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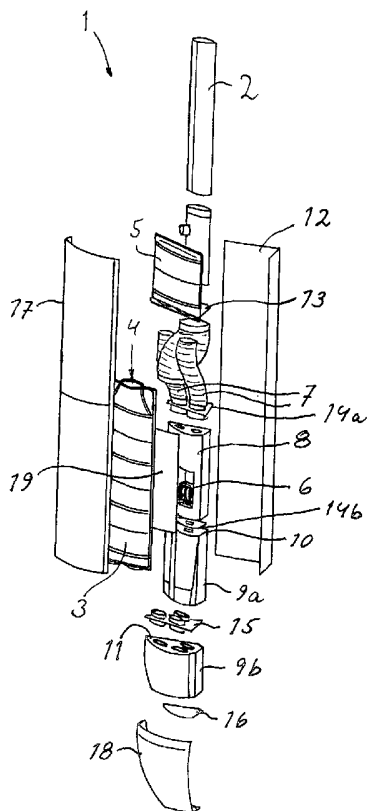
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(54) Title: DEVICE FOR DISPLACEMENT VENTILATION INCLUDING FILTERS, SOUND ABSORBERS AND A FAN UNIT  
SUPPORTED IN A BLOCK OF SOUND ABSORBING MATERIAL.



(57) Abstract: A device (1) for displacement ventilation in a room and including a filter for filtering supply air being supplied to the device, is distinguished by a filter-housing (3) with a filter for supply air and a supply air conduit connection, a device (5, 6) for air circulation including a fan unit (6) for feeding of 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).

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Device for displacement ventilation including filters, sound absorbers and a fan unit supported in a block of sound absorbing material.

### Field of the invention

The invention relates to a displacement ventilation device  
5 according to the preamble of claim 1.

### Description of prior art

The principle of displacement ventilation is that air is  
introduced into a room through one or more low positioned  
0 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.

The supply air from the supply means is also somewhat sub-  
5 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  
10 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.

In previously known air supply means for displacement  
25 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.

30 The previously known air supply means for displacement  
ventilation functions well but its construction brings along  
certain limitations as to its flexibility.

The aim and most important features of the invention

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.

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

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.

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.

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.

It is preferred that said block for supporting the fan unit is connected to the inlet sound absorber and in particular that said block is an integral part of the inlet sound absorber since this enhances provisions for sound-absorbing and reduces risk of leaking noise.

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.

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.

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.

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.

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

### **Brief description of drawings**

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**

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.

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.

5 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.

0 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  $180^\circ$  so as to connect to the filter-housing 3 at an end opposite the end  
5 for the supply air connection 4.

The device 1 comprises a body consisting of a rear portion 12, essentially consisting of a plate bent to  $90^\circ$  for adapting to a corner of a room. Onto this rear portion 12 a number of  
10 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  
25 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.

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

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).

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.

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.

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.

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.

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.

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.

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.

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.

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  
5 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.

10 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  
15 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  
20 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.

25 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  
30 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.

5 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.

10 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,  
15 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.

20 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 for filtering supply air being supplied to the device, **characterised in**
- a filter-housing (3) with a filter for supply air and a supply air conduit connection,
  - a device (5, 6) for air circulation including a fan unit (6) for feeding of 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),
- wherein the fan unit (6) is supported in a block of sound absorbing material.
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 claim 1 or 2, **characterised in** that said block is connected to the inlet sound absorber (8).
4. Device according to claim 3, **characterised in** that said block is an integral part of the inlet sound absorber (8).
5. Device according to any of the previous claims, **characterised in** that the fan unit (6) includes a centrifugal fan.

6. Device according to claim 5, **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

7. 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.

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8. Device according to claim 7, **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°.

15

9. Device according to claim 7 or 8, **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).

20

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

25

11. 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.

30

12. Device according to any of the previous claims 2 - 11,

**characterised in that** the filter-housing (3) and the circulation housing (5) is comprised of closed filter-housing modules.

- 5     13.     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.

