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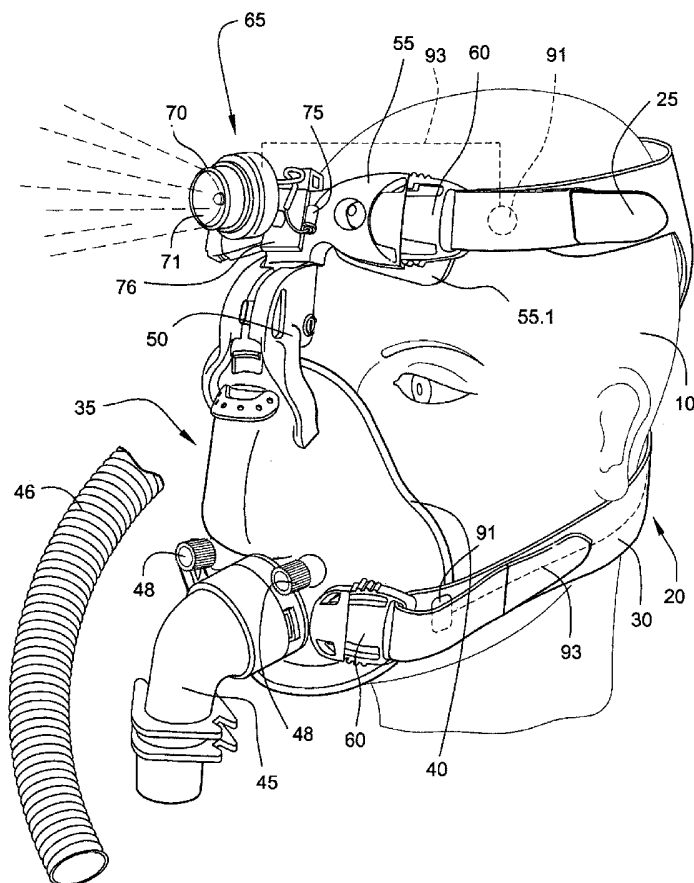
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(54) Title: POSITION SENSITIVE ILLUMINATION SYSTEM



(57) Abstract: A position sensitive illumination system (65) for a patient includes an illumination source (70) and at least one sensor (75) structured and configured to selectively activate the illumination source in dependence of movement of the patient. Illumination source and/or sensor may be provided to one or more portions of a patient interface, e.g., a mask assembly, to thereby allow automatic activation of the illumination source when the patient moves to a predetermined position. Illumination source (70) provides a directed lighted path for the patient as the patient moves about, e.g., during nocturnal visits to the bathroom, thereby avoiding the awakening of a bed partner.



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TITLE OF THE INVENTION

POSITION SENSITIVE ILLUMINATION SYSTEM

CROSS REFERENCE TO APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application No. 60/571,487, filed May 17, 2004, incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] This application is directed to a position sensitive illumination system.

2. Description of Related Art

[0003] Typical patients with sleeping disorders, such as obstructive sleep apnea (OSA), and even people (also referred to herein as "patients") without sleep breathing or other disorders can remain in an awake state lying in bed prior to going to sleep. Some patients may prefer to read a book or relax before going to sleep.

[0004] The bedroom environment at night and during sleep is typically poorly lit or not illuminated at all. The patient may therefore use a room light or switch on a bedside lamp to read. Bedside lamps typically throw stray light in most directions and may disturb a sleeping bed partner.

[0005] Another problem is that occasionally patients at night find need to get up and visit the bathroom or kitchen, or the need to otherwise arise. Typically, such a patient will switch on a light by fumbling in the dark for a light switch or search for a nearby flashlight.

[0006] A patient's travel or walking path during such visits should preferably be lit, therefore either room lighting or a flashlight is required, the latter to prevent disturbing a bed partner.

[0007] Some patients may also use a light-activated lamp or "night light" that plugs into a general purpose power outlet in the home. The lamp illuminates a space in the adjacent vicinity when ambient light levels fall. The space remains illuminated whether the patient or bed partner is awake or asleep. This stray light can disturb patients and bed partners when they wish to sleep. They also illuminate only a defined space, rather than the intended path of movement for a patient, e.g., the path from the bed to the bathroom.

[0008] Further, switching on of room lights can have a negative effect on circadian rhythms. Strong illumination especially reflected into the eyes is known to wake up patients, e.g., to a level of alertness that may diminish their ability to fall asleep again.

[0009] Therefore, a need has arisen to develop a system to allow for convenient and automated lighting of a patient's intended path, while preferably providing minimal disturbance to a patient and the patient's bed partner.

SUMMARY OF THE INVENTION

[0010] One aspect of the invention aims to ameliorate one or more of the above noted problems.

[0011] Another aspect is directed to an illumination system that switches itself on when the patient assumes a predetermined position, e.g., either mobile or sitting up erect in bed, and switches off during sleep, e.g., when the patient is lying down.

