

Respiratory Device with Filter



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Field

- 5 This invention relates to respiratory devices with filters. These respiratory devices are portable and may be worn by users to provide filtered air.

Background

- In recent years, awareness of the danger of airborne disease has been further elevated
10 due to the epidemic levels of the SARS and H1N1 outbreaks.

- One common way such airborne diseases are spread is via water droplets in the air, water droplets having been exhaled into the air from an infected person (through breathing, coughing, sneezing, etc). Bacteria and viruses are able to survive in such
15 water droplets and infect another person when they enter that person's system. Thus, there is a need to find ways to prevent such bacteria and viruses from entering a potential victim's system.

- Apart from the spread of bacteria and viruses, there are many other reasons why such
20 filtration of air is required. For example, individuals with sensitivities to allergens (such as dust particles, pollen, and animal fur) in the air may need filtered air as well. This can be especially true for patients who require cleaner air, but is not always possible given the limitations of the environment within hospitals.

- 25 Present day solutions range from the very common surgical mask, which flu infected patients often wear over their mouth and nose, to respiratory devices capable of filtering



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not only dust and water particles in the air, but also neutralise toxic gases, etc. In any case, the general aim is to form a barrier between the mouth and nose and the surrounding air, such that the air inhaled by the individual wearing the mask is filtered.

- 5 Face masks such as those used by flu patients or doctors with operating theatres are generally simplistic and only prevent water moisture from passing through. The masks are commonly made out of paper and are not very durable. Once wet, it tends to deteriorate rapidly and a replacement is required. Furthermore, they cover a large portion of the individuals face, preventing other common actions such as eating,
10 brushing teeth, washing face, etc.

The present invention is directed at overcoming at least some of the above mentioned problems.

15 **Summary**

- According to one aspect there is provided a respiratory device including an envelope structure, the envelope structure comprising at least one or more filter elements; an air guide forming a pathway with one end in communication with the inside of the envelope structure and extending from the envelope structure; wherein an opposed end
20 of the air guide is mounted to a pair of nasal plugs, for delivering air from the envelope structure to the nasal plugs.

The nasal plugs may be worn by an individual, plugged directly into the nose. The plugs should form a substantial seal within the individual's nasal canal, ensuring that most of

the air inhaled or exhaled via the nose is from/to the air guide. The nasal plugs may also be made secure enough such that it will not easily slip out from a user's nasal canal. In some expressions of the invention, depending on the intended function of the respiratory device, the nasal plugs need not form a seal within the individual's nasal canal. Such
5 nasal plugs which loosely fit the individual's nasal canal could be desirable in certain embodiments where comfort and ease of attachment/removal are of higher priority than ensuring a maximum amount of filtered air delivered.

In some expressions of the invention, the respiratory device and/or air guide includes a
10 securing means, for securing the respiratory device to a user. This will allow the envelope structure to be secured to a user or other medical device. Some common methods of securing the envelope structure include attaching a loop to it such that the loop may be worn around a user's neck or body, or via securing means such as a clip, Velcro strips, etc.

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The air guide may also include securing means to ensure that it stays in place and does not cause the nasal plugs to slip out from a user's nose. For example, in some expressions of the invention, the air guide may be designed such that it is tubular, and may be worn around a user's ears such that the air guide extend around the side of the
20 user's head, the air guides secured by resting on the user's ears, towards the face and nose of the user.

The filter elements used in the envelope structure may come in different forms, as long as it ensures that air passing into the air guide has been filtered. In some expressions of

the invention, the entire envelop structure is made out of said filter elements. In other expressions, the envelope structure may be made out of non- permeable material, with certain portions made out of the filter elements. Those filter portions allow air to pass through and into the envelope structure. In yet some other expressions of the invention, 5 the filter elements may simply be placed within the envelope structure, covering the connection to the air guide.

A skilled reader would understand that the actual shape of the envelope structure is immaterial. The envelope structure may take the form of, but not limited to, a cartridge, 10 tube or bag, etc.

Preferably, the filter elements possess anti-microbial components. For example, the filter elements could be made from, or contain, titanium dioxide, silver and/or silver dioxide, which are common anti-microbial substances. It would be clear to a skilled 15 reader that any material or component with similar anti-microbial properties could be used. The filter elements may be made from paper, nylon fabric, cloth, or any suitable material, commonly used in filter manufacture. Although anti-microbial filter elements are preferred, the filter elements may also include more alternative filters with other features, such as charcoal filters, odor filters, chemical filters, etc.

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In some expressions of the invention, the respiratory device includes one or more valve elements arranged to allow unidirectional air flow from outside, to within the envelope structure, the air guide and the nasal plugs. These valves allow air to flow in only one direction, and may be placed within the envelope structure or the air guide itself. By

preventing backflow of air from a user into the air guide or envelope structure, the valves ensure that fresh filtered air is being supplied to the user.

More preferably, a second set of valve elements may be arranged to allow exhaled air
5 entering the nasal plugs to flow from within nasal plugs or air guide to outside, allowing a user to exhale air from his nose and out into the surroundings.

The respiratory device is not limited to purely filter functions and may include additional components to allow other common functions to be integrated within. For
10 example, it may include a nebulizer for administering medication with the filtered air to a user. It may also include additional inputs such as connectors to connect the device to an oxygen tank to provide filtered air mixed with pure oxygen.

Brief Description of the Drawings

15 In order that the invention may be fully understood and readily put into practical effect there shall now be described by way of non-limitative example only exemplary embodiments, the description being with reference to the accompanying illustrative drawings.

20 In the drawings:

Figure 1 shows an exemplary embodiment of the invention, the envelope structure made completely from filter elements and connecting air guides from the envelope structure to two nasal plugs;

Figure 2 shows the cross sectional view of an exemplary triple layer filter element used in an embodiment of the invention.

