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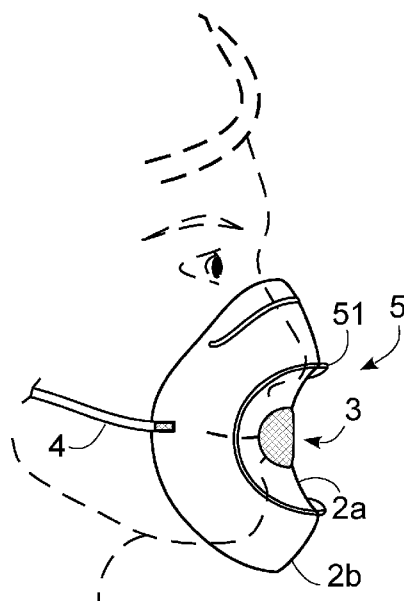


Fig. 2b

(57) Abstract: A dust mask (1) is provided, which comprises a rigid wall (2) suitable to form in use a breathing chamber (1a) containing the mouth and the nose of the user and separated from the external environment; a connection device (3) secured to the rigid wall (2) and suitable to allow a passage of air between the breathing chamber (1a) and the external environment; the rigid wall (2) defines a breathing chamber (1a) having a maximum depth in the sub nasal area and a minimum depth at the mouth so as to place the connection device (3) next to the mouth.

DESCRIPTION

DUST MASK

The present invention relates to a dust mask of the type specified in the preamble of the first claim.

- 5 In particular, the invention relates to a half mask, i.e. a mask adapted to cover only the mouth, the nose and face parts adjacent thereto, preventing inhalation of dust or other bodies suspended in the air.

As is known, masks, and in particular the dust half masks on the market today include a covering that forms an inner chamber enclosing the mouth and the nose,
10 which are thus separated from the external environment; and an elastic band fastening the covering to the face of the user.

It should be noted that these masks are worn together with glasses or eye-shield visors.

The covering is entirely made of a filtering material, and usually of non-woven fabric.
15 Alternatively, it is air-tight (for example of rubber, neoprene or silicone) and equipped with interchangeable filters.

The above-mentioned prior art has a few major drawbacks.

A first drawback is that the air breathed out by the user is not completely discharged and may cause a pressure increase in the inner chamber which, by moving the mask
20 away from the face, turns the chamber into a non-air-tight chamber.

Consequently, the air breathed out can escape the perimeter of the chamber and, due to its content of water vapour, fog the visor or glasses, thereby limiting the operator's vision.

Another drawback is that the operator must frequently stop his/her work to take off
25 the glasses or the visor and remove the fogging.

It should be noted that, due to the high frequency of work interruptions, the operator often decides not to wear such eye protection, thus jeopardizing his/her vision.

Another drawback, due to the incorrect expulsion of the exhaled air, is the formation of condensation in the mask. In fact, such condensation moistens the filtering parts,
5 thus reducing the filtering capacity of the mask and in some cases causing the formation of droplets that fall onto the work area, thereby spoiling it.

Furthermore, this air, by remaining inside the chamber formed by the mask, may be breathed in again by the operator who then inhales air with a high carbon dioxide content.

10 In this context, the technical task underlying the present invention is to devise a dust mask, which is capable of substantially obviating the above-mentioned drawbacks. Within the scope of said technical task, a major object of the invention is to provide a dust mask, which allows a correct expulsion of the exhaled air.

In particular, a major object of the invention is to provide a dust mask, which allows
15 removal of the water vapour, thus preventing it from spoiling the mask or dripping onto the work area.

The technical task and the specified objects are achieved by means of a dust mask as claimed in the appended claim 1.

Preferred embodiments are set forth in the dependent claims.

20 The features and advantages of the invention will be clarified in the following detailed description of preferred embodiments of the invention, with reference to the accompanying drawings, in which:

Fig. 1 shows a dust mask according to the invention;

Fig. 2a shows a configuration of the dust mask;

25 **Fig. 2b** shows a second configuration of the dust mask;

Fig. 3 shows another dust mask according to the invention; and

Fig. 4 shows a section of the dust mask according to the invention.

