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(54) **Title:** ADAPTOR INTERFACE FOR PROTECTIVE EQUIPMENT

(57) **Abstract:** The invention provides an adaptor interface for forming a seal between a respirator mask and a protective suit. The adaptor interface is formed of an elastomeric material. The adaptor interface comprises a first surface shaped for sealing engagement with an outer surface of the respirator mask, and a second surface shaped for sealing engagement with the protective suit.

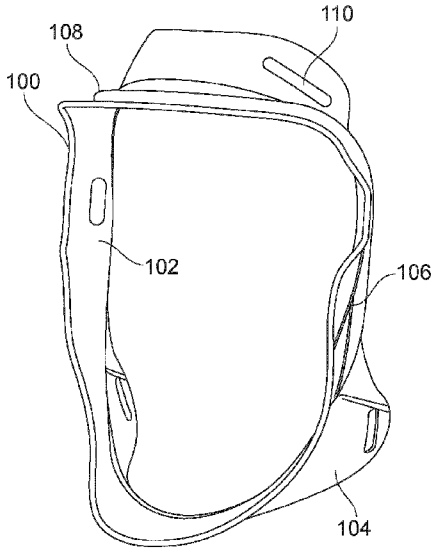

FIG. 1

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ADAPTOR INTERFACE FOR PROTECTIVE EQUIPMENT

Field of the Invention

The present invention relates to an adaptor interface for use with protective equipment. In particular, the adaptor interface is designed to form a seal between a respirator mask and a protective suit.

Background

Protective equipment is critical in a range of different fields. For example, in chemical, biological, radiological, and nuclear (CBRN) defence, protective equipment is needed to protect the wearer against hazards that may be present in the environment. CBRN protective equipment such as gloves, boots and respirators typically include barrier materials which act to block the permeation of dangerous substances through the clothing and respirator, preventing the dangerous substances from reaching the wearer's skin.

A CBRN respirator mask is a device that is used to protect a wearer from dangerous materials or substances in the environment. A CBRN respirator mask typically includes a full facepiece with an integral visor, such that the facepiece fully encloses the users face and provides full respiratory tract, ocular and dermal protection. The respirator facepiece is provided either with a filter for filtering air inhaled into the facepiece by the user, or with a connector for connecting the facepiece to a supply of filtered air. The respirator facepiece is also typically provided with an exhale valve through which exhaled air can be discharged from the facepiece.

A protective suit (or over-suit) is typically a one-piece or multi-piece garment made of a CBRN agent-resistant materials, to protect the wearer from dangerous materials or substances in the environment. In many cases, a protective suit will include a hood for covering and protecting the wearer's head. To avoid ingress of materials or substances into the protective suit, the protective suit may comprise seals at interfaces to other protective equipment, e.g. for forming seals around the wearer's wrists, ankles neck, face and/ or respirator.

The present invention has been devised in light of the above considerations.

Summary of the Invention

According to a first aspect, the invention provides an adaptor interface for forming a seal between a respirator mask and a protective suit, the adaptor interface being formed of an elastomeric material and comprising: a first surface shaped for sealing engagement with an outer surface of the respirator mask; and a second surface shaped for sealing engagement with the protective suit.

In this manner, a seal can be effectively and reliably formed between the respirator mask and the protective suit, to avoid ingress of dangerous materials or substance via the connection between the respirator mask and the protective suit. In particular, as the first surface and the second surface of the adaptor interface are specifically shaped for sealing engagement with the respirator mask and the protective suit, respectively, the adaptor interface is configured to form a sealed connection between the respirator mask and the protective suit.

Additionally, as the adaptor interface forms the seal between the respirator mask and the protective suit, the respirator mask and protective suit do not need to be specifically adapted for use with one another. Thus, for example, existing respirator masks and protective suits can be retrofitted with the adaptor interface of the invention to enable them to be used together and enhance safety of the protective equipment.

The elastomeric material is an elastically deformable (resilient) material. This serves to ensure that a seal can be maintained between the adaptor interface and the respirator mask on the one hand, and between the adaptor interface and the protective suit on the other hand. In particular, the adaptor interface may be configured to be stretched around the outer surface of the respirator mask, e.g. so that an interference fit is formed between the adaptor interface and the respirator mask. In other words, the adaptor interface is configured to be retained on the outer surface of the respirator mask via friction between the adaptor interface and the outer surface of the respirator mask.

The elastomeric material can be a CBRN agent-resistant material. For example, the elastomeric material may comprise a rubber-based material. Rubber-based materials may provide desired levels of elasticity in combination with suitable levels of CBRN resistance.

The first surface of the adaptor interface may correspond to an inner surface of the adaptor interface. In other words, in use the first surface may face inwards, e.g. towards the respirator. The shape of the first surface is specifically adapted to the shape of the outer surface of the respirator, to ensure that a seal is formed along an entire interface between the adaptor interface and the respirator mask. For example, the first surface can be shaped (configured) to conform to the shape of the outer surface of the respirator mask.

The outer surface of the respirator mask may correspond to a region around a periphery of the respirator mask, and with which the first surface of the adaptor interface is engaged in use. For example, the first surface may be arranged to engage an edge region on the outer surface of the respirator mask around a periphery of the respirator mask.

The adaptor interface may be shaped to extend around the periphery of the respirator mask. Thus, the adaptor interface may form a closed loop, such that in use it extends around the periphery of the respirator mask.

