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(54) **Ventilation device for climate control systems**

(57) A ventilation device particularly for climate control systems installed in floors, walls, ceilings and the like, comprising a supporting frame (11) for at least one oscillating basket (12, 13), which is adapted to support at least one motorized blower (14, 15, 16, 17) for aspirating the conditioned air from a plenum with which the device

(10) is associated, the at least one oscillating basket (12, 13) being in turn coupled to the frame (11) with means for the rotation of the basket (12, 13) about at least one axis, the basket (12, 13) being arrangeable with a preset inclination with respect to the arrangement of the floor (19), wall or ceiling in which the device (10) is flush-mounted.

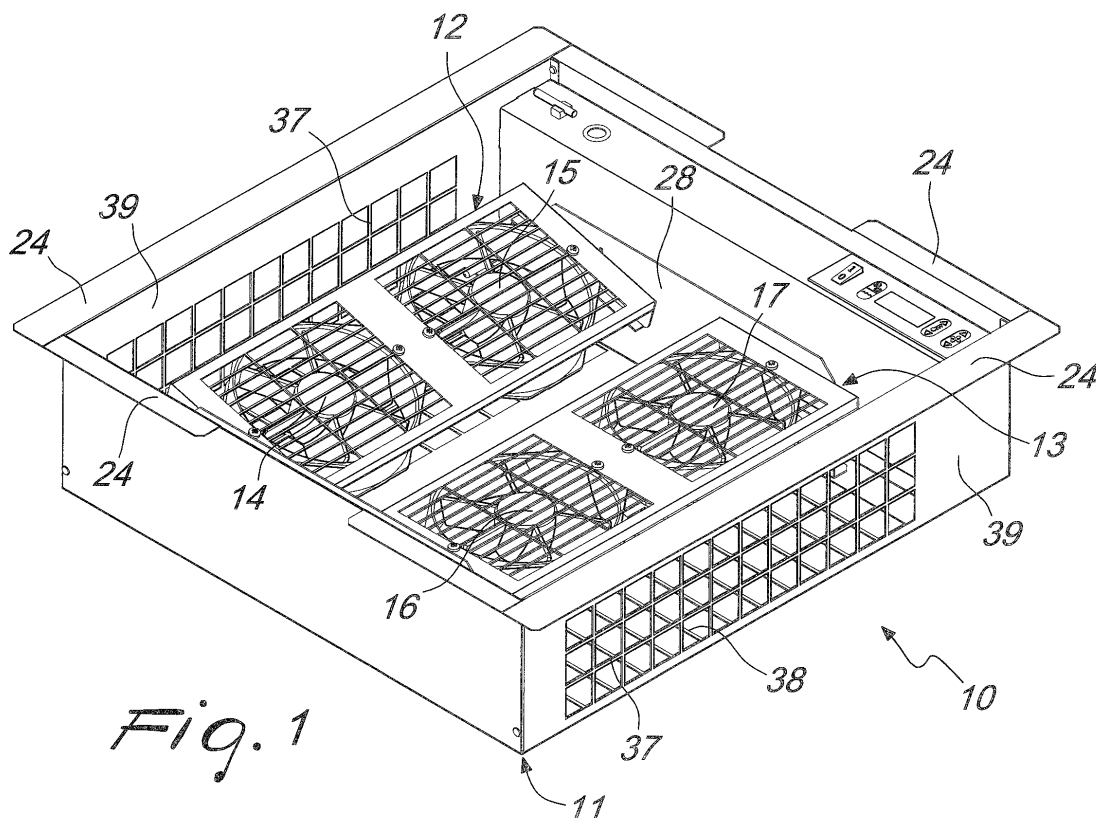


Fig. 1

Description

[0001] The present invention relates to a ventilation device for climate control systems.

[0002] Computer rooms, and in general any site that contains several items of electronic equipment and racks (i.e., supporting frames for a plurality of electrical, electronic and similar instruments, generally enclosed within appropriately provided ventilated cabinets), require continuous climate control, suitable to prevent the heat generated by the computers and electronic instruments from accumulating, generating temperatures that are so high as to damage the internal components of the electronic instruments and the like.

[0003] Likewise, in so-called "open space" environments, in which several operators work, each operator being generally required to manage a computer, there is the important problem of providing suitable climate control of the open space while complying with the varying needs of the operators and at the same time of the electronic instruments.

[0004] Today, in order to obviate these drawbacks, underfloor climate control systems are generally installed in computer rooms and are increasingly widespread particularly in environments provided on a raised floor.

[0005] The interspace between the floor slab and the raised floor can in fact be equipped easily not only for the distribution of the cables for connecting and supplying power to the racks and computers but also as a plenum, i.e., as a passage space for air conditioning, said plenums conveying the air to the overlying environments by means of floor-mounted grilles.

[0006] The transfer of the cooled air from the plenum to the environment to be climate-controlled occurs mainly by so-called displacement, a principle according to which the stratification of the air according to temperature is used and its penetration into the overlying environment is facilitated by way of the difference in relative density with respect to the warmer air that is already present in the environment.

[0007] Recently, climate control systems for computer rooms which are capable of inducing a forced motion of the cooled air instead of leaving its diffusion to natural stratification are becoming increasingly widespread.

