A harness assembly for a nasal mask for communicating breathable gas to a patient’s airways includes a cap portion adapted to engage an occipital region of the patient’s skull in use and side straps extending from the cap portion. The cap portion includes an upper strap portion and a lower strap portion that cooperate to define an opening through which the occiput region at least partially protrudes in use. Each of the side straps includes hook and loop connectors.
HARNESS ASSEMBLY FOR A NASAL MASK

CROSS-REFERENCE TO RELATED APPLICATIONS


FIELD OF THE INVENTION

[0002] This invention relates to a harness assembly for a nasal mask.

[0003] The invention will be described with reference to a harness assembly for a nasal mask fitted to the head of a wearer for communicating breathable gas to a patient's airways, for example in the administering of continuous positive airway pressure (CPAP) treatment. However, the invention is not limited to this particular field of use and is equally suited for masks used in assisted respiration or mechanical ventilation.

BACKGROUND OF THE INVENTION

[0004] CPAP treatment is administered when a person is asleep. It is therefore crucial that nasal CPAP masks be securely fastened to the wearer's head. Leaks occurring due to mask movement caused by gross body motion during sleep can result in the inefficacy of CPAP treatment being defeated. An effective seal of the mask cushion to the patient's face is, in part, a function of the mask design, and is also a function of the correct tension in the harness being maintained. Under-tensioning results in a loose mask and poor seal. Over-tensioning can lead to discomfort for the wearer. All of these problems can lead to patient non-compliance.

[0005] A prior art nasal mask and harness arrangement is taught in U.S. Pat. No. 5,243,971 assigned to the University of Sydney. The nasal mask is secured to a wearer's head by a harness comprised of an upper strap and a lower strap, each of which is secured to a frame of the nasal mask. The upper portion of the frame includes a pad that engages the wearer's forehead. The frame further carries a nasal cushion that, in use of the mask, sealingly engages the wearer's nose and face. The frame also carries a mask body to which is connected a flexible conduit for the delivery of breathable gas to the mask and thereafter to an entrance to the patient's airway.

[0006] A problem with this arrangement is that the upper and lower straps are made from an elastic or resilient material which lose elasticity with time and become loose fitting about the wearer's head. Furthermore, movement of the wearer during sleep, may cause sliding movement of the straps to the point where the mask can become loose and leaks occur.

[0007] Also, the tightening of either the upper or lower strap tends to pivot the mask thereby altering the tension of the other strap making comfortable and correct adjustment difficult and time consuming.

[0008] Other harness arrangements, such as that shown in U.S. Pat. No. 5,542,128 in the name of Lomas, include an upper strap around the head and a lower strap around the neck. This arrangement exacerbates the tensioning problem discussed above as rocking of the head moves the face relative to the neck thereby altering the tension of the straps, especially the neck strap.

[0009] Another prior art arrangement is disclosed in published Australian Patent Application No. 32914/95 in the name of Buckley-Mendez.

[0010] It is important to distinguish nasal masks for the administration of CPAP treatment from respirators or breathing apparatus that are characterised by full face cover and are intended to simultaneously deliver air to the nose and mouth of a conscious and mobile patient. In contrast, CPAP treatment primarily occurs during sleep when the wearer of a nasal mask is mostly immobile and cannot tolerate the discomfort of respirators or breathing apparatus for want of arousing from the sleep state.

[0011] The present invention is directed to overcoming, or at least ameliorating, one or more of the disadvantages of the prior art.

SUMMARY OF THE INVENTION

[0012] Accordingly, in a first aspect, the present invention provides a harness assembly for a nasal mask for communicating breathable gas to a patient's airways, the harness assembly includes a cap portion adapted to engage, in use, the occipital region of the skull, said cap portion including a connection means at each end, and a pair of upper and lower straps, each of the straps extending between one of the cap connection means and the nasal mask.

[0013] The harness assembly according to the invention grips the head in a region substantially fixed relative to the face and, as such, strap tension is not substantially affected by head movement.

