

## **A FACE MASK**

### **Field of Invention**

The present invention relates generally to a face mask for filtering air inhaled by a user thereof.

### **Background**

Conventional surgical masks are worn for catching bacteria shed in liquid droplets and aerosols from the wearer's mouth and nose. However, the surgical masks are also worn, to a for reducing chances of catching virus or bacteria that has been shed by people in the immediate environment of the wearer. As the surgical mask has to be worn in close contact with the wearer's mouth and nose, they have to be changed, at least daily, for hygiene reasons. In an event of a virus outbreak, the demand for such masks increases manifold. Recent events have demonstrated that daily use and change of existing masks based on existing availability and continuous production of these surgical masks to meet immediate demands is unsustainable. Further, the effectiveness of conventional surgical masks has also been called into question. Therefore, there is an apparent need to provide a closure addressing the foregoing problems.

### **Summary**

In accordance with an aspect of the invention, there is disclosed a face mask comprising a mask body adapted to fit over and receive within an inside space a nose and mouth of a wearer. The mask body comprises a tray defining at least one first aperture and a first mating structure circumscribing the at least one first aperture, and a lid movably coupled to the tray and defining at least one second aperture. The mask body further comprises a second mating structure circumscribing the at least one second aperture. The lid is displaceable between a closed position for abutting the first mating structure with the second mating structure to thereby configure the at least one first aperture with the at least one second aperture for fluid communicating the inside space with a mask exterior, and an open position to enable receiving of an air permeable article between the lid and the tray, the first mating structure and the second mating structure sandwiching and forming a substantially air tight seal with the air permeable article when in the closed position such that when the mask body is fitted

over the nose and the mouth of the wearer, exchange of air between the inside space and mask exterior thereof passages substantially through the air permeable article for filtering thereby.

In accordance with a second aspect of the invention, there is disclosed a face mask comprising a mask body, a lid and a cover. The mask body is adapted to fit over and receive within an inside space a nose and mouth of a wearer, the mask body comprising a tray defining at least one first aperture and a first mating structure adjacent the at least one first aperture. The mask body further comprises a rigid portion extending and diverging from the tray to terminate at a first periphery and a skirt portion extending from the first periphery and away from the tray to terminate at a second periphery. Each of the rigid portion and the skirt portion being shaped and dimensioned to enable contact of the face of the wearer with the skirt portion of the mask body, the skirt portion further being at least one of elastic, shaped and dimensioned for conforming to the contours of the face area around the nose and mouth of the wearer for substantially forming a seal therewith. The lid is movably coupled to the tray and defining at least one second aperture and a second mating structure adjacent the at least one second aperture. The lid is displaceable between a closed position for abutting the first mating structure with the second mating structure to thereby configure the at least one first aperture with the at least one second aperture for fluid communicating the inside space with a mask exterior, and an open position to enable receiving of an air permeable article between the lid and the tray, the tray being decouplable from the mask body for forming a cartridge assembly with the lid and the air permeable article disposed between the tray and the lid, the lid being movably coupled to the tray. The cover is moveably coupled to the mask body and displaceable between a secure position for securing the cartridge assembly to the mask body, and a release position for enabling removable of the cartridge assembly from the mask body. The mask body defines a receptacle for receiving the cartridge assembly, the receptacle defining a first opening and the cover defining a second opening for being aligned with the at least one first aperture and the at least one second aperture when the cartridge assembly is received by the receptacle and the cover is in the secure position for securing the cartridge assembly to the mask body to thereby fluid communicate the inside space of the mask body with the mask exterior substantially through the air permeable material, the receptacle comprising a first compressible seal for abutting the cartridge assembly for

forming a substantially air-tight seal therewith and the cover comprising a second compressible seal for abutting the cartridge assembly for forming a substantially air-tight seal therewith, the cartridge assembly being disposed substantially between the first compressible seal and the second compressible seal when the cover is in the secure position for compressing the air permeable article between the tray and the lid such that when the mask body is fitted over the nose and the mouth of the wearer, exchange of air between the inside space and mask exterior thereof passages substantially through the air permeable article for filtering thereby.

