(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
16 October 2014 (16.10.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/168489 A1

(51) International Patent Classification:
A61M 16/06 (2006.01) *A61M 16/08* (2006.01)

(21) International Application Number:
PCT/NZ2014/000057

(22) International Filing Date:
4 April 2014 (04.04.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/811,017 11 April 2013 (11.04.2013) US

(71) Applicant: **FISHER & PAYKEL HEALTHCARE LIMITED** [NZ/NZ]; 15 Maurice Paykel Place, East Tamaki, Auckland, 2013 (NZ).

(72) Inventors: **SALMON, Andrew Paul Maxwell**; 15 Maurice Paykel Place, East Tamaki, Auckland, 2013 (NZ). **HUDDART, Brett John**; 15 Maurice Paykel Place, East Tamaki, Auckland, 2013 (NZ).

(74) Agents: **BROWN, Hadleigh, R** et al.; A J Park, PO Box 949, Wellington, 6140 (NZ).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,

[Continued on next page]

(54) Title: FLEXIBLE MASK COUPLING

(57) Abstract: Mask interfaces having mask frames and mask seals are disclosed. Headgear and breathing conduits can be connected to the mask interfaces. The connection between the mask seals and the mask frames can enable movement of the mask seals relative to the mask frames. The relative movement may be at the mounting locations of the mask seals and mask frames.

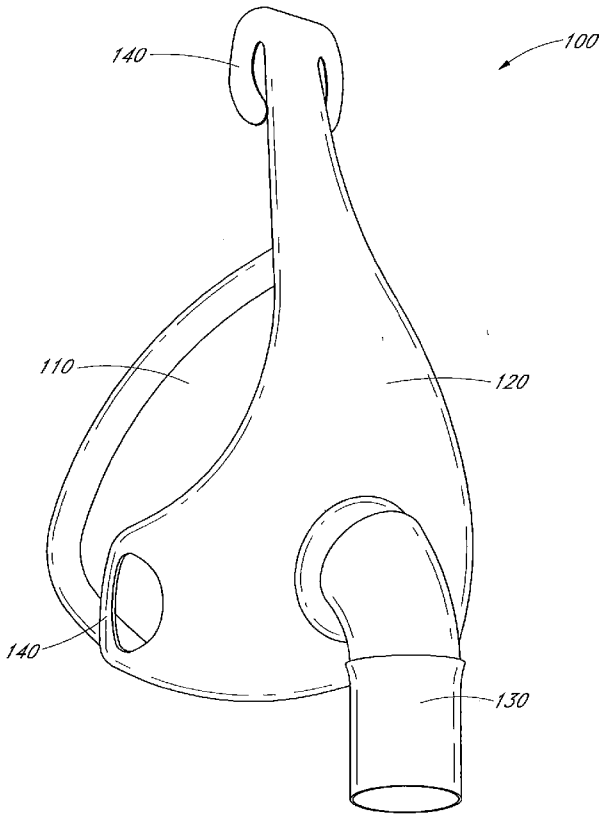


FIG. 1

WO 2014/168489 A1

TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

FLEXIBLE MASK COUPLING

INCORPORATION BY REFERENCE TO ANY PRIORITY APPLICATIONS

[0001] The present application claims priority benefit of U.S. Provisional Application No. 61/811,017, filed April 11, 2013 the entirety of which is hereby incorporated by reference herein.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present disclosure generally relates to connections between mask frames and mask seals. More particularly, the present disclosure relates to such connections that facilitate relative movement between the mask frames and mask seals.

Description of the Related Art

[0003] The treatment of obstructive sleep apnea (OSA) by continuous positive airway pressure (CPAP) flow generator systems involves the continuous delivery of pressurized air to the airways of a human via a conduit and an interface (e.g., a mask). Typically, the interface creates at least a substantial "seal" on or around the nose and/or the mouth. This act of creating a "seal" results in pressurization of the patient's airway and the CPAP system.

[0004] Due to the simple physics of pressurising this mask, it results in a force being generated that is proportional to the projected area of the mask and the pressure difference between the inside and the outside of the mask. For the mask to be stable on the patient's face, this force must be opposed by an equal and opposite force. A head gear system is typically used to provide the equal and opposite force.

[0005] In addition to this direct force created by the pressurization of the mask, there are a number of external forces that the head gear also counteracts. Examples of other external forces includes pull or drag on the delivery tube and loading induced by the patient/bedding on the mask as the patent moves.

SUMMARY OF THE DISCLOSURE

[0006] These external forces typically are considerably larger (e.g., about 3-5 times larger) than the force required to restrain the mask against the pressure-based movement. The implications that this has on traditional mask and headgear system is that changes to the

external forces typically result in movement of the mask system until the headgear system is able to counteract these forces.