In the present document, the measures, values, shapes and geometric references (such as perpendicularity and parallelism), when associated with words like “about”
5 or other similar terms such as “almost” or “substantially”, are to be understood as unless measurement errors or inaccuracies due to production and/or manufacturing defects and, especially, unless a slight difference from the value, the measure, the shape, or the geometric reference with which it is associated. For example, these terms, if associated with a value, preferably indicate a difference not exceeding 10%
10 of the value itself.

Furthermore, when used, terms such as "first", "second", "higher", "lower", "main" and "secondary" do not necessarily identify an order, a priority relationship or a relative position, but can simply be used to distinguish more clearly the different components from each other.

15 With reference to the aforementioned figures, the dust mask according to the invention, as a whole, is indicated by the numeral **1**.

It is adapted to form in use, i.e. when worn, a breathing chamber **1a** separated from the external environment and containing at least the mouth and the nose of the user.

In particular, it can be a full-face mask, thus defining a breathing chamber 1a
20 containing the mouth, nose and eyes of the user.

Preferably, the mask **1** is a half mask, and therefore the breathing chamber **1a** contains almost exclusively the mouth and the nose of the user.

The dust mask **1** is suitable to allow the passage of air between the breathing chamber **1a** and the external environment, preventing entry of dust or other
25 impurities suspended in the air within the same breathing chamber **1a**.

The dust mask 1 comprises a rigid wall 2 which, in use, is adapted to come into contact, preferably only at its perimeter, with the face, thus forming the breathing chamber 1a; and a connection device 3 secured to the rigid wall 2 and suitable to allow the passage of air between the breathing chamber 1a and the external environment.

The breathing chamber 1a is delimited by the rigid wall 2 and by the portion of the face enclosed by it.

The rigid wall 2 can be made of a polymeric material, rubber, neoprene, silicone or other material impermeable to air, which, therefore, exits the breathing chamber 1a only through the connection device 3 and enters only through known filters applied to the rigid wall and conveniently removable.

Alternatively, the rigid wall 2 can be made of a non-woven fabric or other filtering material permeable to air, which can then preferably enter the breathing chamber 1a through the wall 2 and exit from the connection device 3.

The rigid wall 2 is suitable to define a breathing chamber 1a having a minimum depth at the mouth and a maximum depth at least in the sub nasal area, i.e. between the nose and the mouth. In particular, it has a toroidal profile and, therefore, is adapted to define a breathing chamber 1a with a toroidal profile having a minimum depth at the mouth and a maximum depth in the perioral area of the face (the portion of the face surrounding the mouth).

Suitably, said minimum depth is such that the connection device 3 is almost adjacent to and, in detail, substantially in contact with the mouth when the dust mask 1 is in use.

The term "depth" identifies the height of the breathing chamber 1a calculated perpendicular to the face, and thus the distance of the rigid wall 2 from the face.

The rigid wall 2 comprises a central portion **2a** convex with respect to the face and which, in use, is designed to be brought close to the mouth; and a peripheral portion **2b** concave with respect to the face and surrounding the central portion 2a, defining said toroidal profile for the chamber 1a.

5 Advantageously, the rigid wall 2 is at least partially deformable, suitably in an elastic manner, so as to vary its distance from the mouth and define two stable configurations. In particular, it defines a working configuration, in which the breathing chamber 1a has a minimum depth at the mouth and a maximum depth at least in the sub nasal area, and a rest configuration, in which it has the shape of a
10 shell with a maximum depth at the mouth.

More advantageously, only the central portion 2a therefore defines a sector for adjusting the position of the connection device 3 with respect to the mouth when the mask is in use. It is deformable between a working configuration, in which it assumes, with respect to the face, a convex shape, thus moving close to the mouth,
15 and a rest configuration, in which, with respect to the face, it has a concave shape, thus moving away from the mouth.

The peripheral portion 2b is substantially non-deformable.

