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(54) **Inner mask for protective face mask.**

(57) The present invention relates to an inner mask for protective masks with openings allowing air to flow from the space between protective mask and inner mask. Said openings (6, 8) are provided with non-return valves in the form of a compression moulded membrane (7, 7') of elastomeric material designed to tightly abut the area surrounding the inner mask (1) thanks to the inherent elasticity of the material.

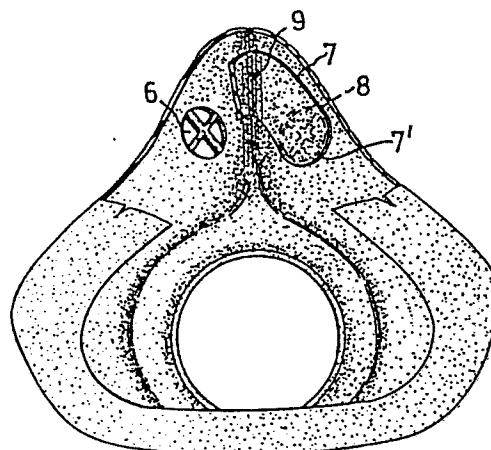


FIG. 2

The present invention relates to an inner mask for protective masks of the type fitting tightly around the whole face of the wearer, said inner mask being designed to surround the nose and mouth of the
5 wearer and comprising at least one opening provided with a non-return valve for the supply of air from the space between protective mask and inner mask, and an exhalation opening.

10 Inner masks having non-return valves located on both sides of the wearer's nose are already known for use in protective masks. Such known non-return valves comprise circular seats of metal or plastic arranged in the mask, and valve membranes of rubber. The
15 membrane is fitted at the centre of the valve seat and the arrangement is known as a disc valve. The seat is provided with support ribs extending from the centre to carry a central attachment part for the valve membrane and to prevent the valve membrane
20 from being pressed out through the seat during exhalation.

One serious drawback with these known inner masks provided with disc valves is that the valves give rise to relatively great resistance upon inhalation which, together with the inhalation resistance caused
25 by the inhalation valve and filter on the protective mask, contributes to the use of the protective mask being experienced as troublesome and performance being undesirably reduced during work necessitating the use of protective masks.

30 Other drawbacks are that the valve seat is hard and may cause irritation by rubbing, assembly requires several steps, and since the valve seat is made of

metal, there is a risk of corrosion. Furthermore, these valve elements are difficult to clean.

5 The primary object of the present invention is thus to produce an inner mask for protective masks, having at least one non-return valve which offers negligible inhalation resistance.

10 Another object of the invention is to achieve an inner mask which is simple and inexpensive to manufacture, which lacks any kind of hard parts and which is easy to clean.

15 The above and other objects are achieved by means of the inner mask according to the present invention wherein the non-return valve is formed by a membrane of elastomeric material secured to the inner mask and arranged in closed position to be in sealing contact with the area surrounding the air through-flow opening in the inner mask.

20 The membrane may be elongate and secured to the inner surface of the inner mask so that a free end covers said opening and is sealing against the area surrounding the opening in the inner mask. The membrane is preferably compression-moulded to a flat shape and the inherent elasticity of the material is utilized to effect the sealing abutment.

25 According to a preferred embodiment of the invention, the membrane is secured to the inner mask by means of beaded attachment studs.

According to another embodiment of the invention air through-flow openings are arranged on each side of the

inner mask, the membranes covering both air through-flow openings consisting of the free ends of an elongate membrane of elastomeric material secured between the two openings. The arrangement of said elongate membrane
5 between the two openings guides the air entering towards the respiratory organs.

According to the preferred embodiment, thus, the entire valve arrangement in the inner mask consists of a single part which cooperates with the parts of the
10 inner mask surrounding the openings. The membrane may be made of the same material as the inner mask, the mask has no hard parts, the inhalation resistance is negligible and the air entering is favourably directed since the valve membrane can be arranged to open towards
15 the respiratory organs of the wearer.

Additional important advantages of the arrangement according to the invention over known solutions are that the inner mask is less expensive to manufacture and assemble, easier to clean, it has no corrosive
20 parts, there are no parts which can get caught thereby jeopardizing the function of the mask, and one of the non-return valves will always function even if the inner mask is not located exactly correctly over the face.

25 Further characteristics and advantages of the inner mask according to the invention will be revealed in the following detailed description, with reference to the accompanying drawings in which

Figure 1 shows a side view of an inner mask according
30 to the present invention, and

Figure 2 shows a view of the interior of the inner mask and its valve arrangement.

The inner mask shown in Figure 1 is designated 1 and is provided with an exhalation part 2 with collar-like edge 3 around an outlet. At assembly the edge is intended to be connected to an exhalation valve and to be sealingly connected by a locking means to an outer mask. The inhalation part 4 of the inner mask is provided with an edge 5, intended to fit tightly around the nose and mouth of the wearer. Air through-flow openings 6 are arranged in both side sections of the mask. The opening on the far side is hidden in the drawing. In the embodiment shown, the through-flow openings 6 for air comprise four openings cut so that the remaining material functions as support ribs and prevents the valve membrane from being pressed out through the openings upon exhalation.

Figure 2 shows a view of the interior of the inner mask with portions removed with the object of clarification. The valve membrane consists of an elongate compression-moulded piece 7 of elastomeric material, secured between the two air through-openings 6, 8 at 9, preferably by means of beaded studs arranged in the membrane which are passed through corresponding openings in the inner mask. The free end parts 7' of the membrane thus function as valve membrane.