[0007] The movement of the mask system results in loading change and/or movement of the seal, either of which can change how the seal interacts with the patient's skin. This change may be in the pressure level the seal exerts on the patient's skin or, in some cases, it is sufficient to enable a leak to be created between the seal and the patient's skin.

[0008] The effect of these changes on the patient is that the patient interacts with the mask system to reposition it on their face, in either a sub-conscious manner or a conscious manner, in order to correct the fit, which may be defined as an "equipment induced" sleep interruption. Equipment induced sleep interruption compromises the therapy that the patient is receiving.

[0009] The creation of practical and not so practical solutions to the underlying causes of equipment induced sleep interruption has been the subject of considerable development effort from numerous organizations, which has resulted in numerous patents.

[0010] The following is a description of a number of practical options to improve current designs by providing a decoupling mechanism between the mask seal member and the mask frame to minimise the effect on the seal of external forces exerted on the mask frame and/or small movement of the mask frame. In effect, certain features, aspects and advantages of various embodiments of the present disclosure provide a "suspension" mechanism between the seal and the mask frame.

[0011] An object of the present disclosure is to provide an interface that will at least provide the industry and users with useful choice.

[0012] In accordance with at least one of the embodiments disclosed herein, a patient interface is provided comprising a seal portion sized and shaped to surround the nose and/or mouth of a user and adapted to create at least a substantial seal with the user's face, a frame portion adapted to couple to the seal portion, a connector that permits the interface to be coupled to a conduit; and a coupling that permits the seal portion to move relative to the frame portion.

[0013] In some configurations, the relative movement of the seal portion is generally constrained to a slip plane across the frame portion of the interface. The relative movement can be permitted generally across and/or perpendicular to the slip plane.

[0014] In some configurations, the relative movement of the seal portion is constrained to a spherical boundary. The coupling can be a ball and socket type joint. The relative movement can be permitted around a common rotational center. In some configurations, the relative movement can be permitted along a principal axis of the ball and socket joint. The seal portion can comprise a socket and the frame portion can comprise a complementary ball.

[0015] In some configurations, the relative movement of the seal portion is constrained to a cylindrical boundary. The coupling can be a shaft and bearing type joint. The relative movement can be permitted along an axis of the cylindrical boundary.

[0016] In some configurations, the patient interface can comprise any combination of the relative movements described above.

[0017] In accordance with at least one of the embodiments disclosed herein, a patient interface is provided comprising a seal portion sized and shaped to surround the nose and/or mouth of a user and adapted to create at least a substantial seal with the user's face, the seal portion comprising a seal inlet; a frame portion comprising a frame inlet and a frame outlet, the frame portion adapted to couple to the seal portion; a connector comprising a first end adapted to couple with the frame inlet and a second end that permits the interface to be coupled to a conduit; and a coupling adapted to couple the frame outlet and the seal inlet, and permit the seal portion to move relative to the frame portion; wherein the coupling is generally the same size and generally aligned with the frame inlet.

[0018] In some configurations, the relative movement of the seal portion is generally constrained to a slip plane across the frame portion of the interface. The relative movement can be permitted generally across and/or perpendicular to the slip plane.

[0019] In some configurations, the coupling is made of a flexible material. The coupling can have a bellows construction.

[0020] The term "comprising" as used in the specification and claims means "consisting at least in part of'. When interpreting a statement in this specification and claims that includes

"comprising," features other than that or those prefaced by the term may also be present. Related terms, such as "comprise" and "comprises," are to be interpreted in the same manner.

[0021] In this specification where reference has been made to patent specifications, other external documents, or other sources of information, this is generally for the purpose of providing a context for discussing the features of the disclosure. Unless specifically stated otherwise, reference to such external documents is not to be construed as an admission that such documents, or such sources of information, in any jurisdiction, are prior art, or form part of the common general knowledge in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and other features, aspects and advantages of the present disclosure will now be described with reference to the drawings of one or more preferred embodiments, which embodiments are intended to illustrate and not to limit the disclosure, and in which figures:

[0023] Figure 1 shows the design of a typical mask.

[0024] Figure 2 shows a cross section through a mask with a flexible coupling between the mask seal and the mask frame.

[0025] Figure 3 shows a cross section through a mask with a ball and socket style coupling between the mask seal and the mask frame.

[0026] Figure 4 shows a nasal mask and associated force vectors.

[0027] Figure 5A shows the force vectors for a mask with no external forces.

