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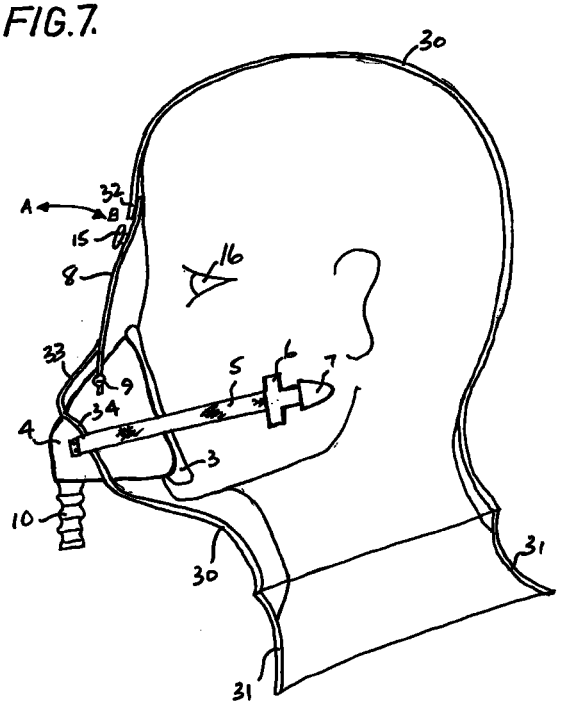
(54) Facemask with adjustable visor

(57) A facemask or respirator incorporating breathing equipment comprising an outer body or shell (4) to enclose the wearer's nose and mouth with a flexible oro-nasal oxygen mask (3) mounted therein whose periphery makes a seal with the wearer's face. A visor (8) is mounted on the body in the line of sight of the wearer by a pivot mechanism (9) which allows the angular position of the visor (8) relative to the body (4) to be adjusted and retained in its selected position. The pivot mechanism (9) can also be mounted to be movable in a linear direction towards and away from the wearer's face.

An NBC hood (30) can be attached to the visor (8).

FIG.7.



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Description

[0001] This invention relates to a facemask or respirator which incorporates a transparent visor compatible with helmet mounted electro-optical sighting devices such as, for example, night vision goggles (NVG). The facemask of the present invention is however not exclusively designed for use with NVG's but can be used with other helmet mounted devices. The facemask of the invention is particularly suitable for use by aircrew but it can also be incorporated into a respirator worn by other persons such as firefighters.

[0002] Some helmet mounted electro-optical sighting devices project their images onto a visor located in front of the wearer's eyes. To work satisfactorily, the distance between the exit lens of the NVG's and the wearer's eyes (known as eye relief) is critical if the images are to be in focus, and clearly visible with the optimum field of view to the wearer. Some facemasks currently available have the visor formed as part of the rigid exo shell in which the flexible oro-nasal mask which covers the wearer's nose and mouth is mounted. Oxygen is supplied to the wearer through this flexible mask. A rubber nuclear, biological and chemical (NBC) hood can be attached to the top and sides of the visor as well as to the periphery of the rigid front shell to enclose the wearer's head. A problem with this prior art respirator is that the eye relief dimension is neither fixed nor adjustable. For instance, if the wearer has a pronounced forwardly extending chin, the bottom of the oxygen mask and thus the rigid shell and the visor extending upwardly from it will be inclined at a lesser angle to the wearer's eyes than it would be if he has a receding chin. Thus, with a protruding chin, the top of the visor will be tilted closer to the wearer's eyes whereas with a receding chin, it will be tilted further away from them.

[0003] In order to overcome this problem, a separate visor has been used which is attached to the NBC hood along its top, side and bottom edges, the hood extending over the rigid exo-shell to enclose it completely. The problems with these mechanisms are:

a) the eye relief distance is random determined by the NVG;
b) after initial positioning during dressing, the visor can move thereafter, (for instance, if worn by aircrew in flight when subjected to high G forces) so it may end up being too far away from the wearer's eyes to permit the proper use of electro-optical devices. For NVG's to work properly, the preferred eye relief distance should be between 15mm and 30mm.

[0004] It is therefore an object of the present invention to provide a facemask or respirator including a visor which overcomes these problems.

[0005] According to the invention, there is provided a facemask incorporating breathing equipment comprising an outer body to enclose the wearer's nose and mouth, a flexible oro-nasal oxygen mask mounted inside said outer body whose periphery makes a seal with the wearer's face, said flexible mask having an inspiratory and expiratory valve therein and a visor mounted on the body in the line of sight of the wearer by a pivot mechanism which allows the angular position of the visor relative to the outer body to be adjusted and retained in its selected angular position relative to the wearer's face.

[0006] Preferably the pivot mechanism includes a ratchet system which allows the visor to be incrementally moved to various different angular positions and retained therein. The pivot mechanism can also be mounted on adjustment means which also permit linear movement thereof towards or away from the wearer's face.

[0007] In the preferred embodiment, the body is a rigid shell which has a lateral extension on each side thereof on which the pivot mechanism is mounted. Each lateral extension can take the form of a wing integrally moulded with the rigid shell or alternatively it can be a tubular bar. The visor is pivotally attached to these lateral extensions.

[0008] In the preferred embodiment, the bottom of the visor has a pair of legs extending therefrom for attachment to the pivot mechanism. In one embodiment an adjustment handle is mounted on said legs and extends forwardly therefrom, the handle being engagable by the wearer's hand to pivot the visor. Alternatively, a handle can be attached to the top of the visor so that the wearer can pull the visor into a different position.

[0009] If necessary, a flexible NBC hood can be attached to the periphery of the visor to extend over the wearer's head and includes a front portion which encloses the rigid body and visor pivot mechanism.

[0010] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a side view of one form of facemask of the present invention in position on a wearer's head and connected to his helmet;
Figure 2 is a front view of one means for mounting the visor on the rigid shell shown in Figure 1;
Figure 3 is a side view of the arrangement shown in Figure 2;
Figure 4 is another way of mounting the visor on the rigid shell;
Figure 5 is a still further way of mounting the visor on the shell;
Figure 6 is a perspective view of the visor shown in Figure 5;
Figure 7 is a schematic view showing the facemask of Figure 1 but including an NBC hood;
Figure 8 is a front view of the facemask and hood shown in Figure 7;

Figure 9 is a schematic view of an alternative facemask and hood assembly;

Figure 10 is a front view of the hood and facemask assembly shown in Figure 9.

Figure 11 is a schematic view of another facemask assembly of the invention;

Figure 12 is a view of a facemask of the invention incorporated into a full face respirator;

Figure 13 is a schematic cross section of the respirator shown in Figure 12; and

Figure 14 is a view of an alternative form of respirator.

[0011] Referring now to the drawings, Figure 1 shows a pilot 1 wearing a rigid protective helmet 2. A flexible oro-nasal face-piece 3, usually made of a natural or synthetic rubber material, surrounds the wearer's nose and mouth and is mounted in a rigid plastic shell 4 attached to the helmet 2 by means of a harness arrangement 5 having a fitting 6 at one end to releasably attach it to a corresponding fitting part 7 mounted on the helmet. The harness 5 includes adjustable means (not shown) so that its length can readily be changed to ensure that the face-piece 3 rests comfortably on the wearer's face with its edge lip 14 making a seal with the area of the wearer's face surrounding his nose and mouth. An oxygen supply 10 is connected to the rigid shell 4 in known manner.

[0012] A transparent visor 8 is connected to the rigid shell 4 by a pivot mechanism 9 and extends upwardly from the shell into the wearer's line of sight. An electro-optical sighting device 13 such as a pair of night vision goggles (NVG) is mounted on arm 12 attached by means 17 to the helmet, the electro-optical sighting device 13 being mounted in front of the visor 8 but in line with the wearer's eyes 16. The electro-optical sighting device projects an image through the visor 8 in known manner so no further description thereof will be given here. The eye relief dimension is the distance X between the wearer's eye 16 and the exit lens of the NVG 13. When properly adjusted and, during flight, the visor should not touch the exit lens of the NVG.