### **Brief Description of the Drawings**

FIG. 1 shows a partial front perspective view of a face mask comprising a mask body, a cover, a tray and a lid in accordance with an aspect of the invention with the cover being in the secure position;

FIG. 2 shows a partial front perspective view of the face mask of FIG. 1 with the cover being in the release position and the lid being in the closed position and forming a cartridge assembly with the tray;

FIG. 3 shows a partial front perspective view of the face mask of FIG. 2 with the tray being detachable and displaced from a receptacle of the mask body;

FIG. 4 shows a partial side sectional view of the face mask along section A-A of FIG. 1 with the cover in a secure position and the lid in the closed position;

FIG. 5 shows a partial perspective view of the of the cartridge assembly of FIG. 3 being detached from the mask body with the lid being in an open position; and

FIG. 6 shows another partial front perspective view of FIG. 1 with securing means being rigged with the at least one anchor formed with the mask body.

**Detailed Description**

Reference will now be made in detail to an exemplary embodiment of the present invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the embodiment, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of embodiments of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be recognized by one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the embodiments of the present invention

An exemplary embodiment of the invention, a face mask 20, is described with reference to FIGS 1 to 6. The face mask 20 is preferably used for filtering air for inhalation by a wearer thereof and to impede germs and viruses carried by bodily fluids from being exhausted from the nose and mouth of the wearer from reaching the people or environment therearound.

The face mask 20 comprises a mask body 22 adapted to fit over and receive within an inside space 24 a nose and mouth of a wearer. The mask body 22 comprises a tray 30 defining at least one first aperture 32 and a first mating structure 34 circumscribing the at least one first aperture 32. The face mask 20 further comprises a lid 36 movably coupled to the tray 22 and defining at least one second aperture 38 and a second mating structure 40 circumscribing the at least one second aperture 38. In an implementation of the face mask 20, the first mating structure 34 substantially circumscribes the at least one first aperture 32 and the second mating structure 34 substantially circumscribes the at least one second aperture 38.

The lid 36 is displaceable between a closed position and an open position. In the closed position, the first mating structure 34 abuts the second mating structure 40 to thereby configure the at least one first aperture 32 with the at least one second aperture 38 for fluid communicating the inside space 24 with a mask exterior 42. In the open position, an air

permeable article 44 is receivable between the lid 36 and the tray 30. The first mating structure 34 and the second mating structure 40 sandwich and form a substantially air tight seal with the air permeable article 44 when in the closed position such that when the mask body 22 is fitted over the nose and the mouth of the wearer, exchange of air between the inside space 24 and mask exterior 42 thereof passages substantially through the air permeable article 44 for filtering thereby.

Preferably, at least one of the mask body 22 and the lid 36 being formed from material that is substantially not air-permeable. The first mating structure 34 and the second mating structure 40 have complementary shapes and dimension to shape-conform with one another and for locating the air permeable article 44 between the at least one first aperture 32 and the at least one second aperture 38 when the lid 36 is in the closed position.

Further, at least one of the first mating structure 34 and the second mating structure 40 is a ridge 46a/46b protruding from a frame 48a/48b and circumscribing the respective one of the at least one first aperture 32 and the at least one second aperture 38. The ridge 46a/46b of each of the tray 30 and lid 36 is preferably one of resiliently biased and rigid for abutting the air permeable article 44 for forming substantially air-tight seal with the air permeable article 44 when the lid 36 is in the closed position. Preferably, the ridge 46a/46b of one of the tray 30 and the lid 36 is substantially flat while the ridge 46a/46b of the other thereof is shaped as a raised ridge. The ridge 46a/46b may be form integral the frame 48a/48b, formed as one or more layers of material coating, for example elastomeric coating, or is a seal article being shaped and dimensioned for snap-fitting, adhering or fastening to the respective frame 48a/48b. Alternatively, the ridge 46a/46b of both the tray 30 and the lid 36 has substantially the same shape and dimension with both the ridge 46a/46b of both the tray 30 and the lid 36 being either substantially flattened or raised.

The mask body 22 further comprises a rigid portion 50 extending and diverging from the tray 30 to terminate at a first periphery 52, and a skirt portion 54 extending from the rigid portion 50 and away from the tray 30 to terminate at a second periphery 56. Preferably, each of the rigid portion 50 and the skirt portion 54 being shaped and dimensioned to enable contact of the face of the wearer with the skirt portion. The skirt portion 54 is preferably at least one of

elastic, shaped and dimensioned for conforming to the contours of the face area around the nose and mouth of the wearer for substantially forming a seal therewith. The skirt portion 54 is one of fixably and removably coupled to the tray 50 at the first periphery 52. Preferably, the skirt portion 54 is made from bio-compatible silicon while the rigid portion 50 is formed from polypropylene.

