



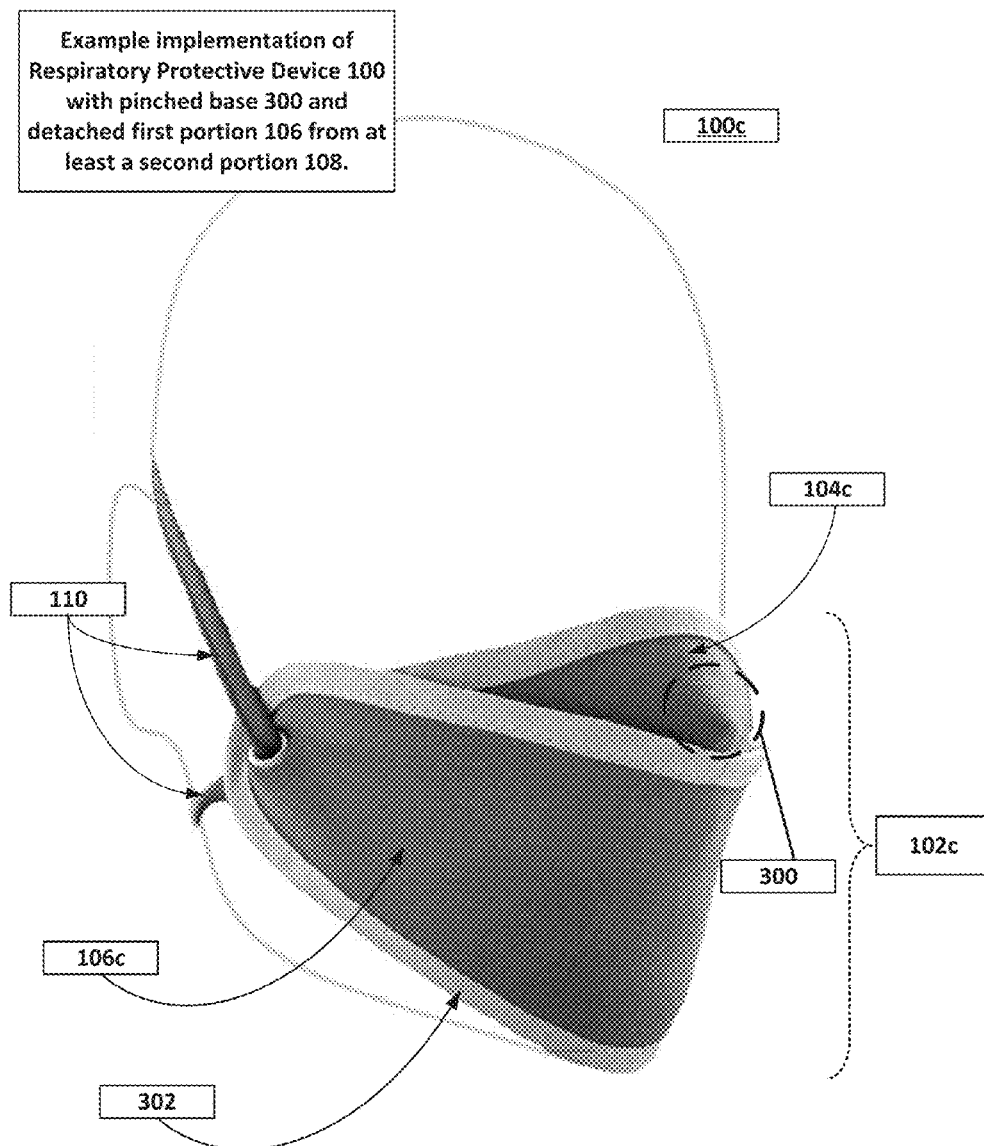
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(2013.01)(21) Appl. No.: **17/332,314**(22) Filed: **May 27, 2021**(57) **ABSTRACT**

A respiratory protective device may include a mask. The mask may include a first portion configured to at least partially cover a nose of a user when the respiratory protective device is worn. The mask may also include a second portion configured to at least partially cover a mouth of a user when the respiratory protective device is worn. The respiratory protective device may also include a divider associated with one or more of the first portion and the second portion. The divider may be configured to be generally positioned between the nose and the mouth of the user.

Related U.S. Application Data

(60) Provisional application No. 63/030,450, filed on May 27, 2020.