[0013] Figures 2-5 show by way of example two different ways in which the visor 8 can be mounted on the rigid shell 4. Figures 2 and 3 show the assembly of Figure 1 wherein visor 8 is pivotally mounted by suitable means 9 to the rigid shell 4 and has a handle 15 attached to its upper region which the pilot can grip to move the visor either forwardly in the direction of arrow A or rearwardly in the direction of arrow B. Val Salva holes 11 are provided in the rigid shell 4 allowing the pilot access to pinch his nose during descent to equalise the pressure in his ears with that of the ambient pressure in the cockpit.

[0014] Referring now to Figures 2 and 3, one preferred form of mounting the visor 8 on the rigid shell 4 is shown which comprises lateral extensions or wings 20 extending from opposite sides of the shell 4, and moulded integrally therewith. Each wing includes means 9 thereon which cooperate with corresponding means on legs 23 of the visor 8 whereby a hinge pin can be inserted through said co-operating parts to hingedly attach the visor 8 to the rigid shell 4. In order to be able to incrementally change the position of the visor 8 relative to the rigid shell 4, and retain it in a selected position, the hinge means preferably includes a ratchet mechanism of known type (not shown).

[0015] Referring now to the embodiment shown in Figures 4-6, it can be seen that it differs from the embodiment of figures shown in Figures 2 and 3 in that the lateral extensions comprise tubular rods 21 extending from each side of the upper part of the rigid shell 4. The visor 8 has a centrally located cut-out section 18 which fits over the top end of rigid shell 4 and the bottom parts or legs 23 of the visor on either side of said cut-out 18 are pivotally attached to the laterally extending rods 21 by a hinge mechanism 9 which also preferably includes a ratchet system. As a result, the visor 8 can be pivoted in the direction A or B relative to the coaxially aligned laterally extending rods 21 when the pilot pulls on the handle 15 at the top of the visor or alternatively pushes it.

[0016] Figures 5 and 6 show an alternative arrangement wherein the pair of downwardly extending legs 23 on the visor 8 which extend below pivot axis 26 have a U-shaped handle 25 connected thereto by means of feet 24 as illustrated. It can be seen therefore that if the pilot pulls on the handle 25 in the direction of arrow A, the top of the visor will move in the direction of arrow B to move it closer to the wearer's face. Similarly, if the pilot pushes on the handle in the direction of arrow B, the top of the visor 8 will move away from the wearer's face in the direction of arrow A.

[0017] Figures 7 and 8 show the embodiments of Figures 1-6 but with an NBC cowl 30 having a neck portion 31 attached to the visor 8. The cowl 30 is sealed to the visor around its periphery 32. The front of the cowl 30 in the region of the rigid shell 4 has an extension 33 having a hole 34 formed therein. The perimeter of the hole 34 is sealingly attached to the rigid shell 4. The attachment harness 5 is also mounted on the rigid shell 4.

[0018] A handle 15 is attached to the top of the visor 8 and it will be appreciated that when the pilot pulls on this handle, the visor can move forwardly in the direction of arrow A away from the wearer's head or inwardly in the direction of arrow B towards the wearer's head when the pilot pushes on the handle 15. This movement is allowed and accommodated for by the resilience in the material of the cowl 30 which is normally made of neoprene or natural rubber.

[0019] The embodiment shown in Figures 9 and 10 is the embodiment of Figures 5 and 6 but with an NBC cowl 30 having a neck portion 31 attached to the visor 8. As can be seen from the drawing, the cowl 30 is sealed to the visor 8 around its periphery at 32. The cowl has a

front section 33 which encloses a substantial part of the rigid shell 4, the section 33 having an aperture 34 therein which is sealingly attached to the front portion of the rigid shell 4 allowing the front portion thereof to protrude through to which the oxygen hose 10 is connected. The upper part of the U-shaped handle 25 protrudes through an NBC seal 37 in the front section 33 of the cowl. As with the embodiment of Figures 7 and 8, if the pilot pulls on the handle 25 in the direction of arrow A, the visor 8 will pivot about the pivot axis 9 and will move towards the wearer's eyes 16. If the pilot pushes on the handle 25 in the direction of arrow B, the top of the visor 8 will move away from the wearer's eyes 16.

[0020] Figure 11 shows a similar design of facemask to that shown in Figures 9 and 10 except that the rigid shell 4 on which the visor 8 is pivotally mounted at 9 is totally enclosed within front extension 33 of the NBC hood.

[0021] As with the Figures 9 and 10 embodiment, an inverted U-shaped handle 25a is attached by portions 24 to legs 23 extending downwardly from each side of the visor 8 in the same manner as shown in Figure 6.

[0022] The NBC hood 30 is attached to the periphery of the visor 8 at 32 in the same manner as that shown in Figure 10. However, the front portion 33 completely encloses the oro-nasal rigid shell 4 and the handle 25a. The front section 33 is made from a thin flexible rubber material so the wearer can easily feel the location of the handle 25 within it. Thus, if he pulls on the handle 25a in the direction of arrow A, the top of the visor 8 connected thereto will move towards his eyes 16 and vice versa.

[0023] The advantage of this design over that shown in Figures 9 and 10 is that as the handle 25a is totally enclosed within the front portion 33 of the hood 30 so there is nothing to impair the wearer's downward vision. Also, the need for the NBC seals 37 is avoided.

[0024] Turning now to Figures 12 and 13, there is shown a facemask of the invention incorporated into a full face respirator for use, for instance, by a firefighter. As firefighters are now using helmet mounted electro-optical devices such as NVG's to help them see in smoke filled environments, they need the position of the visor 48 to be adjustable to ensure the correct eye relief dimension so that the wearer can focus on the projected image.

[0025] The facemask comprises a moulded rubber body 41 having a front portion 42 to the end of which an outlet 43 for exhaled air is mounted in known manner. An inlet 44 for air/oxygen is provided on either side of the rubber body 41, each inlet being closed by a one-way flap valve of known type. Each inlet 44 has means on it such as a screwthread or bayonet fitting (not shown) to allow a supply hose to be attached to it.

[0026] Peripheral edge 46 of the body is formed with a flexible return 46a which cooperates with and seats on the wearer's face when the facemask is fitted thereto. Tabs 47a, b, c are moulded on the facemask and include attachment means for releasably securing straps 49a, b, c thereto, the straps fitting over the wearer's head to retain the facemask 41 on the wearer's face with the return 46a making an airtight seal therewith.

[0027] A rigid or flexible oro-nasal mask 40 of known type is mounted within the facemask 41 and includes an outlet therefrom (not shown) which communicates with the outlet 43 and also includes a known one-way valve which only permits the passage of exhaled air therethrough. A pair of inlet valves 45 are provided on each side of the oro-nasal mask 40, each inlet being closed by a known one-way flap valve which only allows breathable air/oxygen mixture supplied to the interior of the facemask 41 via the inlets 44 to reach the interior of the oro-nasal mask 40.

[0028] A full face transparent visor 48 is mounted in a two part rigid frame 39a,39b clamped together by means such as bolts 38 on either side of the visor. It should be noted that the peripheral region of the facemask body 41 around the visor 48 includes an expandable or extendable bellows section 50 for reasons to be explained hereafter.

[0029] The mid section of the bottom of the frame 39a,39b is mounted on a pivot mechanism which includes a pivot pin 9. Thus, the visor 48 can rotate about pivot pin 9 and the top of the visor can be moved towards or away from the wearer's eyes along arc A-B. Preferably, the pivot mechanism includes a ratchet system allowing the visor to be pivoted incrementally about pivot 9 and then retained in the selected angular position.

[0030] The pivot mechanism including pivot pin 9 is preferably also mounted on an adjustment mechanism 51 which allows the pivot 9 to be moved in linear direction X-Y either away from or towards the wearer's face. This adjustment mechanism 51 preferably also incorporates a ratchet mechanism to allow incremental linear movements to be made, the pivot pin 9 then being retained in the selected position.

[0031] It will be appreciated that any movement of the frame 39a,39b and visor 48 relative to the wearer's face to adjustment for eye relief will be accommodated by the bellows section 50 around the visor 48 on the body 41.

[0032] Figure 14 shows an alternative arrangement to that shown in Figures 12 and 13 in which the visor adjustment mechanism is located inside the facemask rather than externally.