[0008] Accordingly, these systems are provided not only with the central ventilation unit, which propels the conditioned air into the plenum under the floor, and with the floor-mounted grilles adapted to make said conditioned air flow out into the environment, but also with auxiliary ventilation units, which are arranged predominantly within the interspace between the raised floor and the floor slab, which acts as a plenum.

[0009] These auxiliary ventilation units intensify the efficiency of the central ventilation unit, reducing climate control times.

[0010] The ventilation devices that constitute such auxiliary units, although being appreciated and widespread due to the swiftness of the climate control that

they are able to provide to the environment in which they are installed, are adapted to convey the conditioned air generically upward, with the risk of obtaining excessive cooling for the computers and racks that lie closer and insufficient cooling, or at least slow cooling, for the computers and racks that are located further from said devices.

[0011] The aim of the present invention is to provide a ventilation device particularly for climate control systems installed in floors, walls, ceilings and the like, which is capable of obviating the drawbacks shown by known types of ventilation device.

[0012] Within this aim, an object of the present invention is to provide a ventilation device which can optimize the distribution of the conditioned air in the environment to be climate-controlled.

[0013] Another object of the present invention is to provide a ventilation device whose configuration can be changed easily even by a user who does not have particular prior training.

[0014] Another object of the present invention is to provide a ventilation device which can be installed in known panel-type raised floors.

[0015] Another object of the present invention is to provide a ventilation device which is compact and can be installed even in small interspaces between the floor slab and the raised floor.

[0016] A further object of the present invention is to provide a ventilation device whose effectiveness and efficiency are at least equal to those of conventional devices.

[0017] A still further object of the present invention is to provide a ventilation device particularly for climate control systems installed in floors, walls, ceilings and the like, which can be manufactured with known systems and technologies.

[0018] This aim and these and other objects, which will become better apparent hereinafter, are achieved by a ventilation device, particularly for climate control systems installed in floors, walls, ceilings and the like, characterized in that it is constituted by a supporting frame for at least one oscillating basket, which is adapted to contain at least one motorized fan for aspirating the conditioned air from a plenum with which said device is associated, said at least one oscillating basket being in turn coupled to said frame with means for the rotation of said basket about at least one axis, said basket being arrangeable with a preset inclination with respect to the arrangement of the floor, wall or ceiling in which the device is flush-mounted.

[0019] Further characteristics and advantages of the invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of a ventilation device according to the invention;

Figure 2 is an exploded perspective view of part of a ventilation device according to the invention;
 Figure 3 is an exploded perspective view of a detail of a device according to the invention;
 Figure 4 is a sectional side view of a ventilation device according to the invention installed in a floor;
 Figures 5 to 8 each illustrate schematically a configuration in which a ventilation device according to the invention can be provided.

[0020] With reference to the figures, a ventilation device particularly for climate control systems installed in floors, walls, ceilings and the like according to the invention is generally designated by the reference numeral 10.

[0021] The device 10 is constituted by a supporting frame 11 for two oscillating baskets, respectively 12 and 13.

[0022] Each of the two baskets 12 and 13 contains two motorized fans.

[0023] The first basket 12 contains two first fans, which are arranged inside blowers 14 and 15, and the second basket 13 contains two second fans, each arranged inside two additional blowers 16 and 17.

[0024] The blowers 14, 15, 16 and 17 are adapted to draw conditioned air from a plenum with which the device 10 is associated; the conditioned air reaches said plenum from a central climate control unit, which is not shown for the sake of simplicity.

[0025] In the embodiment of the invention described here, the device 10 is recessed in a raised floor 19, in an interspace 22 between panels 42 that compose it and the floor slab 23; the interspace 22 provides the plenum for feeding conditioned air.

[0026] Each oscillating basket 12 and 13 in turn is coupled to the frame 11 by way of means for the rotation of said basket about an axis.

[0027] The two baskets 12 and 13 each rotate about an axis which is parallel to the rotation axis of the other basket.

[0028] The baskets 12 and 13 therefore can be rotated and positioned with a preset inclination with respect to the plane of arrangement of the floor 19 (or wall or ceiling) in which the device 10 is recessed.

[0029] Each basket 12 and 13 can be inclined independently with respect to the other basket 12 and 13.

[0030] The frame 11 has lips 24 for resting on cross-members 20 of the raised floor 19 in which the device 10 is recessed, so that said device is arranged, as mentioned, in the interspace 22 between the floor 19 and the underlying surface, i.e., the floor slab 23; the interspace 22, as mentioned, forms the plenum by means of which the conditioned air reaches the device 10.

[0031] The means for the rotation of each basket 12 and 13 are constituted by two coaxial pivots 25 and 26, as shown in Figure 4.

[0032] The pivots 25 and 26 are adapted to couple rotatably the respective basket 12 and 13 (the first basket 12 is visible in the cross-section of Figure 4) to two sup-

porting brackets 27 and 28, which are mutually opposite with respect to the baskets that they support.

[0033] The brackets 27 and 28 are rigidly coupled to the supporting frame 11.

5 **[0034]** In the embodiment of the device 10 according to the invention described herein, the brackets 27 and 28 are made of punch-cut and bent sheet metal and are fixed to the frame by means of additional threaded elements 36.

