



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.05.2021 Bulletin 2021/19

(51) Int Cl.:
A62B 18/02 (2006.01)

(21) Application number: **19207020.9**

(22) Date of filing: **05.11.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(54) **A FACE MASK**

(57) A face mask (10) has an outer casing (12) and a filter member (14). A fan module (20) is mounted on the filter member (14) and also extends through an open-

ing in the outer casing (12). It attaches to that opening to fix the position of the fan module (14) relative to the outer casing (12).

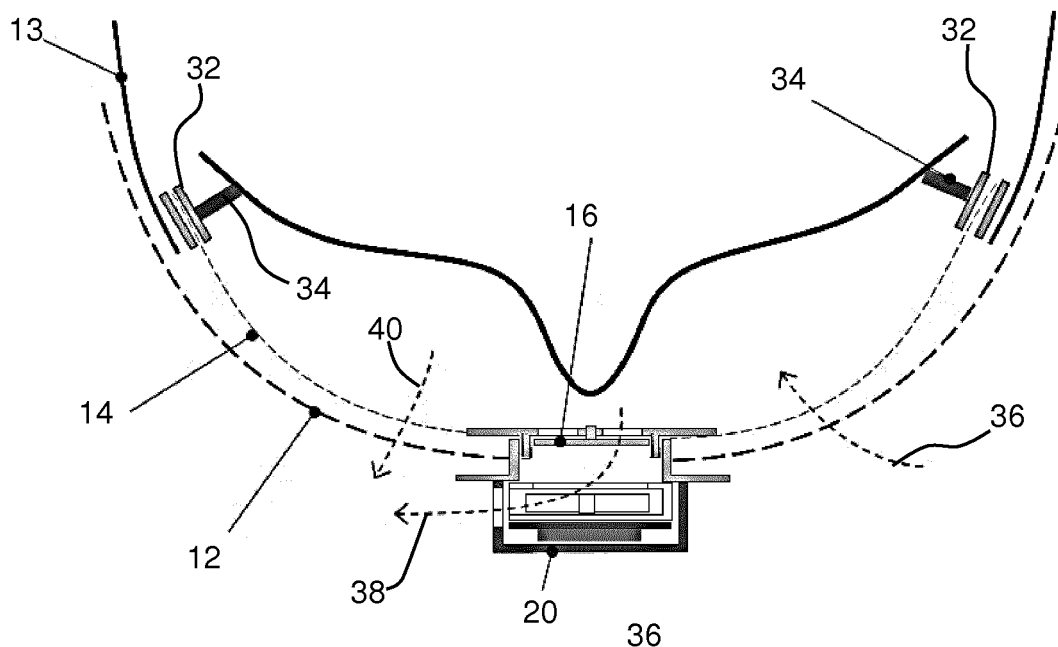


FIG. 4

Description

FIELD OF THE INVENTION

[0001] This invention relates to face masks, for providing filtering of pollutants.

BACKGROUND OF THE INVENTION

[0002] Air pollution is a worldwide concern. The World Health Organization (WHO) estimates that 4 million people die from air pollution every year. Part of this problem is the outdoor air quality in cities. Nearly 300 smog-hit cities fail to meet national air quality standards.

[0003] Official outdoor air quality standards define particle matter concentration as mass per unit volume (e.g. $\mu\text{g}/\text{m}^3$). A particular concern is pollution with particles having a diameter less than $2.5 \mu\text{m}$ (termed "PM2.5") as they are able to penetrate into the gas exchange regions of the lung (alveoli), and very small particles ($<100 \text{ nm}$) may pass through the lungs to affect other organs.

[0004] Since this problem will not improve significantly on a short time scale, a common way to deal with this problem is to wear a mask which provides cleaner air by filtration and the market for masks in China and elsewhere has seen a great surge in recent years.

[0005] Such masks may be made of material that acts as a filter of pollutant particles, or may have a filter for only part of the mask surface, and this filter may be replaceable when it becomes clogged.

[0006] However, during use, the temperature and relative humidity inside the mask increases and, combined with the pressure difference inside the mask relative to the outside, this makes breathing uncomfortable. This can be mitigated in part by providing an outlet valve or check valve which allows exhaled air to escape the mask with little resistance, but which requires inhaled air to be drawn through the filter. To improve comfort and effectiveness, a fan can be added to the mask, this fan drawing in air through the filter and/or providing assistance when breathing out.

[0007] One possible benefit to the wearer of using a fan-powered mask is that the lungs are relieved of the slight strain caused by inhalation against the resistance of the filters in a conventional non-powered mask. Furthermore, in a conventional non-powered mask, inhalation also causes a slight pressure drop within the mask which leads to leakage of the contaminants into the mask, which leakage could prove dangerous if these are toxic substances.

[0008] Fan-assisted masks thus may improve the breathing comfort by reducing the temperature, humidity and breathing resistance.

[0009] In one arrangement, an inlet (i.e. inhale) fan may be used to provide a continuous intake of air. In this way, the lungs are relieved of the slight strain caused by inhalation against the resistance of the filters in a conventional non-powered mask. A steady stream of air may

then be provided to the face and may for example provide a slight positive pressure, to ensure that any leakage is outward rather than inward. However, this gives additional resistance to breathing when exhaling.

[0010] In another arrangement, an exhaust (i.e. exhale) fan may be used to provide a continuous release of air. This instead provides breathing assistance when exhaling. An exhale fan may be combined with a series check valve so that no flow can enter the mask through the fan.

[0011] The fan again creates a continuous flow of air through the mask. Air is drawn into the mask cavity through the filter by the flow induced by the fan or by inhaling. This improves the wearer's comfort.

[0012] Another alternative is to provide both inlet and exhaust fans, and to time the control of the fans in synchronism with the breathing cycle of the user. The breathing cycle may be measured based on pressure (or differential pressure) measurements. This provides improved control of temperature and humidity as well as reducing the resistance to breathing for both inhalation and exhalation.

