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(54) POWERED AIR PURIFYING RESPIRATOR ASSEMBLY

(57) The present disclosure relates to a powered air purifying respirator assembly comprising:
a blower unit for providing powered airflow including a blower housing (126) with an air inlet port (122);
a filter cartridge (140) with a filter element (144), the filter cartridge comprising a connector portion (142) configured to be removably connected to the air inlet port (122) of the blower housing (126); and
an inlet valve member (332) connected to the air inlet port and transferable between an open position, in which air can flow through the air inlet port (122) into the blower housing (126), and a closed position, in which the air inlet port (122) is sealed in an airtight and watertight manner, the inlet valve member (332) being biased towards its closed position,
wherein the inlet valve member comprises an inlet valve actuator (336) for transferring the inlet valve member between its closed position and its open position, the inlet valve actuator (336) being arranged within the air inlet port (122) in such a way that the inlet valve actuator is movable by means of the connector portion (142) of the filter cartridge to transfer the inlet valve member (332) into its open position, when the connector portion (142) is inserted into the air inlet port, and
wherein the inlet valve actuator (336) comprises a sealing member adapted to sealingly engage with the connector portion (142) when the connector portion is inserted into the air inlet port (122).

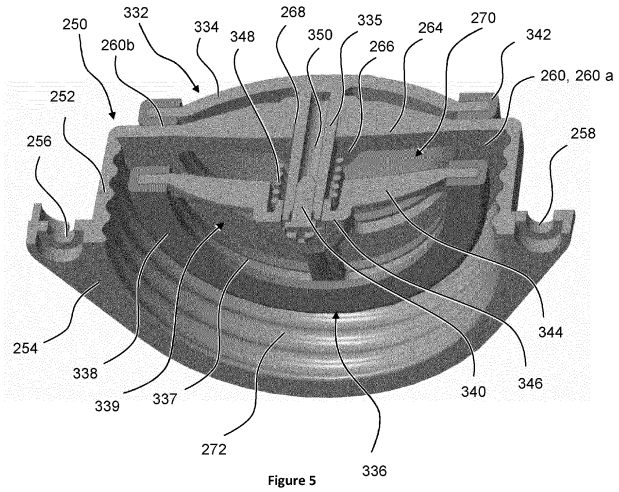

Figure 5

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Description

Background of the Invention

[0001] The present disclosure relates to a powered air purifying respirator assembly, particularly, but not exclusively, to a powered air purifying respirator assembly for use in contaminated areas, such as environments with biological hazards, such as viruses or asbestos.

[0002] It is generally known to utilise powered air purifying respirators (PAPRs) in industrial applications with environmental hazards. Such environmental hazards may include respiratory hazards such as gases, vapours, and/or particulate matter that is harmful to the respiratory system of a human being. Examples of respiratory hazards are particulate matters such as ashes frequently encountered by fire fighters or asbestos often found in old buildings. Other hazards include viruses, such as the recent COVID-19 virus, which is extremely contagious and therefore requires healthcare staff to be protected appropriately.

[0003] For all of the above applications, PAPRs can provide purified (e.g. filtered) air to the user when operating in such hazardous environments. To this end, PAPRs usually include a blower unit equipped with a fan/impeller for generating a forced air flow. The blower unit typically includes a blower housing with an inlet port and an outlet port. In some examples, the inlet port is connectable to a removeable air filter. Air flow that is created by the blower unit is sucked into the blower housing via said air filter and provided to a face mask worn by the user via the aforementioned outlet port. Air flow exiting the blower housing via the outlet port is typically provided to a face mask worn by the user via a hose.

[0004] Particularly after working in hazardous environments, the operator is often required to have a decontamination shower. To this end, the operator will typically remove the PAPR and step into the decontamination shower with their safety gear only. The PAPR itself will then be decontaminated in a separate device, e.g. a washing chamber.

[0005] The above process for decontamination is known to be cumbersome and often insufficient. Accordingly, PAPR systems are required that can be cleaned more readily without specific decontamination equipment.

[0006] It is an aim of the present disclosure to solve or at least ameliorate one or more problems of the prior art.

Summary of the Invention

[0007] Aspects and embodiments of the disclosure provide powered air purifying respirators as claimed in the appended claims.

[0008] According to a first aspect of the present disclosure, there is provided a powered air purifying respirator assembly comprising:

a blower unit for providing powered airflow including a blower housing with an air inlet port;

a filter cartridge with a filter element, the filter cartridge comprising a connector portion configured to be removably connected to the air inlet port of the blower housing;

an inlet valve member connected to the air inlet port of the blower housing and transferable between an open position, in which air can flow through the air inlet port into the blower housing, and a closed position, in which the air inlet port is sealed in an airtight and watertight manner, the inlet valve member being biased towards its closed position,

wherein the inlet valve member comprises an inlet valve actuator for transferring the inlet valve member between its closed position and its open position, the inlet valve actuator being arranged within the air inlet port in such a way that the inlet valve actuator is movable by means of the connector portion of the filter cartridge to transfer the inlet valve member into its open position, when the connector portion is inserted into the air inlet port, and

wherein the inlet valve actuator comprises a sealing member adapted to sealingly engage with the connector portion when the connector portion is inserted into the air inlet port.

[0009] According to another embodiment, the inlet valve member is arranged in such a way that the sealing member of the inlet valve actuator is biased against the connector portion of the filter cartridge when the inlet valve member is in its open position.

[0010] The sealing member may be ring shaped.

[0011] In another embodiment, the inlet valve actuator comprises an annular collar, the annular collar being at least partly covered by the sealing member.

[0012] In another embodiment, the inlet valve member comprises a valve head configured to close the air inlet when the inlet valve member is in its closed position and open the air inlet when the inlet valve member is in its open position, and wherein the inlet valve actuator is removably connected to the valve head.

[0013] In another embodiment, the inlet valve member comprises a valve shaft arranged between the valve head and the inlet valve actuator.

[0014] In another embodiment, the valve shaft is integrally formed with the valve head.

[0015] In another embodiment, the powered air purifying respirator assembly comprises a valve guide arranged within the air inlet port, and wherein the valve shaft is movably received within said valve guide.

[0016] In another embodiment, the inlet valve member comprises a coil spring arranged around the valve shaft and adapted to bias the inlet valve member into its closed position.

[0017] In another embodiment, the coil spring is arranged between the inlet valve actuator and the valve guide arranged within the air inlet port.

[0018] In another embodiment, the inlet valve actuator comprises a cap portion configured to receive at least parts of the coil spring.

[0019] In another embodiment, the cap portion at least partly surrounds the valve shaft.

[0020] In another embodiment, the inlet valve actuator comprises an annular collar and a plurality of radial struts connecting an inner surface of the annular collar with an outer surface of the cap portion.