In order to deform almost exclusively the central portion 2a, the rigid wall 2 may have a contour of the central portion 2a with a smaller section with respect to the
20 portions 2a and 2b so as to define a folding edge of the central portion 2a. Alternatively or in addition to said contour, the peripheral portion 2b may have a greater rigidity than the central portion 2a. This greater rigidity can be obtained by inserting one or more stiffening sticks in the peripheral portion 2b or by manufacturing said peripheral portion 2b with a different material or thickness with
25 respect to the central portion 2a.

The connection device 3 is adapted to allow the passage of air between the breathing chamber 1a and the external environment, and specifically to accommodate the totality of the air breathed out of the mouth, thus preventing it from entering the breathing chamber 1a.

- 5 It can be one-way so as to allow the air to exclusively exit from the breathing chamber 1a. Alternatively, the connection device 3 may be a two-way device so that the air, in addition to coming out, also enters, filtered by the connection device 3, the breathing chamber 1a through the same connection device 3.

The connection device 3 may comprise a valve **31** of a known type, e.g. a membrane
10 valve.

It is firmly secured at the central portion 2a so as to come close to, and in particular to come into contact with the mouth when the dust mask 1 is in use. Specifically, the connection device 3 is placed at the vertex of the central portion 2a, i.e. at the point closest to the mouth when the central portion 2a is convex.

- 15 The connection device 3 may comprise a shaped profile **32** suitable to ensure a perfect contact of the device 3, and precisely of the valve 31 with the lips of the mouth so that the air coming out of the mouth is entirely collected by the connection device 3 and does not enter the chamber 1a.

The shaped profile 32 (Fig. 4) may have a tapered section and, in particular, a
20 maximum section at the mouth and a minimum section at the valve. Said maximum section is at least equal to the profile of the mouth.

The dust mask 1 may comprise means **4** for attaching the mask 1 to the head of the user, which are suitable to press the perimeter of the rigid wall 2 against the face.

The attaching means 4, known per se, are identifiable as at least one elastic band.

- 25 Finally, the dust mask 1 may comprise a collector **5** for the water vapour coming out

of the connection device 3 so as to prevent its dripping.

The collector 5 is placed in proximity of the connection device 3 and outside the breathing chamber 1a.

It can comprise a rim **51** protruding, on the opposite side of the chamber 1a, from the rigid wall 2 and defining, together with the rigid wall 2, a water vapour collection channel.

The rim 51 may be formed along a lower peripheral area of the connection device 3, and in detail of the central portion 2a, i.e. at a portion of the perimeter having, when the mask 1 is in use, a lower gravity potential so as to collect the water vapour by gravity.

The rim 51 may be conical in shape with a minimum section at the device 3 and a maximum section at the mouth and enclosing therein the lips, and adjacent thereto. Said lower peripheral area may have an angular extent substantially equal to at least 120°, and in detail equal to 180°.

Preferably, the rim 51 is formed along the entire perimeter of the connection device 3, and in detail of the central portion 2a.

The collector 5 may comprise a filtering membrane **52** suitable to overlap the central portion 2a defining an additional chamber **5a** separate from said external environment.

Said additional chamber 5a is thus delimited by the central portion 2a, the connection device 3 and the filtering membrane 51.

The filtering membrane 52, shown for clarity only in Fig. 3, is adapted to filter the air passage between the additional chamber 5a and the external environment. It thus prevents the entry of bacteria, microbes, suspended particles coming out of the mouth, which could contaminate the external environment.

The filtering membrane 51 can be made of fabric.

The filtering membrane 51 is designed not to deform during a change of configuration and, for example, to remain spaced from the central portion 2a in the working configuration, and suitably to be adjacent to said central portion 2a in the
5 rest configuration.

Alternatively, the filtering membrane 51 is designed to deform, and in particular to remain adjacent to the central portion 2a in the two configurations.

In addition or alternatively, the collector 5 may comprise a water vapour-absorbing body located on the outside of the chamber 1a and identifiable, for example, as a
10 sponge adapted to absorb the water vapour coming out of the connection device 3. Said absorbent body may be integral with the rim 51.

The operation of a dust mask, described above as regards structure, is as follows.