[0014] Preferably, the cap connection means are adapted to allow the cap portion to pivot substantially independently of the mask and straps.

[0015] The connection means are desirably disposed, in use, adjacent the ears of the wearer. Most desirably, they are just above the ears.

[0016] The cap connection means are preferably further adapted to allow each strap to move substantially independently of the other straps.

[0017] Each strap is preferably length adjustable.

[0018] Desirably, the cap portion, in use, covers the occiput of the wearer.

[0019] In an embodiment, the cap portion engages and/or grips the curved region of the occiput.

[0020] In another embodiment, the cap portion includes an opening through which, in use, the occiput at least partially protrudes.

[0021] The connection means desirably also allows the straps to slide normally relative to the direction of the strap.

[0022] In a particularly preferred embodiment, the connection means are in the form of substantially D-shaped members. In this embodiment, the cap portion is connected to the straight portion of the D-shaped members and the
upper and lower straps are each respectively connected to the upper and lower curves of the D-shaped members.

[0023] In another preferred embodiment, the connection means is in the form of a triangular member. In this embodiment, the cap ends and the upper and lower straps each respectively engage a side of the triangle.

[0024] In another particularly preferred embodiment, the connection means is in the form of a yoke shaped member having a inner bar and a pair of outer bars each angled slightly with respect to the inner bar. In this embodiment, the cap portion is connected to the inner bar and the upper and lower straps are each connected to one of the outer bars.

[0025] In yet another embodiment, the connection means are in the form of substantially “C” shaped members. In this embodiment the lower straps connect to the head of the C, the upper straps to the middle and the cap portion to the base. In this embodiment, the cap portion and the upper straps can be manufactured from a single component.

[0026] The connection means is preferably produced from plastics, elastomers, composites, laminates or other like materials.

[0027] The cap portion and straps can be produced from fabric or like materials or laminates thereof. The cap portion may also be moulded to snugly fit the head, in particular to replicate the shape of the occiput, by thermoforming, fabric darting, or joining two or more pieces along a non-straight seam.

[0028] In a second aspect, the invention provides a nasal CPAP mask and harness assembly, the assembly includes a mask with a nasal cushion and mask body connected to the harness assembly of the first aspect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Preferred embodiments of the invention now will be described with reference to the accompanying drawings, in which:

[0030] FIG. 1 is a front perspective view of a harness assembly according to a first embodiment of the invention;

[0031] FIG. 2 is a rear perspective view of the harness assembly shown in FIG. 1;

[0032] FIG. 3 is a front perspective view of a harness assembly according to a second embodiment of the invention;

[0033] FIG. 4 is a rear perspective view of the harness assembly shown in FIG. 3;

[0034] FIG. 5 is a front perspective view of the harness assembly according to a third embodiment of the invention;

[0035] FIG. 6 is a rear view of the harness assembly as shown in FIG. 5;

[0036] FIG. 7 is a side view of a D-shaped coupling of the first embodiment of the present invention; and

[0037] FIG. 8 is a side view of a triangular shaped coupling used in a fourth embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0038] Referring to the FIGS. 1 and 2, there is disclosed a harness assembly 40 according to a first embodiment of the invention. The harness assembly 40 is shown, in use, securing a nasal mask 42, which is suitable for CPAP treatment, to a human head 43. A suitable mask is shown in FIG. 3. The nasal mask 42 includes a mask body and a mask cushion attached to the mask body. The mask cushion engages the patient’s face. A coupling tube is connected at one end with the mask body and at the other end to a sock into which can be received a gas delivery tube (not shown).

[0039] The harness 40 includes a cap portion 44 which is adapted to engage the lower rear region of the wearer’s skull. The cap portion 44 is substantially semi-circular in shape when laid flat. When worn, the lower most portion 46 of the cap portion 44 covers and grips the occipital region of the wearer to facilitate securely locating the cap portion during use.