[0021] According to another aspect of the present disclosure, there is provided a powered air purifying respirator assembly comprising:

a blower unit for providing powered airflow including a blower housing with an air outlet port;
a hose for transferring powered airflow from the blower unit to a head mask, the hose comprising a first end configured to be removably connected to the air outlet port of the blower housing;
an outlet valve member connected to the air outlet port and transferable between an open position, in which air can flow through the air outlet port into the hose, and a closed position, in which the air outlet port is sealed in an airtight and watertight manner, the outlet valve member being biased towards its closed position,
wherein the outlet valve member comprises an outlet valve actuator for transferring the outlet valve member between its closed position and its open position, the outlet valve actuator being arranged within the air outlet port in such a way that the actuator is movable by means of the first end of the hose to transfer the outlet valve member into its open position, when the first end of the hose is inserted into the air outlet port, and
wherein the outlet valve actuator comprises a sealing member adapted to sealingly engage with the connector portion when the connector portion is inserted into the air inlet port.

[0022] In another embodiment, the hose comprises a second end, opposite the first end, and wherein the powered air purifying respirator comprises a loose fitting or tight fitting head mask connected to the second end of the hose.

[0023] According to another aspect of the present disclosure, there is provided a valve assembly for connection to an air inlet port of a PAPR blower housing, the valve assembly comprising:

an inlet port socket removably connectable to an air inlet port of a PAPR blower housing, the inlet port socket comprising a valve guide;
a valve member removably connectable to the inlet port socket and transferable between an open position, in which air can flow through the valve assembly, and a closed position, in which the valve assembly is closed in an airtight and watertight manner, wherein the inlet valve member is biased towards its closed position,
wherein the inlet valve member comprises an inlet valve actuator for transferring the inlet valve member between its closed position and its open position, the inlet valve actuator being arranged in such a way that the inlet valve actuator is movable by means of a connector portion of a filter cartridge to transfer the inlet valve member into its open position, when the connector portion is inserted into an air inlet port, and
wherein the inlet valve actuator comprises a sealing member adapted to sealingly engage with a connector portion when said connector portion is inserted into an air inlet port of a PAPR blower housing.

[0024] According to another aspect of the present disclosure, there is provided a PAPR blower unit for providing powered airflow comprising:

a blower housing with an air inlet port;
a filter cartridge with a filter element, the filter cartridge comprising a connector portion configured to be removably connected to the air inlet port of the blower housing;
an inlet valve member connected to the air inlet port of the blower housing and transferable between an open position, in which air can flow through the air inlet port into the blower housing, and a closed position, in which the air inlet port is sealed in an airtight and watertight manner, the inlet valve member being biased towards its closed position,
wherein the inlet valve member comprises an inlet valve actuator for transferring the inlet valve member between its closed position and its open position, the inlet valve actuator being arranged within the air inlet port in such a way that the inlet valve actuator is movable by means of the connector portion of the filter cartridge to transfer the inlet valve member into its open position, when the connector portion is inserted into the air inlet port, and
wherein the inlet valve actuator comprises a sealing member adapted to sealingly engage with the connector portion when the connector portion is inserted into the air inlet port.

[0025] Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, and the claims and/or the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and all features of any embodiment can be combined in any way and/or combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not

originally claimed in that manner.

Brief Description of the Drawings

[0026] One or more embodiments of the present disclosure will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a powered air purifying respirator;

Figure 2 is a sectional view of a filter cartridge connected to a blower housing via an inlet valve member;

Figures 3A and 3B are perspective top and bottom views of a valve socket;

Figure 4 is a perspective view of a valve member;

Figure 5 is a perspective view of the valve member shown in Fig. 4 inserted into the valve socket shown in Figures 3A and 3B;

Figures 6A and B are top and bottom views of the valve member shown in Figure 5; and

Figure 7 is a cross sectional view of a blower housing comprising an inlet valve member and an outlet valve member.

Detailed Description of the Drawings

[0027] Figure 1 shows a powered air purifying respirator (PAPR). The PAPR 10 shown in Figure 1 is an example of a PAPR that is used in welding applications. To this end, the PAPR 10 of Figure 1 comprises a face cover 12 that is a welding helmet. However, it should be appreciated that the face cover of the PAPR of the present disclosure could equivalently be any other tight or loose fitting face cover/mask, such as a half mask or a surgical hood. In some examples, the face cover 12 may also be replaced by or attached to a full body suit as is typically worn by medical staff when operating in environments containing bio-hazards, such as lethal viruses.

[0028] The face cover 12 provides a cover for a user's face and mouth while the user is performing their duties. The face cover protects at least mouth and nose of the user from an external atmosphere and defines a breathing zone. The face cover 12 includes an inlet port through which air may be introduced into the breathing zone of the face cover 12, e.g. via a hose 16.

[0029] The face cover 12 is connected to a blower unit 14 via a hose 16. A first end of the hose 16 is connected to an air outlet port 24 of the blower unit 14. A second, opposite end of the hose 16 is connected to the air inlet port of the face cover 12. In other words, the hose 16 transfers forced air flow from the blower unit 14 into the breathing zone of the face cover 12.

[0030] The blower unit comprises a blower housing 26 with an air inlet port 22. A fan or impeller 18 is received within the housing 26 of the blower unit 14. The impeller 18 is arranged to provide a forced air flow to the breathing zone inside the face cover 12. When in operation, the impeller 18 sucks air into the housing 26 via the air inlet port 22 and transfers the air towards the face cover 12 via the air outlet port 24. In order to purify the air introduced into the blower housing 26, the blower unit 14 further comprises a filter element 20 arranged within or attached to the outside of (not shown) the blower housing 26. Air sucked into the air inlet port 22 of the blower housing 26 is, therefore, forced through the filter element 20 via flow path F and into the hose 16 and face cover 12 via the outlet port 24.

[0031] As will be explained in more detail with reference to the remaining drawings, the powered air purifying respirator of the present disclosure preferably includes a removeable filter that maybe attached to/detached from the blower housing quickly and easily for maintenance or replacement. To this end, the filter of the present disclosure is received within a filter cartridge that is removably connectable to outside of the blower housing.

[0032] Turning to Figure 2, there is shown a cross sectional view of a filter cartridge attached to an air inlet port of a blower housing. Only parts of the blower housing 126 are shown in Figure 2. The blower housing 126 comprises an inlet port 122. The inlet port 122 of the blower housing 126 shown in Figure 2 is an opening extending through the external wall of the blower housing 126.

[0033] An inlet port socket 150 is removeable received within the inlet port 122. The inlet port socket 150, which is shown in more detail in Figure 4A and 4B, fulfils two functions. Firstly, the inlet port socket 150 facilitates a connection between an inlet valve 132 and the blower housing 126. Secondly, the inlet port socket 150 facilitates a connection between the blower unit 126 and a filter cartridge 140. In the embodiment of Figure 2, the interconnection between the inlet port socket 150 and the filter cartridge 140 is achieved by means of a threaded connection. To this end, the inlet port socket 150 includes internal, female threads, whereas the filter cartridge 140 comprises a connector portion 142 with external, male threads.

[0034] The filter cartridge 140 comprises a schematically represented filter element 144 for filtering contaminated outside air before it is introduced into the lower housing 126. In order to exchange the filter element 144, an entirely new filter cartridge with a new filter element is typically inserted into the inlet opening 122.