The respirator mask may include any suitable type of respirator mask. As described above, the respirator mask can include a facepiece with an integral visor, such that the facepiece is

arranged to cover the user's whole face. The visor may also be referred to as goggles. The respirator mask may be arranged to form a seal with the user's face, e.g. around the user's nose, mouth and eyes. The respirator mask may further include one or more straps and/or buckles for securing the respirator mask to the user's head. The respirator facepiece is provided either with a filter for filtering air inhaled into the facepiece by the user, or with a connector for connecting the facepiece to a supply of filtered air.

The second surface of the adaptor interface may correspond to an outer surface of the adaptor interface. In other words, in use the second surface may face outwards, e.g. away from the outer surface of the respirator mask. The second surface may be on an opposite side of the adaptor interface relative to the first surface.

The second surface may have a different shape (or surface profile) compared the first surface. In particular, whilst the shape (surface profile) of the first surface may include variations or other surface features to conform with the outer surface of the respirator mask, such variations or other surface features are not needed on second surface. Thus, the surface profile of the second surface may be smoother (i.e. it may have fewer variations, such as peaks and/or troughs) compared with the surface profile of the first surface. A smoother second surface may serve to enhance sealing with the protective suit, whilst the variations in the first surface may serve to enhance sealing with the respirator mask. As an example, the second surface may have a more regular shape, e.g. a more convex or oval shape, compared to the first surface (when looking face on at the adaptor interface on the respirator mask).

The second surface may be configured for engagement with an edge of the protective suit. The edge of the protective suit is configured to fit over the second surface of the adaptor interface to form a seal with the adaptor interface. The edge of the protective suit can for example comprise an elasticated sealing edge which fits over the second surface of the adaptor interface to form a seal with the adaptor interface. Additionally or alternatively, the edge of the protective suit can include a drawstring for tightening the edge of the protective suit around the adaptor interface. In some implementations, the protective suit includes a hood for covering the user's head. The second surface of the adaptor interface may then be shaped for sealing engagement with an edge (sealing edge) of the hood. In this manner, the user's head may be completely protected by the combination of the respirator mask, adaptor interface, and hood.

The adaptor interface may be separate (e.g. distinct) from the respirator mask and the protective suit. In other words, the adaptor interface may not form part of the respirator mask or the protective suit. Thus, the adaptor interface may not be attached (e.g. sewn, bonded, or otherwise secured) to the respirator mask or the protective suit. Likewise, the adaptor interface may not be integrally formed as part of the respirator mask or protective suit. Thus, the adaptor interface can constitute an independent component, which can be arranged at the interface between the respirator mask and the protective suit to form a seal therebetween.

A shape of the first surface may be complementary to a shape of the outer surface of the respirator mask. The complementary shape of the first surface serves to enhance a quality of the seal with the respirator mask, by enabling uniform contact along the outer surface of the respirator mask, despite any potential variations in shape (e.g. bumps, protrusions, peaks, troughs) along the outer surface of the respirator mask. For instance, the first surface may comprise one or more surface features whose shapes are complementary to one or more corresponding surface features on the outer surface of the respirator mask. Such surface features may however not be included in the second surface, such that the second surface may have a smoother profile compared to the first surface.

As an example, the first surface may comprise a bulge or a protrusion whose shape is complementary to a dip or indent in the outer surface of the respirator mask. Additionally or alternatively, the first surface may comprise a dip or indent whose shape is complementary to a bulge or protrusion in the outer surface of the respirator mask.

The shape of the first surface may match the shape of the outer surface of the respirator mask, to enable a tight fit between the adaptor interface and the respirator mask. In other words, the first surface may be specifically adapted to fit the outer surface of the respirator mask. For instance, a profile (or contour) of the first surface may (exactly, or substantially) match a profile (or contour) of the outer surface of the respirator mask. Thus, the first surface is arranged to provide a reflection of the profile of the outer surface of the respirator mask. In this manner, any variations in the profile of the outer surface of the respirator mask are reflected in the profile of first surface.

For example, the outer surface of the respirator mask may comprise one or more surface features, such as a bump, protrusion, peaks, and/or trough (dip). The first surface may then comprise a complementary (matching) arrangement of surface features, arranged to fit (e.g. exactly, or substantially) the one or more surface features on the outer surface of the respirator mask. For each of the one or more surface features on the outer surface of the respirator mask, a corresponding complementary (matching) feature may be provided on the first surface. A shape of each surface feature on the first surface may be arranged to match a shape of a corresponding feature on the outer surface of the respirator mask. Thus, there may be a one-to-one correspondence between surface features on the outer surface of the respirator mask and surface features on the first surface.

Such specific fitting between the adaptor interface and the respirator mask may serve to ensure correct positioning of the adaptor interface on the respirator mask. In some cases, the complementary (matching) shapes of the first surface and the outer surface of the respirator mask may be arranged to define a correct engagement orientation of the first surface with the outer surface of the respirator mask.

The adaptor interface may be moulded so as to adapt the shape of the first surface to the outer surface of the respirator mask. For example, a mould used for shaping the first surface of the

adaptor interface may be based on (e.g. determined using) the shape of the outer surface of the respirator mask. This may ensure accurate fitting between the first surface and the outer surface of the respirator mask.

A cross-sectional shape of the adaptor interface may vary around the adaptor interface to complement a shape of the outer surface of the respirator mask. This enables the shape of the first surface to be adapted to the outer surface of the respirator mask, without having to include corresponding surface features on the second surface. In other words, the varying cross-sectional shape (e.g. thickness) of the adaptor interface serves to compensate for variations in the profile of the first surface to keep the second surface relatively smooth. For example, the cross-sectional shape of the adaptor interface may vary along the adaptor interface as a result of the one or more surface features included in the first surface.