[0013] Thus, several types of mask for preventing daily exposure to air pollutants are available, including passive masks, passive masks with an exhale valve, and masks with at least one active fan.

[0014] This invention relates in particular to active masks, having a fan, and more particularly to designs having at least an exhale fan.

[0015] Axial fans may be used. However, these have the problem of a large size, and the exit or entrance opening is clearly visible. It is preferred to make use of a centrifugal fan, having an axial flow on one side and a radial flow on the other side. By arranging the radial flow on the outside of the mask, the radial outlet can be hidden from view, for example it can face downwardly or backwardly.

[0016] It is desirable to maintain a clear pathway for the radial fan outlet air, to keep noise and turbulence low. However, in many mask designs, the inherent flexibility of the filter layer means the attached fan module has some freedom of movement, and as a result the path of the outlet flow is not accurately controlled. The outlet air flow may for example become obstructed with a cover through which the fan module passes.

[0017] There is therefore a need to address this problem to improve the consistency of the face mask function, and maintain a clear air flow path.

SUMMARY OF THE INVENTION

[0018] The invention is defined by the claims.

[0019] According to examples in accordance with an aspect of the invention, there is provided a face mask, comprising:

an outer casing having an opening;
a filter member for mounting inside the outer casing, wherein a mask cavity is defined between the filter

member and the face of a user when the face mask is worn by the user; and
a fan module,
wherein:

the filter member comprises a first connector part;
the fan module comprises a second connector part, for connection to the first connector part thereby to fix the fan module to the filter member, and a third connector part; and
the outer casing comprises a fourth connector part, for connection to the third connector part thereby to fix the outer casing to fan module, with the fan module projecting through the opening.

[0020] The invention thus relates to a face mask design with a two-layer structure of a filter member and an outer casing. The fan module is connected to the filter member, which itself is flexible (so that it can adapt to the contour of the face of the user). Thus, some movement of the fan module is possible. The fan module extends through an opening in the outer casing. The invention provides a further coupling between the fan module and the outer casing, in particular around the inner edge of the opening in the outer casing. In this way, the fan module is positionally fixed with respect to the outer casing. The characteristics of the airflow to or from the fan module are thus maintained consistent, independent of any shape adjustment of the flexible filter member. The set of connector parts also prevents leakage and improves protection efficacy.

[0021] The fourth connector part for example comprises a ring around the opening. Thus, it defines the edge around the inside of the opening, stabilizes the opening and protects the inner edge from damage. The fan module for example is pushed through the opening during assembly of the face mask and it then locks into a fixed position. The ring can be any closed shape, which matches the shape of the opening in the outer casing. The ring may be generally circular or generally square or indeed any other shape.

[0022] The fourth connector part for example comprises a first ring on the outside of the outer casing (i.e. on the side facing away from the user) and a second ring on the inside of the outer casing (i.e. on the side facing towards the user), and the outer casing comprises a structural layer which is sandwiched between the first and second rings. The first and second rings thus provide a termination to an opening in the structural layer. The structural layer for example has some flexibility, but is preferably more rigid than the filter member.

[0023] The first and second rings may be:

a mechanical snap fit together; or
glued together; or
welded together.

[0024] There are therefore various ways to form the fourth connector part, and to couple it to the structural layer of the outer casing. A one-piece fourth connector part is instead possible.

[0025] The first and second connector parts are for example a push fit together to enable the filter member to be attached to and detached from the fan module. This enables the filter member to be replaced separately from the fan module, with easy assembly and disassembly.

[0026] The third connector part is for example a push fit to the fourth connector part. This enables easy assembly of the fan module to the outer casing.

[0027] The third connector part may be a recess and the fourth connector part may be a sprung tab (or more preferably a set of sprung tabs) for engaging with the recess. This provides a snap fit connection.

[0028] The fan module may comprise a centrifugal fan having an axial inlet communicating with the inside of the mask cavity and a radial outlet outside the mask cavity. The fan module is then an exhaust fan. The flow is outwardly from the mask volume. By controlling the flow path by fixing the fan module to the outer casing (as well as to the filter member), the outlet flow characteristics are made more constant hence giving a more uniform functionality of the face mask, in terms of the outlet flow characteristics.

[0029] The fan module for example projects through the opening with the radial outlet positioned beyond the outer casing, for example beyond the fourth connector part. Thus, the radial outlet is positioned with a minimum of obstructions to the outlet flow.

[0030] These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] For a better understanding of the invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings, in which:

Figure 1 shows one example of a mask design to which the invention may be applied;

Figure 2 shows the design of Figure 1 in an assembled state from one front side;

Figure 3 shows the design of Figure 1 in an assembled state from an opposite front side;

Figure 4 is used to show the way the components interface with the wearer and shows an alternative design;

Figure 5 shows the outlet of the centrifugal fan;

Figure 6 shows a design in accordance with an example of the invention, as a first cross sectional view;

Figure 7 shows a second cross sectional view of the design of Figure 6; and

Figure 8 shows a possible design for the first and second connector parts.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0032] The invention will be described with reference to the Figures.

[0033] It should be understood that the detailed description and specific examples, while indicating exemplary embodiments of the apparatus, systems and methods, are intended for purposes of illustration only and are not intended to limit the scope of the invention. These and other features, aspects, and advantages of the apparatus, systems and methods of the present invention will become better understood from the following description, appended claims, and accompanying drawings. It should be understood that the Figures are merely schematic and are not drawn to scale. It should also be understood that the same reference numerals are used throughout the Figures to indicate the same or similar parts.

[0034] The invention provides a face mask with an outer casing and a filter member. A fan module is mounted on the filter member and also extends through an opening in the outer casing. It attaches to that opening to fix the position of the fan module relative to the outer casing.