10 **[0035]** Each of the pivots 25 and 26 is formed by a threaded element, which is adapted to pass through two holes 29 and 30: the first hole 29 is provided in the bracket 27 and 28, and the second hole 30 is provided in a facing connecting flap 31 of the basket 12 and 13.

15 **[0036]** Each threaded element is screwed to a corresponding complementarily threaded locking female thread element 32.

[0037] The female thread element 32 is fixed inside the connecting flap 31 of the basket 12 and 13.

20 **[0038]** Each basket 12 and 13 is constituted by a cover made of sheet metal, respectively designated by the reference numerals 12a and 13a, to which the connecting flaps 31 belong; the cup-shaped bodies of the motorized blowers, respectively 14, 15, 16 and 17, hang from the covers 12a and 13a.

25 **[0039]** The covers 12a and 13a have a grille-shaped portion 12b and 13b at each of the underlying fans.

[0040] The means for the rotation of the baskets 12 and 13 also comprise means for maintaining the configuration on the part of the baskets 12 and 13.

30 **[0041]** Said means for maintaining configuration are constituted by two protrusions 33 and 34, which protrude from the connecting flaps 31 with which each basket 12 and 13 is provided.

35 **[0042]** Each protrusion 33 and 34 is adapted to be inserted reversibly in selectively one of a plurality of holes 35 arranged in a circular arc in the vicinity of the first hole 29 on the facing bracket 27 and 28.

40 **[0043]** Reversible insertion is obtained by elastic deformation of the brackets 27 and 28 and/or the flap 31 on which the protrusions are provided.

[0044] As mentioned, each connecting flap 31 has two protrusions 33 and 34, which are symmetrical with respect to the rotation axis of the basket 12 and 13 to which they belong.

45 **[0045]** Accordingly, each pair of protrusions 33 and 34 can be inserted reversibly in a corresponding pair of symmetrical holes, designated by the reference numerals 35a and 35b in Figure 3 by way of example, selected among a plurality of pairs of holes.

50 **[0046]** Said plurality of pairs of holes is formed by two arcs of holes 35, which are symmetrically mutually opposite with respect to the axis of the first hole 29, on the facing supporting bracket 27 and 28.

55 **[0047]** Each one of the protrusions 33 and 34 is formed by a stud, which is obtained on the connecting flap 31 to which the protrusions belong, the flap 31 being made of sheet metal, like the cover 12a and 13a, on which the

flaps are obtained by bending.

[0048] The supporting frame 11 is constituted by a box-like body made of sheet metal, which is open on the side directed toward the environment to be climate-controlled.

[0049] The box-like body is provided with intake grilles 37 and 38 for protection against the suction of any foreign objects from the plenum with which the device 10 is associated.

[0050] In this embodiment of the invention, as already mentioned above, the plenum is provided by the inter-space 22.

[0051] In particular, the frame 11 has a grille 37 on each of its faces 39 which lie transversely to the supporting brackets 27 and 28 and two additional grilles 38 on its bottom 40, at the two overlying baskets 12 and 13.

[0052] Advantageously, the frame 11 has a substantially square shape and its dimensions are such that it can be positioned on a raised floor 19 of a per se known type instead of a panel 42, which together with other identical panels 42 composes the raised floor 19.

[0053] The device 10 is conveniently closed in an upper region by a grille, preferably of the walkable type 43.

[0054] The device 10 according to the invention therefore allows to orient each basket 12 and 13 according to the type of distribution of conditioned air to be obtained in the environment to be climate-controlled.

[0055] It is in fact sufficient to loosen the threaded elements that form the pivots 25 and 26 to be able to rotate the baskets manually, arranging them with the chosen inclination.

[0056] In the embodiment of the invention described here, the inclination is selected among a plurality of positions set by the number of holes 35 that constitute each arc of holes.

[0057] The inclination is changed, after releasing the bracket 27 and 28 and the flap 31 from the grip of the threaded elements 25 and 26, by applying to the basket 12 and 13 a torque which makes the protrusions 33 and 34 slide out of the holes 35a and 35b in which they are accommodated.

[0058] This occurs by way of the elastic flexing that the bracket 27 and 28, as well as the flap 31, are free to perform.

[0059] Once the new inclination for the basket has been defined, the pivots 25 and 26 are tightened again.

[0060] In another embodiment, not shown for the sake of simplicity, the device 10 is provided with an electric motor drive for the continuous and not stepwise rotation of each basket.

[0061] The motor drive also comprises the means for maintaining the set configuration.

[0062] Figures 5 to 8 each illustrate a possible distribution of the stream of conditioned air which can be obtained with a combination of configurations of the baskets 12 and 13.

[0063] In Figure 5, the two baskets 12 and 13 are both parallel to the floor, and the air stream, shown by the dashed line 50, has a so-called "fountain" shape, which

is relatively flat.

[0064] In Figure 6, the baskets 12 and 13 are both inclined toward the center of the device 10, with identical and opposite angles.

[0065] This configuration allows to obtain a greater "fountain" flow, capable therefore of providing direct cooling to regions which lie higher up from the floor 19 with respect to what the baskets 12 and 13 in the configuration of Figure 5 can do.

[0066] In Figure 7, the first basket 12 is parallel to the floor 19, while the second basket 13 is inclined toward the first basket 12; in this manner, the flow 50 concentrates in the region that lies above the first basket 12.