Here, variations in cross-sectional shape along the adaptor interface refers to variations in a direction along a length of the seal.

The second surface may have a channel for receiving a sealing edge of the protective suit. In this manner, a seal may be reliably formed between the sealing edge of the protective suit and the adaptor interface. The channel in the second surface of the adaptor interface may serve to locate the sealing edge of the protective suit on the second surface. Additionally, the channel in the second surface may be configured to retain the sealing edge of the protective suit. This may ensure that sealing engagement between the adaptor interface and the protective suit is maintained, even as the user moves around. As an example, the channel may be dimensioned (shaped) so as to grip (clamp) the sealing edge of the protective suit when the sealing edge of the protective suit is received in the channel. In some cases, the channel may be formed as a groove in the second surface. In other cases, the second surface may comprise a pair of protrusions (e.g. ridges) between which the channel is defined. The channel may extend along all or part of the second surface.

The sealing edge of the protective suit may be provided on a hood of the protective suit, as mentioned above. The sealing edge may comprise a material for forming a seal with the adaptor interface. For example, the sealing edge may comprise an elastomeric material, such as a rubber-based material. Additionally or alternatively, the sealing edge can include a drawstring for tightening the sealing edge.

The second surface may comprise a ridge for engaging the sealing edge of the protective suit. This may facilitate accurately locating the sealing edge on the second surface and ensuring that a seal is formed between the two. For example, the ridge may act as a guide for the user when they are engaging the sealing edge with the second surface of the adaptor interface. The ridge may comprise a protrusion which extends outwards from the second surface. The ridge may extend along all or part of the second surface.

One or more apertures may be provided in the adaptor interface, each of the one or more apertures arranged to receive a buckle or strap of the respirator mask when the first surface is

in sealing engagement with the respirator mask. In this manner, the adaptor interface may not interfere with buckles and/or straps of the respirator mask which are used for securing the respirator mask to the user's head . This also enables the adaptor interface to be entirely backwards compatible with respirator masks currently in use. Accordingly, the adaptor interface can be fitted over the outer surface of the respirator mask, such that buckles and/or straps on the respirator mask protrude through the apertures in the adaptor interface.

The adaptor interface may be integrally formed as a single piece of elastomeric material. This may ensure integrity of the adaptor interface and enhance a quality of the seals formed by the adaptor interface. This may also facilitate manufacture of the adaptor interface. For example, the adaptor interface may be formed integrally formed as a single piece via a moulding (e.g. injection moulding) procedure.

The adaptor interface of the first aspect may form part of a set of protective equipment. Thus, according to a second aspect of the invention, there is provided protective equipment comprising: a protective suit; a respirator mask; and an adaptor interface according to the first aspect of the invention, wherein the first surface of the adaptor interface is shaped for sealing engagement with the respirator mask, and the second surface of the adaptor interface is shaped for sealing engagement with the protective suit.

Any of the features described above in relation to the first aspect of the invention may be shared with the second aspect of the invention.

The protective suit may be as described above in relation to the first aspect. The protective suit may comprise a one-piece or multi-piece garment for protecting a user's body. The protective suit may comprise a protective material for protecting the user from dangerous materials or substances in the environment. For example, the protective suit may comprise one or more CBRN agent-resistant materials. The protective suit can include a barrier material (which acts as an outer barrier against CBRN agents), in combination with an absorbent layer (used to absorb any agents which have reached an inside of the protective suit. Carbon cloth can be used as the absorbent layer. The protective suit may further include rubber seals, e.g. around the user's wrists, ankles, neck and/or with other parts of protective equipment.

The protective suit may comprise a hood, and the second surface of the adaptor interface may be shaped for sealing engagement with an edge (sealing edge) of the hood.

The respirator mask may be as described above in relation to the first aspect.

According to a third aspect of the invention, there is provided a method for manufacturing an adaptor interface for forming a seal between a respirator mask and a protective suit, the adaptor interface comprising a first surface shaped for sealing engagement with an outer surface of the respirator mask, and a second surface shaped for sealing engagement with the protective suit, the method comprising: providing a mould for the adaptor interface, wherein a shape of a portion of the mould used for shaping the first surface is determined based on a shape of the

outer surface of the respirator mask; and performing a moulding process with the mould to form the adaptor interface with an elastomeric material.

The method of the third aspect of the invention may be used for manufacturing the adaptor interface of the first aspect of the invention. Accordingly, any features discussed above in relation to preceding aspects of the invention may be shared with the third aspect of the invention (and vice versa).

The shape of the portion of the mould used for shaping the first surface may be determined such that the shape of the first surface is complementary to (e.g. matches) the shape of outer surface of the respirator mask. For example, the shape of the portion of the mould may be determined using the shape of the outer surface of the respirator mask as a reference.

The moulding process may comprise an injection moulding process, or any other suitable moulding process.

Summary of the Figures

Embodiments and experiments illustrating the principles of the invention will now be discussed with reference to the accompanying figures in which:

Fig. 1 is a schematic diagram showing a perspective view of an adaptor interface according to an embodiment of the invention;

Fig. 2 is a schematic diagram showing a perspective view of the adaptor interface mounted on a respirator mask;

Fig. 3 is a schematic diagram showing a side view of the adaptor interface mounted on the respirator mask;

Fig. 4 is a schematic diagram showing a side view of the adaptor interface forming a seal between the respirator mask and a hood of a protective suit; and

Fig. 5 is a schematic diagram showing a cross-sectional view of a portion of the adaptor interface mounted on the respirator mask.

Detailed Description of the Invention

Aspects and embodiments of the present invention will now be discussed with reference to the accompanying figures. Further aspects and embodiments will be apparent to those skilled in the art. All documents mentioned in this text are incorporated herein by reference.

