(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 466 669 A1**

(12) # EUROPEAN PATENT APPLICATION

(21) Application number : **91850142.0**

(51) Int. Cl.^{5} : **F24F 7/007,** F24F 13/08

(22) Date of filing : **29.05.91**

(30) Priority : **20.06.90 SE 9002202**

(43) Date of publication of application :
15.01.92 Bulletin 92/03

(84) Designated Contracting States :
DE FR GB

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(54) **Adjustable air supply device.**

(57) Supply air device intended for placing in the vicinity of the floor in a room. The device is adjustable between two different operational states, namely one for normal operation where air at, or below, room temperature flows out at a low flow rate substantially over the entire outflow zone (Z_1,Z_2) of the device, and another state for heat-supplying operation, air at above room temperature being caused to flow out with a relatively high flow rate excusively from a lower outflow zone (Z_1). The adjustment is achieved with the aid of flap and/or screening means (11).

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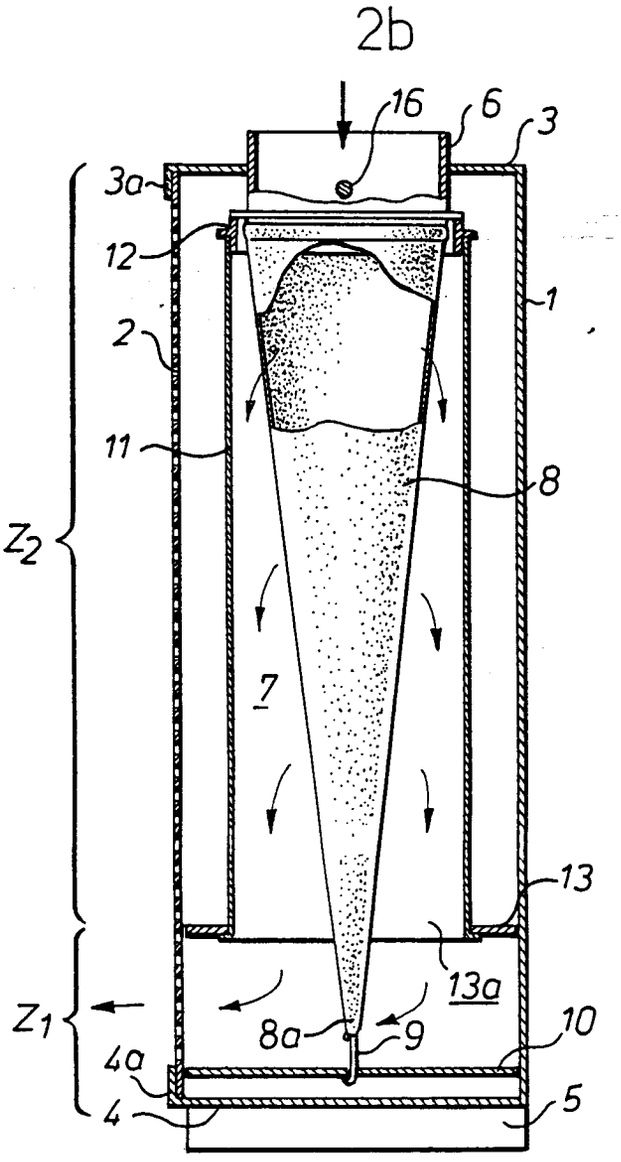
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The invention relates to an air supply device intended for placing in the vicinity of the floor in a room or premises, which are to be ventilated, the device having a relatively large extension in height and in normal operation being adapted for supplying air at, or below, room temperature with a relatively low flow rate for achieving uniform and draught-free, i.e. so-called displacement air supply.

Known air supply devices of this kind (see US-A-4 316 406, for example) are used to an ever-increasing extent in industrial and office premises as well as public rooms for achieving so-called displacement ventilation, the supply air at, or below, room temperature forming a layer of comparatively clean air in the occupational zone of the room, while somewhat warmer air with a substantially greater degree of polution is collected upwardly, above the occupational zone. The somewhat warmer, poluted air is then sucked out with the aid of outlet air devices arranged in or close to the ceiling of the premises. In addition, there are sometimes point suction devices for capturing polutions in direct connection with different polution sources, so that the average degree of polution in the premises can be kept at an acceptable level.

