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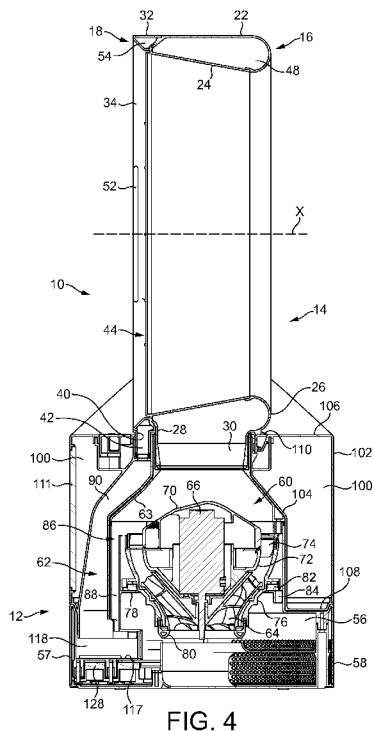
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(54) Title: A FAN ASSEMBLY



(57) Abstract: A fan assembly includes a nozzle and a base on which the nozzle is mounted. The nozzle has a first air inlet, a first air outlet, and a first interior passage for conveying air from the first air inlet to the first air outlet. The nozzle also includes a second air inlet, a plurality of second air outlets, and a second interior passage for conveying air from the second air inlet to the second air outlets. The nozzle defines a bore about which the interior passages extend and through which air from outside the fan assembly is drawn by air emitted from the air outlets. The body includes a motor and impeller unit for generating a first air flow through the first interior passage and a second air flow through the second interior passage. A first air passageway conveys the first air flow to the first air inlet and a second air passageway conveys the second air flow to the second air inlet. One of the temperature, humidity, composition and electrical charge of the second air flow is changed before it is emitted from the nozzle.

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## **A FAN ASSEMBLY**

### **FIELD OF THE INVENTION**

The present invention relates to a fan assembly. In a preferred embodiment, the present invention provides a humidifying apparatus for generating a flow of moist air and a flow of air for dispersing the moist air within a domestic environment, such as a room, office or the like. The invention may also be used to disperse a hot, cool, scented or ionized air flow within an environment.

### **BACKGROUND OF THE INVENTION**

Domestic humidifying apparatus is generally in the form of a portable appliance having a casing comprising a water tank for storing a volume of water, and a fan for creating a flow of air through an air duct of the casing. The stored water is conveyed, usually under gravity, to an atomizing device for producing water droplets from the received water. This device may be in the form of high frequency vibrating device, such as a transducer. The water droplets enter the flow of air passing through the air duct, resulting in the emission of a mist into the environment. The appliance may include a sensor for detecting the relative humidity of the air in the environment. The sensor outputs a signal indicative of the detected relative humidity to a drive circuit, which controls the transducer to maintain the relative humidity of the air in the environment around a desired level. Typically, the actuation of the transducer is stopped when the detected relative humidity is around 5% higher than the desired level, and is restarted when the detected relative humidity is around 5% lower than the desired level.

The flow rate of the air emitted from such a humidifier tends to be relatively low, for example in the range from 1 to 2 litres per second, and so the rate at which the humid air is dispersed into a room can be very low. Furthermore, as the relative humidity of the air in the local environment of the humidifier will rise relatively rapidly in comparison to that of the air in the local environment of the user, the relative humidity detected by the sensor will not, at least initially, be indicative of the relative humidity of the air local to the user. As a result, the actuation of the transducer may be stopped

when the relative humidity of the air in the local environment of the user is significantly below the desired level. Due to the relatively low rate at which the humid air is dispersed into the room, it can then take some time for the detected relative humidity to fall to a level at which the actuation of the transducer is restarted. Consequently, it may  
5 take a long period of time for the relative humidity of the air in the local environment of the user to reach the desired level.

WO 2010/100462 describes humidifying apparatus which comprises a humidifier for emitting moist air into the atmosphere, and, positioned in front of the humidifier, a fan  
10 assembly which comprises a body housing a motor-driven impeller for creating an air flow, and an annular nozzle mounted on the body which comprises an interior passage receiving the air flow and an air outlet for emitting the air flow. The nozzle defines a bore through which both air from outside the nozzle and the moist air emitted from the humidifier are drawn by the air flow emitted from the mouth. The outlet of the  
15 humidifier is located at the same level as the lowermost portion of the bore of the nozzle. Through the entrainment of the moist air emitted from the humidifier within an air current generated by the fan assembly, the moist air can be rapidly conveyed away from the humidifier to a distance of up to several metres. This can enable a user located at this distance from the humidifier to experience a rapid rise in the relative humidity of  
20 the air in the local environment.

### **SUMMARY OF THE INVENTION**

In a first aspect, the present invention provides a fan assembly comprising:

a nozzle having at least one first air inlet, at least one first air outlet, a first  
25 interior passage for conveying air from said at least one first air inlet to said at least one first air outlet, at least one second air inlet, at least one second air outlet, and a second interior passage for conveying air from said at least one second air inlet to said at least one second air outlet, the nozzle defining a bore about which the interior passages extend and through which air from outside the fan assembly is drawn by air emitted  
30 from the air outlets;

a body on which the nozzle is mounted, the body comprising flow generating means for generating a first air flow through the first interior passage and a second air flow through the second interior passage, a first air passageway for conveying the first air flow to said at least one first air inlet, and a second air passageway for conveying the second air flow to said at least one second air inlet, the second air passageway being arranged to receive air from the first air passageway downstream from the flow generating means, and

means for changing one of the temperature, humidity, composition and electrical charge of the second air flow.

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In an illustrated embodiment, the fan assembly includes a humidifier for humidifying the second air flow, but the fan assembly may alternatively comprise one of a heater, a chiller, an air purifier and an ionizer for changing another parameter of the second air flow.

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A difference between the fan assembly of the present invention, when used to emit a humidified air current, and the humidifying apparatus described in WO 2010/100462 is that in the present invention, the nozzle of the fan assembly is arranged to emit both the humidified second air flow and the first air flow which carries the humidified air flow into the environment. In contrast, in WO 2010/100462 the humidified air flow is emitted from an outlet of the humidifying apparatus located behind the fan assembly, and entrained within a lower part of the air flow generated by the fan assembly. The present invention can thus allow the humidified air flow to be emitted from one or more different air outlets of the nozzle. These air outlets may be positioned, for example, about the bore of the nozzle to allow the humidified air flow to be dispersed relatively evenly within the first air flow. The means for changing one of the aforementioned parameters of the second air flow is preferably located in the body of the fan assembly. By locating the components that change the humidity of the second air flow within the body, the fan assembly may have a compact appearance, a reduced number of components and therefore reduced manufacturing costs.

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The body of the fan assembly comprises a first air passageway for conveying the first air flow to the first air inlet(s) of the nozzle and a second air passageway for conveying the second air flow to the second air inlet(s) of the nozzle. The means for changing the aforementioned parameter of the second air flow may therefore be located at least  
5 partially within the second air passageway.

The body may comprise an air flow inlet for admitting the first air flow into the fan assembly. The air flow inlet may comprise a single aperture, but it is preferred that the air flow inlet comprises a plurality of apertures. These apertures may be provided by a  
10 mesh, a grille or other molded component forming part of the external surface of the body.

The first air passageway preferably extends from the air flow inlet to the first air inlet(s) of the nozzle. The second air passageway is arranged to receive air from the first air  
15 passageway. An advantage of locating the junction downstream from the flow generating means is that the flow generating means may comprise a single impeller and a motor for generating an air flow which is divided into the first and second air flows downstream from the impeller. The impeller may be a mixed flow impeller or an axial  
20 impeller.

Preferably, the first air flow is emitted at a first air flow rate and the second air flow is emitted at a second air flow rate which is lower than the first air flow rate. The first air flow rate may be a variable air flow rate, and so the second air flow rate may vary with  
25 the first air flow rate.

The air passageways may be arranged within the body in any desired configuration depending on, inter alia, the location of the air flow inlet and the nature of the chosen means for changing the humidity or temperature of the second air flow. To reduce the size of the body, the first air passageway may be located adjacent the second air  
30 passageway. Each air passageway may extend vertically through the body, with the second air passageway extending vertically in front of the first air passageway.