[0035] Figure 1 shows one example of a mask design to which the invention may be applied. The mask 10 is shown in exploded view and comprises an outer casing 12 which functions as a mask body and a filter member 14 mounted within the outer casing. The outer casing is rigid or semi-rigid with ear straps 13, whereas the filter member 14 is for example formed of a fabric and thus easily deforms such that an outer edge can match the shape of a wearer's face.

[0036] The outer casing is porous so that air can flow through the outer casing. The outer casing improves the outer appearance of the mask. The outer casing may be made from a material which itself is porous, for example it may be an air mesh, a polyurethane layer, a cotton blend, or other porous material. However, it may instead be made from a non-porous material, such as a plastics material, but with openings to allow air flow. A gap around the edge of the outer casing, between the outer casing and the filter member, may alternatively or additionally be used to enable air flow.

[0037] The filter member 14 is sealed around a connector module 16. The connector module 16 is for connecting to a fan module, in particular to a corresponding connector part 17 of the fan module. This connection may be circular so that it allows relative rotation between the fan module 20 and the filter member 14. The fan module comprises a centrifugal fan. A centrifugal fan has a small form factor and is able to overcome the flow resistance of the check valve.

[0038] In this particular example, the connector module 16 comprises a check valve. The connector module 16 and the fan module 20 may be considered together to comprise a fan assembly and the two modules may be connected together and disconnected manually, for example with a simple push fit. For example, a lip around

one part may cooperate with a recess around the other part.

[0039] A control module 18 is coupled to the outside of the filter member 14. The control module includes the fan module 20 of the fan assembly and also a control unit 22. The control unit is inside the outer casing (i.e. on the side of the outer casing facing the face of the user). The control unit 22 for example comprises a battery and other control circuitry. This may include sensors. Note that the control circuitry may instead be on the fan module side and be integrated into the fan module. Thus, the various additional circuitry elements and battery may be divided between the fan module and the control unit in different ways.

[0040] The battery of the control unit is protected from the ambient surroundings by the outer casing 12.

[0041] The connector module 16 is permanently fixed to the filter member 14 so that it is discarded with the filter member 14 when there is filter replacement. The fan module 20 of the fan assembly is reusable and includes (at least) the fan drive circuitry and fan impeller.

[0042] The outer casing 12 has an opening 24 in which the fan module 20 of the fan assembly is received.

[0043] An inner surface of the outer casing may also have a receiving dock area for the control unit 22, or else there may be a receiving dock area 26 (as shown in Figure 1) on the outer surface of the filter member for locating the control unit 22. The control unit may connect to the filter member or to the outer casing by a magnetic coupling as well as, or instead of, a mechanical alignment feature.

[0044] An electrical connector bridge 28 provides electrical connection between the control unit 22 and the fan module 20 of the fan assembly, for transfer of power and control signals.

[0045] The fan module 20 of the fan assembly and the control unit 22 are at opposite lateral sides of the mask, i.e. one on each side of the nose of the wearer. This provides a balanced weight distribution. By having two modules, the weight of each individual part is reduced, so that the loading at any one location is reduced.

[0046] In a preferred design, the fan module is an exhaust fan. In a most simple design, it operates continuously to provide a continuous supply of air to the face (using air drawn through the mask filter). This provides temperature and humidity control. However, it may be operated in synchronism with the breathing of the wearer (with suitable breath sensing), and it may be controlled bi-directionally. Alternatively, there may be separate inlet and exhaust fans, e.g. one on each lateral side.

[0047] The use of an exhaust fan is preferred. It means the fan does not need a filter just before or after the fan, reducing the airflow. Users also find air blowing on the face to be uncomfortable. The fan should be made waterproof, as the exhaled air is humid and condensation will be formed at the air outlet and fan.

[0048] All of the various known options for control of the fan may be applied, since this invention relates in

particular to the physical connection of the filter member, fan module and outer casing.

[0049] Figure 2 shows the design of Figure 1 in an assembled state from one front side and Figure 3 shows the design of Figure 1 in an assembled state from an opposite front side.

[0050] The mask design shown has a V-shape when viewed from above. Thus, it has two opposite lateral sides, and a ridge between the opposite lateral sides.

[0051] Figure 4 is used to show the way the components interface with the wearer and shows an alternative design with a single module. The invention may equally be applied to a single module design. The face 30 of the wearer is shown in cross section from above.

[0052] The filter member 14 connects to the outer casing 12 with fixings 32. These are for example push fit poppers. An outer periphery of the filter member also carries an inwardly projecting seal 34 to form a substantially closed volume between the filter member and the face 30.

[0053] The single module of this example is located centrally rather than at a lateral side (again so that the weight is balanced). The module comprises the connector module 16 and the fan module 20 as in the example of Figure 1. The fan module 20 then incorporates the reusable parts of both the fan assembly and the control module.

[0054] When breathing in, air is drawn through the filter member 14 as shown by arrow 36. The exhaust fan may be operating during this time, providing flow 38, or it may be turned off to save power. When breathing out, the exhaust fan is operating to create flow 38, and there may also be outward flow through the filter member as shown by arrow 40. The flow 36 may also continue (depending on how the fan is being operated) but that flow is not breathed in at that time, but instead circulates out through the fan. Breathing comfort is improved particularly because the fan removes the exhaled air from the mask cavity and therefore prevents re-breathing (recycling) of previously exhaled and hence un-fresh air.

[0055] The single module may for example comprise a fan, a one-way check valve, a battery and a printed circuit board carrying control circuitry. The fan is on top of the check valve.

[0056] In the example of Figure 4, the connector module 16 and fan module 20 are again separable so that the filter member may be replaced (or washed) while re-using the module.