Initially, the dust mask 1 is in the rest configuration, i.e. with the central portion 2a concave.

15 The user wears the dust mask 1 and uses the attaching means 4 to firmly attach the mask 1 to the head by superimposing the rigid wall 2 to the mouth and nose.

It should be noted that, at this point, the dust mask 1, by being in the rest configuration, has the connection device 3 spaced from the mouth as shown in Fig. 2a.

20 At this point, the user shifts the dust mask 1 into the configuration of use.

In detail, he/she presses on the connection device 3 with a force oriented towards the mouth so as to give the central portion 2 a convex shape and thus bring the connection device 3 into contact with the mouth.

In this configuration, the user can breathe in the air from the nose, which air thus
25 enters the breathing chamber 1a through the rigid wall 2, and breathe out from the

mouth.

Consequently, as the mouth is in contact with the connection device 3, the air exits exclusively from the connection device 3 without invading the breathing chamber 1a. In conclusion, the exhaled air charged with carbon dioxide and water vapour is completely expelled from the connection device 3, thus avoiding its stagnation inside the breathing chamber 1a.

As the air exits from the connection device 3, the water vapour accumulates at the connection device 3 and, pushed by expiration, exits outside the breathing chamber 1a where it is collected by the collection body 5.

10 The invention provides significant advantages.

A first advantage is that, as the connection device 3 is adjacent to the mouth, the exhaled air is totally expelled from the mask 1 through said connection device 3, preventing it from invading the breathing chamber.

Accordingly, an important advantage is that, as the chamber 1a is also only used for inhalation, it is always maintained perfectly adjacent to the face, making it impossible for dust or other suspended bodies to enter and preventing fogging of the visor or glasses.

Accordingly, the use of the innovative mask 1 does not require the operator to frequently stop working for cleaning the glasses/visor, making the work much faster.

20 Another advantage is therefore that the exhaled air, as it is totally collected by the connection device 3, does not enter the breathing chamber 1a, and therefore is not breathed in by the operator, thus avoiding inhalation of air with a high carbon dioxide content.

A key advantage is also given by the fact that the connection device 3, by collecting all the water vapour, allows the collector 5 to collect all the water vapour, thus

avoiding the formation of droplets falling onto the work area.

Finally, another advantage lies in the fact that, as the exhaled air is totally collected by the connection device 3, the water vapour does not dampen the rigid wall 2, thus ensuring the maintenance of its filtering capacity for an extended time span.

- 5 The invention is susceptible of variations falling within the scope of the inventive concept, as specified in the independent claims, and of the related technical equivalents. In this context, all details are replaceable by equivalent elements and any type of materials, shapes and dimensions may be present.

CLAIMS

1. A dust mask (1) comprising

- a rigid wall (2) suitable to form in use a breathing chamber (1a) containing at least the mouth and nose of the user and separated from the external environment;
- a connection device (3) secured to said rigid wall (2) and suitable to allow a passage of air between said breathing chamber (1a) and said external environment;

– characterised in that

- said rigid wall (2) is suitable to define a breathing chamber (1a) having a maximum depth at least in the sub nasal area and a minimum depth at said mouth so as to place said connection device (3) next to said mouth.

2. Dust mask (1) according to claim 1, wherein said rigid wall (2) is suitable to define a toroidal breathing chamber (1a) having a minimum depth at said mouth and a maximum depth in the area around the mouth.

3. Dust mask (1) according to claim 2, wherein said rigid wall (2) comprises a convex central portion (2a) and a concave peripheral portion (2b) surrounding said central portion (2a); and wherein said connection device (3) is constrained to the central portion (2a).

4. Dust mask (1) according to claim 3, wherein said central portion (2a) defines a sector for adjusting the position of said connection device (3) with respect to said mouth.

5. Dust mask (1) according to one or more of the claims 2-3, wherein said central portion (2a) is deformable between a working configuration in which it assumes a convex shape moving said connection device (3) towards said mouth

and a rest configuration in which it assumes a concave shape moving said connection device (3) away from said mouth.