The first air outlet(s) are preferably located behind the second air outlet(s) so that the second air flow is conveyed away from the nozzle within the first air flow. Each interior passage is preferably annular. The two interior passages of the nozzle may be defined by respective components of the nozzle, which may be connected together during assembly. Alternatively, the interior passages of the nozzle may be separated by a dividing wall or other partitioning member located between common inner and outer walls of the nozzle. As mentioned above, the first interior passage is preferably isolated from the second interior passage, but a relatively small amount of air may be bled from the first interior passage to the second interior passage to urge the second air flow through the second air outlet(s) of the nozzle.

As the flow rate of the first air flow is preferably greater than the flow rate of the second air flow, the volume of the first interior passage of the nozzle is preferably greater than the volume of the second interior passage of the nozzle.

The nozzle may comprise a single continuous first air outlet, which preferably extends about the bore of the nozzle, and is preferably centred on the axis of the bore. Alternatively, the nozzle may comprise a plurality of first air outlets which are arranged about the bore of the nozzle. For example, the first air outlets may be located on opposite sides of the bore. The first air outlet(s) are preferably arranged to emit air through at least a front part of the bore. The first air outlet(s) may be arranged to emit air over a surface defining part of the bore to maximise the volume of air which is drawn through the bore by the air emitted from the first air outlet(s). Alternatively, the first air outlet(s) may be arranged to emit the air flow from an end surface of the nozzle.

The second air outlet(s) of the nozzle may be arranged to emit the second air flow over this surface of the nozzle. Alternatively, the second air outlet(s) may be located in a front end of the nozzle, and arranged to emit air away from the surfaces of the nozzle. The first air outlet(s) may therefore be located adjacent to the second air outlet(s). The nozzle may comprise a single continuous second air outlet, which may extend about the

axis of the nozzle. Alternatively, the nozzle may comprise a plurality of second air outlets, which may be arranged about the front end of the nozzle. For example, the second air outlets may be located on opposite sides of the front end of the nozzle. Each of the plurality of air outlets may comprise one or more apertures, for example, a slot, a plurality of linearly aligned slots, or a plurality of apertures. The first air outlets may extend parallel to the second air outlets.

In a preferred embodiment, the fan assembly comprises a humidifying system which is configured to increase the humidity of the second air flow before it is emitted from the nozzle. To provide the fan assembly with a compact appearance and with a reduced component number, at least part of the humidifying system may be located beneath the nozzle. At least part of the humidifying system may also be located beneath the impeller and the motor. For example, a transducer for atomizing water may be located beneath the nozzle. This transducer may be controlled by a controller that controls the motor. The second air passageway may be arranged to convey the second air flow over a reservoir for receiving water from the water tank and the transducer for atomizing water located in the reservoir.

The body may comprise a removable water tank for supplying water to the humidifying system. To provide the body with a compact appearance, the water tank preferably extends about the flow generating means. In a preferred embodiment, the water tank surrounds the flow generating means. The water tank may surround at least part of the first air passageway, and at least part of the second air passageway. The body may comprise a base comprising the air inlet through which air enters the fan assembly, and the water tank may be mounted on the base. Preferably, the base and the water tank each have a curved, for example cylindrical, outer surface, and the outer surfaces of the base and the water tank may have substantially the same radius. This can further contribute towards the compact appearance of the fan assembly.

In a second aspect, the present invention provides humidifying apparatus comprising:



a nozzle having at least one first air inlet, at least one first air outlet, a first interior passage for conveying air from said at least one first air inlet to said at least one first air outlet, at least one second air inlet, at least one second air outlet, and a second interior passage for conveying air from said at least one second air inlet to said at least one second air outlet, the nozzle defining a bore about which the interior passages extend and through which air from outside the fan assembly is drawn by air emitted from the air outlets;

a body on which the nozzle is mounted, the body comprising flow generating means for generating a first air flow through the first interior passage and a second air flow through the second interior passage, a first air passageway for conveying the first air flow to said at least one first air inlet, a second air passageway for conveying the second air flow to said at least one second air inlet, the second air passageway being arranged to receive air from the first air passageway downstream from the flow generating means, and means for humidifying the second air flow.

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In a third aspect, the present invention provides humidifying apparatus comprising:

a nozzle having at least one first air inlet, at least one first air outlet, a first interior passage for conveying air from said at least one first air inlet to said at least one first air outlet, at least one second air inlet, at least one second air outlet, and a second interior passage for conveying air from said at least one second air inlet to said at least one second air outlet, the nozzle defining a bore through which air from outside the fan assembly is drawn by air emitted from the air outlets; and

a body on which the nozzle is mounted, the body comprising a base and a water tank mounted on the base, the base comprising flow generating means for generating a first air flow through the first interior passage and a second air flow through the second interior passage, a reservoir for receiving water from the water tank, a transducer for atomizing water located in the reservoir, a first air passageway for conveying the first air flow to said at least one first air inlet, and a second air passageway for conveying the second air flow over said reservoir and to said at least one second air inlet, and wherein the water tank preferably extends about the flow generating means. The second air passageway is preferably connected to the first air passageway downstream from the

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flow generating means. The flow generating means preferably comprises an impeller and a motor for driving the impeller.

The impeller is preferably in the form of a mixed flow impeller. The benefit of using a  
5 mixed flow impeller to generate the first and the second air flows is that the pressure of the air flow emitted from a rotating mixed flow impeller can be sufficiently high to allow the second air flow to overcome any flow impedences encountered, for example, as the air flow through the base is divided into the first air flow and the second air flow, and as the second air flow passes along the second air passageway to the at least one  
10 second air inlet of the nozzle.

In a fourth aspect, the present invention provides humidifying apparatus comprising a body and a nozzle mounted on the body, the body comprising an impeller, a motor for driving the impeller to generate an air flow, a first duct for conveying the air flow to  
15 humidifying means for humidifying the air flow, and a second duct for conveying the humidified air flow to the nozzle, and wherein the nozzle comprises at least one air inlet for receiving the humidified air flow and at least one air outlet for emitting the humidified air flow, the nozzle extending about an opening through which air from outside the apparatus is drawn by air emitted from the nozzle.

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The impeller is preferably in the form of a mixed flow impeller. The humidifying means preferably comprises a transducer for atomizing water. This transducer may be controlled by a controller that controls the motor. The body may comprise a removable water tank for supplying water to the transducer. To provide the body with a compact  
25 appearance, the water tank preferably extends about the impeller. In a preferred embodiment, the water tank surrounds the impeller. The body may comprise a base comprising the air inlet through which air enters the humidifying apparatus, and the water tank may be mounted on the base. Preferably, the base and the water tank each have a curved, for example cylindrical, outer surface, and the outer surfaces of the base  
30 and the water tank may have substantially the same radius. The first duct is preferably located adjacent to the second duct. The first duct and the second duct are preferably

arranged to convey air in substantially opposite directions. The first duct is preferably configured to convey air over a reservoir for receiving water from the water tank, and the second duct preferably has an air inlet located above the reservoir. The transducer is preferably arranged to atomize water within the reservoir.

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Features described above in connection with the first aspect of the invention are equally applicable to each of the second to fourth aspects of the invention, and vice versa.

### **BRIEF DESCRIPTION OF THE INVENTION**

10 An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a front view of a fan assembly;

15 Figure 2 is a side view of the fan assembly;

Figure 3 is a rear view of the fan assembly;

Figure 4 is a side sectional view taken along line A-A in Figure 1;

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Figure 5 is a top sectional view taken along line B-B in Figure 1;

Figure 6 is a sectional view take along line C-C in Figure 5;

25 Figure 7 is a top sectional view taken along line D-D in Figure 1;

Figure 8 is a close-up of area P indicated in Figure 7; and

Figure 9 is a schematic illustration of a control system of the fan assembly.

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**DETAILED DESCRIPTION OF THE INVENTION**

Figures 1 to 3 are external views of a fan assembly 10. In overview, the fan assembly 10 comprises a body 12 comprising an air inlet through which air enters the fan assembly 10, and a nozzle 14 in the form of an annular casing mounted on the body 12,  
5 and which comprises a plurality of air outlets for emitting air from the fan assembly 10.

The nozzle 14 is arranged to emit two different air flows. The nozzle 14 comprises a rear section 16 and a front section 18 connected to the rear section 16. Each section 16, 18 is annular in shape, and extends about a bore 20 of the nozzle 14. The bore 20  
10 extends centrally through the nozzle 14 so that the centre of each section 16, 18 is located on the axis X of the bore 20.