[0035] The inlet valve 132 is moveably received within the inlet port socket 150. In particular, the inlet valve 132 is transferable between an open position (shown in Figure 2), in which air can flow through the inlet port 122 into the blower housing 126, and a closed position (shown in Figure 5), in which the air inlet port 122 is sealed in an airtight and watertight manner.

[0036] The air inlet valve 132 comprises a valve head 134. The valve head 134 is shaped so as to cover one or more inlet openings 152 of the inlet port socket 150, when the inlet valve member 132 is in its closed position. Further details of this will be described with reference to Figure 5 below.

[0037] The valve member 132 comprises an inlet valve actuator 136. The inlet valve actuator 136 is connected to the valve head 134 so as to transfer the inlet valve member 132 between its closed and open position. The inlet valve actuator 136 is arranged within the air inlet port 122, and particularly within the inlet port socket 150, in such a way that the inlet valve actuator 136 is moveable by means of the connector portion 142 of the filter cartridge 140. In particular, the inlet valve actuator 136 is arranged within the inlet port socket 150 such that the inlet valve actuator 136 will be pushed into the inlet port socket 136 (upwards in Figure 2) when the connector portion 142 of the filter cartridge 140 is inserted into the inlet port socket 150. The valve actuator 136 is constructed in such a way that a distal portion of the connector portion 142 will contact the valve actuator 136 as the filter cartridge 140 is inserted (e.g. screwed) into the inlet port socket 150.

[0038] The valve actuator 136 includes a sealing member 138, particularly a ring-shaped sealing member, that is arranged to contact the distal end of the connector portion 142 of the filter cartridge 140, when the filter cartridge 140 is inserted into the inlet port socket 150. Accordingly, the valve actuator 136 fulfils two functions. Firstly, the valve actuator 136 acts to open and close the inlet port 122 of the blower housing 126 automatically upon insertion or removal of the filter cartridge 140. Secondly, the valve actuator 136 ensures a fluid tight seal between the filter cartridge 140 and the blower housing 126 as long as the inlet valve member 132 remains open.

[0039] The inlet valve member 132 is biased towards its closed position (details below) and so the valve member 132 will automatically close as soon as the distal end of the connector portion 142 of the filter cartridge 140 is removed from the sealing member 138 of the valve actuator 136. Only when the valve actuator 136 is actuated by the connector portion 142 of the filter cartridge 140, i. e. when the sealing member 138 is engaged with the distal end of the connector portion 142, can the inlet valve 132 be opened.

[0040] The above actuation and sealing functionality of the valve actuator 136 ensures that outside air can never be directly introduced into the blower housing 126 when the filter cartridge 142 is removed. In other words, the valve actuator 136 acts as a device for transferring the inlet valve member 132 between its closed and open position and, at the same time, acts as a moveable seal against a distal end of the connector portion 142 of the filter cartridge 140.

[0041] Turning to Figures 3A and 3B, there are shown perspective top and bottom views of 7 an inlet port socket 250, such as the socket 150 shown in Figure 2. The inlet port socket 250 comprises a substantially cylindrical housing 252. The housing 252 comprises a bottom flange 254 at a first end of the housing 252, and a top flange 260 at an opposite, second end of the cylindrical housing 252. The bottom flange 254 protrudes circumferentially outwards from the first end of the housing 252.

[0042] The bottom flange 254 defines two lugs 256, 258. The lugs 256, 258 are adapted to receive fastening members, such as fastening screw or bolts for removably attaching the inlet port socket 250 to the inlet port (122, Figure 2) of the blower housing. As will be explained in more detail with reference to Figure 7 below, the blower housing may include blind bores that can be aligned with the lugs 256, 258 to fix the socket 250 to the blower housing.

[0043] A top flange 260 is arranged at a second end of the cylindrical housing 252. The top flange 260 protrudes circumferentially inside the cylindrical housing 252 along its second end. The top flange 260 has an outer surface 260a, which in use faces the outside of the blower housing. In other words, in use, the outer surface 260a of the flange 260 faces the connector portion of the filter cartridge. The top flange also has an inner surface 260b that is arranged opposite to the outer surface 260a and shown in Figure 3B. The inner surface 260b, in use, acts as a valve seat against which the valve head (e.g. 334, Fig. 5) will be biased in the closed state of the valve member. The upper flange 260 is annular in shape and extends partly inside the cylindrical housing 252.

[0044] The inlet port socket 250 comprises a plurality of radial struts connecting an inner edge 262 of the upper flange 260 with a valve guide 266, particularly a valve guide bushing. The valve guide 266 defines an opening 268 that extends along a longitudinal axis of the cylindrical housing 252 of the inlet port socket 250. The opening 268 of the valve guide 266 is configured to receive a valve shaft, such as valve shaft 335 shown in Figure 5. In the embodiment of Figures 3A and 3B, the inlet port socket 250 comprises four radial struts 264 extending between the valve guide 266 and the inner edge 262 of the upper flange 260. The valve struts 264 are substantially equiangularly arranged around the valve guide 260, e.g. at angles of around 90 degrees with respect to each other.

[0045] One or more windows 270 are arranged between the inner edge 262 of the upper flange 260 and the valve guide 266. In the example of Figures 3A and 3B, there are four windows 270 separated from each other via the radial struts 264. The one or more windows 270 allow inflow air received from the filter cartridge to enter the blower housing as will be described in more detail below.

[0046] As mentioned before, a female thread 272 is provided along an inner surface of the cylindrical housing 252 of the inlet port socket 250. The female thread 272 is arranged to connect with a male thread of the connector portion that is part of the filter cartridge.

[0047] Turning to Figure 4, there is shown an embodiment of a valve member 332. The valve member 332

differs slightly from the inlet valve member 132 described with reference to Figure 2. However, the functionality is substantially identical to the functionality of the valve member 132 discussed in Figure 2. The valve member 332 comprises a valve head 334 and a valve actuator 336. The valve actuator 336 is connected to the valve head 334 via a valve shaft 335. As is derivable from Figure 5, the valve shaft 335 is integrally formed with the valve head 334. The valve actuator 336 is removably connected to the valve shaft 335 via a fastening member 340.

[0048] The valve head 334 is substantially disc shaped. A sealing member 342, particularly a first ring-shaped sealing member, is arranged around the circumference of the valve head 334. The first sealing member 342 has a substantially U-shaped cross section.

[0049] The valve actuator 336 comprises an annular collar 337. A second sealing member 338, particularly a second ring-shaped sealing member, is arranged around the circumference of the annular collar 337. The second sealing member 338 has a substantially U-shaped cross section so as to partially surround the annular collar 337 of the valve actuator 336 as will be explained in more detail below.

[0050] The valve actuator comprises a central cap portion 346. The valve actuator 336 comprises a plurality of radial struts 344 extending between an inner surface of the annular collar 337 of the valve actuator 336 and the cap portion 346. Although not directly visible in Figure 4, the valve actuator 336 shown in Figure 4 may include four radial struts 344 extending between the inner surface of the annular collar 337 and the cap portion 346 of the actuator 336. The radial struct 344 may be equiangularly spaced around the cap portion 346, e.g. at 90 degree angles with respect to each other.

