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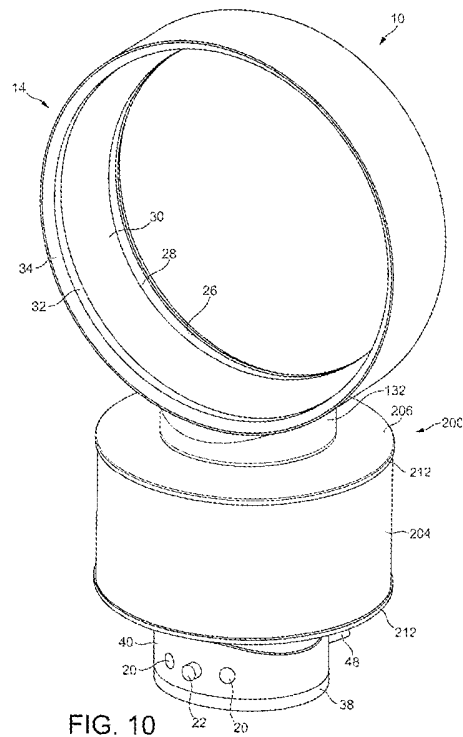
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(54) Title of the Invention: **An accessory for a fan**
Abstract Title: **External filter for a fan**

(57) An external accessory for a portable fan, especially a bladeless fan, includes a high energy particle arrester (HEPA) filter 200 and attachment fixtures for detachably attaching the accessory to a portable fan. Preferably the accessory is an annular sleeve which is locatable over an air inlet of the fan and is formed from two annular discs 206, 208 between which the filter, preferably in the form of a radially pleated filter material, is located. The filter may be surrounded by a perforated cylindrical outer cover 204 which is preferably transparent. Also claimed is the combination of the accessory and a portable fan. The accessory may be located upstream of the air inlet of the fan which may be a desk fan, a tower fan or a pedestal fan.



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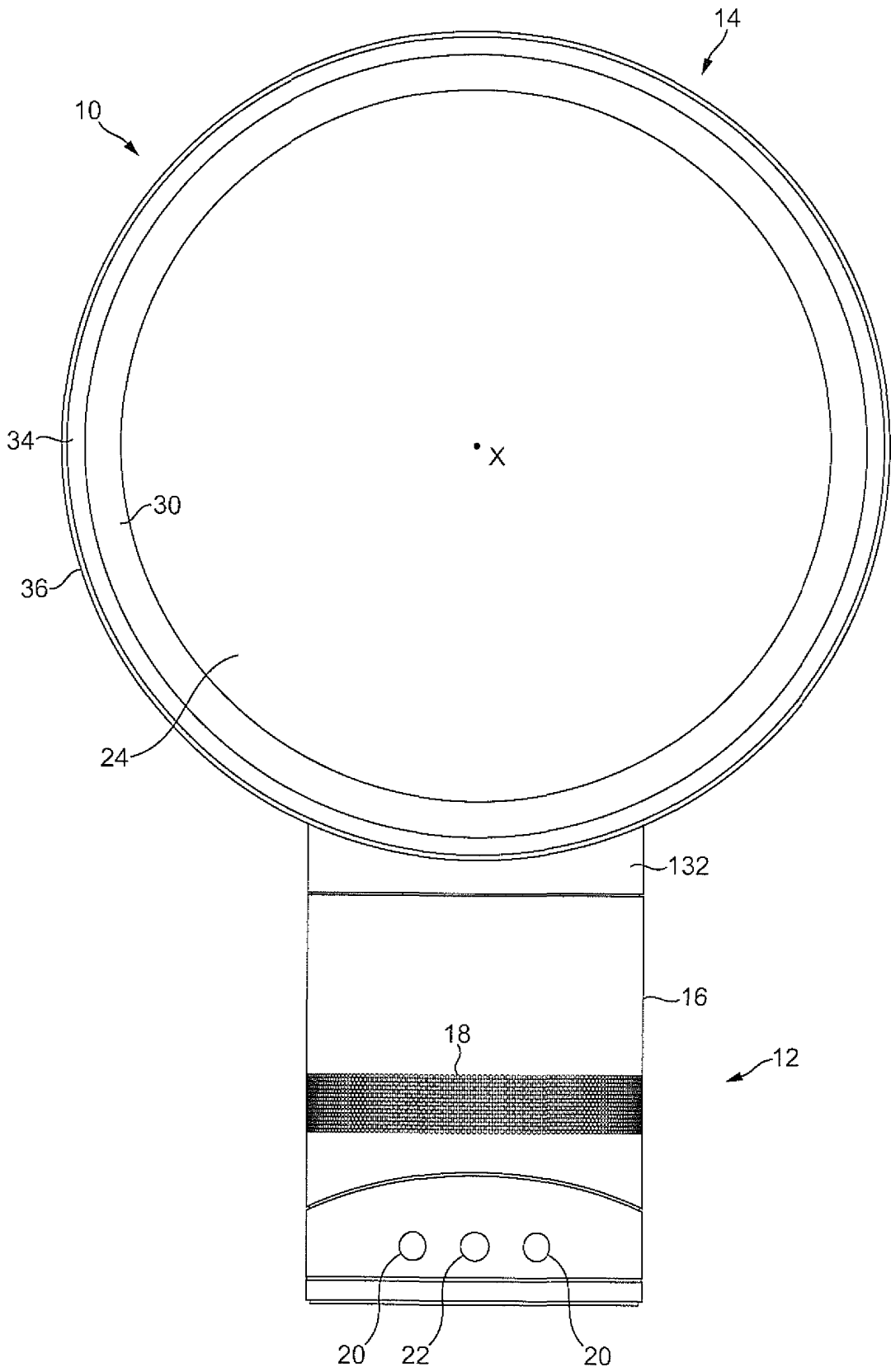


FIG. 1

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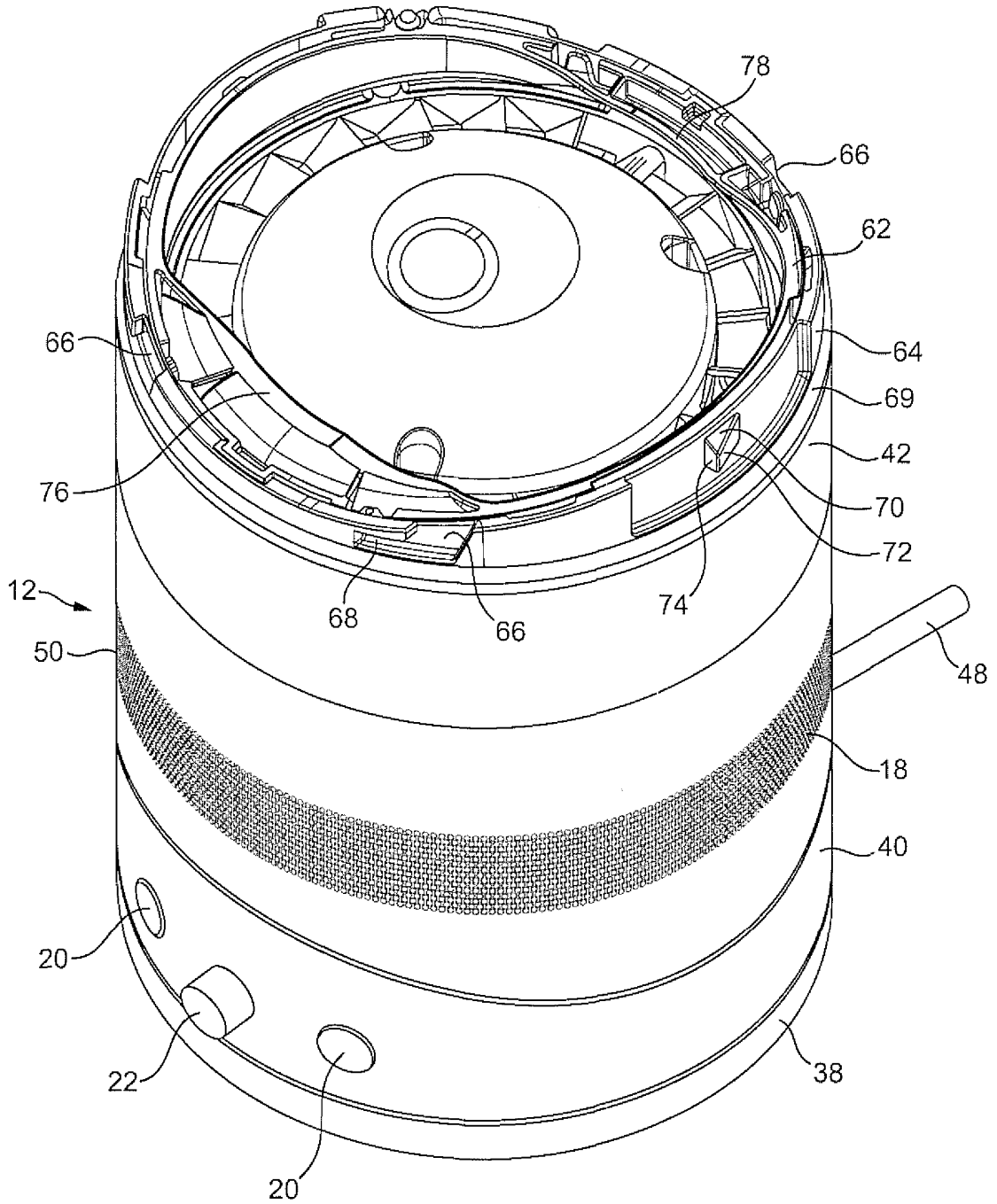


