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Magidson et al.

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(54) **DUAL MODE RESPIRATOR**

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(51) **Int. Cl.**

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A62B 7/10	(2006.01)
A62B 9/04	(2006.01)

(52) **U.S. Cl.**

CPC ***A62B 9/02*** (2013.01); ***A62B 7/10*** (2013.01); ***A62B 9/04*** (2013.01)

(58) **Field of Classification Search**

CPC A62B 9/02; A62B 9/04; A62B 7/10

See application file for complete search history.

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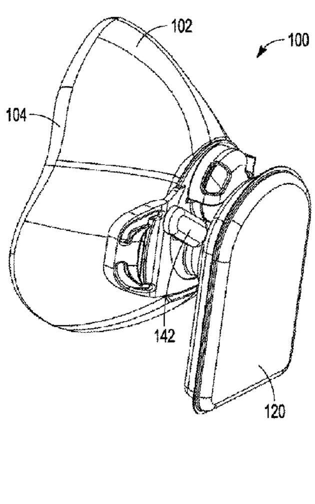
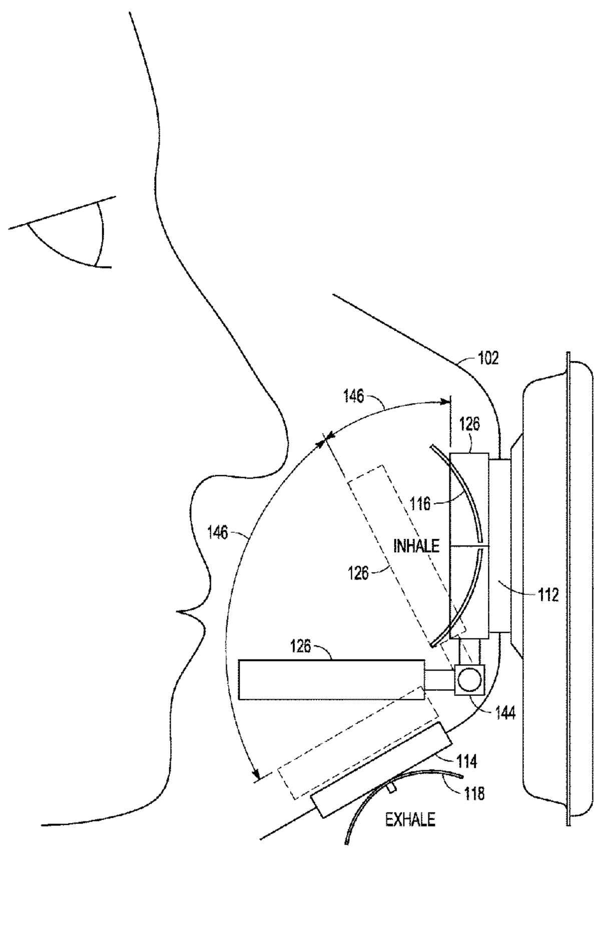
(57) **ABSTRACT**

In some examples, a dual mode respirator comprises a face piece; an inhalation port; an exhalation port; and a port closure movable to close the exhalation port and switch the dual mode respirator from a source control mode to a free exhalation mode of the dual mode respirator.

