circular, for positioning against a plain wall or completely circular or elliptical, for free-standing purposes, or recessed into a wall, the rear portion is preferably constructed as a plane plate possibly having bent out portions for support of supporting planes, which at occasions, if necessary, may also be supported by cantilever-like elements.

[0038] The fan may be made differently, for example having its inlet from only one direction. Other basic types of fans may also be used such as for example axial fans.

Claims

1. Device (1) for displacement ventilation in a room and including: a filter-housing (3) with a filter for supply air being supplied to the device, a supply air conduit connection, means (5, 6) for air circulation and sound absorber means,

wherein

- the means (5, 6) for air circulation including a fan unit (6) for feeding of circulation air from the room into the filter-housing (3),
- an inlet sound absorber (8), for sound reduction at the inlet of the fan unit (6), and
- an outlet sound absorber (9a, 9b), for sound reduction at the outlet of the fan unit (6), **characterised in that** the fan unit (6) is supported in a block of sound absorbing material, said block being connected to the inlet sound absorber (8) by being an integral part of the inlet sound absorber.

2. Device according to claim 1, **characterised in**

- a circulation housing (5) with a circulation air filter for filtering said room air before the inlet to the fan unit (6).

3. Device according to any of the previous claims,
characterised in that the fan unit (6) includes a centrifugal fan.

4. Device according to claim 3, **characterised in that** the centrifugal fan has two axially opposite directed inlets and that the inlet sound absorber (8) has two separate channels for supply to the inlets of the fan.

5. Device according to any of the previous claims,
characterised in that the outlet sound absorber has a first connection portion for connection to the fan unit and a second connection portion for connection to the filter-housing.

6. Device according to claim 5, **characterised in that** the outlet sound absorber includes one portion (9b) in the region of the second connection portion for redirection of the flow essentially 180°.

7. Device according to claim 5 or 6, **characterised in that** the outlet sound absorber in the region of the second connection portion includes a bifurcation for splitting the flow into at least two part-flows which are arranged to be connected to the filter-housing (3).

8. Device according to claim 6 or 7, **characterised in that** the outlet sound absorber is comprised of two separable parts (9a, 9b).

9. Device according to any of the previous claims,
characterised in that at least one of the sound absorbers (8, 9a, 9b) is essentially comprised of a foamed synthetic material having open cells and a surface layer essentially covering its outer surfaces.

10. Device according to any of the previous claims in dependence of claim 2,
characterised in that the filter-housing (3) and the circulation housing (5) are comprised of closed filter-housing module.

11. Device according to any of the previous claims,
characterised in that it has a modular support body being comprised of a rear portion (12) and supporting planes (13, 14, 15, 16), which are fastenable perpendicular thereto, for filter-housing and sound absorber.

Patentansprüche

1. Vorrichtung (1) zur Verdrängungsbelüftung eines Raums enthaltend: ein Filtergehäuse (3) mit einem Filter für die der Vorrichtung zugeführten Zuluft, ein Zuluftleitungsverbindungsmittel (5, 6) zur Luftzirkulation, und ein Schallabsorptionsmittel, wobei

- das Mittel (5, 6) zur Luftzirkulation eine Lüftereinheit (6) zum Zuführen von Zirkulationsluft aus dem Raum in das Filtergehäuse (3),
- einen Einlassschallabsorber (8) zur Schallreduktion am Einlass der Lüftereinheit (6) und
- einen Auslassschallabsorber (9a, 9b) zur Schallreduktion am Auslass der Lüftereinheit (6) enthält,

dadurch gekennzeichnet, dass die Lüftereinheit (6) in einem Block eines schallabsorbierenden Materials gehalten

wird, wobei der Block mit dem Einlassschallabsorber (8) **dadurch** verbunden ist, dass er ein integraler Teil des Einlassschallabsorbers ist.

2. Vorrichtung nach Anspruch 1, **gekennzeichnet durch**

- ein Zirkulationsgehäuse (5) mit einem Zirkulationsluftfilter zum Filtern von Luft aus dem Raum vor dem Einlass in die Lüftereinheit (6).

3. Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Lüftereinheit (6) einen Zentrifugallüfter enthält.

4. Vorrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** der Zentrifugallüfter zwei axial entgegengesetzt gerichtete Einlässe hat und dass der Einlassschallabsorber (8) zwei separate Kanäle zum Speisen der Einlässe des Lüfters hat.

5. Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Auslassschallabsorber ein erstes Verbindungsteil zur Verbindung mit der Lüftereinheit und ein zweites Verbindungsteil zur Verbindung mit dem Filtergehäuse aufweist.

6. Vorrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** der Auslassschallabsorber im Bereich des zweiten Verbindungsteils ein Teil (9b) zum Umleiten der Strömung um im wesentlichen 180° enthält.

7. Vorrichtung nach Anspruch 5 oder 6, **dadurch gekennzeichnet, dass** der Auslassschallabsorber im Bereich des zweiten Verbindungsteils eine. Gabelung zum Aufteilen der Strömung in mindestens zwei Teil-Strömungen enthält, die zur Verbindung mit dem Filtergehäuse (3) eingerichtet sind.

8. Vorrichtung nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** der Auslassschallabsorber aus zwei separaten Teilen (9a, 9b) besteht.

9. Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** mindestens einer der Schallabsorber (8, 9a, 9b) im wesentlichen aus geschäumten synthetischen offenporigem Material und einer im wesentlichen seine äußere Oberfläche bedeckenden Oberflächenbeschichtung besteht.

10. Vorrichtung nach einem der vorangehenden Ansprüche in Abhängigkeit von Anspruch 2, **dadurch gekennzeichnet, dass** das Filtergehäuse (3) und das Zirkulationsgehäuse (5) ein geschlossenes Filtergehäusemodul umfassen.

11. Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** es einen ein Rückteil (12) und daran rechtwinklig befestigbare Halteflächen (13, 14, 15, 16) umfassenden modularen Haltekörper für Filtergehäuse und Schallabsorber hat.

Revendications

1. Dispositif (1) de ventilation par déplacement dans une pièce et comprenant : un boîtier de filtre (3) contenant un filtre pour l'air d'alimentation fourni au dispositif, une connexion de conduit d'air d'alimentation, des moyens (5, 6) de circulation d'air et des moyens d'absorbeur de sons, dans lequel :

- les moyens (5, 6) de circulation d'air comprenant une unité de ventilateur (6) pour amener l'air de circulation de la pièce dans le boîtier de filtre (3) ;
- un absorbeur de sons d'entrée (8) pour réduire le son à l'entrée de l'unité de ventilateur (6) ; et
- un absorbeur de sons de sortie (9a, 9b) pour réduire le son à la sortie de l'unité de ventilateur (6),

caractérisé en ce que l'unité de ventilateur (6) est supportée dans un bloc de matériau d'absorption de sons, ledit bloc étant connecté à l'absorbeur de sons d'entrée (8) en faisant intégralement partie de l'absorbeur de sons d'entrée.

2. Dispositif selon la revendication 1, **caractérisé par** un boîtier de circulation (5) équipé d'un filtre à air de circulation pour filtrer ledit air ambiant avant l'entrée dans l'unité de ventilateur (6).

3. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'unité de ventilateur (6) comprend un ventilateur centrifuge.

4. Dispositif selon la revendication 3, **caractérisé en ce que** le ventilateur centrifuge comporte deux entrées en opposition axiale et **en ce que** l'absorbeur de sons d'entrée (8) comprend deux canaux séparés conduisant aux entrées du ventilateur.

5. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'absorbeur de sons de sortie comprend une première partie de connexion à connecter à l'unité de ventilateur et une deuxième partie de connexion à connecter au boîtier de filtre.

6. Dispositif selon la revendication 5, **caractérisé en ce que** l'absorbeur de sons de sortie comprend une partie (9b) située dans la région de la deuxième partie de connexion pour rediriger l'écoulement essentiellement à 180°.

7. Dispositif selon la revendication 5 ou 6, **caractérisé en ce que** l'absorbeur de sons de sortie situé dans la région de la deuxième partie de connexion comprend une bifurcation pour scinder l'écoulement en au moins deux écoulements partiels agencés pour être connectés au boîtier de filtre (3).

8. Dispositif selon la revendication 6 ou 7, **caractérisé en ce que** l'absorbeur de sons de sortie est constitué de deux parties séparables (9a, 9b).

9. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**au moins un des absorbeurs de sons (8, 9a, 9b) est essentiellement constitué d'une matière synthétique en mousse comportant des cellules ouvertes et d'une couche de surface recouvrant sensiblement ses surfaces extérieures.