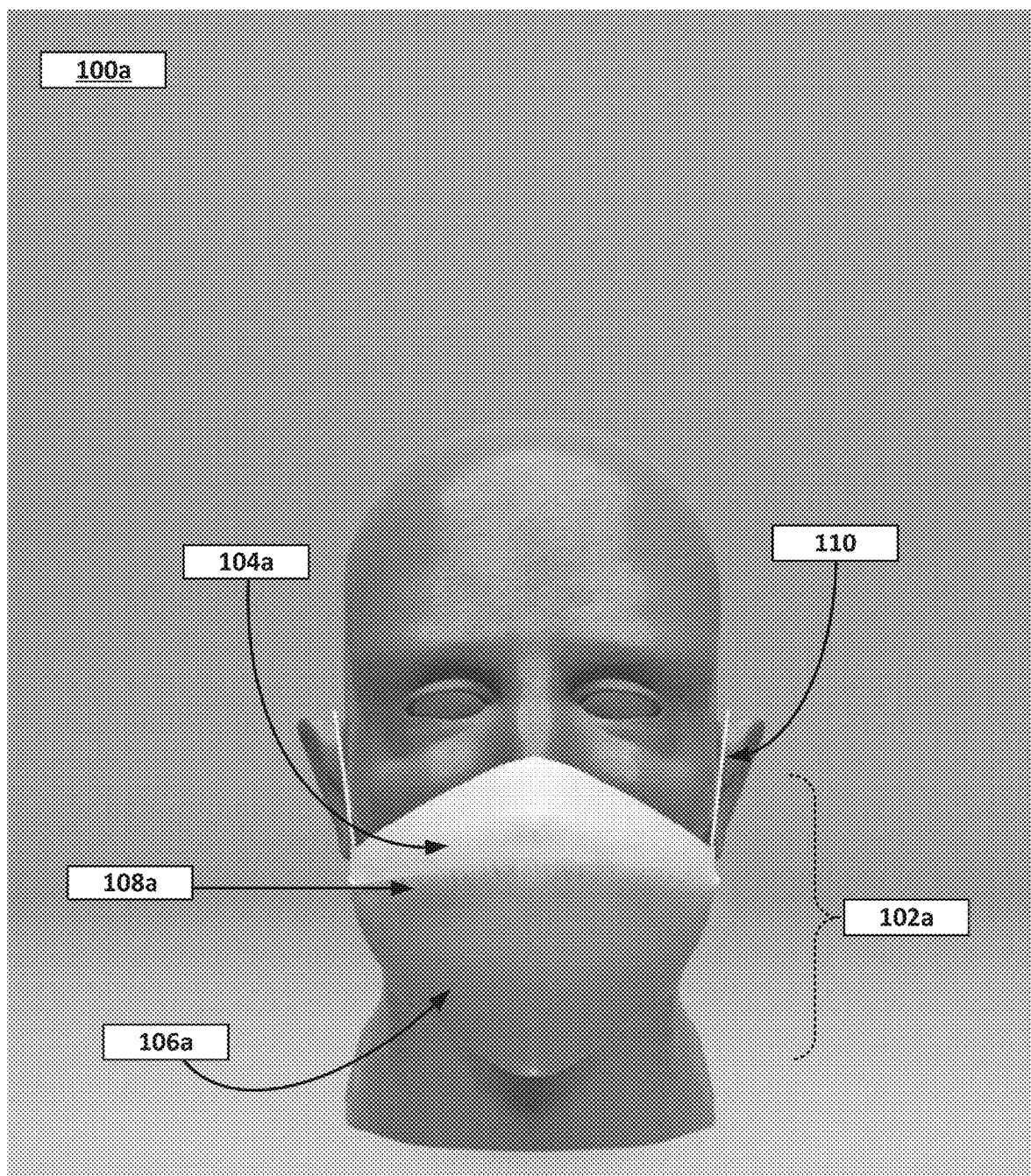


FIG. 1

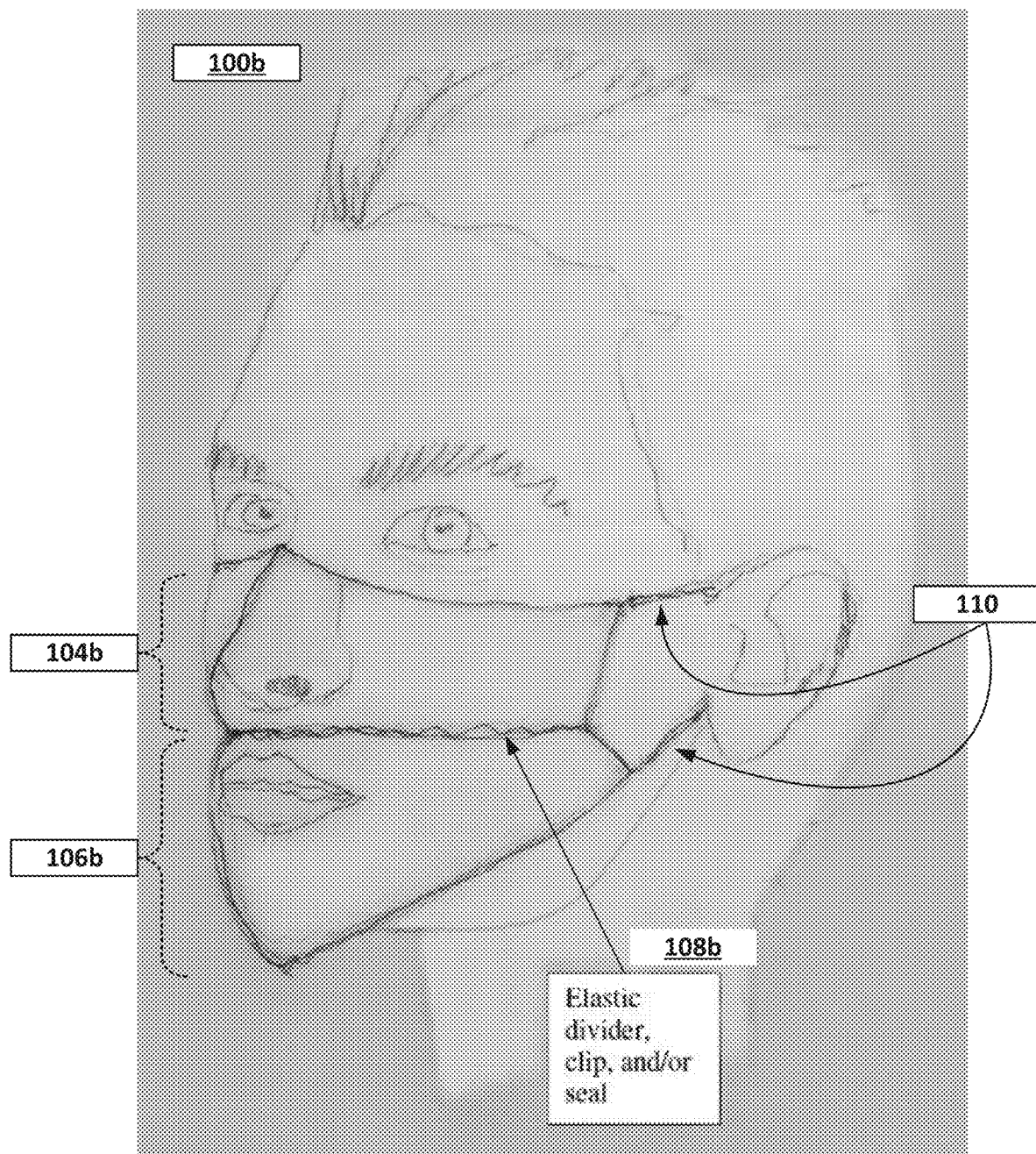


FIG. 2

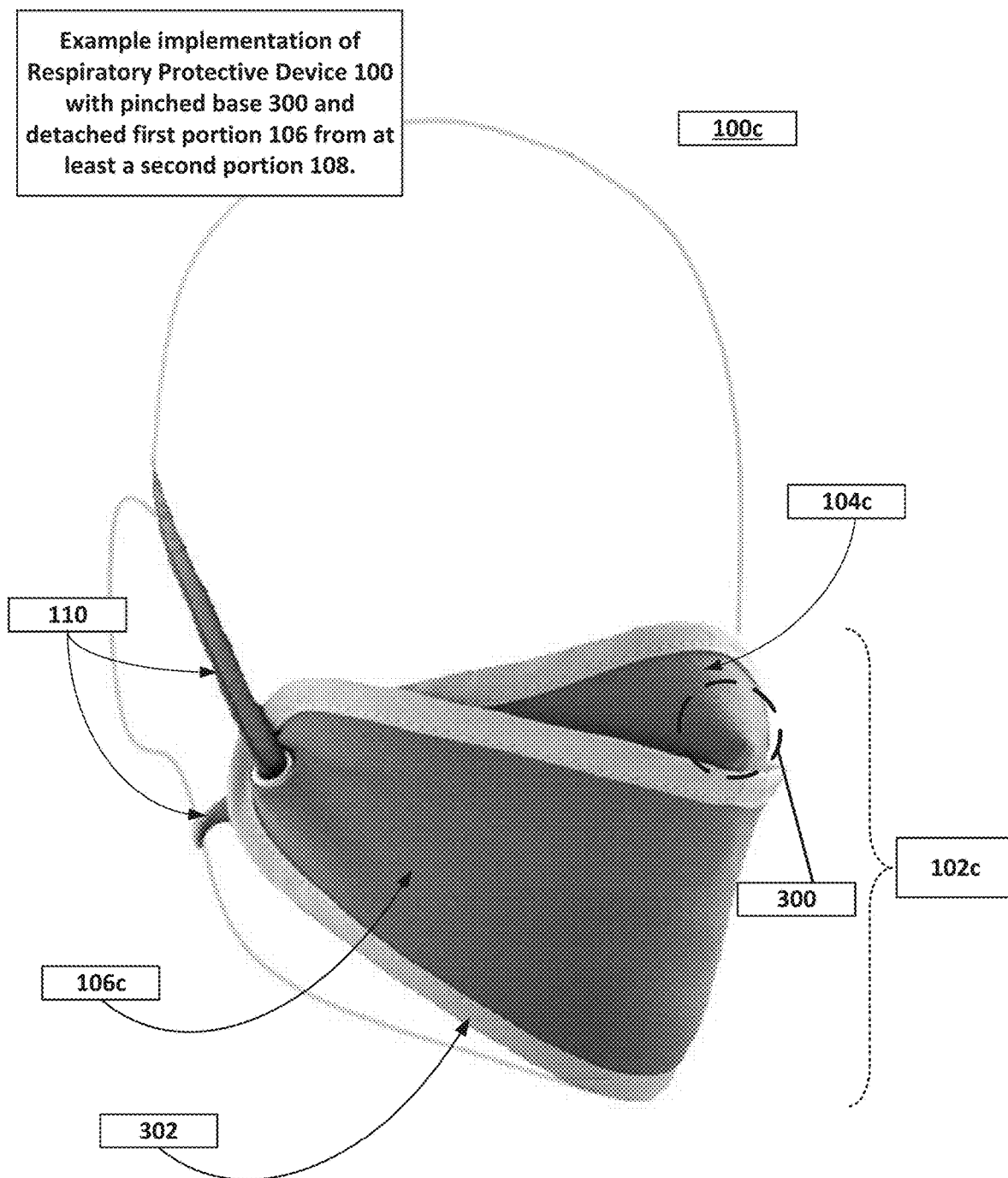


FIG. 3

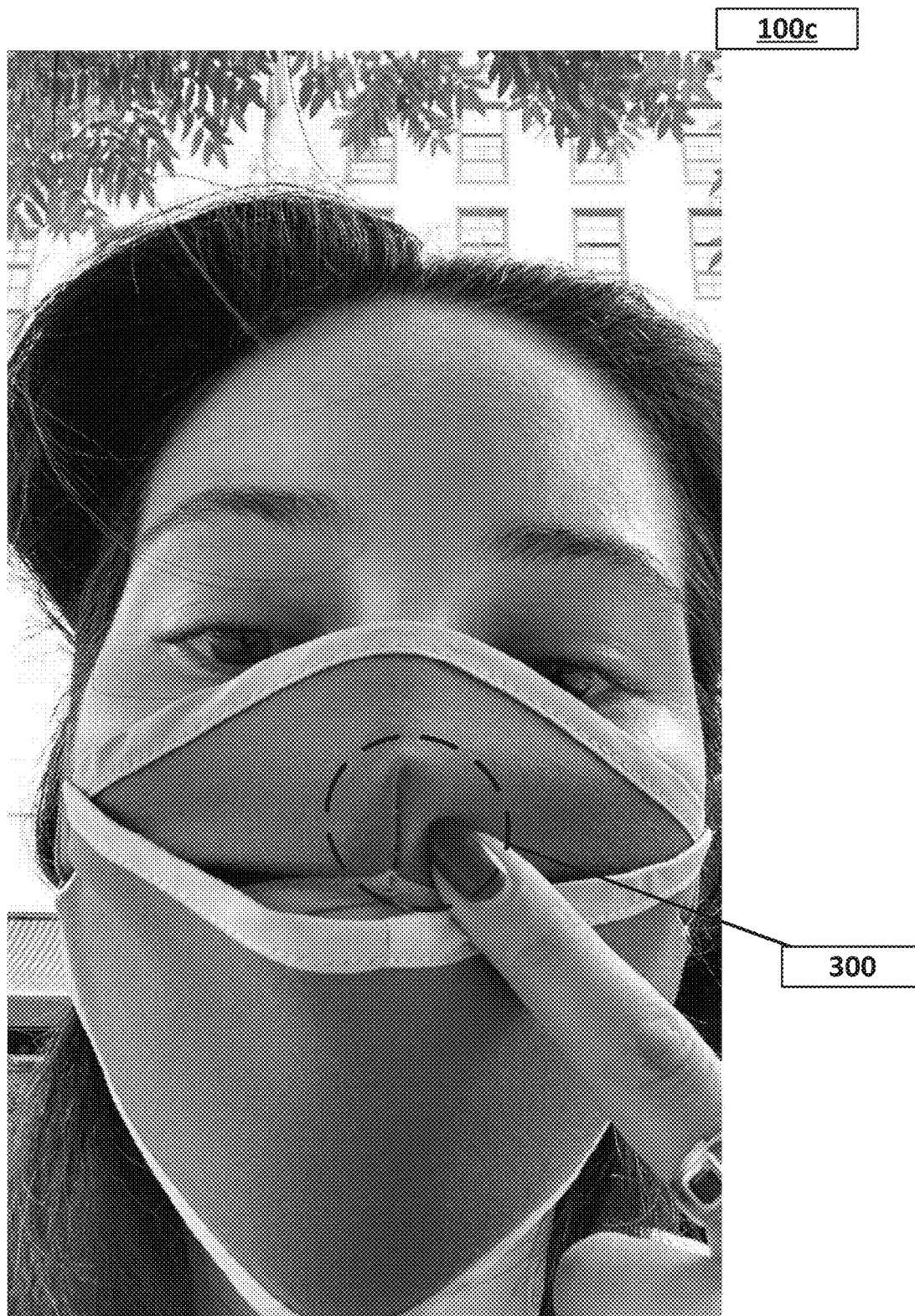


FIG. 4

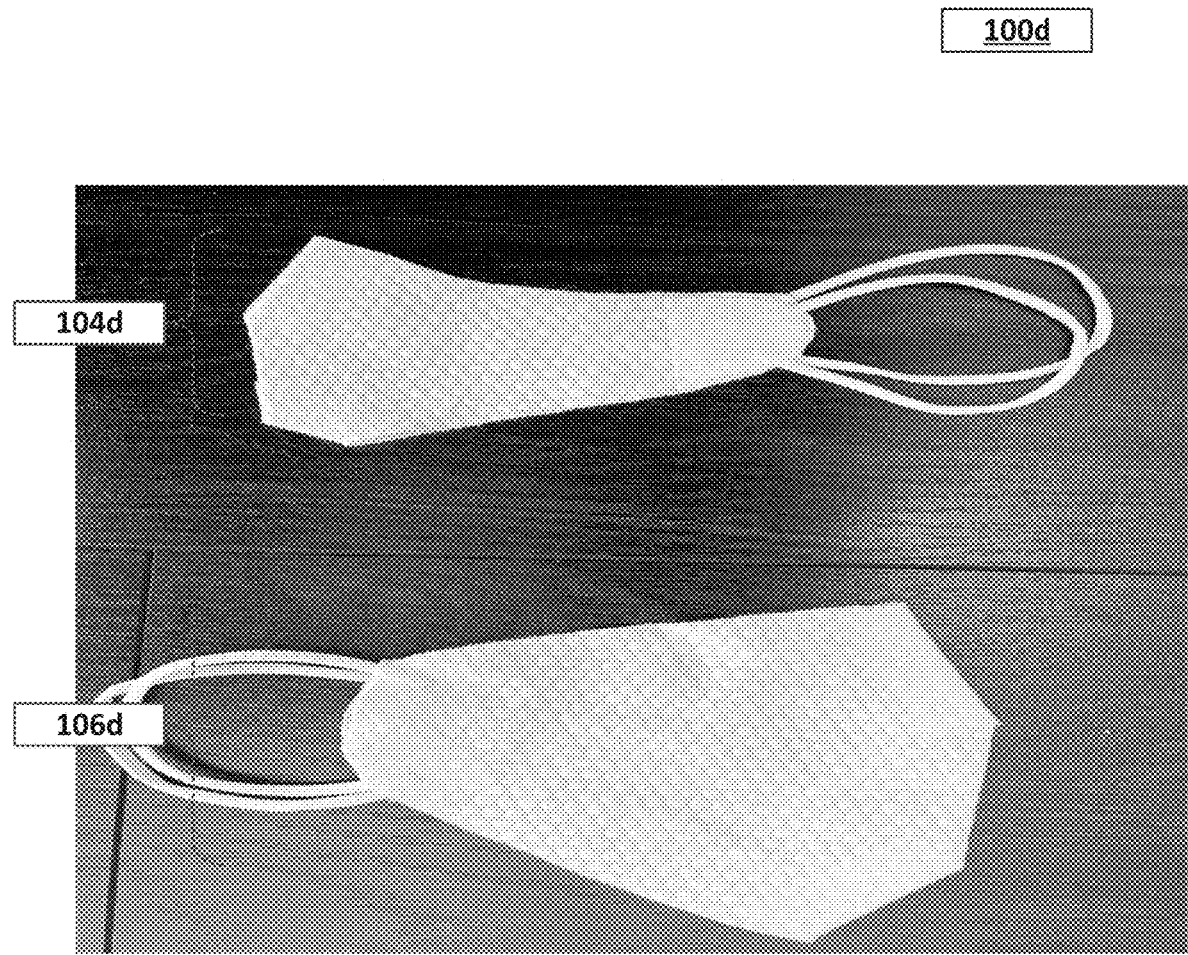


FIG. 5

100d



FIG. 6

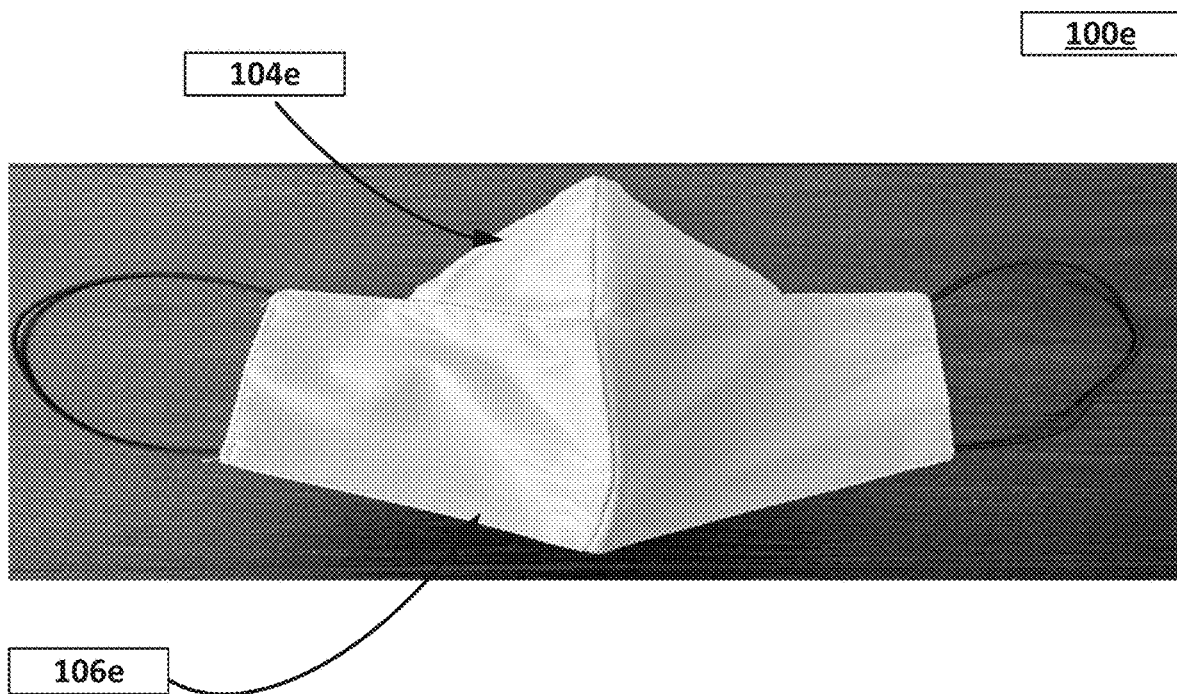


FIG. 7

RESPIRATORY PROTECTIVE DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application No. 63/030,450, entitled “Respiratory Protective Device,” filed on 27 May 2020; the entire contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention generally relates to a respiratory protective device (RPD), for filtering contaminants in the air and, more particularly relates to a respiratory protective device providing at least partially separate airflow pathways for the user’s nose and mouth.