[0067] In Figure 8, both baskets are oriented toward one side and the flow 50 is directed toward a region which is lateral with respect to the device 10.

[0068] The examples shown in Figures 5 to 8 show how the device 10 can be set up to provide climate control of different regions of the environment according to requirements, i.e., depending on where the computerized units, racks and other similar electronic units to be cooled are arranged and at what height they are located, or depending on the computerized stations of the operators working in a same open space.

[0069] In this last case, it is in fact fundamentally important for the health of an operator not to be overexposed to the flow of conditioned air, and it is also inappropriate to have a station which is not affected by the flow.

[0070] The possibility to orient the baskets 12 and 13 that characterizes the device 10 according to the invention can therefore be used also to increase the well-being, and therefore the work quality, of several operators working in a single environment, such as for example an open space.

[0071] The device 10 is provided with a compartment 44 for accommodating a unit for controlling and managing the rotation rate of the motorized blowers 14, 15, 16 and 17.

[0072] The device 10 is provided with suitable holes, such as the through hole 45 on the bracket 27, for the passage of the power supply cables of the motorized fans.

[0073] The control and management unit can be interfaced with a network of identical devices 10, mutually controlled according to a configuration of the "master-slave" type.

[0074] Accordingly, all the adjustments performed on the master device 10 are transferred automatically to the slave devices 10 that are connected to it.

[0075] The devices 10 accordingly behave in the same manner.

[0076] This facilitates the saving of time and energy when one wishes to change the speed of the fans of a series of devices 10 simultaneously, since it is sufficient to perform just once the operation on the master device 10 instead of having to repeat it for each device 10.

[0077] It is further possible to connect all the units to

a remote control panel, so as to be able to monitor continuously their status and setting and modify it from there.

[0078] The control panel further allows to manage the speeds of the fans.

[0079] If the plenum is not pressurized, for an equal speed of the fans of the various devices 10 the resulting flow-rate is in fact lower than necessary.

[0080] Accordingly, in order to compensate for the lack of pressure, it is necessary to increase the speed in order to obtain the same flow-rate.

[0081] The advantage of being able to adjust the flow-rate of the air that flows out of each device 10 also allows energy saving, as in the case in which the racks are not filled to full capacity and the heat to be conditioned is lower than the standards of said racks when fully loaded.

[0082] In this case, it is in fact convenient to reduce the refrigerating power of the central climate control unit in proportion to the reduced load of the racks.

[0083] The device 10 according to the invention offers maximum flexibility in use.

[0084] Its dimensions in fact are such that it can be accommodated easily within the floor without having to remove other panels besides the one where it will be positioned.

[0085] Further, its technology allows to reposition it easily as required, if the layout of the racks within the environment is changed.

[0086] The device 10 in fact merely needs to be connected to an electric power supply, and if it is provided with a power supply cable of suitable length, it may not be indispensable to remove the plug from the socket in order to move it to another socket.

[0087] In practice it has been found that the invention thus described solves the problems noted in ventilation devices particularly for climate control systems installed in floors, walls, ceilings and the like of the known type.

[0088] In particular, the present invention provides a ventilation device which is capable of optimizing the distribution of the conditioned air in the environment to be climate-controlled.

[0089] Further, the present invention provides a ventilation device whose configuration can be changed easily even by a user who does not have particular prior training.

[0090] Further, the present invention provides a ventilation device which can be installed in known panel-type raised floors.

[0091] Still further, the present invention provides a ventilation device which is compact and can also be installed in small interspaces between the floor slab and the raised floor.

[0092] Moreover, the present invention provides a ventilation device whose effectiveness and efficiency are at least equal to those of known types.

[0093] Moreover, the present invention provides a ventilation device particularly for climate control systems installed in floors, walls, ceilings and the like which can be manufactured with known systems and technologies.

[0094] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0095] In practice, the materials employed, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

10 [0096] The disclosures in Italian Patent Application No. PD2005A000196 from which this application claims priority are incorporated herein by reference.

15 [0097] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A ventilation device, particularly for climate control systems installed in floors, walls, ceilings and the like, **characterized in that** it is constituted by a supporting frame (11) for at least one oscillating basket (12, 13), which is adapted to support at least one motorized blower (14, 15, 16, 17) for aspirating the conditioned air from a plenum with which said device (10) is associated, said at least one oscillating basket (12, 13) being in turn coupled to said frame (11) with means for the rotation of said basket (12, 13) about at least one axis, said basket (12, 13) being arrangeable with a preset inclination with respect to the arrangement of the floor (19), wall or ceiling in which the device (10) is flush-mounted.
2. The ventilation device according to claim 1, **characterized in that** said supporting frame (11) is provided with lips (24) for supporting the cross-members (20) of a raised floor (21) in which it is flush-mounted, so as to be arranged in the interspace (22) between said floor (19) and the underlying surface (23).
3. The device according to one or more of the preceding claims, **characterized in that** it comprises two of said at least one oscillating basket (12, 13), each basket (12, 13) being able to tilt independently of the other basket (12, 13).
4. The device according to one or more of the preceding claims, **characterized in that** each oscillating basket (12, 13) supports two motorized blowers (14, 15, 16, 17).
5. The device according to one or more of the preceding claims, **characterized in that** said means for the

rotation of each basket (12, 13) are constituted by two pivots (25, 26), which are coaxial and are adapted to rotatably couple the respective basket (12, 13) to two supporting brackets (27, 28), which are mutually opposite with respect to the baskets that they support, said brackets (27, 28) being rigidly coupled to the supporting frame (11).