[0028] Figure 5B shows the force vectors for a mask with external forces.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

[0029] The application of pressure to the inside of a mask results in a force vector being created which can be restrained by an equal and opposite force, as discussed above. Figure 4 shows an example of such a configuration using a side view of a nasal mask wearer. The pressure force vector F_P that results is a combination of the pressure difference between the inside and the outside of the mask seal, the projected area of the mask seal and the orientation of the mask. Over the combination of pressures potentially used for CPAP (about 4~20 cm water), for a typical nasal mask, this force varies between at least about 0.7N and less than or equal to about 3.5N. Figure 5A illustrates the force vectors for situations with no external

forces. As shown in the figure, the pressure force F_P is restrained by an equal and opposite retention force F_R, which can be provided by headgear or other retention system.

[0030] Figure 4 also shows an external force F_E that can be exerted on the mask, such as by pulling forces from an attached hose or other external forces. Figure 5B illustrates the force vectors for situations that include external forces F_E. As shown in Figure 5B, the combination of the pressure force F_P and the external force F_E can have a total force F_T. The total force F_T is restrained by an equal and opposite retention force F_R, which can be provided by headgear or other retention system.

[0031] The external forces F_E that may be applied to a mask system, primarily from hose drag, typically result in mask retention forces F_R being about 3-5 times greater than what is required to purely hold the mask in place (e.g., at least about 10.5N to less than or equal to 17.5N). The vector that these external forces F_E pass though varies due to the nature of how they are created and, to resolve them, a small amount of head gear stretch or slip may occur.

[0032] Because the force that opposes hose pull is considerably larger than the minimum force required to hold the seal in place, the hose pull-based force dominates and, when a conventional mask is in use, the hose pull-based force results in seal movement on the patients face, which typically creates a leak or compromises therapy.

[0033] With reference to Figure 1, a mask interface 100 generally comprises a mask seal 110, which is configured to be positioned on the skin of a patient, and a frame 120, to which the mask seal is mounted. The mask frame 120 can include attachment points 140 for headgear or otherwise be configured to connect to headgear. A conduit can be connected to one or more of the mask frame and the mask seal. In some configurations, the connection to the mask frame and/or mask seal is a rotating connector or swiveling connector. In the illustrated configuration, the conduit can be connected to a ball jointed elbow 130 and the ball jointed elbow is connected to the mask frame 120.

[0034] The disclosed mask assemblies seek to decouple or segregate the mask seal from the mask frame that carries/supports the tube connection. There are a number of embodiments to achieve the segregation. With reference to Figures 2-3, some embodiments of a mask interface in accordance with the present disclosure are illustrated.

[0035] In some configurations, such as the interface 200 shown in Figure 2, the mask seal 210 includes a seal inlet 212 and the mask frame 220 includes a frame outlet 222. In the illustrated configuration, the seal inlet 212 and the frame outlet 222 are shown as male connectors. The seal inlet 212 and frame outlet 222 can be coupled by a coupling member 250, which can be flexible or otherwise allow relative movement between the mask seal 210 and mask frame 220. For example, the coupling member can at least partially be made of rubbers, textiles, plastics, or other suitable material and can be flexible and/or stretchable. In some configurations, the coupling member can be a slip coupling. In the illustrated configuration, the coupling member 250 comprises an articulable member. The articulable member can have a bellows construction with an undulating side wall.

[0036] With continued reference to Figure 2, the interface 200 can have a connector 230 for connection with a conduit that is in fluid communication with a gas delivery system. The connector 230 can be configured to be coupled with a frame inlet of the mask frame 220. In the illustrated configuration, the connector 230 and mask frame 220 have a ball and socket connection. In other configurations, other connection types can be used, such as rotational couplings and fixed joints. The frame outlet 222 and the seal inlet 212 can be generally aligned with the frame inlet. The area of the opening of the seal inlet 212 and the frame outlet 222 can be approximately the same size as the opening of the frame inlet. This can allow the flow of gases to travel through the interface without substantially impeding, restricting or reducing the flowrate of the gases flow. The coupling member 250 can also be generally the same size and generally aligned with the frame inlet. This advantageously helps improve the flexibility and relative movement between the seal portion and frame portion. For example, because the coupling member is localized around the frame inlet, as opposed to a larger perimeter of the seal portion, the coupling member is more easily bendable and provides improved flexibility between the seal portion and the frame portion. In some configurations, the coupling member 250 can have non-uniform stiffness or structure to allow flexing in one direction easier than others. For example, the bottom portion of the coupling member can be softer than the top portion of the coupling member such that the frame is biased to bend downward when the interface is on a patient. Furthermore, the coupling member can advantageously help reduce the probability of the seal moving or being displaced on the user's

face due to the frame being moved or pulled. The coupling member can provide the ability for the frame to have relative and independent movement from the seal.

