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(54) **DEVICE FOR REMOVING DUST PARTICLES AND PATHOGENS FROM AN AIRFLOW, AND USE OF SUCH A DEVICE**

(57) Particle catch arrangements are used to remove particles from polluted air. Particles, such as smut, fine particular matter and exhaust gas particles pollute the air and are extremely unhealthy for human beings. The in-

vention relates to a device for removing dust particles and pathogens from an airflow. The invention also relates to the indoor use of such a device.

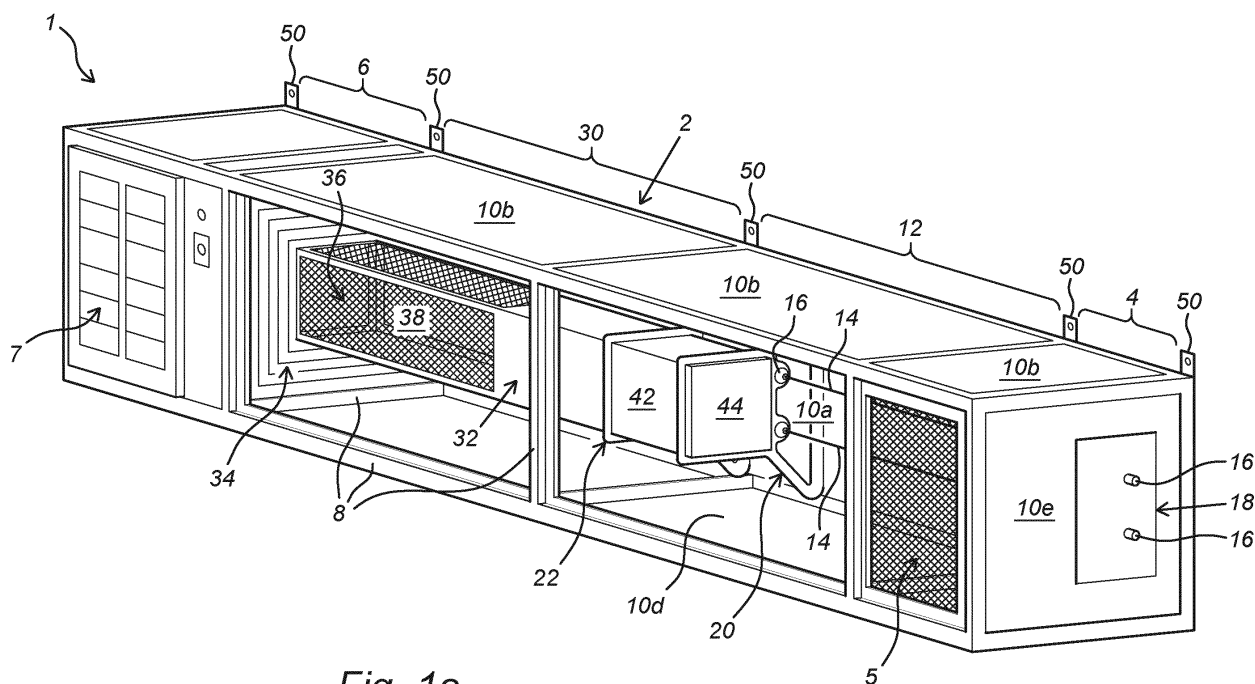


Fig. 1a

Description

[0001] The invention relates to a device for removing dust particles and pathogens from an airflow. The invention also relates to the indoor use of such a device.

[0002] Particle catch arrangements are used to remove particles from polluted air. Particles, such as smut, fine particular matter and exhaust gas particles pollute the air and are extremely unhealthy for human beings. Particle catch arrangements using electrostatic fields combined with corona generating electrodes are used to catch particles and remove them from polluted air. The corona generating electrodes locally ionizes the air resulting in ionized particles, which can be attracted by or forced towards a collecting surface to remove these particles from the contaminated air, as a result of which the air is at least partially purified. The known particle catch arrangements are typically applied outdoor along roads, in particular highways. This known particle catch arrangement has several drawbacks. The known particle catch arrangement is relatively bulky and voluminous, and requires a relative large electrostatic field to be generated to filter the polluted air. The required relative large electrostatic field results in relative large energy required and/or relative large collector plates. This results in a negative impact on environmental issues such as visual pollution and/or energy usage.

[0003] It is a first object of the present invention to eliminate the abovementioned problems or at least to provide an alternative.

[0004] It is a second object of the present invention to provide a relatively compact device for removing (dust) particles and pathogens from an airflow.

[0005] It is a third object of the present invention to provide an improved device for relatively efficiently removing dust particles and pathogens from an airflow.

[0006] At least one of these objects can be achieved by providing a device according to the preamble, comprising: at least one housing, comprising at least one air inlet for contaminated air and at least one air outlet for purified air, and at least one control unit connectable to a power source for powering the device, at least one fan connected to said control unit and configured to force a contaminated airflow to flow from the air inlet to the air outlet; wherein the housing encloses a plurality of compartments, extending between the air inlet and the air outlet, wherein a first compartment, connecting to the air inlet, comprises: at least one first grounded conductive wall of the housing, at least one corona generating electrode positioned within the first compartment and connected to the control unit, wherein the control unit is configured to apply a first voltage to the corona generating electrode, wherein said at least one corona generating electrode is configured to ionise at least a fraction of the dust particles and/or pathogens present in a contaminated airflow, and wherein said at least one corona generating electrode is positioned at a distance from said first conductive wall such that an electric wind is induced by

the electrostatic field extending between said at least one corona generating electrode, in charged state, and said at least one first grounded conductive wall of the housing; wherein a second compartment, connecting to the air outlet, comprises: at least one second grounded wall of the housing for collecting ionised dust particles and/or ionised pathogens, at least one conductive tube at least partially positioned within the second compartment and connected both to the air outlet and to the control unit, wherein the control unit is configured to apply a second voltage to the at least one tube, wherein said second voltage is at least half of the first voltage, wherein said tube comprises: a first outer end connected, directly or indirectly, to the air outlet, a conductive circumferential wall to be charged with the second voltage, and a substantially closed second outer end, directed away from the air outlet, wherein the circumferential wall is partially open in a first zone connecting to the first outer end, and wherein the circumferential wall is substantially closed in a second zone connecting both to the first zone and to the second outer end.