6. The device according to one or more of the preceding claims, **characterized in that** said pivots (25, 26) are each formed by a threaded element, which is adapted to pass through two holes (29, 30), a first hole (29) being open on said bracket (27, 28), a second hole (30) being open on a facing connecting flap (31) of the basket (12, 13), said threaded element being adapted to be screwed to a corresponding complementarily threaded locking female thread element (32).
7. The device according to claim 6, **characterized in that** said female thread element (32) is fixed inside the connecting flap (31) of the basket (12, 13).
8. The device according to one or more of the preceding claims, **characterized in that** said means for the rotation of the baskets (12, 13) also comprise means for maintaining the configuration of said baskets (12, 13).
9. The device according to claim 8, **characterized in that** said configuration maintaining means are constituted by at least one protrusion (33, 34), which protrudes from at least one connecting flap (31) of the two which each basket (12, 13) has, said protrusion (33, 34) being adapted to be inserted reversibly, by elastic deformation of the bracket (27, 28) and/or the flap (31), in selectively one of a plurality of holes (35) which are arranged in a circular arc in the vicinity of the first hole (29) on the facing bracket (27, 28).
10. The device according to one or more of the preceding claims, **characterized in that** said brackets (27, 28) are made of punch-cut and folded sheet metal fixed to the frame by means of threaded elements (36).
11. The device according to one or more of the preceding claims, **characterized in that** each connecting flap (31) is provided with two protrusions (33, 34), which are symmetrical with respect to the rotation axis of the basket (12, 13) to which it belongs, each pair of protrusions (33, 34) being insertable reversibly in a corresponding pair of symmetrical holes (35a, 35b) selected among a plurality of pairs of holes formed by two arcs of holes (35), which are arranged symmetrically and mutually opposite with respect to the axis of said first hole (29), on the facing supporting bracket (27, 28).

12. The device according to one or more of the preceding claims, **characterized in that** each one of said protrusions (33, 34) is formed by a stud provided on the connecting flap (31) to which they belong, said flap (31) being made of sheet metal.

13. The device according to one or more of the preceding claims, **characterized in that** said supporting frame (11) is formed by a box-like body made of sheet metal, which is open on the side directed toward the environment to be climate-controlled, said box-like body being provided with intake grilles (37, 38) for protection against the suction of any foreign objects.

14. The device according to one or more of the preceding claims, **characterized in that** said frame (11) is provided with a grille (37) on each of its faces (39) arranged transversely with respect to the supporting brackets (27, 28) of the baskets (12, 13), and at least one additional grille (38) on the bottom (40).

15. The device according to one or more of the preceding claims, **characterized in that** said frame (11) has a substantially square shape and has such dimensions that it can be positioned on a raised floor (19), of a per se known type, instead of a panel (42), which together with other identical panels (42) composes said raised floor (19).

16. The device according to one or more of the preceding claims, **characterized in that** it is closed in an upper region by a grille (43) preferably of the walkable type.

17. The device according to one or more of the preceding claims, **characterized in that** each basket (12, 13) is constituted by a cover (12a, 13a) made of sheet metal, to which the connecting flaps (31) belong, the cup-shaped bodies of the motorized blowers (14, 15, 16, 17) hanging from said cover (12a, 13a), said cover (12a, 13a) having a grille-shaped portion (12b, 13b) at each of the underlying fans.

18. The device according to one or more of the preceding claims, **characterized in that** it has a compartment (44) for accommodating a unit for controlling and managing the rotation rate of the blowers (14, 15, 16, 17), said control and management unit being interfaceable with a network of identical devices (10), which can be mutually controlled according to a configuration of the master-slave type.