16 Claims, 7 Drawing Sheets





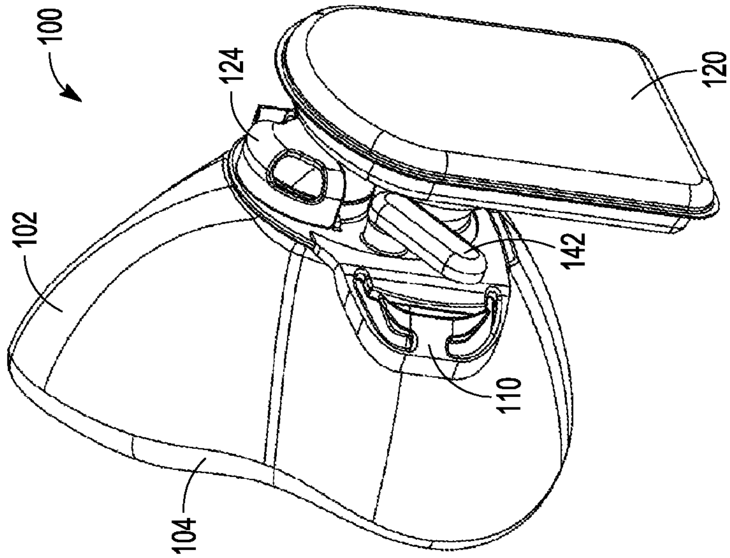


FIG. 2

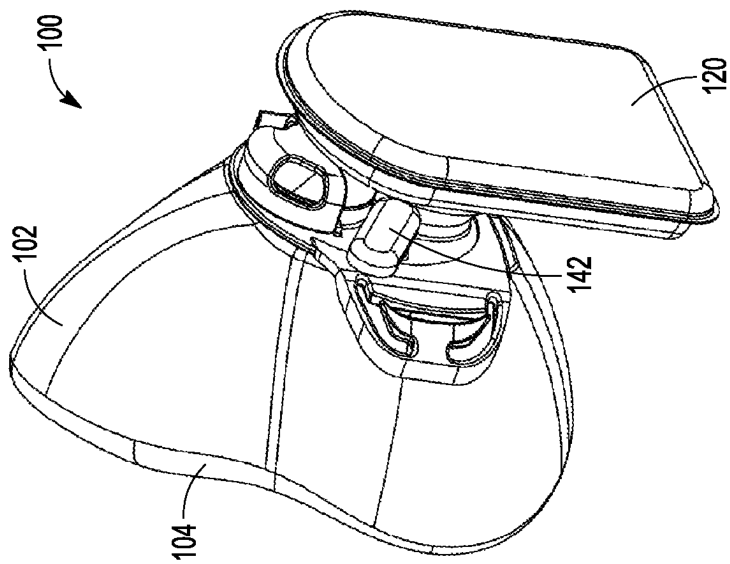


FIG. 1

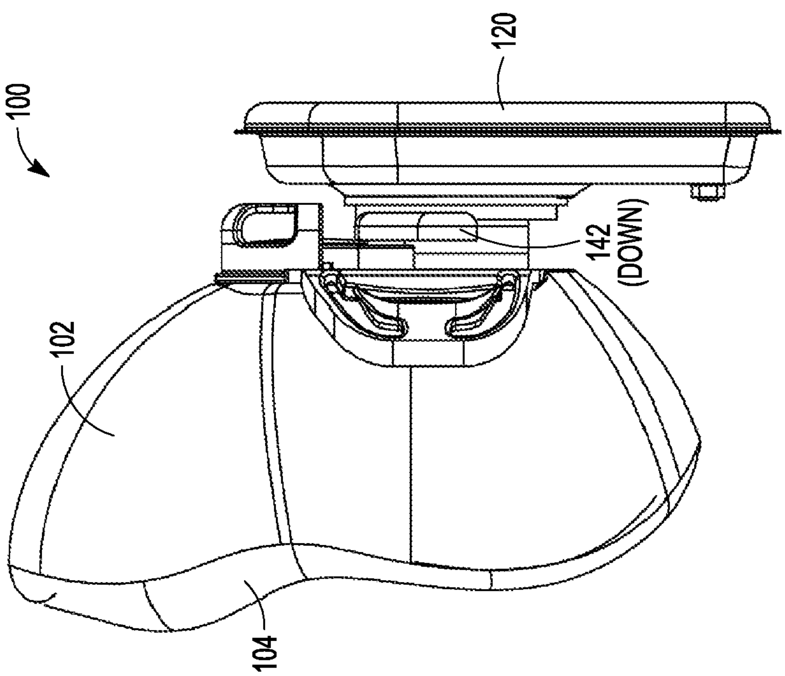


FIG. 4

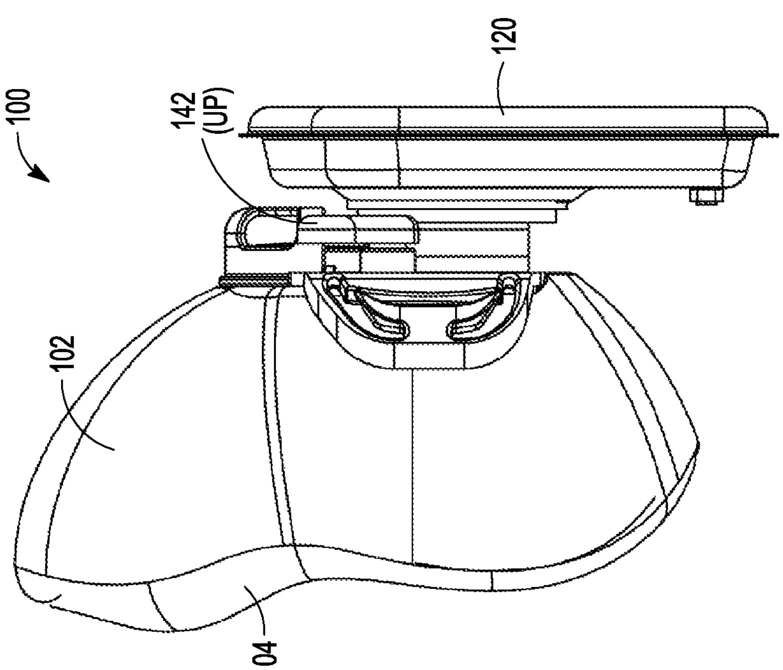


FIG. 3

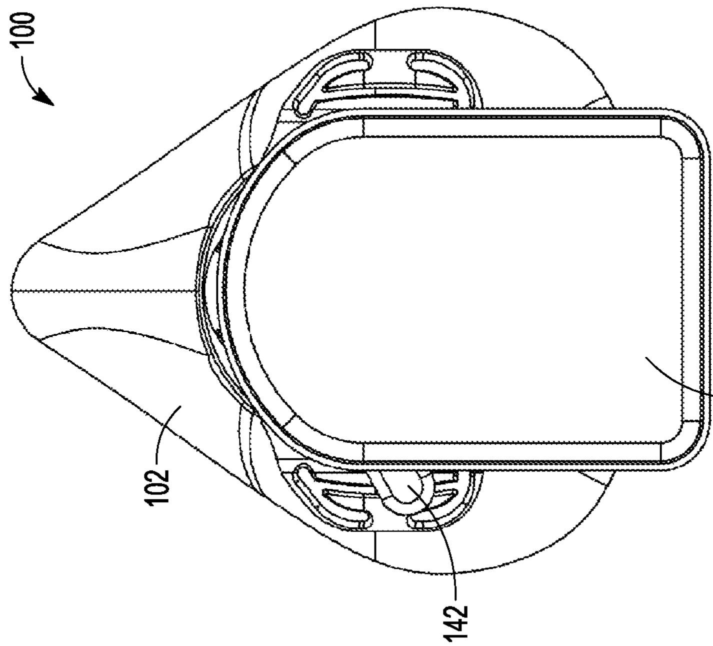


FIG. 6

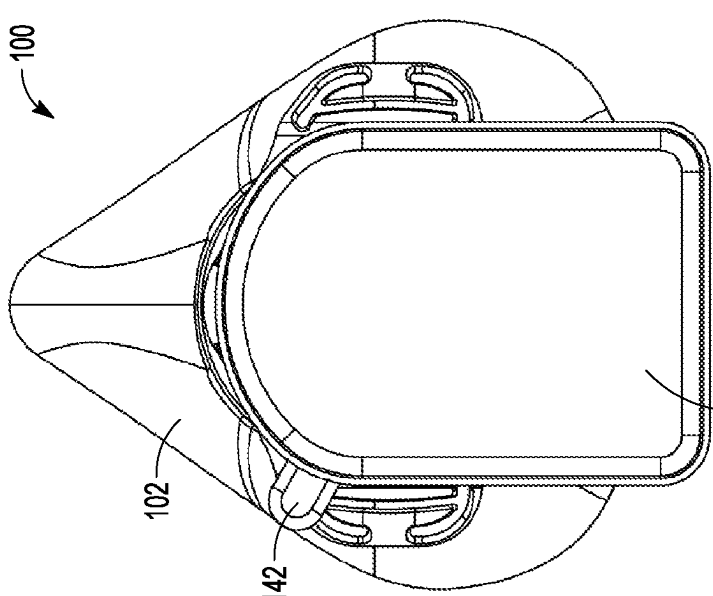