[0033] In this arrangement, the same reference numerals will be used for the same or similar parts to those shown in the earlier Figures.

[0034] In the illustrated embodiment, the visor 48 is sealingly mounted in a rigid frame 39. The bottom of the frame 39 has attached to its internal surface a fixture 51 as illustrated which rotates about pivot 9. The pivot 9 is

mounted on an assembly (not shown) which is attached to the facemask so that the pivot 9 can move in a linear direction towards or away from the wearer's face in the direction of arrows X-Y. The assembly mounting pivot 9 is preferably mounted on a ratchet mechanism so that it can be incrementally moved in the direction of arrows X-Y and retained in the selected position.

[0035] The front of the fixture 51 includes a section 52 which protrudes upwardly through an aperture 54 in the front portion 42 of the facemask body 41. A flexible rubber section 43a is connected to the front portion 42 and extends over the section 52 to enclose it, this flexible section being connected to the frame 39 via a bellows section 50 which extends around the whole of the periphery of the visor 48 and forms part of the body 41.

[0036] With the illustrated arrangement, the wearer of the facemask can readily adjust the angle of inclination of the visor 48 relative to the wearer's face by pushing or pulling on the section 52 thereby causing the fixture 51 to rotate about pivot 9 whereby the visor moves in the direction of arrows A-B. By applying a linear pressure to the base of the frame 39, the pivot point 9 can be moved in a linear manner in the direction of arrows X-Y relative to the wearer's face on its ratchet mounting (not shown) and then retained in its selected position.

[0037] In yet another embodiment (not illustrated), the section 52 and the part of the fixture 51 connecting it to the pivot 9 can be omitted. With this embodiment, the wearer can pivot the top of the visor 48 relative to his or her face in the direction of arrows A-B by pushing or pulling on the top of the visor. By pushing on the base of the frame 39, the pivot 9 can be moved in a linear manner in the direction of arrows X-Y to change the location of the pivot 9 relative to the wearer's face.

[0038] It will be appreciated that the pivot 9 in the embodiments of Figures 1-11 can also be mounted on a mechanism which allows it to be moved in a linear direction towards or away from the wearer's face. The mounting mechanism can also include a ratchet system to retain the pivot 9 in its selected position.

[0039] The facemask of the invention allows the orientation of the visor 48 relative to the wearer's face and eyes 16 to be infinitely adjusted to suit the wearer's eye relief dimension thereby ensuring optimum performance.

Claims

1. A facemask incorporating breathing equipment comprising an outer body to enclose the wearer's nose and mouth, a flexible oro-nasal oxygen mask mounted inside said outer body whose periphery makes a seal with the wearer's face, said flexible mask having an inspiratory and expiratory valve therein, and a visor mounted on the body in the line of sight of the wearer, by a pivot mechanism which allows the angular position of the visor relative to the outer body to be adjusted and retained in its selected angular position relative to the wearer's face.

2. A facemask as claimed in claim 1 wherein the pivot mechanism includes a ratchet system which allows the visor to be incrementally moved to various different angular positions and retained therein.

3. A facemask as claimed in claim 1 or claim 2 wherein the outer body is a rigid shell which has a lateral extension on each side thereof on which the pivot mechanism is mounted.

4. A facemask as claimed in claim 3 wherein each lateral extension is a wing.

5. A facemask as claimed in claim 4 wherein each wing is moulded integrally with the rigid shell.

6. A facemask as claimed in claim 3 wherein each lateral extension is a tubular bar.

7. A facemask as claimed in any of claims 3-6 wherein the visor is pivotally attached to said lateral extensions.

8. A facemask as claimed in claim 7 wherein the bottom of the visor is pivotally attached to said lateral extensions.

9. A facemask as claimed in claim 7 wherein the bottom of the visor has a pair of legs extending therefrom.

10. A facemask as claimed in claim 9 wherein an adjustment handle is mounted on said legs and extends forwardly therefrom.

11. A facemask as claimed in any preceding claim wherein a handle is attached to the top of the visor.

12. A facemask as claimed in any preceding claim wherein a flexible NBC hood is attached to the periphery of the visor and extends over the wearer's head and includes a front portion which encloses the rigid shell and pivot mechanism for the visor.

13. A facemask as claimed in claim 1 wherein the body is moulded from a flexible material and the visor is full face and mounted in a frame.

14. A facemask as claimed in claim 13 wherein the periphery of the moulded body adjacent the frame includes an extendable portion.

15. A facemask as claimed in claim 14 wherein the extendable portion is moulded as bellows.

16. A facemask as claimed in any preceding claim wherein the pivot mechanism is mounted on adjustment means which allow linear fore-aft movement of the pivot mechanism relative to the wearer's face.

17. A facemask as claimed in claim 16 wherein the adjustment means includes a ratchet mechanism.

FIG.1.

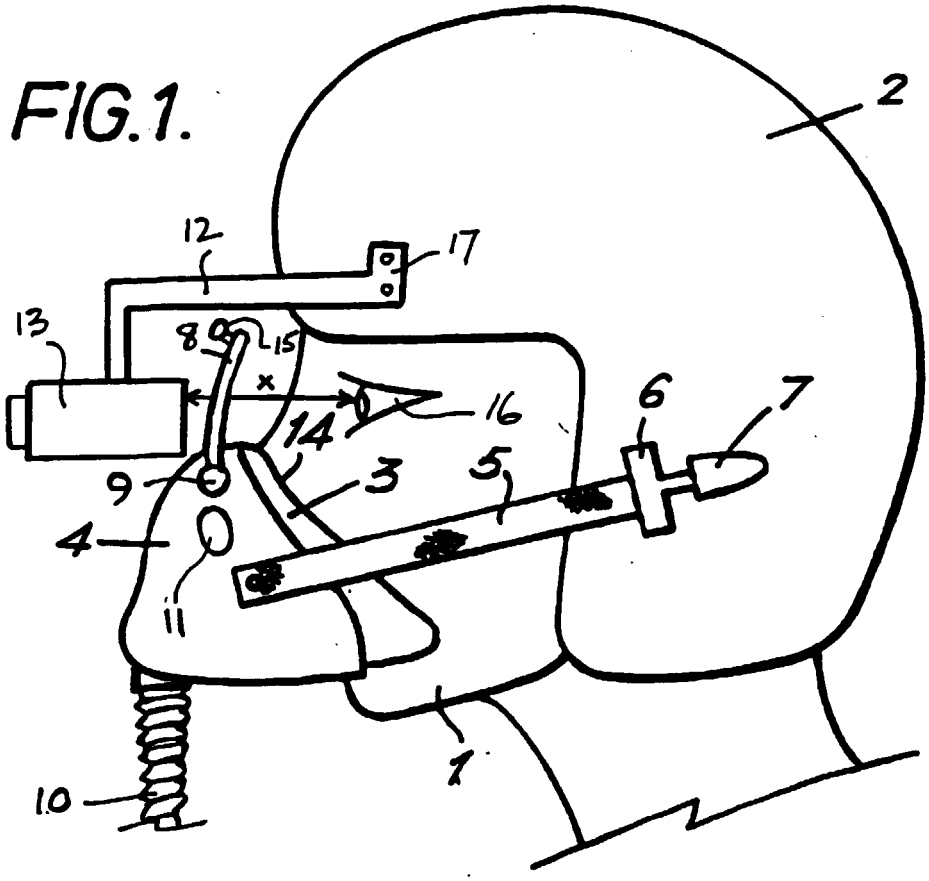


FIG.6.

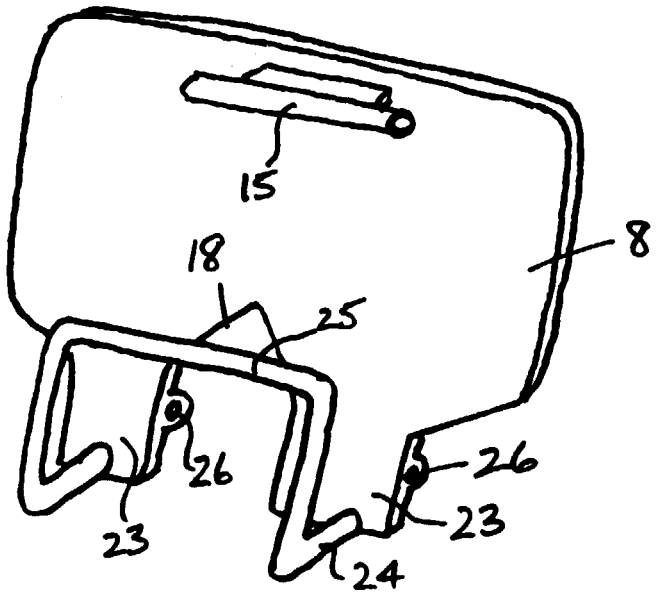


FIG.2.