[0037] Other configurations are possible. In some configurations, the coupling member can be attached directly to the mask seal and mask frame without male connector portions. The coupling member can be attached by any of a variety of suitable means, such as adhesives, welding, and the like. In some configurations, the coupling member can be removably attached such as with clips, hook and loop fasteners, straps, screws, and the like. In some configurations, the coupling member can be integrated into one or both of the mask frame and the mask seal. For example, the coupling member can be overmoulded onto the mask seal at one end and attached to the mask frame at the other end through any of the attachment means discussed previously.

[0038] With reference to Figure 3, in some configurations, the mask frame 320 of the interface 300 includes a frame inlet 324 that receives the first end 332 of the elbow 330, and a frame outlet 326 that is received by a seal inlet 314 of the mask seal 310. In the illustrated configuration, the frame inlet 324 is a female connector portion and the first end 332 is a ball joint. The illustrated configuration also shows the frame outlet 326 as a male connector portion and the seal inlet 314 as a female connector portion. In other configurations, the connections can be reversed, for example the frame outlet can be a female connector portion and the seal inlet can be a male connector portion. In some configurations, the seal inlet 314 of the mask seal 310 and the frame outlet 326 of the mask frame 320 define a ball and socket configuration with a common rotational center 328. Other configurations are possible, such as rotational bearings, coiled shafts and universal joints.

[0039] Advantageously, the two couplings shown in Figure 2 and Figure 3 can enable independent movement between the frame and the seal which contacts the patients face. In some configurations, the independent movement is relative movement between the portion of the mask frame that is coupled to the mask seal and the portion of the mask seal that is coupled to the mask frame. In other words, the relative movement is between the two mounting locations. In some configurations, the independent movement between the frame and the seal is a slip movement. In other words, the independent movement is along a slip plane 260 defined across the mask frame of the interface, as illustrated in Figure 2. The slip

plane 260 can be generally normal to a plane that extends in a generally vertical direction and that substantially bisects the interface. In some configurations, the relative movement can include movement generally perpendicular to the slip plane. In some configurations, the relative movement is constrained to a generally spherical boundary with a common rotational center, such as that created by a ball and socket type joint. In some configurations, the relative movement can be along the principal axis of the ball and socket type joint (i.e., the axis of connection of the ball and socket). In some configurations, the relative movement is rotational and constrained to a generally cylindrical boundary, such as that created by a shaft and bearing type joint. In some configurations, the relative movement can be permitted along an axis of the cylindrical boundary. In some configurations, any combination of these relative movements can result. In some configurations, the ball and socket type joint can be asymmetric to allow flexing in one direction easier than others, or decoupling in one direction easier than others.

[0040] Although the present disclosure has been described in terms of certain embodiments, other embodiments apparent to those of ordinary skill in the art also are within the scope of this disclosure. Thus, various changes and modifications may be made without departing from the spirit and scope of the disclosure. For instance, various components may be repositioned as desired. Moreover, not all of the features, aspects and advantages are necessarily required to practice the present disclosure. Accordingly, the scope of the present disclosure is intended to be defined only by the claims that follow.

WHAT IS CLAIMED IS:

1. A patient interface, comprising:

a seal portion sized and shaped to surround the nose and/or mouth of a user and adapted to create at least a substantial seal with the user's face;

a frame portion adapted to couple to the seal portion;

a connector that permits the interface to be coupled to a conduit; and

a coupling that permits the seal portion to move relative to the frame portion.

2. The patient interface of Claim 1, wherein the relative movement of the seal portion is generally constrained to a slip plane across the frame portion of the interface.

3. The patient interface of Claim 2, wherein the relative movement is permitted generally perpendicular to the slip plane.

4. The patient interface of Claim 1, wherein the relative movement of the seal portion is constrained to a spherical boundary.

5. The patient interface of Claim 4, wherein the coupling is a ball and socket type joint.

6. The patient interface of Claim 5, wherein relative movement is permitted along a principal axis of the ball and socket joint.

7. The patient interface of Claim 5 or Claim 6, wherein the seal portion comprises a socket and the frame portion comprises a complementary ball.

8. The patient interface of Claim 1, wherein the relative movement of the seal portion is constrained to a cylindrical boundary.

9. The patient interface of Claim 8, wherein the coupling is a shaft and bearing type joint.

10. The patient interface of Claim 8 or Claim 9, wherein relative movement is permitted along an axis of the cylindrical boundary.

11. The patient interface comprising any combination of the relative movements described in claims 2 through 10.

12. A patient interface, comprising:

a seal portion sized and shaped to surround the nose and/or mouth of a user and adapted to create at least a substantial seal with the user's face, the seal portion comprising a seal inlet;

a frame portion comprising a frame inlet and a frame outlet, the frame portion adapted to couple to the seal portion;

a connector comprising a first end adapted to couple with the frame inlet and a second end that permits the interface to be coupled to a conduit; and

a coupling adapted to couple the frame outlet and the seal inlet, and permit the seal portion to move relative to the frame portion;

wherein the coupling is generally the same size and generally aligned with the frame inlet.