[0051] The valve member 332 comprises a coil spring 348. The coil spring 348 of this embodiment surrounds the valve shaft 335. The coil spring 348, in use, acts to bias the valve member 332 into its closed position, as will be described in more detail with reference to Figure 5. It will be appreciated that the coil spring 348 may also be replaced by any other biasing member known in the art.

[0052] One or more windows 339 are arranged between the inner edge of annular collar 337 and the cap portion 346. In the example of Figure 4, there are four windows 339 separated from each other via the radial struts 344. The one or more windows 339 allow inflow air received from the filter cartridge to enter the blower housing.

[0053] Figure 5 shows the valve member 332 of Figure 4 inserted into the inlet port socket 250 of Figure 3A and 3B. In Figure 5, the inlet valve member 332 is moveably received within the inlet port socket 250. The inlet valve member 332 is shown in its closed position in Figure 5.

[0054] The valve shaft 335 is integrally formed with the valve head 334 of the inlet valve member 332 and extends through the guide opening 268 of the inlet port socket 250. The valve shaft 335 is configured to slide within the guide opening 268, particularly in a longitudinal direction of the guide opening 268. Such a sliding movement will transfer the inlet valve member 332 between its closed state (Figure 5) and its open state (Figure 2).

[0055] The guide opening 268 and the valve shaft 335 have a matching cross-section, e.g. a substantially rectangular cross-section, that is ensures that the radial struts 264 of the inlet port socket 250 are aligned with the radial struts 344 of the actuator valve 336. It follows that the openings 270 of the inlet port socket 250 are always aligned with the inlet openings 339 of the valve actuator 336 so as to create as little flow resistance within the inlet port of the PAPR as possible.

[0056] As described above, the valve member 332 is a normally-closed valve that is biased towards its closed position shown in Figure 5. In the embodiment shown, this bias is achieved by means of the coil spring 348. The coil spring 348, in this example, extends around the valve shaft 335 of the valve member 332. The coil spring 348 has a first end that is in contact with a first surface of the valve guide 266. A second, opposite end of the coil spring 348 engages with a surface of the valve actuator 336. In the example of Figure 5, the second end of the coil spring 348 is received within the cap portion 346 of the valve actuator 336. The cap portion 346 at least partly surrounds the coil spring 348 and acts as a receptacle for the coil spring 348, when the valve member 332 is in its fully open position and the coil spring 348 is fully compressed.

[0057] As will be appreciated, the resetting force of the coil spring 348 will act to push the valve actuator 336 away from the upper flange 260 of the inlet port socket 250. Since the valve actuator 336 is rigidly connected with the valve head 334 via the valve shaft 335, this force created by the coil spring 348 is transferred from the valve actuator 336 onto the valve head 334. Accordingly, when no external forces are applied onto the valve actuator 336, the coil spring 348 will act to force the valve head 334 against the valve seat, i.e. the outer surface 260b of the upper flange 260. In the closed position of the inlet valve member 332, the first sealing member 342 of the valve head 334 is biased against the outer surface 260b of the upper flange section 260. Even in the open position of the valve member 332, the coil spring 348 will try to push the valve actuator 336 away from the upper flange 260 and thus towards the connector portion of the filter cartridge (not shown). In other words, as soon as the connector portion of the filter cartridge engages with the second sealing member 338 of the valve actuator 336, the valve actuator 336 and the second sealing member 338 are biased against the connector portion by means of the coil spring 348.

[0058] As is derivable from Figure 5, in the closed position of the valve member 332, the valve head 334 completely covers the air flow openings 270 of the inlet port socket 250.

[0059] As set out before, the valve actuator 336 is re-

movably connected to the valve head 334, particularly via the valve shaft 335. To this end, the valve shaft 335 comprises a blind bore 350 extending along its longitudinal length. The blind bore 350 may be provided with an internal thread that is configured to receive a corresponding fastening member, such as the fastening member 340. A shank of the fastening member 340 may extend through a slot arranged at a top end of the cap portion 346. The head of the fastening member 340 may be larger than the slot. Accordingly, the valve actuator 336 may be removably attached to the valve shaft via the fastening member (e.g. fastening bolt) 340 extending into the blind bore 350 of the valve shaft 335. This will allow for easy assembly of the valve member 332 within the inlet port socket 250 and simplify maintenance of the PAPR in general.

[0060] As mentioned in more detail above, once a connector portion of a filter cartridge (see Figure 2) is inserted far enough into the socket 250, a distal end of said connector portion engages with the sealing member 338 of the valve actuator 336. This will create an air and watertight seal between the filter cartridge and the valve ember 332. As the filter cartridge is further inserted into the inlet port socket 250, the valve actuator 336 is pushed further into the socket 250 (i.e. towards the top in Figure 5), thereby pushing the valve shaft 335 through the guide opening 268 of the inlet port socket 250. This, in turn, will cause the valve head 334 to lift off the valve seat, thereby transferring the valve member 332 into its open position. Once the filter cartridge is fully inserted, the second sealing member 338 of the valve actuator 336 will, on one side, seal against the distal end of the connector portion of the filter cartridge, and, on the other side, seal against the outer surface 260a of the upper flange section 260.

[0061] Figures 6A and 6B show top and bottom views of the assembly shown in Figure 5. With particular reference to Figure 6B, it will be appreciated that the inlet openings 270 between the radial struts 344 of the valve actuator and the radial struts 264 (Figure 5) of the inlet port socket 250 are fully covered by the valve head 334 when the valve member 332 is in its closed state.

[0062] Figure 7 shows a schematic cross-section through a blower housing according to another embodiment of the present disclosure. The blower housing 426 shown in Figure 7 comprises an inlet port 422 with an inlet valve member 432 and an outlet port 470 with an outlet valve member 472 (illustrated as a black box). The inlet valve member 432 and the outlet valve member 472 may be substantially identical in construction.

[0063] Turning in more detail to the inlet valve member 432, the inlet valve member 432 is received within an inlet valve socket 450 that is substantially identical to the inlet valve socket 250 described with reference to Figures 3A and 3B. The inlet valve member 432 is substantially identical to the valve member 332 described in Figure 4.

[0064] The inlet valve member 432 is received within a guide opening of the inlet port socket 450 and comprises a valve head 434 that is connected to a valve actuator 436 via a valve shaft that extends through the guide opening of the inlet port socket 450.

[0065] The inlet port socket 450 comprises first and second lugs 456, 458. The blower housing 426 comprises first and second blind bores 460, 462. The first and second lugs 456, 458 can be aligned with the first and second blind bores 460, 462 of the blower housing 426. Accordingly, fastening members, such as fastening bolts, may be introduced into the blind bores 460, 462 through the first and second lugs 456, 458 to removably secure the inlet port socket 450 to the blower housing 426.