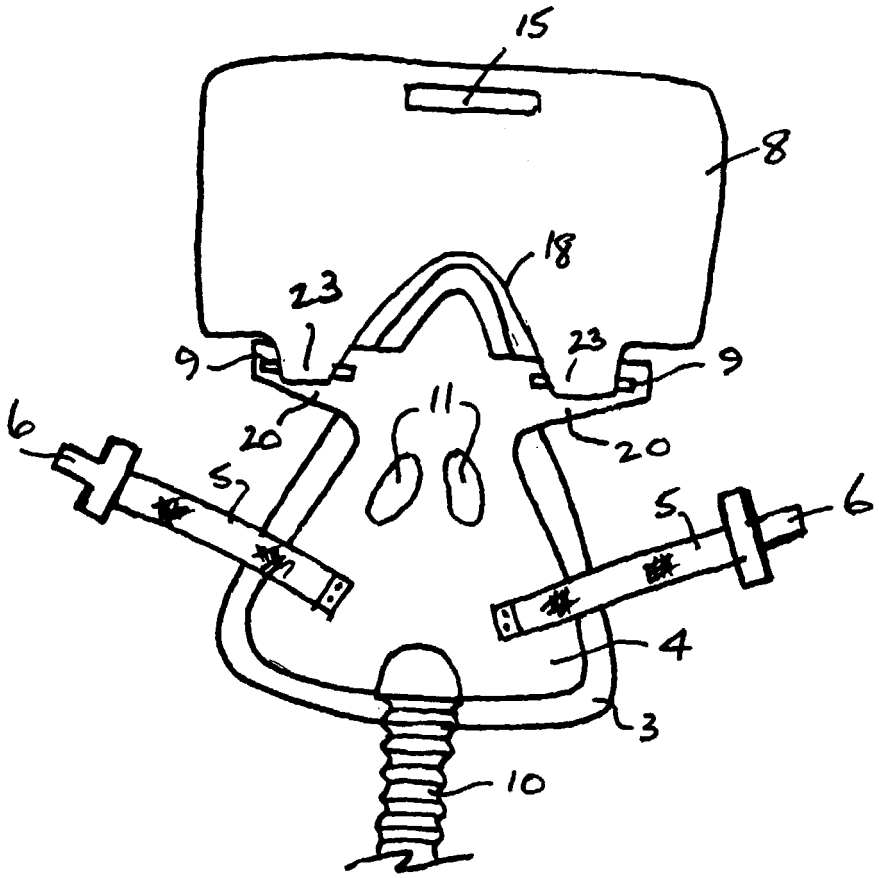


FIG.3.

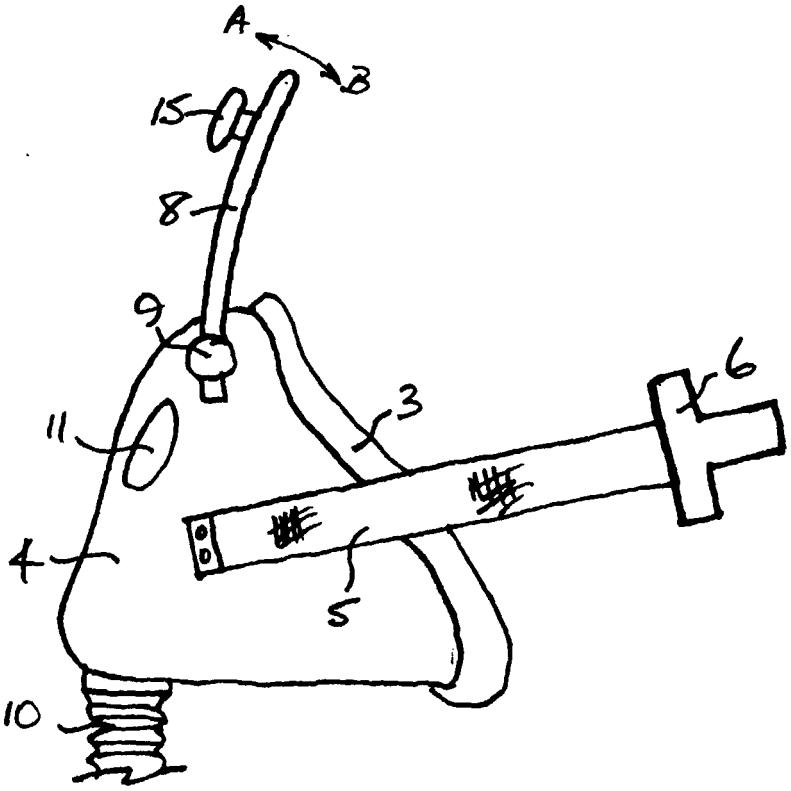


FIG.4.

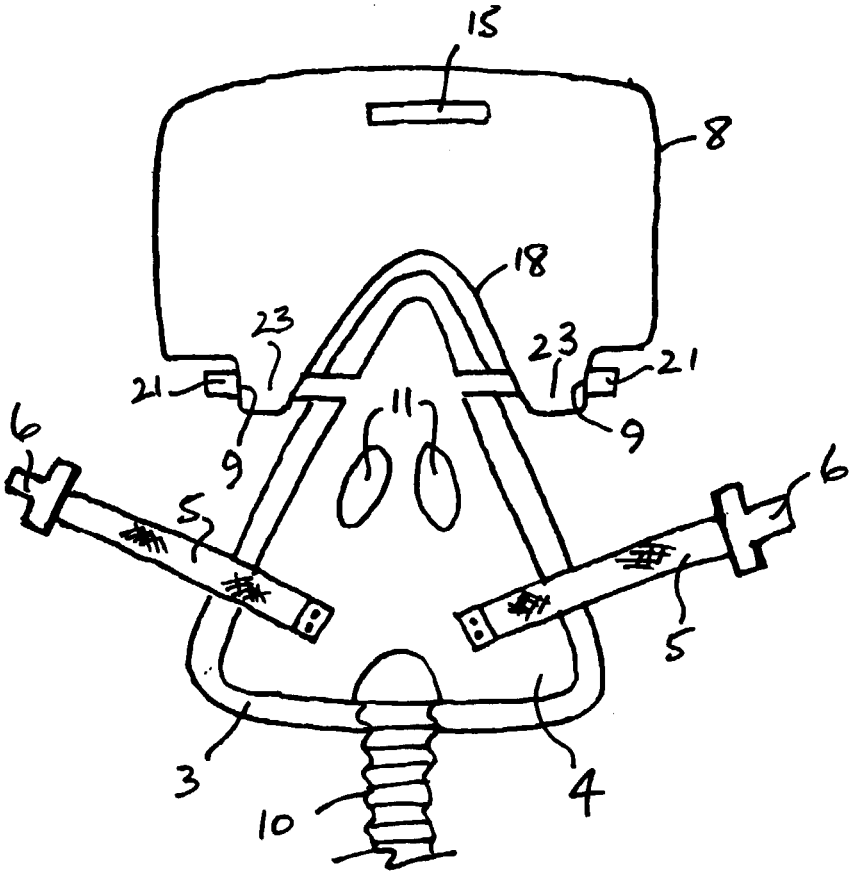


FIG.5.