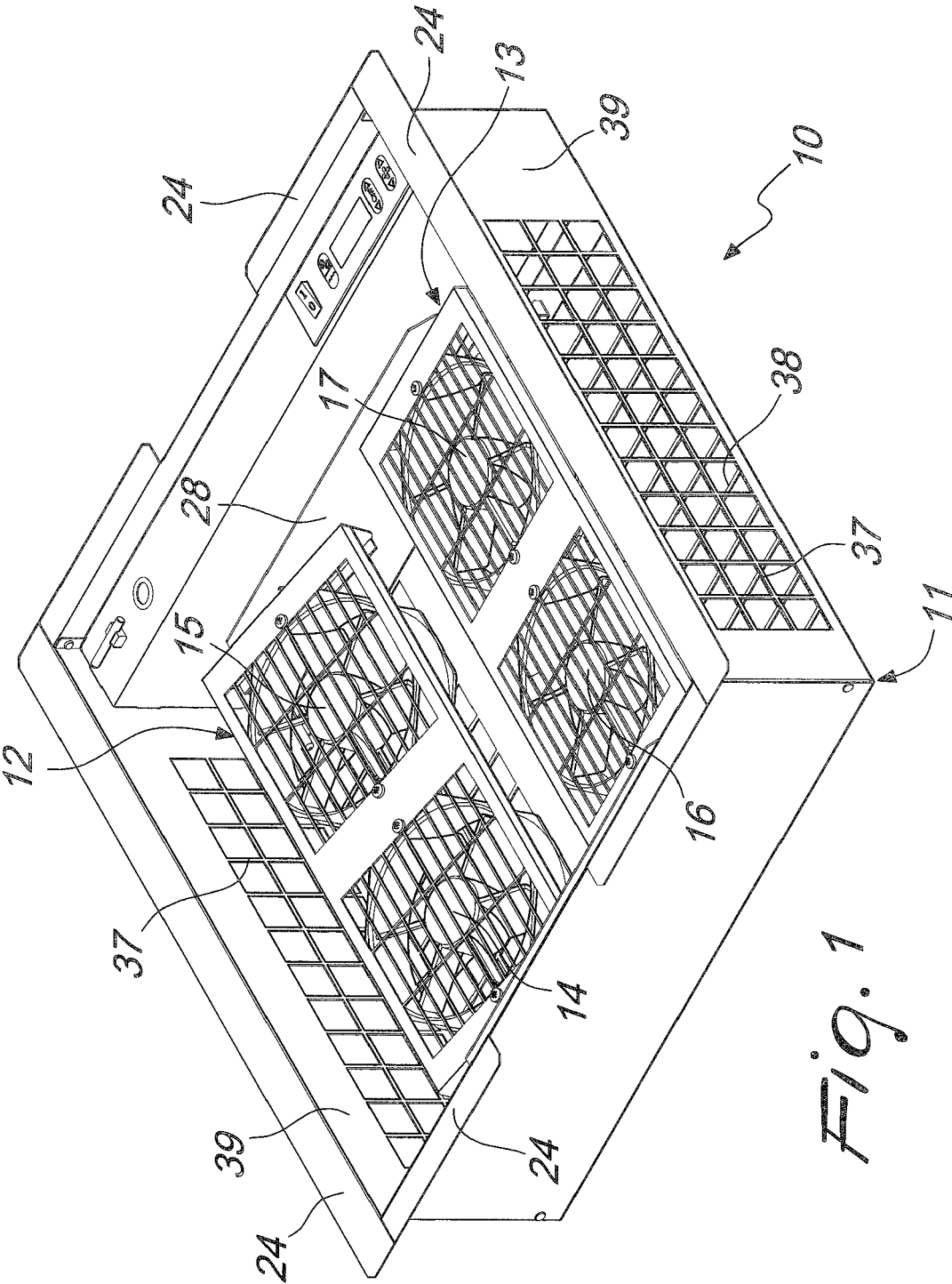


Fig. 1

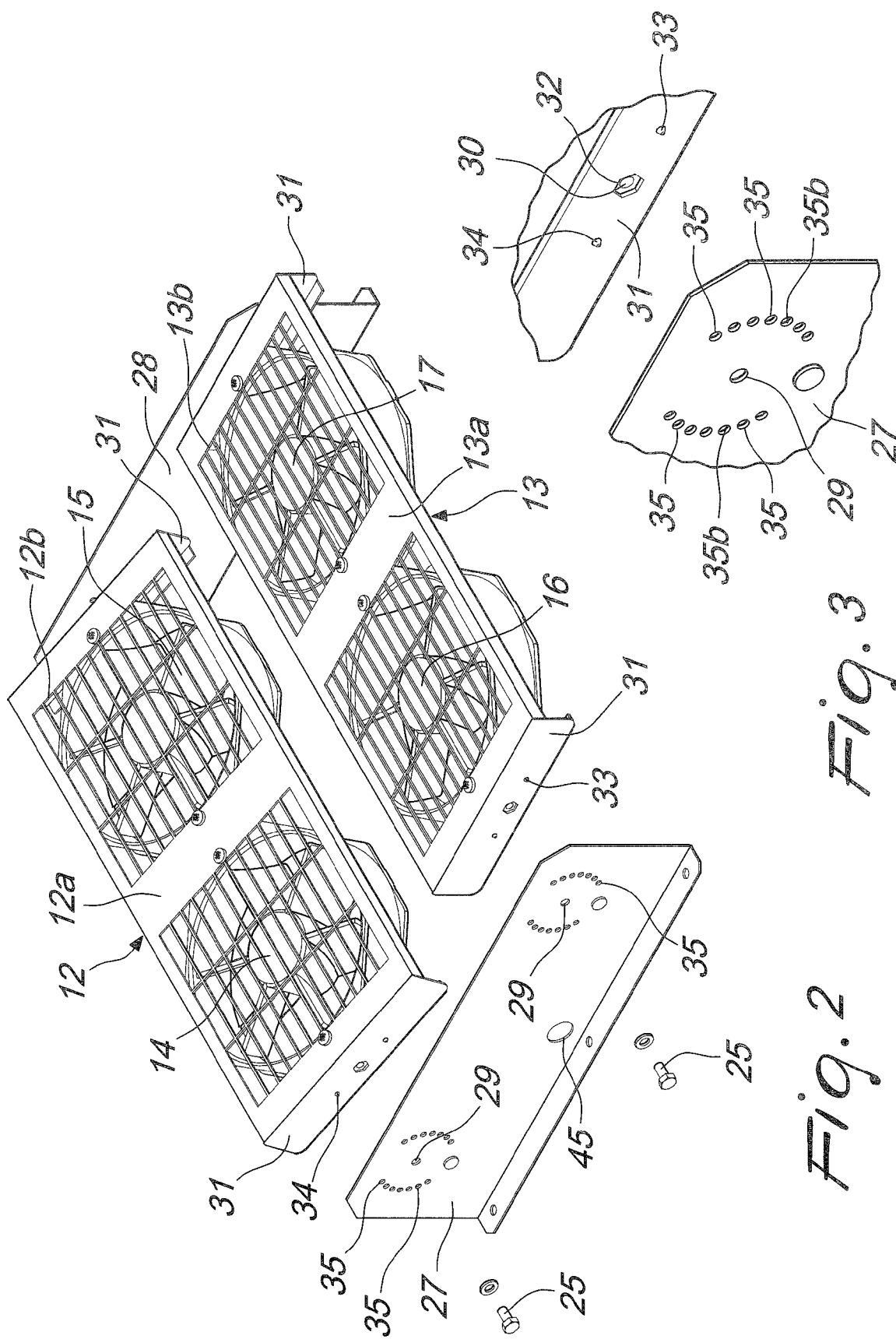


Fig. 2

Fig. 3

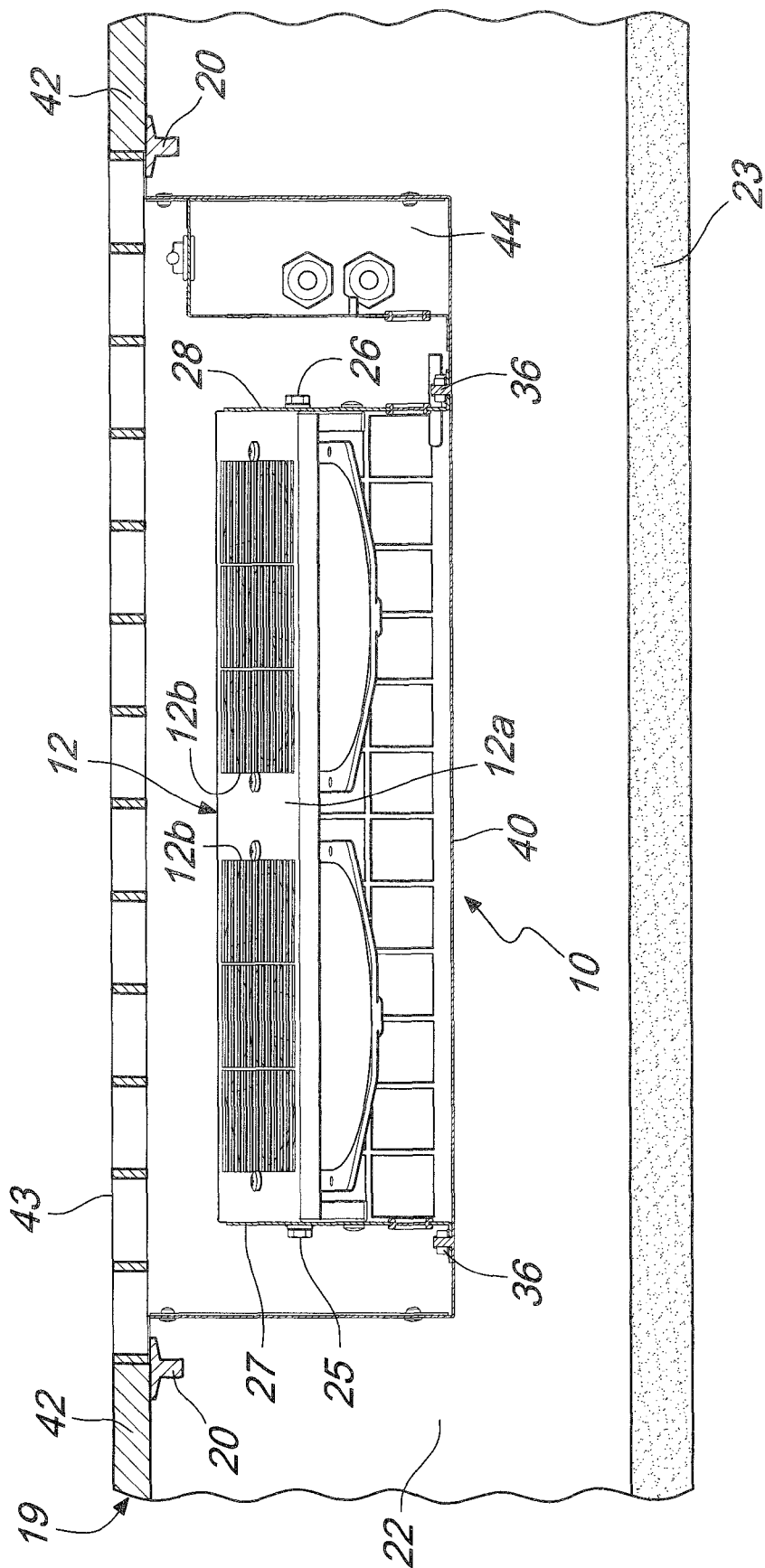
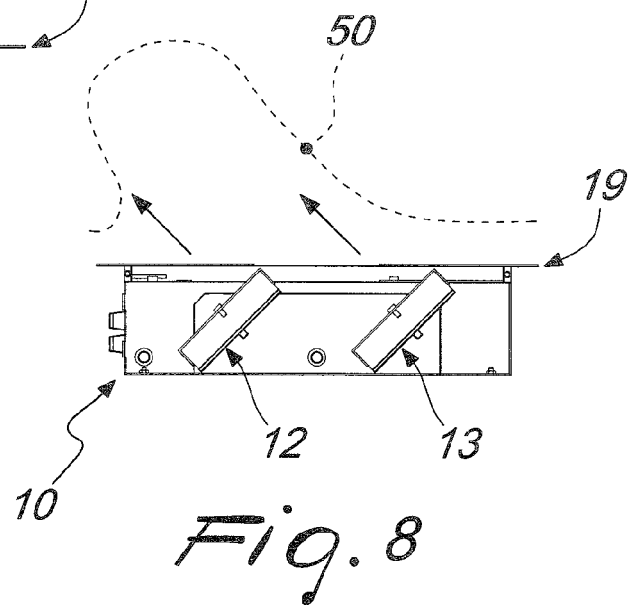