[0007] The device according to the invention is configured to subject to a contaminated air flow to a multi-stage purification, which increases the purification process of the contaminated air significantly. Moreover, since the successive purification steps take place in a single housing, the device can be designed in a relatively compact manner, which makes it suitable to apply the device indoor (in a building) and/or to purify an indoor atmosphere. Moreover, the (slim) device according to the invention is configured to operate with a significant lower energy consumption compared to existing solutions applied along car highways. The control unit may be either a simplistic control unit, without (a lot of) pre-programmed intelligence or may be formed by a (micro)computer. Typically, the device according to the invention is powered by an external power supply, such as the mains (such as 110/230 V AC).

[0008] The multi-stage purification comprises a first purification step, which takes place in the first compartment of the housing, and a second purification step, which takes place in the second compartment of the housing. More in particular, in the first compartment, at least a fraction of the contaminated air flow is charged, in particular ionized, by the (high-voltage) corona generating electrode(s). The charged particles are subjected to an electrical field extending in between the electrode(s) and at least one grounded wall of the first compartment, which creates an electric wind from the electrode(s) towards said at least one grounded wall. This electric wind moves the charged particles, and consequently other (collided and unbound) particles towards and onto the ground wall, where at least a fraction of these particles will stick, and hence will be collected. Typically, due to gravitational forces, the collected particles will eventually fall down onto a first collector plate, typically a bottom wall of the first compartment, after which the collected particles are removed from the device. The charged par-

ticles which are not collected (removed from the air flow) in the first compartment flow into the second compartment, wherein a similarly charged tube forces the charged particles towards at least one grounded wall of the second compartment, where at least a fraction of these particles will stick, and hence will be collected. Typically, due to gravitational forces, the collected particles will eventually fall down onto a second collector plate, typically a bottom wall of the second compartment, after which the collected particles are removed from the device. In the second compartment, a fraction of the charged particles will be caught by the at least second wall of the housing, and a remaining part of - then purified - air flow will flow through the opening(s) in the circumferential wall of the tube towards the outlet opening where the purified air will be released. Particles that can be removed by the device according to the invention are, for example, smut, exhaust gas, and fine particular matter, including solid and liquid particles, and including pathogens, in particular infectious microorganisms, such as (corona) viruses, bacteria, protozoans, prions, viroids, and fungi. Typically, pathogens will often be killed when subjected to a corona discharge generated by the corona generating electrode(s).

[0009] Preferably, the first compartment comprises at least two, and more preferably only two, corona generating electrodes positioned at a mutual distance and at a distance from the first grounded conductive wall. Preferably, the corona generating electrodes are oriented in parallel. Preferably, one corona generating electrode is oriented right above at least one other corona generating electrode. Preferably, each corona generating electrode is subjected to the same (constant) voltage.

[0010] Preferably, the control unit is configured to apply a first voltage of at least 15 kV, preferably at least +15 kV, to each corona generating electrode. This is often sufficient to realize a corona discharge. Preferably, the first voltage does not exceed 40 kV. Preferably, the second voltage does not exceed the first voltage, but is at least 50% of the first voltage, and may be identical to the first voltage. Preferably, the applied voltage as first voltage (and as second voltage) is a DC voltage. Although the corona generating electrode(s) can be subjected both to a positive voltage and a negative voltage, a positive voltage is often preferred since no ozone is produced with a positive voltage in contrary to a negative voltage, although a positive voltage is typically more difficult to realize than a negative voltage. Preferably, each corona generating electrode comprises a corona-emitting wire. This wire preferably extends through the substantially entire first compartment. Preferably, the diameter of each wire is between 0.1 and 2 mm and is more preferably approximately 0.25mm.

[0011] The first compartment is preferably elongated, wherein each corona generating electrode extends in a length direction of the first compartment. The second compartment is preferably elongated, wherein the tube extends in a length direction of the second compartment.

Typically, the first compartment and the second compartment together form a collective space, enclosed by the housing as such, and used for flow-through of air to be purified from the air inlet to the air outlet. A physical partition to separate the first compartment from the second compartment is conceivable, but typically such a physical partition is not required. The partition of the housing into a plurality of compartment may thus be a functional partition (or virtual partition). Preferably, the second compartment is positioned in line with the first compartment, wherein, more preferably the longitudinal axis of the second compartment coincides with the longitudinal axis of the first compartment. This can be realized by applying a linearly shaped elongated housing.

[0012] Preferably, each corona generating electrode and each tube is connected by at least one power cable to the control unit for powering (charging) each corona generating electrode and each tube.

[0013] Preferably, each corona generating electrode is mounted onto an insulating mounting structure, wherein said mounting structure is preferably affixed and/or clamped to the housing. This mounting structure may, for example, be at least partially made of plastic. Typically, the mounting structure is formed by an open frame to allow, preferably a substantially unhindered, flow-through of air. Preferably the at least one or each tube is mounted onto an insulating mounting structure, wherein said mounting structure is preferably affixed and/or clamped to the housing. Here, it is imaginable to use a mounting structure which is configured to simultaneously mount the tube(s) and the corona generating electrode(s).

[0014] In a preferred embodiment, the first compartment comprises a pair of a first grounded conductive rear wall and an opposed first front wall, wherein each corona generating electrode is positioned in between said pair of first walls and closer to the first rear wall than to the first front wall. This eccentric position of the corona generating electrode(s), as seen in a cross-sectional view of the first compartment, leads to an increased electrical field strength between the corona generating electrode(s) and the rear wall, which facilitates the induction of a desired electrical wind between said electrode(s) and said rear wall. A preferred wind speed of the electrical wind is at least 0.5 m/s. To this end, the mutual distance between each corona generating electrode is situated in between 10 and 30 cm, more preferably between 15 and 28 cm. In case a plurality of (neighbouring) corona generating electrodes is used, then the preferred minimum distance between neighbouring electrodes is between 5 and 45 cm, more preferably between 7.5 and 42 cm.

[0015] The length of the housing may vary strongly, but is typically situated between 1 and 8 m, more preferably between 2 and 6 m, and may, for example, be approximately 5 m. The depth and height of the housing may be identical or may mutually be distinctive. A typical depth and a typical height of the housing is situated between 40 and 90 cm, preferably between 60 and 80 cm,

and may, for example, be 70 cm.