Fig. 1 shows a schematic diagram of an adaptor interface 100 according to an embodiment of the invention. The adaptor interface 100 is designed to be used as part of protective equipment, including CBRN protective equipment, to protect a wearer from hazardous materials and

substances in the environment. The adaptor interface 100 is configured to provide a seal between a respirator mask and a protective suit, to avoid ingress of hazardous materials or substances via the connection between the respirator mask and the protective suit. Figs. 2 and 3 respectively show a perspective view and a side view of the adaptor interface 100 in use on a respirator mask 200. Fig. 4 shows a schematic diagram of the adaptor interface 100 in use to form a seal between the respirator mask 200 and a hood 400 of a protective suit.

The adaptor interface 100 is formed of an elastomeric material, such as a rubber-based material. The adaptor interface 100 is integrally formed as a single part, for example using a moulding procedure such as injection moulding. The adaptor interface 100 includes a first, inner surface 102 which is configured to engage an outer surface of the respirator mask 200 and form a seal with the outer surface of the respirator mask 200. As shown in Fig. 1, the adaptor interface 100 forms a closed loop (ring), such that it fits around an outside of the respirator mask 200. The inner surface 102 of the adaptor interface 100 has a shape which is complementary to a peripheral portion of the outer surface of the respirator mask 200. In particular, any variations (e.g. bumps, dips, indents, protrusions, etc.) in the peripheral portion of the outer surface of the respirator mask 200 are reflected in the inner surface 102 of the adaptor interface to ensure a tight fit between the two surfaces. In this manner, when the adaptor interface 100 is installed on the peripheral portion of the outer surface of the respirator mask 200, the inner surface 102 of the adaptor interface 100 conforms to the outer surface of the respirator mask 200 to form a tight seal with the outer surface of the respirator mask 200. The adaptor interface 100 may further shaped so that the elastomeric material is stretched when the adaptor interface 100 is installed on the outer surface of the respirator mask 200. This increases a tightness of the fit between the adaptor interface 100 and the respirator mask 200, which may further improve a quality of the seal. A shape of a mould used for producing the adaptor interface 100 may be determined based on a shape of the outer surface of the respirator mask 200, to ensure the tight fit between the inner surface 102 and the respirator mask 200. In particular, a portion of the mould which is used to shape the inner surface 102 may be determined using the outer surface of the respirator mask 200 as a reference, so as to accurately reflect all surface features of the outer surface of the respirator mask 200 in the inner surface 102 of the adaptor interface 100.

The respirator mask 200 comprises a facepiece 204 which is configured to cover a wearer's face to provide protection against liquids, gases, vapours, and/or airborne particles when the wearer breathes. The facepiece 204 includes an integral flexible visor 202, which provides eye protection for the wearer. In the embodiment shown, the facepiece 204 includes filters 208 configured to filter ambient gas inhaled into the facepiece 204 by the wearer, to produce filtered gas for breathing by the wearer. The facepiece 204 can therefore protect the person wearing the mask from inhaling harmful substances in the ambient gas. The filters 208 include a filtration medium, such as activated carbon, that filters ambient air (or other gas) inhaled into the facepiece 204 from outside the facepiece 204 by the wearer to produce filtered air. In an

alternative embodiment (not shown), the facepiece 204 may instead be connected to a source of breathable gas, for example a container or tank of breathable gas, or an external air filter.

The adaptor interface 100 is arranged such that, when it is installed on the respirator mask 200, the adaptor interface 100 extends around a periphery of the respirator mask 200. In particular, the adaptor interface 100 extends around the facepiece 204. Thus, when the respirator mask 200 is worn, the adaptor interface 100 extends around the wearer's face. In this manner, the seal between the adaptor interface 100 and the respirator mask 200 extends around the wearer's face, to avoid ingress of hazardous materials or substances into the respirator mask 200. In the example shown, the peripheral portion of the outer surface of the respirator mask 200 includes an indent between the visor 202 and an adjacent portion of the facepiece 204. Accordingly, the inner surface 102 of the adaptor interface 100 includes a region which is complementary in shape to the indent on the outer surface of the respirator mask 200, e.g. the inner surface 102 of the adaptor interface 100 can include a bump or protrusion whose shape is complementary to that of the indent.

The adaptor interface 100 further includes a second, outer surface 104 which is on an opposite side of the adaptor interface 100 relative to the inner surface 102. The second surface 104 is shaped for sealing engagement with an edge 402 of the hood 400 of the protective suit. The hood 400 is part of a protective suit which is configured to protect the wearer from hazardous materials or substances in the environment. The hood 400 is designed to cover the wearer's head, and includes an opening for the wearer's face. The edge 402 of the hood 400 corresponds to the edge of the hood's opening. The edge 402 may be elasticated, and in some cases can include a seal-forming material such as an elastomeric material (e.g. rubber-based material). Additionally or alternatively, the edge 402 can include a drawstring 404 for tightening the edge 402 of the hood 400 around the adaptor interface 100.