FIG. 2

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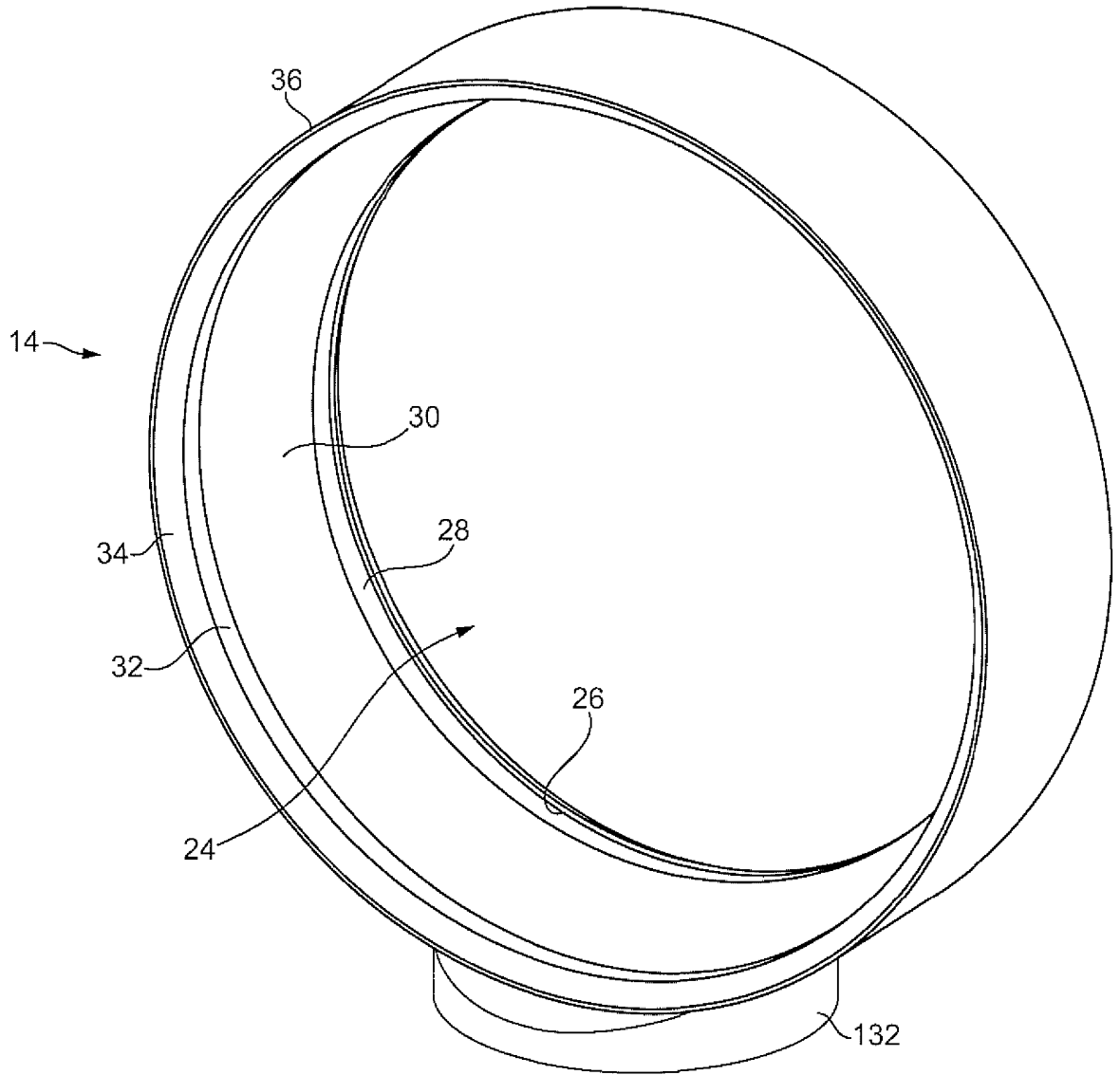