Such ventilation functions excellently as long as the supplied air has a lower temperature than the air in the ceiling zone, so that the layers can be retained. However, it is often desirable to supply warmer air via the air supply devices, particularly during winter, to compensate for heat losses, particularly transmission losses to the surroundings outside-the premises in question. The problem is here, however, that the warm air flowing out from the air supply device, this air having a low rate of flow in air supply devices of this kind, rises upwards by convection. In such a case, there is the risk of the formation of a warm air cushion in the upper zone of the premises, while the temperature in the occupational zone remains relatively low, in spite of the warm air being supplied. A large temperature gradient can thus occur, and the climate in-the occupational zone would be unfavourable. In addition, this results in poor heat economy.

The present invention has the object of solving this problem and providing an air supply device enabling heat-supplying operation while retaining a relatively low temperature gradient,satisfactory climate in the occupational zone and good heat economy.

This object is achieved in accordance with the invention by the supply air device being adjustable between two different operational states in the manner described in principle in claim 1. Accordingly, the air supply device can function in normal operation in a corresponding manner to previous air supply devices of this kind, while for heat-supplying operation at least the major portion of the air flow heated above room temperature will flow out from the device through a lower, outflow zone comparatively near the flow, and at an increased rate of flow directed substantially parallel to the flow. The supply air flowing out from the device will adhere to the floor due to the so-called Coanda-effect for a substantially greater distance than would be case if the clean supply air heated to above room temperature flowed out at a low flow rate from the entire active outflow surface of the device. Consequently, it can be ensured with this implementation of the device that the clean air above room temperature at least reaches a major part of the occupational zone, in particular the area for work stations in the premises. There is no disadvantage in the flow rate being substantially higher in this case, since flowing warm air is not felt as an uncomfortable draught. On the other hand, in the case where a very high flow rate is required, it is possible within the scope of the inventive concept to screen off some part of the lower outflow zone for preventing the out flowing supply air from coming directly to a work station. Such further screening should however be restrcited to a relatively narrow sector of the flow pattern.

Further characterizing features and advantages of the invention are disclosed in claims 2 - 11 as well as being apparent from the detailed description given below, which is made in connection with the accompanying drawings, where:

Fig. 1 is a perspective view of an air supply device in accordance with the invention, a part of the front grid of the device being cut away to illustrate the interior of the device;

Fig. 2a is a vertical section to a larger scale of an upper part of the air supply device;

Fig. 2b shows to a somewhat smaller scale than in Fig. 2a the entire air supply device in vertical section (rotated 90° relative the secton in Fig.2a);

Fig. 3 illustrates a modified, second embodiment of the device, similarly in a vertical section; and

Fig. 4 illustrates in a corresponding manner a third embodiment of the air supply device in accordance with the invention

The air supply device illustrated in Fig. 1 comprises, in a manner known per se, a flat, air-tight rear wall 1, an approximately semicylindrical front grid wall 2 with an air-permeable mat (unillustrated in the schematic figures on the drawings) and made from e.g. as foamed plastics, an upper, approximately semicircular end wall 3 with a downwardly directed flange 3a engaging over the upper edge portion of the grid wall 2, and a corresponding lower end wall 4 with an upwardly directed flange 4a. The air supply device, the height of which is preferably greater than its width, and which has dimensions which can vary, rests on a bottom base 5 and is intended for placing upright on the floor in a room which is to be ventilated. The dimensions and exterior configuration of the device are unessential for the invention, provided that it has a relatively large extension in height and that the front outflow surface is of a size such that desired outflow of the air can be obtained at a relatively low flow rate,

as discussed in the introduction.

In the upper end wall 3 the air supply device has a cylindrical inlet stub 6 projecting upwards a short distance for connection to an unillustrated supply air duct, the stub also projecting downwards a distance into the substantially semicylindrical chamber 7 formed by the walls 1,2,3 and 4. In a similarly known manner, a downwardly conicly tapering, air-permeable bag 8 is connected to the inlet stub 6 such as to extend downwards throughout the entire chamber 7 for being retained at its vertex 8a by a fixing means 9 at a lower fixed plate 10. The plate 10 is arranged level with the upper edge of the flange 4a of the lower end wall 4 and serves to ensure substantially horizontal air flow even in the bottom-most portion of the device also. The flange 4a would otherwise cause an irregular flow pattern in this lower part of the device.