13. The patient interface of Claim 12, wherein the relative movement of the seal portion is generally constrained to a slip plane across the frame portion of the interface.

14. The patient interface of Claim 13, wherein relative movement is permitted generally perpendicular to the slip plane.

15. The patient interface of any one of Claims 12-14, wherein the coupling is made of a flexible material.

16. The patient interface of any one of Claims 12-15, wherein the coupling has a bellows construction.

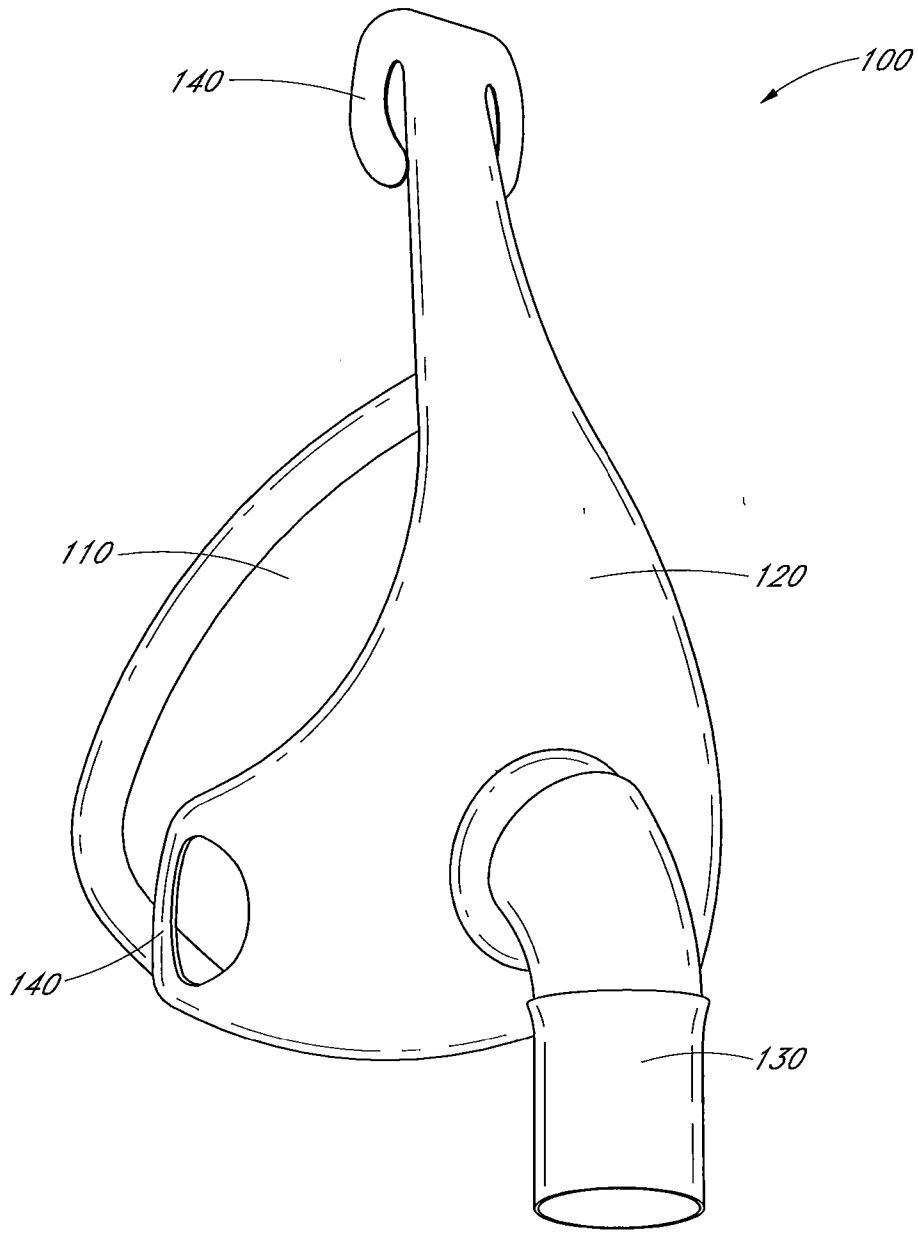


FIG. 1

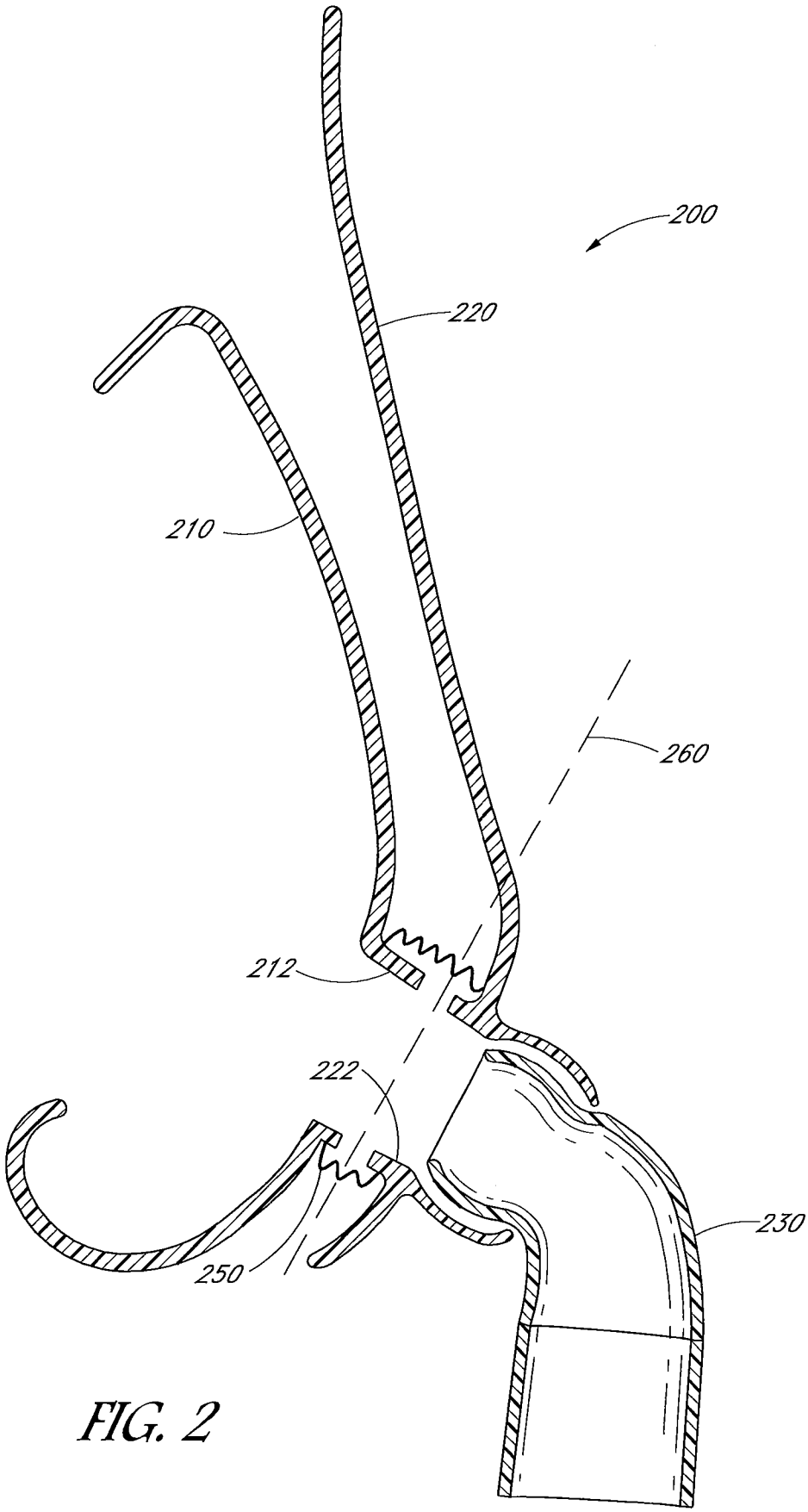


FIG. 2

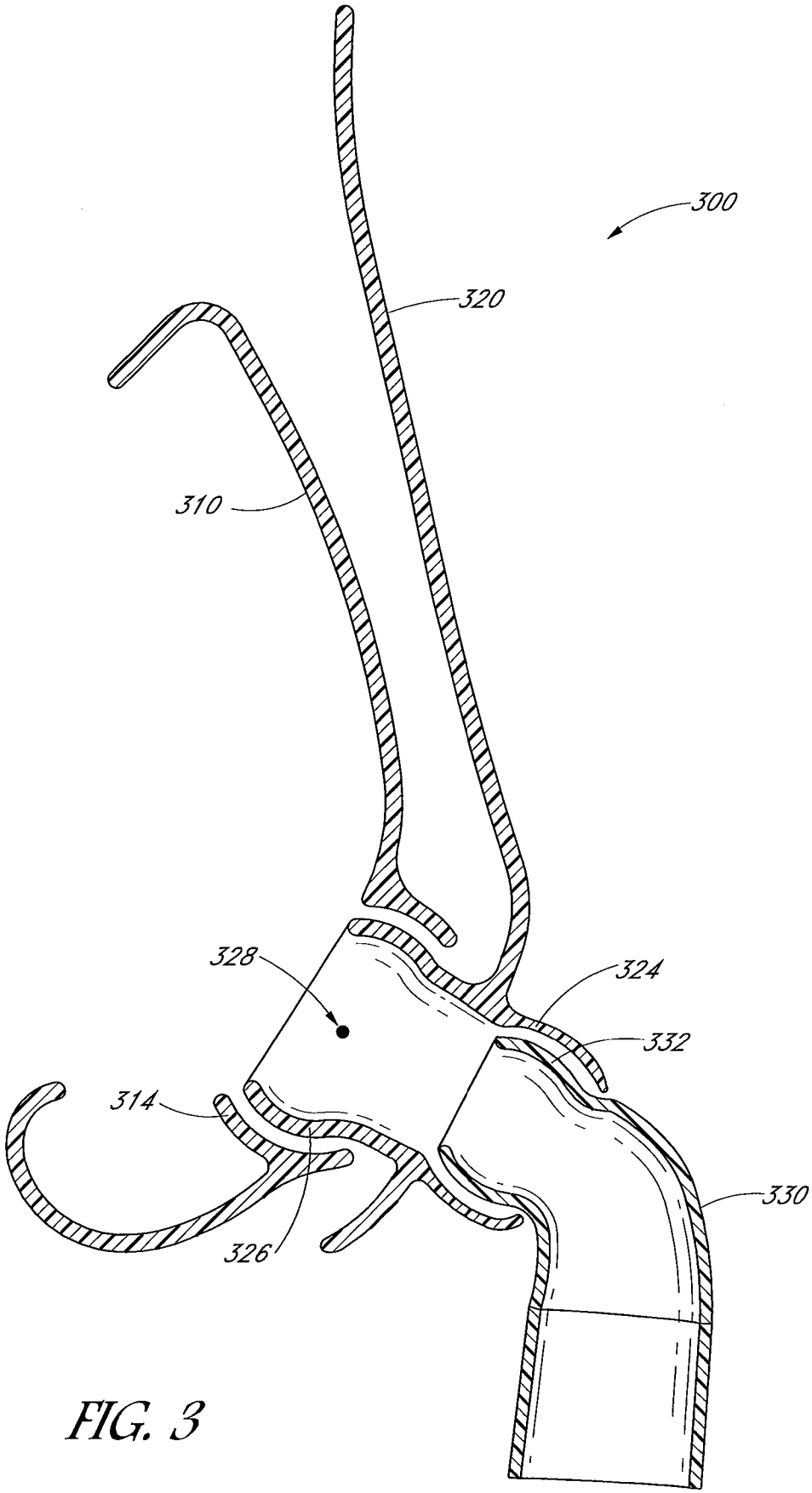


FIG. 3

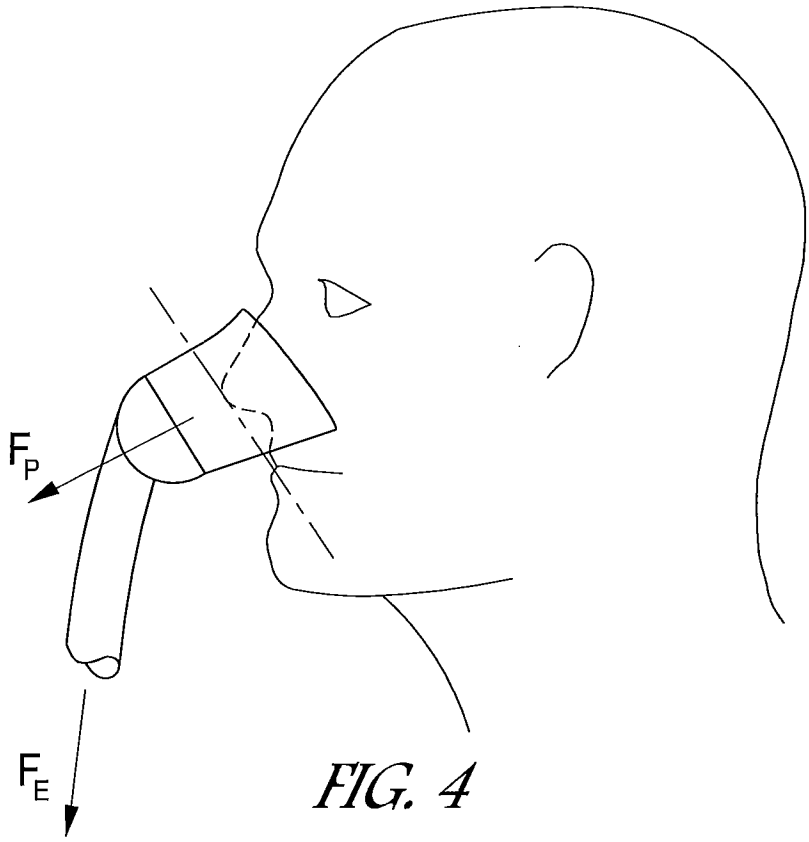


FIG. 4

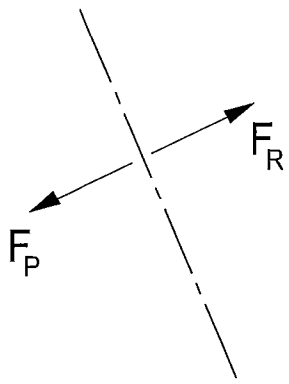


FIG. 5A

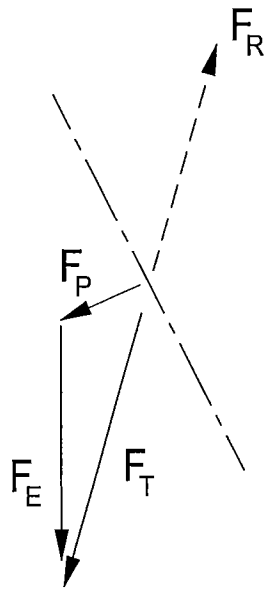


FIG. 5B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2014/000057