FIG. 3

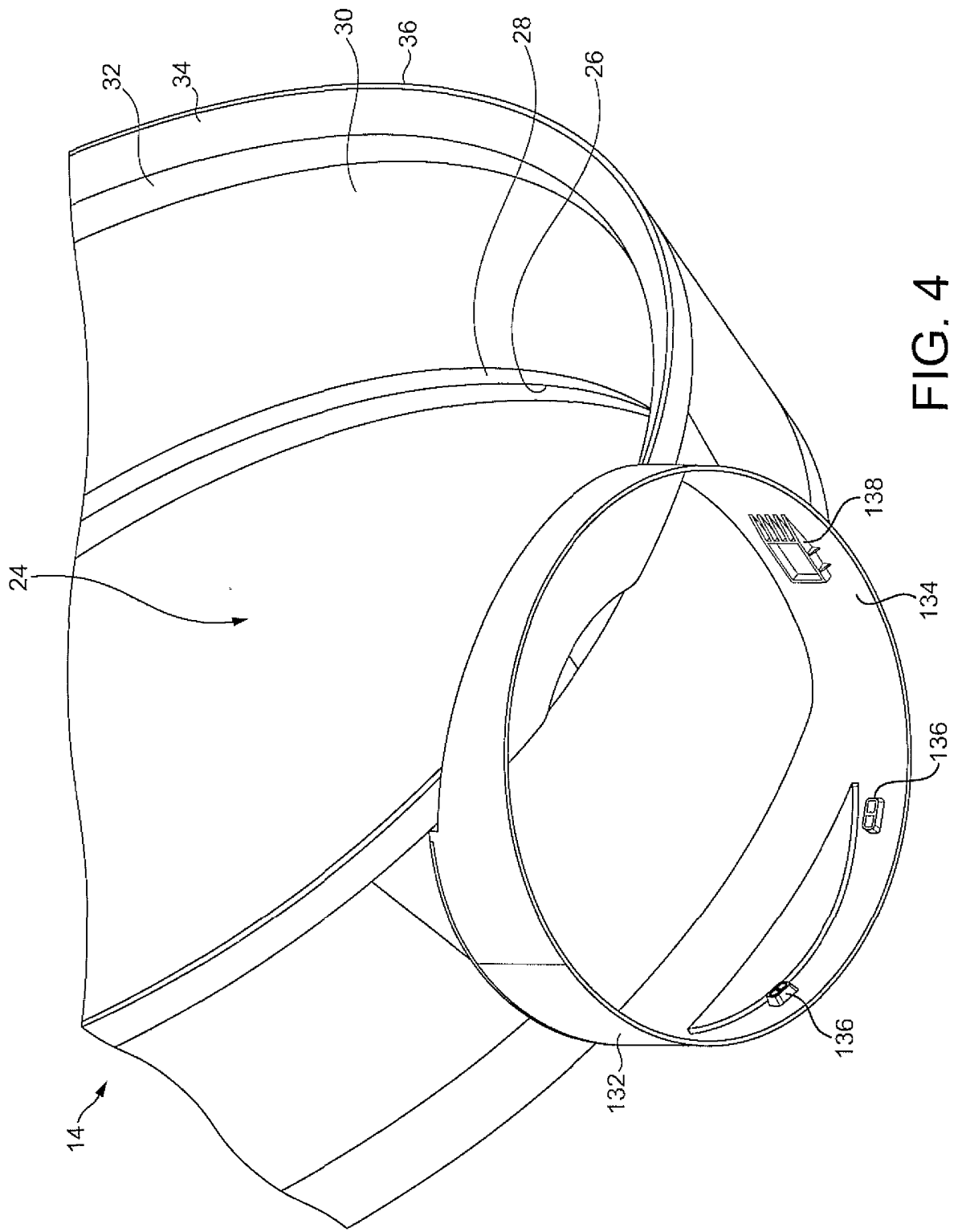


FIG. 4

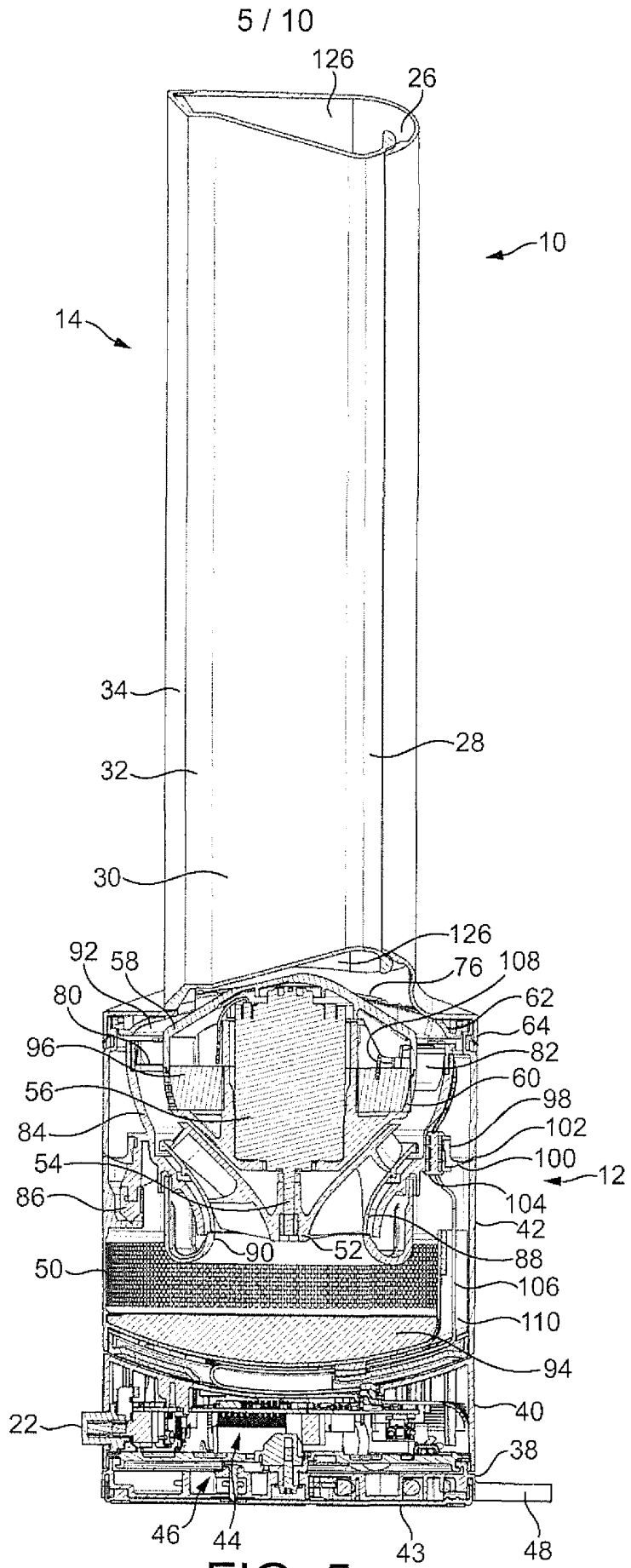


FIG. 5

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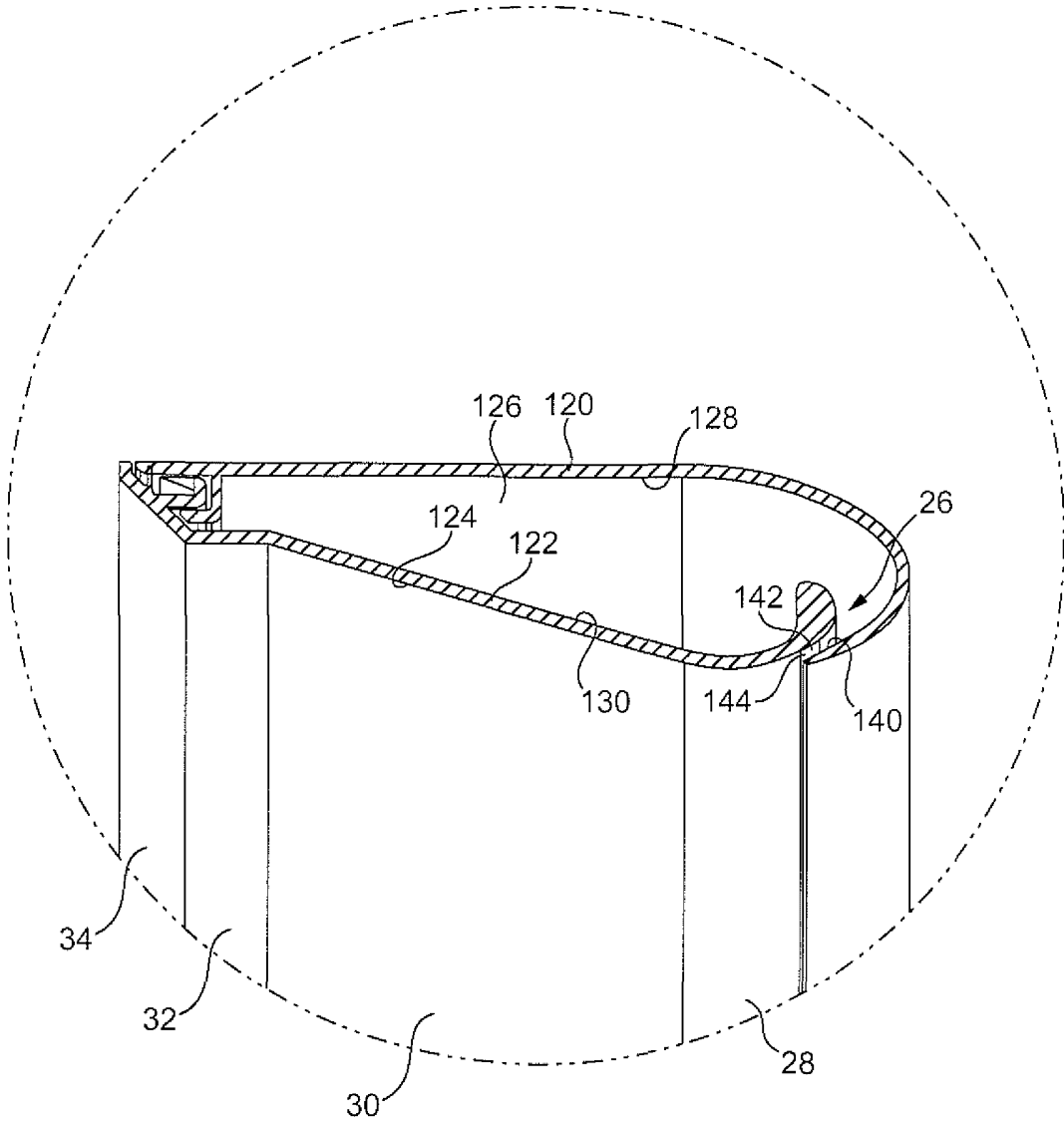