BACKGROUND OF THE INVENTION

[0003] The science around the use of face masks by the public to impede viral transmission experienced an increase in attention during the COVID-19 global pandemic. As is known, a significant route of transmission of many infectious diseases is via respiratory particles, and may transmissible from both symptomatic and asymptomatic individuals. In conjunction with existing hygiene methods, social-distancing, and contact-tracing strategies, the preponderance of evidence indicates that face mask wearing may reduce transmissibility per contact by reducing transmission of infected respiratory particles. As such, public mask wearing proves to be the most effective strategy for reducing the spread of infectious disease when public compliance is consistently followed. Despite the variety of different types of face masks that are commercially available, the majority of facemasks implement the same kind of filtration system, which tends to offer the user no other choice but to share air supply between the user’s nose and mouth.

BRIEF SUMMARY OF DISCLOSURE

[0004] In one example implementation, a respiratory protective device may include a mask including a first portion configured to at least partially cover a nose of a user when the respiratory protective device is worn. The mask may also include a second portion configured to at least partially cover a mouth of a user when the respiratory protective device is worn. The respiratory protective device may also include a divider associated with one or more of the first portion and the second portion. The divider may be configured to be generally positioned between the nose and the mouth of the user.

[0005] One or more of the following features may be included. The first portion and the second portion may be at least partially joined to one another. At least part of the first portion of the mask may be at least partially separated from at least part of the second portion of the mask. The first portion of the mask and the at least second portion of the mask may be configured to be at least partially folded away from each other.

[0006] The respiratory protective device may include a seal generally corresponding to the divider between the first portion of the mask and the at least second portion of the mask. The respiratory protective device may include a retention system extending from one or more of the first portion and the second portion of the mask.

[0007] The mask may include a filtering material. The filtering material may be associated with one or more of the first portion and the second portion. The first portion of the mask may be lined with the filtering material having a substantially equivalent configuration as the first portion of the mask. The second portion of the mask may be lined with the filtering material having a substantially equivalent configuration as the second portion of the mask.

[0008] The divider may include a malleable feature. The malleable feature may be disposed between the first portion and the second portion. The malleable feature may be associated with one or more of the first portion and the second portion. The first portion of the mask may include a pinched base configured to be positioned below the nose of the user when worn. The second portion of the mask may be configured to at least partially conform around a chin of the user.

[0009] According to another implementation, a respiratory protective device may include a first portion configured to cover a nose of a user. The respiratory protective device may include a second portion configured to cover a mouth of the user. The first portion and the second portion may be configured to provide a first volume around the nose and a second volume around the mouth. The first volume may be at least partially separated from the second volume.

[0010] One or more of the following features may be included. The first portion and the second portion may be at least partially separated by a divider. The divider may be configured to be disposed between the nose and the mouth of the user. The first portion and the second portion may include a separation configured to be positioned generally between the nose and the mouth. The separation may include one or more of a lower edge of the first portion and an upper edge of the second portion.

[0011] The first portion and the second portion may include at least partially separate components. The first portion and the second portion may be at least partially coupled to one another at generally opposed lateral aspects. A seal may be associated with one or more of the first portion and the second portion. The seal may be configured to engage a region between the nose and the mouth. The seal may at least partially impede air exchange between the first volume and the second volume.

[0012] According to yet another implementation, a method for preventing the spread of infectious disease via a respiratory protective device may include providing a respiratory protective device including a first portion and a second portion. The method may include fitting the respiratory protective device to a user with the first portion generally overlying a nose of the user and the second portion generally overlying the mouth of the user. The first portion may generally define a first volume associated with the nose. The second portion may generally define a second volume associated with the mouth of the user. The first volume may be at least partially separated from the second volume to reduce air exchange between the first volume and the second volume.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 depicts an example respiratory protective device as applied to a user’s face according to one or more example implementations of the disclosure; and

[0014] FIG. 2 depicts another illustrative example respiratory protective device according to one or more example implementations of the disclosure.

[0015] FIG. 3 depicts another example implementation of a respiratory protective device consistent with the present disclosure, having a pinched base and an at least a partially separated first portion from at least a second portion.

[0016] FIG. 4 depicts the illustrative example of a respiratory protective device of FIG. 3, further indicating the pinched base, according to an example embodiment.

[0017] FIG. 5 depicts another example implementation of a respiratory protective device consistent with the present disclosure including a separate first portion and second portion, according to an example embodiment.

[0018] FIG. 6 depicts the example implementation of FIG. 5 worn by a user.

[0019] FIG. 7 depicts another example implementation of a respiratory protective device consistent with the present disclosure, according to an example embodiment.

DETAILED DESCRIPTION

[0020] Consistent with the present disclosure, respiratory protective devices may be provided that may, at least in part, provide some degree of separation between air pathways associated with a nose of a person and air pathways associated with a mouth of a person. Consistent with some such illustrative example embodiments, a volume of air inhaled through the persons nose may be at least partially separated from a volume of air exhaled through the persons mouth (or vice versa). According to some such configurations, the at least partially separated air pathways associated with the mouth and nose of a person may provide many unique advantaged, e.g., as compared with generally conventional face masks, e.g., which may generally provide a user with a uniform seal around the periphery of the mask. By contrast to generally conventional face masks, e.g., which may generally cause a user to re-breathe previously exhaled air, respiratory protective devices consistent with some aspect of the present disclosure may provide some degree of separation between previously exhaled air and subsequently inhaled air. Consistent with some such embodiments, a quantity of carbon dioxide re-breathed by a user of the respiratory protective device may be reduced to some degree. Various additional and/or alternative features, advantage, and/or aspects may be realized consistent with the present disclosure.

[0021] As is generally known, the primary function of the respiratory system is to deliver oxygen to the cells of the body's tissues and remove carbon dioxide; a cell waste product. The main structures of the human respiratory system are the nasal cavity (i.e., nose), the trachea (i.e., throat), and the lungs. During typical inhalation, air enters the body through the nose where the air is then warmed to body temperature, humidified, and at least partially filtered of particles. The processes of warming, humidifying, and removing particles are important protective mechanisms that prevent damage to the throat and lungs. As air continues to make its way to the throat, the air is funneled to the lungs to facilitate gas exchange wherein oxygen is diffused into the blood to be distributed to the cells of the body, and carbon dioxide is diffused from the blood to be exhaled as a waste product. The air, including the carbon dioxide waste product, may typically be exhaled through the mouth. It will be appreciated, of course, that additional and/or alternative

mechanisms of breathing may occur, such as inhaling through the mouth and exhaling through the nose, inhaling and exhaling through the mouth, and/or inhaling and exhaling through the nose, and/or combinations of the foregoing.

[0022] Consistent with the above-described typical respiration (e.g., inhalation through the nose and exhalation through the mouth, or vise-versa), the concept of carbon dioxide re-breathing in respiratory protective devices (RSD) (e.g., face masks, such as surgical masks and N95 masks, as well as other respiratory protective devices (RPDs)), has been identified as a point of concern during respiratory use (i.e., breathing while wearing a face mask or an alternative RPD). That is, as recognized by the present disclosure, the exhalation of air (e.g., including an increased carbon dioxide level relative to normal ambient air as a result of the elimination of carbon dioxide waste from the respiratory processes) into the generally closed volume defined by a RPD may result in the subsequent inhalation of air having an elevated carbon dioxide level.

[0023] Recognizing that the anatomical structure and respiratory functional purposes of the nose and the mouth may be independent, yet may be forced to share the same air supply when a user is wearing a conventional face mask (e.g., as a result of the conventional mask covering the periphery of both the user's mouth and the nose to generally form a common volume at least partially enclosing both the mouth and the nose), the present disclosure recognizes that carbon dioxide re-breathing may be a serious concern due to the hazard it may cause the user, depending on the condition of the user's health and/or the state of the user's immune system. For instance, carbon dioxide re-breathing (e.g., which may result from at least a portion of exhaled air remaining in the common volume of the face mask being subsequently re-inhaled) may result from respiratory use of some conventional face masks, and may be related to symptoms of fatigue, dizziness, headaches, muscular weaknesses, and drowsiness. All and/or some of these symptoms may be experienced by some users, in various combinations, while wearing some conventional face masks.

[0024] Previous test investigations have largely been limited by small sample sizes and have not typically evaluated the relationship of continuous inhalation of CO₂ in phonic respiration (breathing during speech) in RPDs. However, during one particular test regarding some of the foregoing effects, a total of 40 workers trained in the use of RPDs performed a graded exercise test that increased workload every five minutes. During the 30 minutes of each stage, participants read aloud a prepared text. Measures of mixed expired CO₂ (PeCO₂), mixed inspired CO₂ (PICO₂), and respiration were monitored. The results showed significantly higher levels of CO₂ breathing as a result of wearing a conventional RPD.

[0025] Consistent with some aspects of the present disclosure, it is recognized that the amount of oxygen that is needed to function on a daily basis may be put at risk with current, conventional RPDs. Consistent with some aspects of the present disclosure, reducing CO₂ exposure may result in improved wear time of the disclosed RPDs (e.g., with reduced consequences of CO₂ rebreathing). Consistent with some implementations of the present disclosure, the findings of the above-mentioned testing may be incorporated in technical specifications regarding human factors for RPDs. Consistent with some embodiments of the present disclosure, the effects of CO₂ rebreathing that were identified

during the above-mentioned testing may be at least partially mitigated, alleviated and/or eliminated. By implementing a design consistent with the present disclosure, a user may be able to go about the user's day, and even exercise while wearing a RPD consistent with the present disclosure, while reducing the risk to a user's health.