Before attachment the membrane is flat and due to the inherent elasticity of the material it will therefore seal the through-flow openings for air when in assembled state. This valve arrangement offers extremely little inhalation resistance, as well as suitably directing the in-flowing air since the two ends of the membrane open towards the respiratory organs.

The invention has been described above with reference to the preferred embodiment but is of course not limited thereto. The membranes covering the air through-flow openings may, for instance, be formed as separate parts and secured individually. Furthermore, the design of the inner mask and its connections for the exhalation valve, as well as other parts can be freely adapted without deviating from the inventive concept. The location of the openings is also optional, being located lower down in the portion surrounding the cheeks, for instance.

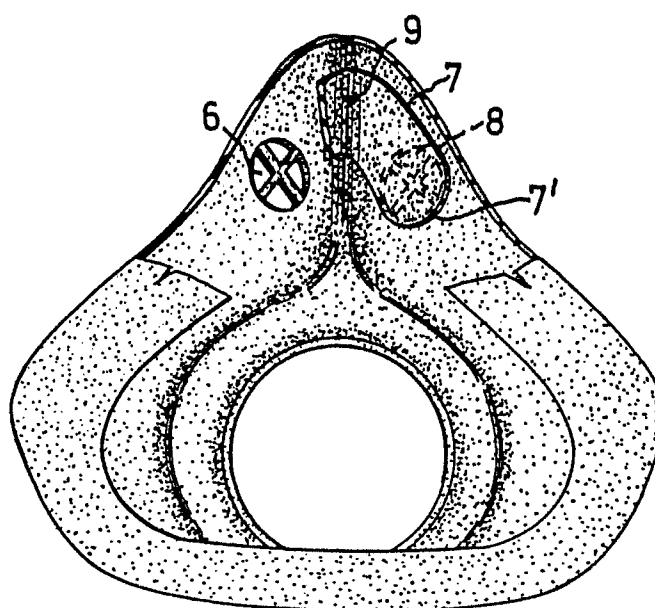
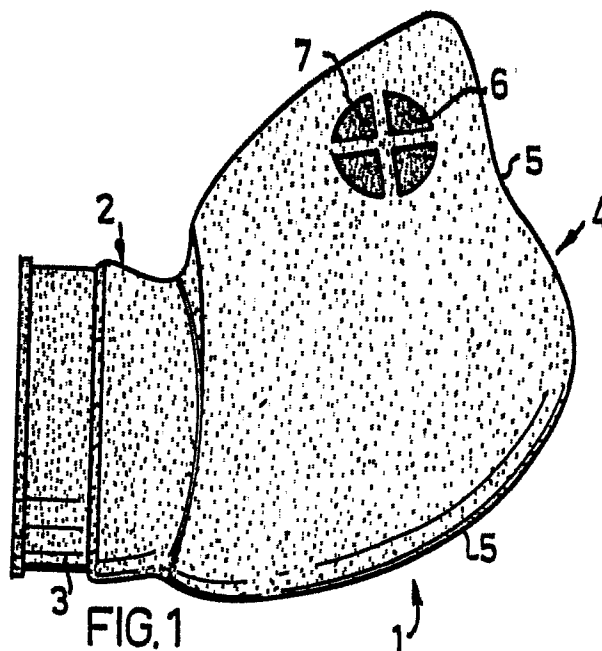
The choice of material for the inner mask and valve membrane is determined by the requirements, i.e. the material shall be resistant to chemicals, withstand high temperatures without deformation, be non-flammable and self-extinguishing.

C l a i m s

1. An inner mask for protective masks of the type fitting tightly around the whole face of the wearer, said inner mask being designed to surround the nose and mouth of the wearer and comprising at least one opening provided with a non-return valve for the supply of air from the space between protective mask and inner mask, and an exhalation opening, w h e r e i n the non-return valve is formed by a membrane of elastomeric material secured to the inner mask (1) and arranged in closed position to be in sealing contact with the area surrounding the air through-flow opening (6) in the inner mask (1).
2. An inner mask as claimed in claim 1, w h e r e i n the membrane is elongate and so secured to the inner surface of the inner mask that it is forming a free end, which covers said opening (6) and is sealing against the area surrounding the opening in the inner mask (1).
3. An inner mask as claimed in claims 1 - 2, w h e r e i n the membrane is compression-moulded to a flat shape and that the inherent elasticity of the material is utilized to effect the sealing abutment.
4. An inner mask as claimed in claims 1 - 3, w h e r e i n the membrane is secured to the inner mask by means of beaded attachment studs.
5. An inner mask as claimed in claims 1 - 4, w h e r e i n the membrane covering the opening is arranged to guide the air entering, towards the respiratory organs.

6. An inner mask as claimed in claims 1 - 5,
w h e r e i n air through-flow openings (6, 8) are
arranged on each side of the inner mask (1), the
membranes covering both air through-flow openings
5 (6, 8) consisting of the free ends (7') of an elongate
membrane (7) of elastomeric material secured between
the two openings (at 9).

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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 (Int. Cl.4)
X	GB-A-2 042 346 (DRAEGERWERK) * Page 2, lines 5-14; figure 1 *	1,2,3	A 62 B 18/02 F 16 K 15/14
Y		4,5,6	
Y	--- US-A-2 999 498 (MATHESON) * Column 2, lines 31-64; figures 2,3,7,8 *	4,5	
Y	--- US-A-2 954 048 (RYCHLIK) * Column 3, lines 1-46; figures 3,9 *	6	
A	--- US-A-2 647 511 (BARACH) * Column 1, lines 38-45; figures 1,2 *	1-5	
A	--- US-A-3 042 035 (COANDA) * Column 2, lines 59-69; figure 2 *	1-5	

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 07-10-1987	Examiner WOHLRAPP R.G.
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	