[0016] Preferably the first compartment comprises a displaceable, in particular slidable and/or removable, bottom wall. As mentioned above collected particles onto a side wall of the first compartment, in particular onto a rear wall of the first compartment, will eventually fall, due to gravitational forces, down onto a first collector plate, typically a bottom wall of the first compartment, after which the collected particles are removed from the device. By applying a displaceable, in particular a slidable and/or removable, bottom wall, the bottom wall can be cleaned in a user-friendly and safe manner. For the same reason, the second compartment preferably comprises a displaceable, in particular slidable and/or removable, bottom wall. The bottom walls of the first compartment and the second compartment can be mutually connected or can even be integrated with each other as to form a single bottom wall.

[0017] The first compartment preferably comprises a substantially closed circumferential wall which is composed of a plurality of adjacent walls, including the at least one first grounded conductive wall, wherein the adjacent walls are preferably connected to a support frame of the (housing of the) device. Preferably, the housing as such is grounded. At least a part of the housing is preferably made of conductive materials, such as metal, in particular (stainless) steel or aluminium.

[0018] The conductive tube can be made entirely of a conductive material, such as metal. It is also imaginable that the conductive tube is made of a laminated material, wherein at least an outer layer (defining an outer surface) of the tube is made of a conductive material. One or more inner layers of the tube may be of an insulating material, which could be favourable for mounting purposes. The tube may have a rectangular, circular, oval or may have another polygonal cross-section. The (maximum) diameter of the conductive tube is preferably situated between 20 and 50 centimetres.

[0019] The second outer end of the tube may be pinched or closed e.g. by folding flaps of circumferential wall material over each other, in order to close this outer end. However, it is commonly preferable that the second outer end of the tube is provided with a lid, preferably a conductive lid, connected to the conductive circumferential wall of the tube, preferably conductively connected to the conductive circumferential wall of the tube. This conductive lid typically has a flat configuration, although other shapes, such as e.g. conical shapes, are also imaginable. Typically, this lid will be charged as well by the control unit during operation of the device, as a result of which the lid also contributes to the repulsion of particles charged in the first compartment, towards a grounded wall of the second compartment.

[0020] Preferably, at least a part of conductive circumferential wall of the tube, located in the first zone, is formed by a conductive lattice allowing flow-through of air from the second compartment towards the air outlet of the device. This lattice may make integral part of the

circumferential wall of the tube. Typically, the lattice is also actively charged by the control unit during operation of the device. The lattice may cover a part of the entire circumferential wall, as seen in cross-sectional view of the first zone of the tube. Preferably, in the first zone of the tube, the circumferential wall has an air permeability of between 30 and 70 percent. Less permeability will hinder flow-through of air in an undesired manner, and more permeability will affect a preferred repulsion effect caused by charging the lattice. Instead of a lattice, which is typically formed by a regular pattern of small orifices, often oriented in a matrix configuration, also other kinds of openings may be used, such as e.g. slits or slots applied in the circumferential wall.

[0021] Preferably, the second compartment comprises a substantially closed circumferential wall which is composed of a plurality of adjacent walls, including the at least one second grounded conductive wall, wherein the adjacent walls are preferably connected to a support frame of the device.

[0022] The fan is preferably positioned downstream the second compartment, and preferably in between the second compartment and the air outlet. This allows that only purified air can pass the fan, which counteracts fouling of the fan by contaminated air. The fan is preferably configured to realize an air flow speed through the housing of between 0.5 and 2 m/s within the device, more preferably an air flow speed through the housing of approximately 1 m/s. The air flow speed caused by the fan is preferably adjustable, more preferably manually adjustable, e.g. by using a rotary knob or other kind of switch.

[0023] An inlet opening of the air inlet of the device, and an inlet opening of the first compartment mutually enclose an angle, preferably a 90 degrees angle. This angled orientation of both air inlets forces the contaminated air flow to follow a nonlinear path causing a desired turbulence in the air flow, which will improve the purification process, at least in the first compartment.

[0024] Preferably, the housing is provided with one or more mounting elements, such as hooks and/or suspension eyes, for mounting the device to a wall and/or ceiling.

[0025] Preferably, the device comprises at least one heating element to heat the air flow guided through the device, preferably to a temperature of at least 40 degrees Celsius. This heating element may be positioned, for example, in the first compartment and/or second compartment. This heating element may kill specific pathogens, such as (corona) viruses. Also, other irradiation sources, such as for example an ultraviolet (UV) irradiation source may be used to disinfect the contaminated air flow within the device, in particular within the housing. It is also imaginable, that the device comprises at least one cooling unit to cool the air flowing through the device, which allows the device to function as air-conditioning unit as well. It is conceivable that the heating element (or other irradiation source) and the cooling unit are both applied in the device according to the invention.

[0026] Preferably, the device comprises a power source connected to the control unit. This power source may be formed, for example, by a rechargeable battery and/or by a solar panel, to be able to (relatively) autonomously power the device if needed/desired.

[0027] The invention also relates to the use of a device according to the invention in a building and/or to purify air within a building and/or (temporarily) extracted from a building. Although the device according to the invention can be used in a residential environment (at home), the device is primarily intended for use in public or commercial spaces, such a governmental building, stores, malls, and shops, and in industries.

[0028] The invention will be further explained with reference to the appended non-limitative figures, which show preferred embodiments of the present invention and wherein:

- Figure 1a shows a perspective view of a part of an embodiment of a device for removing dust particles and pathogens from an airflow according to the invention;
- Figure 1b shows a perspective view of the device shown in figure 1a;
- Figure 1c shows a cross-sectional top view of the device shown in figure 1a;
- Figure 1d shows a detailed perspective view of a conductive tube of the device shown in figure 1a;
- Figure 2 shows a cross-section of a first compartment of the device according to figures 1a-1c; and
- Figure 3 shows a cross-section of a first compartment of a device according to an alternative embodiment of the invention.

[0029] In figures 1a-1d different views of the same embodiment of a device 1 according to the present invention are shown. In these figures the same reference numbers are used for the same or equivalent features.