In this example, each section 16, 18 has a “racetrack” shape, in that each section 16, 18 comprises two, generally straight sections located on opposite sides of the bore 20, a  
15 curved upper section joining the upper ends of the straight sections and a curved lower section joining the lower ends of the straight sections. However, the sections 16, 18 may have any desired shape; for example the sections 16, 18 may be circular or oval. In this embodiment, the height of the nozzle 14 is greater than the width of the nozzle, but the nozzle 14 may be configured so that the width of the nozzle 14 is greater than the  
20 height of the nozzle 14.

Each section 16, 18 of the nozzle 14 defines a flow path along which a respective one of the air flows passes. In this embodiment, the rear section 16 of the nozzle 14 defines a first air flow path along which a first air flow passes through the nozzle 14, and the  
25 front section 18 of the nozzle 14 defines a second air flow path along which a second air flow passes through the nozzle 14.

With reference also to Figure 4, the rear section 16 of the nozzle 14 comprises an annular first outer casing section 22 connected to and extending about an annular inner casing section 24. Each casing section 22, 24 extends about the bore axis X. Each  
30 casing section may be formed from a plurality of connected parts, but in this

embodiment each casing section 22, 24 is formed from a respective, single moulded part. With reference also to Figures 7 and 8, a rear portion 26 of the first outer casing section 22 is curved inwardly towards the bore axis X to define a rear end of the nozzle 14 and a rear part of the bore 20. During assembly the end of the rear portion 26 of the  
5 first outer casing section 22 is connected to the rear end of the inner casing section 24, for example using an adhesive. The first outer casing section 22 comprises a tubular base 28 which defines a first air inlet 30 of the nozzle 14.

The front section 18 of the nozzle 14 also comprises an annular second outer casing section 32 connected to and extending about an annular front casing section 34. Again,  
10 each casing section 32, 34 extends about the bore axis X, and may be formed from a plurality of connected parts, but in this embodiment each casing section 32, 34 is formed from a respective, single moulded part. In this example, the front casing section 34 comprises a rear portion 36 which is connected to the front end of the outer casing section 22, and a front portion 38 which is generally frusto-conical in shape and flared  
15 outwardly from the rear portion 36 away from the bore axis X. The front casing section 34 may be integral with the inner casing section 24. The second outer casing section 32 is generally cylindrical in shape, and extends between the first outer casing section 22 and the front end of the front casing section 34. The second outer casing section 32  
20 comprises a tubular base 40 which defines a second air inlet 42 of the nozzle 14.

The casing sections 24, 34 together define a first air outlet 44 of the nozzle 14. The first air outlet 44 is defined by overlapping, or facing, surfaces of the inner casing section 24 and the rear portion 36 of the front casing section 34 so that the first air outlet 44 is  
25 arranged to emit air from a front end of the nozzle 14. The first air outlet 44 is in the form of an annular slot, which has a relatively constant width in the range from 0.5 to 5 mm about the bore axis X. In this example the first air outlet 44 has a width of around 1 mm. Where the inner casing sections 24, 34 are formed from respective components, spacers 46 may be spaced about the first air outlet 44 for urging apart the overlapping  
30 portions of the casing sections 24, 34 to control the width of the first air outlet 44. These spacers may be integral with either of the casing sections 24, 34. Where the

casing sections 24, 34 are formed from a single component, the spacers 46 are replaced by fins which are spaced about the first air outlet 44 for connecting together the inner casing section 24 and the front casing section 34.

- 5 The nozzle 14 defines an annular first interior passage 48 for conveying the first air flow from the first air inlet 30 to the first air outlet 44. The first interior passage 48 is defined by the internal surface of the first outer casing section 22 and the internal surface of the inner casing section 24. A tapering, annular mouth 50 guides the first air flow to the first air outlet 44. A first air flow path through the nozzle 14 may therefore  
10 be considered to be formed from the first air inlet 30, the first interior passage 48, the mouth 50 and the first air outlet 40.

The front casing section 34 defines a plurality of second air outlets 52 of the nozzle 14. The second air outlets 52 are also formed in the front end of the nozzle 14, each on a  
15 respective side of the bore 20, for example by moulding or machining. Each of the second air outlets 52 is located downstream from the first air outlet 44. In this example, each second air outlet 52 is in the form of a slot having a relatively constant width in the range from 0.5 to 5 mm. In this example each second air outlet 52 has a width of around 1 mm. Alternatively, each second air outlet 52 may be in the form of a row of  
20 circular apertures or slots formed in the front casing section 34 of the nozzle 14.

The nozzle 14 defines an annular second interior passage 54 for conveying the second air flow from the second air inlet 42 to the second air outlets 52. The second interior passage 54 is defined by the internal surfaces of the casing sections 32, 34, and by the  
25 front part of the external surface of the first outer casing section 22. The second interior passage 54 is isolated within the nozzle 14 from the first interior passage 48. A second air flow path through the nozzle 14 may therefore be considered to be formed by the second air inlet 42, the second interior passage 54 and the second air outlets 52.

- 30 The body 12 is generally cylindrical in shape. The body 12 comprises a base 56 upon which the nozzle 14 is mounted. The base 56 has an external outer wall 57 which is

cylindrical in shape, and which comprises an air inlet 58. In this example, the air inlet 58 comprises a plurality of apertures formed in the outer wall 57 of the base 56. The base 56 comprises a first air passageway 60 for conveying a first air flow to the first air flow path through the nozzle 14, and a second air passageway 62 for conveying a  
5 second air flow to the second air flow path through the nozzle 14.

A front portion of the base 56 may comprise a user interface of the fan assembly 10. The user interface is illustrated schematically in Figure 9, and described in more detail below. A mains power cable (not shown) for supplying electrical power to the fan  
10 assembly 10 extends through an aperture formed in the base 56.

The first air passageway 60 passes through the base 56 from the air inlet 58 to the first air inlet 30 of the nozzle 14. The first air passageway 60 is generally defined by a tubular upper wall 63 of the base 56. The tubular base 28 of the nozzle 14 is inserted  
15 into the open upper end of the upper wall 63. The upper wall 63 extends about an impeller 64 for generating a first air flow through the first air passageway 60. In this example the impeller 64 is in the form of a mixed flow impeller. The impeller 64 is connected to a rotary shaft extending outwardly from a motor 66 for driving the impeller 64. In this embodiment, the motor 66 is a DC brushless motor having a speed  
20 which is variable by a drive circuit 68 in response to a speed selection by a user. The maximum speed of the motor 66 is preferably in the range from 5,000 to 10,000 rpm. The motor 66 is housed within a motor bucket comprising an upper portion 70 connected to a lower portion 72. The upper portion 70 of the motor bucket comprises a diffuser 74 in the form of a stationary disc having curved blades. The diffuser 74 is  
25 located beneath the first air inlet 30 of the nozzle 14.

The motor bucket is located within, and mounted on, a generally frusto-conical impeller housing 76. The impeller housing 76 is, in turn, mounted on an annular support 78 extending inwardly from the upper wall 63. An annular inlet member 80 is connected  
30 to the bottom of the impeller housing 76 for guiding the air flow into the impeller housing 76. An annular sealing member 82 is located between the impeller housing 76

and the annular support 78 to prevent air from passing around the outer surface of the impeller housing 76 to the inlet member 80. The annular support 78 preferably comprises a guide portion 84 for guiding an electrical cable from the drive circuit 68 to the motor 66.

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The second air passageway 62 is arranged to receive air from the first air passageway 60. The second air passageway 62 is located adjacent to the first air passageway 60. The second air passageway 62 comprises an inlet port 86 located downstream from the diffuser 74 for receiving part of the air flow emitted from the diffuser 74. The second  
10 air passageway 62 is defined by an inlet duct 88 which is arranged to receive the second air flow from the inlet port 86. With reference to Figures 5 and 6, the inlet duct 88 is defined by the upper wall 63 and is located adjacent to, and in this example in front of, part of the first air passageway 60. The second air passageway 62 is further defined by an outlet duct 90 which is arranged to receive the second air flow from the inlet duct 88,  
15 and to convey the air flow to the second air inlet 42 of the nozzle 14. The second air flow is conveyed through the inlet duct 88 and the outlet duct 90 in generally opposite directions. The base 40 of the second outer casing section 32 of the nozzle 14 is inserted into the open upper end of the outlet duct 90.