FIG. 5

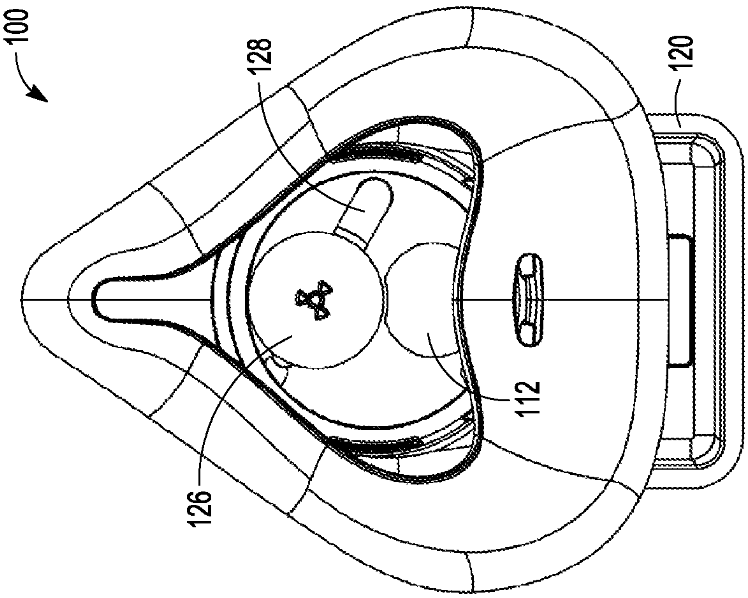


FIG. 8

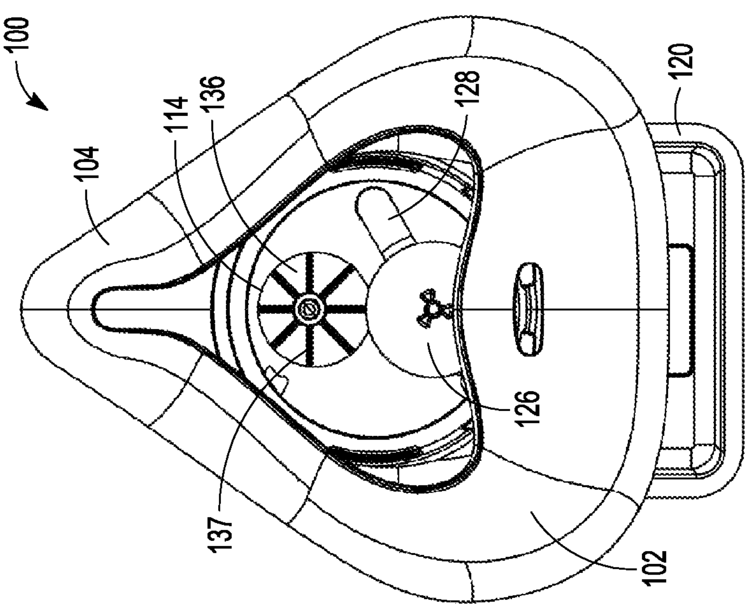


FIG. 7

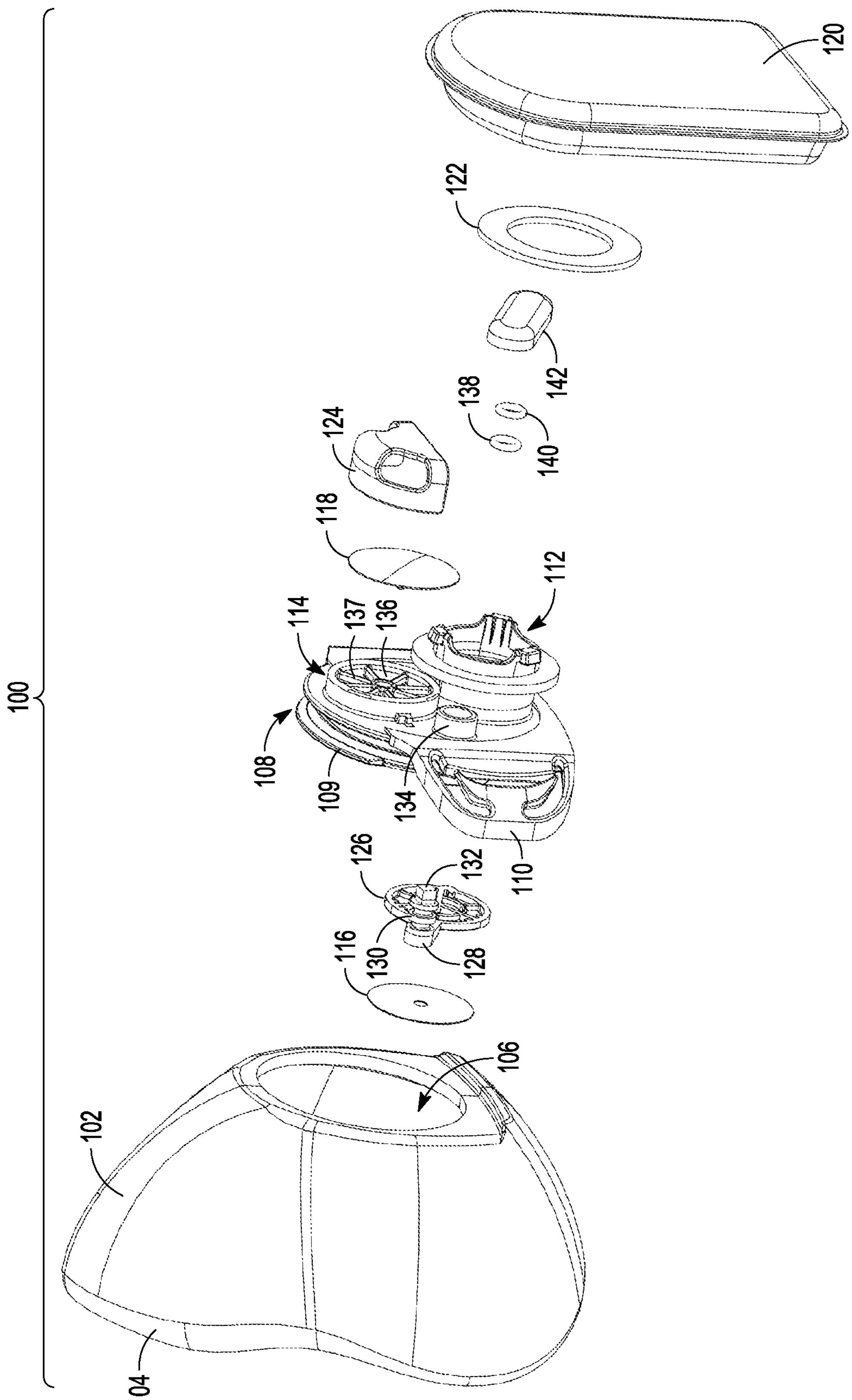


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FIG. 9

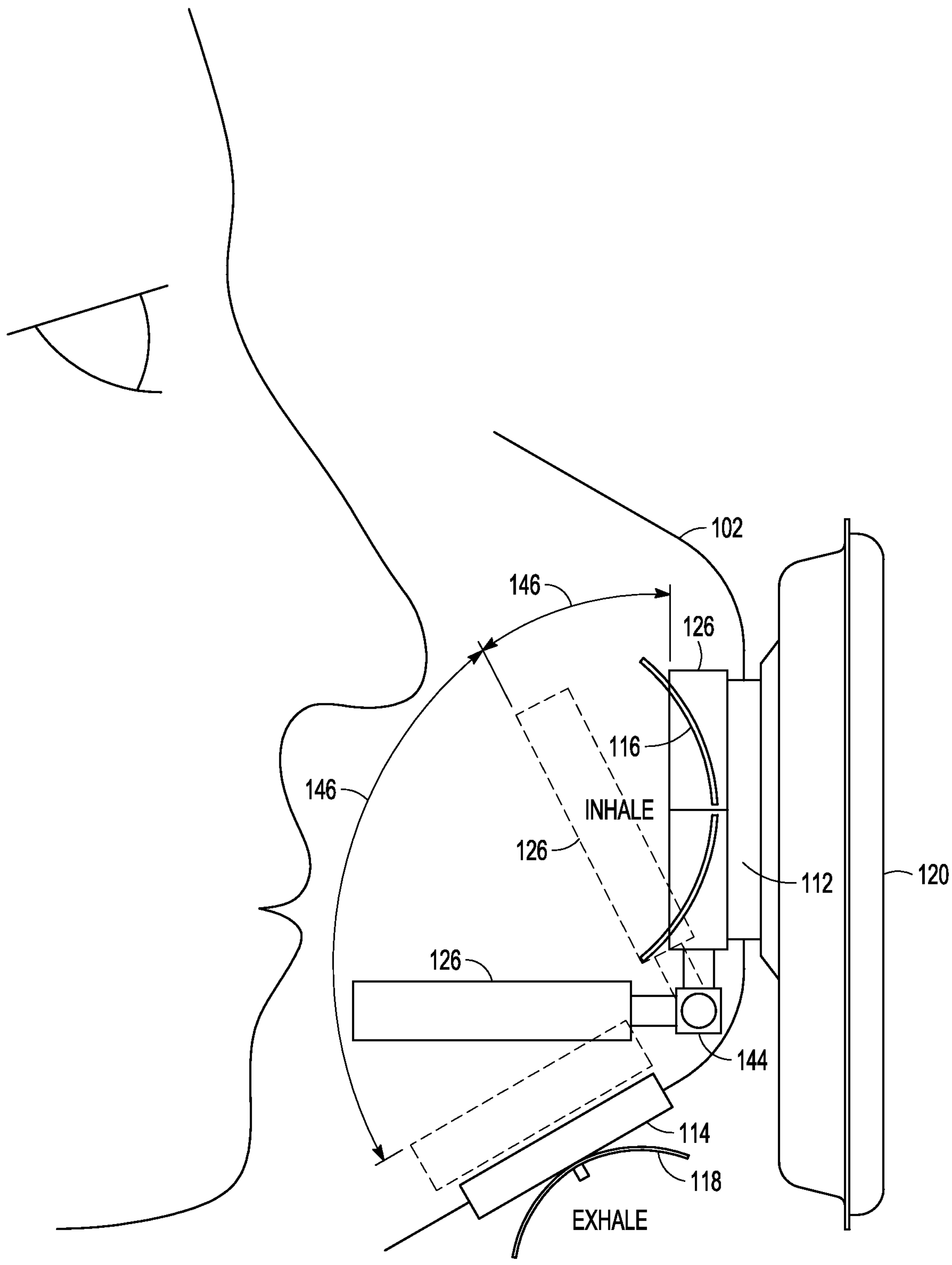

FIG. 10

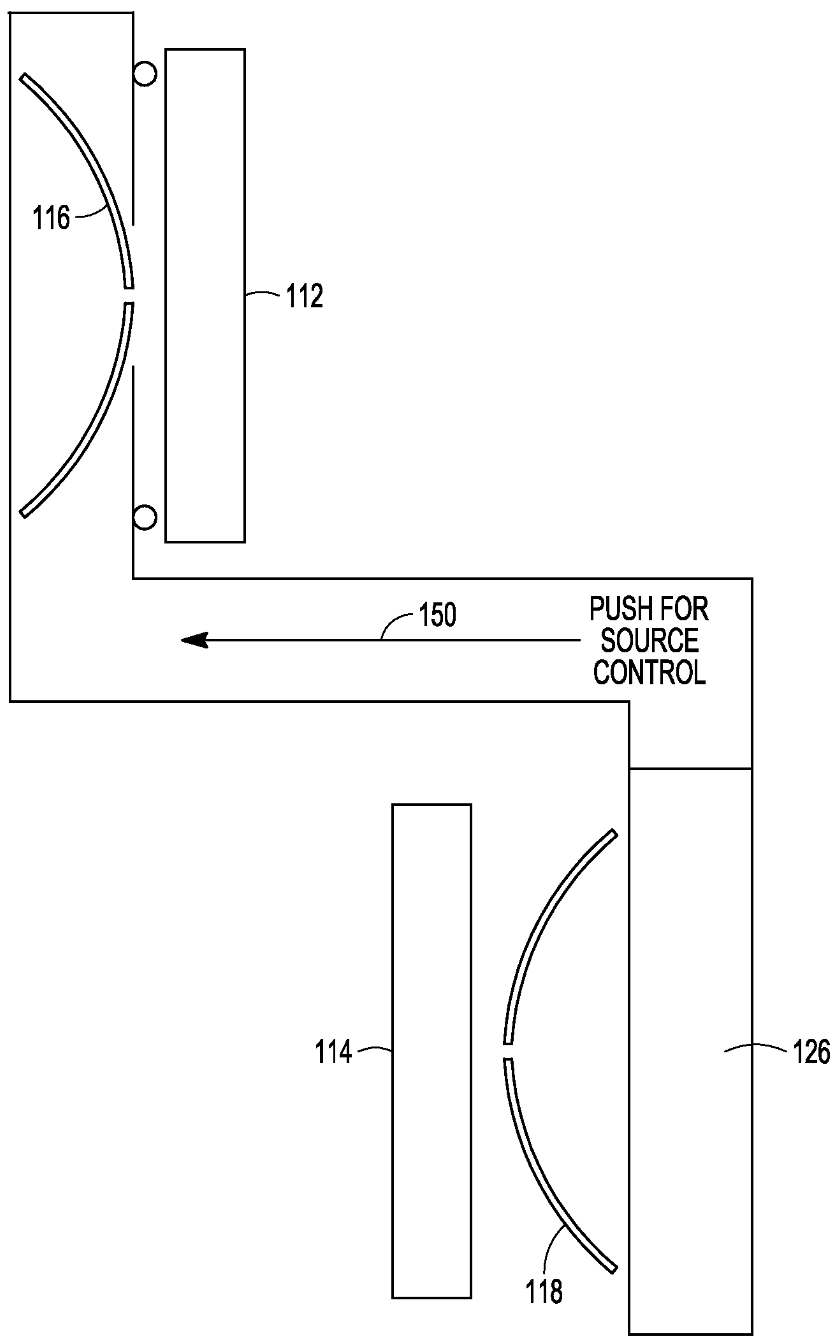

FIG. 11

DUAL MODE RESPIRATOR

TECHNICAL FIELD

The present disclosure relates to a dual mode respirator. Some examples enable source control and free exhalation breathing modes allowing a respirator user to switch back and forth conveniently between the two modes while wearing the respirator.