[0012] Still another aspect is to provide a system in which a patient waking at night is not overly awakened so that the patient may fall asleep again more easily without trouble.

[0013] Another aspect of the invention is directed to a switching circuit that may prevent inadvertent switching on in certain and/or common sleeping positions, e.g., laying on a side in an oblique manner or lateral body position.

[0014] The position sensitive illumination system may be applied in a number of ways, including but not limited to a system that is integrated into a human interface such

as a breathing mask system, an accessory that can be attached to an interface, or a stand-alone product that can be used in conjunction with a multitude of therapy equipment or additional lighting as required.

[0015] The systems described herein may also be used during non-therapy related sessions, for example, simply reading in bed during the night.

[0016] These and other aspects of the invention will be described in or apparent from the following detailed description of preferred embodiments.

BRIEF DESCRIPTION OF DRAWINGS

[0017] Preferred embodiments of the invention will be described in relation to the following drawings, in which:

[0018] Figure 1 is a perspective view of a position sensitive illumination system according to a first embodiment of the present invention in which a model patient's head is upstanding and light is generated;

[0019] Figure 2 is a perspective view of the system shown in Figure 1, in which the model patient is lying asleep on his side and light is not generated;

[0020] Figures 3 and 4 are partial schematic side views illustrating base supports according to embodiments of the present invention;

[0021] Figure 5 is a perspective view of a position sensitive illumination system according to another embodiment of the present invention, with the illumination source shown in exploded view for clarity;

[0022] Figures 5A and 5B are schematic views showing exemplary positioning angles of sensors according to an embodiment of the present invention;

[0023] Figure 6 illustrates a schematic diagram of a blower according to yet another embodiment of the present invention; and

[0024] Figure 7 illustrates a schematic block diagram of a position illumination system along with possible options for upgrading the basic system according to yet another embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0025] Figures 1 and 2 illustrate a mask system integrated with a position sensitive illumination system according to an embodiment of the present invention.

[0026] As shown in Figures 1 and 2, a model patient 10 is provided with a patient interface, e.g., mask assembly 20, which in this embodiment is a full face mask, although other mask assemblies, e.g., nasal masks, prongs, nozzles, and even nasal cannulae, etc., are contemplated as well. Various components of mask assembly 20 are commercially available from ResMed Limited and are described in U.S. Non-provisional Patent Application No. 10/838,537, filed 5 May 2004 (P152US2), incorporated herein by reference in its entirety.

[0027] Mask assembly 20 includes in this example headgear including upper and lower straps 25, 30 that are provided to a mask 35. A cushion 40 is provided to mask 35. Typically, although not necessarily, mask 35 is in the form of a rigid polycarbonate shell, while cushion 40 is in the form of a flexible, elastic and/or silicone based sealing member that is structured to comfortably contact the patient's face without localized pressure points. Mask 35 is provided with a swivel elbow 45 which is connectible to an air delivery tube 46 (shown in a disconnected position), which is in turn supplied with pressurized breathable gas from a blower or flow generator (not shown). Mask 35 typically includes one or more ports 48 that are provided for pressure monitoring, or for the supply of supplemental gas, such as oxygen, etc. Ports 48 are typically provided with caps when not in use.

[0028] Mask includes an extension or joining member 50 that is structured to support a forehead support 55 having forehead pads 55.1. Upper strap 25 is connected to forehead support 55 via a releasable clip connector 60. Similarly, lower strap 30 is provided to mask 35 via releasable clip connector 60.

POSITION SENSITIVE ILLUMINATION ASSEMBLY

[0029] Mask assembly 20 includes and/or is provided with a position sensitive illumination assembly 65, as shown in Figure 1. In one basic form, assembly 65 includes

an illumination source 70 and at least one sensor 75, preferably non-Mercury tilt switches, although it is also possible to use Mercury switches as well. In the embodiment of Figures 1 and 2, two sensors 75 are provided. At least one of the source 70 and sensor 75, or a component or combination of components thereof, is connected or otherwise provided to the patient interface, e.g., one or more portions of mask assembly 20.

[0030] Preferably, at least a portion of illumination assembly 65 is formed as an integrated component of mask assembly. However, portions of illumination assembly 65 could be retro-fitted to mask assembly 20, in which case the mask assembly would not need to be specifically designed to accommodate illumination assembly 65.

[0031] In either case, structure will be provided to support the selected portions of assembly 65 on the patient interface. That structure, e.g., as shown in Figure 3, may include at least one base support 76 having a first portion 77 provided to the patient interface, e.g., at the intersection of T-shaped cross-bar of forehead support 55, and a second portion 78 that is provided to support source 70 and/or sensor 75. Sensor 75 is not shown in Figure 3, for clarity purposes, but is connected to one or more of wire ends 79a, 79b of source 70. Positioning in this manner is advantageous because support 76 is located between the two forehead support pads 55.1 shown in Figures 1 and 2. Because the pads 55.1 are generally spaced away or offset from the forehead support 55, there is ample room for the support 76 and little possibility that the support 76 can contact the patient's forehead. One such pad 55.1 is schematically shown in phantom in Figure 3 to illustrate this offset.