[0040] The cap portion includes a connection means at each end which in the first 10 embodiment shown in FIGS. 1 and 2 is in the form of a D-shaped coupling 48. A pair of upper straps 50, of which only the left-hand is shown in FIG. 2, extend between the coupling 48 and an upper portion 52 of the nasal mask. Similarly, a pair of lower straps 54 extend between the coupling 48 and a lower portion of the mask 56.

[0041] In the embodiment shown, each of the straps are length adjustable, by virtue of is hook and loop connectors 58. In another embodiment, not shown, the straps are of constant length and the harness is produced in a number of sizes to suit various size heads.

[0042] The connection of the straps to the D-shaped coupling member 48 allows each of the straps 50 and 54 to pivot with respect to each other and the cap portion 44. The coupling member 48 also allows the straps and cap portion to slide slightly in a direction normal to the longitudinal direction of the strap or cap portion. As the D-shaped coupler allows the upper and lower straps and the cap portion to all move independently of one another then an improved harness is provided as movements of one of the above parts, caused by, for example, repositioning of the wearer’s head during sleep, will not unduly affect the others thereby providing a more securely fitted nasal mask.

[0043] The location of the mask 42 is also unaffected when the position of cap portion 44 is independently moved for best fit.

[0044] Further, as no part of the harness assembly engages the neck, head movements, such as rocking, which alter the face to neck distance, do not affect strap tension resulting in more secure and comfortable fitting mask.

[0045] A second embodiment of the harness assembly is shown in FIGS. 3 and 4 in which like reference numerals are used to indicate like features. In this embodiment the connection means is in the form of a yoke shaped coupling 60. The yoke 60 includes an inner bar 62 connected to an upper and lower bar 64 and 66 respectively. The upper and lower bars are angled slightly with respect to the inner bar so as to be substantially normal to the longitudinal axis of the upper and lower straps 50 and 54. Once again, the yoke 60 allows the straps 50, 54 and the cap portion 44 to move independently of one another.
A third embodiment of the harness assembly is shown in FIGS. 5 and 6. Once again, like reference numerals are used to indicate like features. In this embodiment the connection means are in the form of C-shaped members disposed, in use, above the wearer's ears. A cap portion includes an opening through which the occiput protrudes to assist in securely locating the cap portion.

The opening improves the maintenance of the cap portion in the correct position. Further, the opening reduces heat build up under the cap portion, compared to those shown in FIGS. 1 to 4.

Although the invention has been described with respect to preferred embodiments, it will be appreciated by those skilled in the art, that the invention may be embodied in many other forms.

As an example, the cap portion of the third embodiment may be used instead of the cap portion 44 of the first and second embodiment.

1-26. (canceled)

27. A harness assembly for a nasal mask for communicating breathable gas to a patient's airways, the harness assembly comprising:

- a cap portion adapted to engage an occipital region of the patient's skull in use, the cap portion including an upper strap portion and a lower strap portion that cooperate to define an opening through which the occiput region at least partially protrudes in use; and
- side straps extending from the cap portion, each of the side straps including hook and loop connectors.

28. The harness assembly according to claim 27, wherein the side straps extend superior to the patient's ears in use.

29. The harness assembly according to claim 27, wherein the cap portion and side straps are produced from fabric or like materials.

30. The harness assembly according to claim 27, wherein each side strap intersects with the cap portion at an intersection location.

31. The harness assembly according to claim 30, wherein the intersection location is positioned slightly posterior to the patient's ear in use.

32. The harness assembly according to claim 30, wherein each side strap includes a first end having a portion of the hook and loop connector and a second end positioned at the intersection location.

33. The harness assembly according to claim 32, wherein each side strap comprises a single component extending from the first end to the second end.