[0057] The fan module comprises a centrifugal fan having an axial inlet inside the mask cavity and a radial outlet outside the mask cavity. Figure 5 shows a front view of the mask and shows the radial outlet 50. The positioning of the outlet is for example selected so that it is not visible from in front and above the mask body, i.e. from the likely position of the eyes of another person. For example, the radial outlet may face downwardly or backwardly (i.e. back towards the user).

[0058] In a basic design, the fan module 20 projects

through the opening in the outer casing but is a loose fit in the opening. It has been found that movement of the fan module causes different flow characteristics, for example because the outlet flow may strike the outer casing, creating altered turbulence.

[0059] The invention provides an additional connection between the fan module 20 and the outer casing 12, in particular around the inner rim of the opening 24 in the outer casing 12. The use of a rim around the opening 24 in the outer casing also provides stability to the edge of the opening.

[0060] Figure 6 shows one example of a design for a connection arrangement around the opening in the outer casing. Figure 7 shows a cross section along line VII-VII to show connection between the fan module and the outer casing.

[0061] Figure 6 shows the outer casing 12 with a main structural layer 60.

[0062] The mask has four connector parts.

[0063] The filter member 14 comprises a first connector part 16 (i.e. the connector module) and the fan module 20 comprises a second connector part 17 for connection to the first connector part thereby to fix the fan module 20 to the filter member 14. These parts are shown in Figure 1 and also in Figures 6 and 7.

[0064] The fan module also has a third connector part 70.

[0065] The outer casing 12 has a fourth connector part 72 for connection to the third connector part 70 to fix the outer casing 12 to the fan module 20, with the fan module projecting through the opening.

[0066] The fan module is thus connected to the inner filter in the manner already explained above, and there is a further coupling between the fan module and the outer casing. In this way, the fan module is positionally fixed with respect to the outer casing. The characteristics of the airflow to or from the fan module are thus maintained consistent, independent of any shape adjustment of the flexible filter.

[0067] The fourth connector part 72 in the example shown comprises a ring around the inner edge of the opening 24. The fan module 20 is pushed through the opening 24 during assembly of the face mask and it then locks into a fixed position.

[0068] Note that the connection is not intended to be released by the user, since the fan module and outer casing may remain attached when the filter member is removed for cleaning. However, the connection may be reversible, for example the user may have different outer cover designs.

[0069] The fourth connector part may be a single component, but for ease of assembly, the example shown has a fourth connector part with a first ring 74 on the outside of the outer casing (i.e. on the side facing away from the face of the user) and a second ring 76 on the inside of the outer casing (i.e. on the side facing the face of the user). The structural layer 60 is sandwiched between the first and second rings. The first and second

rings thus provide a termination to the opening 24 in the structural layer 60. The structural layer 60 may have some flexibility, but it is more rigid than the filter member.

[0070] The first and second rings 74, 76 may be a mechanical snap fit together, or glued together or welded (e.g. ultrasonically) together. They are plastics parts. For example they may be formed of a thermoplastic material, such as acrylonitrile butadiene styrene (ABS), which is suitable for ultrasonic welding. Other plastics may be used such as polypropylene or polycarbonate.

[0071] The first and second connector parts 16, 17 are a push fit together to enable the filter member to be attached to and detached from the fan module as explained above.. The third connector part 70 is also a push fit to the fourth connector part 72. This enables easy assembly of the fan module to the outer casing.

[0072] The third connector part 70 is for example a recess around an outer side wall of the fan module and the fourth connector part 72 includes a sprung tab 78, more preferably a set of sprung tabs, for engaging with the recess. This provides a snap fit connection. The recess may be all around the outer side wall, or there may be only a set of recess portions at the locations of the sprung tabs.

[0073] Figure 7 shows the tab and recess arrangement in more detail. The sprung tab 78 is biased outwardly (i.e. towards the center of the opening). It is pushed back by insertion of the fan module and then springs back into the recess 70. There may be a set of the tabs around the opening, for example three or more. However, a continuous tab is also possible.

[0074] The outer appearance of the first ring 74 (which is visible) is uniform, so that the tab design does not detract from the visual appearance. The second ring 76 has regions where the tabs are formed where the connection between the first and second rings is interrupted. In the example shown, the tabs are at the end of a folded leg, and this folded leg projects into a cavity formed in the first ring 74 as shown in Figure 7.

[0075] When the fan module is in place, projecting through the opening, the radial outlet 50 is positioned beyond the outer casing, for example extending outwardly beyond the outermost surface of the first ring 74. Thus, the radial outlet is positioned with a minimum of obstruction to the outlet flow. However, an alternative is that the radial outlet is positioned with a desired positional relationship to a flow deflecting member 80 as is shown schematically in Figure 5.

[0076] A possible design of the third and fourth connector parts is presented above. For completeness, Figure 8 shows a possible design for the first and second connector parts. In Figure 8, the third and fourth connector parts are represented schematically only as unit 70,72.

[0077] The fan module 20 of the fan assembly comprises an outer housing 82, a fan control circuit board 84, a main housing 86 of the fan module 20 which houses the fan motor 88 and a fan impeller.

[0078] In this example, the connector module 16 comprises an annular channel 90 and the fan module comprises a spring biased engagement feature 92.

[0079] The left image of Figure 8 shows the connector module and fan module separated and the right image shows the connector module and fan module coupled together. When coupled together, the feature 92 engages with the annular channel 90 thereby to provide attachment of the connector module to the fan module by a push fit.

[0080] The connector module 16 is connected to the filter member 14 for example with ultrasonic welding, to create a seal around the connector module 16. In this example, the connector module 16 defines a check valve 94, such as a rubber flap valve.

[0081] The annular channel 90 results in a ring 96 of greater diameter above the channel. When pushing the connector module 16 into the fan module 20 (the arrow is only intended to show the relative movement), the feature 92 is deflected radially outwardly by the ring 96 and then snaps back into the channel 90.