[0030] Figure 1a shows the (elongated) device 1 for removing dust particles and pathogens from an airflow. The device contains a housing 2 which is provided with an air inlet section 4 with an air inlet 5 for contaminated air at one end, and an air outlet section 6 with an air outlet 7 for purified air at an opposed end. The outer surface of the housing 2 is constructed from a rectangular frame structure 8 onto which outer walls 10 are provided to create an enclosed inner space between the air inlet 5 and the air outlet 7. The housing 2 thus has the overall shape of a tube which acts as a conduit for the airflow from the air inlet 5 towards the air outlet 7. In figure 1, the rear walls 10a, the top walls 10b and the bottom walls 10d are depicted. Front walls 10c are left out in fig. 1, in order to show the inner space of the housing 2. All the walls 10a-d are made of conductive material and are grounded. The air inlet 4 is provided with a grid 5. Inside the air outlet section 6, a fan 3 is present (not visible in figure 1a) to create an airflow from the air inlet 5 to the air outlet 7. The air inlet section is further provided with an end

wall 10e.

[0031] The housing contains a first compartment 12 which is a zone of the housing directly connected to the air inlet 5, wherein two corona generating electrodes 14 are positioned. The electrodes 14 are conductive wires which are strung between respective wire clamps 16 and positioned at a mutual distance from each other. The wire clamps 16 are fixed onto the housing 2 by non-conductive support structures 18 and 20, so that the electrodes 14 are electrically isolated from the outer conductive walls 10a-d.

The housing 2 further contains a second compartment 30 which is a zone wherein a tube 32 made out of a conductive circumferential wall is positioned. The tube 32 is supported within the housing 2 by non-conductive support structures 20 and 22 that connect the tube 32 to the housing 2 in a fixed position. The tube 32 is at one open end connected to a non-conductive partition 34 which closes off any direct airflow from the second compartment into the outlet section 6. The partition 34 is provided with an opening 36 onto which the open end of the tube 32 is connected so that the inner space of the tube 32 is fluidly connected to the outlet section 6 in a direct way. The circumferential wall of the tube 32 has a section 38 which is provided with holes 40 in the form of a conductive lattice permitting the airflow to pass through, as well as a section 42 which is impermeable to the airflow. A second end of the tube 32 that is opposite to the first end of the tube 32, is permanently closed off by a conductive lid 44. The configuration of the second compartment establishes that an airflow that is led through the device 1, necessarily passes through the inside of the tube 32.

The device 1 further contains a control unit (not visible) which is located in the air outlet section 6. The control unit is configured for connection to a power source for powering the device, and for controlling the voltages to be applied to the corona electrodes 14 and the tube 32. Preferably, the voltage applied each of to the corona (generating) electrodes 14 is at least +15 kV. Preferably the voltage applied to the tube is at least +7.5 kV, more preferably +15 kV. For this purpose, one or more power cables are used to connect the corona electrodes 14 and the tube to the control unit. The top side of the housing 2 is provided with several mounting elements 50 for mounting the device to a wall or ceiling.

[0032] The elongated device 1 typically has a length between 3 and 5 m, and the diameter of the conductive tube can vary between 20 and 50 cm.

[0033] Figure 1b shows a closed perspective view of the elongated device 1 for removing dust particles and pathogens from an airflow, showing the front wall(s) 10c and top wall(s) 10b. The figure shows that the housing 2 encloses a plurality of compartments 30, 12, 4, 6, extending between the air inlet 5 for contaminated air and the air outlet 7 for purified air. The air inlet 5 is connected to the air inlet section 4, which is connected to the first compartment 12. The first compartment is connected to the

second compartment 30 and the second compartment 30 is connected to the air outlet section 6 through openings 40 in a lattice 38 in the tube 32 (shown in figure 1c). The purified air can leave the device 1 from the air outlet section 6 to the air outlet 7. In this embodiment the air inlet 5 and outlet 7 are shown in the front of the device 1. These do not necessarily need to be on the same side of the device. The figure also shows a control element 51 for regulating the fan speed of the fan 7.

[0034] Figure 1c shows a cross-sectional top view of an embodiment shown in figure 1a and 1b of a device 1 for removing dust particles and pathogens from an airflow. This figure shows a housing 2, comprising the air inlet 5 positioned in an inlet section 4 for contaminated air and an air outlet 7 for purified air and a control unit 9 connectable to a power source for powering the device and a fan 3 inside the air outlet section 6. The fan 3 is connected to said control unit and configured to force a contaminated airflow to flow from the air inlet 5 to the air outlet 7. The control unit 9 is covered by an air shield 41, which guides the purified air towards the air outlet. The fan 3 is in this embodiment positioned downstream the second compartment 30 in between the second compartment 30 and the air outlet 7. The corona generating wires 14 in the first compartment 12 are connected to the control unit 6, wherein the control unit 6 is configured to apply a first voltage to the corona generating wires 14. These corona generating wires 14 are configured to ionise at least a fraction of the dust particles and/or pathogens present in a contaminated airflow coming from the air inlet 5. In this top view it is visible that both corona generating wires 14 as were shown in figure 1a are positioned spaced at the same distance from the front and rear walls of the housing 2 in the first compartment 12. The first compartment 12 comprises a pair of a first grounded conductive rear wall 10a' and an opposed first front wall 10c', wherein each corona generating wire 14 is positioned in between said pair of walls and closer to the first rear wall 10a' than to the first front wall 10c'. The corona generating wires 14 are positioned such that an electric wind is induced by the electrostatic field extending between said corona generating wires 14, in charged state, and the grounded conductive wall 10a' of the housing 2. The shown eccentric position of these corona generating wires 14, leads to an increased electrical field strength between the corona generating wires 14 and the first rear wall 10a', which facilitates the induction of a desired electrical wind between said wires 14 and said first rear wall 10a'.

[0035] Figure 1d shows a detailed view of the first zone 42 of the conductive tube 32 of the device shown in figures 1a-1c wherein the circumferential wall is partially open in a first zone 42 connecting to the first outer end. The circumferential wall is partially open due to the holes 40 in the form of a conductive lattice allowing purified air to pass through to the opening 36. The lattice covers a part of the entire circumferential wall of the first zone 38 of the conductive tube 32. The figure also shows that the

second zone 42 of the tube 32 connects to the first zone 38, wherein the circumferential wall in the second zone is substantially closed.