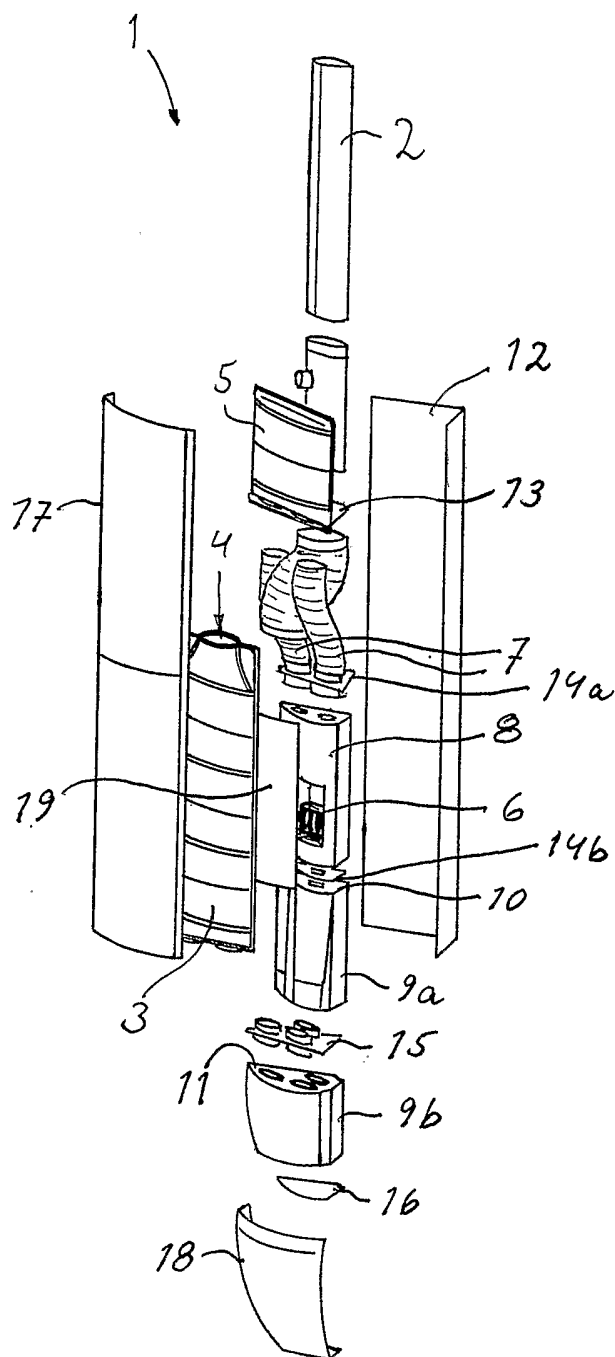
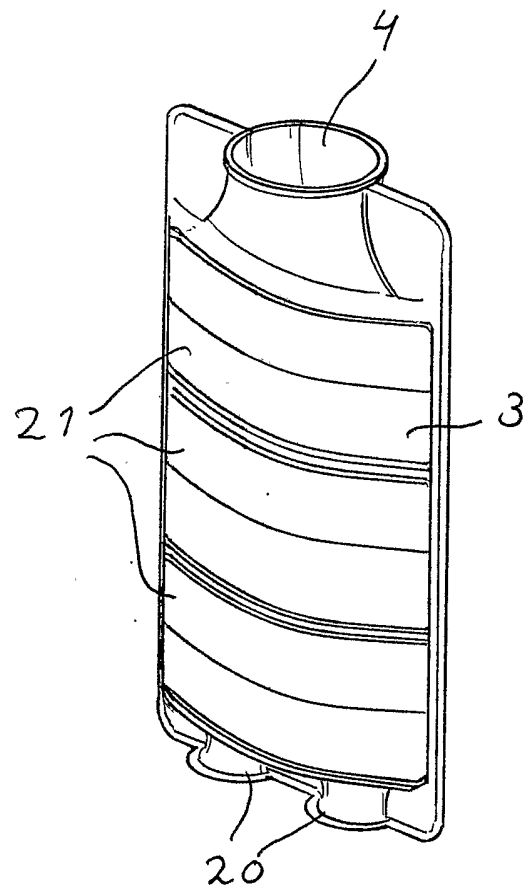
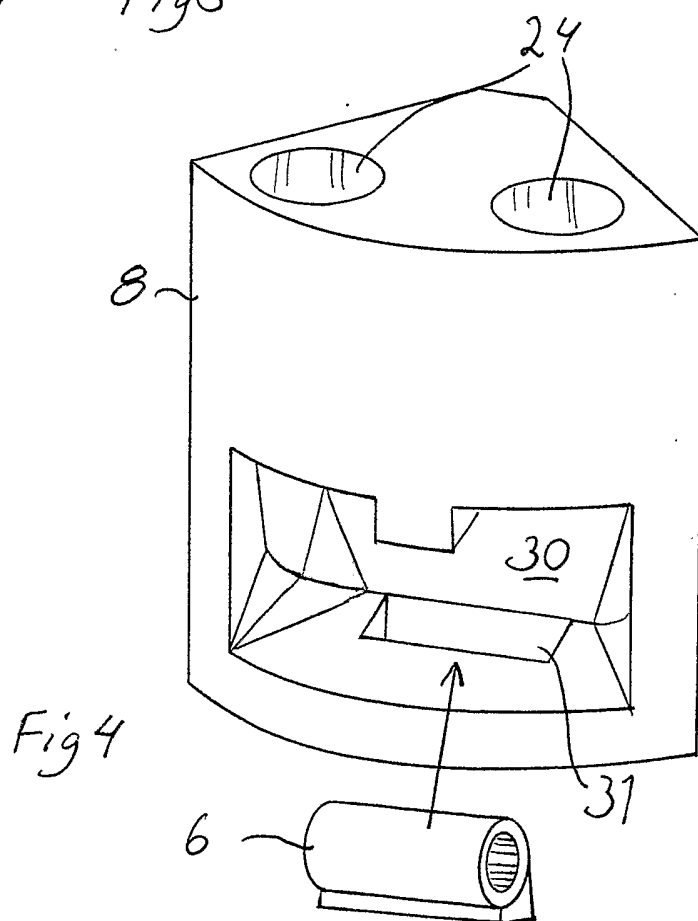
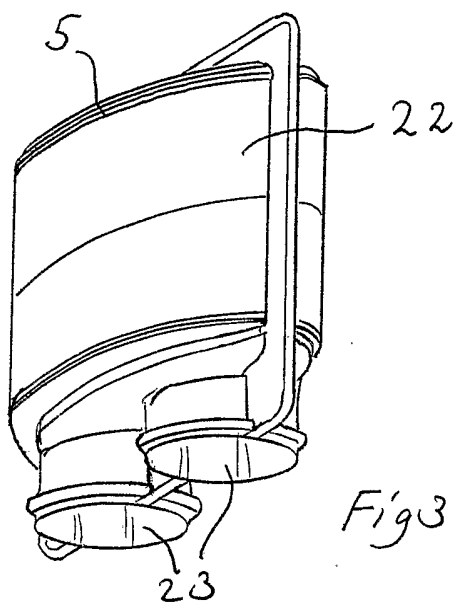
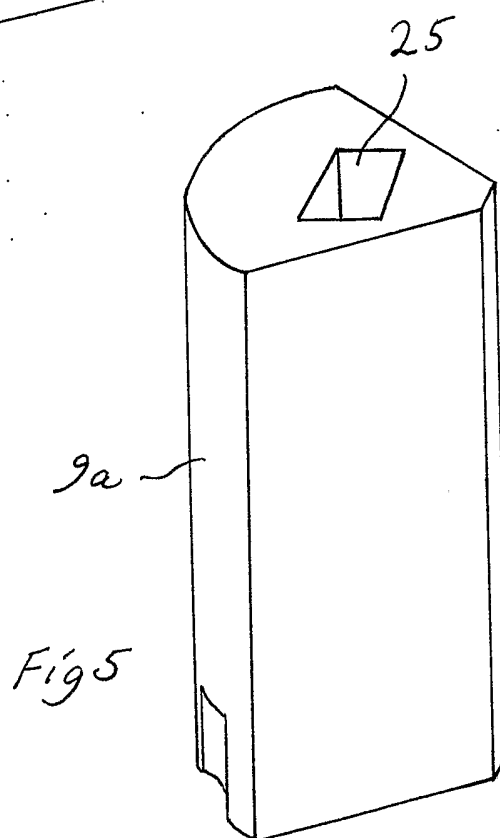
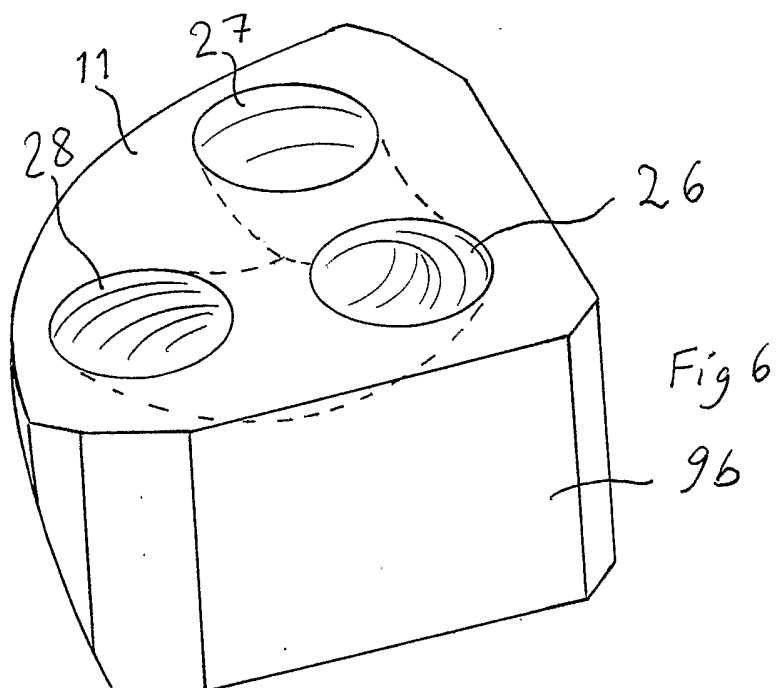
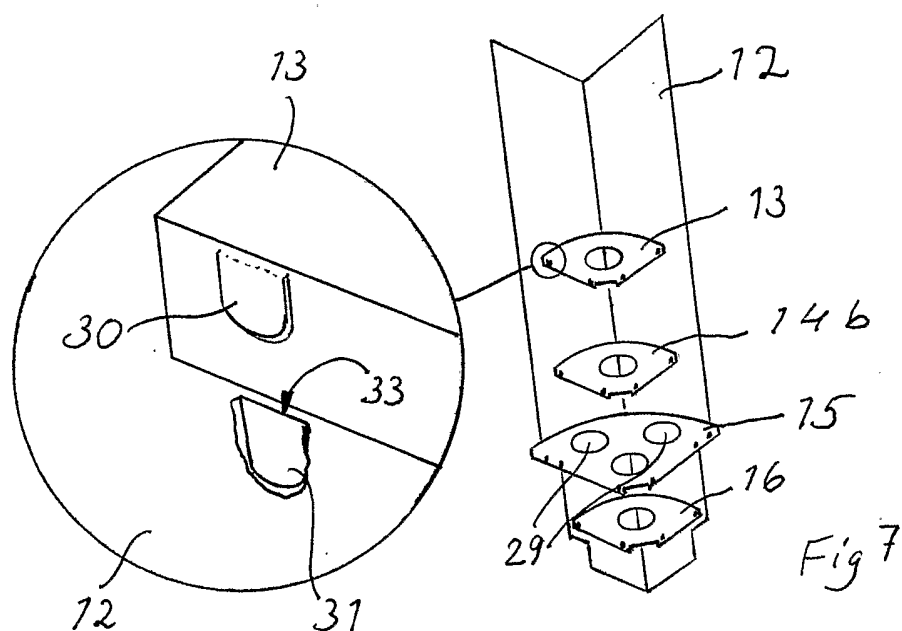


Fig 1

*Fig 2*







# INTERNATIONAL SEARCH REPORT

International application No.

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## A. CLASSIFICATION OF SUBJECT MATTER

**IPC7: F24F 1/00, F24F 3/16, F24F 13/068, F24F 13/24**  
According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: F24F**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**EPO-INTERNAL, WPI DATA, PAJ**

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

|                                                                                                                                                                         |                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| Date of the actual completion of the international search<br><b>31 July 2003</b>                                               | Date of mailing of the international search report<br><b>31 -07- 2003</b>           |
| Name and mailing address of the ISA/<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. +46 8 666 02 86 | Authorized officer<br><b>Heléne Eliasson / MRo</b><br>Telephone No. +46 8 782 25 00 |

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/00761

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

29/06/03

International application No.

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