[0026] As generally discussed above, and referring at least to the illustrated example implementations, consistent with some embodiments a respiratory protective device (e.g., one or more of illustrated example respiratory protective devices **100a**, **100b**, **100c**, **100d**, **100e**, which may be generally referenced as respiratory protective device **100**, when not discussing particular distinctions between the illustrated example embodiments) may include a mask (e.g., one or more of masks **102a**, **102b**, **102c**, **102d**, and **102e**, which may be generally referenced as mask **102**, when not discussing particular distinctions between example embodiments) that may be configured to at least partially and/or substantially cover the nose and the mouth of a user when respiratory protective device **100** is worn. In this regard, the respiratory protective device **100** may (among other various uses) reduce the extent to which the user may spread respiratory particles (e.g., which may include pathogens) during exhalation, and/or reduce the extent to which the user may breath in airborne pathogens (and/or other airborne contaminants). As generally shown, the mask may generally include a first portion (e.g., one or more of first portions **104a**, **104b**, **104c**, **104d**, **104e**, which may be generally referenced as first portion **104**, when not discussing particular distinctions between illustrated example embodiments) and a second portion (e.g., one or more of second portions **106a**, **106b**, **106c**, **106d**, **106e**, which may be generally referenced as second portion **106**, when not discussing particular distinctions between illustrated example embodiments). Consistent with the illustrated example embodiments, the first portion **104** may be configured to at least partially (and/or substantially or completely) cover a nose of a user when the respiratory protective device **100** is worn. Correspondingly, the second portion **106** may be configured to at least partially (and/or substantially or completely) cover a mouth of the user when the respiratory protective device **100** is worn. Consistent with some illustrative example embodiments, the respiratory protective device **100** may also include a divider (e.g., one or more of dividers **108a**, **108b**, which may be generally referenced as divider **108**, when not discussing particular distinctions between illustrated example embodiments) associated with one or more of the first portion **104** and the second portion **106** of the mask **102**. In some such embodiments, the divider may be configured to be generally positioned between the nose and the mouth of the user. Consistent with some such embodiments, the divider **108** may be configured to at least partially aid in defining first portion **104** of mask **102** generally surrounding the nose of the user, and at least a second portion **106** of mask **102** generally surrounding the mouth of the user.

[0027] As shown, consistent with example implementations of the present disclosure, respiratory protective device **100** may generally include mask **102**, which may be configured to generally and/or substantially cover the nose and the mouth of a user when respiratory protective device **100** is worn. For example, and referring at least to the illustrated example implementations, the first portion **104** and the second portion **106** may generally define at least partially

separate volumes around the user's nose and mouth, respectively. As such, the air being exhaled by the mouth may be at least partially separated from the air being inhaled by the nose of the user. Consistent with some implementations, the divider **108** may aid in the separation of the volumes defined by the first portion and the second portion, e.g., which may at least partially impede air exchange between the first volume and the second volume. Accordingly, consistent with some implementations of the present disclosure air inhaled from one of the volumes (e.g., the first volume at least partially defined by the first portion) may have an at least somewhat lower carbon dioxide concentration as compared to air exhaled into the other volume (e.g., the second volume at least partially defined by the second portion).

[0028] Consistent with some example embodiments, divider **108** may be configured to be generally positioned between the user's mouth and nose (i.e., in the general region between the top of the user's upper lip and the bottom of the user's nose), such that first portion **104** of mask **102** may define the first volume generally surrounding the user's nose, and second portion **106** of mask **102** may define the second volume generally surrounding the user's mouth, with the two volumes being at least partially separated. As such, there may be at least some limitation on the mixing of air exhaled through the user's mouth (which may be relatively higher in CO₂ as compared to inhaled air) into the second volume and air inhaled through the user's nose, thereby at least partially reducing the rebreathing of exhaled CO₂. It will be appreciated that the pattern of inhalation and exhalation of a respective user may be interchangeable, such that the described separation of airflow may be accomplished by respiratory protective device **100** regardless of which respiratory tract (i.e., nose or mouth) is doing the inhaling or exhaling, providing the user is not inhaling and exhaling via the same respiratory tract (e.g., both inhaling and exhaling via the mouth and/or inhaling and exhaling via the nose). It will be appreciated that the dimensions of mask may vary and will be dependent on the shape and size of the face of the user. Consistent with various embodiments, mask may be provided having different relative sizes. Consistent with various embodiments, masks may be provided having different relative sizes of the first portion and/or the second portion (e.g., as may more suitably accommodate users having larger relatively noses and/or relatively smaller noses and/or having users having relatively larger mouths and/or relatively smaller mouths).

[0029] As generally discussed above, according to some illustrative example embodiments, respiratory protective device **100** may include divider **108** that may be configured to be generally positioned between the nose and the mouth of the user, wherein divider **108** may be configured to at least in define, and/or aid in defining, first portion **104** of mask **102** generally surrounding the nose of the user, and at least second portion **106** of mask **102** generally surrounding the mouth of the user. For example, and as shown in FIG. 2, consistent with an illustrative example embodiment the first portion **104b** and the second portion **106b** may be at least partially, and/or completely joined to one another about the respective adjacent edges or regions (e.g., generally the bottom of first portion **104b** and the top of second portion **106b**). In some such embodiments, the first portion and the second portion may include a single body (e.g., a single piece of fabric, woven and/or non-woven textile, etc.) and/or may include two separate pieces that are joined along at least

a portion, and/or all of, the intersection of the two portions. In one such example implementation divider **108b** may be secured (e.g., stitched, glued, woven, and/or otherwise attached or coupled) into a material of mask **102** (e.g., which may include one or both of the first portion and the second portion). Consistent with the illustrated example embodiment, divider **108b** may generally be secured at a predefined location (e.g., medially) to create one or more designated regions for a user's nose and/or mouth (i.e., the first portion and the second portion, generally). Accordingly, divider **108** may essentially provide two autonomous mask regions (i.e., one mask region or mask feature generally covering the nose and one mask region or mask feature generally covering the mouth). As noted above, the dimensions of the mask may vary to accommodate different shapes and/or sizes of the faces and/or facial features. Similarly, it will be appreciated that the divider may be provided at various locations to accommodate different shapes and/or sizes of unique facial features. As generally described above, and as will be appreciated, in some example embodiments, the divider may generally be disposed between the first portion and the second portion. Consistent with some such embodiments, the divider may be configured to be generally located between a user's nose and mouth when the respiratory protective device is being worn, which may, at least in part, aid in defining the first portion and the second portion of the mask. In this regard, the divider may assist in and/or facilitate separating the flow of air exhaled by the mouth and inhaled by the nose. This may create a consistent flow of air in through the nose while the mouth exhales into a separate, but connected part of the mask (e.g., the second portion of the mask).

[0030] According to various implementations, the divider may include a variety of configurations. For example, consistent with some embodiments, e.g., in which the first portion of the mask and the second portion of the mask may include a common piece, structure, or body and/or may include two or more separate pieces, structures, or bodies that may be joined to one another about at least a portion of the intersection therebetween, the divider may include a separate component or feature that is attached to the mask in a region between the first portion and the second portion (e.g., which may, as discussed above, include a region of the mask that may generally be configured to be positioned between the nose and the mouth of a user when wearing the respiratory protective device). For example, the divider may include, but is not limited to, an elastic band coupled to the mask, an elongated elastic body coupled to the mask, a malleable feature (such as a flexible metal wire or body, or a flexible plastic body, or the like) that may be manipulated to generally conform to the shape of a user's face (e.g., in generally the region of the upper lip of the user), as well as any other suitable conformable, shapeable and/or pre-shaped body. As noted above, any suitable arrangement for attaching the divider to the mask (e.g., sewing, gluing, welding, etc.) and/or integrating the dividing into the mask may be utilized.

[0031] Consistent with some illustrative example embodiments, e.g., such as the illustrative example embodiment shown in FIG. 3, the first portion **104c** and the second portion **106c** may include at least partially separate separated pieces. For example, the first portion **104c** and the second portion **106c** may not generally be coupled, or joined, to one another about at least the region of the nose

of the user. Consistent with such an implementation, the first portion **104c** may generally define the first volume and the second portion **106c** may generally define the second volume. As generally shown, in an illustrative example embodiment, an edge of the first portion adjacent the second portion and an edge of the second portion adjacent the first portion may at least partially overlap with one another. Consistent with some such embodiments, while the first portion and the second portion may include at least partially separate components (e.g., the first portion and the second portion may be at least partially separate at least in the region of the nose and/or mouth of the user), the overlapping of the first portion and the second portion may, in some embodiments, provide a generally continuous (albeit divided into at least two generally separate volumes) covering over the user's face.