BACKGROUND

Respirator masks, also known as respirators, are generally used to protect a user against air pollutants or airborne particles while breathing. A closed gas compartment, which is separated from the environment, is formed for the user by means of a mask body that can be arranged over the user's mouth and nose. By means of at least one exhalation valve and at least one inhalation valve both of which are arranged on the mask body and penetrate the same, a gas or air exchange can then take place between the user and the environment through the mask body. In addition, the mask bodies usually, comprise coupling elements wherein one or more head fastening straps can be fastened to the coupling elements and, when tightened around the back of the user's head, pull the respirator against the user's face to ensure that the respirator tightly lies against the face.

With the advent of the Covid pandemic and other airborne diseases, the use of masks and respirators has increased significantly. Some conventional respirators have a source control-breathing configuration. No exhalation port or valve is typically provided in this configuration. This source control configuration is fixed and intended to restrict free exhalation and control the source of a user's exhaled breath to prevent spread of viruses that could be transmitted via exhaled airborne particles.

One problem with respirators having a fixed source control configuration is that heat and moisture can quickly build up inside the face piece and become uncomfortable. This heat and moisture build up cannot easily be removed without tearing off the respirator. This is not convenient or safe when seeking to restrict the spread of airborne viruses, or when working in close environments with other colleagues. In extreme cases, a user might even be tempted not to use a respirator, completely negating its intended use and safety function.

SUMMARY

In some examples, the present disclosure addresses a need to maintain a fixed source control when required but allows the user to select a second mode of operation that allows for the evacuation of heat and moisture through an exhalation valve at those times when the exhalation of the user's breath does not pose a risk to others, while maintaining protection for the user and not requiring the removal of the respirator.

Thus, in some examples, a dual mode respirator comprises a face piece; an inhalation port; an exhalation port; and a port closure movable to close the exhalation port and switch the dual mode respirator from a source control mode to a free exhalation mode of the dual mode respirator.

In some examples, the dual mode respirator further comprises a first valve diaphragm associated with the inhalation port, and a second valve diaphragm associated with the exhalation port or the port closure, the first valve diaphragm and the second valve diaphragm respectively operable to open or close the inhalation port and the exhalation port under air pressure fluctuations within the dual mode respirator in use.

In some examples, the port closure is generally coin-shaped and sized to close the exhalation port when moved to a closing position of the exhalation port in a source control mode of the dual mode respirator.

In some examples, the port closure is movable within the face piece in a circular path around a rotation axis.

In some examples, the port closure has a flat surface sized to close the exhalation port in the source control mode of the dual mode respirator.

In some examples, the circular path is coincident with or parallel to a plane of the flat surface of the port closure.

In some examples, the dual mode respirator further comprises an exoskeleton supported in an opening of a face piece.

In some examples, a rotation axis is defined by a shaft mounted rotatably in the exoskeleton, the shaft extending through the exoskeleton between an internal end and an external end of the shaft.

In some examples, the dual mode respirator further comprises an internal lever, the internal lever connected to the internal end of the shaft.

In some examples, the port closure is connected to the internal lever and is rotatable about the rotation axis under action of the internal lever.

In some examples, the dual mode respirator further comprises an external lever, the external lever connected to the external end of the shaft.

In some examples, the external lever is operable by a user to switch the dual mode respirator between the source control mode and a free exhalation mode of the dual mode respirator.

In some examples, the exhalation port is positioned above the exhalation port in the exoskeleton or the face piece.

In some examples, the exhalation port is positioned below the exhalation port in the exoskeleton or the face piece.

In some examples, the port closure is pivotable about a hinge to open or close the exhalation port and effect a switch between the source control mode and the free exhalation mode of the dual mode respirator.

In some examples, the port closure is moveable in a linear direction relative to the face piece to open or close the exhalation port and effect a switch between the source control mode and the free exhalation mode of the dual mode respirator.

In some examples, the port closure is vented and carries a diaphragm to open or close vents in the port closure during an inhalation or exhalation of a user.

In some examples, the port closure is unvented.

DESCRIPTION OF THE DRAWINGS

The drawings illustrate generally, by way of example, but not by way of limitation, various embodiments discussed in the present document. For ease of understanding and simplicity, common numbering of elements within the illustrations may be employed where an element is the same in different drawings.

FIG. **1** is a pictorial view of a dual mode respirator in a free exhalation-breathing mode, according to an example.

FIG. **2** is a pictorial view of the dual mode respirator of FIG. **1** in a source control-breathing mode, according to an example.

FIG. **3** is a left side view of the dual mode respirator of FIG. **1** in a free exhalation-breathing mode, according to an example.

FIG. **4** is a left side view of the dual mode respirator of FIG. **1** in a source control-breathing mode, according to an example.

FIG. **5** is a front view of the dual mode respirator FIG. **1** in a free exhalation-breathing mode, according to an example.

FIG. **6** is a front view of a dual mode respirator FIG. **1** in a source control-breathing mode, according to an example.

FIG. **7** is a rear view of the dual mode respirator FIG. **1** in a free exhalation-breathing mode, according to an example.

FIG. **8** is a rear view of the dual mode respirator FIG. **1** in a source control-breathing mode, according to an example.

FIG. **9** is an exploded view of the dual mode respirator FIG. **1** illustrating certain components thereof, according to an example.

FIG. **10** shows aspects of a dual mode respirator, according to another example.

FIG. **11** shows aspects of a dual mode respirator, according to yet another example.