[0032] In general, components of the illumination assembly 65 should be positioned on the interface in such a way as to avoid interference with the patient, e.g., the patient's line of vision, etc. In addition, the components should be placed such that they maintain a low profile, so as to avoid snagging and interference with head movement. Further, at least the source 70 should be positioned such that it best illuminates the patient's path during movement. Positioning of the source 70 on the forehead support 55 achieves this goal, although there are other positions which would be acceptable.

[0033] Second portion 78 may be in the form of a fixture, e.g., a ball socket, which is adapted such that that source and/or sensors can be selectively attached and/or removed. Of course, multiple supports may be provided to support separate components of illumination assembly.

[0034] As shown in Figure 3, support 76 includes front and rear walls 81, 82 on either side of forehead support 55. As mentioned above, rear wall 82 would not contact the patient's forehead, because forehead support pads 55.1 space the forehead support 55 away from the patient's forehead. In this embodiment, support 76 may act as a clip so that it can be selectively attached to and detached from the forehead support 55. Front and rear walls 81 and 82 may be pre-tensioned or provided with a spring so as to be biased towards one another, to grasp support 55. Finger engagement portions 84 may be provided to facilitate operation.

[0035] In addition and/or in the alternative, one or more screws (not shown) or other fastening devices may be provided to connect support base 76 to mask assembly, e.g., forehead support 55.

[0036] Support 76 may be connected to patient interface in a number of different ways. For example, as shown in Figure 4, first portion 77, instead of being separate, may be provided in one piece with mask assembly 20, e.g., cross-bar of support 55. Second portion 78 may also be formed in one piece with support 55. It is contemplated that mask assembly could be sold to customers with a standard forehead support, without illumination assembly. An upgrade kit could be sold which would include sensor/source and a forehead support specifically adapted to support an illumination assembly, e.g., source and/or sensor.

[0037] The illumination source 70 is preferably mounted to a flexible and/or adjustable positioning joint, such as gimbals or ball joint 85. Gimbal 85 or another universal joint allows the user to variably adjust the direction of illumination according to the relative positioning of the patient. The light could, for example, provide an ideal position for reading a book whilst sitting up in bed or an appropriate angle to allow the patient to light their intended path for a nocturnal visit to the bathroom. Universal joint

may either lock manually in position, be friction locked whereby a overriding force is applied to adjust position and release to lock, or may otherwise be automated into a position. Sensor 75 is preferably not adjustable, at least once the patient interface is donned by the patient. Sensors can be attached by mechanical fastening and/or adhesives, e.g., self adhesive tape. Further, sensors may be mounted in an adjustable fashion to fine tune and/or adjust their on/off angle/threshold.

[0038] As shown in Figure 1, illumination source 70 is on, meaning that light is provided. In addition, the light generally follows the walking path of the patient, since the light is mounted on mask 35 in a way that follows the movement of the patient's head. Figure 2 shows the patient 10 in a sleep mode, in which the head is resting on its side against a pillow 80. In this position, the sensor 75 is in the position which causes the illumination source 70 to be deactivated.

[0039] As shown in Figures 1-4, illumination source 70 and/or sensors 75 are provided on the forehead support 55. However, either one or both of these elements may be provided on other parts of the mask assembly 20, such as the mask 35, straps 25 or 30, elbow 45, ports 48, etc. In other embodiments, e.g., source 70 may be provided to mask 35, sensor may be provided on forehead support 55, and a power source may be provided on headgear straps. Moreover, the embodiments of Figures 1-4 is integrated into a mask assembly to minimize size, weight, components, and obtrusiveness to a patient.

ILLUMINATION SOURCE

[0040] Illumination source 70 may include, but is not limited to, one or more incandescent lamps, cold-cathode fluorescent lights, fiber optic lights, light emitting diodes (LEDs), Xenon high intensity lamps, and/or halogen lamps, etc.

[0041] LEDs are long lasting, inexpensive, and tend to throw softer light that is easier on the eyes (less strain) compared with other types of lights, such as halogen lights. LED illumination also offers various brightness including ultra bright versions that offer high illumination however with desirably low power consumption. Low power consumption results in a smaller battery storage device that results in smaller size and

less weight therefore increased comfort to the patient. One or more LEDs may be used depending on the illumination and intensity required.

[0042] LEDs may be mounted together or apart in different areas of the interface system. For example, the LEDs may be mounted into headgear strap on either side of the head. In another example, only a single LED is used.