6. Dust mask (1) according to one or more of the preceding claims, comprising a collector (5) of the water vapour in output from said connection device (3).

5 **7.** Dust mask (1) according to the preceding claim, wherein said collector (5) comprises a rim (51) protruding from said rigid wall (2) and defining, together with said rigid wall (2), a water vapour collection channel.

8. Dust mask (1) according to one or more of the claims 5-6, wherein said collector (5) comprises a body absorbing said water vapour.

10 **9.** Dust mask (1) according to one or more of the claims 5-7, wherein said collector (5) comprises a filtering membrane (52) suitable to overlap said central portion (2a) defining an additional chamber (5a) separate from said external environment.

10. Dust mask (1) according to one or more of the preceding claims, wherein
15 said connection device (3) comprises a shaped profile (32) suitable to ensure a perfect contact of said connection device (3) with the lips.

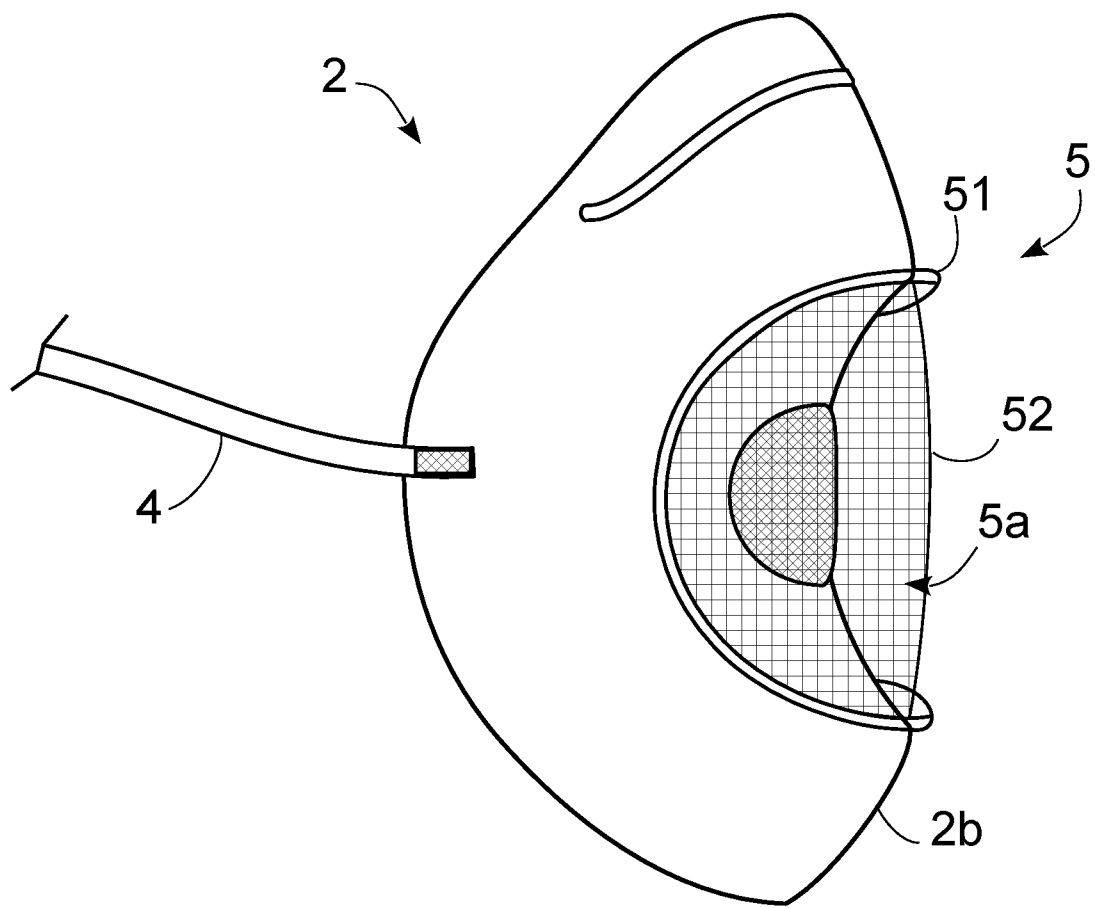
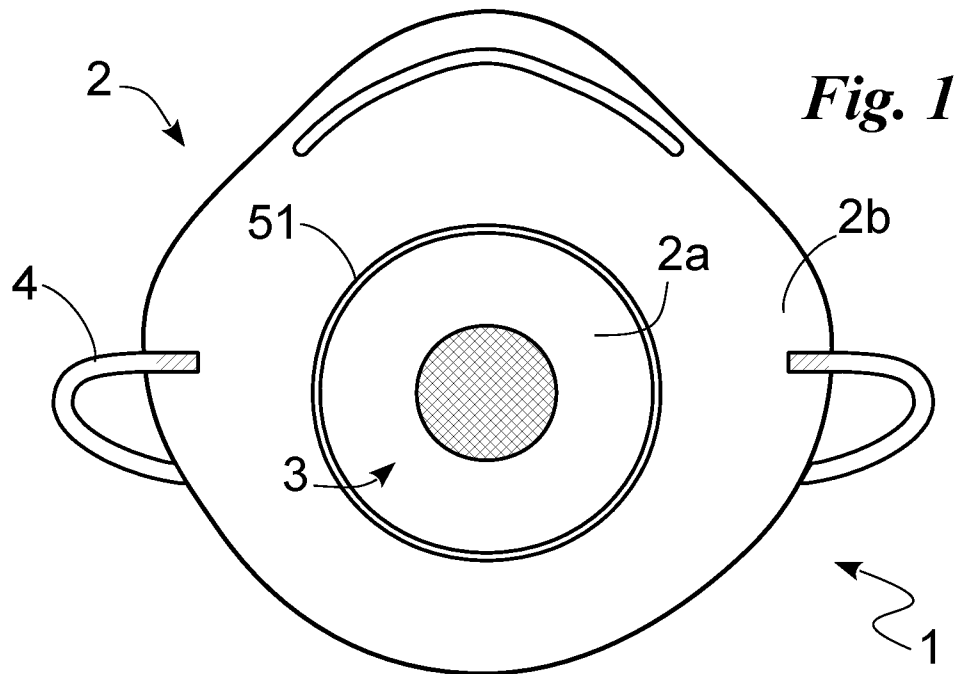