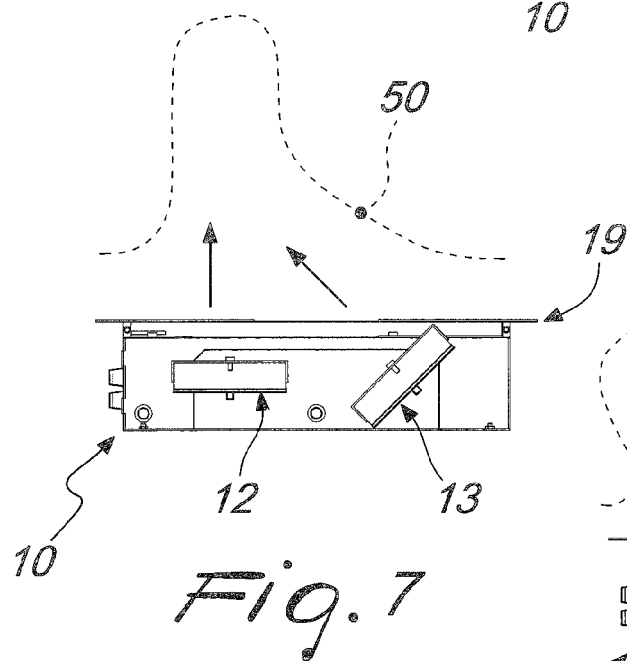
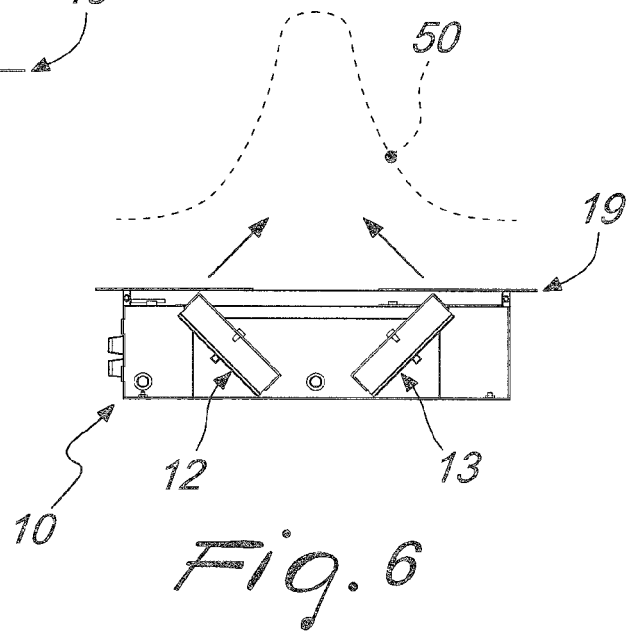
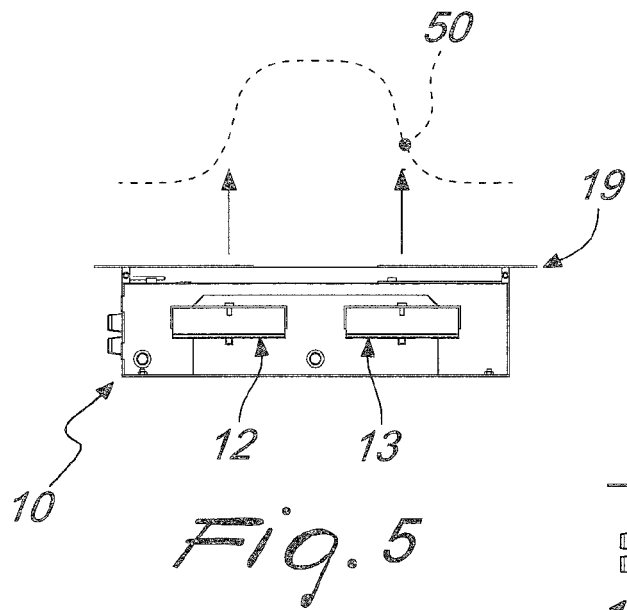


Fig. 4





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 11 4727

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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 06 11 4727

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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