[0032] In some embodiments, consistent with the foregoing, the divider may be associated with one or more of the first portion **104c** and the second portion **106c**. For example, as generally discussed above, the divider may include a conformable or malleable component, etc. In an embodiment, the divider may be associated with (e.g., attached to and/or integrated with) the first portion **104c**, for example in a generally lower edge thereof (e.g., which may generally be disposed the nose of the user in use). In an embodiment, the divider may be associated with (e.g., attached to and/or integrated with) the second portion **106c**, for example in a generally upper edge thereof (e.g., which may generally be disposed above the mouth of the user in use). In some embodiments, a divider may be associated with each of the first portion **104c** and the second portion **106c**. In some implementations, the divider may include one or more of a lower edge and/or hem of the first portion **104c** and/or an upper edge and/or hem of the second portion **106c**.

[0033] As generally described above, consistent with some embodiments of the present disclosure, the mask may provide a volume around the nose of the user that is at least partially separated from a volume around the mouth of the user. Consistent with the foregoing, in some embodiments, the divider may generally cause some degree of physical conformance of the mask between the two volumes of the user's face. Accordingly, the divider may define, aid in defining, and/or at least partially separate, the first portion (i.e., the first volume generally surrounding the user's nose), and the second portion (i.e., the second volume generally surrounding the user's mouth). As will be discussed in greater detail below, the divider may share one or more elastic components with at least a portion of a retention system of the respiratory protective device to support the degree of physical conformance of the mask between the two volumes and the user's face, which may further define, and/or at least partially separate, the two volumes of the mask.

[0034] In some implementations, respiratory protective device **100** may include a seal, e.g. that may at least partially limit airflow between the mask **102** and the user's face. In some implementations, the seal may be positioned in a location generally corresponding to divider **108** (e.g., may be generally positioned between first portion **104** of mask **102** and second portion **106** of mask **102**). For example, and referring to the example implementations of FIGS. 1-2, the inside of the mask (e.g., which may include a lining, or liner material) may generally correspond to a respective portion (i.e., first portion **104** and at least second portion **106**) of mask **102**.

Consistent with this example, the separation between the two volumes (i.e., first volume generally surrounding the user's nose, and the second volume generally surrounding the user's mouth), may be fitted to the user's face with a seal to create better air separation of the space for both the nose and the mouth (i.e., separating the air inhaled through the nose from the air exhaled through the mouth). For example, the seal may include, but is not limited to, a rubber-like material (e.g., natural rubber, synthetic rubber, nitrile, latex, silicone, urethane elastomer, thermoplastic elastomer, etc.). For example, the rubber-like material may provide an at least partial seal against a user's face, which may reduce mixing of air between the volume around the mouth and the volume around the nose. It will be appreciated that the seal may not be required to create a completely airtight (or even necessarily a semi-airtight) seal between the mask and the user's skin. For example, while the function of the seal is generally directed at reducing, to at least some degree, the mixing of between the first volume and the second volume, and thereby contamination exchanged between the user's nose and the mouth, complete isolation of the first volume and the second volume may not be necessary to reduce the amount of re-breathed carbon dioxide. For example, the general structure and configuration of the mask, including the first portion (e.g., which may generally permit airflow from the top of the mask and down in through the sides of the mask before entering the nose), and the second portion (e.g., which may generally be configured to send exhaled air from the user's mouth downward to the user's neck area) may also reduce the amount of re-breathed carbon dioxide.

[0035] In some implementations, the first portion of the mask and/or the second portion of the mask may be configured to be folded away from the user's face and/or to be folded away from each other. For example, and as generally discussed above, a divider may, at least in part, enable autonomy between first portion **104** and at least second portion **106** of mask **102**. Consistent with this example, divider **108** may enable mask **102** to be folded so that first portion **104** or at least second portion **106** of mask **102** may be left in place over the mouth and/or the nose, respectively, while the other portion may be folded away from the mouth and/or the nose (i.e., depending upon which portion is to remain in place and which portion is to be folded away). For example, in some embodiments, the first portion of the mask may be capable of being folded downwardly, e.g., to at least partially expose the nose of the user. In some embodiments, the second portion of the mask may be capable of being folded upwardly, e.g., to at least partially expose the mouth of the user. In an embodiment (e.g., such as the embodiment depicted in FIGS. **3** and **4**, in which the first portion **104c** and the second portion **106c** may be at least partially separate from one another) the first portion may be folded upwardly to at least partially expose the nose of the user. Further, consistent with some such implementations, the second portion may be folded downwardly to at least partially expose the mouth of the user. Consistent with some such implementations, a user may continue to use the mask during meals (i.e., for eating and drinking) with the second portion of the mask folded away from the user's mouth (e.g., either upwardly and/or downwardly, depending upon the configuration of the mask), while the first portion of the mask may remain over the nose. As such, it may be possible for the user to engage in activities, such as eating, drinking, etc., without losing all protection against airborne contami-

nants and/or contagions. For example, in an implementation in which the second portion of the mask (intended to be disposed over the mouth) is folded away (e.g., folded upwardly about the region generally coinciding with the upper lip/region between the upper lip and the nose, consistent with some embodiments), the user's nose may still be protected against inhalation of particles or droplets.

[0036] In some implementations, the respiratory protective device may further include a retention system (e.g., retention system **110**), which may retain and/or assist in retaining, the mask in position relative to a user's face (e.g., relative to the user's mouth and/or nose). In some illustrative example embodiments (e.g., as variously shown in FIGS. **1-4**) retention system **110** may be configured generally extending from one or more regions of mask **102**. For example, retention system **110** may include one or more head straps (e.g., ear or head loops, ties, or straps, or the like) that may be configured to hold mask **102** stationary over the space around the user's nose and/or mouth. The one or more head straps may extend outwardly from one or more regions of mask **102**, including, but not limited to, one or more corners of mask **102**. As discussed above, divider **108** may include an elastic strip. Accordingly, in some such embodiments, at least a portion of retention system **110** for mask **102** may extend from a region at least generally associated with the divider, and/or configured to exert tension on the divider (e.g., which may aid in conformance of the divider to the user's face). Consistent with some such embodiments, the retention system for the mask may facilitate defining the two volumes (i.e., by the respective first portion and second portion), thereby improving separation between the two volumes, and/or providing conformance of the divider to the user's face.

[0037] In some implementations, the mask (e.g., one or more of the first portion and the second portion) may be made from and/or may be lined with a filtering material. For example, the mask may include a filtering material making up, removeably disposed within, and/or integrally disposed within, at least a portion of the mask. Consistent with various embodiments, the filtering material may be a breathable material (e.g., may allow airflow there through) that may be configured to filter inhaled air that passes through the mask, e.g., to remove at least a portion of particulate contaminants from the inhaled airstream. Similarly, in some embodiments, the filtering material may include a breathable material that may filter at least a portion of contaminants from exhaled air. As will be discussed in detail below, the filtering material may be made up of one or more layers having the same or substantially equivalent configuration (e.g., dimensions, shape, and/or arrangement, etc.) as one or more of the respective portions of the mask. The filtering material may include one or more fabrics, textiles (woven and/or non-woven), foams, perforated materials, or the like. For example, the mask may be made up of the same or multiple filtering materials for each respective portion of mask, and/or may include different materials in different portions of the mask. For example, the first portion may be made of a same and/or different filtering material(s) than the second portion. In some example embodiments, the mask may include a filtering material which may include FDA approved materials (e.g., N95 approved materials and/or other materials identified by the FDA as being suitable materials for user in respiratory masks), reusable fabrics, and/or fashionable materials and designs. Examples of such

materials may include, but are not limited to, woven and/or non-woven materials (e.g., knit materials, random spun fabrics, felt materials, or the like).

[0038] In some implementations, the first portion of the mask may include and/or be lined with a filtering material having a substantially equivalent configuration to first portion of the mask. For example, the first portion of the mask may include a filtering material configured to cover the same or substantially equivalent region as the first portion of the mask. The filtering material may include one or more fabrics. For example, the first portion may be made up of the same or multiple filtering materials. In some implementations, at least the second portion of the mask may include and/or may be lined with a filtering material having a substantially equivalent configuration as the second portion of the mask. For example, the second portion of the mask may include a filtering material configured to cover the same and/or substantially equivalent region as the second portion of mask. The filtering material may include one or more fabrics. For example, the second portion may be made up of the same or multiple filtering materials.