DETAILED DESCRIPTION

The following is a detailed description of illustrative examples of the present disclosure. As these examples are described with reference to the aforementioned drawings, various modifications, or adaptations of the methods and or specific structures described may become apparent to those skilled in the art. All such modifications, adaptations, or variations that rely upon the teachings of the present disclosure, and through which these teachings have advanced the art, are considered to be within the scope of the present disclosure. Hence, these descriptions and drawings are not to be considered in a limiting sense, and the present examples are in no way limited to the embodiments illustrated.

As mentioned above, with the recent advent of pandemics and increased threat of other airborne diseases, the use of masks and respirators has become more prevalent. Some conventional respirators have a source control-breathing configuration in which no exhalation valve is provided. In a source control mode or configuration, a user's inhaled and exhaled breath may pass through a common inhale and exhale orifice or valve. The orifice or valve may be connected to a filter. The source control configuration is fixed and disallows free exhalation of a user's breath. The source of a user's exhaled breath is restricted to prevent spread of viruses that can be transmitted via exhaled airborne particles.

The present inventors have recognized, among other things, that a significant problem with respirators having a source control configuration is that heat and moisture can quickly build up inside the face piece and become uncomfortable. In some instances, a user might be tempted to remove or not even wear a respirator, completely negating its intended use and allowing the free spread of airborne disease.

The present subject matter can help provide a solution to this problem, such as by providing a dual mode respirator enabling dual source control and free exhalation breathing modes. Some present examples allow a respirator wearer to switch back and forth conveniently between the two modes while wearing the respirator. Heat and moisture can be released without having to take the respirator off.

Some examples of a free exhalation-breathing mode enable filtered or non-filtered exhalation. Some examples of a source control-breathing mode enable filtered inhalation and filtered exhalation. Combinations of inhalation and exhalation filtration are possible in the two modes.

The accompanying drawings FIGS. **1-9** illustrate one example of a dual mode respirator according to the present disclosure. Other examples of respirators and respirator configurations are possible, for example shown in FIGS. **10-11**. With reference in particular to the exploded view of FIG. **9**, a dual mode respirator **100** comprises a face piece **102**, which is formed to separate the nose and the mouth of a user from the environment when worn. The face piece **102** includes a flexible sealing lip **104** which faces the user and fits to the shape of the user's face in a gas-tight manner while the respirator **100** is pressed against the user's face. The face piece **102** also includes an opening **106** disposed on the opposite side of the sealing lip **104**. An exoskeleton **108** is supported in the opening **106**. In some examples, the exoskeleton **108** is formed separately of the face piece **102**. In some examples, the exoskeleton is integrally formed with the face piece **102**. In the illustrated example, a retaining formation **109** secures the exoskeleton in the opening **106** of the face piece **102**. The exoskeleton **108** includes a plurality of strap coupling elements **110**, two in the illustrated instance, one on each side of the exoskeleton **108**. The ends of a head strap (not shown) may be fitted to the coupling elements **110** and adjusted as desired.

For purposes of explanation, a direction extending generally between the two coupling elements **110** (i.e., across the exoskeleton **108**) may be said to represent a transverse direction in relation the dual mode respirator **100** and/or the exoskeleton **108** depending on the context. A direction extending generally towards or away from a user's face (when the dual mode respirator is worn) may be said to represent an axial direction in relation to the dual mode respirator **100** and/or the exoskeleton **108** depending on the context.

The exoskeleton **108** includes an inhalation port **112** and an exhalation port **114**. The designations "inhalation" and "exhalation" do not necessarily mean that a designated port operates only in that manner. An inhalation port may allow both inhaled and exhaled air to pass through it, and vice versa, as described in some examples below. In some examples, a valve or valve diaphragm is associated with each of the inhalation and exhalations ports **112** and **114**, respectively. For example, a flexible inhale valve diaphragm **116** may be fitted to the exoskeleton **108** in association with the inhalation port **112**. A flexible exhale valve diaphragm **118** may be fitted to the exoskeleton **108** in association with the exhalation port **114**. The valve diaphragms **116** and **118** can deform or move, under air pressure fluctuations, to open or close the inhalation and exhalation ports **112** and **114**. The exhalation port **114** includes a plurality of vents **136** defined by ribs **137**, for example.

In the source control mode, the exhalation port **114** is closed by a port closure **126** described more fully below. In some examples, the exhale valve diaphragm **118** is carried on the port closure **126**. When switched to the source control mode of the dual mode respirator **100**, the exhalation port **114** is closed and both inhaled and exhaled air passes into and out of the face piece **102** through the inhalation port **112** as the user breathes in and out. In some examples, the inhaled and exhaled air is filtered to remove airborne particles or debris. To this end, an external removable filter **120** is fitted to the exoskeleton **108** and surrounds and covers the inhalation port **112**. In some examples, the removable filter

120 is sealed to the inhalation port 112 by a gasket 122. Other gasket arrangements and filter configurations are possible. In the source control mode of the dual mode respirator 100, inhaled air is filtered to protect the user, and exhaled air is filtered to remove airborne particles and debris and seek to reduce the transmission or airborne viruses and the like. The exhalation port 114 that would otherwise allow the exit of unfiltered air is closed (for example, see FIG. 8). In some examples, the flexible diaphragm 118 installed on the port closure 126 forms a valve to close the exhalation port 114 (for source control). In some examples, the port closure 126 is vented or has apertures extending through it in an axial direction. The flexible exhale diaphragm 118 seals or opens the vents or apertures to allow or prevent the passage of air through the port closure. In some examples, exhalation though the port closure 126 is disallowed, but inhalation is allowed. Some examples may operate in a reverse configuration i.e., exhalation allowed, inhalation prevented through the port closure 126, or an inhalation port or exhalation port 112 or 114 to which the port closure 126 has been moved to lie adjacent a port. In this sense, the port closure 126 operates as a movable one-way valve. In the source control mode, the port closure 126 is moved away from the inhale opening to allow the user to inhale and exhale through the inhale opening. The configuration of the diaphragm 118 on the port closure 126 is such that exhalation through vents in the exhalation port 114 is prevented.

In some examples, the port closure 126 acts merely as a port occluder and carries no vents or apertures allowing air to pass through it. In these or similar examples, the flexible diaphragm 118 may be mounted on the exoskeleton and arranged directly in association with the exhalation port 114. In these configurations, the port closure 126 may be operated in a similar way, but the air blocking and/or venting occurs directly at the exhalation port 114 and not on the port closure 126.