A. CLASSIFICATION OF SUBJECT MATTER

A61M 16/06 (2006.01) A61M 16/08 (2006.01)

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)

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)

EPODOC, WPI: /IC/CC/CN/EC A61M16/00, A62B9/00, A62B18/08, A61B5/097, A62B18/02 & Keywords: CPAP, PRESSURE, RESPIRATORY, BREATHING, APNEA, SLEEP, HYPOPNEA, DYSPLASIA, DYSSOMNIA, INHALE, OXYGEN, MASK, INTERFACE, SEAL, AIRTIGHT, COUPLE, LINKAGE, FLEX, MOVE, BEND, SWIVEL, ADJUST, ALTER, BELLOWS, ACCORDION, FLEXIBLE, ARTICULATED, SEGMENTED, JOINTED, BENDING, PLEAT, BALL, SOCKET, SPHEROIDAL, HINGE, ROTATE, PIVOT and similar terms/combinations; Google Patents & Keywords: mask, interface, visor, hood, seal, cushion, airtight, hermetic, coupling, linkage, joint, flex, bend, swivel, bellows, accordion, flexible, articulated, segmented, ball, socket, hinge, rotate, pivot and similar terms and/or combinations.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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
10 July 2014	10 July 2014

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
Email address: pct@ipaustralia.gov.au

Authorised officer

Mukunthan Krishnapillai
AUSTRALIAN PATENT OFFICE
(ISO 9001 Quality Certified Service)
Telephone No. (03) 9935 9601

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/NZ2014/000057**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/0044804 A1 (MATULA, JR. et al.) 01 March 2007 fig. 2 & 5, 9-11, 16A & 16B; para. 0052, 0060, 0063-0064, 0066, 0068, 0070	1-16
X	US 2006/0283456 A1 (GEISELHART et al.) 21 December 2006 abstract; fig. 1-6, 7A & 7B; para. 0003, 0005, 0063, 0065-0067, 0072	1-3, 10-16

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/NZ2014/000057**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		**Patent Family Member/s**	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
US 2007/0044804 A1	01 March 2007	US 8245711 B2	21 Aug 2012
		AU 2006279974 A1	22 Feb 2007
		AU 2006279974 B2	12 Jan 2012
		BR PI0614281 A2	22 Mar 2011
		CA 2619137 A1	22 Feb 2007
		CN 101282767 A	08 Oct 2008
		CN 101282767 B	21 Dec 2011
		EP 1915199 A2	30 Apr 2008
		JP 2009504320 A	05 Feb 2009
		JP 4903795 B2	28 Mar 2012
		US 2012216813 A1	30 Aug 2012
		US 8596275 B2	03 Dec 2013
		US 2014083430 A1	27 Mar 2014
		WO 2007021777 A2	22 Feb 2007
US 2006/0283456 A1	21 December 2006	US 7900630 B2	08 Mar 2011
		AU 2006259451 A1	28 Dec 2006
		AU 2006259451 B2	21 Apr 2011
		CA 2612382 A1	28 Dec 2006
		EP 1968676 A1	17 Scp 2008
		JP 2008543443 A	04 Dec 2008
		WO 2006138416 A1	28 Dec 2006

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.