The outer surface 104 of the adaptor interface 100 includes a pair of channels (or grooves) 106, arranged such that they are located on either side of the visor 202 when the adaptor interface 100 is mounted on the respirator mask 200. Each of the channels 106 is defined between a pair of ridges which protrude from the outer surface 104 of the adaptor interface 100. The channels 106 are configured to receive the edge 402 of the hood 400. In this manner, the channels 106 serve to accurately locate the edge 402 of the hood on the adaptor interface 100, to ensure effective sealing between the adaptor interface 100 and the edge 402 of the hood 400. In particular, the channels 106 may serve to maintain contact between the adaptor interface 100 and the edge 402 of the hood 400, and prevent the edge 402 of the hood 400 from slipping off the outer surface 104 of the adaptor interface 100. The channels 106 are dimensioned to receive the edge 402 of the hood 400, i.e. a width of the channels 106 is arranged to accommodate the edge 402 of the hood 400. In some cases, the channels 106 are arranged to grip or clamp the edge 402 of the hood 400 when the edge 402 is received in the channels 106. For example, the channels 106 may be dimensioned such that the elastomeric material of the

adaptor interface 100 is stretched when the edge 402 of the hood 400 is received in the channels 106, such that the edge 402 is gripped between edges of the channels 106.

Additionally, the adaptor interface 100 comprises a ridge 108 protruding from the outer surface 104, the ridge 108 being arranged such that it extends across a top of the visor 202 when the adaptor interface 100 is mounted on the respirator mask 200. Similarly to the channels 106, the ridge 108 serves to locate the edge 402 of the hood 400 on the outer surface 104, and to prevent the edge 402 from slipping off the outer surface 104.

The adaptor interface 100 further includes a set of apertures (through-holes) 110. The apertures 110 are arranged such that, when the adaptor interface 100 is mounted on the respirator mask 200, buckles and/or straps 206 on the respirator mask 200 protrude through the apertures 110 (e.g. as shown in Fig. 2). The buckles and/or straps 206 serve to secure the respirator mask 200 to the wearer's head. In this manner, use of the adaptor interface 100 does not interfere with the buckles and/or straps 206, so that the respirator mask can be securely attached to the user's head. Additionally, passing the buckles and/or straps 206 through the apertures 110 acts to further secure the adaptor interface 100 to the respirator mask 200, e.g. to prevent slippages between the two. This makes the adaptor interface 100 entirely backwards compatible with in-service respirator masks and requires no modification or change to the in-service masks.

As discussed above, the shape of the inner surface 102 of the adaptor interface 100 is specifically adapted to the shape of the outer surface of the respirator mask. As a result, the inner surface 102 can include a number of variations to provide a tight fit with the respirator mask 200. On the other hand, such variations are not needed on the outer surface 104. Preferably, the second second 104 has a relatively smooth profile, to provide a high-quality seal with the edge 402 of the hood 400. Thus, the outer surface 104 may not include some of the variations in topography which are included in the first surface 102. In particular, with the exception of the ridge 108 and the channels 106, the outer surface 104 can have a more regular (smoother) profile compared to the inner surface 102. For example, the outer surface 104 can have a more oval or convex shape compared to the inner surface 102. This may be achieved by varying a cross-sectional shape (and/or thickness) of the adaptor interface 100 around the adaptor interface 100, in order to compensate for the variations in the first surface 102 and provide a relatively smooth outer surface 104.

As an example, Fig. 5 shows a cross-sectional view of part of the adaptor interface 100 on the respirator mask 200. The cross-sectional view of Fig. 5 shows a region around one of the channels 106. As can be seen, in this region, the adaptor interface includes a non-uniform thickness across its width. This non-uniform thickness is due to the inclusion of a bump in the inner surface 102 corresponding to the indent in the outer surface of the respirator mask 200 mentioned above, which causes part of the adaptor interface to have an increased thickness. Fig. 5 further provides a schematic illustration of a position of the edge 402 of the hood 400

when received in the channel 106. Where the edge 402 of the hood 400 includes the drawstring 404, the drawstring 404 may also be located in the channel 106.

Together, the adaptor interface 100, the respirator mask 200 and the protective suit (including hood 400) form a set of protective equipment according to an embodiment of the invention.

The features disclosed in the foregoing description, or in the following claims, or in the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for obtaining the disclosed results, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

While the invention has been described in conjunction with the exemplary embodiments described above, many equivalent modifications and variations will be apparent to those skilled in the art when given this disclosure. Accordingly, the exemplary embodiments of the invention set forth above are considered to be illustrative and not limiting. Various changes to the described embodiments may be made without departing from the spirit and scope of the invention.

For the avoidance of any doubt, any theoretical explanations provided herein are provided for the purposes of improving the understanding of a reader. The inventors do not wish to be bound by any of these theoretical explanations.

Any section headings used herein are for organizational purposes only and are not to be construed as limiting the subject matter described.

Throughout this specification, including the claims which follow, unless the context requires otherwise, the word “comprise” and “include”, and variations such as “comprises”, “comprising”, and “including” will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

It must be noted that, as used in the specification and the appended claims, the singular forms “a,” “an,” and “the” include plural referents unless the context clearly dictates otherwise. Ranges may be expressed herein as from “about” one particular value, and/or to “about” another particular value. When such a range is expressed, another embodiment includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by the use of the antecedent “about,” it will be understood that the particular value forms another embodiment. The term “about” in relation to a numerical value is optional and means for example +/- 10%.

Claims:

1. An adaptor interface for forming a seal between a respirator mask and a protective suit, the adaptor interface being formed of an elastomeric material and comprising:

a first surface shaped for sealing engagement with an outer surface of the respirator mask; and

a second surface shaped for sealing engagement with the protective suit.

2. An adaptor interface according to claim 1, wherein a shape of the first surface is complementary to a shape of the outer surface of the respirator mask.

3. An adaptor interface according to claim 1 or 2, wherein a cross-sectional shape of the adaptor interface varies around the adaptor interface to complement a shape of the outer surface of the respirator mask.

4. An adaptor interface according to any preceding claim, wherein the second surface has a channel for receiving a sealing edge of the protective suit.