[0043] Preferably, a reflector 71 is provided to back the illumination source, e.g., one or more LEDs, to thereby provide a greater concentration of light towards the required area to be illuminated. The reflector also serves to prevent stray light and minimize intensity of lamp required. The ideal illumination provides concentration towards the center of the light beam and gradually softens towards the edge that may be achieved by diffusing more light near the reflector edge. Reflector should effectively lower the power requirements for the power source.

[0044] In addition, shield members may be provided in conjunction with the illumination source and/or reflector to direct a more focused beam of light, to thereby illuminate the patient's path and to help prevent waking of the patient's bed partner. Shield members can mask the light from certain zones to provide a defined illumination zone. Shield members can take the form of a hood, e.g., having the shape of a traffic light hood, or a blinder, such as a horse blinder.

[0045] The emitted light may also be provided with a filter or otherwise filtered to allow certain objects to be more readily seen in dark surroundings. For example, a red filter may be used to preserve night vision without straining the eyes.

SENSOR

[0046] As described above, sensors may take the form of Mercury switches or non-Mercury switches. However, sensor can be any type of tilt or motion sensor, for example yaw/roll sensors such as used in automotive chassis stability systems. While the illustrated embodiments make use of two sensors, the use of a single sensor or more than two sensors is also contemplated.

[0047] Mercury tilt switches (usually found in home security systems that incorporate a capsule of Mercury) are electrically communicated via wired or wireless connection in series to illumination source. Tilt switches when positioned according to the patient supine sleeping position provide no illumination because both tilt switches are angled in the off position with the open circuit ends pointing towards the centerline of the patient. The orientation of the sensors depends in part on the patient's sleeping position. Ideally, the orientation is adjustable by the patient, since patients may sleep in different positions due to, e.g., higher pillows. As shown in Figures 5A and 5B, the angle α from the front may be in the range of about 50°-90°, and the angle β from the side may be in the range of about 25°-40°, although other angles (higher or lower) are possible. See, e.g., Figures 1, 2 and 5. Should a patient roll onto their side (oblique or lateral position), the lower tilt switch can close, however the uppermost switch remains open.

[0048] Therefore the positioning of sensors help prevent inadvertent illumination in these general body positions as the sensors are wired in series and the lamp will not illuminate unless both tilt switches are closed (connected). Logic with the sensor(s), and/or in the air delivery device, prevents or minimizes inadvertent illumination in certain body positions. For example, it is preferable that the illumination source 70 does not operate in any typical sleeping position lying down, i.e., supine (on back), prone (on front), lateral (on side), and oblique (on side facing toward bed). As the prone position is uncommon during the use of sleep therapy equipment such as masks, the position sensor may not accommodate this position. Therefore, sensors should be arranged such that at least one is open in at least the above body positions, so that source 70 does not provide illumination. As a patient sits or stands upright, the sensor or sensor array closes the electric circuit and the lamp illuminates.

[0049] Non-Mercury tilt switches are preferred for patient safety, since they do not include Mercury which may be a health hazard. Non-Mercury tilt switches typically include a conductive ball, bead or pill inside a small canister, track or guide with the circuit contacts at one end. Tilting the switch one way opens the circuit while tilting the opposite direction closes the switch.

[0050] If provided on the patient interface, sensor 75, .e.g., tilt switches, may include anti-vibration structure to damp vibration as the user walks to prevent or minimize the lamp flickering due to switches opening and closing repeatedly. Such structure may take the form of a damping element built into sensor, to dampen the body of sensor, or otherwise damp assembly 65. This damping, in one example, may be achieved by mounting the tilt switch to the assembly via a soft visco-elastic material such as very soft silicone.

POWER SOURCE

[0051] Illumination assembly 65 includes or is provided with a power source for providing power to the illumination source and/or the sensor. Power source may take the form of a battery, either of the rechargeable or the non-rechargeable type. The battery may be held on the position illumination system via a battery holder, which in embodiments may be provided as part of the mask assembly 20, illumination assembly 65, and/or support 76. For example, one or more batteries 73 (Figure 4) may be provided within the same casing that holds the illumination source. In another embodiment, as seen schematically in Figure 1, battery 91 may be provided to one or more of headgear straps 25, 30. Batteries 91 may include backing including a hook-type fastener which cooperates with the loop material on the straps 25, 30. The batteries 91 may be connected to source 70 by wires 93 that are routed directly to source 70 or along the headgear straps 25, 30 and other components of the mask assembly. For example, clips 60 could include electrical contacts which complete a circuit when the clips 60 are attached to the forehead support 55. Batteries 91 are shown to be positioned within a recess of a doubled-over portion of straps 25, 30.

[0052] A rechargeable version may utilize wired or wireless charging technologies, such as that used in rechargeable toothbrushes. Rechargeable versions may offer user convenience in not having to replace batteries often especially for frequent users. Compact but high-power storage is preferred, for example Lithium-Ion or Nickel Metal Hydride batteries used in small mobile cell phones.