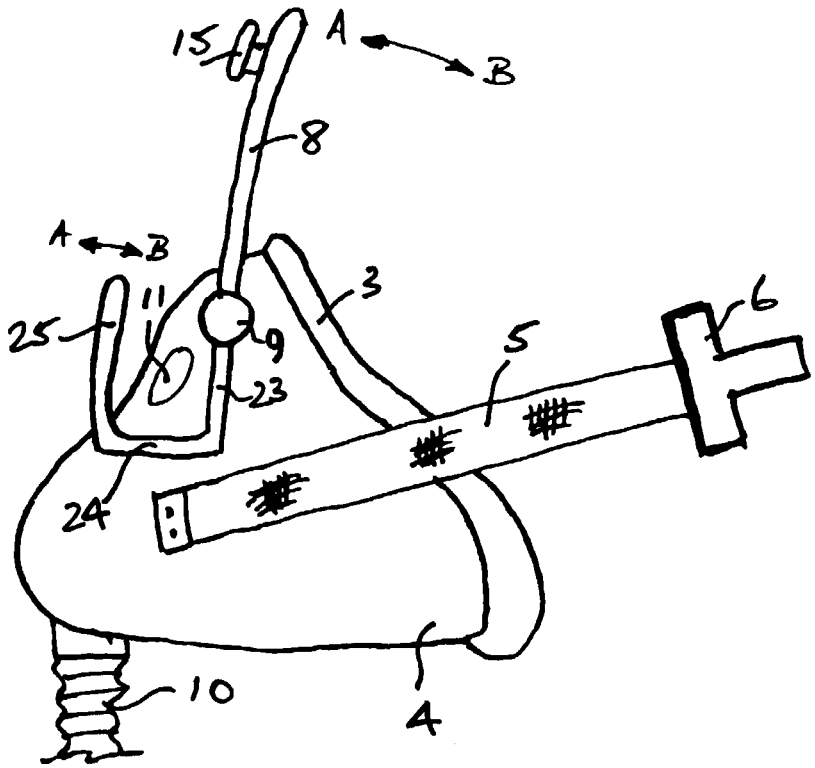


FIG.7.

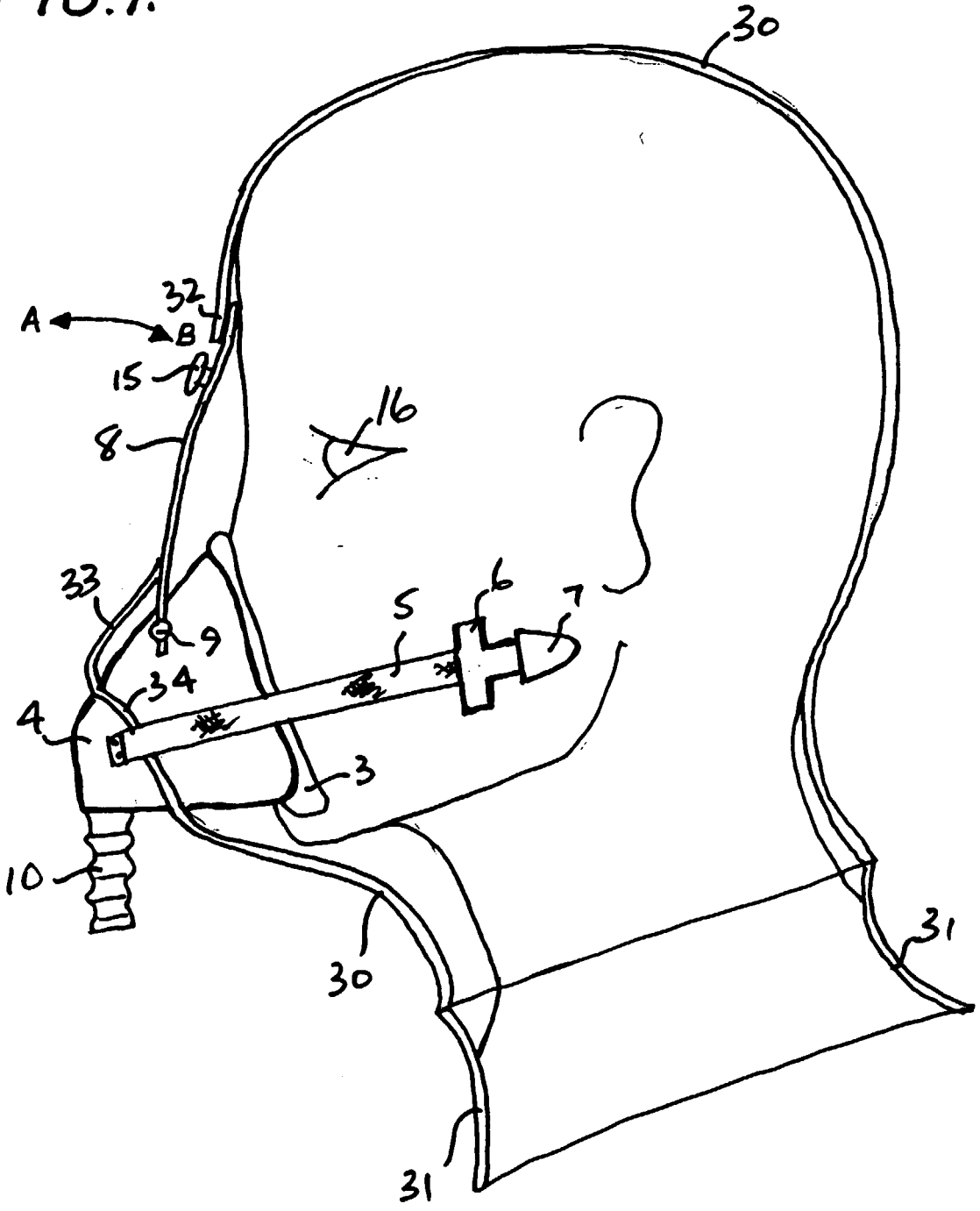


FIG.8.