[0039] Consistent with the foregoing, in some embodiments of the present disclosure, the respiratory protective device may essentially provide two masks in one (i.e., one mask or mask feature generally covering the mouth and one mask or mask feature generally covering the nose). Accordingly, in some embodiments both the first portion and the second portion of the mask may use the same fabric or have a different fabric on each respective portion, depending on the desired protection level and/or other considerations appreciated by a person of skill in the art. In some implementations, the first portion may be fitted with an air filter (including, but not limited to, an N95 filter). It will be appreciated that the one or more fabrics making up the filtering material for the first portion may be made specifically to make it easier to inhale. For example, the one or more fabrics making up the filtering material for the first portion may be configured to create a better airflow intake, e.g., through the user's nose. In a corresponding manner, the second portion of the mask may be fitted with an air filter (e.g., of any suitable configuration, including, but not limited to, an N95 filter). It will be appreciated that the one or more fabrics making up the filtering material for the second portion may be made specifically to make it easier to exhale. For example, the one or more fabrics making up the filtering material for the second portion may be configured to create a better airflow outtake, e.g., through the user's mouth. In some embodiments, one or both portions (i.e., the first portion and/or the second portion) of the mask may be fitted with a portable, electronic, and/or wireless air filter that may maintain a desired air quality while breathing through the mask (e.g., such as a UV filtration and/or purification system). In some embodiments, the mask may be configured to be attached to a helmet or other head covering configured to control a level of air quality and/or to be used independently with the capabilities of testing inhaled air quality.

[0040] As generally discussed above, in some implementations, the mask may include a malleable portion disposed between the first portion and the second portion of the mask. For example, the mask may additionally and/or alternatively utilize the same region between the user's mouth and nose to incorporate a malleable and/or conformable portion, which may, in some embodiments, work as a clip to keep the mask in position while in use. Consistent with some such

implementations, the feature identified as the divider may additionally and/or alternatively include the malleable portion. For example, the malleable portion may at least partially conform to the user's face between the user's mouth and nose, which may provide improved separation of the volume defined by the mask around the mouth (e.g., by the second portion) and the volume defined by the mask around the nose (e.g., by the first portion). Consistent with this example, the malleable portion may include extendable, opposed lateral ends that may be workable to replace conventional hooks, loops, ties, and/or straps configured to loop around the ear and/or head of the user (i.e., to hold a protective mask on the user's face). The extendable lateral ends of the malleable portion may provide a more comfortable fit of the mask around the user's nose, cheeks, and jaw. Additionally or alternatively, the extendable lateral ends of the malleable portion may assist in creating and/or maintaining separation between the first portion and the second portion.

[0041] In some implementations, the first portion of the mask may include pinched base that may be configured to be positioned below the user's nose. For example, and referring at least to the example implementation shown in FIGS. 3 and 4, first portion 104c of mask 102c may include an additional stitching positioned central to first portion 104c and ventral to the user's nose when worn. Consistent with this illustrated example, pinched base 300 may be configured to gently pinch and secure the lower portion of the user's nose in first portion 104c of mask 102c, and enable airflow from a top of mask 102c down through at least one side of mask 102c before entering the user's nose (i.e., nostrils). In some implementations, the user's nose may be outlined in first portion 104c with a foam material configured to provide a suction capability around the user's nose to create a more accurate fit to the user's facial dimensions.

[0042] In some implementations, second portion 106c of mask 102c may be configured to be shrinkable around the chin (e.g., conform to the chin) of the user. For example, second portion 106c of mask 102c may be at least partially made from, and/or may include, an elastic material 302. While the elastic material is generally indicated as hem 302, it will be appreciated that the elastic material may include a greater or lesser region of second portion 106c. The elastic material may include materials composed of polyurethane, including constructed fibers such as, e.g., Lycra®, spandex, and elastane. In a corresponding manner, when the user affixes mask 102c to their face, second portion 106c of mask 102c may stretch to fit the dimension of the size and shape of at least a portion of the user's face (e.g., chin) and, once secured around the perimeter of the user's face, may revert back to its original form. In some implementations, and referring at least to the example implementation of FIGS. 3-4, second portion 106c of mask 102c may be spaced from first portion 104c such that second portion 106c and first portion 104c do not share a seam. In a corresponding manner, second portion 106c may include a fold inlay configured to direct exhaled air downward to the user's neck area, e.g., which may reduce the likelihood and/or occurrence of contamination spreading between the respective portions of mask 102c.

[0043] Consistent with the foregoing, a user may realize at least some degree of protection from any biological and/or non-biological contaminants present in the immediate air around the user (e.g., when other people with certain infec-

tions cough, sneeze, or talk, thereby spewing nasal and throat secretions into the air (e.g., airborne particulates and respiratory droplets)). For example, a respiratory protective device consistent with the present disclosure may enable a user to filter and/or deactivate at least a portion of such biological and non-biological contaminants from the nearby air, which is breathed in by the user. As noted above, the mask may provide a volume around the mouth that is at least partially separated from a volume around the nose. The respective volume around the nose and mouth may, for example, allow a consistent flow of air in through the nose while the mouth exhales into a separate but attached part of the mask. Accordingly, there may be at least some limitation on the mixing of air exhaled through the user's mouth (which may be relatively higher in CO₂ as compared to inhaled air) and air inhaled through the user's nose, thereby at least partially reducing the rebreathing of exhaled CO₂, among other benefits including reducing the occurrence and/or likelihood of transferring contaminants between the user's nose and mouth, which is often experienced with most conventional masks.

[0044] Consistent with the foregoing, a user utilize a respiratory protective device consistent with the present disclosure to reduce and/or prevent the spread of infectious disease and/or otherwise reduce and/or prevent the inhalation of contaminants. The respiratory protective device may generally include a mask configured to cover the nose and the mouth of the user when the respiratory protective device is worn. The respiratory protective device may further include a first portion and a second portion. The first portion may generally define a first volume around a nose of the user. The second portion may generally define a second volume around a mouth of the user. In some implementations, a divider may be generally positioned on the mask so as to be generally positioned between the nose and the mouth of the user when the mask is being worn. In some implementations, the divider may be configured to aid in defining the first portion of the mask generally surrounding the nose of the user, and the second portion of the mask generally surrounding the mouth of the user. The user may affix the mask to the user's face via a retention system extending from one or more regions of the mask. Once affixed to the user's face, the mask may provide at least partially separated airways of breathing (e.g., for inhaling and exhaling). In some implementations the separate airways of breathing may be, at least in part, facilitated via a seal that may, in some implementations, be generally corresponding to the divider between the first portion of the mask and the second portion of the mask. For example, the seal may include, but is not limited to, a rubber-like material that may provide an at least partial seal against a user's face, which may reduce the level of air being exchanged between the volume around the mouth and the volume around the nose.

[0045] As generally discussed above, the first portion of the mask and the second portion of the mask may be configured to be folded away from each other and/or folded away from the face of the user separately from one another. For example, the first portion of the mask may remain over the nose while the second portion of the mask may be folded away to expose the mouth without losing all protection against contaminants and/or contagious air droplets. Consistent with the foregoing, in an implementation in which the portion of the mask that is intended to be disposed over the mouth is folded away (e.g., folded upwardly about the

region generally coinciding with the upper lip/region between the upper lip and the nose), the user's nose may still be protected against inhalation of particles or droplets.

[0046] In some implementations, the mask may be at least partially made from and/or lined with a filtering material. For example, the filtering material may include one or more fabrics generally covering the mouth and the nose of the user and configured to act as a barrier between airborne contaminants and the user's mouth and nose. Consistent with the foregoing, the respective portions (i.e., first portion and second portion) of the mask may use the same fabric or have a different fabric, depending on the desired protection level and/or other considerations appreciated by a person of skill in the art. In a corresponding manner, the mask may be fitted with an Ultraviolet (UV) light (e.g., of any suitable configuration). As would be appreciated by a person of ordinary skill in the art, UV light is a form of electromagnetic radiation present in sunlight and in specialized lamps, that is capable of sterilizing surfaces with which it comes into contact. Consistent with the foregoing, a UV light may be affixed to the mask (e.g., sewn into, etc.) such that the user may turn the UV light on (or off, accordingly) to sterilize one or more regions of the mask after the mask has been worn. Accordingly, the mask may be sterilized and subsequently reused several times, thus providing a sustainable alternative to disposable face masks.

[0047] In some implementations, the first portion of the mask may include and/or may be lined with a filtering material having a substantially equivalent configuration as the first portion of the mask. In a corresponding manner, in some implementations, the second portion of the mask may include and/or may be lined with a filtering material having a substantially equivalent configuration as the second portion of the mask. For example, a filtering material may be integrally-disposed within at least a portion of the mask and may be made up of one or more layers having the same or substantially equivalent outer dimensions of the respective portions (i.e., first portion or second portion) of the mask. According to some example embodiments, the respective portions (i.e., first portion and second portion) of the mask may use the same fabric or may include a different fabric, depending upon the desired protection level and/or other considerations appreciated by a person of skill in the art. Consistent with the foregoing, each of the respective portions of the mask may be fitted with an Ultraviolet (UV) light (e.g., of any suitable configuration).

[0048] In some implementations, The mask may include a malleable portion fastened between the first portion and the second portion of the mask. For example, the mask may use a divider (e.g., which may include, but is not limited to, an elastic, metal, plastic, and/or other malleable or conformable materials, and/or combinations thereof) to separate the air being used by the mouth from the nose. Consistent with such an example, the mask may additionally and/or alternatively utilize that same region between the user's mouth and nose to incorporate the malleable and/or conformable portion, which may, in some embodiments, be configured to secure the mask to the face of the user. For example, the malleable feature may at least partially conform to the user's face between the user's mouth and nose, thus providing and improved separation of the volume defined by the mask around the mouth and the volume defined by the mask around the nose.