FIG. 6

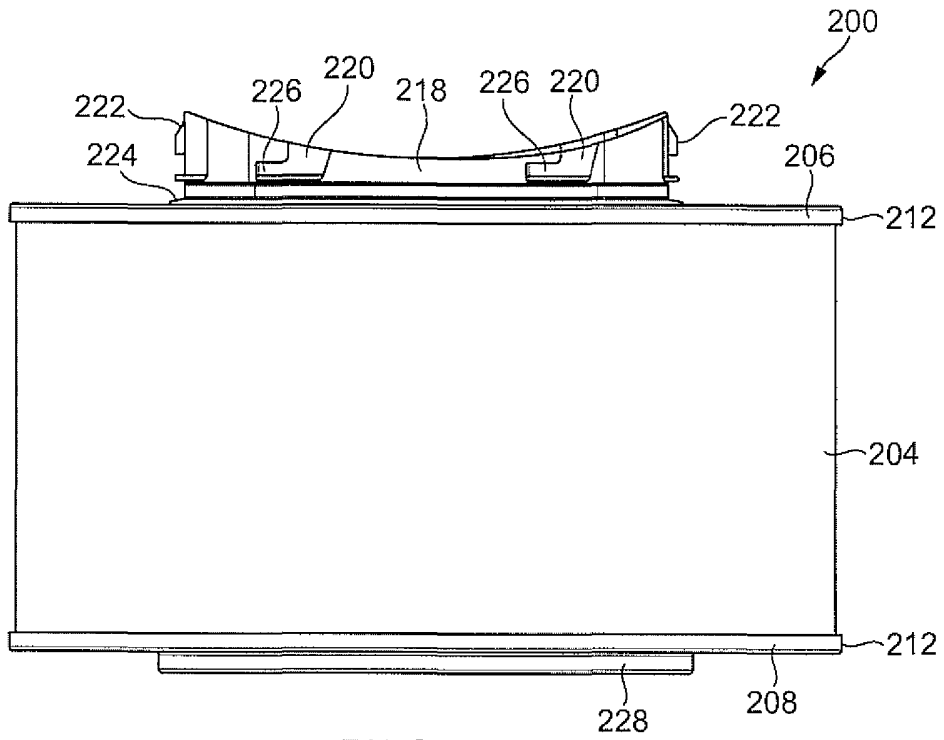


FIG. 7

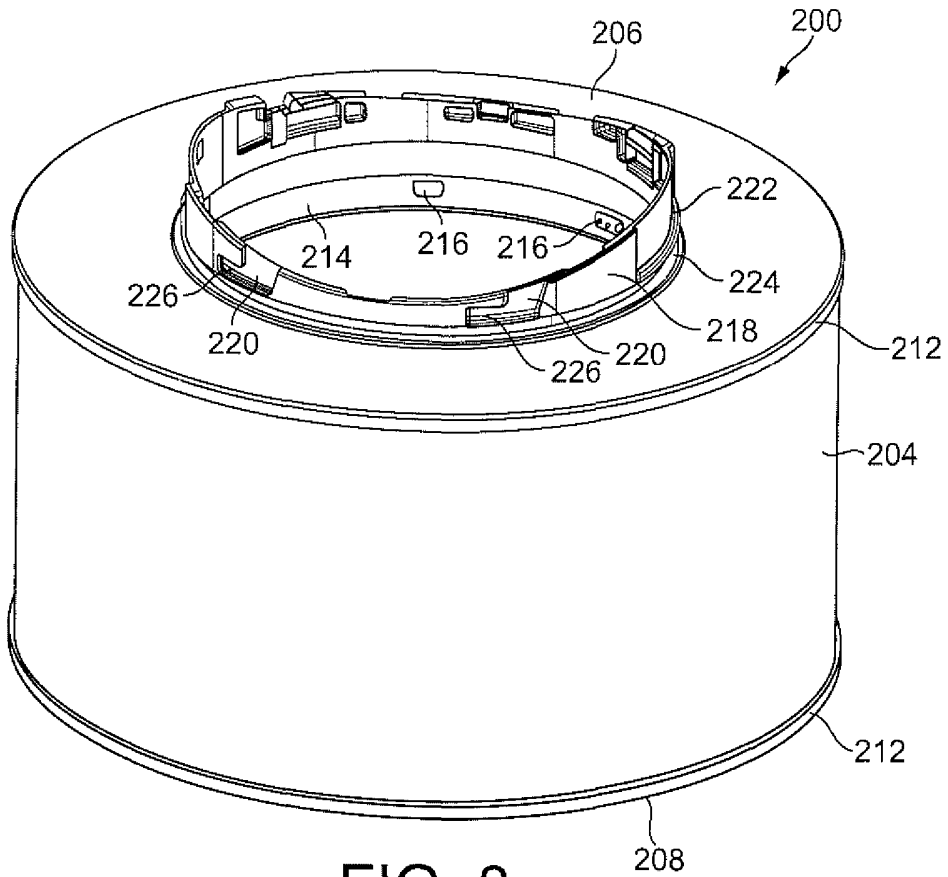


FIG. 8

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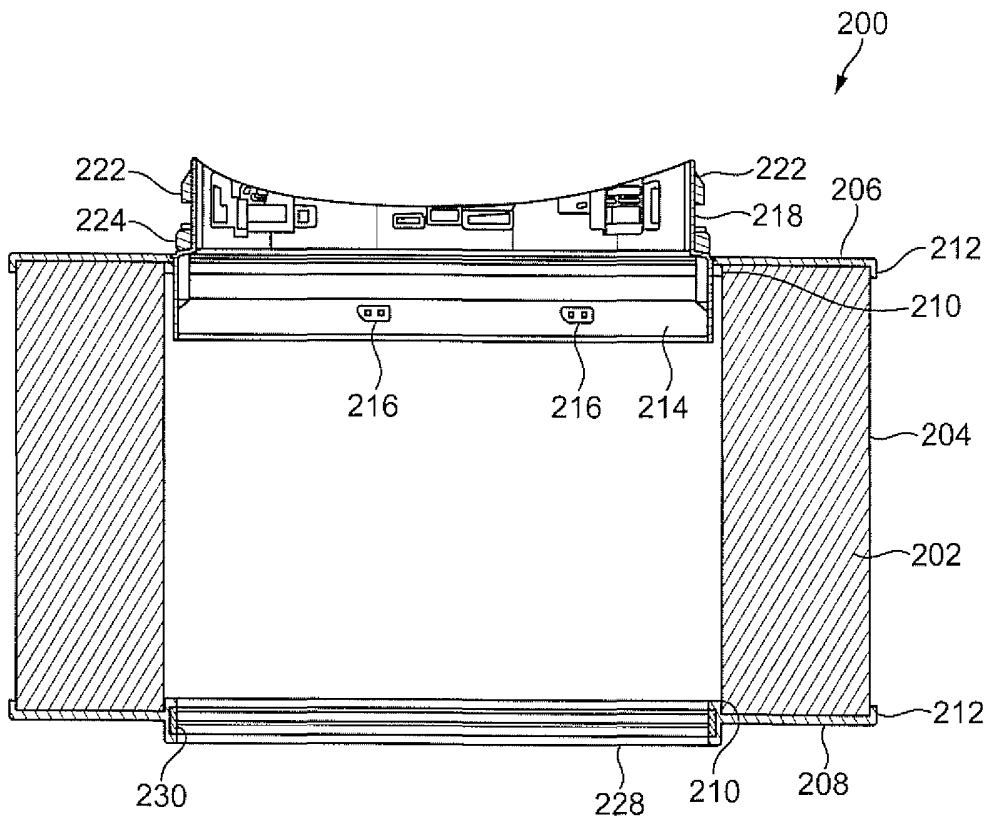


FIG. 9

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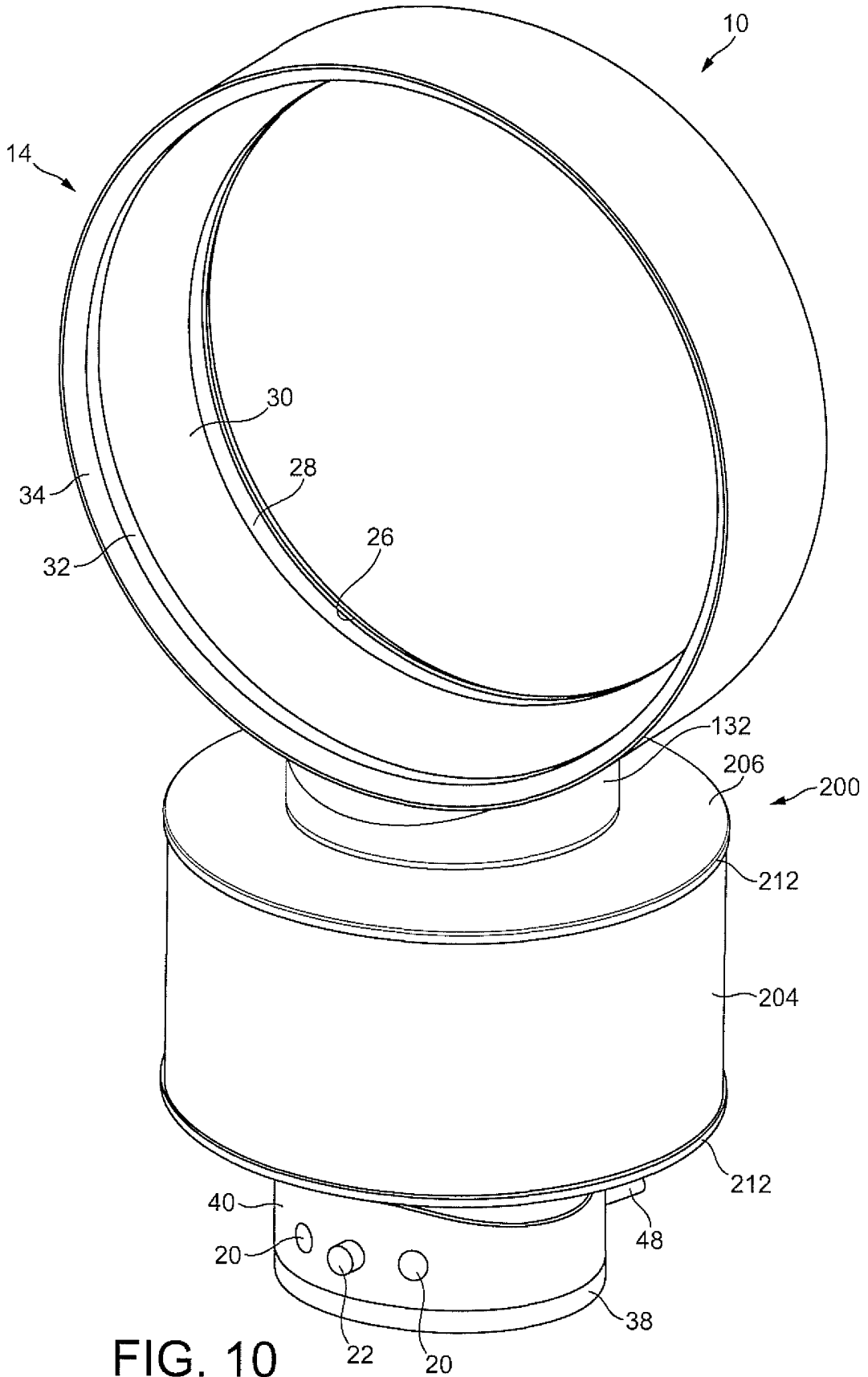


FIG. 10

An Accessory for a Fan

The present invention relates to an accessory for a fan. Particularly, but not exclusively, the present invention relates to an accessory for a floor or table-top fan, such as a desk,
5 tower or pedestal fan.

A conventional domestic fan typically includes a set of blades or vanes mounted for rotation about an axis, and drive apparatus for rotating the set of blades to generate an air flow. The movement and circulation of the air flow creates a 'wind chill' or breeze
10 and, as a result, the user experiences a cooling effect as heat is dissipated through convection and evaporation. The blades are generated located within a cage which allows an air flow to pass through the housing while preventing users from coming into contact with the rotating blades during use of the fan.

15 The use of fans in hospitals to keep patients cool is widespread, both in general wards and in isolation wards. For example, depending on the medical condition of the patient it may be preferable to reduce the body temperature of the patient using a fan rather than by using pharmaceuticals. When a fan is assigned to a patient, generally that fan is treated as an item of medical equipment and so, like other medical equipment, will
20 require frequent cleaning by a nurse or other hospital employee. The cleaning of bladed fans can be time consuming for the employee, as the cage housing the blades of the fan needs to be disassembled before the blades of the fan can be cleaned. This disassembly usually requires the use of a screw driver, which can not be carried by a nurse on a hospital ward. Often, it can be more convenient for the hospital to engage a specialist
25 cleaning company to clean the fan off site, although this can be very expensive.

WO 2009/030879 describes a fan assembly which does not use caged blades to project air from the fan assembly. Instead, the fan assembly comprises a base which houses a motor-driven impeller for drawing a primary air flow into the base, and an annular
30 nozzle connected to the base and comprising an annular slot through which the primary air flow is emitted from the fan. The nozzle defines a central opening through which air

in the local environment of the fan assembly is drawn by the primary air flow emitted from the mouth, amplifying the primary air flow.

5 The time required to clean of the external surfaces of this type of “bladeless” fan is much shorter than that required to clean a fan having caged blades, as there is no requirement to dismantle any parts of the fan to access any exposed parts of the fan. For example, the external surfaces of the fan may be wiped clean using a cloth. While this level of cleaning may be sufficient for bladeless fans which are assigned to patients on general wards, when the bladeless fan is assigned to a patient in an isolation ward or
10 infection containment ward there remains a need to keep the internal components of the base clean to avoid cross-contamination when the fan is assigned to another patient.

In a first aspect the present invention provides an external accessory for a portable fan, the accessory comprising a high energy particle arrester filter and attachment means for
15 detachably attaching the accessory to the fan.

The accessory is preferably in the form of a disposable filter unit which can be replaced when, for example, the fan is assigned to a different patient, when the fan is moved with the patient from an isolation ward to a general ward, or when the filter has reached the
20 end of a prescribed usage period. This can significantly reduce the costs associated with the use of the fan, as the frequency with which the fan may need to be taken off site for cleaning can be significantly reduced.