Fig. 3

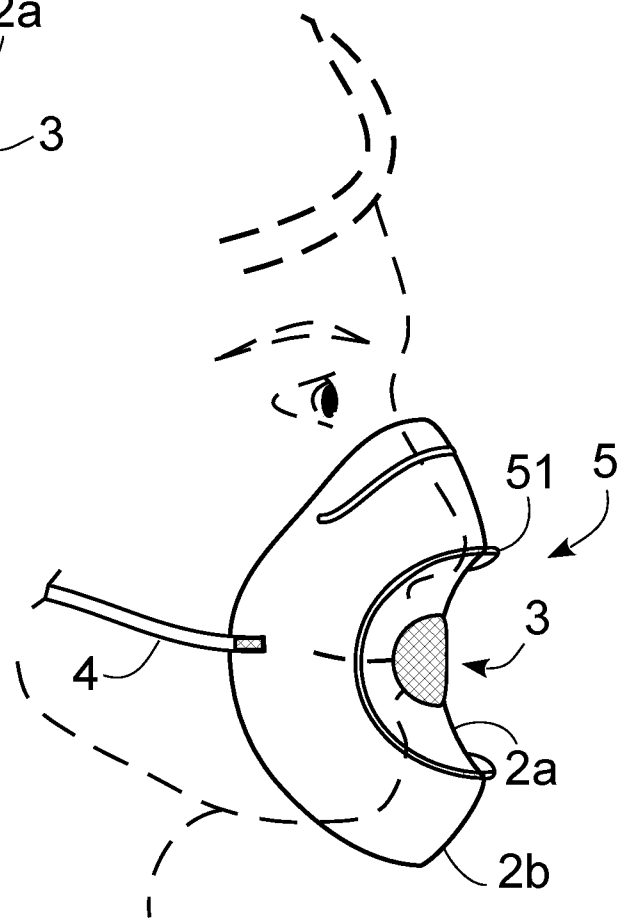
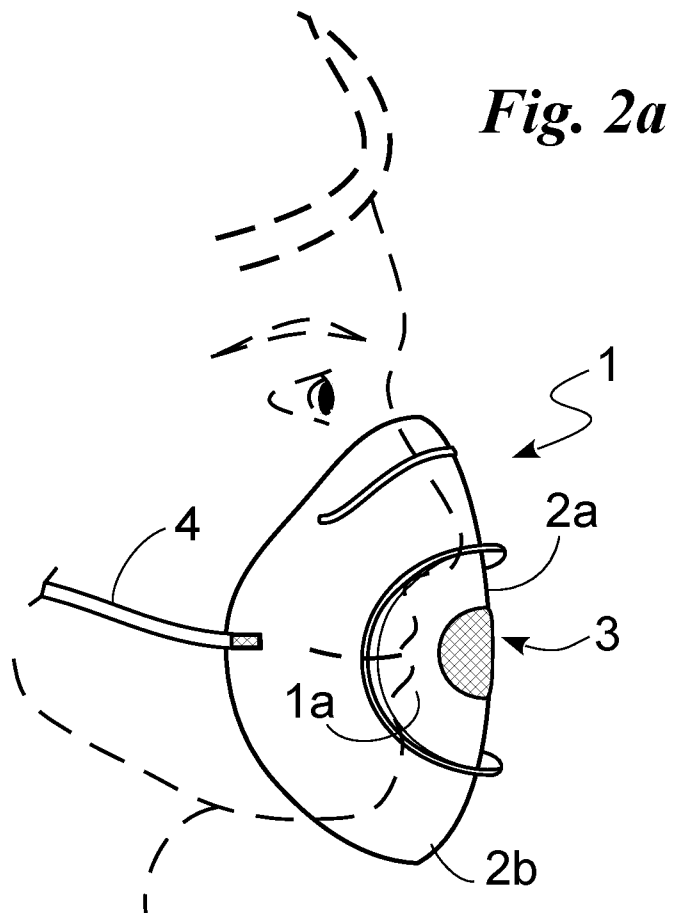


Fig. 2b

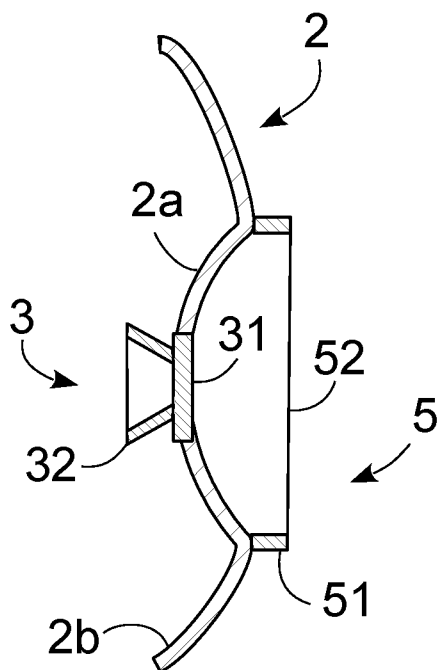


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/052657

A. CLASSIFICATION OF SUBJECT MATTER
INV. A41D13/11
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A41D

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2015/026593 A1 (3M INNOVATIVE PROPERTIES CO [US]) 26 February 2015 (2015-02-26) paragraph [0001]; figures 1, 2, 3 -----	1-10
A	WO 2006/113163 A1 (SURVIVAIR RESPIRATORS INC [US]; SUSTELLO RICK [US]) 26 October 2006 (2006-10-26) figure 1 -----	1-10
A	US 2014/190492 A1 (NOH DONG-SUN [KR] ET AL) 10 July 2014 (2014-07-10) figures 1-3 -----	1-10

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Further documents are listed in the continuation of Box C.

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See patent family annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2017/052657

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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