Detailed Description of the Exemplary Embodiment

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Figure 1 shows a preferred embodiment of the present invention. The respiratory device 10 comprises of an envelope structure 11 which is designed such that it forms a sealed envelope shaped enclosure. In this embodiment, the envelope structure 11 is made entirely from filter elements 12 such that any air flowing from the outside of the
10 envelope structure 11 into the enclosure will need to pass through filter elements 12.

The filter elements 12 may be made from any known filter material, depending on the intended use of respiratory device 10. For example, if it is meant to provide basic filtration capabilities (filtering water moisture / dust particles), it could be made of paper
15 or fabric filter material. If it needs to provide additional odour filtration, it may include an additional charcoal, or equivalent, filter. In this embodiment, filter elements 12 include at least one anti-microbial filter made from titanium dioxide, silver and/or silver dioxide. However, the anti-microbial filter may or may not be present in other embodiments of the invention, and if present, may not necessarily be made from
20 titanium dioxide, silver and/or silver dioxide.

Filter elements 12 may be designed such that multiple filters are used. As shown in figure 2, filter elements 12 may comprise of multiple layers (20, 21, 22). Each layer

may be of the same type to ensure greater filter capabilities, or may be made from different filter material to allow the respiratory device to filter multiple contaminants.

In the case where all three layers (20, 21, 22) are made from the same material, they
5 may or may not be further differentiated to filter the air to a varying level. For example, layer 20 may be designed to filter large water droplets and dust particles, layer 21 to filter medium sized droplets and particles, and layer 22 to filter small droplets and particles.

10 Where layers (20, 21, 22) are designed to filter different contaminants, they may be made from different materials and/or have different composition. Layer 20 may be a water droplet and dust particle filter, layer 21 may be an odour filter, and layer 22 may be a chemical neutralizer. Note that this respiratory device is not limited to medical use and hence filter elements 12 can vary accordingly. The above mentioned example could
15 well be used in an underground mining environment where the air contains many contaminants, and possibly foul and/or harmful gases.

The enclosure within envelope structure 11 is connected to an air guide 13, forming a passageway for filtered air within the enclosure to flow out. One or more air guides 13
20 may be used, but there should be at least a pair of openings on the opposite ends in connection with nasal plugs 14. These nasal plugs 14 are meant to be inserted into a user's nasal canal when putting the respiratory device 10 to use. The nasal plugs 14 should form a substantial seal within a user's nasal canal such that air inhaled or exhaled via the nose is from/to air guide 13.

When the respiratory device 10 is in use, a user will insert nasal plugs 14 into his nose and breathe normally. Through the user's breathing, air will be drawn into envelope structure 11 from the surroundings, the air passing through filter elements 12 as it enters.

- 5 The air travels into the air guides 13 towards nasal plugs 14 and into the user's lungs. When exhaling, the user may exhale via his mouth, or via his nose and into air guide 13.

- When exhaling into air guide 13, is it preferable that an embodiment of the invention with valves is used. Such valves may be installed within the air guide 13 or the envelope structure 11, such that only unidirectional air flow is possible. This means that when a user inhales, air would flow from the envelope structure 11 into the user's lungs, but when the user exhales through his nose, the valves are shut, preventing air from flowing back into the envelope structure 11. To allow the user to exhale comfortably, a second set of valves may be installed within air guide 13 or nasal plug 14, such that it allows air to flow from within the air guide 13 or nasal plug 14 into the surroundings.
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- In this embodiment of the invention, respiratory device 10 further includes securing means 15 to secure the device 10 and/or air guide 13 to the user. This will help in preventing nasal plugs 14 from slipping out or being pulled out from the user's nose.
- 20 Securing means 15 may come in the form of a simple strap 15, tying envelope structure 11 to the user's body or incorporate more sophisticated means. The air guide 13 may also be secured using securing means such as a clip, or Velcro attachments. It may also be secured using the tubing of air guide 13 itself, in a similar fashion to nasal cannulae,

by treading the air guide 13 tubing around the side of the user's head and behind the ears, such that the tubing rests on the ears and extends towards the user's face and nose.

Whilst there has been described in the foregoing description preferred embodiments of
5 the present invention, it will be understood by those skilled in the technology concerned that many variations in details of design, construction and/or operation may be made without departing from the present invention.

The Claims

1. A respiratory device including an envelope structure, the envelope structure comprising at least one or more filter elements; an air guide forming a pathway with one end in communication with the inside of the envelope structure and extending from the envelope structure; wherein
5 an opposed end of the air guide is mounted to a pair of nasal plugs, for delivering air from the envelope structure to the nasal plugs.
2. A respiratory device according to claim 1, wherein the respiratory device
10 further includes a securing means, for securing the respiratory device to a user.
3. A respiratory device according to any one of the preceding claims, wherein at least one of said one or more filter elements is an anti-
15 microbial filter element.
4. A respiratory device according to any one of the preceding claims, wherein the respiratory device includes one or more valve elements arranged to allow unidirectional air flow from outside, to within the
20 envelope structure, the air guide and the nasal plugs.
5. A respiratory device according to claim 4, wherein the respiratory device further includes one or more second set of valve elements arranged to

allow exhaled air entering the nasal plugs to flow from within nasal plugs or air guide to outside.

- 5 6. A respiratory device including one or more filter elements arranged to form an envelope shaped enclosure, for filtering air entering the envelope structure; an air guide forming a pathway with one end in communication with the inside of the envelope shaped enclosure, an opposing end of the air guide in connection with a pair of nasal plugs; and securing means for securing at least one of the envelope shaped enclosure, the air guide or
10 the nasal plugs to a user.