[0082] Because the channel is annular, relative rotation between the two modules is possible. Thus, the connection can be made without needing accurate angular alignment. It also means that little force is applied to the filter member, for example no significant twisting force, which could damage the filter material.

[0083] In the example shown, the feature 92 comprises tabs. The tabs comprise a support arm and a head. The head is designed to fit into the channel and the support arm provides the radially inward spring bias. The main housing 86 is designed to provide space for the tabs to deflect outwardly during the coupling as the tabs ride over the ring 96.

[0084] There may be only two diametrically opposed tabs, or more preferably a set of three, or there may be more than three. The annular channel does not need to be continuous. There is a correct orientation for the fan module 20, in particular so that the electrical connector bridge 28 is in the correct position. Thus, only some angular freedom for adjustment is needed, rather than full angular control. Thus, the annular channel may comprise a set of annular channel portions (one for each tab) but they do not need to form a continuous channel.

[0085] The channels and tabs may of course be reversed, with the channel on the fan module and the tabs on the connector module.

[0086] The feature 92 is preferably metal, to provide increased elasticity and durability compared to plastic features.

[0087] The use of a spring biased connection instead of an interference fit allows regular filter replacement (or separation for cleaning).

[0088] The filter member 14 may connect to the outer casing in any suitable way and the poppers shown are only by way of example. Preferably, a push fit connection is used as this allows easy connection and disconnection of the filter member from the outer casing.

[0089] Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. If the term "adapted to" is used in the claims or description, it is noted the term "adapted to" is intended to be equivalent to the term "configured to". Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A face mask (10), comprising:

an outer casing (12) having an opening;
a filter member (14) for mounting inside the outer casing, wherein a mask cavity is defined between the filter member and the face of a user when face mask is worn by the user; and
a fan module (20),
wherein:

the filter member (14) comprises a first connector part (16);
the fan module comprises a second connector part (17), for connection to the first connector part (16) thereby to fix the fan module (20) to the filter member, and a third connector part (70); and
the outer casing comprises a fourth connector part (72), for connection to the third connector part thereby to fix the outer casing to fan module, with the fan module projecting through the opening.

2. A face mask as claimed in claim 1, wherein the fourth connector part comprises a ring (74,76) around the opening.

3. A face mask as claimed in claim 2, wherein the fourth connector part comprises a first ring (74) on the outside of the outer casing and a second ring (76) on the inside of the outer casing, and the outer casing comprises a structural layer (60) which is sandwiched between the first and second rings.

4. A face mask as claimed in claim 3, wherein the first and second rings (74,76) are:

a mechanical snap fit together; or
glued together; or
welded together.

5. A face mask as claimed in any one of claims 1 to 4, wherein first and second connector parts (16,17) are a push fit together to enable the filter member (14) to attached to and detached from the fan module (20).

6. A face mask as claimed in any one of claims 1 to 5, wherein the third connector part (70) is a push fit to the fourth connector part (72).

7. A face mask as claimed in claim 6, wherein the third connector part (70) is a recess and the fourth connector part is a sprung tab (78) for engaging with the recess.

8. A face mask as claimed in any one of claims 1 to 7, wherein the fan module (20) comprises a centrifugal fan having an axial inlet communicating with the inside of the mask cavity and a radial outlet (50) outside the mask cavity.

9. A face mask as claimed in claim 8, wherein the fan module (20) projects through the opening (24) with the radial outlet positioned beyond the outer casing.

10. A face mask as claimed in claim 8, wherein the fan module projects (20) through the opening with the radial outlet positioned beyond the fourth connector part (72).