[0036] Figure 2 shows schematically a cross-section of the first compartment 12 of the elongated device 1 shown in fig. 1, wherein identical elements are indicated by identical reference numerals. The shown cross-section of the first compartment is made in a plane perpendicular to the longitudinal direction of the device 1, i.e. perpendicular to the corona generating electrodes 14, in this embodiment formed by corona generating wires 14. The housing 2 of the first compartment 12 has a rear wall 10a, a top wall 10b, a front wall 10c, and a bottom wall 10d. The overall width of the first compartment between rear wall and front wall is indicated by d5. The position of the corona wires 14 is chosen such that the distance d1 from the rear wall 10a, is between (and including) $0.1 * d5$ and $0.40 * d5$. Furthermore, the vertical distance d2 between the two wires 14, is between $0.5 * d1$ and $1.5 * d1$. It is preferred that the vertical distance d3 of the upper wire to the top wall 10b is equal to the vertical distance d3 of the lower wire to the bottom wall 10d.

[0037] Figure 3 shows schematically a cross-section of a first compartment 12 of an elongated device 1 that is of an alternative, cylindrical design, wherein the housing 2 is made of a conductive circumferential wall 70. The shown cross-section of the first compartment 12 is made in a plane perpendicular to the longitudinal direction of the device 1, i.e. perpendicular to the corona wires 14. The diameter of the circumferential wall 70 is indicated by d5.

It will be apparent that the invention is not limited to the working examples shown and described herein, but that numerous variants are possible within the scope of the attached claims that will be obvious to a person skilled in the art.

[0038] The verb "comprise" and conjugations thereof used in this patent publication are understood to mean not only "comprise", but are also understood to mean the phrases "contain", "substantially consist of", "formed by" and conjugations thereof.

Claims

1. Device for removing dust particles and pathogens from an airflow, comprising
 - at least one housing, comprising
 - at least one air inlet for contaminated air and
 - at least one air outlet for purified air, and
 - at least one control unit connectable to a power source for powering the device,
 - at least one fan connected to said control unit and configured to force a contaminated airflow

to flow from the air inlet to the air outlet;

wherein the housing encloses a plurality of compartments, extending between the air inlet and the air outlet,

wherein a first compartment, connecting to the air inlet, comprises:

- at least one first grounded conductive wall of the housing,
- at least one corona generating electrode positioned within the first compartment and connected to the control unit, wherein the control unit is configured to apply a first voltage to the corona generating electrode, wherein said at least one corona generating electrode is configured to ionise at least a fraction of the dust particles and/or pathogens present in a contaminated airflow, and wherein said at least one corona generating electrode is positioned at a distance from said first conductive wall such that an electric wind is induced by the electrostatic field extending between said at least one corona generating electrode, in charged state, and said at least one first grounded conductive wall of the housing;

wherein a second compartment, connecting to the air outlet, comprises:

- at least one second grounded wall of the housing for collecting ionised dust particles and/or ionised pathogens,
- at least one conductive tube at least partially positioned within the second compartment and connected both to the air outlet and to the control unit, wherein the control unit is configured to apply a second voltage to the at least one tube, wherein said second voltage is at least half of the first voltage, wherein said tube comprises:

- a first outer end connected, directly or indirectly, to the air outlet,
- a conductive circumferential wall to be charged with the second voltage, and
- a substantially closed second outer end, directed away from the air outlet,

wherein the circumferential wall is partially open in a first zone connecting to the first outer end, and wherein the circumferential wall is substantially closed in a second zone connecting both to the first zone and to the second outer end.

2. Device according to claim 1, wherein the first compartment comprises at least two corona generating electrodes positioned at a mutual distance from each other and from the first grounded conductive wall.

3. Device according to claim 1 or 2, wherein the control unit is configured to apply a first voltage of at least 15 kV, preferably at least +15 kV, to each corona generating electrode.

4. Device according to one of the foregoing claims, wherein each corona generating electrode comprises a corona-emitting wire.

5. Device according to one of the foregoing claims, wherein the first compartment is elongated, and wherein each corona generating electrode extends in a length direction of the first compartment.

6. Device according to one of the foregoing claims, wherein each corona generating electrode is mounted onto an insulating mounting structure, wherein said mounting structure is preferably affixed to the housing.

7. Device according to one of the foregoing claims, wherein the first compartment comprises a pair of a first grounded conductive rear wall and an opposed first front wall, wherein each corona generating electrode is positioned in between said pair of first walls and closer to the first rear wall than to the first front wall.

8. Device according to claim 7, wherein the minimum distance between each corona generating electrode and the first rear wall is 100 millimetres.

9. Device according to one of the foregoing claims, wherein the first compartment comprises a substantially closed circumferential wall which is composed of a plurality of adjacent walls, including the at least one first grounded conductive wall, wherein the adjacent walls are preferably connected to a support frame of the device.

10. Device according to one of the foregoing claims, wherein at least an outer surface of the conductive tube is made of a conductive material.

11. Device according to one of the foregoing claims, wherein the dimension of the intersection and/or the diameter of the conductive tube is situated between 20 and 50 centimetres.

12. Device according to one of the foregoing claims, wherein the second outer end of the tube is provided with a lid, preferably a conductive lid, connected to the conductive circumferential wall of the tube, preferably conductively connected to the conductive circumferential wall of the tube.

13. Device according to one of the foregoing claims, wherein a part of conductive circumferential wall of

the tube, located in the first zone, is formed by a conductive lattice allowing flow-through of air from the second compartment towards the air outlet of the device.

14. Device according to claim 13, wherein, in the first zone of the tube, the circumferential wall has an air permeability of between 30 and 70 percent.
15. Device according to one of the foregoing claims, wherein the second compartment is elongated and wherein the tube extends in a length direction of the second compartment.
16. Device according to one of the foregoing claims, wherein the tube is mounted by at least one insulating mounting structure, which mounting structure is preferably affixed to the housing of the device.
17. Device according to one of the foregoing claims, wherein the first compartment and/or the second compartment comprises a displaceable, in particular removable, bottom wall.
18. Device according to one of the foregoing claims, wherein the second compartment comprises a substantially closed circumferential wall which is composed of a plurality of adjacent walls, including the at least one second grounded conductive wall, wherein the adjacent walls are preferably connected to a support frame of the device.
19. Device account to one of the foregoing claims, wherein the fan is positioned downstream the second compartment, and preferably in between the second compartment and the air outlet.
20. Device account to one of the foregoing claims, wherein the fan is configured to realize an air flow speed of between 0.5 and 2 m/s within the device.
21. Device according to one of the foregoing claims, wherein an inlet opening of the air inlet of the device, and an inlet opening of the first compartment mutually enclose an angle, preferably a 90 degrees angle.
22. Device according to one of the foregoing claims, wherein the housing is provided with one or more mounting elements for mounting the device to a wall and/or ceiling.
23. Device account to one of the foregoing claims, wherein the device comprises at least one heating element to heat the air flow guided through the device, preferably to a temperature of at least 40 degrees Celsius.
24. Device account to one of the foregoing claims,

wherein the device comprises a power source connected to the control unit.