The accessory is particular suitable for use with a portable bladeless fan, such as the
25 Dyson Air Multiplier™ fan, in which an impeller for generating an air flow is located within a casing of the fan. In this case, the accessory may be locatable over or around the casing so that the filter is located upstream from the air inlet of the casing to remove airborne particulates from the primary air flow generated by the impeller before the air flow enters the casing. However, the accessory can be used with any fan which
30 generates an air flow of sufficient pressure that the air flow is not choked by the attachment of the accessory to the fan. For example, the accessory may be used with a

fan which is arranged to generate an air flow with a static pressure of at least 150Pa so that the air flow is not choked when the accessory is attached to the fan, and so the present invention also provides an accessory for a fan for generating an air flow with a static pressure of at least 150Pa, the accessory comprising a high energy particle arrester
5 filter and attachment means for detachably attaching the accessory to the fan.

The attachment means are preferably manually operable to allow a user to attach the accessory to the fan, and subsequently detach the accessory from the fan, without the need for a tool.

10

In addition to a high energy particle arrester (HEPA) filter, the accessory may comprise one or more of a foam, carbon, paper, or fabric filter.

The accessory preferably comprises at least one seal for engaging an outer surface of the fan. This can enable the accessory to form one or more air-tight seals with the fan to
15 ensure that the air flow generated by the fan passes through the filter and not around the filter.

In a preferred embodiment the accessory is in the form of a sleeve which is locatable
20 about an external surface of a fan. Forming the accessory in the form of a sleeve can enable the accessory to be easily pushed or pulled over the fan as required.

The filter preferably has a surface area in the range from 0.5 to 1.5m² which is exposed to the air flow generated by the fan. To minimise the volume of the filter, the filter is
25 preferably pleated to form a filter which is substantially annular in shape for surrounding an air inlet of the fan. In this case, the accessory may comprise two annular discs between which the filter is located. These discs can be easily wiped clean during use of the accessory. Each disc may comprise a raised rim extending towards the other disc for retaining the filter between the discs. The filter may be readily adhered to the
30 discs during the construction of the accessory.

The accessory may comprise an outer cover comprising a plurality of apertures through which air enters the accessory. This outer cover can provide a first, relatively coarse filter of the accessory to prevent airborne objects such as insects or large particles of dust from coming into contact with the filter, and can prevent the filter from being contacted by a user, particularly during the attachment of the filter to the fan, and so prevent damage to the filter. The outer cover is preferably transparent to allow a user to see the amount of dust or debris which has been captured by the filter.

In a second aspect the present invention provides a combination of an accessory as aforementioned and a portable fan. The fan is preferably arranged to generate an air flow having a static pressure of at least 150Pa, more preferably in the range from 250 to 1.5kPa.

Preferably, the fan comprises an air inlet for admitting air into the fan and an air outlet for exhausting air from the fan, with the accessory being attachable to the fan so that the filter is located upstream from the air inlet of the fan. Preferably, the accessory is attachable to the fan so that the filter is located over the air inlet of the fan.

The fan may comprise a base to which the accessory is attachable, the base comprising the air inlet over which the filter is locatable. The air inlet may extend at least partially about the base, and may comprise an array of apertures. The base may be substantially cylindrical in shape. The base of the fan may house means for generating an air flow from the air inlet to the air outlet. The means for generating the air flow preferably comprises an impeller driven by a motor. A diffuser is preferably located downstream from the impeller.

The accessory may be attachable to the portable fan between the base and the air outlet of the fan so that the filter is located upstream of the air inlet of the base.

Part of the accessory may be surrounded by part of the air outlet when the accessory is attached to the fan. For example, the air outlet may comprise a base which is located over part of the accessory when the air outlet is connected to the accessory.

- 5 The accessory may comprise a first seal for engaging the base of the fan, and a second seal for engaging the air outlet of the fan so that an air flow is drawn through the filter unit between the seals and through the filter.

10 The attachment means may comprise means for connecting the accessory to the base, and means for connecting the accessory to the air outlet. The air outlet of the fan is preferably detachably connected to the base of the fan. The air outlet of the fan preferably comprises means for connecting the air outlet to the base, which is preferably substantially the same as the means for connecting the accessory to the base. Similarly, the base of the fan preferably comprises means for connecting the base to the air outlet, 15 which is preferably substantially the same as the means for connecting the accessory to the air outlet. This can simplify the attachment of the accessory to the fan, as the technique for connecting the air outlet to the base is the same as that for connecting the accessory to the base, and for connecting the air outlet to the accessory.

- 20 The air outlet may comprise an interior passage for receiving an air flow and a mouth for emitting the air flow. The interior passage may extend about an opening through which air is drawn by the air flow emitted from the mouth.

25 In a third aspect the present invention provides a portable fan comprising a casing having an air inlet; an air outlet for emitting air from the fan; means for generating an air flow between the air inlet and an air outlet and which has a static pressure of at least 150 Pa downstream from the air generating means, and a filter unit detachably attached to the fan so that a filter of the fan unit is located upstream of the air inlet.

In a fourth aspect the present invention provides a portable fan comprising a casing having an air inlet, a filter unit connected to the casing, the filter unit comprising a filter located upstream from the air inlet, and an air outlet connected to the filter unit.

5 As mentioned above, the filter unit preferably comprises means for connecting the filter unit to the base, and means for connecting the filter unit to the air outlet. The air outlet preferably comprises means for connecting the air outlet to the base, and the means for connecting the filter unit to the base is preferably substantially the same as the means for connecting the air outlet to the base. The base preferably comprises means for
10 connecting the base to the air outlet, and the means for connecting the filter unit to the air outlet is preferably substantially the same as the means for connecting the base to the air outlet.

In a fifth aspect the present invention provides a portable fan comprising a casing
15 having an air inlet and first connecting means, a filter unit comprising second connecting means for connecting the filter unit to the first connecting means, a filter which is located upstream from the air inlet when the filter unit is connected to the casing, and third connecting means which is substantially the same as the first connecting means, and an air outlet comprising fourth connecting means which is
20 substantially the same as the second connecting means of the filter unit.

Other advantageous features are set out in the subsidiary claims.

Features described above in connection with the first aspect of the present invention are
25 equally applicable to any of the second to fifth aspects of the invention, and vice versa.

Preferred features of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

30 Figure 1 is a front view of a fan;

Figure 2 is a perspective view of the base of the fan of Figure 1;

Figure 3 is a perspective view of the air outlet of the fan of Figure 1;

5 Figure 4 is a lower perspective view of a portion of the air outlet of the fan of Figure 1;

Figure 5 is a sectional view of the fan of Figure 1;

Figure 6 is an enlarged view of part of Figure 5;

10

Figure 7 is a side view of an accessory for attachment to the fan of Figure 1;

Figure 8 is a perspective view, from above, of the accessory of Figure 7;

15 Figure 9 is a sectional view of the accessory of Figure 7;

Figure 10 is a perspective view of the fan of Figure 1 with the accessory of Figure 7 attached thereto; and

20 Figure 11 is a sectional view of the fan of Figure 10.

Figure 1 is a front view of a fan 10. The fan 10 is preferably in the form of a bladeless fan 10 comprising a base 12 and an air outlet 14 connected to the base 12. With reference also to Figure 2, the base 12 comprises a substantially cylindrical outer casing 25 16 having a plurality of air inlets 18 in the form of apertures formed in the outer casing 16 and through which a primary air flow is drawn into the base 12 from the external environment. The base 12 further comprises a plurality of user-operable buttons 20 and a user-operable dial 22 for controlling the operation of the fan 10. In this example the base 12 has a height in the range from 200 to 300 mm, and the outer casing 16 has an 30 external diameter in the range from 100 to 200 mm.

As shown in Figure 3, the air outlet 14 has an annular shape and defines an opening 24. The air outlet 14 has a height in the range from 200 to 400 mm. The air outlet 14 comprises a mouth 26 located towards the rear of the fan 10 for emitting air from the fan 10 and through the opening 24. The mouth 26 extends at least partially about the opening 24, and preferably surrounds the opening 24. The inner periphery of the air outlet 14 comprises a Coanda surface 28 located adjacent the mouth 26 and over which the mouth 26 directs the air emitted from the fan 10, a diffuser surface 30 located downstream of the Coanda surface 28 and a guide surface 32 located downstream of the diffuser surface 30. The diffuser surface 30 is arranged to taper away from the central axis X of the opening 24 in such a way so as to assist the flow of air emitted from the fan 10. The angle subtended between the diffuser surface 30 and the central axis X of the opening 24 is in the range from 5 to 25°, and in this example is around 15°. The guide surface 32 is arranged at an angle to the diffuser surface 30 to further assist the efficient delivery of a cooling air flow from the fan 10. The guide surface 32 is preferably arranged substantially parallel to the central axis X of the opening 24 to present a substantially flat and substantially smooth face to the air flow emitted from the mouth 26. A visually appealing tapered surface 34 is located downstream from the guide surface 32, terminating at a tip surface 36 lying substantially perpendicular to the central axis X of the opening 24. The angle subtended between the tapered surface 34 and the central axis X of the opening 24 is preferably around 45°. The overall depth of the air outlet 14 in a direction extending along the central axis X of the opening 24 is in the range from 100 to 150 mm, and in this example is around 110 mm.