[0066] The outlet port 470 may be connected to a first end of a hose, such as the hose 16 shown in Figure 1. As the first end of the hose is connected to, e.g. screwed into, the outlet port 470, the normally-closed outlet valve 472 may open in a similar fashion to the inlet valve member 432. The outlet valve member 472 is substantially identical to the valve member 332 described in Figure 4 and maybe inserted into a socket such as the socket 250 shown in Figures 3A and 3B.

[0067] Both the inlet valve member 432 and the outlet valve member 472 are normally closed valves, such that when the filter cartridge and the hose are disconnected from the filter unit, the filter housing 426 is sealed against the outside environment in an air and watertight manner.

[0068] The listing or discussion of an apparently prior-published document in this specification should not necessarily be taken as an acknowledgement that the document is part of the state of the art or is common general knowledge.

[0069] Preferences and options for a given aspect, feature or parameter of the disclosure should, unless the context indicates otherwise, be regarded as having been disclosed in combination with any and all preferences and options for all other aspects, features and parameters of the disclosure.

Claims

1. A powered air purifying respirator assembly comprising:

   a blower unit for providing powered airflow including a blower housing with an air inlet port;
   a filter cartridge with a filter element, the filter cartridge comprising a connector portion configured to be removably connected to the air inlet port of the blower housing; and
   an inlet valve member connected to the air inlet port of the blower housing and transferable between an open position, in which air can flow through the air inlet port into the blower housing, and a closed position, in which the air inlet port is sealed in an airtight and watertight manner, the inlet valve member being biased towards its closed position,
   wherein the inlet valve member comprises an

inlet valve actuator for transferring the inlet valve member between its closed position and its open position, the inlet valve actuator being arranged within the air inlet port in such a way that the inlet valve actuator is movable by means of the connector portion of the filter cartridge to transfer the inlet valve member into its open position, when the connector portion is inserted into the air inlet port, and
wherein the inlet valve actuator comprises a sealing member adapted to sealingly engage with the connector portion when the connector portion is inserted into the air inlet port.

2. The powered air purifying respirator assembly of Claim 1, wherein the inlet valve member is arranged in such a way that the sealing member of the inlet valve actuator is biased against the connector portion of the filter cartridge when the inlet valve member is in its open position.

3. The powered air purifying respirator assembly of Claim 1 or 2, wherein the sealing member is ring shaped.

4. The powered air purifying respirator assembly of any one of Claims 1 to 3, wherein the inlet valve actuator comprises an annular collar, the annular collar being at least partly covered by the sealing member.

5. The powered air purifying respirator assembly of any one of Claims 1 to 4, wherein the inlet valve member comprises a valve head configured to close the air inlet when the inlet valve member is in its closed position and open the air inlet when the inlet valve member is in its open position, and wherein the inlet valve actuator is removably connected to the valve head.

6. The powered air purifying respirator assembly of any one of Claims 1 to 5, wherein the inlet valve member comprises a valve shaft arranged between the valve head and the inlet valve actuator.

7. The powered air purifying respirator assembly of Claim 6, wherein the valve shaft is integrally formed with the valve head.

8. The powered air purifying respirator assembly of Claim 6 or 7, comprising a valve guide arranged within the air inlet port, and wherein the valve shaft is movably received within said valve guide.

9. The powered air purifying respirator assembly of any one of Claims 6 to 8, wherein the inlet valve member comprises a coil spring arranged around the valve shaft and adapted to bias the inlet valve member into its closed position.

10. The powered air purifying respirator assembly of Claim 9, wherein the coil spring is arranged between the inlet valve actuator and the valve guide arranged within the air inlet port.

11. The powered air purifying respirator assembly of Claim 9 or 10, wherein the inlet valve actuator comprises a cap portion configured to receive at least parts of the coil spring.

12. The powered air purifying respirator assembly of Claim 11, wherein the cap portion at least partly surrounds the valve shaft.

13. The powered air purifying respirator assembly of Claim 12, wherein the inlet valve actuator comprises an annular collar and a plurality of radial struts connecting an inner surface of the annular collar with an outer surface of the cap portion.

14. A powered air purifying respirator assembly comprising:

a blower unit for providing powered airflow including a blower housing with an air outlet port;
a hose for transferring powered airflow from the blower unit to a head mask, the hose comprising a first end configured to be removably connected to the air outlet port of the blower housing;
an outlet valve member connected to the air outlet port and transferable between an open position, in which air can flow through the air outlet port into the hose, and a closed position, in which the air outlet port is sealed in an airtight and watertight manner, the outlet valve member being biased towards its closed position,
wherein the outlet valve member comprises an outlet valve actuator for transferring the outlet valve member between its closed position and its open position, the outlet valve actuator being arranged within the air outlet port in such a way that the actuator is movable by means of the first end of the hose to transfer the outlet valve member into its open position, when the first end of the hose is inserted into the air outlet port, and
wherein the outlet valve actuator comprises a sealing member adapted to sealingly engage with the connector portion when the connector portion is inserted into the air inlet port.

15. The powered air purifying respirator assembly of Claim 14, wherein the hose comprises a second end, opposite the first end, and wherein the powered air purifying respirator comprises a loose fitting or tight fitting head mask connected to the second end of the hose.