25. Use of a device as claimed in one of the foregoing claims in a building.

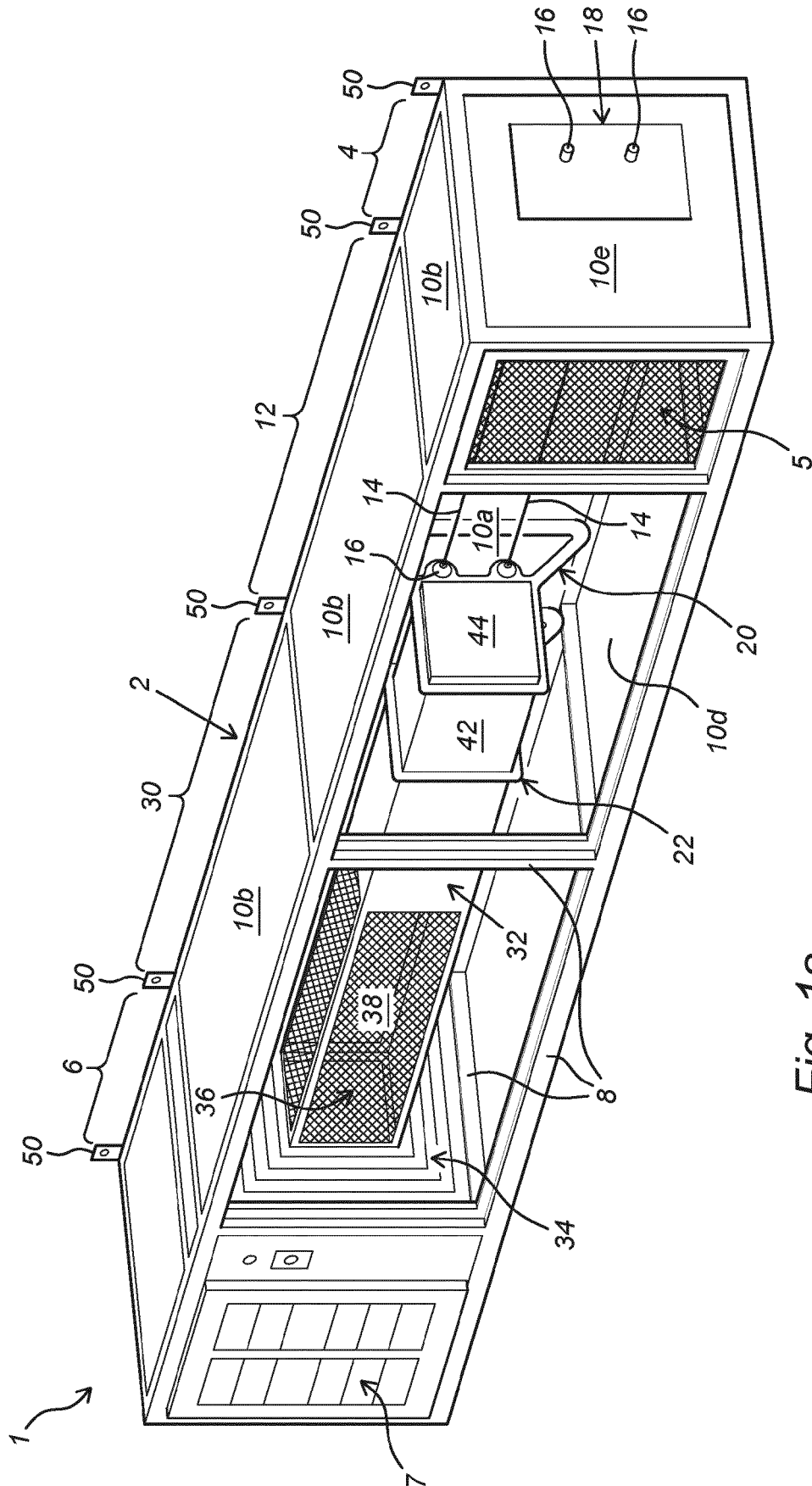
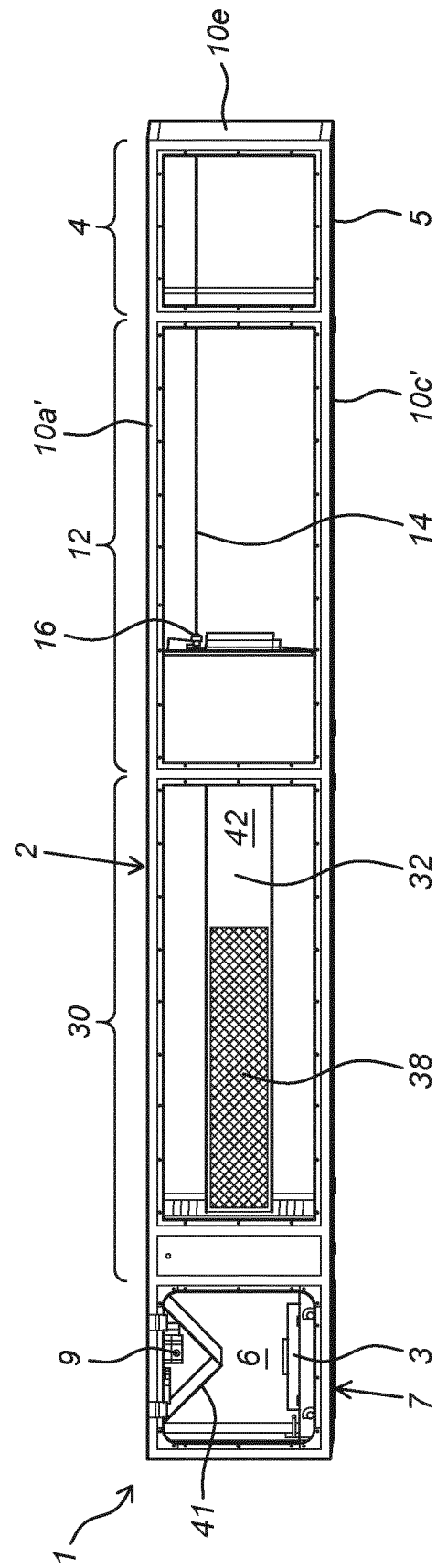
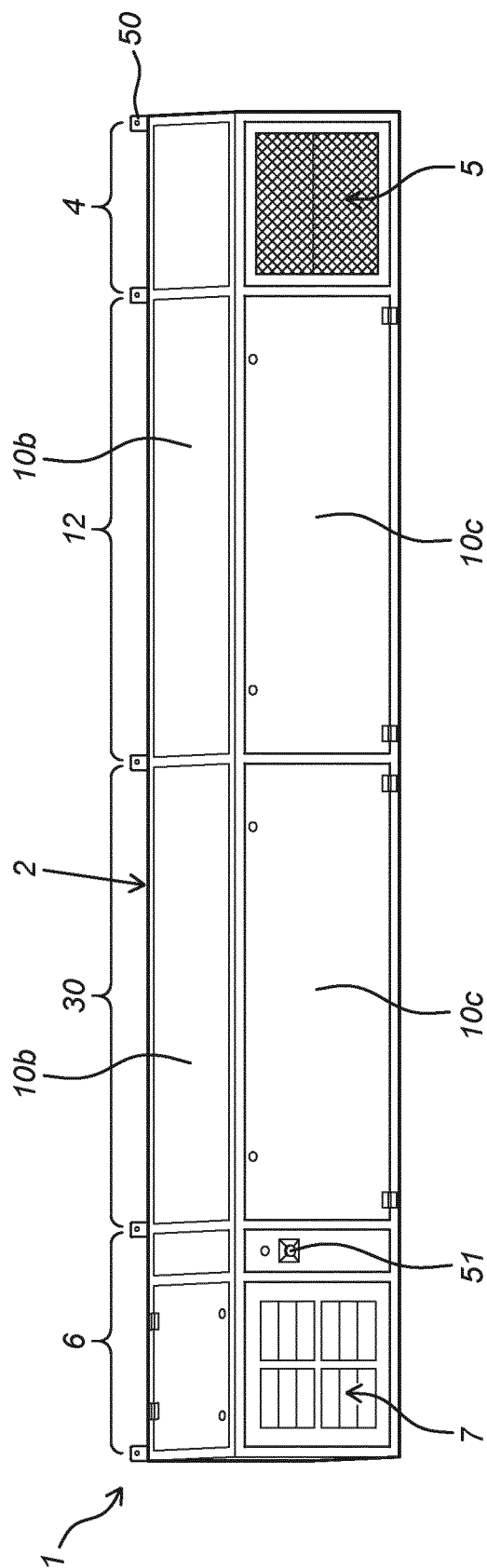