The tray 30 comprises one of a hinge 58 for rotatably coupling and longitudinal guides, for example a guide rail or guide rod assembly, for slidably coupling the lid 36 with the mask body 22, specifically the tray 30 thereof, to enable reciprocation between the open position and the closed position. Further, one of the mask body 22 and the lid 36 comprising at least one of a clasp 60, a latch, screw threadings, a bolt, a pin and a yieldably snap-fittable structure for securing the lid 36 to the mask body 22 when in the closed position.

The face mask 20 further comprises at least one anchor 62 formed on the mask body 22 for coupling of securing means 64 thereto. The at least one anchor 62 can be at least one loop or hook extending from the mask body 22 or at least one hole or notch formed in the mask body 22. The securing means 63 is rigged for being worn around at least a portion of the head of the wearer for positioning and substantially securing the mask body 22 around the nose and mouth of the wearer. Preferably, the securing means 64 is one of strings straps, elastic bands and a harness for being worn over at least one of the scalp, nape, neck and ear of the wearer.

In one embodiment of the face mask 20, the tray 30 is decouplable from the mask body 22 for forming a cartridge assembly 70 with the lid 36 and the air permeable article 44 disposed between the tray 30 and the lid 36. The lid 36 remains movably coupled to the tray 30 in the cartridge assembly 70. In this embodiment, the face mask further comprises a cover 72 being moveably coupled to the mask body 22 at a cover hinge 73 and displaceable between a secure position for securing the cartridge assembly 70 to the mask body 22, and a release position for enabling removable of the cartridge assembly 70 from the mask body 22. The cover hinge 73 is preferably adapted to enable removable coupling of the cover 72, for example by snap-fitting thereof, to the mask body to enable detachment of the cover 72 from the mask body 22.

As such, the mask body 22 defines a receptacle 74 for receiving the cartridge assembly 70. The receptacle 74 defines a first opening 76a and the cover defines a second opening 76b for being aligned with the at least one first aperture 32 and the at least one second aperture 38 when the cartridge assembly 70 is received by the receptacle 74 and the cover 72 is in the secure position for securing the cartridge assembly 70 to the mask body 22 to thereby fluid communicate the inside space 24 of the mask body 22 with the mask exterior 42 substantially through the air permeable material 44.

Preferably, ribs 77a/77b are formed and extend between the respective frame 48a/48b for defining the respective one of the at least one first aperture 32 and the at least one second aperture 38. The cartridge assembly 70 is adapted for receiving the air permeable article 44 of varying thickness between the tray 30 and the lid 36.

Preferably, the receptacle 74 comprises a first compressible seal 78a for abutting the cartridge assembly 70 for forming a substantially air-tight seal therewith and the cover 72 comprises a second compressible seal 78b for abutting the cartridge assembly 70 for forming a substantially air-tight seal therewith. The cartridge assembly 70 is disposed substantially between the first compressible seal 78a and the second compressible seal 78b when the cover 72 is in the secure position to thereby further compress the air permeable article 44 between the tray 30 and the lid 36. Hence, when the tray 30 and lid 36 are implemented as the cartridge assembly 70 for disposing between the mask body 22 and the cover 72, the clasp 60 can instead be formed on one of the mask body 22 and the cover 72 for securing the cover 72 to the mask body 22 when in the secure position.

Preferably, the tray 30 and the lid 36 are coated with biocidal iodinated resin. Further, the air permeable article 44 comprises at least one of textile, cloth, cellulosic material, a sponge, multi-ply surgical mask material and filter material of varying thickness. The frame 48a/48b of the tray 30 and the lid 36 forming the cartridge assembly 70 can be used as a stencil template for shaping existing materials for use as the air permeable material 44. For example, part of a large piece of paper towel or a piece of surgical mask may be clasped between the tray 30 and the lid 36 so that the outline of the frame 48a/48b may be used as a guide for cutting the large piece of paper towel or surgical mask into multiple parts for shape

fitting the outline of the frame 48a/48b. This enables the exemplary large piece of paper towel or a piece of surgical mask which may be used only once into multiple pieces, for example into six pieces, to thereby extend the number of times the single piece of surgical mask or paper towel can be used as the air permeable article 44.