Figure 5 illustrates a sectional view through the fan 10. The base 12 comprises a lower base member 38, an intermediary base member 40 mounted on the lower base member 38, and an upper base member 42 mounted on the intermediary base member 40. The lower base member 38 has a substantially flat bottom surface 43. The intermediary base member 40 houses a controller 44 for controlling the operation of the fan 10 in response to depression of the user operable buttons 20 shown in Figures 1 and 2, and/or manipulation of the user operable dial 22. The intermediary base member 40 may also house an oscillating mechanism 46 for oscillating the intermediary base member 40 and

the upper base member 42 relative to the lower base member 38. The range of each oscillation cycle of the upper base member 42 is preferably between 60° and 120°, and in this example is around 90°. In this example, the oscillating mechanism 46 is arranged to perform around 3 to 5 oscillation cycles per minute. A mains power cable
5 48 extends through an aperture formed in the lower base member 38 for supplying electrical power to the fan 10.

The upper base member 42 may be tilted relative to the intermediary base member 40 to adjust the direction in which the primary air flow is emitted from the fan 10. For
10 example, the upper surface of the intermediary base member 40 and the lower surface of the upper base member 42 may be provided with interconnecting features which allow the upper base member 42 to move relative to the intermediary base member 40 while preventing the upper base member 42 from being lifted from the intermediary base member 40. For example, the intermediary base member 40 and the upper base member
15 42 may comprise interlocking L-shaped members.

The upper base member 42 has an open upper end, and comprises an array of apertures
50 which extend at least partially about the upper base member 42. The apertures 50 provide the air inlet 18 of the base 12. The upper base member 42 houses an impeller
20 52 for drawing the primary air flow through the apertures 50 and into the base 12. Preferably, the impeller 52 is in the form of a mixed flow impeller. The impeller 52 is connected to a rotary shaft 54 extending outwardly from a motor 56. In this example, the motor 56 is a DC brushless motor having a speed which is variable by the controller
44 in response to user manipulation of the dial 22. The maximum speed of the motor 56 is preferably in the range from 5,000 to 10,000 rpm. The motor 56 is housed within a
25 motor bucket comprising an upper portion 58 connected to a lower portion 60. The motor bucket is retained within the upper base member 42 by a motor bucket retainer 62. The upper end of the upper base member 42 comprises a cylindrical outer surface 64. The motor bucket retainer 62 is connected to the open upper end of the upper base
30 member 42, for example by a snap-fit connection. The motor 56 and its motor bucket

are not rigidly connected to the motor bucket retainer 62, allowing some movement of the motor 56 within the upper base member 42.

Returning to Figure 2, the upper end of the upper base member 42 comprises two pairs
5 of open grooves 66 formed by removing part of the outer surface 66 to leave a shaped
'cutaway' portion. The upper end of each of the grooves 66 is in open communication
with the open upper end of the upper base member 42. The open groove 66 is arranged
to extend downwardly from the open upper end of the upper base member 42. A lower
10 part of the groove 66 comprises a circumferentially extending track 68 having upper and
lower portions bounded by the outer surface 66 of the upper base member 42. Each pair
of open grooves 66 is located symmetrically about the upper end of the upper base
member 42, the pairs being spaced circumferentially from each other. An annular
sealing member 69 extends about the outer surface of the upper base member 42, and is
located beneath the tracks 68 of the grooves 66.

15

The cylindrical outer surface 64 of the upper end of the upper base member 42 further
comprises a pair of wedge members 70 having a tapered part 72 and a side wall 74. The
wedge members 70 are located on opposite sides of the upper base member 42, with
each wedge member 70 being located within a respective cutaway portion of the outer
20 surface 64.

The motor bucket retainer 62 comprises curved vane portions 76, 78 extending inwardly
from the upper end of the motor bucket retainer 62. Each curved vane 76, 78 overlaps a
part of the upper portion 58 of the motor bucket. Thus the motor bucket retainer 62 and
25 the curved vanes 76, 78 act to secure and hold the motor bucket in place during
movement and handling. In particular, the motor bucket retainer 62 prevents the motor
bucket becoming dislodged and falling towards the air outlet 14 if the fan 10 becomes
inverted.

30 With reference again to Figure 5, one of the upper portion 58 and the lower portion 60
of the motor bucket comprises a diffuser 80 in the form of a stationary disc having spiral

fins 82, and which is located downstream from the impeller 52. One of the spiral fins 82 has a substantially inverted U-shaped cross-section when sectioned along a line passing vertically through the upper base member 42. This spiral fin 82 is shaped to enable a power connection cable to pass through the fin 82.

5

The motor bucket is located within, and mounted on, an impeller housing 84. The impeller housing 84 is, in turn, mounted on a plurality of angularly spaced supports 86, in this example three supports, located within the upper base member 42 of the base 12. A generally frusto-conical shroud 88 is located within the impeller housing 84. The shroud 88 is shaped so that the outer edges of the impeller 52 are in close proximity to, but do not contact, the inner surface of the shroud 88. A substantially annular inlet member 90 is connected to the bottom of the impeller housing 84 for guiding the primary air flow into the impeller housing 84. The top of the impeller housing 84 comprises a substantially annular air outlet 92 for guiding air flow emitted from the impeller housing 84 towards the air outlet 14.

10

15

Preferably, the base 12 further comprises silencing members for reducing noise emissions from the base 12. In this example, the upper base member 42 of the base 12 comprises a disc-shaped foam member 94 located towards the base of the upper base member 42, and a substantially annular foam member 96 located within the impeller housing 84.

20

25

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A flexible sealing member is mounted on the impeller housing 84. The flexible sealing member inhibits the return of air to the air inlet member 90 along a path extending between the outer casing 16 and the impeller housing 84 by separating the primary air flow drawn in from the external environment from the air flow emitted from the air outlet 92 of the impeller 52 and the diffuser 80. The sealing member preferably comprises a lip seal 98. The sealing member is annular in shape and surrounds the impeller housing 84, extending outwardly from the impeller housing 84 towards the outer casing 16. In the illustrated embodiment the diameter of the sealing member is greater than the radial distance from the impeller housing 84 to the outer casing 16.

Thus the outer portion 100 of the sealing member is biased against the outer casing 16 and caused to extend along the inner face of the outer casing 16, forming a seal. The lip seal 98 of the preferred embodiment tapers and narrows to a tip 102 as it extends away from the impeller housing 84 and towards the outer casing 16. The lip seal 98 is preferably formed from rubber.

The lip seal 98 further comprises a guide portion 104 for guiding a power connection cable 106 to the motor 56. The guide portion 104 of the illustrated embodiment is formed in the shape of a collar and may be a grommet. The electrical cable 106 is in the form of a ribbon cable attached to the motor at joint 108. The electrical cable 106 extending from the motor 56 passes out of the lower portion 60 of the motor bucket through spiral fin 82. The passage of the electrical cable 106 follows the shaping of the impeller housing 84 and the guide portion 104 of the lip seal 98 is shaped to enable the electrical cable 106 to pass through the flexible sealing member. The collar of the lip seal 98 enables the electrical cable 106 to be clamped and held within the upper base member 42. A cuff 110 accommodates the electrical cable 106 within the lower portion of the upper base member 42.

Figure 6 illustrates a sectional view through the air outlet 14. The air outlet 14 comprises an annular outer casing section 120 connected to and extending about an annular inner casing section 122. Each of these sections may be formed from a plurality of connected parts, but in this embodiment each of the outer casing section 120 and the inner casing section 122 is formed from a respective, single moulded part. The inner casing section 122 defines the central opening 24 of the air outlet 14, and has an external peripheral surface 124 which is shaped to define the Coanda surface 28, diffuser surface 30, guide surface 32 and tapered surface 34.

The outer casing section 120 and the inner casing section 122 together define an annular interior passage 126 of the air outlet 14. Thus, the interior passage 126 extends about the opening 24. The interior passage 126 is bounded by the internal peripheral surface 128 of the outer casing section 120 and the internal peripheral surface 130 of the inner

casing section 122. As shown in Figure 4, the outer casing section 120 comprises a base 132 having an inner surface 134. Formed on the inner surface 134 of the base 132 are two pairs of lugs 136 and a pair of ramps 138 for connection to the upper end of the upper base member 42. Each lug 136 and each ramp 138 upstands from the inner surface 134. Thus the base 132 is connected to, and over, the open upper end of the motor bucket retainer 62 and the upper base member 42 of the base 12. The pairs of lugs 136 are located around the outer casing section 120 and spaced from each other so that the pairs of lugs 136 correspond to the spaced arrangement of the pairs of open grooves 66 of the upper end of the upper base member 42 and so that the location of the pair of ramps 138 corresponds to the location of the pair of wedge members 70 of the upper end of the upper base member 42.

The base 132 of the outer casing section 120 comprises an aperture through which the primary air flow enters the interior passage 126 of the air outlet 14 from the upper end of the upper base member 42 and the open upper end of the motor bucket retainer 62.

The mouth 26 of the air outlet 14 is located towards the rear of the fan 10. The mouth 26 is defined by overlapping, or facing, portions 140, 142 of the internal peripheral surface 128 of the outer casing section 120 and the external peripheral surface 124 of the inner casing section 122, respectively. In this example, the mouth 26 is substantially annular and, as illustrated in Figure 4, has a substantially U-shaped cross-section when sectioned along a line passing diametrically through the air outlet 14. In this example, the overlapping portions 140, 142 of the internal peripheral surface 128 of the outer casing section 120 and the external peripheral surface 124 of the inner casing section 122 are shaped so that the mouth 26 tapers towards an outlet 144 arranged to direct the primary flow over the Coanda surface 28. The outlet 144 is in the form of an annular slot, preferably having a relatively constant width in the range from 0.5 to 5 mm. In this example the outlet 144 has a width of around 1.1 mm. Spacers may be spaced about the mouth 26 for urging apart the overlapping portions 140, 142 of the internal peripheral surface 128 of the outer casing section 120 and the external peripheral surface 124 of the inner casing section 122 to maintain the width of the outlet 144 at the desired level.