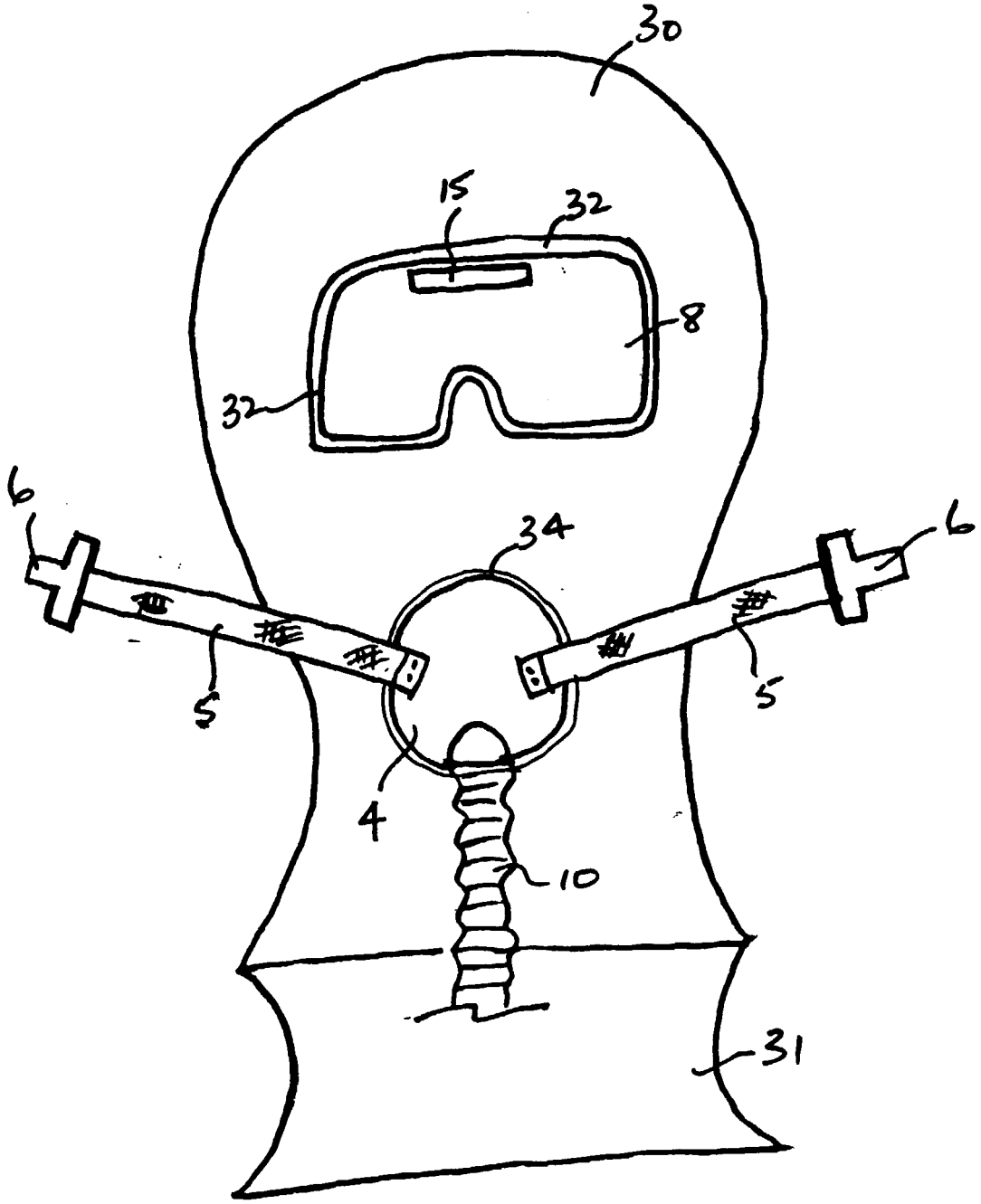


FIG. 9.

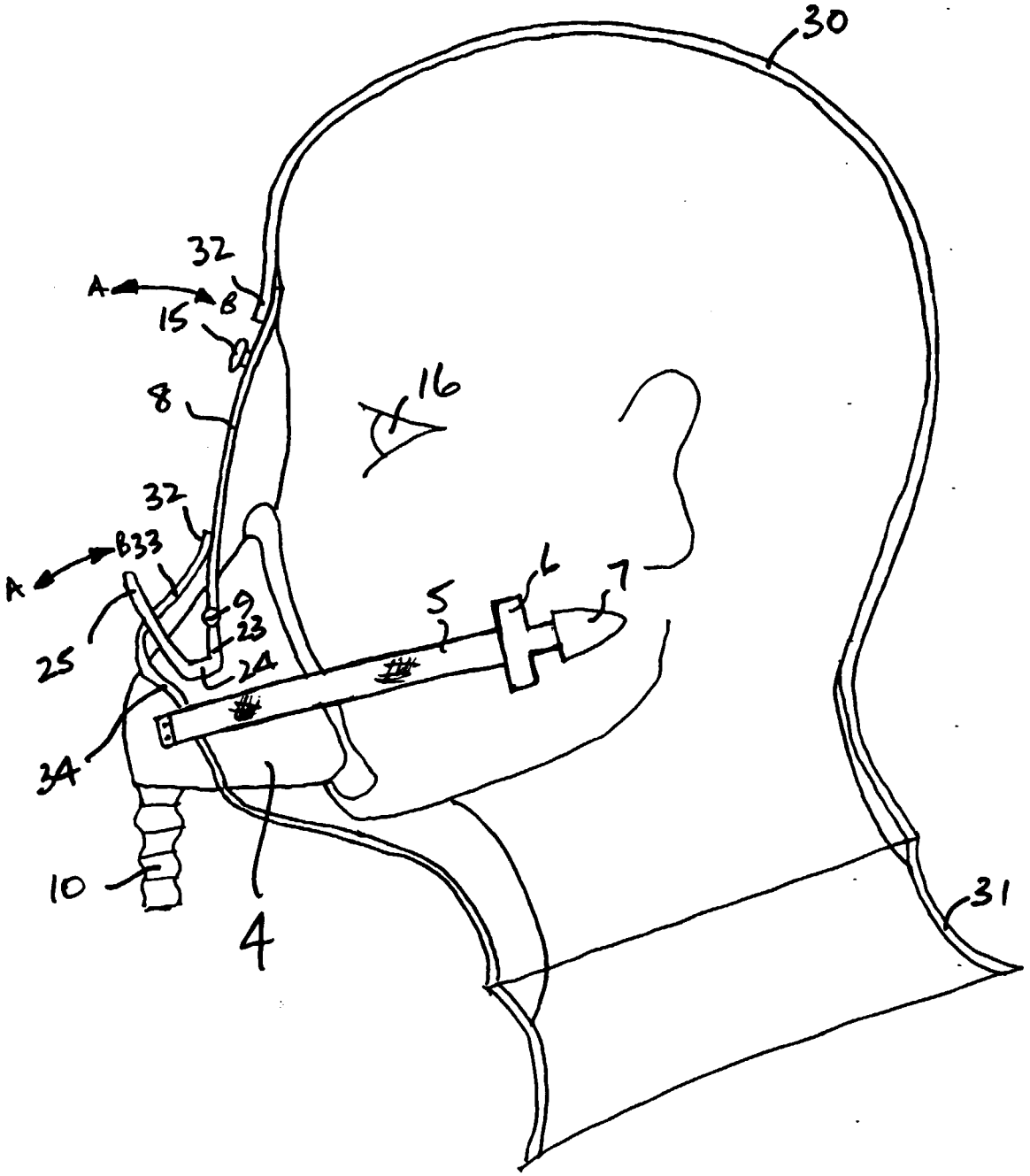
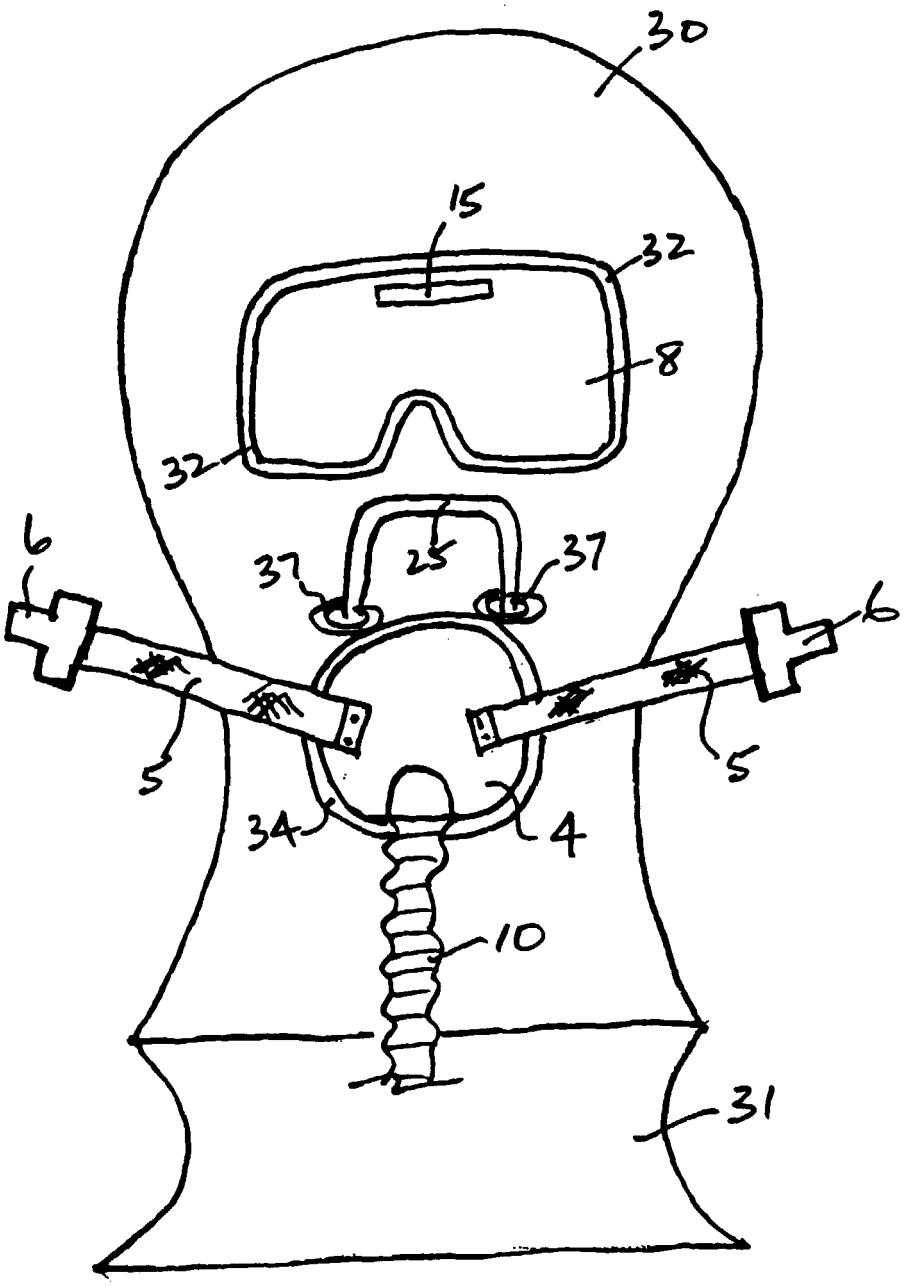


FIG.10.