The bag 8, which is preferably made from a filter material, e.g. polyester fibre, ensures a substantially uniform air flow along the entire height of the device, and for reasons of symmetry the air outflow will be substantially uniform laterally as well (along an angular sector of 180° in this embodiment).

In accordance with the invention, the air supply device is adjustable between normal operation where air at, or below, room temperature is supplied via the inlet stub 6 and flows out substantially uniformly at a relatively low flow rate from the entire surface of the front grid wall 2, and heat supplying operation, where supply air at a temperature in excess of room temperature is caused to flow out substantially via a lower outflow zone Z_1 (Fig. 2b) at an increased flow rate. Reference is made here to the the introductory part of the description.

In the embodiment according to Figs. 1, 2a and 2b this adjustment is provided with the aid of a screening means in the form of a compactable, substantially cylindrical bellows our hose 11 which is upwardly connected to a flange ring 12 and is downwardly fastened to the edge of a circular opening 13a in a semicylindrical plate 13. With a given clearance, this plate 13 fits inside the rear wall 1 of the device and the semicylindrical front grid wall 2 and is vertically movable inside the chamber 7. As well be seen from Fig. 2a the hose 11 in its extended state is somewhat shorter than the height of the chamber 7, and when the hose is raised to its extended state illustrated in Fig. 2b it carries the plate 13 so that the latter is kept at a distance above the underlying plate 10.

The hose 11 is accordingly liftable from its lower compacted position about the hole 13a illustrated in Fig. 1, where the movable plate 13 rests against the plate 10, to its vertically extended state illustrated in Fig. 2e, which is brought about with the aid of two lifting straps 14a,14b. These straps can be wound up on the individual reels 15a and 15b, respectively (see Fig. 2a), these reels being nonrotatably mounted on a shaft 16 passing transversely through the inlet stub 6 and mounted rotatably thereon. The shaft is rotatable with the aid of an electric motor 17 mounted in an unillustrated manner, e.g. at the rear wall 1, the upper end wall 3 or the inlet stub 6.

When the hose 11 is compacted (let down) in its lower position according to Fig. 1, the air at, or below, room temperature supplied via the inlet stub 6 and bag 8 will flow out, as described above, substantially uniformly through the front grid wall 2, i.e. over the entire surface thereof, namely both in the above mentioned lower outflow zone Z_1 and in the upper outflow zone Z_2 (Fig. 2b), which is substantially greater as to area and height.

For adjusting to heat-supplying operation, when supply air at a temperature exceeding normal room temperature, e.g. 25-30°C, is blown via the inlet stub 6, the hose 11 is raised with the aid of the motor 17 and the straps 14a,14b, which can be wound up on the reels 15a,15b, until the upper flange ring 12 engages sealingly against the lower, flanged edge portion of the inlet stub 6. In the final phase of this lifting operation, the plate 13 is also raised to the position illustrated in Fig. 2b. Accordingly, the relatively warm supply air will flow out from the bag 8 and be deflected downwards by the surrounding impermeable hose 11, so that the air flows out via the opening 13a in the plate and substantially horizontally outwards through the grid wall 2 is the lower outflow zone Z_1. Since the surface area of the grid wall 2 in this zone Z_1 is small in comparison with the total area of the grid wall 2, the flow rate for a given air flow will be substantially greater in this position of adjustment. The warm air flowing out will adhere to the floor along a relatively long distance, this effect being reinforced by the so-called Coanda-effect, and the desired lower temperature gradient in a vertical direction can be maintained in spite of the higher temperature of the supply air.

The embodiment according to Figs. 1, 2a and 2b can be modified in many ways. Apart from the possibilities of varying the dimensions and the exterior configuration of the device, e.g. using a semicylindrical, quarter-cylindrical or substantially flat active outflow surface, the hose may consist of a pleated bellows, be provided with interior or exterior guides for ensuring ordered compaction, or may be formed as a flat curtain, possibly in the form of a roller blind, particularly for a device having a substantially flat outflow surface. A bellows or hose can also be used for flat devices, the hose then suitably having a non-circular, e.g. rectangular, elongate cross-section. It is also conceivable to form the screen as a telescopicly collapsible tube having mutually displaceable tube sections or a plurality of pivotable or rotatable screen blades, which are adjustable between a screening and a non-screening position in the area of the upper outflow zone Z_2.