In some examples, in the free exhalation mode of the dual mode respirator 100, inhaled air again passes into the face piece 102 via the removable filter 120 and the inhalation port 112 but, in this mode, air can be quickly exhaled freely via the exhalation port 114. The exhaled air passes through an exhale valve diaphragm cover 124 to the external surrounding environment. In this free exhalation mode, accumulated heat and moisture that has built up within the dual mode respirator 100, for example during a period of source control use, can be discharged quickly and easily through the exhalation port 114. Without needing to remove the dual mode respirator 100, a user can switch between modes and vent accumulated heat and moisture. For increased safety, a user might choose to vent the mask when distanced safely away from colleagues at a work site, for example. Further details of the mode switching capability are described below.

In some examples, internal or external filters are provided in association with the exhalation port 114. If provided, an exhalation port filter may have a less restrictive filtering performance or capacity than the external filter 120 used for source control purposes. Such an arrangement may enable, in some examples, a compromise between a reduced degree of virus protection but nonetheless acceptable breathability and comfort during the free exhalation mode, while still providing a full degree of virus protection, albeit reduced breathability and comfort in the source control mode.

With reference again to FIG. 9, and as mentioned above, the dual mode respirator 100 includes an exhalation port closure 126. The exhalation port closure 126 is movable to close or open the exhalation port 114. In some examples, the port closure 126 is vented and carries a flexible diaphragm acting in conjunction with the vents (opening or closing them under air pressure fluctuations) to operate as a moveable valve to block or allow the passage of air though the port closure 126, and/or an adjacent port, in an inhale or exhale direction (or vice versa). In some examples, the port closure 126 is not vented and is movable to occlude a port and block the passage of air in both exhale and inhale directions. In some examples, the exhalation port closure 126 is movable to partially, or fully, close the exhalation port 114. In some examples, the exhalation port closure 126 is movable by a user to close the exhalation port 114 to enter the source control mode. In some examples, the port closure 126 remains in a closed position for so long as the source control mode is desired. In some examples, the exhalation port closure 126 is movable by a user to open the exhalation port 114 to enter the free exhalation mode. In some examples, the port closure 126 remains in an open position for so long as the free exhalation mode is desired. In some examples, a user is able to move the port closure 126 to enter or leave either mode of operation i.e., switch between modes with a single movement or manipulation. In some examples, a user can fully close or fully open the exhalation port 114 when switching between the dual modes, but in some examples a partially closed or partially open position of the exhalation port 114 (or inhalation port 112) may be selected by the user if desired.

For the example illustrated in FIGS. 1-9, the port closure 126 is mounted rotatably with respect to the exoskeleton 108 and face piece 102. In some examples, the port closure 126 is generally coin-shaped and sized to occlude or close the exhalation port 114 when moved to a closing position. Other shapes and/or sizes of the port closure 126 are possible. In some examples, the port closure 126 is vented and carries a flexible valving diaphragm 118 as discussed above. In the illustrated example, the port closure 126 is movable within the face piece 102 in a circular path around a rotation axis, described further below in some examples. The port closure has a flat continuous or discontinuous surface sized to close the exhalation valve 114 in the source control mode of the dual mode respirator when the flexible diaphragm 118 seals against the port closure vents (or the solid body of the port closure 126 if unvented). The circular path of the port closure 126 may be coincident with or parallel to the plane of the flat surface of the port closure 126, or the plane of the flexible diaphragm fitted thereto.

In some examples, the rotation axis of the port closure 126 extends in a generally axial direction. In the illustrated example, the rotation axis of the port closure 126 is defined by a shaft 130 described further below. The shaft 130 may extend generally in the axial direction of the dual mode respirator i.e., in a direction toward or away from a user's face. In some examples, the rotation axis may be associated with a center of the port closure 126, or a center of the exhalation port 114, or a center of the exoskeleton 108, or a center of the dual mode respirator 100. In other examples, the rotation axis is off-center of the port closure 126, or off-center of the exhalation port 114, or off-center of the exoskeleton 108, or off-center of the dual mode respirator 100. Other locations of the rotation axis of the port closure are possible.

The port closure 126 is connected to an internal lever 128 (seen more clearly in FIGS. 7-8, for example). The internal lever 128 may be fitted to or formed on a periphery of the port closure 126. The term "internal" in this context is intended to indicate that in use the lever 128 is positioned inside the dual mode respirator 100 when in use. The internal lever **128** extends longitudinally in a direction radially away from the center of the port closure **126**.

The axial shaft **130** is located transversely at an outer end of the internal lever **128**. In this example, the axially extending shaft **130** defines an axis of rotation of the port closure **126**. The axial shaft **130** includes a square head **132** to accept torque applied to a manually operable (user-operated) external lever **142** described further below. The axial shaft **130** is supported rotatably in a short, hollow stem **134** of the exoskeleton **108**. The axial shaft **130** is sealed inside the hollow stem **134** by first and second O-rings seals **138** and **140** that sit in complementary grooves formed in the axial shaft **130**. With reference to FIGS. **7-8**, for example, the internal lever **128** and port closure **126** may be said to define an internal "paddle" that can be rotated by the external lever **142** to open and close the exhalation port **114** to switch the dual mode respirator **100** between the source control and free exhalation modes.

In the illustrated examples, the manually operable external lever **142** is positioned outside the dual mode respirator **100**. It can therefore be manipulated by a user when the dual mode respirator **100** is worn. The external lever **142** is fitted to the square head **132** of the axial shaft **130** within the hollow stem **134**, such that the external lever **142** can rotate the shaft **130** and the internal lever **128** attached thereto. The internal lever **128** rotates the port closure **126** under manipulation of the external lever **142** applied by a user.

In some examples, the external lever **142** may be fitted to the axial shaft at other locations, for example internally or externally of the exoskeleton **108** or the face piece **102**. The external lever **142** can be operated as desired by a user to move, in the illustrated example rotate, the exhalation port closure **126** to selectively open and close the exhalation port **114**. The dual-mode respirator **100** can conveniently be switched quickly and easily by a user to adopt either the source control or free exhalation mode of use.

In some examples, the exoskeleton **108** includes one or more detent formations to hold the external lever **142** releasably at each of its two extreme positions in the respective source control and free exhalation modes. This restraint can serve to prevent accidental or unintended lever movements. In some examples, the external lever **142** can be moved up and down to switch between modes and may include a visual cue, for example a tipped or colored end, that is visible (or rendered not visible) as a visual cue in a user's peripheral field of view to indicate a mode status of the dual mode respirator **100**.