5. An adaptor interface according to any preceding claim, wherein the second surface has a ridge for engaging a sealing edge of the protective suit.

6. An adaptor interface according to any preceding claim, wherein one or more apertures are provided in the adaptor interface, each of the one or more apertures arranged to receive a buckle or strap of the respirator mask when the first surface is in sealing engagement with the respirator mask.

7. An adaptor interface according to any preceding claim, wherein the adaptor interface is integrally formed as a single piece of elastomeric material.

8. An adaptor interface according to any preceding claim, wherein the elastomeric material comprises a rubber-based material.

9. Protective equipment comprising:

a protective suit;

a respirator mask; and

an adaptor interface according to any preceding claim, wherein the first surface of the adaptor interface is shaped for sealing engagement with the respirator mask, and the second surface of the adaptor interface is shaped for sealing engagement with the protective suit.

10. Protective equipment according to claim 9, wherein the protective suit comprises a hood, and wherein the second surface of the adaptor interface is shaped for sealing engagement with an edge of the hood.

11. A method for manufacturing an adaptor interface for forming a seal between a respirator mask and a protective suit, the adaptor interface comprising a first surface shaped for sealing engagement with an outer surface of the respirator mask, and a second surface shaped for sealing engagement with the protective suit, the method comprising:

providing a mould for the adaptor interface, wherein a shape of a portion of the mould used for shaping the first surface is determined based on a shape of the outer surface of the respirator mask; and

performing a moulding process with the mould to form the adaptor interface with an elastomeric material.