In embodiments with raisable screens, the lifting means can naturally be formed in different ways.

Instead of motor drive, the lifting movement can be achieved by manually operated means, and the illustrated lifting straps can be replaced by ropes,, belts or chains, possibly in the form of endless loops.

In addition, the vertically movable, holed plate 13 can coact with a stop in its upper position (corresponding to the one in Fig. 2b), possibly in the form of an inwardly directed flange, which can be provided with a resilient sealing means on its underside or on the upper side of the plate 13.

A modified, second embodiment is illustrated in Fig. 3, which only differs from the one described in connection with Figs. 1, 2a and 2b by the hole plate 13′ being immovable and fixedly connected to the rear and front walls 1,2 of the device. In this case the hose 11 will be situated higher up, when it assumes its compacted position, but this only insignificantly affects the total flow pattern in normal operation. For heat-supplying operation the flow will be exactly the same as for the first embodiment, possibly with the difference that no leakage takes place at the edge portions of the plate 13′.

A third embodiment is schematicaly illustrated in Fig. 4. Instead of a screen, a flap is used here for adjusting between the two, operational states. In this case, the air supply device comprises a front, box-like part with a chamber 7 defined by walls 1, 2, 3 and 13" (in this case without a hole opening) and a bag 8 (although without any screen corresponding to the hose 11) there also being an upwardly, rearwardly and downwardly surrounding bypass part, with an upper chamber 18, a rear vertically extending chamber 19 and a lower chamber 20, from which bypassed warm air flows out in a lower outflow zone Z_1 when the above-mentioned flap 21 assumes the position illustrated by chain dotted lines in Fig. 4. When the flap is put into the position denoted by full lines, the air at, or below, room temperature supplied via the stub 6 flows out via the upper outflow zone Z_2, no flow taking place from the lower outflow zone Z_1. The base 5 can be excluded in all embodiments.

In the three illustrated embodiments according to Figs. 1, 2a, 2b; Fig. 3 and Fig. 4, the inlet opening 6 can be arranged downwards in the device, the bag 8 (if such is used at all) being turned upside-down, so that its open end is connected to the inlet opening and its apex is situated upwardly. However, the flap or screening means must in this case also screen off the upper outflow zone Z_2 for heat-supplying operation.

If a compactable screen, bellows or hose is used, it can of course be compacted in an upward position or in a downward position (in the area of the upper outflow zone Z_2).

One skilled in the art can of course modify the described air supply devices with flap and/or screening means arranged in different ways within the scope of claim 1.

Claims

1. Air supply device intended for placing in the vicinity of the floor in a room or premises which are to be ventilated, said device having relatively large extension in height and being adapted for supplying air at, or below, room temperature with a relatively low flow rate during normal operation for providing uniform and draught-free, so-called displacement air supply, **characterized** in that the device is adjustable between two different operational states, namely one for said normal operation and the other for heat-supplying operation when air at above room temperature is supplied, there being flap and/or screening means (11;21) arranged to guide the air flow inside the device during heat-supplying operation such that at least the major portion of the heated air flow flows out from the device through a lower outflow zone Z_1 relatively close to the floor at an increased flow rate directed substantially parallel to the floor.

2. Device as claimed in claim 1, **characterized** in that said screening means (11) is adapted such that during heat-supplying operation it screens an upper outflow zone (Z_2) of the device and on return to normal operation is removed from this outflow zone.

3. Device as claimed in claim 2, **characterized** in that said screening means comprises a compactable, e.g. telescopic, retractable, coilable or foldable screen (11), which is kept extended for heat-supplying operation and compacted for normal operation.

4. Device as claimed in claim 3, **characterized** in that the screen comprises a bellows or hose (11).

5. Device as claimed in claim 3 or 4, **characterized** in that the screen (11), which is extended for heat-supplying operation, is connected downwardly to a through opening (13a) in an intermediate wall (13,13′) delimiting a lower chamber juxtaposed said lower outflow zone (Z_1) in the device.