These spacers may be integral with either the internal peripheral surface 128 of the outer casing section 120 or the external peripheral surface 124 of the inner casing section 122.

Referring to Figures 3 and 4, to attach the air outlet 14 to the base 12, the air outlet 14 is inverted from the orientation illustrated in Figure 4 and the base 132 of the air outlet 14 is located over the open upper end of the upper base member 42. The air outlet 14 is aligned relative to the base 12 so that the lugs 136 of the base 132 of the air outlet 14 are located directly in line with the open upper end of the open grooves 66 of the upper base member 42. In this position the pair of ramps 138 of the base 132 is directly in line with the pair of wedge members 70 of the upper base member 42. The air outlet 14 is then pushed on to the base 12 so that the lugs 136 are located at the base of the open grooves 66. The sealing member 69 of the base 12 engages the inner surface 134 of the base 132 of the air outlet 14 to form an air-tight seal between the base 12 and the air outlet 14.

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To secure the air outlet 14 to the base 12, the air outlet 14 is rotated in a clockwise direction relative to the base 12 so that the lugs 136 move along the circumferentially extending tracks 68 of the open grooves 66. The rotation of the air outlet 14 relative to the base 12 also forces the ramps 138 to run up and slide over the tapers 72 of the wedge member 70 through localised elastic deformation of the side wall 64 of the upper base member 42. With continued rotation of the air outlet 14 relative to the base 12, the ramps 138 are forced over the side walls 74 of the wedge members 70. The open upper end of the upper base member 42 relaxes so that the ramps 138 are generally radially aligned with the wedge members 70. Consequently, the side walls 74 of the wedge members 70 prevent accidental rotation of the air outlet 14 relative to the base 12, whereas the location the lugs 136 within the tracks 68 prevents lifting of the air outlet 14 away from the base 12. The rotation of the air outlet 14 relative to the base 12 does not require excessive rotational force and so the assembly of the fan 10 may be carried out by a user.

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To operate the fan 10 the user depresses an appropriate one of the buttons 20 on the base 12, in response to which the controller 44 activates the motor 56 to rotate the impeller 52. The rotation of the impeller 52 causes a primary air flow to be drawn into the base 12 through the air inlet 18. Depending on the speed of the motor 56, the
5 primary air flow generated by the impeller 52 may be between 20 and 30 litres per second. The pressure of the primary air flow at the outlet 92 of the base 12 may be at least 150 Pa, and is preferably in the range from 250 to 1.5 kPa. The primary air flow passes sequentially through the impeller housing 84, the upper end of the upper base member 42 and open upper end of the motor bucket retainer 62 to enter the interior
10 passage 126 of the air outlet 14. The primary air flow emitted from the air outlet 92 of the base 12 is generally in an upward and forward direction.

Within the air outlet 14, the primary air flow is divided into two air streams which pass in opposite directions around the central opening 24 of the air outlet 14. Part of the
15 primary air flow entering the air outlet 14 in a sideways direction (generally orthogonal to the axis X) passes into the interior passage 126 in a sideways direction without significant guidance, whereas another part of the primary air flow entering the air outlet 14 in a direction parallel to the axis X is guided by the curved vanes 76, 78 of the motor bucket retainer 62 to enable the air flow to pass into the interior passage 126 in a
20 sideways direction. As the air streams pass through the interior passage 126, air enters the mouth 26 of the air outlet 14. The air flow into the mouth 26 is preferably substantially even about the opening 24 of the air outlet 14. Within each section of the mouth 26, the flow direction of the portion of the air stream is substantially reversed. The portion of the air stream is constricted by the tapering section of the mouth 26 and
25 emitted through the outlet 98.

The primary air flow emitted from the mouth 26 is directed over the Coanda surface 28 of the air outlet 14, causing a secondary air flow to be generated by the entrainment of air from the external environment, specifically from the region around the outlet 98 of
30 the mouth 26 and from around the rear of the air outlet 14. This secondary air flow passes through the central opening 24 of the air outlet 14, where it combines with the

primary air flow to produce a total air flow, or air current, projected forward from the air outlet 14. Depending on the speed of the motor 56, the mass flow rate of the air current projected forward from the fan 10 may be in the range from 300 to 400 litres per second, and the maximum speed of the air current may be in the range from 2.5 to 4 m/s.

The even distribution of the primary air flow along the mouth 26 of the air outlet 14 ensures that the air flow passes evenly over the diffuser surface 30. The diffuser surface 30 causes the mean speed of the air flow to be reduced by moving the air flow through a region of controlled expansion. The relatively shallow angle of the diffuser surface 30 to the axis X of the opening 24 allows the expansion of the air flow to occur gradually. A harsh or rapid divergence would otherwise cause the air flow to become disrupted, generating vortices in the expansion region. Such vortices can lead to an increase in turbulence and associated noise in the air flow which can be undesirable, particularly in a domestic product such as a fan. The air flow projected forwards beyond the diffuser surface 30 can tend to continue to diverge. The presence of the guide surface 32 extending substantially parallel to the central axis X of the opening 30 further converges the air flow. As a result, the air flow can travel efficiently out from the air outlet 14, enabling the air flow can be experienced rapidly at a distance of several metres from the fan 10.

Figure 7 to 9 illustrate an external accessory for the fan 10. The accessory is in the form of a filter unit 200 which is detachably attachable to the fan 10 to allow the filter unit 200 to be removed for cleaning or replacement.

The filter unit 200 is in the form of a generally cylindrical sleeve which is locatable around the upper base member 42 of the base 12 so that the filter unit 200 is located over the air inlet 18 of the fan 10, as illustrated in Figures 10 and 11. This allows the filter unit 200 to remove airborne particles from the primary air flow generated by the fan 10 before the primary air flow enters the base 12 of the fan 10.

The filter unit 200 comprises a generally annular filter 202 for removing airborne particles from the primary air flow. The filter 202 is preferably in the form of a radially pleated high energy particle arrester (HEPA) filter. The filter 202 has a surface area that is exposed to the incoming primary air flow generated by the fan which is in the range
5 from 0.5 to 1.5 m², and in this example is around 1.1 m². The filter 202 is surrounded by a cylindrical outer cover 204, which is preferably formed from plastics material, to protect the filter 202 and thus allows a user to handle the filter unit 200 without contacting the filter 202. The cover 204 is preferably transparent to allow a user to examine the state of the filter 202 during use or after a period of use. The cover 204
10 comprises a plurality of apertures (not shown) through which the primary air flow enters the filter unit 200, and thus provides a relatively coarse first stage of filtration of the filter unit 200 to prevent relatively large airborne objects or insects from entering the filter unit 200. The filter unit 200 may further comprise additional filter media between the filter 202 and the cover 204, or downstream from the filter 202. For example, this
15 additional filter media may comprise one or more of foam, carbon, paper, or fabric.

The filter 202 and the cover 204 are sandwiched between two annular plates 206, 208 of the filter unit 200. Each plate 206, 208 includes a circular inner rim 210 and a circular outer rim 212 which both extend partially towards the other plate 206, 208. The filter
20 202 and the cover 204 are located between the rims 210, 212 of the plates 206, 208, and are preferably secured to the plates 206, 208 using an adhesive.

The upper plate 206 comprises a lower collar 214 which is located radially inwardly from the inner rim 210 of the upper plate 206. The lower collar 214 extends axially
25 downwards from the upper plate 206. The inner diameter of the lower collar 214 is substantially the same as the inner diameter of the base 132 of the air outlet 14 of the fan 10. Similar to the base 132 of the air outlet 14, the inner surface of the lower collar 214 comprises two pairs of lugs 216 and a pair of ramps (not shown) for connection to the upper end of the upper base member 42 of the base 12 of the fan 10. The shape of
30 the lugs 216 and the ramps of the lower collar 214, and the angular spacing between the

lugs 216 and the ramps of the lower collar 214, are substantially identical to those of the lugs 136 and ramps 138 of the base 132 of the air outlet 14.

5 The upper plate 206 further comprises an upper collar 218 which is located radially inwardly from the lower collar 214. The upper collar 218 extends axially upwards from the inner circumferential periphery of the upper plate 208. The outer diameter of the upper collar 218 is substantially the same as the outer diameter of the side wall 64 of the open upper end of the upper base member 42. Similar to the upper base member 42, the upper collar 218 comprises two pairs of open grooves 220 and a pair of wedge members
10 222. The open grooves 220 are substantially identical to the open grooves 66 of the side wall 64 of the upper base member 42, and the spacing between the open grooves 220 is substantially the same as that between the open grooves 66. The wedge members 222 are substantially identical to the wedge members 70 of the side wall 64 of the upper base member 42, and the spacing between the wedge members 222 is substantially the same as that between the wedge members 70. A first annular sealing member 224 of
15 the filter unit 200 extends about the outer surface of the upper collar 218, and is located beneath the circumferentially extending tracks 226 of the grooves 220.

20 The collars 214, 218 are preferably integral with the upper plate 206, which is preferably formed from plastics material.

The lower plate 208 includes a relatively small collar 228 which is extends axially downwardly from the inner rim 210 of the lower plate 208. The collar 228 comprises a circumferentially extending groove located on its inner surface. A second annular
25 sealing member 230 of the filter unit 200 is located within this groove. The collar 228 is preferably integral with the lower plate 208, which also preferably formed from plastics material.

To attach the filter unit 200 to the fan 10, first the air outlet 14 is detached from the base
30 12. To detach the air outlet 14 from the base 12, the air outlet 14 is twisted relative the base 12 in the opposite direction (anti-clockwise) to that for attaching the air outlet 14 to

the base 12. With a suitable torque applied manually by the user, the side wall 66 of the upper end of the upper base member 42 is again caused to flex locally radially inwardly. This localised deformation of the upper base member 42 allows the ramp 138 to be rotated over the wedge members 70, while the lugs 136 are moved simultaneously along the tracks 68 of the grooves 66. Once the lugs 136 reach the ends of the tracks 68, the air outlet 14 may be lifted from the base 12.