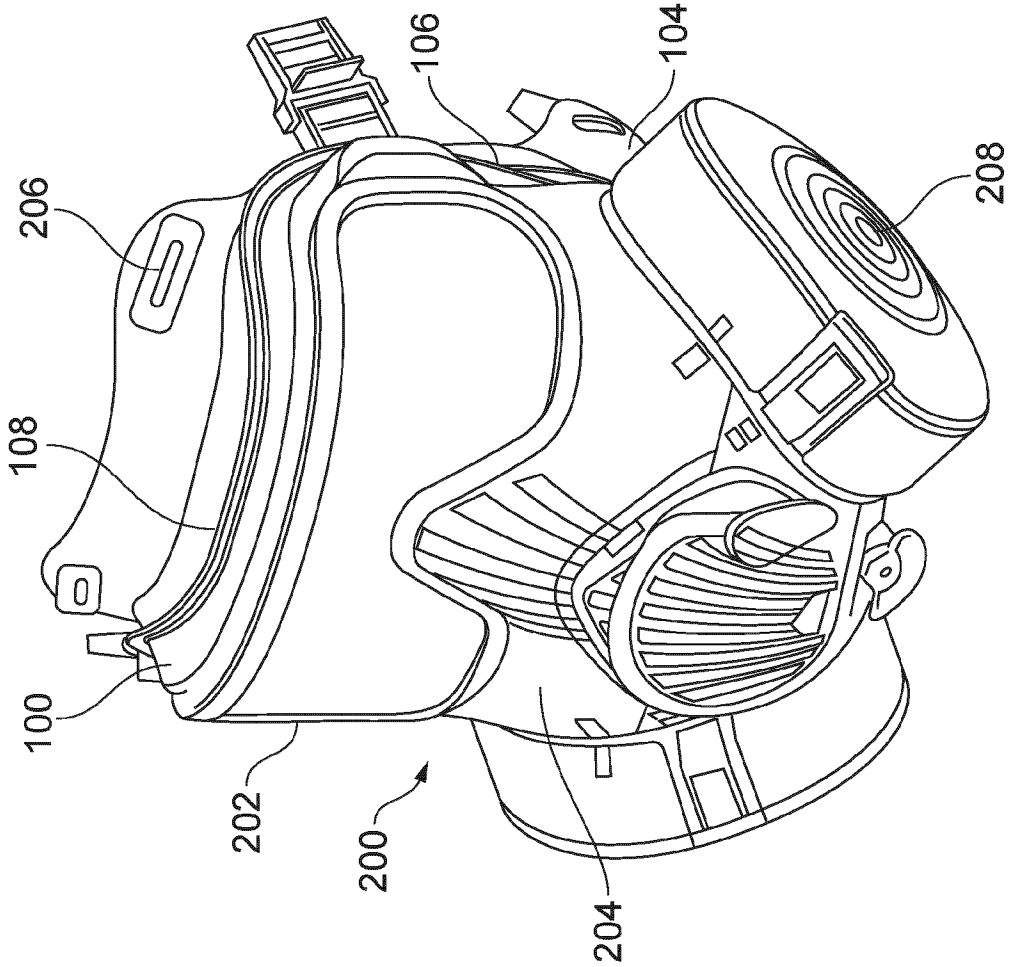

FIG. 2

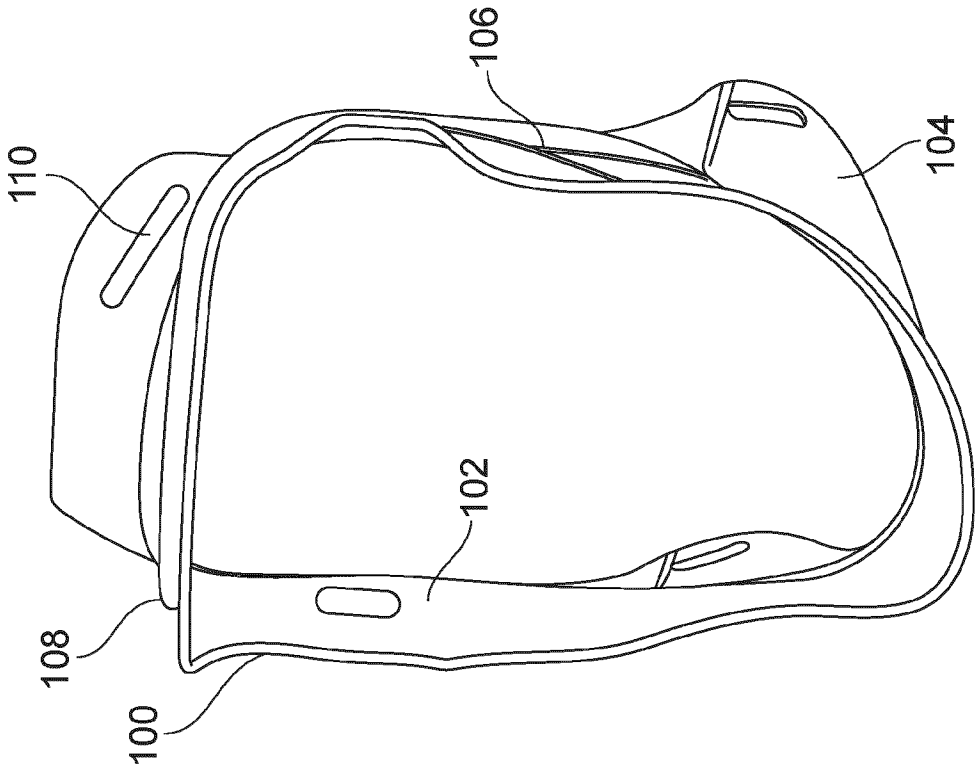

FIG. 1

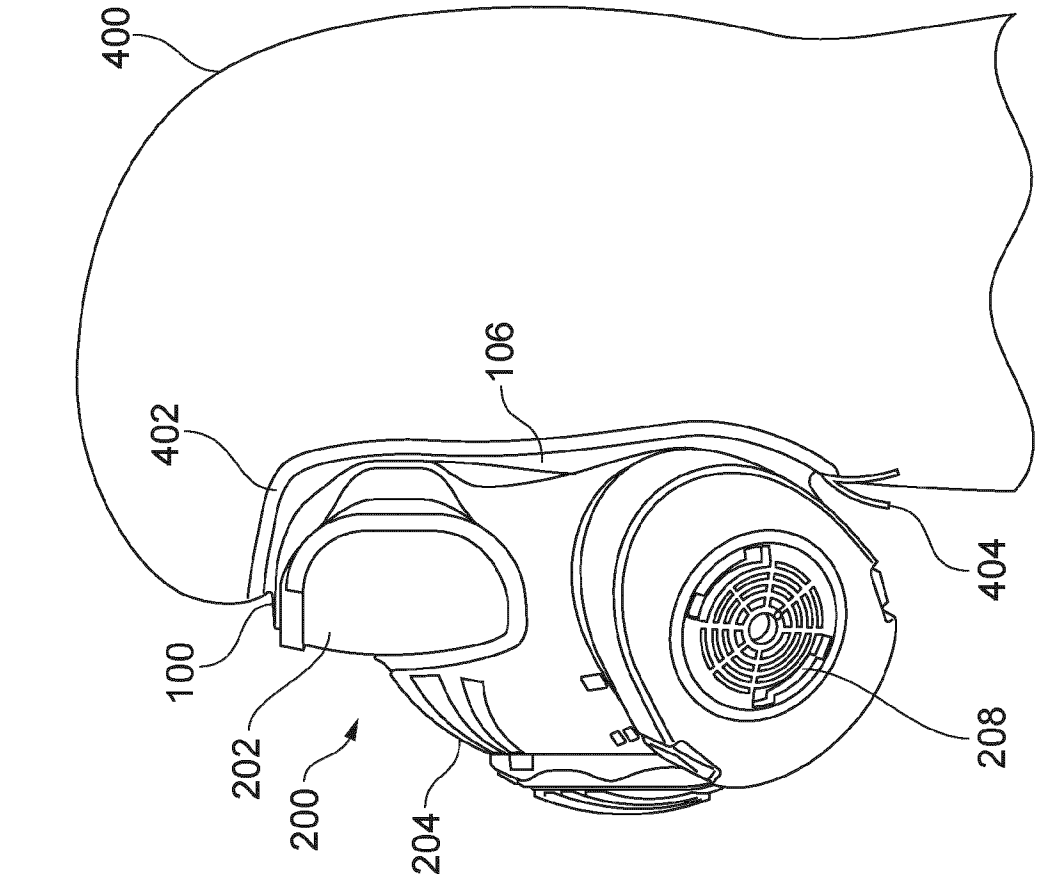
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FIG. 4