10. Dispositif selon l'une quelconque des revendications précédentes dépendant de la revendication 2, **caractérisé en ce que** le boîtier de filtre (3) et le boîtier de circulation (5) sont constitués d'un module de boîtier de filtre fermé.

11. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il comprend un corps de support modulaire constitué d'une partie arrière (12) et de plans de support (13, 14, 15, 16), à relier perpendiculairement à celui-ci, pour le boîtier de filtre et l'absorbeur de sons.

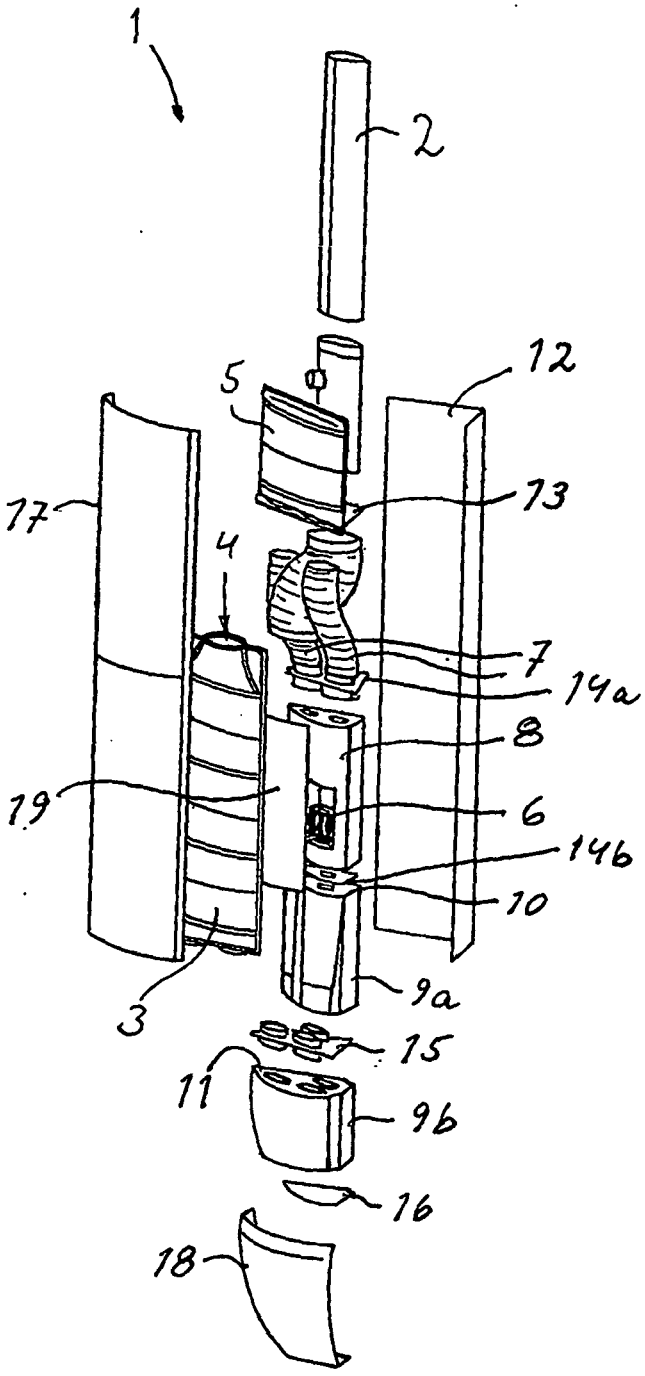

Fig 1