20 In this example, the fan assembly 10 comprises humidifying means or a humidifying system for increasing the humidity of the second air flow before it enters the nozzle 14, and which is housed within the body 12 of the fan assembly 10. This example of a fan assembly 10 may thus be considered to provide humidifying apparatus. With reference to Figures 4 to 6, the humidifying means comprises a water tank 100 removably  
25 mountable on the base 56 of the body 12. The water tank 100 has a cylindrical outer wall 102 which has the same radius as the external outer wall 57 of the base 56 of the body 12 so that the body 12 has a cylindrical appearance when the water tank 100 is mounted on the base 56. The water tank 100 has an annular inner wall 104 which has the same shape as, and surrounds, the upper wall 63 of the base 56. The outer wall 102  
30 and the inner wall 104 define, with the upper wall 106 and the lower wall 108 of the water tank 100, an annular volume for storing water. The water tank 100 thus surrounds



the impeller 64 and the motor 66, and so at least part of the first air passageway 60, and at least part of the second air passageway 62.

The water tank 100 preferably has a capacity in the range from 2 to 4 litres. The upper  
5 wall 106 of the water tank 100 is shaped to define a handle 110 to enable a user to lift the water tank 100 from the base 56 using one hand. A window 111 is provided on the outer wall 102 of the water tank 100 to allow a user to see the level of water within the water tank 100 when it is disposed on the base station 56.

10 A spout 112 is removably connected to the lower wall 108 of the water tank 100, for example through co-operating threaded connections. In this example the water tank 100 is filled by removing the water tank 100 from the base 56 and inverting the water tank 100 so that the spout 112 is projecting upwardly. The spout 112 is then unscrewed from the water tank 100 and water is introduced into the water tank 100 through an aperture  
15 exposed when the spout 112 is disconnected from the water tank 100. Once the water tank 100 has been filled, the user reconnects the spout 112 to the water tank 100, re-inverts the water tank 100 and replaces the water tank 100 on the base 56. A spring-loaded valve 114 is located within the spout 112 for preventing leakage of water through a water outlet 116 of the spout 112 when the water tank 100 is re-inverted. The  
20 valve 114 is biased towards a position in which a skirt of the valve 114 engages the upper surface of the spout 112 to prevent water entering the spout 112 from the water tank 100.

The base 56 comprises an inner wall 117 which defines a water reservoir 118 for  
25 receiving water from the water tank 100. In this example, the water reservoir 118 has a capacity of 200 ml. An upwardly extending pin 120 of the base 56 protrudes into the spout 112 when the water tank 100 is located on the base 56. The pin 120 pushes the valve 114 upwardly to open the spout 112, thereby allowing water to pass under gravity into the water reservoir 118 from the water tank 100. This results in the water reservoir  
30 118 becoming filled with water to a level which is substantially co-planar with the

upper surface of the pin 120. A magnetic level sensor 122 is located within the water reservoir 118 for detecting the level of water within the water reservoir 118.

5 The inner wall 117 of the base 56 comprises apertures 124 each for exposing the surface of a respective piezoelectric transducer 126 for atomising water stored in the water reservoir 118. A metallic heat sink 128 is located between the inner wall 117 and the transducers 126 for conveying heat away from the transducers 126. Part of the heat sink 128 may be located adjacent a second set of apertures formed in the outer surface of the base 56 of the body 12 so that heat can be conveyed from the heat sink 128  
10 through those apertures. Annular sealing members form water-tight seals between the transducers 126 and the heat sink 128. The drive circuit 68 actuates ultrasonic vibration of the transducers 126 to atomise water within the water reservoir 118.

The open bottom ends of the inlet duct 88 and the outlet duct 90 are each located above  
15 the maximum level of water within the water reservoir 118 so that the second air flow passes between these ducts 88, 90 over the surface of the water located in the water reservoir 118. The outlet duct 90 is defined by the water tank 100.

A user interface for controlling the operation of the fan assembly is located on the side  
20 wall of the casing section of the body 12. Figure 9 illustrates schematically a control system for the fan assembly 10, which includes this user interface and other electrical components of the fan assembly 10. In this example, the user interface comprises a plurality of user-operable buttons 140a, 140b and 140c, and a display 142. The first button 140a is used to activate and deactivate the motor 66, and the second button 140b  
25 is used to set the speed of the motor 66, and thus the rotational speed of the impeller 64. The third button 140c is used to set a desired level for the relative humidity of the environment in which the fan assembly 10 is located, such as a room, office or other domestic environment. For example, the desired relative humidity level may be selected within a range from 30 to 80% at 20°C through repeated actuation of the third  
30 button 140c. The display 142 provides an indication of the currently selected relative humidity level.

The user interface further comprises a user interface circuit 144 which outputs control signals to the drive circuit 68 upon actuation of one of the buttons, and which receives control signals output by the drive circuit 68. The user interface may also comprise one or more LEDs for providing a visual alert depending on a status of the humidifying apparatus. For example, a first LED 146a may be illuminated by the drive circuit 68 indicating that the water tank 100 has become depleted, as indicated by a signal received by the drive circuit 68 from the level sensor 122.

10 A humidity sensor 148 is also provided for detecting the relative humidity of air in the external environment, and for supplying a signal indicative of the detected relative humidity to the drive circuit 68. In this example the humidity sensor 148 may be located immediately behind the air inlet 58 to detect the relative humidity of the air flow drawn into the fan assembly 10. The user interface may comprise a second LED 146b  
15 which is illuminated by the drive circuit 68 when an output from the humidity sensor 148 indicates that the relative humidity of the air flow entering the fan assembly 10 is at or above the desired relative humidity level set by the user.

To operate the fan assembly 10, the user actuates the first button 140a, in response to  
20 which the drive circuit 68 activates the motor 66 to rotate the impeller 64. The rotation of the impeller 64 causes air to be drawn into the body 12 through the air inlet 58. An air flow passes through the impeller housing 76 and the diffuser 74. Downstream from the diffuser 74, a portion of the air emitted from the diffuser 74 enters the inlet duct 88 through the inlet port 86, whereas the remainder of the air emitted from the diffuser 74  
25 is conveyed by the upper wall 63 to the first air inlet 30 of the nozzle 14. The impeller 64 and the motor 66 may thus be considered to generate a first air flow which is conveyed to the nozzle 14 by the first air passageway 70 and which enters the nozzle 14 through the first air inlet 30.

30 The first air flow enters the first interior passage 48 at the base of the rear section 16 of the nozzle 14. At the base of the first interior passage 48, the air flow is divided into

two air streams which pass in opposite directions around the bore 20 of the nozzle 14. As the air streams pass through the first interior passage 48, air enters the mouth 50 of the nozzle 14. The air flow into the mouth 50 is preferably substantially even about the bore 20 of the nozzle 14. The mouth 50 guides the air flow towards the first air outlet 44 of the nozzle 14, from where it is emitted from the fan assembly 10.

The air flow emitted from the first air outlet 40 causes a secondary air flow to be generated by the entrainment of air from the external environment, specifically from the region around the first air outlet 44 and from around the rear of the nozzle 14. Some of this secondary air flow passes through the bore 20 of the nozzle 14, whereas the remainder of the secondary air flow becomes entrained within the air flow emitted from the first air outlet in front of the nozzle 14.

As mentioned above, with rotation of the impeller 64 air enters the second air passageway 72 through the inlet port 86 of the inlet duct 88. Simultaneous with the actuation of the motor 66, the drive circuit 68 actuates the vibration of the transducers 126, preferably at a frequency  $f_1$  in the range from 1 to 2 MHz, to atomise water present within the water reservoir 118. This creates airborne water droplets above the water located within the water reservoir 118. As water within the water reservoir 118 is atomised, the water reservoir 118 is constantly replenished with water from the water tank 100, so that the level of water within the water reservoir 118 remains substantially constant while the level of water within the water tank 100 gradually falls.

With rotation of the impeller 66, a second air flow passes through the inlet duct 88 and is emitted directly over the water located in the water reservoir 118, causing airborne water droplets to become entrained within the second air flow. The – now moist – second air flow passes upwardly through the outlet duct 90 of the second air passageway 62 to the second air inlet 42 of the nozzle 14, and enters the second interior passage 54 within the front section 18 of the nozzle 14.