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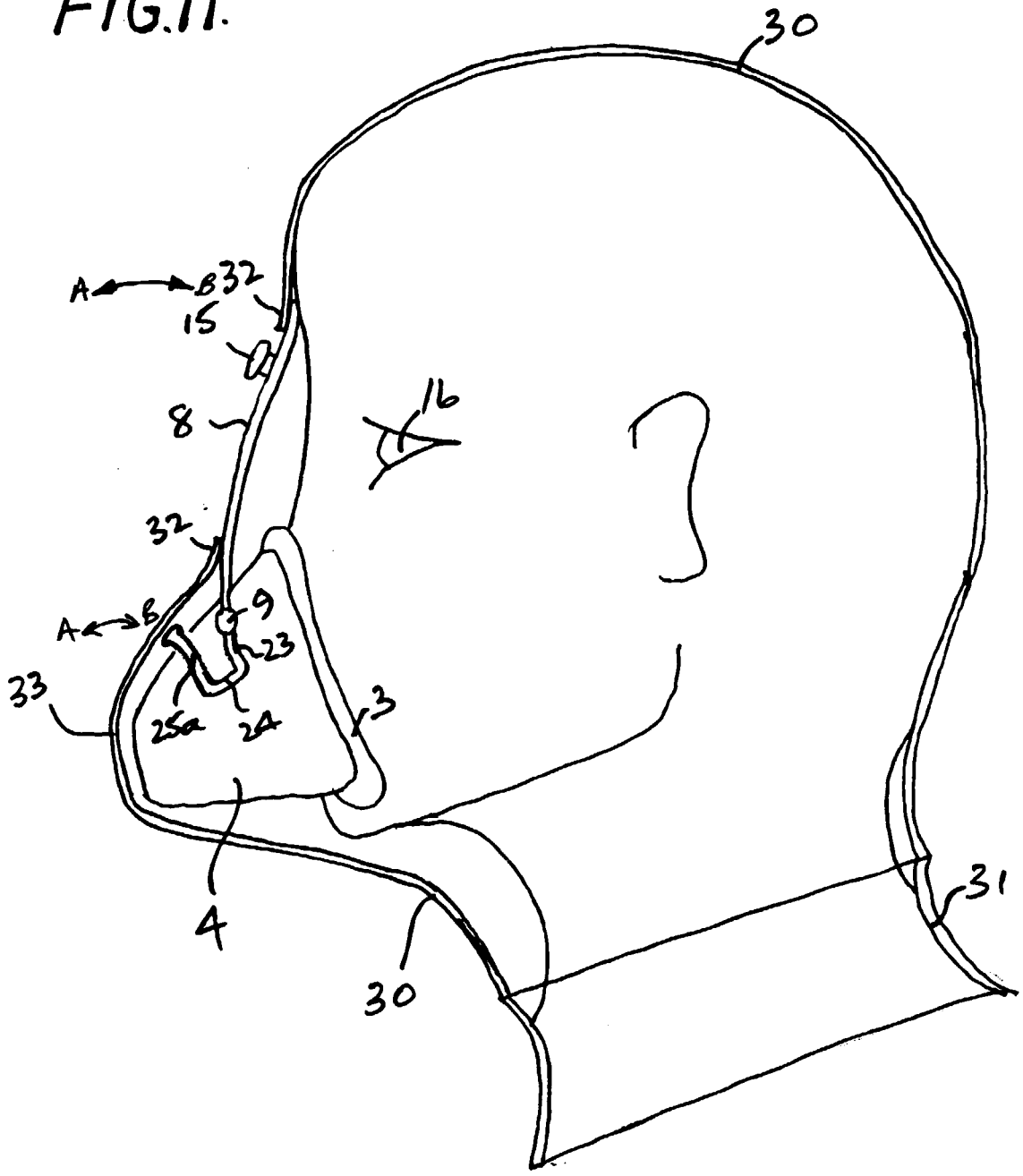

FIG.12.

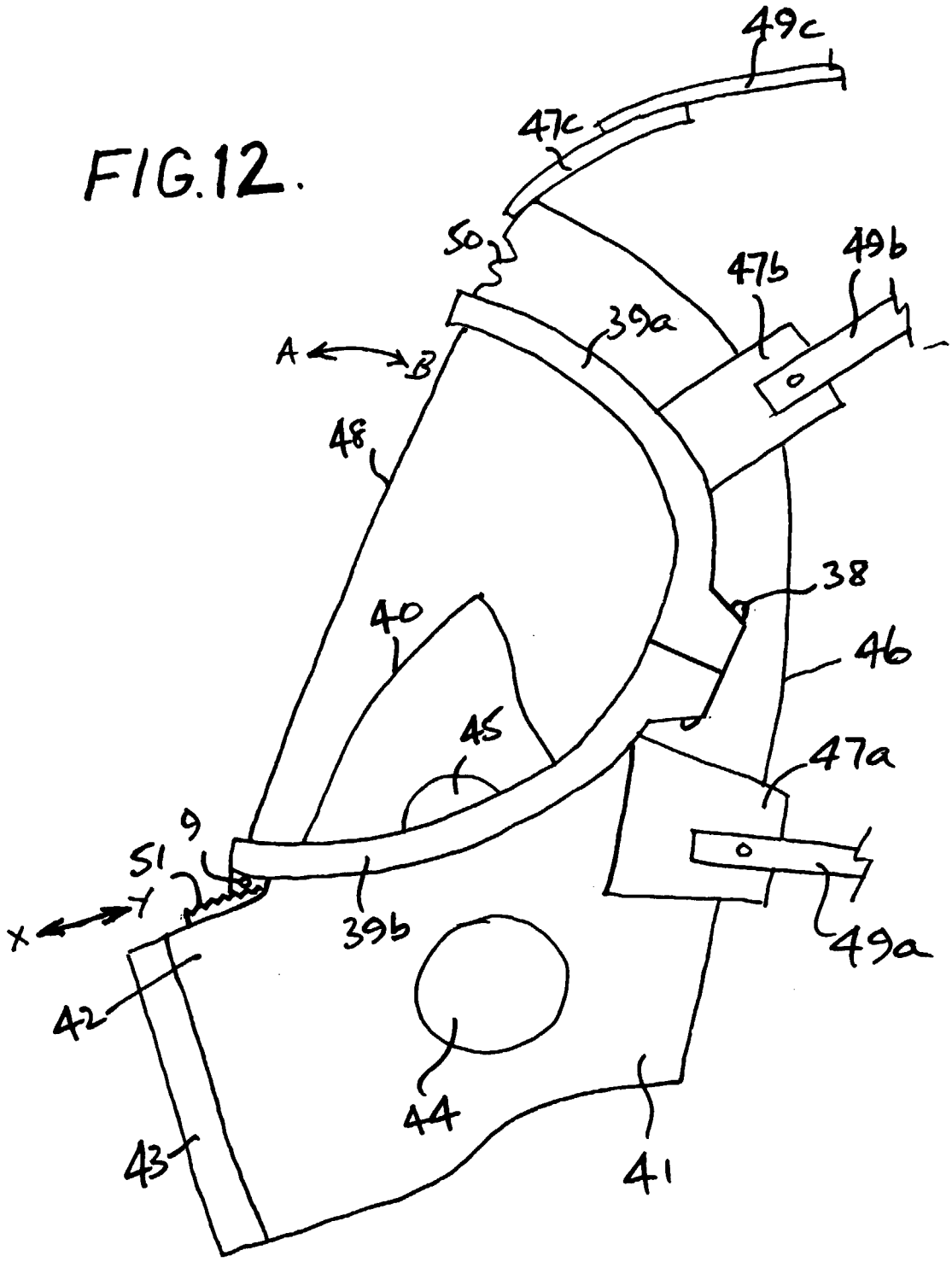
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FIG. 13.