34. A mask assembly comprising:

- a nasal mask assembly including a nasal cushion that defines an air chamber and an air delivery tube that delivers breathable gas to the air chamber; and
- a harness assembly provided to the nasal mask to maintain the nasal mask in a desired position on the patient's face, the harness assembly comprising:

- a cap portion adapted to engage an occipital region of the patient's skull in use, the cap portion including an upper strap portion and a lower strap portion that cooperate to define an opening through which the occiput region at least partially protrudes in use; and
- side straps extending from the cap portion, each of the side straps including hook and loop connectors.

35. The mask assembly according to claim 34, wherein the side straps extend superior to the patient's ears in use.

36. The mask assembly according to claim 34, wherein the cap portion and side straps are produced from fabric or like materials.

37. The mask assembly according to claim 34, wherein each side strap intersects with the cap portion at an intersection location.

38. The mask assembly according to claim 37, wherein each side strap includes a first end having a portion of the hook and loop connector and a second end positioned at the intersection location.

39. The mask assembly according to claim 38, wherein each side strap comprises a single component extending from the first end to the second end.

40. The mask assembly according to claim 39, wherein the intersection location is positioned slightly posterior to the patient's ear in use.

41. The mask assembly according to claim 39, further comprising a slotted connector provided at each side of the mask assembly, wherein the first end of each said side strap is structured to be threaded through the respective slotted connector.

42. The mask assembly according to claim 41, wherein each of the side straps is length adjustable.

43. The mask assembly according to claim 34, further comprising a second pair of side straps.

44. A harness assembly for a mask for communicating breathable gas to a patient's airways, the harness assembly comprising:

- a rear portion adapted to engage a posterior portion of the patient's skull in use, the rear portion including only a single band; and
- a first set of side straps extending forward of the rear portion, each of the side straps including a hook and loop fastener, wherein:

- the side straps extend superior to the patient's ears in use,
- the rear portion and side straps are produced from fabric material, and

- each said side strap includes a first end having a non-variable length portion positioned adjacent a respective end of the rear portion and a second end structured to be threaded through a slotted connector associated with the mask whereby each said side strap portion is adjustable in length relative to the mask via the hook and loop fastener.

45. The harness assembly according to claim 44, wherein each said side strap and the rear portion are formed as an integral unit.

46. A CPAP nasal mask assembly comprising:

- a mask having a frame carrying a cushion;
- a slotted connector provided to each lateral side of the frame; and

- the harness assembly of claim 44.

47. The harness assembly according to claim 44, wherein each said side strap and the cap portion are formed as a continuous unit.
48. The harness assembly according to claim 47, wherein said continuous unit is formed from a single piece.

49. The harness assembly according to claim 44, wherein each said side strap and the cap portion are formed as a single piece.

50. The harness assembly according to claim 44, further comprising a second set of side straps that are length adjustable.

51. A harness assembly for a mask for communicating breathable gas to a patient’s airways, the harness assembly comprising:

- a cap portion adapted to engage a portion of the patient’s skull in use; and
- a pair of upper and lower straps provided to each lateral side of the cap portion, each of the upper and lower straps including a hook and loop fastener; and
- a coupling member for each said lateral side that couples at least a selected strap of the upper and lower straps to the cap portion, the coupling member having a slotted portion that is at least partially curved such that the selected strap may translate along a curved path within the slotted portion.

52. A harness assembly according to claim 51, wherein each of said upper and lower straps is adjustable in length relative to the mask via the hook and loop fastener.

53. A CPAP mask assembly comprising:

- a mask having a mask body and a sealing portion to engage the patient’s face in use; and
- the harness assembly of claim 51 to support the mask on the patient in use.

54. The harness assembly according to claim 53, further comprising a coupling tube having a first end coupled to the mask and a second end adapted to be coupled with an air delivery tube, the coupling tube extending upwardly along the length of the patient’s nose in use.

55. The harness assembly according to claim 46, further comprising a coupling tube having a first end coupled to the mask and a second end adapted to be coupled with an air delivery tube, the coupling tube extending upwardly along the length of the patient’s nose in use.

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