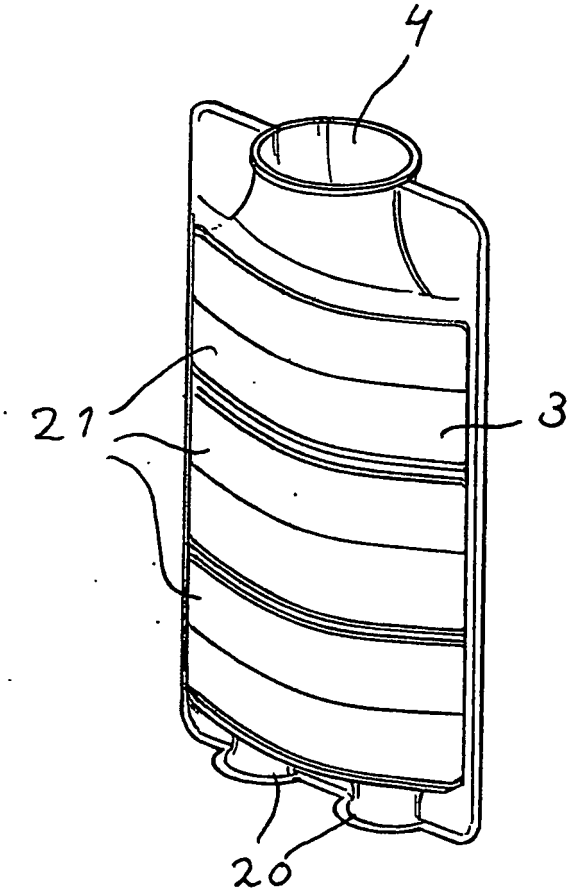

Fig 2

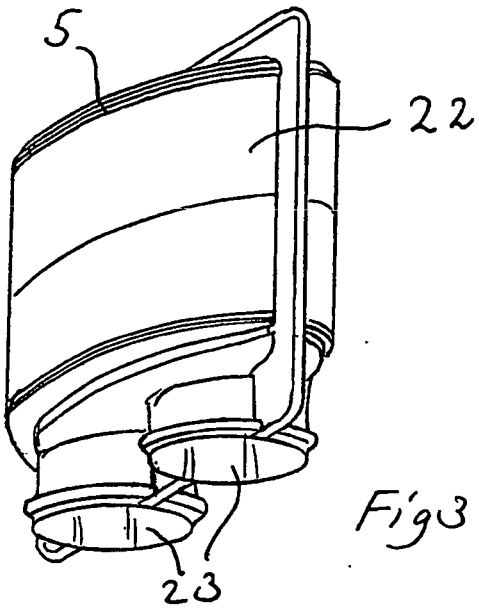

Fig3

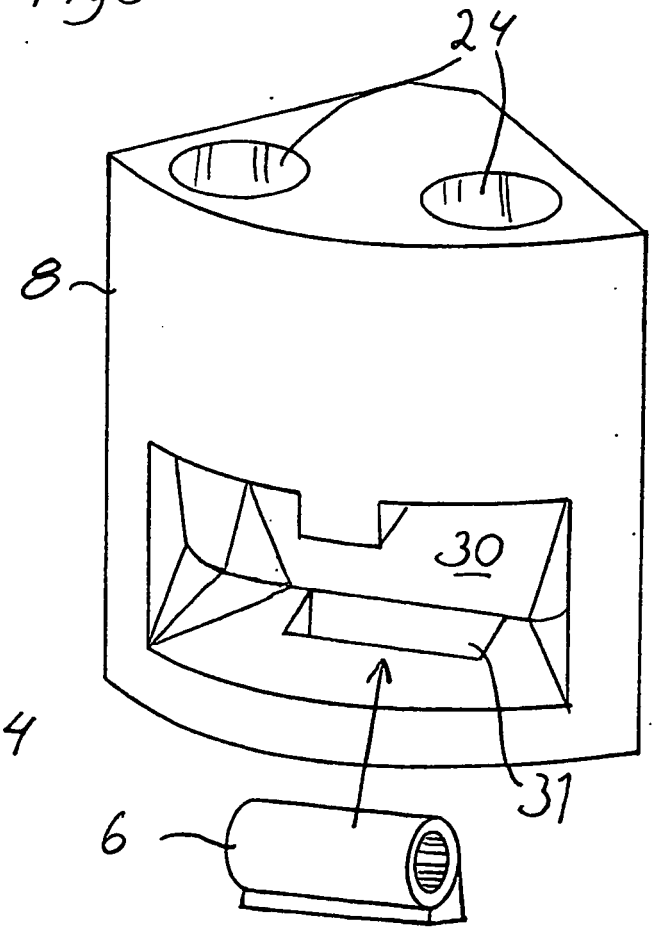

Fig 4

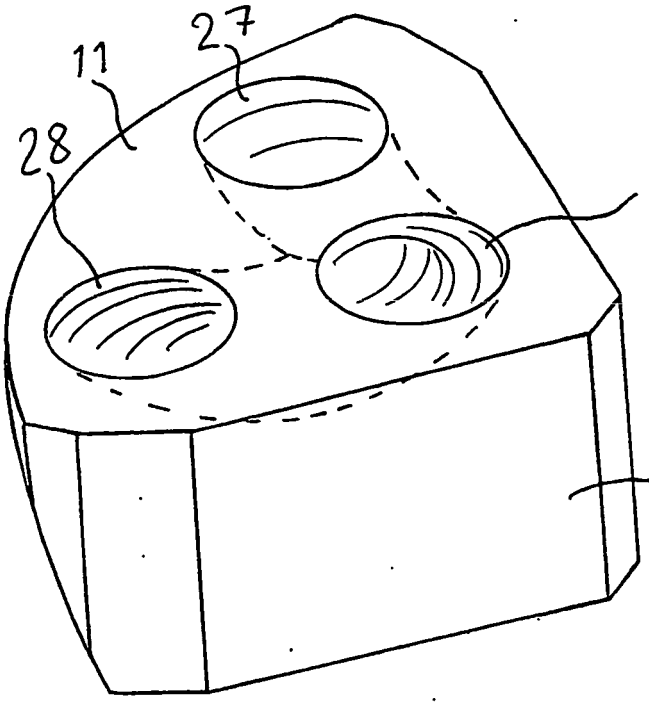

Fig 6

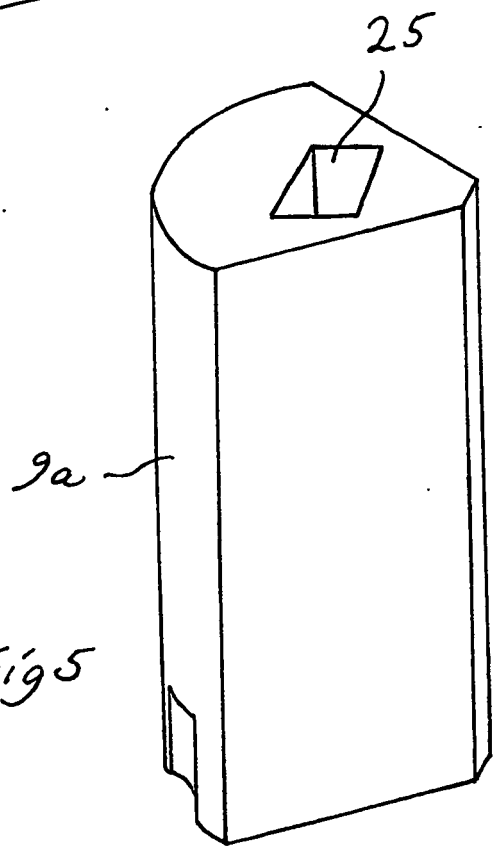

Fig 5

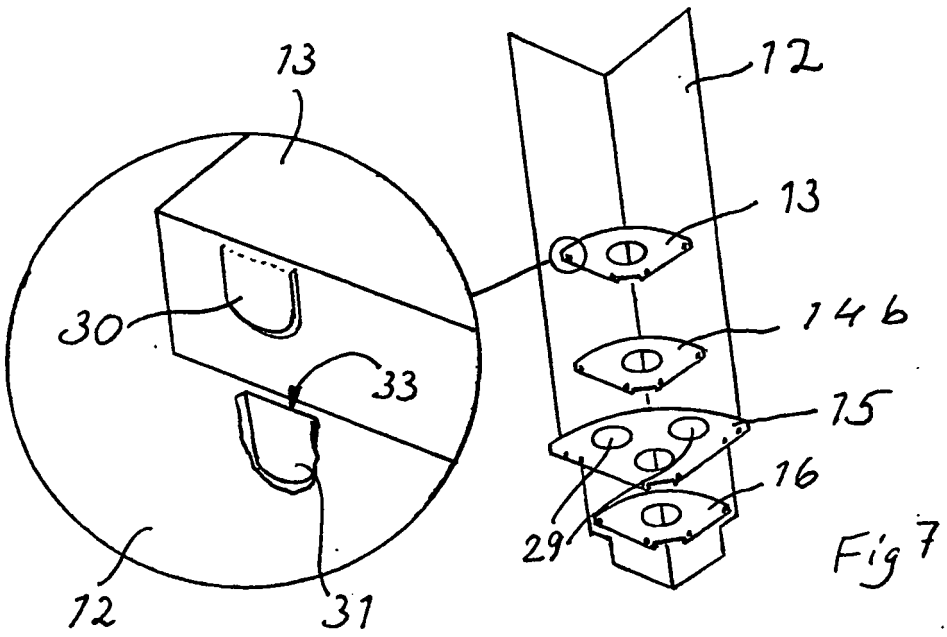

Fig 7