Although the detachment of the air outlet 14 from the base 12 requires a greater force to be applied to the air outlet 14 than the force required for attachment, the resilience of the side wall 66 of the upper base member 42 is selected so that the detachment of the air outlet 14 may be performed manually

The user then attaches the filter unit 200 to the base 12. The technique for attaching the filter unit 200 to the base 12 is essentially the same as that for attaching the air outlet 14 to the base 12. The user locates the open lower end of the collar 228 of the lower plate 208 over the open upper end of the upper base member 42, and lowers the filter unit 200 around the base 12. When the bottom end of the lower collar 214 of the upper plate 206 is located immediately above the open upper end of the upper base member 42, the user rotates the filter unit 200 until the lugs 216 of the filter unit 200 are located directly in line with the open upper end of the open grooves 66 of the upper base member 42. In this position the pair of ramps of the filter unit is directly in line with the pair of wedge members 70 of the upper base member 42. The filter unit 200 is then pushed further on to the base 12 so that the lugs 216 of the filter unit 200 are located at the base of the open grooves 66 of the base 12. To secure the filter unit 200 to the base 12, the filter unit 200 is rotated in a clockwise direction relative to the base 12 so that the lugs 216 move along the circumferentially extending tracks 68 of the open grooves 66. The rotation of the filter unit 200 relative to the base 12 also forces the ramps to run up and slide over the tapers 72 of the wedge members 70 through localised elastic deformation of the side wall 64 of the upper base member 42. With continued rotation of the filter unit 200 relative to the base 12, the ramps are forced over the side walls 74 of the wedge members 70. The open upper end of the upper base member 42 relaxes so that the

ramps are generally radially aligned with the wedge members 70. Consequently, the side walls 74 of the wedge members 70 prevent accidental rotation of the filter unit 200 relative to the base 12, whereas the location the lugs 216 within the tracks 68 prevents lifting of the filter unit 200 away from the base 12.

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As shown in Figure 11, when the filter unit 200 is attached to the base 12 the second sealing member 230 of the filter unit 200 is located beneath the air inlet 18 of the base 12, and engages the outer surface of the base 12 to form an air-tight seal between the base 12 and the filter unit 200. As also shown in Figure 10, the buttons 22 and user operable dial 22 of the base 12 remain accessible by the user when the filter unit 200 is attached to the base 12.

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The air outlet 14 is then attached to the filter unit 200. The attachment of the air outlet 14 to the filter unit 200 is essentially the same as the attachment of the air outlet 14 to the base 12. The base 132 of the air outlet 14 is located over the upper collar 218 of the filter unit 200, and the air outlet 14 is aligned relative to the base 12 so that the lugs 136 of the base 132 of the air outlet 14 are located directly in line with the open upper end of the open grooves 220 of the filter unit 200. The air outlet 14 is then pushed on to the filter unit 200 so that the lugs 136 are located at the base of the open grooves 220. The first sealing member 224 of the filter unit 200 engages the inner surface 134 of the base 132 of the air outlet 14 to form an air-tight seal between the filter unit 200 and the air outlet 14. Again, to secure the air outlet 14 to the filter unit 200 the air outlet 14 is rotated in a clockwise direction relative to the filter unit 200 so that the lugs 136 move along the circumferentially extending tracks 226 of the open grooves 220 of the filter unit 200. The rotation of the air outlet 14 relative to the filter unit 200 also forces the ramps 138 to run up and slide over the tapers of the wedge members 222 of the filter unit 200 through localised elastic deformation of the upper collar 218. With continued rotation of the air outlet 14 relative to the filter unit 200, the ramps 138 are forced over the side walls of the wedge members 220. The upper collar 218 relaxes so that the ramps 138 are generally radially aligned with the wedge members 220. Consequently, the side walls of the wedge members 200 prevent accidental rotation of the air outlet 14

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relative to the filter unit 200, whereas the location the lugs 136 within the tracks 226 of the grooves 200 prevents lifting of the air outlet 14 away from the filter unit 200.

The assembled combination of the fan 10 and the filter unit 200 is shown in Figures 10 and 11. The air-tight seals that the filter unit 200 makes with the base 12 and the air outlet 14 force the primary air flow to pass through the filter 202 of the filter unit 200 to remove airborne particulates from the primary air flow before it enters the base 12. In addition to purifying the air in the local environment of the fan 10, the removal of airborne particulates from the primary air flow before it enters the base 12 can significantly reduce the rate at which dust and debris can build-up on the internal components of the fan 10, thereby reducing the frequency at which the fan 10 needs to be cleaned. The filter unit 200 may be easily replaced for cleaning or replacement by detaching the air outlet 14 from the filter unit 200, which is performed in the same manner as the removal of the air outlet 14 from the base 12, and subsequently detaching the filter unit 200 from the base 12. This can performed quickly and easily without the use of any tools. When the use of the filter unit 200 is no longer required, the filter unit 200 can be rapidly removed from the fan 10 by detaching the filter unit 200 from the base 12, and re-attaching the air outlet 14 directly to the base 12.

CLAIMS

1. An external accessory for a portable fan, the accessory comprising a high energy
5 particle arrester filter and attachment means for detachably attaching the accessory to
the fan.
2. An accessory as claimed in claim 1, comprising at least one seal for engaging an
outer surface of the fan.
- 10 3. An accessory as claimed in claim 1 or claim 2, wherein the accessory is in the
form of a sleeve locatable about an external surface of a portable fan.
4. An accessory as claimed in any of the preceding claims, wherein the filter is
15 substantially annular in shape.
5. An accessory as claimed in claim 4, comprising two annular discs between
which the filter is located.
- 20 6. An accessory as claimed in claim 5, wherein each disc comprises a raised rim
extending towards the other disc for retaining the filter between the discs.
7. An accessory as claimed in claim 5 or claim 6, wherein the filter is adhered to
the discs.
- 25 8. An accessory as claimed in any of the preceding claims, comprising an outer
cover comprising a plurality of apertures.
9. A combination of an accessory as claimed in any of the preceding claims and a
30 portable fan.

10. A combination as claimed in claim 9, wherein the fan comprises an air inlet and an air outlet, wherein the accessory is attachable to the fan so that the filter is located upstream from the air inlet of the fan.

5 11. A combination as claimed in claim 10, wherein the accessory is attachable to the fan so that the filter is located over the air inlet of the fan.

12. A combination as claimed in claim 10 or claim 11, wherein the fan comprises a base to which the accessory is attachable, the base comprising said air inlet.

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13. A combination as claimed in claim 12, wherein the air inlet extends at least partially about the base.

14. A combination as claimed in claim 12 or claim 13, wherein the air inlet
15 comprises an array of apertures.

15. A combination as claimed in any of claims 12 to 14, wherein the base is substantially cylindrical in shape.

20 16. A combination as claimed in any of claims 12 to 14, wherein the base houses means for generating an airflow from the air inlet to the air outlet.

17. A combination as claimed in claim 16, wherein the means for generating an air flow is arranged to generate an air flow having a static pressure of at least 150 Pa.

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18. A combination as claimed in claim 16 or claim 17, wherein the means for generating an air flow is arranged to generate an air flow having a static pressure in the range from 250 to 1kPa.

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19. A combination as claimed in any of claims 12 to 18, wherein the accessory is attachable to the portable fan between the base and the air outlet.

20. A combination as claimed in claim 19, wherein the accessory comprises a first seal for engaging the base of the fan, and a second seal for engaging the air outlet of the fan.

21. A combination as claimed in any of claims 12 to 20, wherein the attachment means comprises means for connecting the accessory to the base, and means for connecting the accessory to the air outlet.

22. A combination as claimed in claim 21, wherein the air outlet comprises means for connecting the air outlet to the base, and wherein the means for connecting the accessory to the base is substantially the same as the means for connecting the air outlet to the base.

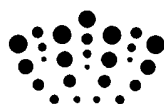
23. A combination as claimed in claim 21 or claim 22, wherein the base comprises means for connecting the base to the air outlet, and the means for connecting the accessory to the air outlet is substantially the same as the means for connecting the base to the air outlet.

24. A combination as claimed in any of claims 10 to 23, wherein the air outlet comprises an interior passage for receiving an air flow and a mouth for emitting the air flow.

25. A combination as claimed in claim 24, wherein the interior passage extends about an opening through which air is drawn by the airflow emitted from the mouth.

26. A combination as claimed in any of claims 10 to 25, wherein the fan is one of a desk fan, a tower fan and a pedestal fan.

27. An accessory or a combination of an accessory and a portable fan substantially as herein described with reference to the accompanying drawings.



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Claims searched: 1-27

Date of search: 20 May 2010

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,Y	X:1-4, 8-19, 24, 26. Y:25	US4905340 A (GUTSCHMIT) See especially filter 12 shown on the figures.
X	1, 2, 9-11, 24.	US5094676 A (KARBACHER) See especially filter 40, 42, 44.
X	1, 3, 4, 8-11.	JP11159499 A (NOMURA) See especially figures, EPODOC Abstract and WPI Abstract Accession No. 1999-401252 [34]
Y	25	JP56167897 A (TOKYO SHIBAURA ELECTRIC) See especially figures and EPODOC Abstract.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

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Worldwide search of patent documents classified in the following areas of the IPC

F04D; F24F

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
F24F	0013/28	01/01/2006
F04D	0025/08	01/01/2006
F24F	0001/02	01/01/2006