At the base of the second interior passage 54, the second air flow is divided into two air streams which pass in opposite directions around the bore 20 of the nozzle 14. As the air streams pass through the second interior passage 54, each air stream is emitted from a respective one of the second air outlets 52 located in the front end of the nozzle 14 in front of the first air outlet 44. The emitted second air flow is conveyed away from the fan assembly 10 within the air flow generated through the emission of the first air flow from the nozzle 14, thereby enabling a humid air current to be experienced rapidly at a distance of several metres from the fan assembly 10.

The moist air flow is emitted from the nozzle 14 until the relative humidity of the air flow entering the fan assembly 10, as detected by the humidity sensor 148, is 1% at 20°C higher than the relative humidity level selected by the user using the third button 140c. The emission of the humidified air flow from the nozzle 14 may then be terminated by the drive circuit 68, preferably by reducing the frequency of the vibration of the transducers 126 to a frequency  $f_2$ , where  $f_1 > f_2 \geq 0$ . Optionally, the motor 66 may also be stopped so that no air flow is emitted from the nozzle 14. However, when the humidity sensor 148 is located in close proximity to the motor 66 it is preferred that the motor 66 is operated continually to avoid undesirable temperature fluctuation in the local environment of the humidity sensor 148.

20

As a result of the termination of the emission of a moist air flow from the fan assembly 10, the relative humidity detected by the humidity sensor 148 will begin to fall. Once the relative humidity of the air of the environment local to the humidity sensor 148 has fallen to 1% at 20°C below the relative humidity level selected by the user, the drive circuit 68 re-activates the vibration of the transducers 126 at frequency  $f_1$ . If the motor 66 has been stopped, the drive circuit 68 simultaneously re-activates the motor 66. As before, the moist air flow is emitted from the nozzle 14 until the relative humidity detected by the humidity sensor 170 is 1% at 20°C higher than the relative humidity level selected by the user.

30

This actuation sequence of the transducers 126 (and optionally the motor 66) for maintaining the detected humidity level around the level selected by the user continues until button 140a is actuated again, or until a signal is received from the level sensor 122 indicating that the level of water within the water reservoir 118 has fallen below the minimum level. If the button 140a is actuated, the drive circuit 68 deactivates the motor 66 and the transducers 126 to switch off the fan assembly 10.

**CLAIMS**

1. A fan assembly comprising:

5 a nozzle having at least one first air inlet, at least one first air outlet, a first interior passage for conveying air from said at least one first air inlet to said at least one first air outlet, at least one second air inlet, at least one second air outlet, and a second interior passage for conveying air from said at least one second air inlet to said at least one second air outlet, the nozzle defining a bore about which the interior passages  
10 extend and through which air from outside the fan assembly is drawn by air emitted from the air outlets;

a body on which the nozzle is mounted, the body comprising flow generating means for generating a first air flow through the first interior passage and a second air flow through the second interior passage, a first air passageway for conveying the first  
15 air flow to said at least one first air inlet, and a second air passageway for conveying the second air flow to said at least one second air inlet, the second air passageway being arranged to receive air from the first air passageway downstream from the flow generating means, and

means for changing one of the temperature, humidity, composition and electrical  
20 charge of the second air flow.

2. A fan assembly as claimed in claim 1, wherein the first interior passage is isolated from the second interior passage.

25 3. A fan assembly as claimed in claim 1 or claim 2, wherein the first interior passage surrounds the bore of the nozzle.

4. A fan assembly as claimed in any preceding claim, wherein the second interior passage surrounds the bore of the nozzle.

30

5. A fan assembly as claimed in any preceding claim, wherein said at least one first air outlet is arranged to emit the first air flow through at least a front part of the bore.
6. A fan assembly as claimed in any preceding claim, wherein said at least one first  
5 air outlet comprises a plurality of first air outlets located about the bore.
7. A fan assembly as claimed in any preceding claim, wherein said at least one second air outlet is located in a front end of the nozzle.
- 10 8. A fan assembly as claimed in claim 7, wherein said at least one second air outlet comprises a plurality of air outlets located about the bore.
9. A fan assembly as claimed in any preceding claim, wherein each of the plurality of air outlets comprises one or more apertures.
- 15
10. A fan assembly as claimed in any preceding claim, wherein the means for changing one of the temperature, humidity, composition and electrical charge of the second air flow is located in the body.
- 20 11. A fan assembly as claimed in any preceding claim, wherein the means for changing one of the temperature, humidity, composition and electrical charge of the second air flow is located at least partially in the second air passageway.
12. A fan assembly as claimed in any preceding claim, wherein the means for  
25 changing one of the temperature, humidity, composition and electrical charge of the second air flow is configured to humidify the second air flow.
13. A fan assembly as claimed in any preceding claim, wherein the means for  
30 changing one of the temperature, humidity, composition and electrical charge of the second air flow comprises a water tank.



14. A fan assembly as claimed in claim 13, wherein the body comprises a base comprising an air inlet through which air enters the body, and the water tank is mounted on the base.

5 15. A fan assembly as claimed in claim 14, wherein the base and the water tank each have a cylindrical outer surface, and wherein the outer surfaces of the base and the water tank have substantially the same radius.

10 16. A fan assembly as claimed in any of claims 13 to 15, wherein the means for changing one of the temperature, humidity, composition and electrical charge of the second air flow comprises a reservoir for receiving water from the water tank, and a transducer for atomizing water stored in the reservoir, and wherein the second air passageway is arranged to convey the second air flow over at least part of the reservoir.