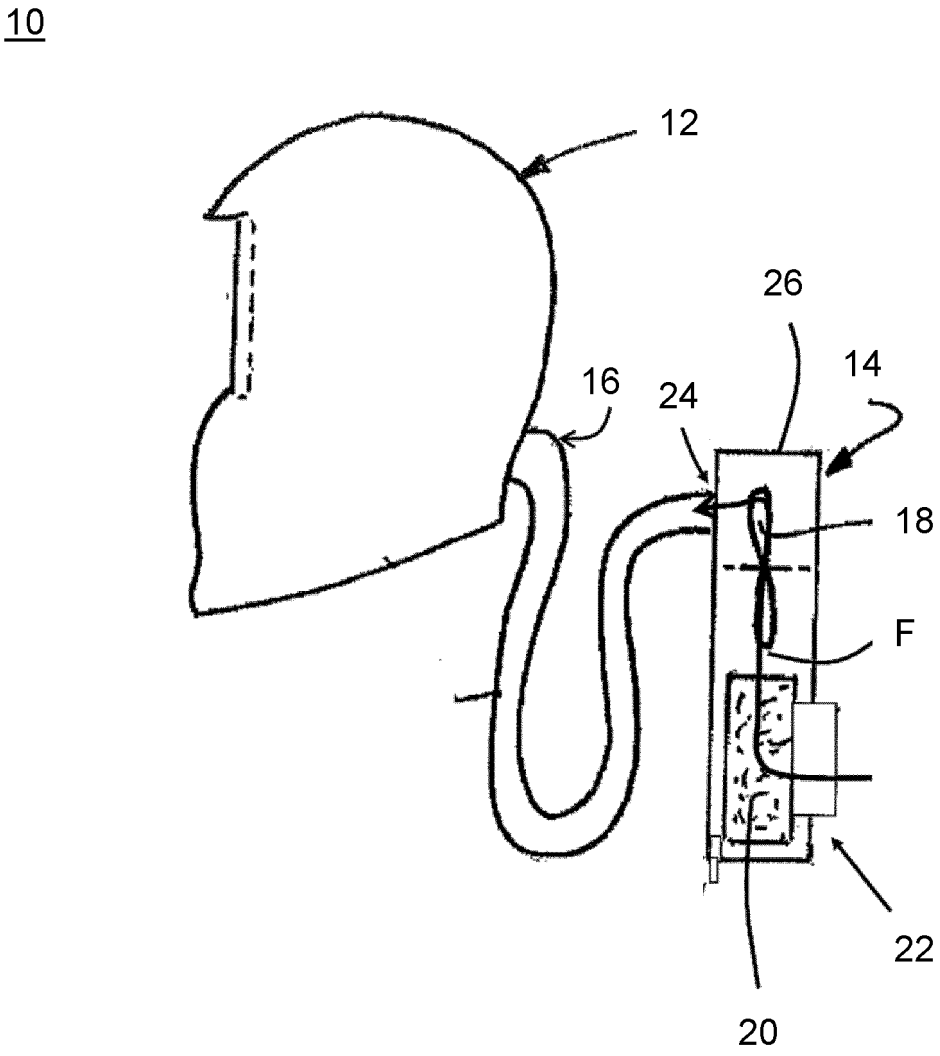

Figure 1

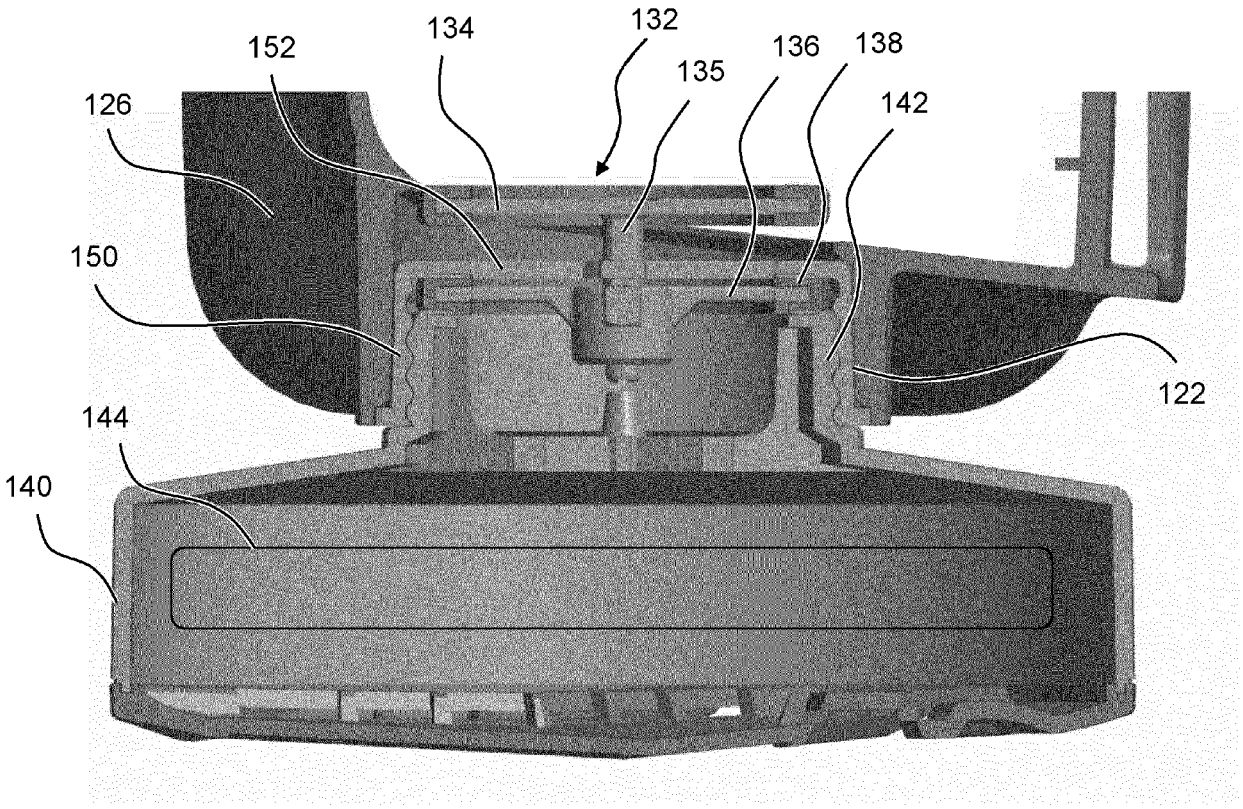

Figure 2

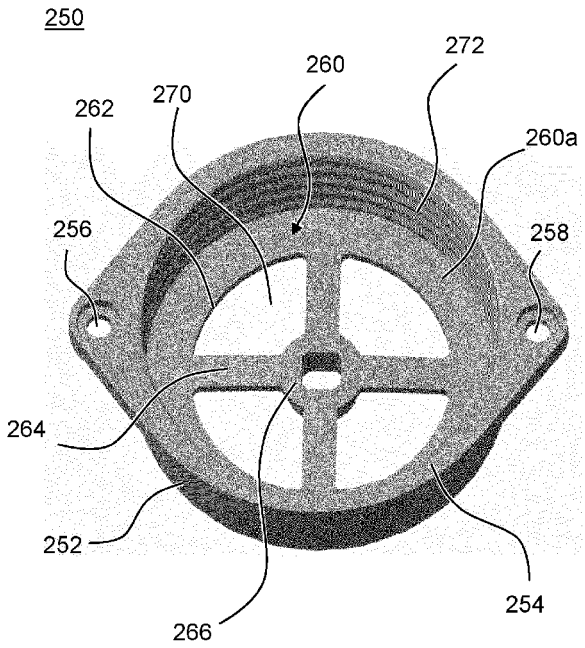

Figure 3A

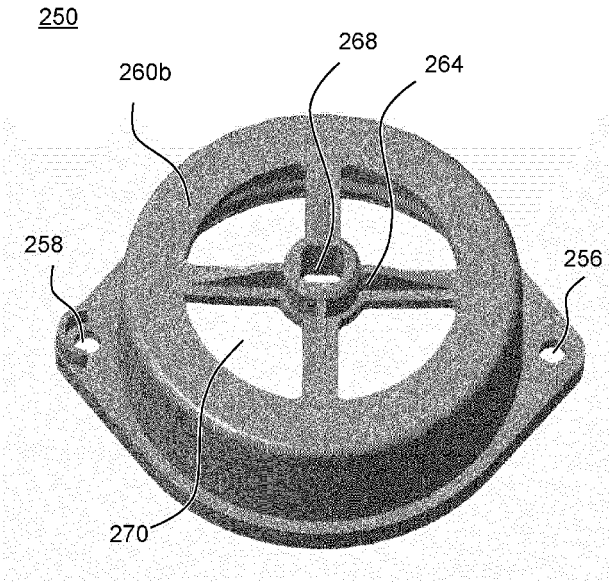