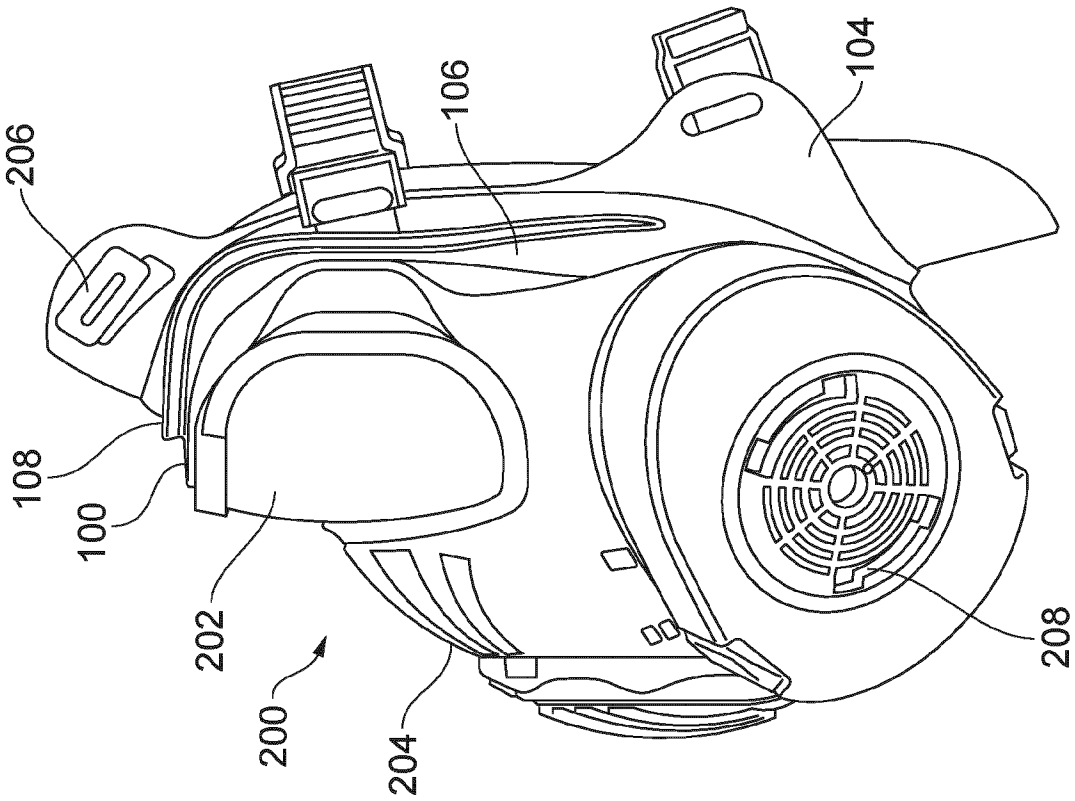
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FIG. 3

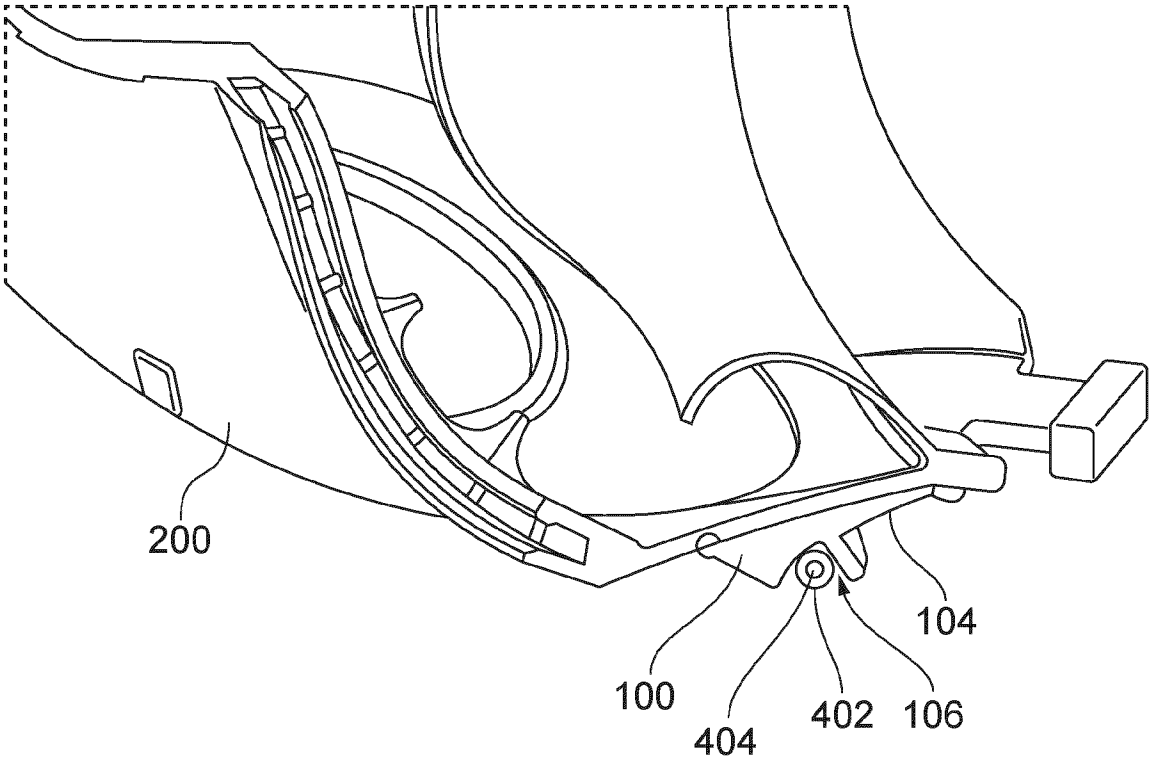

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/071384

A. CLASSIFICATION OF SUBJECT MATTER
INV. A62B9/04 A41D13/00 A62B18/02 A62B18/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A62B A44C A41D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2005/068021 A2 (HELMET INTEGRATED SYST LTD [GB]; DAMPNEY IAN [GB] ET AL.) 28 July 2005 (2005-07-28) figures 1, 4 page 20, paragraph 2	1-11
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 October 2024	04/11/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Almeida, Mariana

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 2007/235033 A1 (REIER MATTHEW D [US] ET AL) 11 October 2007 (2007-10-11) figure 12 paragraph [0048]	1-11

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