6. Device as claimed in claim 5, **characterized** in that the intermediate wall (13′) is fixedly mounted in the device.

7. Device as claimed in claim 5, **characterized** in that the intermediate wall (13) is raisable and lowerable between a rest position and a working position in which it delimits said lower chamber.

8. Device as claimed in claim 7, **characterized** in that the intermediate wall (13) is suspended in the

lower edge portion of the screen (11).

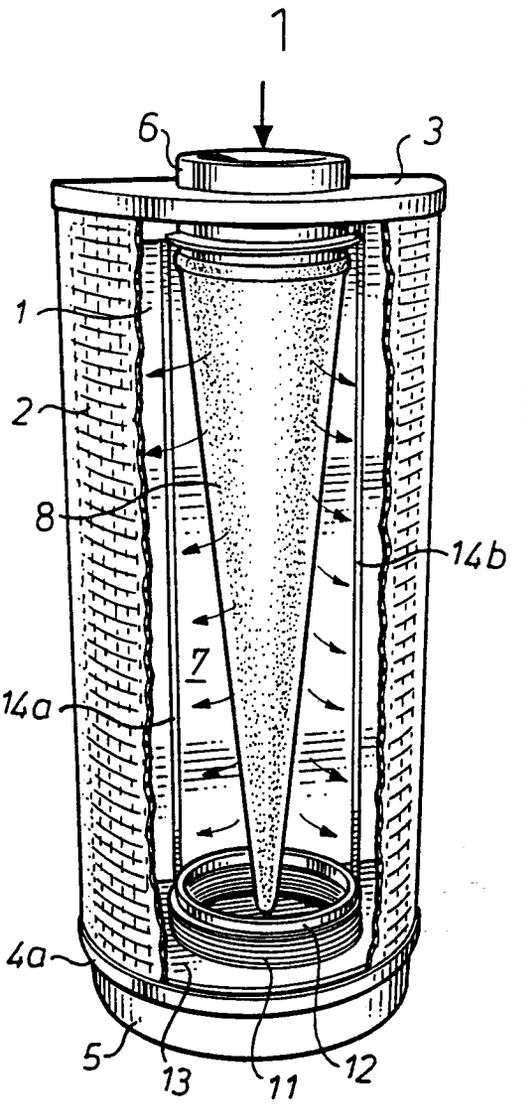
9. Device as claimed in any one of claims 3 - 8, **characterized** in that one edge portion (12) of the compactable screen (11) is raisable and lowerable for extension and compaction of the screen.

10. Device as claimed in any one of the preceding claims, **characterized** in that said flap or screening means are motor driven.

11. Device as claimed in claims 9 and 10, **characterized** in that said one edge portion (12) of the screen (11) is raisable and lowerable with the aid of a motor (17) which is connected to at least one reel or drum (15a,15b) for at least one lifting loop, e.g. in the form of a chain, belt, rope or strap (14a,14b).

12. Device as claimed in claim 11, **characterized** in that the motor (17) is mounted in connection with an inlet stub (6) and has a shaft (16) passing transversely through the inlet stub, the shaft being provided with a winding reel (15a,15b) on either side of the stub.