[0053] Preferred battery storage device that requires no additional wiring harness from the patient to a power source not located adjacent to the body. The battery storage device is preferably compact, such as alkaline 'coin' batteries that may be stacked to achieve higher storage capacity of voltages to offer the required illumination life before batteries run flat on power.

[0054] A solar charging version allows the battery storage medium to be charged during day, with enough power stored for subsequent use during the night.

STAND ALONE POSITION SENSITIVE ILLUMINATION

[0055] Figure 5 illustrates yet another embodiment of the invention. A position sensitive illumination assembly 100 is provided to a model patient's head 105. Assembly 100 includes a patient interface, e.g., a head strap 110, one or more sensors, e.g., switches 115, and an illumination source 117 (shown as exploded view; connectable to wire ends 120 and 125). Source and sensors may be as described above. In this embodiment, assembly 100 is provided to a patient who is not using a mask for sleep therapy, i.e., a stand alone assembly which in fact need not include a sensor in a more basic form. In one embodiment, it may be possible to provide an override switch to deactivate the sensor, in the event the patient is taking a break from therapy. The override switch can be formed as part of the illumination assembly, or as part of a blower or flow generator.

[0056] Headgear 110 includes in this example a first strap 111 guided along the patient's forehead and toward the back of the head along the temples of the patient. A second strap 112 is provided over the top of the patient's head. A support 113 is provided with first and second connection portions, e.g., slotted connectors, for the ends of first strap 111, and a third connection portion for second strap 112. Support 113 includes provision for the support of sensors 115, as well as illumination source 70. For example, support may include receiving structure which allows source and/or sensors to be automatically snap-fitted into place or fastened in any suitable manner. In another embodiment, sensors can be attached to a bracket with self-adhesive tape. In still another embodiment, sensor, source and/or mounts may be coupled using hook and loop

fasteners. Preferably, support 113 includes a padded layer in contact with the patient's head.

INTEGRATION WITH FLOW GENERATOR

[0057] As shown in Figure 6, power to sensor(s) and/or illumination source may also be provided via air flow generator 200, which is typically plugged into an outlet in the patient's room and is described, e.g., in relation to U.S. Patent No. 6,591,834, incorporated herein by reference in its entirety. Air flow generator 200 could include an additional wire or electric cable 202 that may be routed along or through or otherwise integrated into air delivery tube 6 for connection to illumination source and/or sensor.

[0058] A wire or cable may also run to an alternate battery source, for example, mounted to a belt or some portion of the patient's body. The wire/cable may also run to an alternate power source such the home general power point.

[0059] In Figure 6, illumination source may be connected to or otherwise provided to a hole formed in an elastomeric vent insert 204 which can be selectively attached to and removed from the mask assembly, which in this case is a nasal mask assembly 206. The insert 204 is normally provided with a plurality of holes 207, one of which can be used to support the illumination source 70, provided the remaining holes provided ample gas washout. Otherwise, an additional hole can be added, or the insert 204 can be replaced with a new insert having the proper number of holes, one of which is for source support and the others of which are for gas washout. The elastomeric nature of the insert can frictionally hold the source 70 in the desired position. The source may move in one or more planes, e.g., via a flexible joint, or a hinge or ball joint, to direct the light beam in the intended direction. Otherwise, the source may be provided directly within the shell of mask assembly 206.

[0060] In another embodiment, one or more illumination sources may be supported by ports 48, as shown in Figures 1-2, following temporary removal of port caps. In one form, source may be mounted on a stem which is frictionally received within port 48. Source could include a battery and an on/off switch, without the need for

a sensor. Preferably, the source would allow for some form of adjustability, e.g., via a ball joint or a flexible, deformable stem.

[0061] Signals produced by sensor(s) may be communicated by wire or wireless methods to flow generator 200, or another diagnostic device. For example, flow generator includes a sensor module 208 that provides a signal to controller 210 to switch off impeller 212 when patient sits up, or to stop the flow of air to mask, based on output from sensor, and preferably before mask is taken off face to prevent blow out and noise that may disturb a bed partner. In this embodiment, mask may not necessarily include an illumination source and/or position sensor, each of which may be provided elsewhere in the patient's room. Such information may also be used in diagnostics to determine and record head and/or body position related to severity of OSA.

[0062] As shown in Figure 6, a light sensor 300 built into flow generator 200 can sense when a patient aims the activated illumination source towards and it can also conveniently turn the machine on and off. The sensor should preferably be able to differentiate ambient lighting from light generated by illumination source, which may be achieved by providing the source with a filter and adjusting the sensor to such filtered source light. This provides a 'touchless' start and stop function of the treatment device, e.g., flow generator. Further, machine performance may be modified relative to the sensed body position of the patient.