Fig. 1a



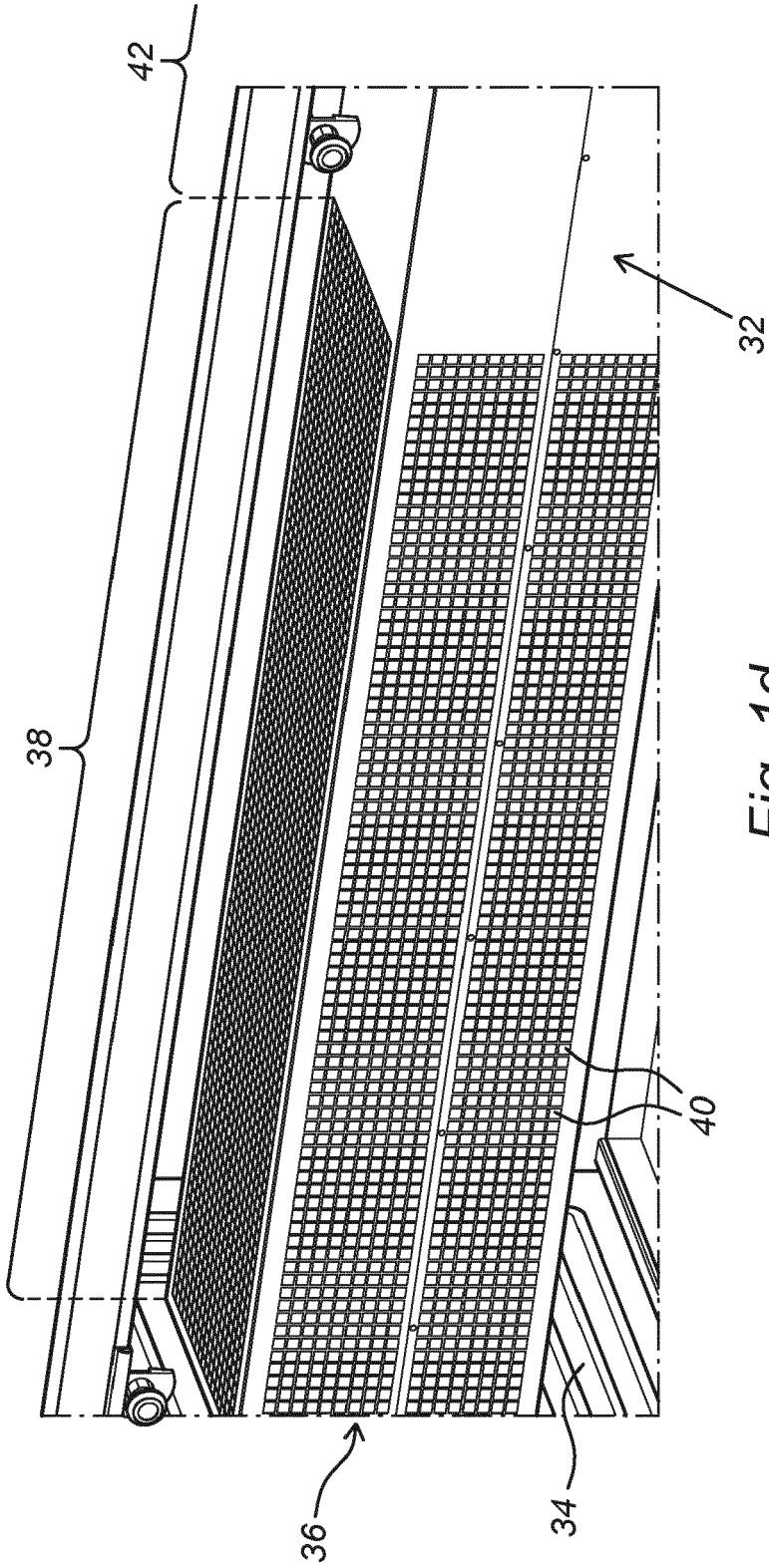


Fig. 1d

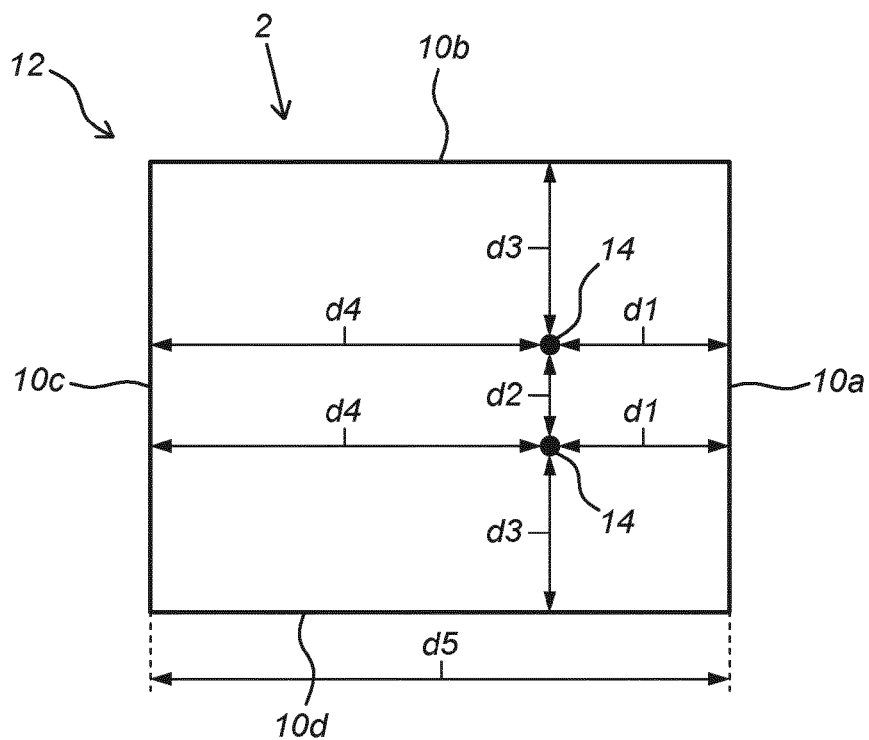


Fig. 2

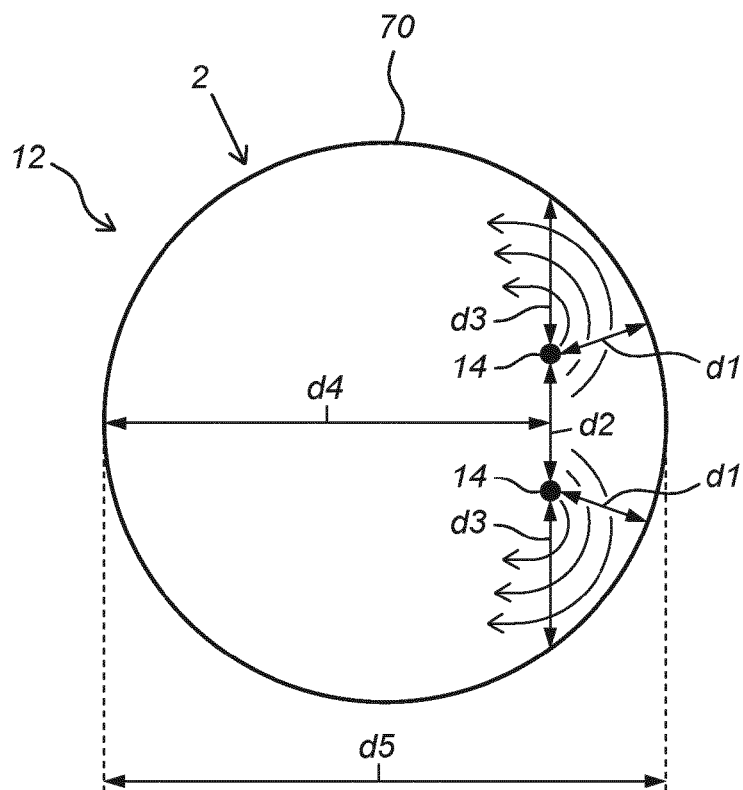


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 21 17 5293

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 2 528 939 A (UNIV STAFFORDSHIRE [GB]) 10 February 2016 (2016-02-10) * abstract * * figure 1 * * page 4, line 10 - page 7, line 3 *	1-25	INV. B03C3/06 B03C3/12 B03C3/49
A	US 2004/025497 A1 (TRUCE RODNEY JOHN [AU]) 12 February 2004 (2004-02-12) * abstract * * figure 4 * * paragraphs [0064] - [0072] *	1-25	
A	US 2 142 129 A (WILHELM HOSS FRIEDRICH ET AL) 3 January 1939 (1939-01-03) * abstract * * figure 1 * * column 2, lines 30-48 * * column 3, lines 1-71 *	1-25	
A	US 1 605 648 A (COOKE MILTON W) 2 November 1926 (1926-11-02) * abstract * * figures 1-4 *	1-25	TECHNICAL FIELDS SEARCHED (IPC) B03C
A	US 5 288 305 A (GELLERT BERND [CH] ET AL) 22 February 1994 (1994-02-22) * abstract * * figure 3 *	1-25	
A	US 4 853 010 A (SPENCE BILLY F [US] ET AL) 1 August 1989 (1989-08-01) * abstract * * figure 1 *	1-25	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 28 September 2021	Examiner Bielert, Erwin
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	

EPO FORM 1503 03.82 (P04C01)

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

EP 21 17 5293

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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28-09-2021

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2528939 A	10-02-2016	NONE	
US 2004025497 A1	12-02-2004	CN 1476354 A	18-02-2004
		EP 1343590 A1	17-09-2003
		US 2004025497 A1	12-02-2004
		WO 0242003 A1	30-05-2002
US 2142129 A	03-01-1939	NONE	
US 1605648 A	02-11-1926	NONE	
US 5288305 A	22-02-1994	EP 0504452 A1	23-09-1992
		ES 2075238 T3	01-10-1995
		US 5288305 A	22-02-1994
US 4853010 A	01-08-1989	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82