Figure 3B

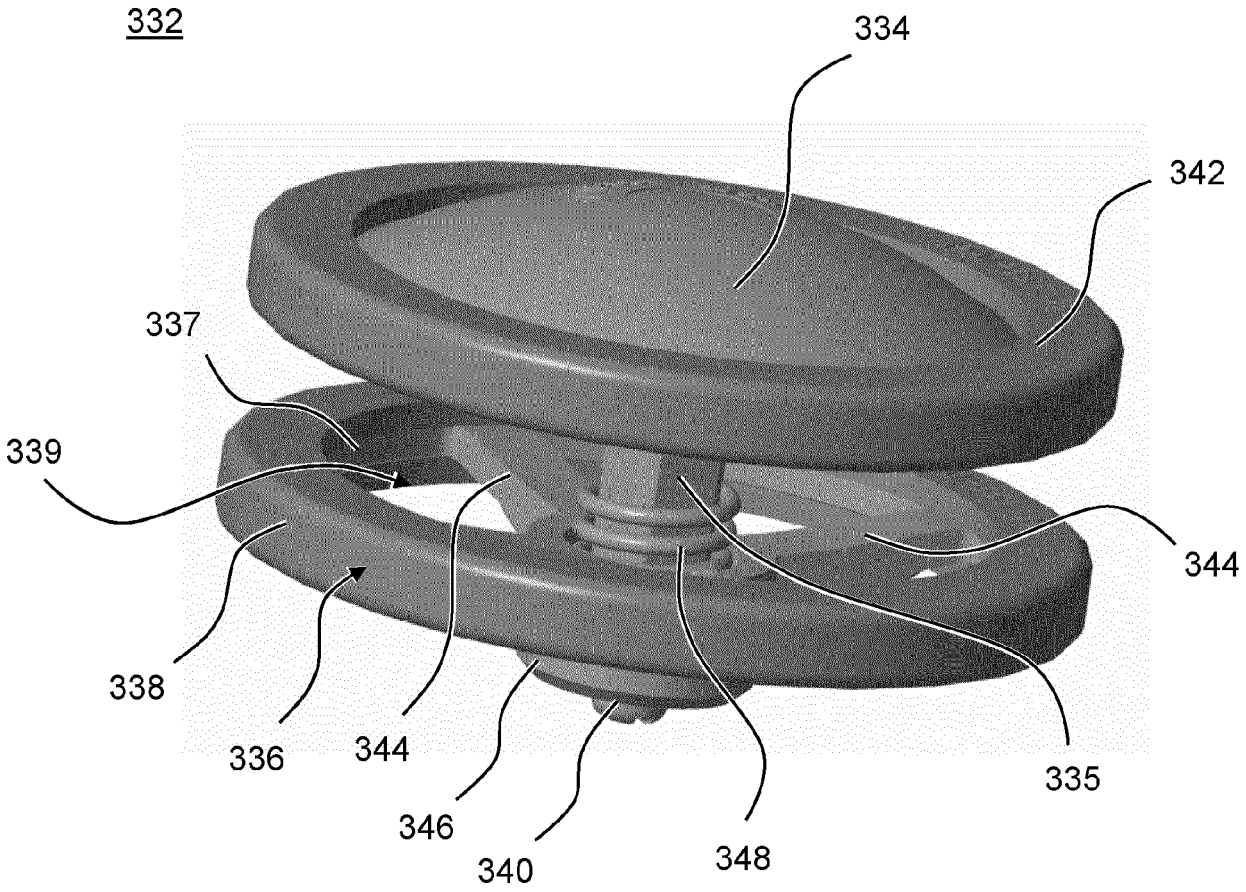

Figure 4

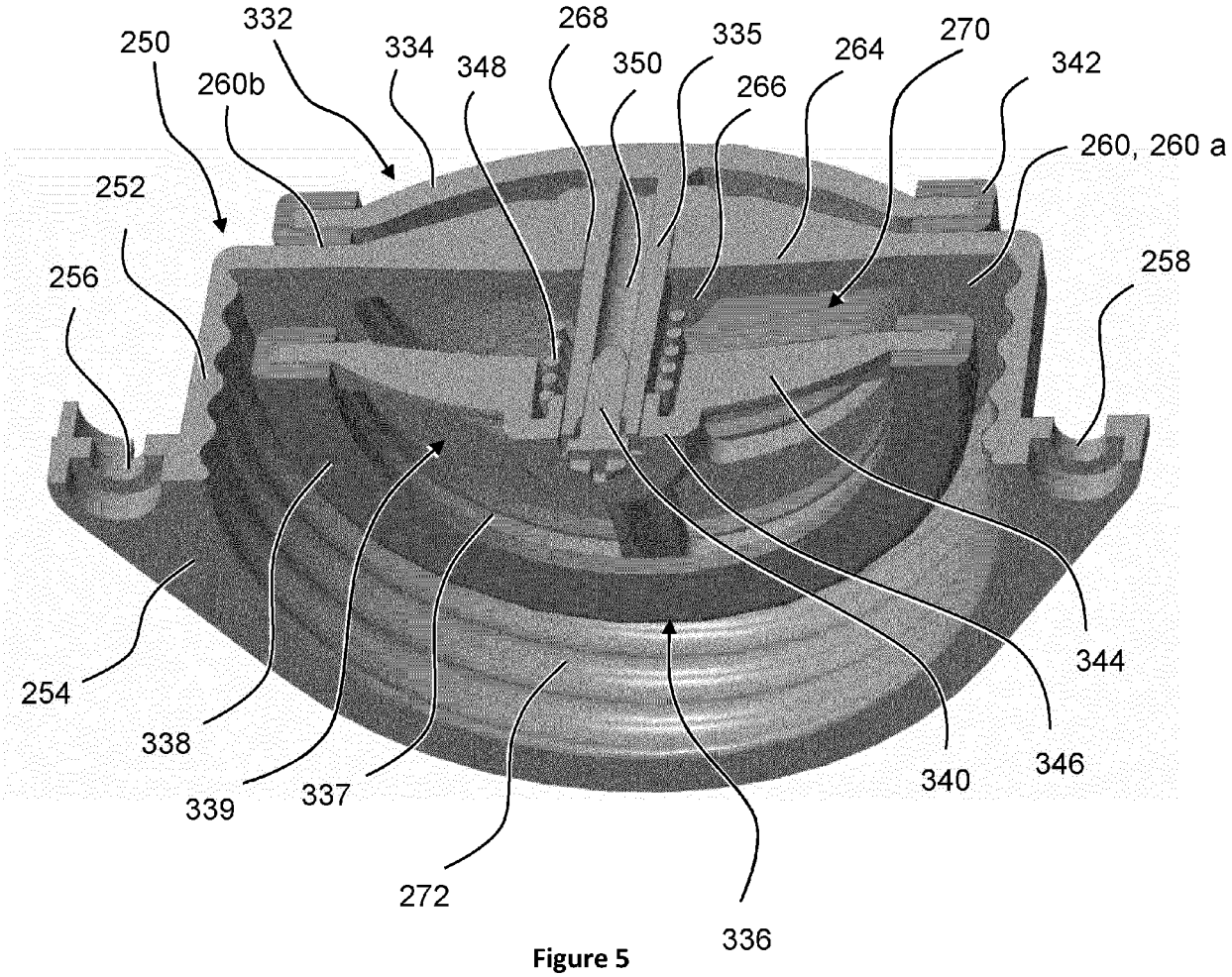
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Figure 5