ADDITIONAL EMBODIMENTS

[0063] Figure 7 illustrates position illumination system in a basic form, including illumination source 70 and sensor 75. A channel 90 is provided to allow communication between illumination source and sensor. Channel may be mechanical, magnetic and/or electrical, etc. in nature. Moreover, wired and/or wireless communication channels may be provided.

[0064] Figure 7 includes a bank 95 of optional subcomponents which are described below. One or more subcomponents of bank 95 may be provided directly to or

integrated into flow generator and/or illumination system, e.g., a printed circuit board including the required circuitry and/or logic components.

[0065] Sensor is optionally in communication with a sensitivity module 700 that has an ability to adjust the sensitivity of angular adjustment of the sensors so that in certain body positions, the patient may not wish the lamp to illuminate as readily.

[0066] An "on/off" switch 702 may be provided to override the position sensor in case the device is being transported and not being used. Switch 702 may also have an option whereby an additional light sensor completely opens the circuit during daylight ambient light levels.

[0067] Selectable brightness switch 704 may be provided so a patient can select more than one illumination level. These may be defined steps or otherwise fully variable. The light intensity may also automate to adjust beam intensity according to ambient room lighting levels, e.g., by use of a photo resistor. A lower intensity may be preferred during reading where the area to be illuminated is in close proximity to the face as opposed to a path where the patient is walking.

[0068] A soft-start illumination module 706 may be provided to minimize eyestrain similar to that used in automobile delay courtesy light systems. When the device is switched on as a patient becomes upright, the source 70 slowly illuminates (by steps or continuously variable) to the defined intensity to prevent sudden eyestrain and/or to avoid disruption of the patient's or bed partner's circadian rhythms. This may be done using several methods including use of capacitors or simple electronic dimming circuit. For example, the ramping and/or stepping of the light brightness/intensity occurs over about 2-10 seconds, preferably about 5 seconds.

[0069] This above feature is most useful where a patient has been sleeping and is awakened with the desire to visit the bathroom or kitchen at night. The patient's eyes have acclimatized to darkness and therefore a soft-start feature provides substantially improved patient comfort. The other benefit prevents the patient from being harshly affected, which may reduce the ability for a patient to fall asleep again on return to bed.

[0070] An indicator 708, such as a small LED, can be used to signal low battery power to notify a user to replace and/or recharge the battery storage device. Additional options or features may be provided in module 710.

[0071] Patients with a physical disability may also benefit from aspects of the invention, e.g. loss of an upper limb or arthritis, as two examples. In one example of an application, the position sensitive components (e.g., sensors) may be mounted to the patient's head, and a bedside light or series of lights may be connected.

[0072] In another alternative, the sensor may be a pressure detector which is provided in the patient's pillow, bed sheets, mattress, etc. The sensor may be in the form of a pressure sensitive mat or floor piece provided next to the patient's bed. Sensor may be provided to a patient's walker and trigger activation of illumination source when the walker is moved.

[0073] Sensor may be in the form of a magnetic circuit. For example, a patient's eyeglasses can be provided with a magnetic component, which, when the patient dons the glasses, cooperates with a complementary magnetic component supported by the patient interface, e.g., mask, to thereby complete an electric circuit and thereby activate the illumination source, which may be provided on glasses or mask. When the patient removes the glasses, e.g., when a reading session is complete and the patient desires sleep, the glasses are removed and the illumination source goes out. When the patient wakes at night to visit the bathroom, the glasses are donned, thus activating illumination source.

[0074] Alternatively, the illumination source may be provided to the patient interface, and the position sensitive components (e.g., a motion detector) may be provided to the patient's surroundings in the room.

[0075] In other embodiments, both the sensor and illumination source may be provided somewhere in the patient's surroundings rather than being supported on the patient.

[0076] Embodiments of the invention may include integral components in a single assembly or module, or a number of parts can plug into each other, e.g., a reflector,

battery, switch, position sensor, etc. In still further embodiments, structure may be provided to swap and change any of the components as required by the patient.

[0077] For example, a general kit can be provided along with a number of optional lamp/reflectors to suit certain users or larger battery storage mediums for patients wishing to read for extended periods.

[0078] Furthermore, the use of position sensitive control is not limited with use to an illumination source. For example, instead of or in addition to selectively (de)activating an illumination source (accessory) in dependence of a signal from one or more sensors, such control could be applied to other accessories, e.g., stereo/radio and/or speakers, a television or other appliance, etc. Moreover, the position sensitive sensor can be used to produce a signal, e.g., an alarm, in the event the patient, e.g., the patient's head, assumes a sleeping position when the patient should be awake.

[0079] The invention has been described in reference to preferred embodiments thereof, which are intended to be illustrative and not limiting. Various modifications and changes would be apparent to those of ordinary skill in the art without departing from the scope of the invention.