13. Device as claimed in claim 1 or 10, **characterized** in that said flap means (21) is provided at an opening between a first chamber (18,19,20), communicating up with an inlet opening (6) and said lower outflow zone (Z_1), and a second chamber (7), communicating up with an upper vertically extending outflow zone (Z_2), such that the supply air flow exclusively out through said lower outflow zone (Z_1) during heat-supplying operation and through said upper outflow zone (Z_2) and optionally also through said lower outflow zone during normal operation.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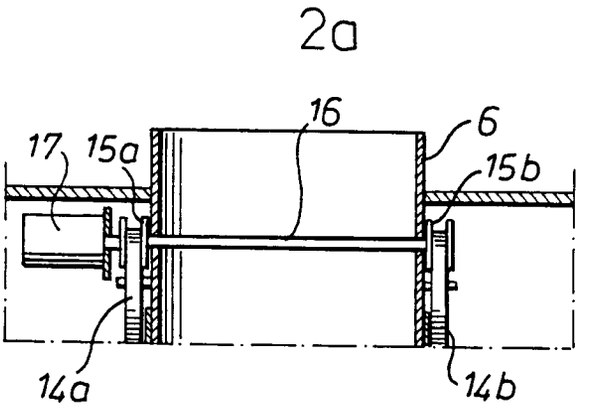
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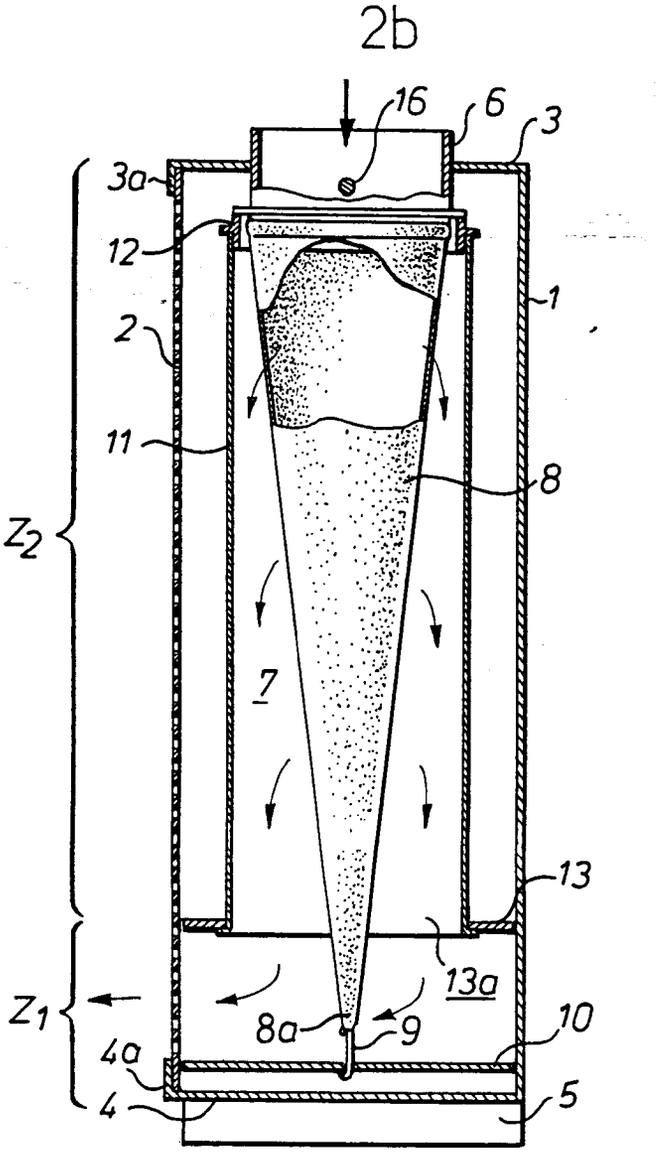
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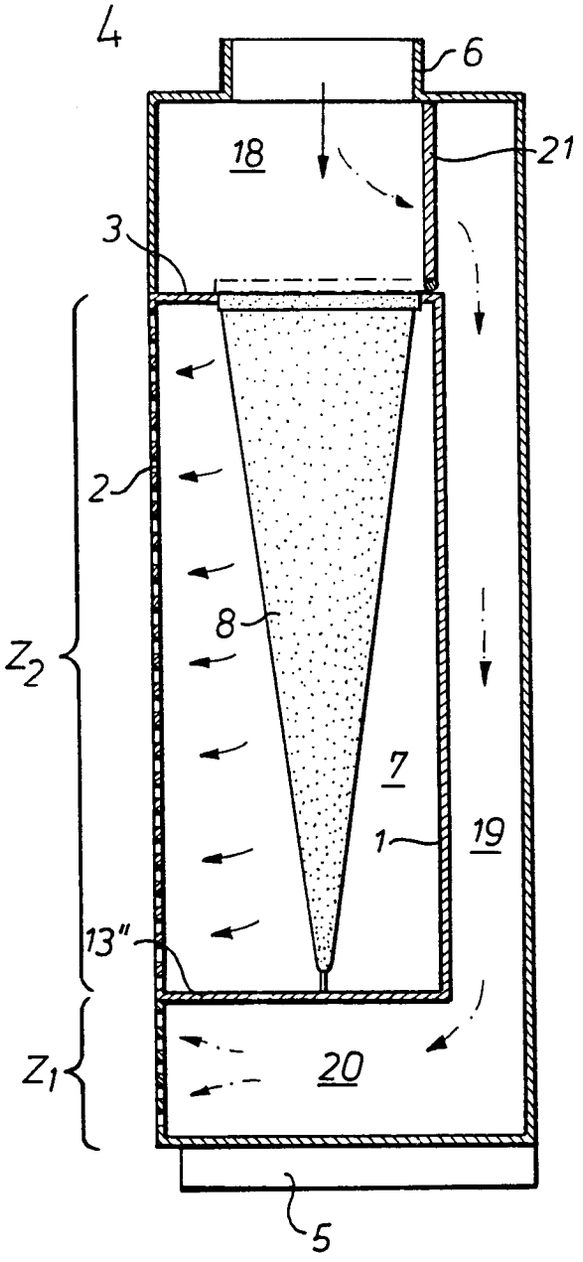