The face mask 20 can further comprise at least one of a sensor module coupled to at least one of the lid 36 and the mask body 22 for monitoring quality of air being filtered by the air permeable article 44 and the respiratory condition of the wearer estimated from the air in the inside space 24 of the mask body 44, and a dispenser removably coupled to at least one of the lid 36 and the mask body 22 for dispensing one of fluids and atomized fluids one of onto the air permeable material 44 and into the inside space 24 of the mask body 22.

The face mask 20 can also further comprise one of a visor and an eye mask coupled to the mask body 22 and positioned by the mask body 22 over the eyes of the wearer without occluding vision thereof when the mask body 22 is worn over the nose and mouth of the wearer.

Also, the face mask 20 can further comprise a one-way valve formed with or adapted for coupling to the mask body 22 to facilitate one way exhaust of air from the inside space 24, specifically the exhalation of the wearer, to the mask exterior 42 therevia.

In a forgoing manner, a face mask is described according to an exemplary embodiment of the invention. Although only one embodiment of the invention is disclosed in this document, it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modifications can be made to the disclosed embodiment without departing from the scope and spirit of the invention.

**Claims**

1. A face mask comprising:
  - a mask body adapted to fit over and receive within an inside space a nose and mouth of a wearer, the mask body comprising a tray defining at least one first aperture and a first mating structure adjacent the at least one first aperture; and
  - a lid movably coupled to the tray and defining at least one second aperture and a second mating structure adjacent the at least one second aperture, the lid being displaceable between a closed position for abutting the first mating structure with the second mating structure to thereby configure the at least one first aperture with the at least one second aperture for fluid communicating the inside space with a mask exterior, and an open position to enable receiving of an air permeable article between the lid and the tray,
  - wherein the first mating structure and the second mating structure sandwich the air permeable article therebetween when in the closed position such that when the mask body is fitted over the nose and the mouth of the wearer, exchange of air between the inside space and mask exterior thereof passages substantially through the air permeable article for filtering thereby.
2. The face mask as in claim 1, the first mating structure substantially circumscribing the at least one first aperture and the second mating structure substantially circumscribing the at least one second aperture,
  - wherein the first mating structure and the second mating structure form a substantially air tight seal with the air permeable article when in the closed position
3. The face mask as in claim 1, at least one of the mask body and the lid being formed from material that is substantially not air-permeable.
4. The face mask as in claim 1, the first mating structure and the second mating structure having complementary shapes and dimension for locating the air permeable article between the at least one first aperture and the at least one second aperture when the lid is in the closed position.

5. The face mask as in claim 1, at least one of the first mating structure and the second mating structure being a ridge protruding from a frame and substantially circumscribing the respective one of the at least one first aperture and the at least one second aperture, the ridge being one of resiliently biased and rigid for abutting the air permeable article for forming substantially air-tight seal with the air permeable article when the lid is in the closed position.
6. The face mask as in claim 1, the mask body comprising:
  - a rigid portion extending and diverging from the tray to terminate at a first periphery; and
  - a skirt portion extending from the rigid portion and away from the tray to terminate at a second periphery, each of the rigid portion and the skirt portion being shaped and dimensioned to enable contact of the face of the wearer with the skirt portion of the mask body, the skirt portion further being at least one of elastic, shaped and dimensioned for conforming to the contours of the face area around the nose and mouth of the wearer for substantially forming a seal therewith.
7. The face mask as in claim 6, the skirt portion being one of fixably and removably coupled to the tray at the first periphery.
8. The face mask as in claim 1, the tray comprising one of a hinge for rotatably coupling and longitudinal guides for slidably coupling the lid with the tray and enabling reciprocation between the open position and the closed position.
9. The face mask as in claim 8, one of the mask body and the lid comprising at least one of a clasp, a latch, screw threadings, a bolt, a pin and a yieldably snap-fittable structure for securing the lid to the mask body when in the closed position.
10. The face mask as in claim 1, further comprising at least one anchor formed on the mask body for coupling of securing means thereto, the securing means being rigged for being worn around at least a portion of the head of the wearer for positioning and substantially securing the mask body around the nose and mouth of the wearer.