FIG. **10** illustrates aspects of a further example of a dual mode respirator **100**. These example aspects may be combined where appropriate with one or more of the aspects described above. In FIG. **10**, a sectional view is shown of an outer portion of a face piece **102** of the dual mode respirator **100** connected to a filter **120**. An inhalation port **112** and an exhalation port **114** are shown schematically by rectangles numbered accordingly. In this version of the dual mode respirator **100**, the inhalation port **112** lies above the exhalation port **114**. The exhalation port **114** vents to the outside environment below the filter **120**. The inhalation port **112** is associated with a flexible inhale valve diaphragm **116** and the exhalation port is associated with an exhale-valve diaphragm **118**. The valve diaphragms **116** and **118** are shown schematically can deform or move under air pressure fluctuations to act as valves for their respective ports **112** and **114** in the manner described above.

In this example, a port closure **126** is movable (pivotable) both to open and close the exhalation port **114** and to open and close the inhalation port **112**. In some examples, when the exhalation port **114** is closed, the inhalation port **112** is open, and vice versa. In some examples, the port closure **126** can adopt or pass through an intermediate position as indicated in dotted outline. In the illustrated example, the port-closure **126** is supported movably by hinge **144** disposed inside the face piece **102**. The hinge **144** may be provided by an exoskeleton (not shown) or in the face piece **102**.

The port closure **126** is pivotable as shown by arrows **146** in a direction generally orthogonal to the transverse plane of the port closure **126**. Moving fully from one position to an opposed position at the ends of the arrows **146** switches the dual mode respirator **100** from a source control mode to a free exhalation mode. In some positions of the port closure **126**, for example when the inhalation port **112** is closed, both inhaled and exhaled air passes through the open exhalation port **114**. In this situation, neither the inhaled or exhaled air is filtered and the dual mode respirator **100** is entirely free flowing in a free exhalation and free inhalation configuration. In some examples, dual modes enabled by the dual mode respirator include fully filtered (for both inhale and exhale) in which the exhalation port **114** is always blocked by the port closure **126**, or fully unfiltered (for both inhale and exhale) in which the inhalation port **112** is always blocked by the port closure **126**.

Referring now to FIG. **11**, an alternate configuration of a port closure **126** for a dual mode respirator **100** is shown. Example inhalation and exhalation ports **112** and **114**, and associated valve diaphragms **116** and **118**, are shown schematically and numbered as above. Here, a linear push action on the port closure **126** in the direction of the arrow **150** closes the exhalation port **114** to enter the source control mode of the dual mode respirator. The linear push action may occur in a generally axial or transverse direction of the dual mode respirator **100**.

In the illustrated example, the push action simultaneously opens the inhalation port **112**. A linear pull action or retraction on the port closure **126** by a user has the reverse effect to enter the free exhalation mode. The linear pull action or retraction may occur in a generally axial or transverse direction of the dual mode respirator. In some examples, a dog-legged configuration of the port closure **126** as illustrated can facilitate a simultaneous switch between the two modes. Other push-pull configurations and arrangements are possible.

The above description is intended to be illustrative, and not restrictive. For example, the above-described examples (or one or more aspects thereof) may be used in combination with each other. Other embodiments can be used, such as by one of ordinary skill in the art upon reviewing the above description. The Abstract is provided to comply with 37 C.F.R. § 1.72(b), to allow the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims. Also, in the above Detailed Description, various features may be grouped together to streamline the disclosure. This should not be interpreted as intending that an unclaimed disclosed feature is essential to any claim. Rather, inventive subject matter may lie in less than all features of a particular disclosed embodiment. Thus, the following claims are hereby incorporated into the Detailed Description as examples or embodiments, with each claim standing on its own as a separate embodiment, and it is contemplated that such embodiments can be combined with each other in various combinations or permutations. The scope of the embodiments should be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

The invention claimed is:

1. A dual mode respirator comprising:

a face piece;

an inhalation port;

an exhalation port;

a port closure movable to close the exhalation port and switch the dual mode respirator from a source control mode to a free exhalation mode of the dual mode respirator;

an exoskeleton supported in an opening of the face piece, wherein a rotation to move the port closure to effect a switch from the source control mode to the free exhalation mode is provided by a shaft mounted rotatably in the exoskeleton, the shaft extending through the exoskeleton between an internal end and an external end of the shaft; and

an internal lever connected to the internal end of the shaft.

2. The dual mode respirator of claim 1, further comprising a first valve diaphragm associated with the inhalation port, and a second valve diaphragm associated with the exhalation port or the port closure, the first valve diaphragm and the second valve diaphragm respectively operable to open or close the inhalation port and the exhalation port under air pressure fluctuations within the dual mode respirator in use.

3. The dual mode respirator of claim 1, wherein the port closure is generally coin-shaped and sized to close the exhalation port when moved to a closing position of the exhalation port in a source control mode of the dual mode respirator.

4. The dual mode respirator of claim 1, wherein the port closure is movable within the face piece in a circular path around a rotation axis.

5. The dual mode respirator of claim 4, wherein the port closure has a flat surface sized to close the exhalation port in the source control mode of the dual mode respirator.

6. The dual mode respirator of claim 5, wherein the circular path is coincident with or parallel to a plane of the flat surface of the port closure.

7. The dual mode respirator of claim 1, wherein the port closure is connected to the internal lever and is rotatable about the shaft under action of the internal lever.

8. The dual mode respirator of claim 7, further comprising an external lever, the external lever connected to the external end of the shaft.

9. The dual mode respirator of claim 8, wherein the external lever is operable by a user to switch the dual mode respirator between the source control mode and a free exhalation mode of the dual mode respirator.

10. The dual mode respirator of claim 1, wherein the exhalation port is positioned above the inhalation port in the exoskeleton or the face piece.

11. The dual mode respirator of claim 1, wherein the exhalation port is positioned below the inhalation port in the exoskeleton or the face piece.

12. The dual mode respirator of claim 1, wherein the port closure is pivotable about a hinge to open or close the exhalation port and effect a switch between the source control mode and the free exhalation mode of the dual mode respirator.

13. The dual mode respirator of claim 1, wherein the port closure is moveable in a linear direction relative to the face piece to open or close the exhalation port and effect a switch between the source control mode and the free exhalation mode of the dual mode respirator.

14. The dual mode respirator of claim 1, wherein the port closure is vented and carries a diaphragm to open or close vents in the port closure during an inhalation or exhalation of a user.

15. The dual mode respirator of claim 1, wherein the port closure is unvented.

16. A dual mode respirator comprising:

a face piece;

an inhalation port;

an exhalation port; and

a port closure movable to close the exhalation port and switch the dual mode respirator from a source control mode to a free exhalation mode of the dual mode respirator, wherein the port closure is manually movable by a user to pivot about a hinge to open or close the exhalation port and effect a switch between the source control mode and the free exhalation mode of the dual mode respirator.

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