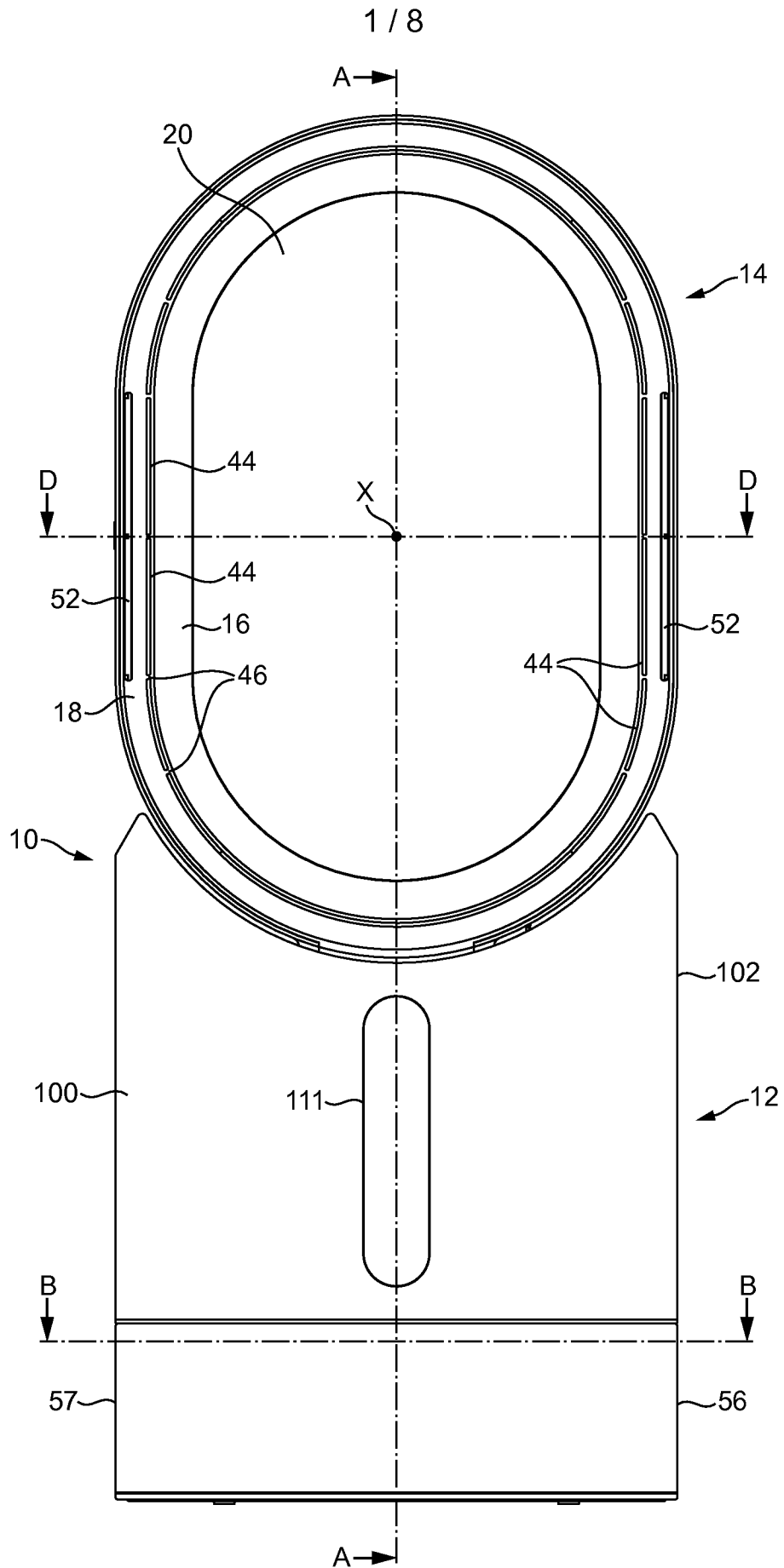


FIG. 1

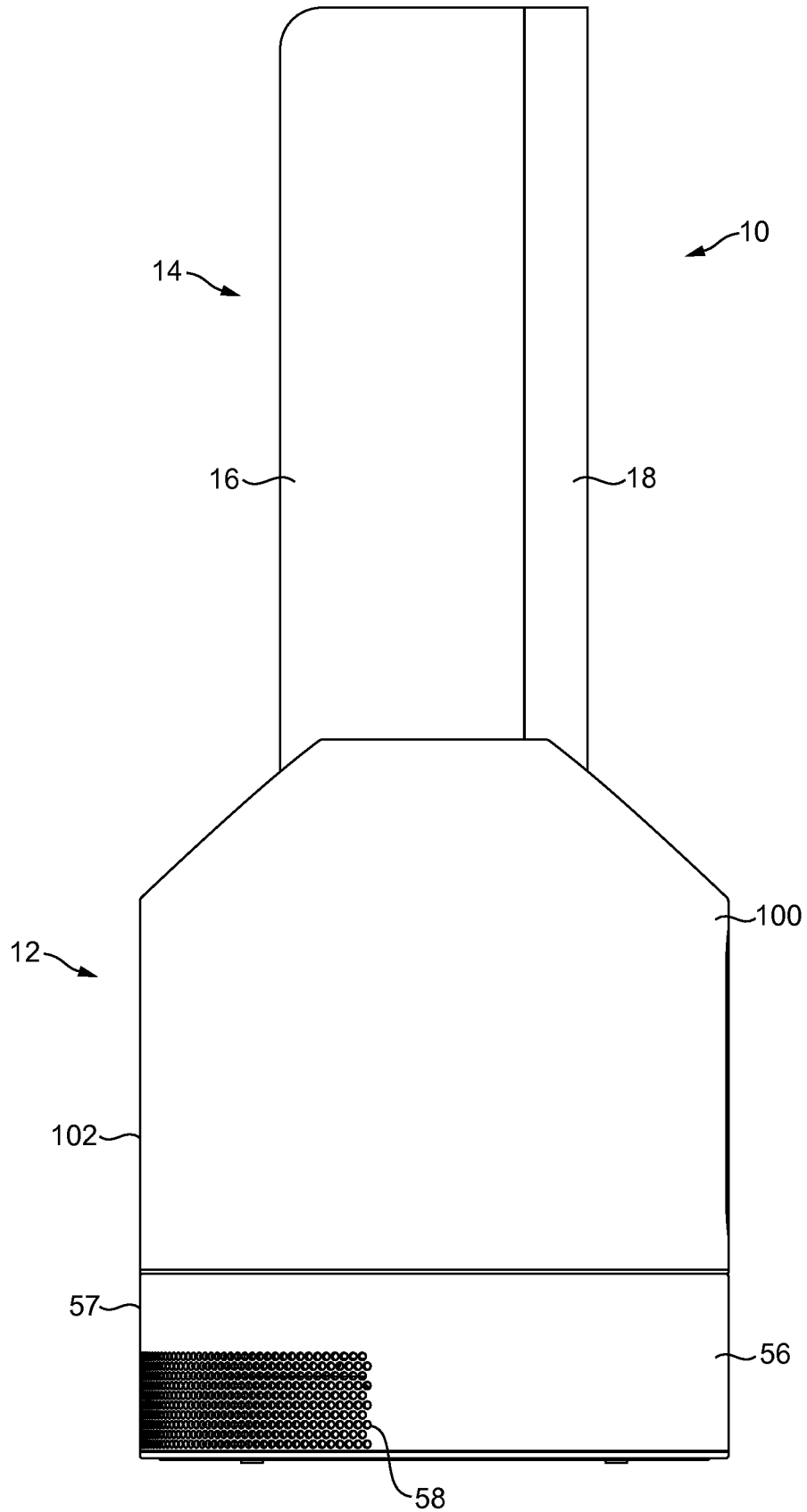


FIG. 2

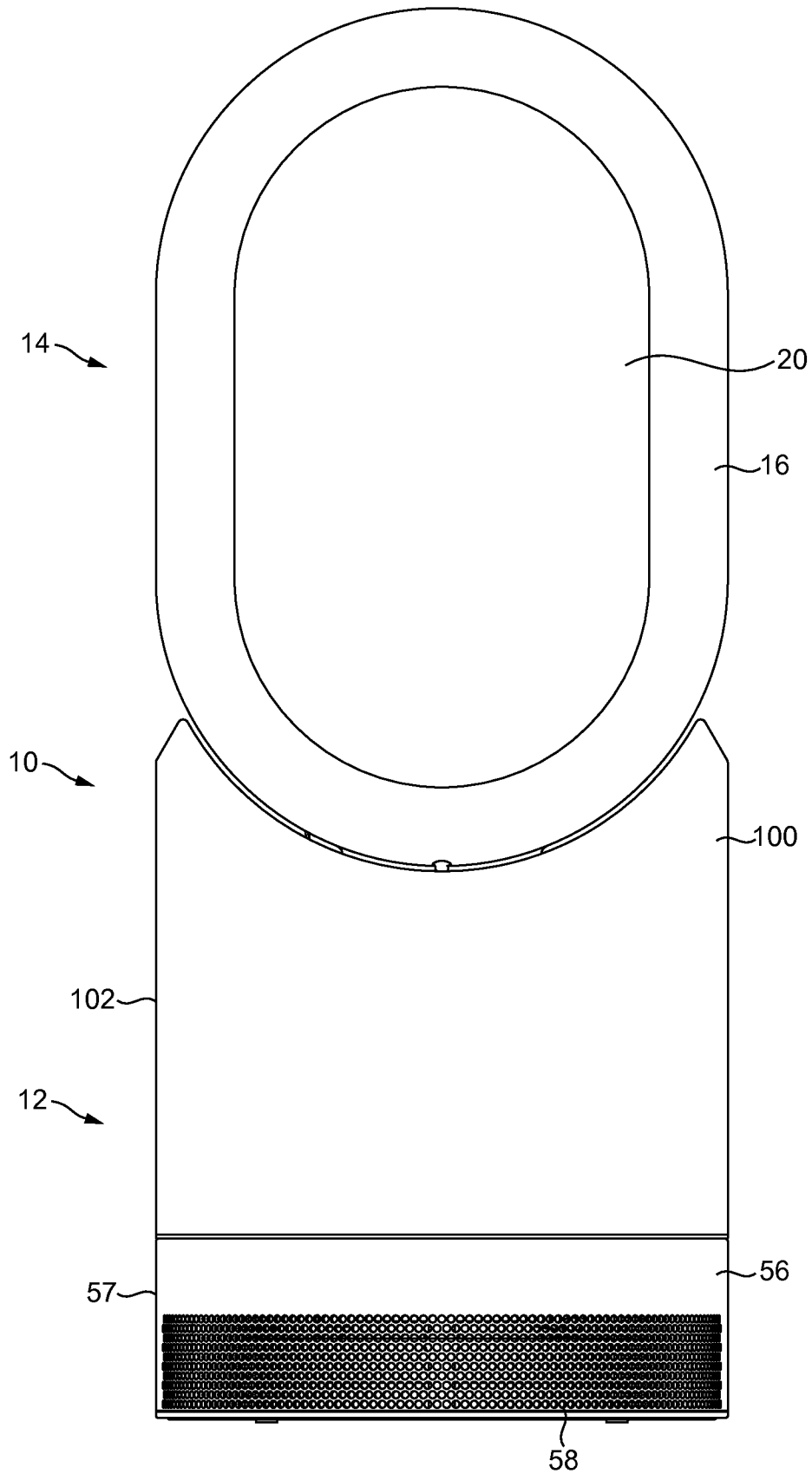


FIG. 3

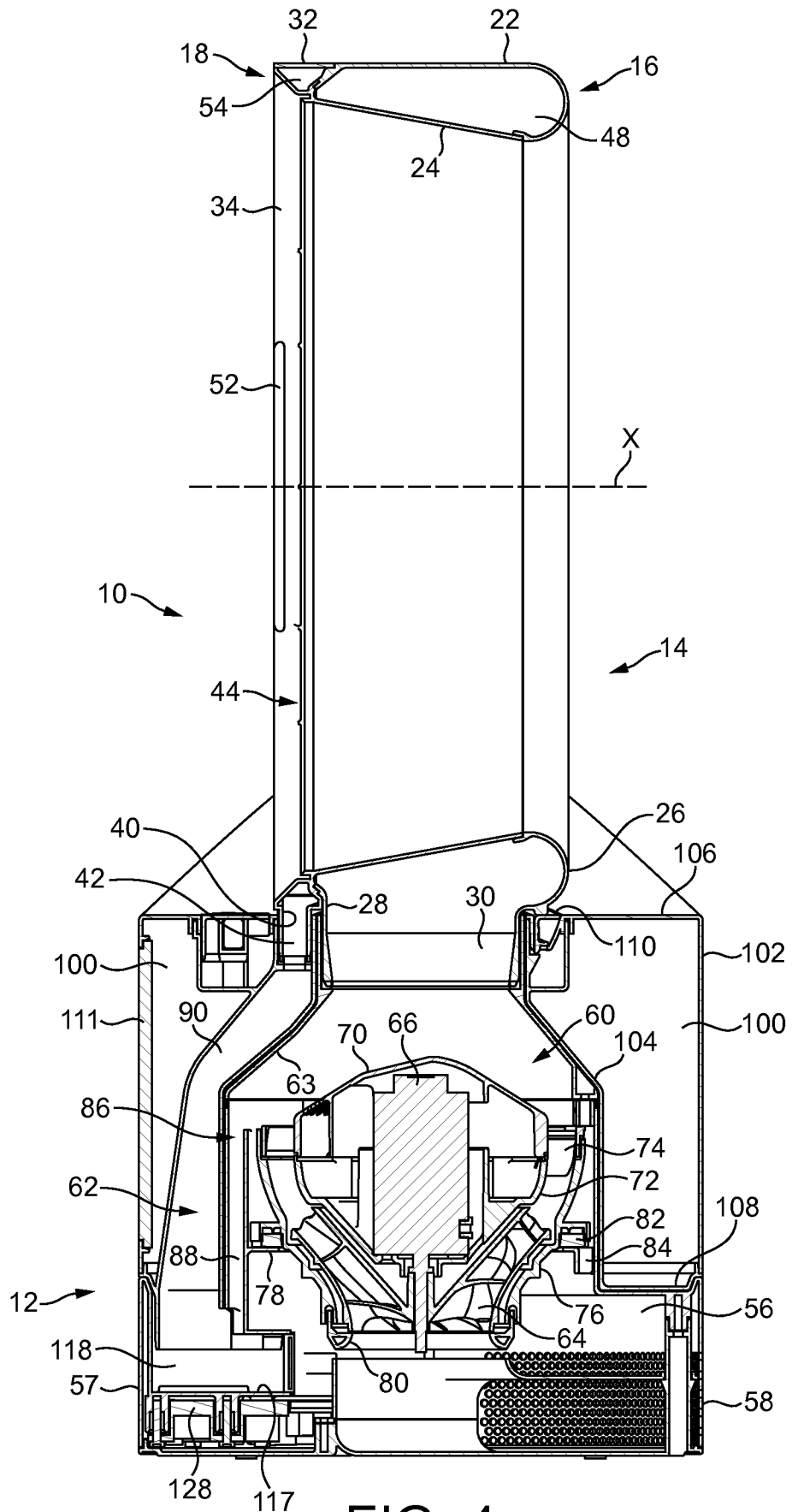


FIG. 4

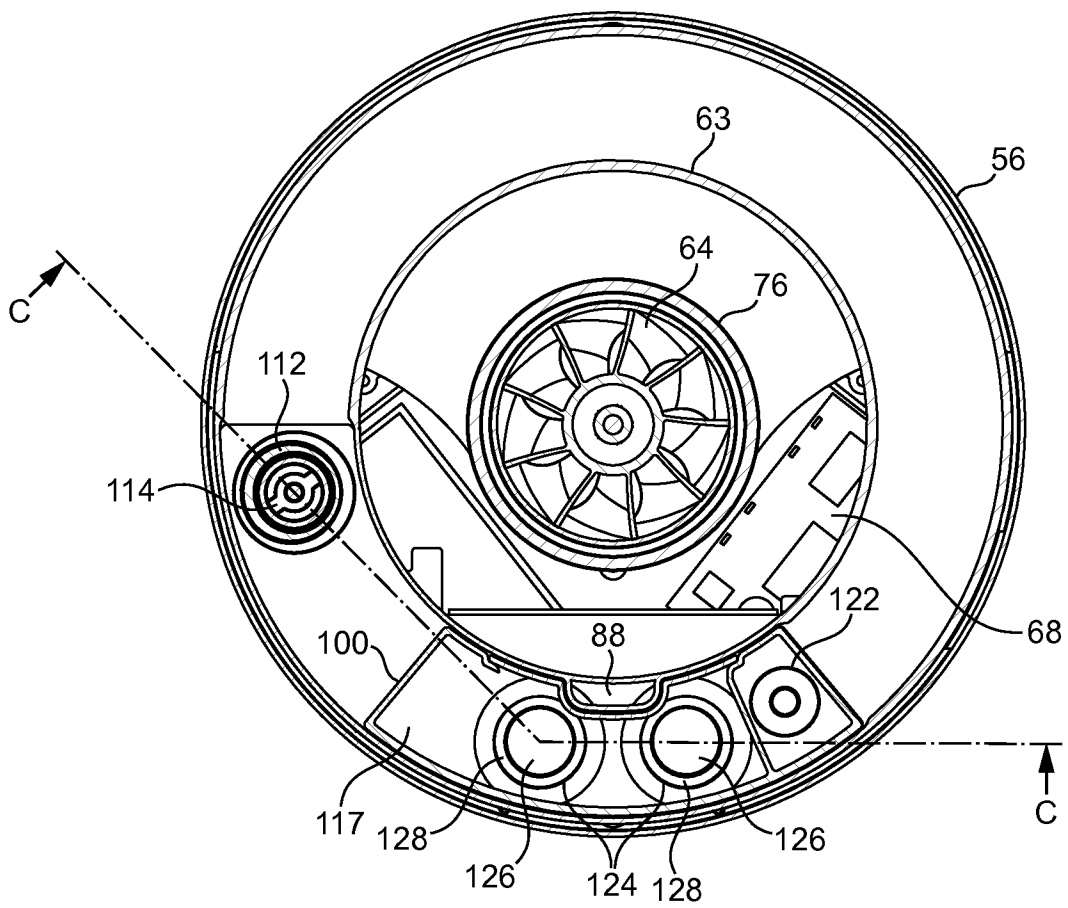


FIG. 5



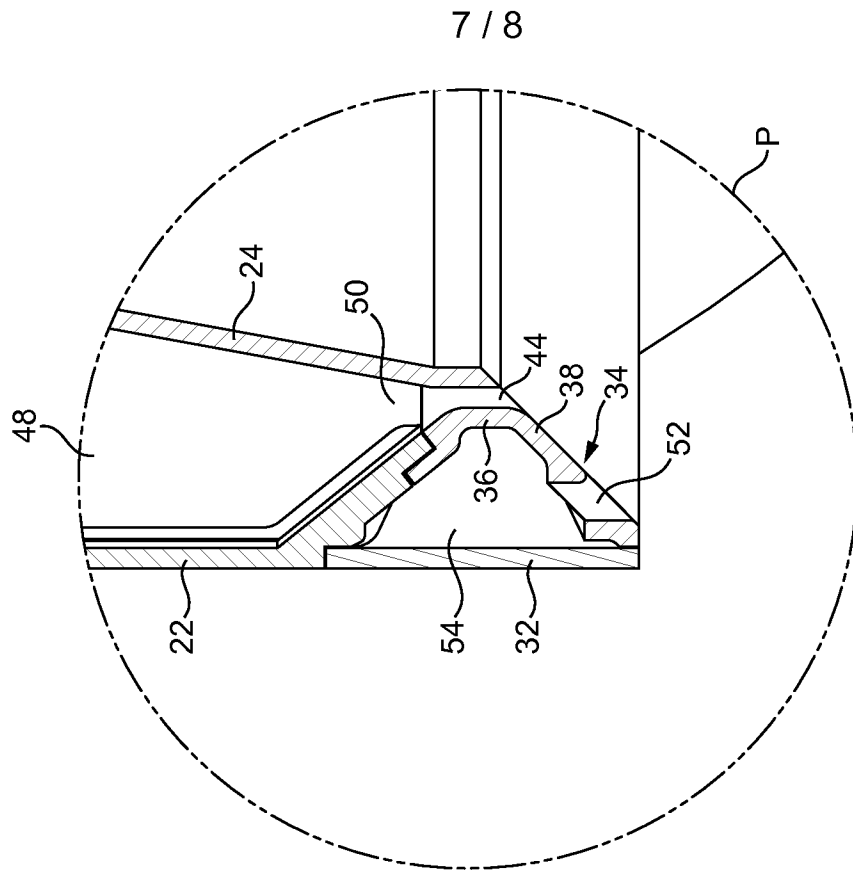


FIG. 8

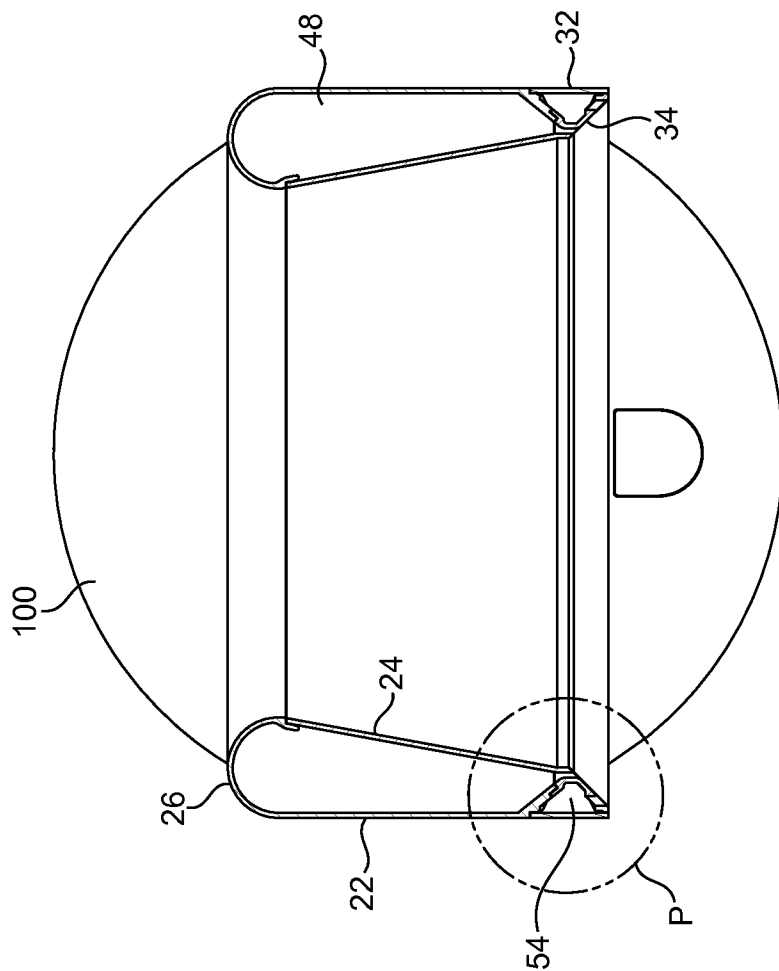


FIG. 7



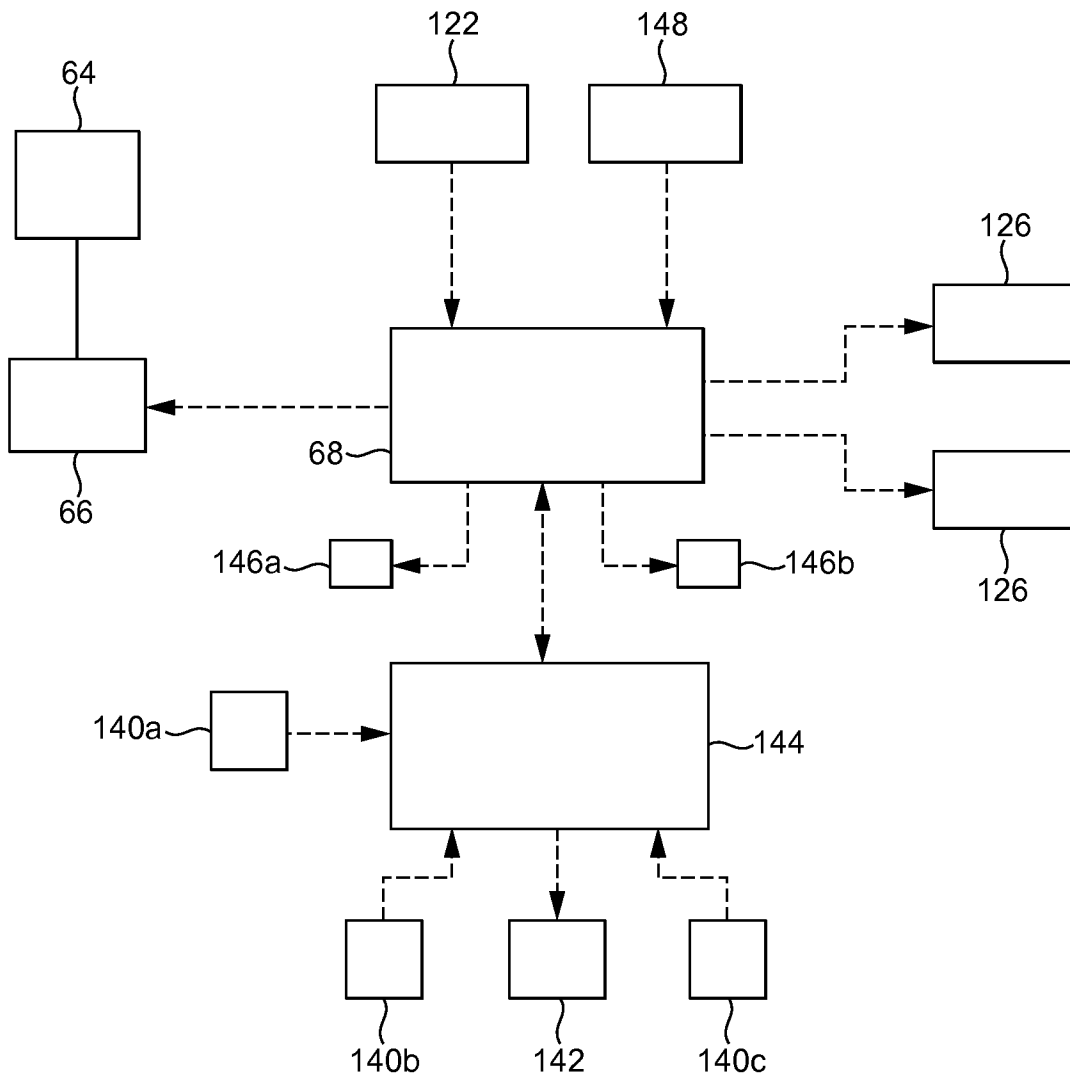


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No  
PCT/GB2012/051489

A. CLASSIFICATION OF SUBJECT MATTER  
 INV. F24F1/01 F24F6/14 F24F13/26 F04D25/08 F04D29/70  
 F04F5/16  
 ADD.  
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED  
 Minimum documentation searched (classification system followed by classification symbols)  
 F24F F04D F04F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 EPO-Internal, WPI Data

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A	JP 4 366330 A (TAIKISHA KK) 18 December 1992 (1992-12-18) abstract	1
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Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p>
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Date of the actual completion of the international search  22 October 2012	Date of mailing of the international search report  02/11/2012
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Lienhard, Dominique
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International application No  
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	WO 2008/139491 A2 (APARNA THIRUMALAI ANANDAMPILLAI [IN]; ANANDVISHNU THIRUMALAI ANANDAMPI) 20 November 2008 (2008-11-20) abstract -----	1

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Information on patent family members

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