11. The face mask as in claim 10, the securing means being one of strings straps, elastic bands and a harness for being worn over at least one of the scalp, nape, neck and ear of the wearer.
12. The face mask as in claim 1, the tray being decouplable from the mask body for forming a cartridge assembly with the lid and the air permeable article disposed between the tray and the lid, the lid being movably coupled to the tray.
13. The face mask as in claim 12, further comprising:
  - a cover moveably coupled to the mask body and displaceable between a secure position for securing the cartridge assembly to the mask body, and a release position for enabling removable of the cartridge assembly from the mask body.
14. The face mask as in claim 13, the mask body defining a receptacle for receiving the cartridge assembly, the receptacle defining a first opening and the cover defining a second opening for being aligned with the at least one first aperture and the at least one second aperture when the cartridge assembly is received by the receptacle and the cover is in the secure position for securing the cartridge assembly to the mask body to thereby fluid communicate the inside space of the mask body with the mask exterior substantially through the air permeable material.
15. The face mask as in claim 14, the receptacle comprising a first compressible seal for abutting the cartridge assembly for forming a substantially air-tight seal therewith and the cover comprising a second compressible seal for abutting the cartridge assembly for forming a substantially air-tight seal therewith, the cartridge assembly being disposed substantially between the first compressible seal and the second compressible seal when the cover is in the secure position for compressing the air permeable article between the tray and the lid.

16. The face mask as in claim 1, the air permeable article comprising at least one of textile, cloth, cellulosic material, a sponge, multi-ply surgical mask material and filter material.
17. The face mask as in claim 1, the tray and the lid being coated with biocidal iodinated resin.
18. The face mask as in claim 1, further comprising at least one of:
  - a sensor module coupled to at least one of the lid and the mask body for monitoring quality of air being filtered by the air permeable article and the respiratory condition of the wearer estimated from the air in the inside space of the mask body; and
  - a dispenser removably coupled to at least one of the lid and the mask body for dispensing one of fluids and atomized fluids one of onto the air permeable material and into the inside space of the mask body.
19. The face mask as in claim 1, further comprising:
  - one of a visor and an eye mask coupled to the mask body and positioned by the mask body over the eyes of the wearer without occluding vision thereof when the mask body is worn over the nose and mouth of the wearer.
20. A face mask comprising:
  - a mask body adapted to fit over and receive within an inside space a nose and mouth of a wearer, the mask body comprising:
    - a tray defining at least one first aperture;
    - a first mating structure adjacent the at least one first aperture;
    - a rigid portion extending and diverging from the tray to terminate at a first periphery; and
    - a skirt portion extending from the first periphery and away from the tray to terminate at a second periphery, each of the rigid portion and the skirt portion being shaped and dimensioned to enable contact of the face of the wearer with the skirt portion of the mask body, the skirt portion further being

at least one of elastic, shaped and dimensioned for conforming to the contours of the face area around the nose and mouth of the wearer for substantially forming a seal therewith,

a lid movably coupled to the tray and defining at least one second aperture and a second mating structure adjacent the at least one second aperture, the lid being displaceable between a closed position for abutting the first mating structure with the second mating structure to thereby configure the at least one first aperture with the at least one second aperture for fluid communicating the inside space with a mask exterior, and an open position to enable receiving of an air permeable article between the lid and the tray, the tray being decouplable from the mask body for forming a cartridge assembly with the lid and the air permeable article disposed between the tray and the lid, the lid being movably coupled to the tray; and

a cover moveably coupled to the mask body and displaceable between a secure position for securing the cartridge assembly to the mask body, and a release position for enabling removable of the cartridge assembly from the mask body,

wherein the mask body defines a receptacle for receiving the cartridge assembly, the receptacle defining a first opening and the cover defining a second opening for being aligned with the at least one first aperture and the at least one second aperture when the cartridge assembly is received by the receptacle and the cover is in the secure position for securing the cartridge assembly to the mask body to thereby fluid communicate the inside space of the mask body with the mask exterior substantially through the air permeable material, the receptacle comprising a first compressible seal for abutting the cartridge assembly for forming a substantially air-tight seal therewith and the cover comprising a second compressible seal for abutting the cartridge assembly for forming a substantially air-tight seal therewith, the cartridge assembly being disposed substantially between the first compressible seal and the second compressible seal when the cover is in the secure position for compressing the air permeable article between the tray and the lid, such that when the mask body is fitted over the nose and the mouth of the wearer, exchange of air between the inside space and mask exterior thereof passages substantially through the air permeable article for filtering thereby.