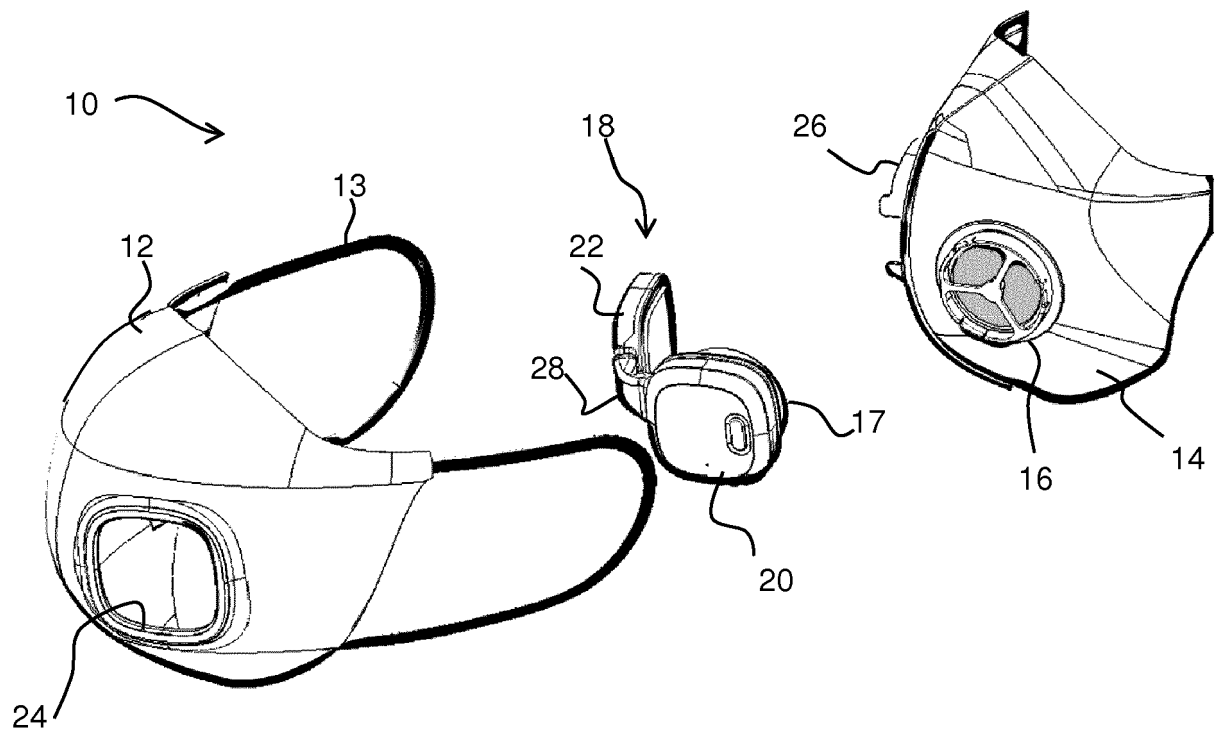


FIG. 1

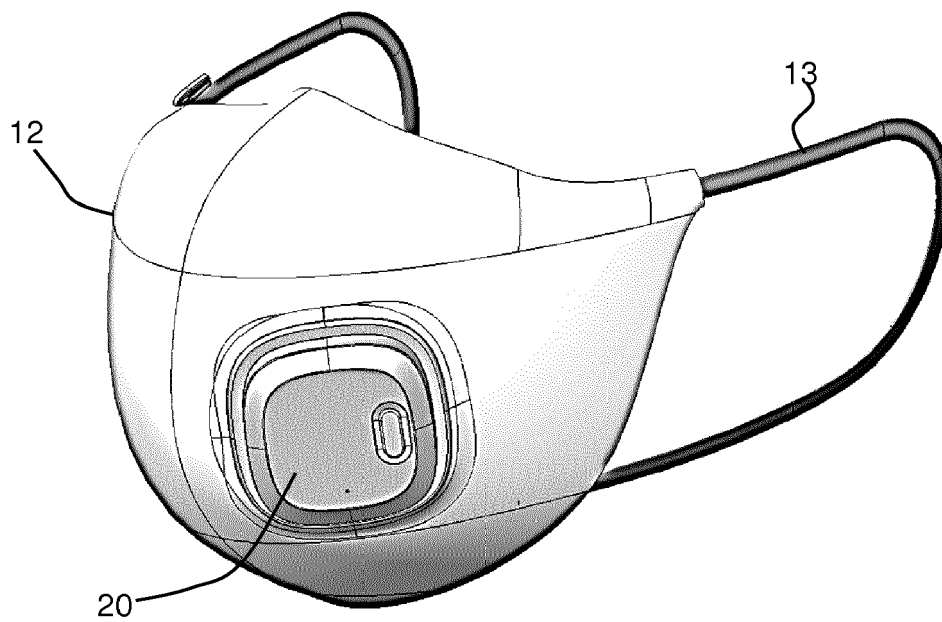


FIG. 2

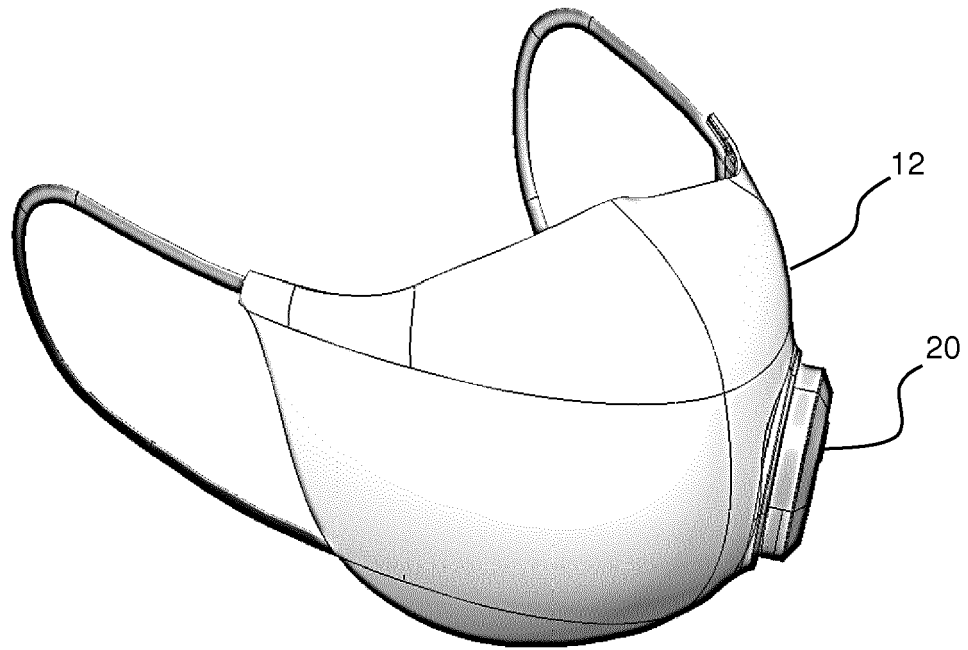


FIG. 3

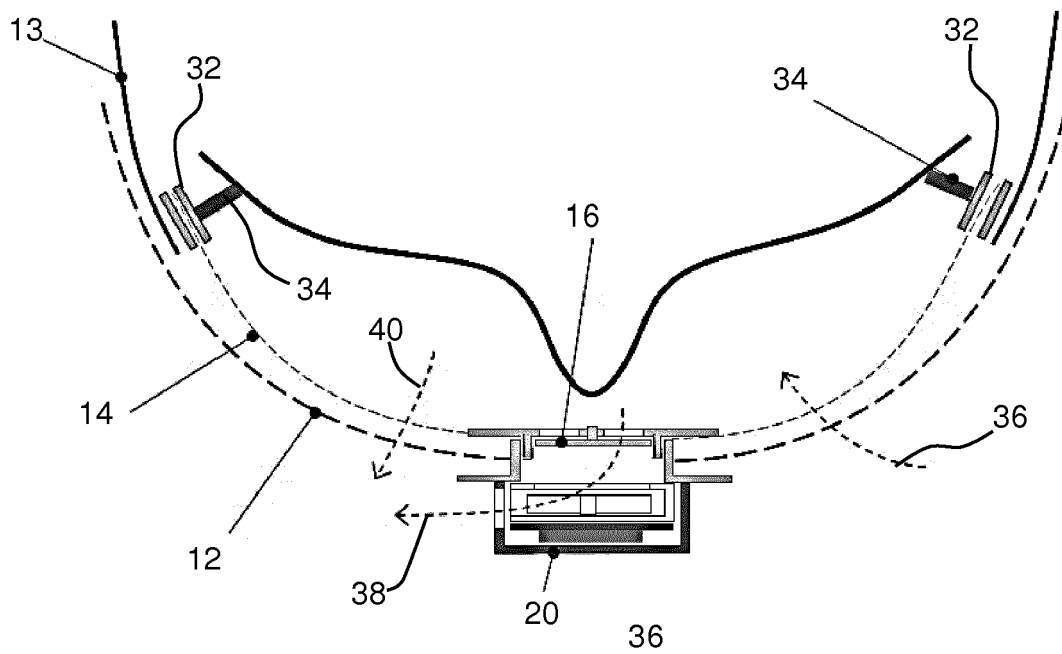


FIG. 4

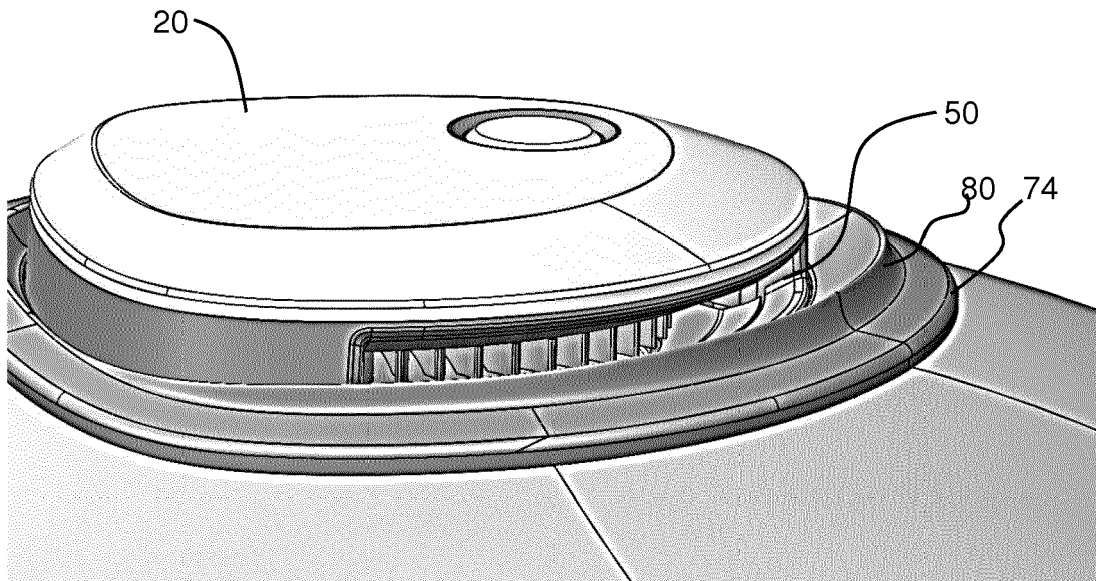


FIG. 5