CLAIMS

1. A position sensitive illumination system for a patient, comprising:
an illumination source;
at least one sensor structured and configured to selectively activate the illumination source based on positioning of the patient in use; and
a patient interface that supports at least one of the illumination source and the sensor.
2. A position sensitive illumination system according to claim 1, wherein the patient interface supports the illumination source and the sensor.
3. A position sensitive illumination system according to any one of claims 1 or 2, wherein the patient interface includes a strap structured for support in use by the head of the patient.
4. A position sensitive illumination system according to any one of claims 1 to 3, wherein the patient interface comprises a mask assembly.
5. A position sensitive illumination system according to claim 4, wherein the mask assembly includes a forehead support that supports at least one of the illumination source and the sensor.
6. A position sensitive illumination system according to claim 4, wherein the mask assembly includes a headgear strap that supports at least one of the illumination source and the sensor.

7. A position sensitive illumination system according to claim 6, wherein the headgear strap supports a battery for the illumination source, and the illumination source is provided to a forehead support of the mask assembly.

8. A position sensitive illumination system according to claim 4, wherein the mask assembly includes an elbow that supports at least one of the illumination source and the sensor.

9. A position sensitive illumination system according to claim 4, wherein the mask assembly includes a supplemental port that supports at least one of the illumination source and the sensor.

10. A position sensitive illumination system according to any one of claims 1 to 9, further comprising a base support configured to be provided to the patient interface, the base support supporting at least one of the illumination source and the sensor.

11. A position sensitive illumination system according to claim 10, wherein the base support includes a first portion to be affixed to a portion of an existing mask system and a second portion to support the illumination source.

12. A position sensitive illumination system according to claim 10, wherein at least a portion of the base support is provided in one piece with the patient interface, which is a mask assembly.

13. A position sensitive illumination system according to any one of claim 1 to 12, wherein the illumination source includes at least one of an LED, an incandescent light source, and a halogen bulb.

14. A position sensitive illumination system according to claim 13, wherein the illumination source includes an array of LEDs.
15. A position sensitive illumination system according to any one of claims 1-14, wherein the illumination source includes a reflector.
16. A position sensitive illumination system according to claim 15, wherein the illumination source further comprises a shield member.
17. A position sensitive illumination system according to any one of claims 1 to 16, wherein the sensor includes a Mercury switch.
18. A position sensitive illumination system according to any one of claims 1 to 16, wherein the sensor includes a non-Mercury switch.
19. A position sensitive illumination system according to claim 18, wherein two non-Mercury switches are provided, each being oriented such that at least one switch within a predetermined angular range is open in typical sleeping positions of the patient.
20. A position sensitive illumination system according to any one of claims 1 to 19, wherein the sensor includes a sensor array including at least two illumination sources.
21. A position sensitive illumination system according to any one of claims 1 to 20, wherein the sensor is provided to the patient interface.
22. A position sensitive illumination system according to any one of claims 1 to 20, wherein the sensor is not provided as part of the patient interface.

23. A position sensitive illumination system according to claim 22, wherein at least a portion of the sensor is provided to the patient's eye glasses.

24. A position sensitive illumination system according to claim 22, wherein the sensor is provided as part of the patient's bed pillow, mattress, or other surroundings.

25. A position sensitive illumination system according to any one of claims 1 to 24, further comprising a power source to power at least one of the illumination source and the sensor.

26. A position sensitive illumination system according to claim 25, wherein the power source is rechargeable.

27. A position sensitive illumination system according to any one of claims 1 to 26, further comprising an override on/off switch.

28. A position sensitive illumination system according to any one of claims 1 to 27, further comprising a sensitivity module.

29. A position sensitive illumination system according to claim 28, wherein the sensitivity module is configured to gauge ambient light conditions in the patient's vicinity.

30. A position sensitive illumination system according to any one of claims 1 to 29, further comprising a filter to filter light from illumination source.

31. A position sensitive illumination system according to any one of claims 1 to 30, further comprising a dimmer module adapted to adjust the brightness level of the illumination source.

32. A position sensitive illumination system according to any one of claims 1 to 31, further comprising a soft start module configured to slowly ramp/step power to the illumination source from a lower level to a predetermined higher level.

33. A position sensitive illumination system according to claim 32, wherein the ramping/stepping occurs over about 2-10 seconds, preferably about 5 seconds.

34. A position sensitive illumination system according to any one of claims 1 to 33, further comprising at least one vibration damper provided to the interface.

35. A position sensitive illumination system according to claim 34, wherein the vibration damper is a silicone mount for at least one of the illumination source and the sensor.

36. A position sensitive illumination system according to any one of claims 1 to 35, further comprising a base support supporting the illumination source and the sensor, the support including at least one slotted connector for attachment of a head strap.

37. An air delivery system comprising:
a flow generator;
a mask assembly coupled to the flow generator and adapted to receive pressurized gas via an air delivery conduit positioned between the flow generator and the mask assembly; and
a position sensitive illumination system as claimed in any one of claims 1 to 36, at least a portion of which is mounted on the mask assembly.