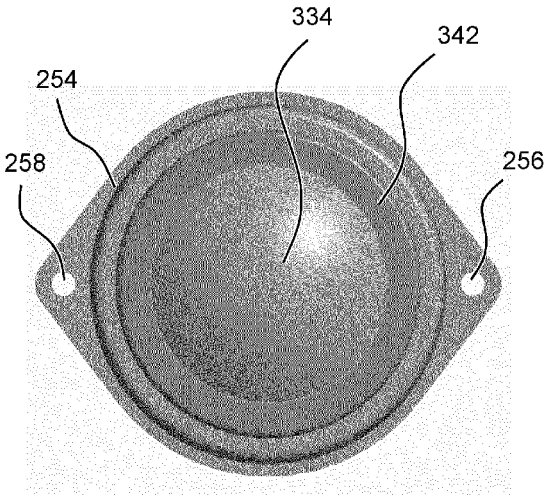

Figure 6A

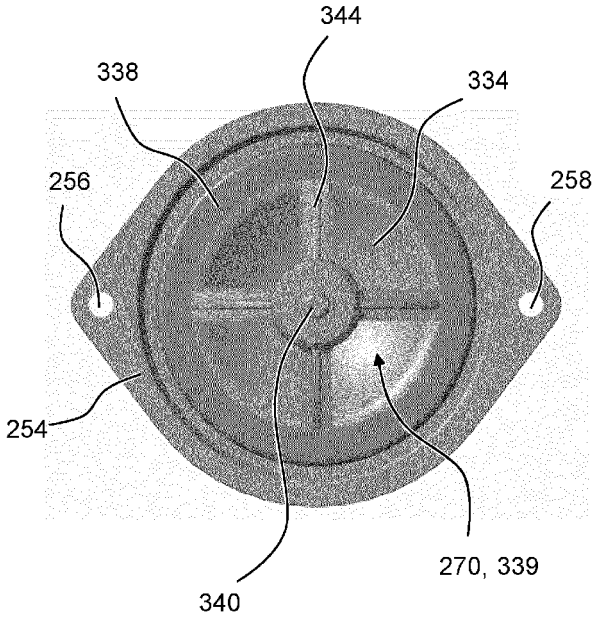

Figure 6B

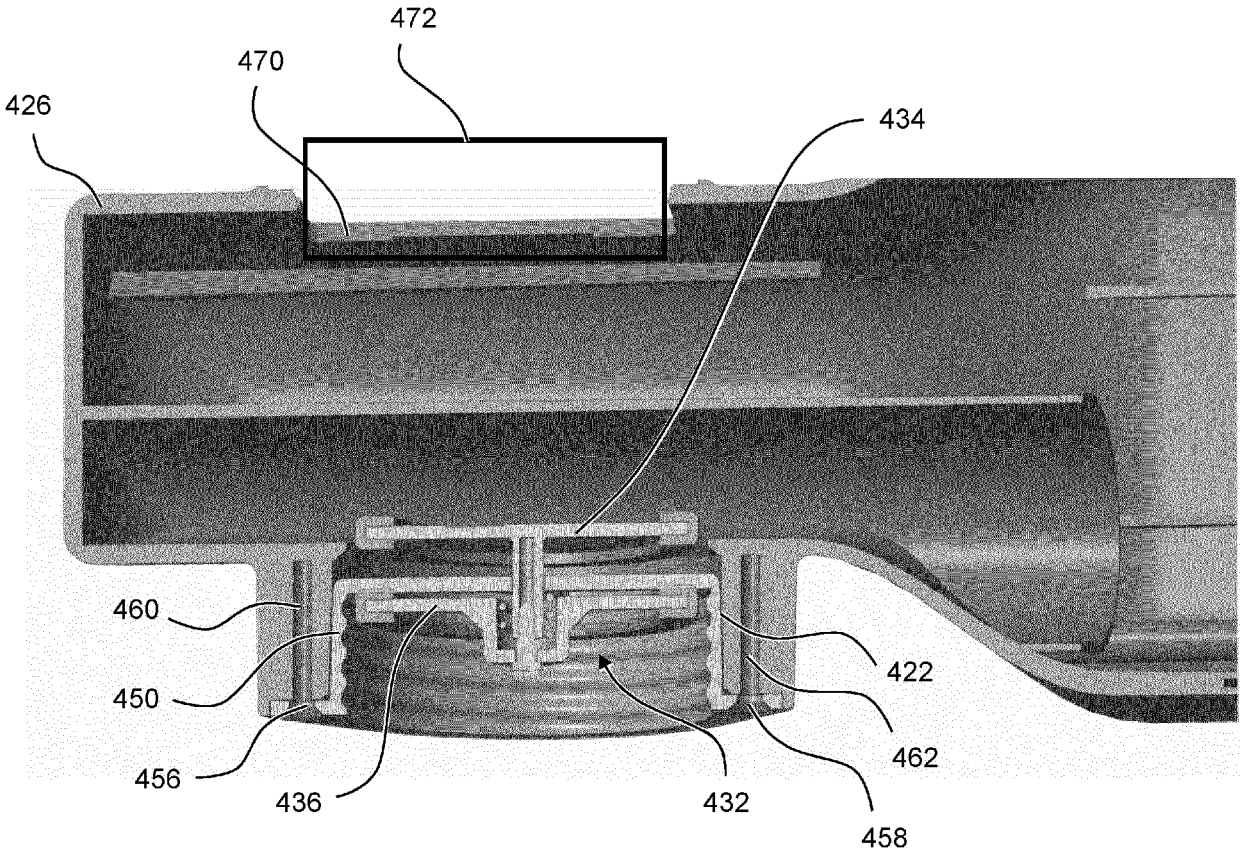

Figure 7

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EUROPEAN SEARCH REPORT

Application Number
EP 21 27 5099

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 7 101 412 B2 (TVI CORP [US]) 5 September 2006 (2006-09-05) * column 1, lines 8-9 * * column 1, lines 25-38 * * column 2, lines 3-28 * * column 4, line 5 - column 5, line 25 * * figures 2, 3 *	1-15	INV. A62B9/02 A62B9/04 A62B18/00
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A	US 10 159 856 B1 (WILKE DOUGLAS E [US] ET AL) 25 December 2018 (2018-12-25) * column 1, lines 32-43 * * column 1, line 64 - column 2, line 20 * * column 2, line 60 - column 4, line 16 * * figures 1-4 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) A62B
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1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 December 2021	Zupancic, Gregor

CATEGORY OF CITED DOCUMENTS

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