[0049] Continuing with the foregoing, in some embodiments the first portion of the mask may include a pinched base positioned below the user's nose. For example, the pinched base may be configured to gently pinch and secure the lower portion of the user's nose in the first portion of the mask. The pinched base may be configured to enable airflow from the top of the mask through to at least one side of the mask before entering the user's nose (i.e., nostrils).

[0050] Referring also to FIGS. 5 and 6, consistent with an illustrative example embodiment, the first portion 104d and the second portion 106d may be configured as separate components, e.g., in which each of the first portion 104d and the second portion 106d may include separate retention systems (e.g., ear loops, or other suitable retentions systems, as generally discussed herein). As such, the first portion 104d and the second portion 106d may be worn cooperatively, e.g., as generally depicted in FIG. 6. Consistent with related embodiments, the first portion and the second portion may be at least partially connected to one another. For example, the first portion and the second portion may be connected to one another, e.g., at the generally lateral expanses or edges thereof, and/or may be connected to one another via a common retention system. For example, both the first portion and the second portion may be connect via common ear loops (or other retention system as generally discussed herein), which may both serve to connect the first portion and the second portion and to retain the first portion and the second portion relative to a user's face.

[0051] As generally shown, and similar to the foregoing discussions, in an example embodiment, the first portion 104d may generally include a configuration that pinches the nose of the user, and/or otherwise provides an at least partially fitted or contoured shape to the first portion in the region of the nose of the user. Consistent with such an implementation, the lower edge of the first portion may at least partially fit around the nostril region of the nose of the user (e.g., which may include approximating, abutting, and/or at least partially overlying the upper lip of the user). In some such configurations, the fitted shape of the lower region of the first portion 104d may tend to direct and/or create an airflow from the top of the first portion coming down and in through the side of the first portion before entering the nostrils of the user, during inhalation via the nose. Similarly, during exhalation from nose, the shape of the first portion may tend to create an airflow that may be at least partially directed up along the sides of the nose and exiting from an upper region of the first portion. Of course, in at least some implementations, the first portion may be formed from an at least partially air permeable material (such as a filtering material, a fabric, etc.). As such, at least a portion of inhaled air may be drawn through the first portion itself.

[0052] As generally shown, and similar to the foregoing discussion, in an example embodiment the second portion 106d may generally include a configuration that may include a fold and spacing in the middle region that may facilitate contouring the second portion around the mouth, face, and/or chin of a user in a manner that may tend to encourage and/or create an airflow of exhaled air from the mouth of the user in a generally downward direction that exit towards and/or below the chin, jawline, and/or neck region of the user. Similarly, if air inhaled through the mouth of the user, the shape of the second portion may tend to encourage and/or create an airflow in an upward direction, e.g., from a

region at and/or below a neck, jawline, and/or chin of the user. Of course, in at least some implementations, the second portion may be formed from an at least partially air permeable material (such as a filtering material, a fabric, etc.). As such, at least a portion of inhaled air may be drawn through the second portion itself. The combination of the foregoing configurations of the first portion 104d and the second portion 106d may at least partially decrease mixing of exhaled air and inhaled air. Accordingly, in some implementations, contamination of inhaled air with exhaled carbon dioxide may be at least partially reduced.

[0053] Referring also to FIG. 7, another implementation of a respiratory protective device 100e is shown. Consistent with the illustrated example embodiment, the respiratory protective device 100e may include a first portion 104e and a second portion 106e. In some implementations, the first portion 104e and the second portion 106e may each be generally configured in a similar manner as the first portion 104d and the second portion 106d depicted in FIGS. 5 and 6. However, consistent with the illustrated example embodiment of FIG. 7, the first portion 104e and the second portion 106e may be at least partially, substantially, and/or fully connected to one another about the interface therebetween (e.g., at a line of junction, contact, and/or intersection as may occur when worn by a user). Consistent with some such embodiments, the respiratory protective device 100e may include many of the features and configurations as the respiratory protective device 100d, but may generally be provided as a single assembly.

[0054] The terminology used herein is for the purpose of describing particular implementations only and is not intended to be limiting of the disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. As used herein, the language "at least one of A, B, and C" (and the like) should be interpreted as covering only A, only B, only C, or any combination of the three, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps (not necessarily in a particular order), operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps (not necessarily in a particular order), operations, elements, components, and/or groups thereof.

[0055] The corresponding structures, materials, acts, and equivalents (e.g., of all means or step plus function elements) that may be in the claims below are intended to include any structure, material, or act for performing the function in combination with other claimed elements as specifically claimed. The description of the present disclosure has been presented for purposes of illustration and description, but is not intended to be exhaustive or limited to the disclosure in the form disclosed. Many modifications, variations, substitutions, and any combinations thereof will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the disclosure. The implementation(s) were chosen and described in order to explain the principles of the disclosure and the practical application, and to enable others of ordinary skill in the art to understand the disclosure for various implementation(s)

with various modifications and/or any combinations of implementation(s) as are suited to the particular use contemplated.

[0056] A number of implementations have been described. Having thus described the disclosure of the present application in detail and by reference to implementation(s) thereof, it will be apparent that modifications, variations, and any combinations of implementation(s) (including any modifications, variations, substitutions, and combinations thereof) are possible without departing from the scope of the disclosure defined in the appended claims.

What is claimed is:

1. A respiratory protective device comprising:
a mask including a first portion configured to at least partially cover a nose of a user when the respiratory protective device is worn, and a second portion configured to at least partially cover a mouth of a user when the respiratory protective device is worn; and
a divider associated with one or more of the first portion and the second portion, wherein the divider is configured to be generally positioned between the nose and the mouth of the user.
2. The respiratory protective device according to claim 1, wherein the first portion and the second portion are at least partially joined to one another
3. The respiratory protective device according to claim 1, wherein at least part of the first portion of the mask is at least partially separated from at least part of the second portion of the mask.
4. The respiratory protective device according to claim 1, wherein the first portion of the mask and the at least second portion of the mask are configured to be at least partially folded away from each other.
5. The respiratory protective device according to claim 1 further comprising a seal generally corresponding to the divider between the first portion of the mask and the at least second portion of the mask.
6. The respiratory protective device according to claim 1 further comprising a retention system extending from one or more of the first portion and the second portion of the mask.
7. The respiratory protective device according to claim 1, wherein the mask includes a filtering material, the filtering material associated with one or more of the first portion and the second portion.
8. The respiratory protective device according to claim 7, wherein the first portion of the mask is lined with the filtering material having a substantially equivalent configuration as the first portion of the mask.
9. The respiratory protective device according to claim 7, wherein the second portion of the mask is lined with the filtering material having a substantially equivalent configuration as the second portion of the mask.
10. The respiratory protective device according to claim 1, wherein the divider includes a malleable feature one or more of disposed between the first portion and the second portion, and associated with one or more of the first portion and the second portion.

11. The respiratory protective device according to claim 1, wherein the first portion of the mask includes a pinched base configured to be positioned below the nose of the user when worn.

12. The respiratory protective device according to claim 1, wherein the second portion of the mask is configured to at least partially conform around a chin of the user.

13. A respiratory protective device comprising:

- a first portion configured to at least partially cover a nose of a user; and
- a second portion configured to at least partially cover a mouth of the user;

wherein the first portion and the second portion are configured to provide a first volume around the nose and a second volume around the mouth, the first volume being at least partially separated from the second volume.

14. The respiratory protective device according to claim 13, wherein the first portion and the second portion are at least partially separated by a divider, the divider configured to be disposed between the nose and the mouth of the user.

15. The respiratory protective device according to claim 13, wherein the first portion and the second portion include a separation configured to be positioned generally between the nose and the mouth.

16. The respiratory device according to claim 15, wherein the separation includes one or more of a lower edge of the first portion and an upper edge of the second portion.

17. The respiratory device according to claim 16, wherein the first portion and the second portion include at least partially separate components.

18. The respiratory device according to claim 17, wherein the first portion and the second portion are at least partially coupled to one another at generally opposed lateral aspects.

19. The respiratory device according to claim 13, further including a seal associated with one or more of the first portion and the second portion, the seal configured to engage a region between the nose and the mouth and at least partially impede air exchange between the first volume and the second volume.

20. A method for preventing the spread of infectious disease via a respiratory protective device, the method comprising:

- providing a respiratory protective device comprising a first portion and a second portion;
- fitting the respiratory protective device to a user with the first portion generally overlying a nose of the user and the second portion generally overlying the mouth of the user;

wherein the first portion generally defines a first volume associated with the nose and the second portion generally defines a second volume associated with the mouth of the user, the first volume being at least partially separated from the second volume to reduce air exchange between the first volume and the second volume.

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