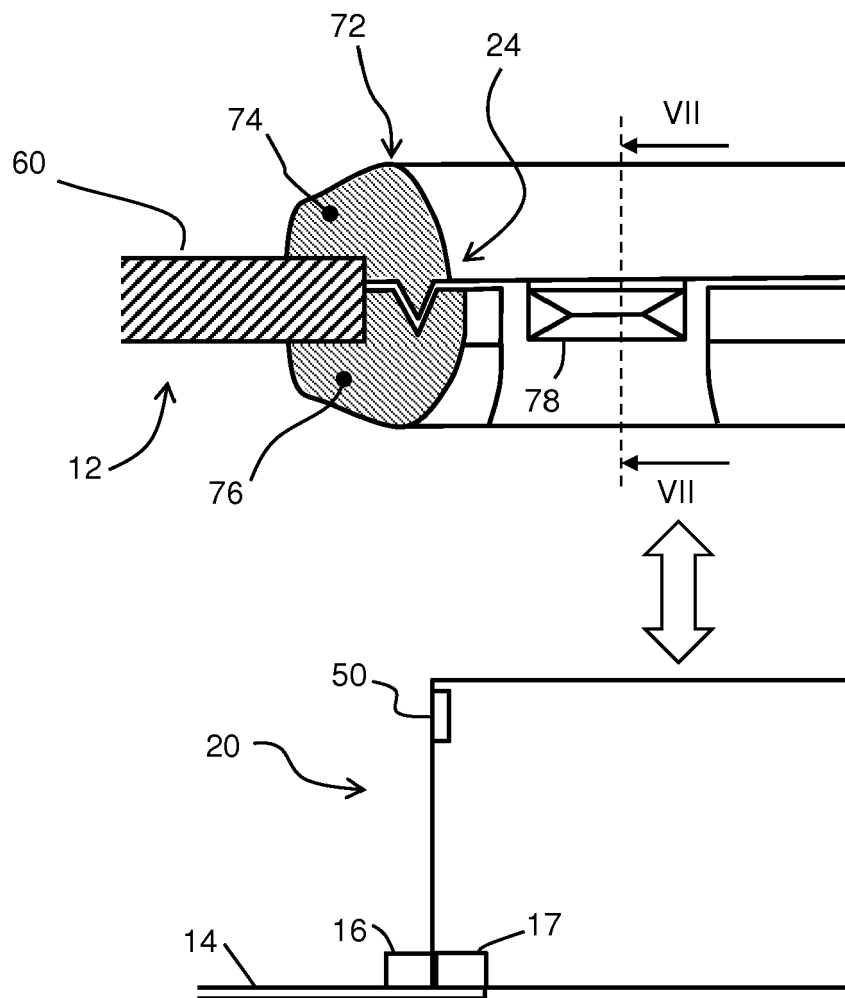


FIG. 6

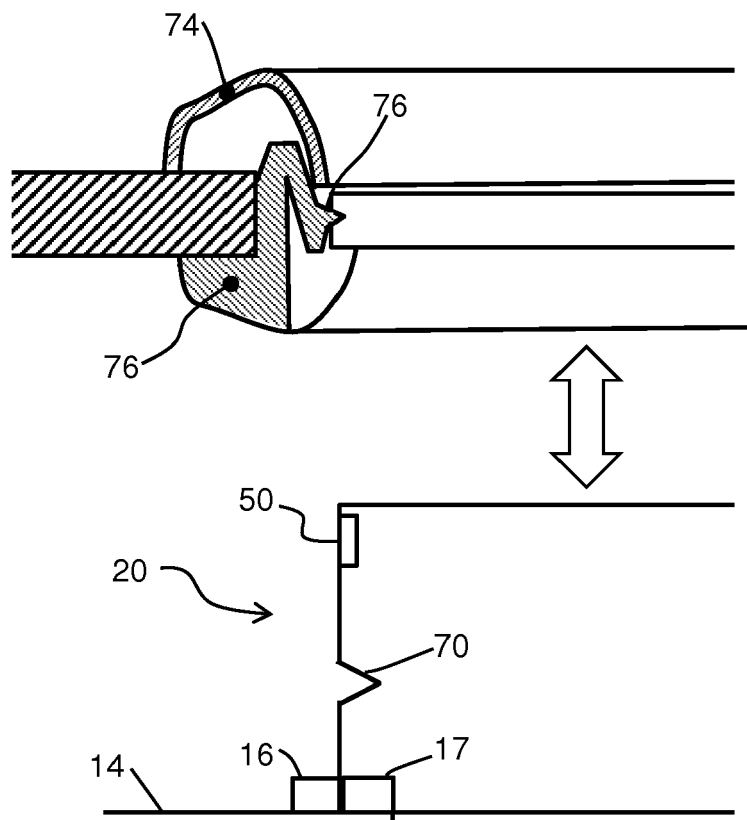


FIG. 7

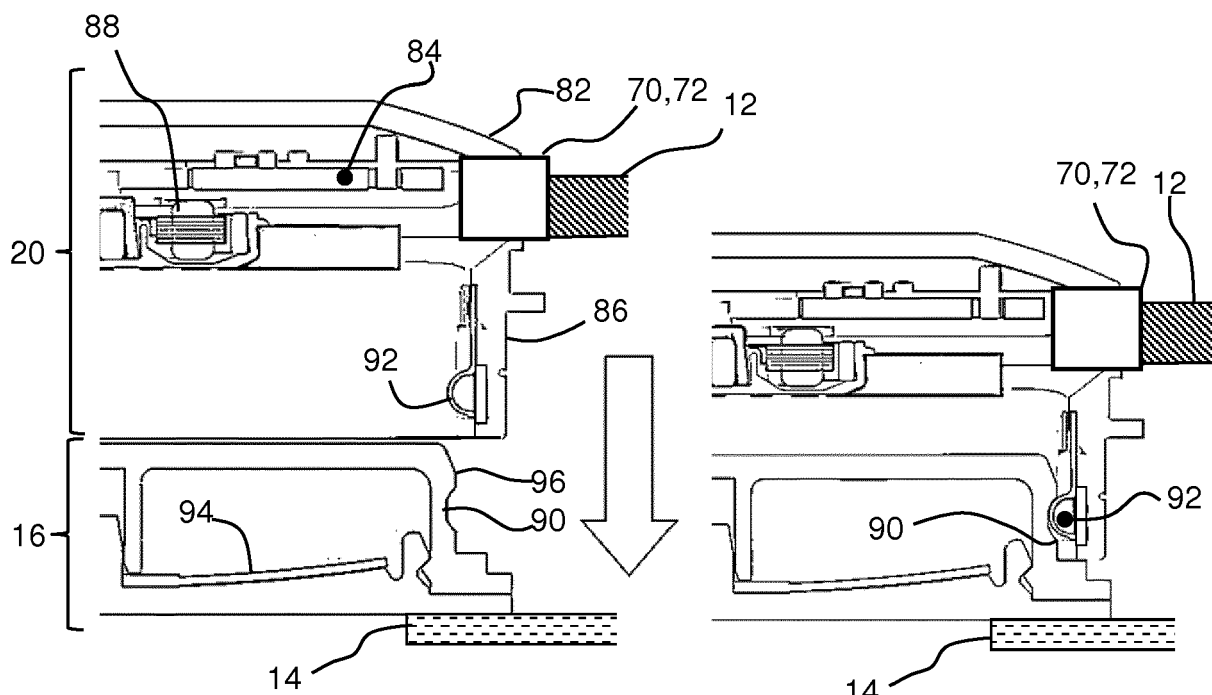


FIG. 8



EUROPEAN SEARCH REPORT

Application Number
EP 19 20 7020

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 205 055 245 U (YANG YUKUN; ZHANG YONG) 2 March 2016 (2016-03-02) * figures 1-3 *	1-10	INV. A62B18/02
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 20 April 2020	Examiner Nehrdich, Martin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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