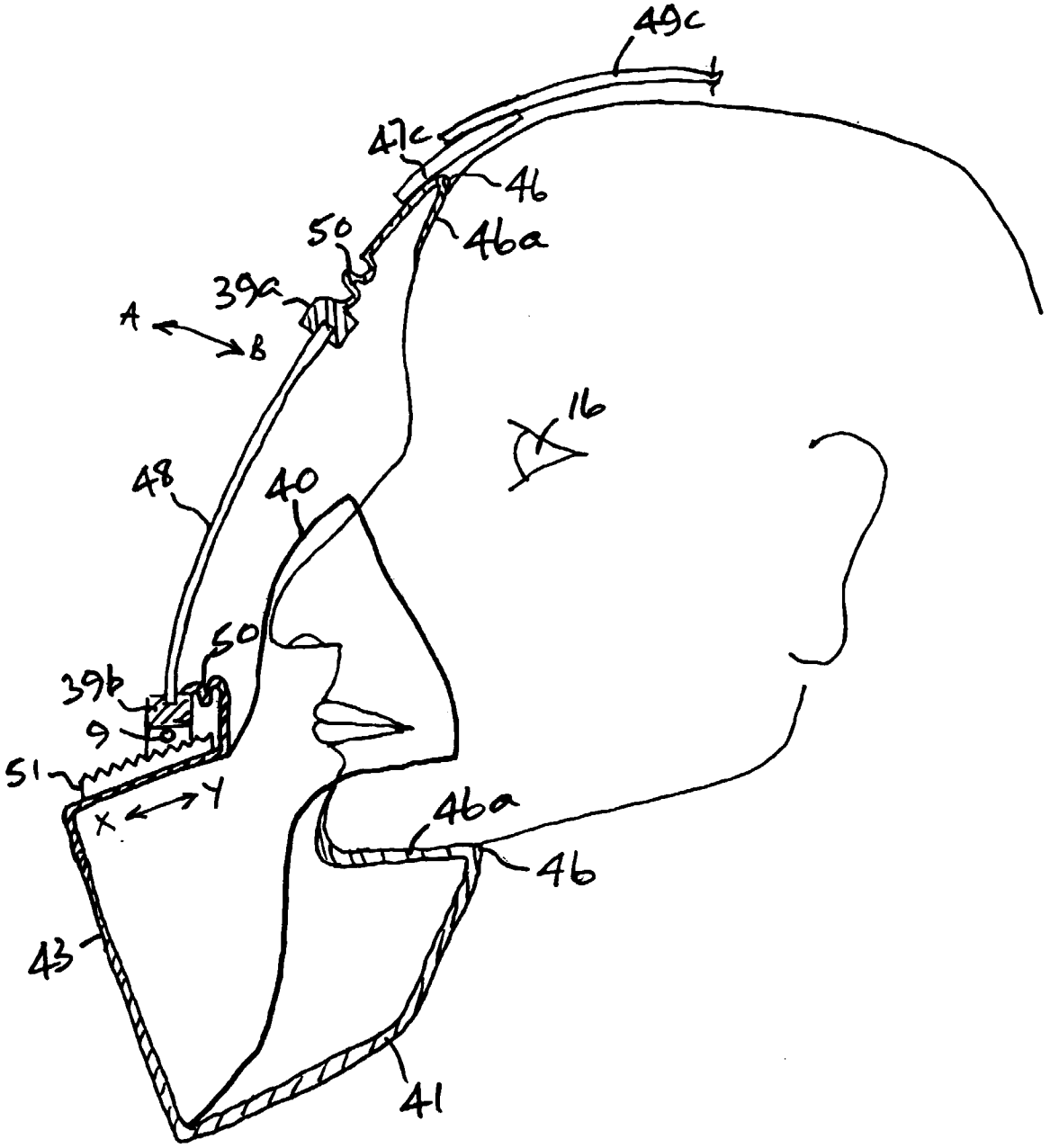
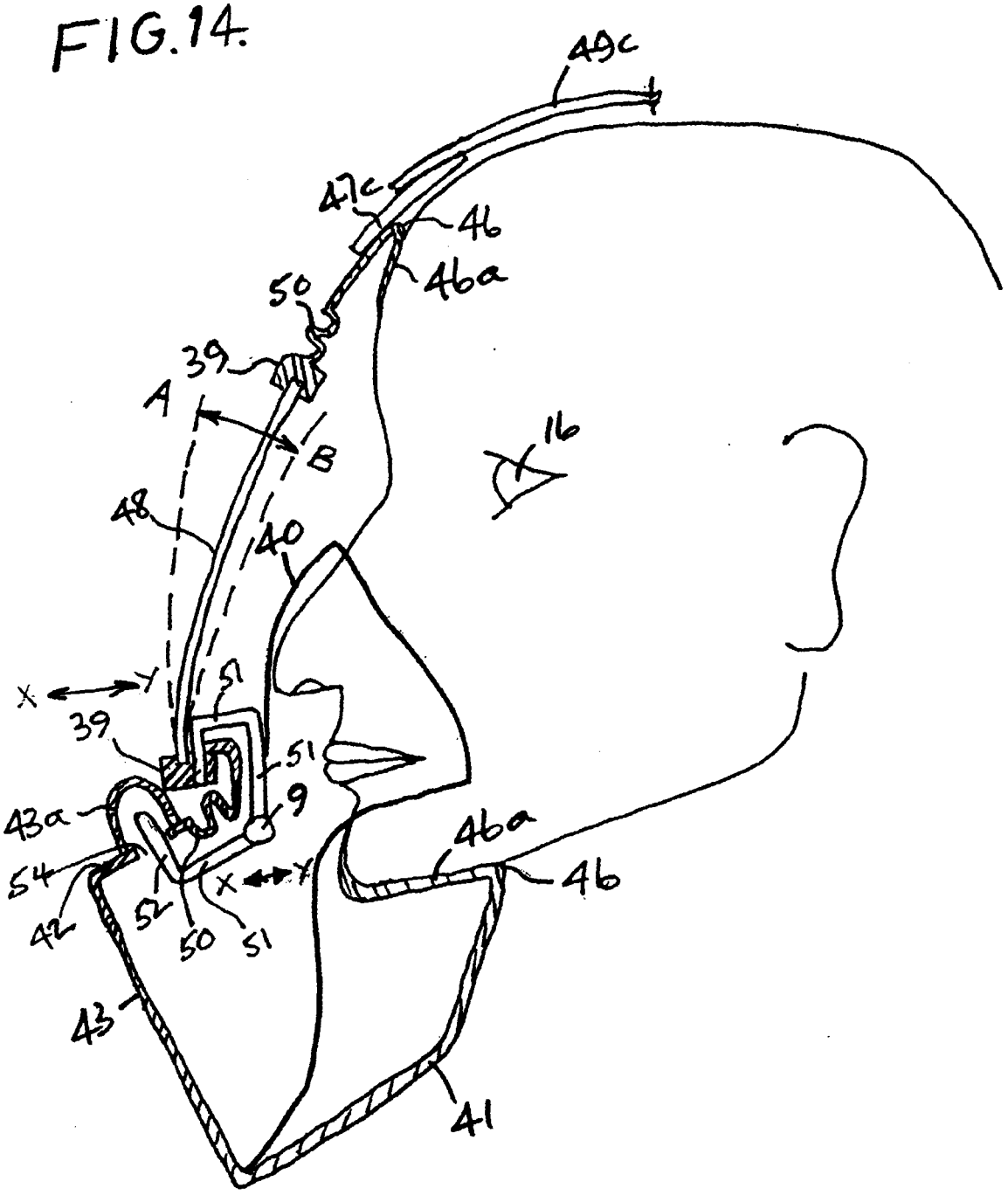


FIG.14.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