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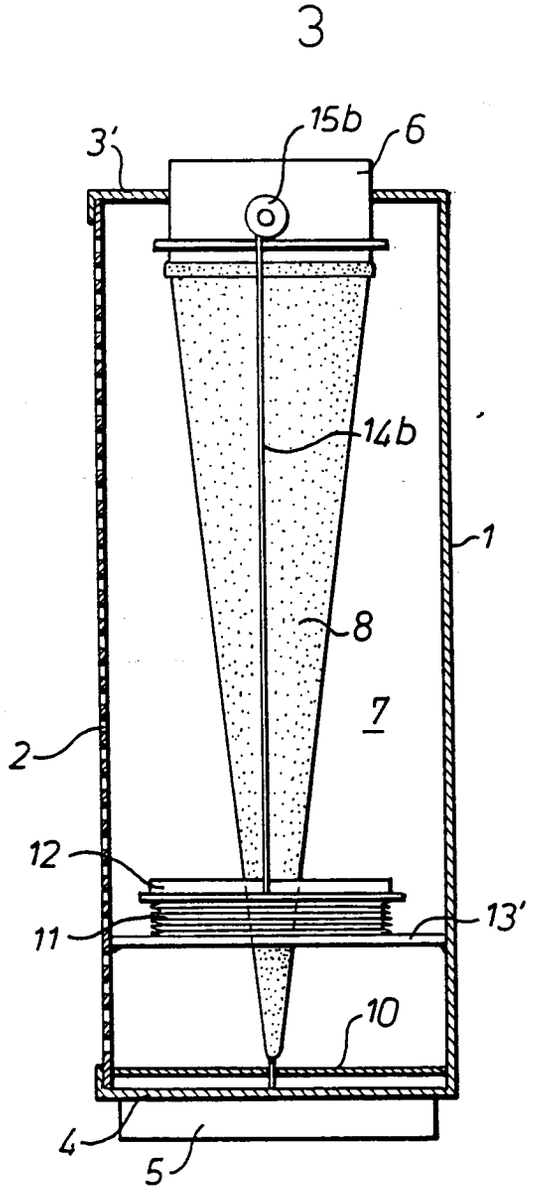
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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91850142.0

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	DE - A1 - 2 718 760 (MABAG LUFT- UND KLIMATECHNIK GMBH) * Claims; fig. 1,2; pages 9-11 *	1-4	F 24 F 7/007 F 24 F 13/08
A	--	5-9	
Y	US - A - 4 738 188 (NISHIDA) * Abstract; columns 3,4; claims; fig. 2 *	1-4	
A	--	13	
A	WO - A1 - 86/07 439 (ARGON CORPORATION) * Abstract; claim 1; fig. 1,5 *	1,13	
	--		
A	CH - A5 - 667 515 (BÖHM) * Abstract; fig. 1; claims 1-6 *	1	
	----		TECHNICAL FIELDS SEARCHED (Int. Cl.5)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	07-10-1991	LANG

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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