38. An air delivery system according to claim 37, further comprising circuitry to deactivate the flow generator in dependence of output of the sensor.

39. An air delivery system according to any one of claims 37 to 38, wherein the flow generator includes a light sensor adapted to receive illumination from the illumination source, to selectively activate and deactivate the flow generator.

40. An air delivery system according to any one of claims 37 to 39, wherein at least a portion of position sensitive illumination system is powered via the flow generator.

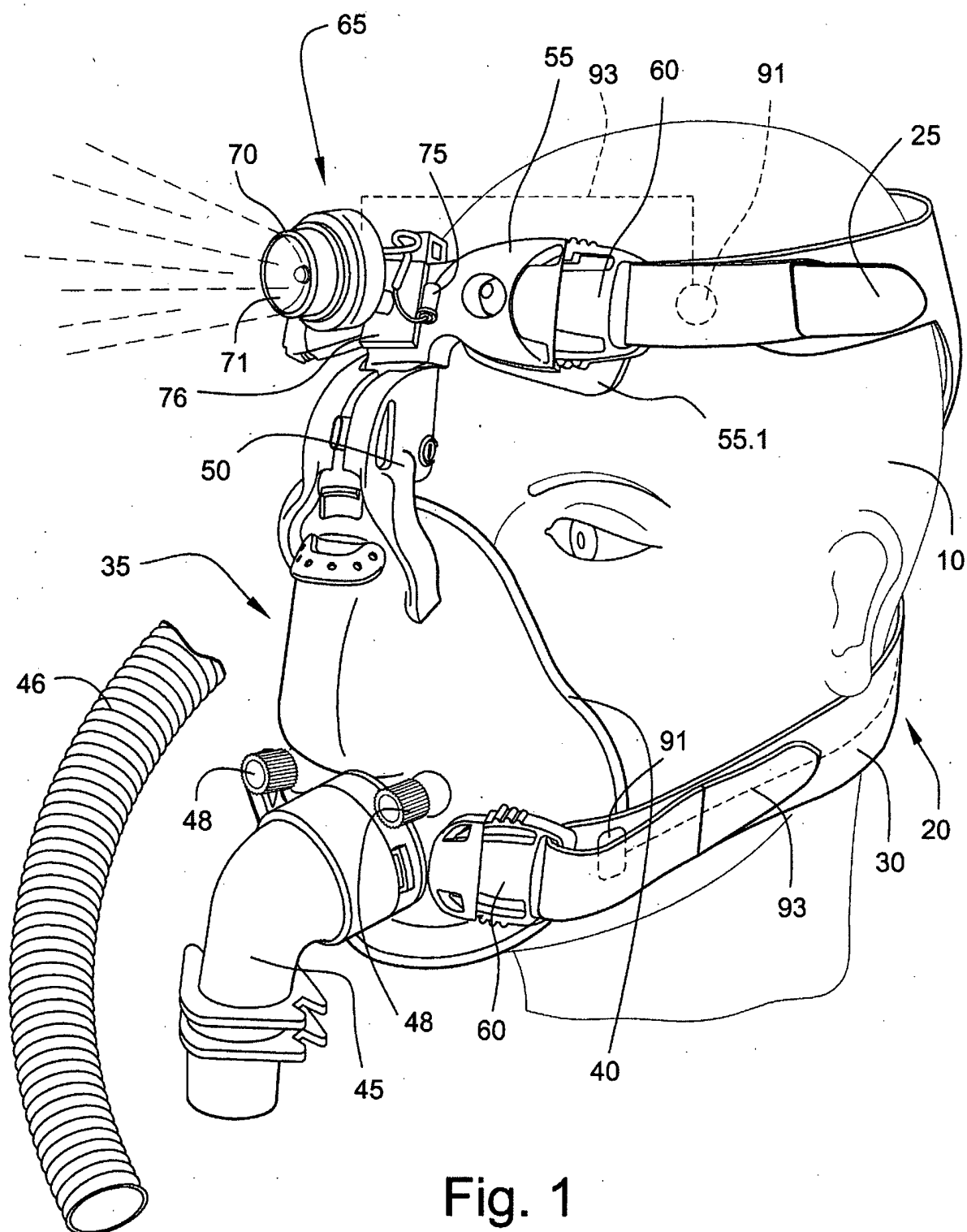
41. A method for controlling a patient accessory comprising:
monitoring the position of the patient's head;
determining whether the patient's head moves between a sleeping position and an awake position; and
activating the accessory in dependence of whether the sleep position of the awake position is sensed.

42. A method for controlling a patient accessory as claimed in claim 41, wherein the sleeping position is horizontal.

43. A method for controlling the patient accessory as claimed in any one of claims 41 and 42, wherein the awake position is vertical.

44. A method for controlling the patient accessory as claimed in any one of claims 41-43, wherein the accessory is an illumination source.

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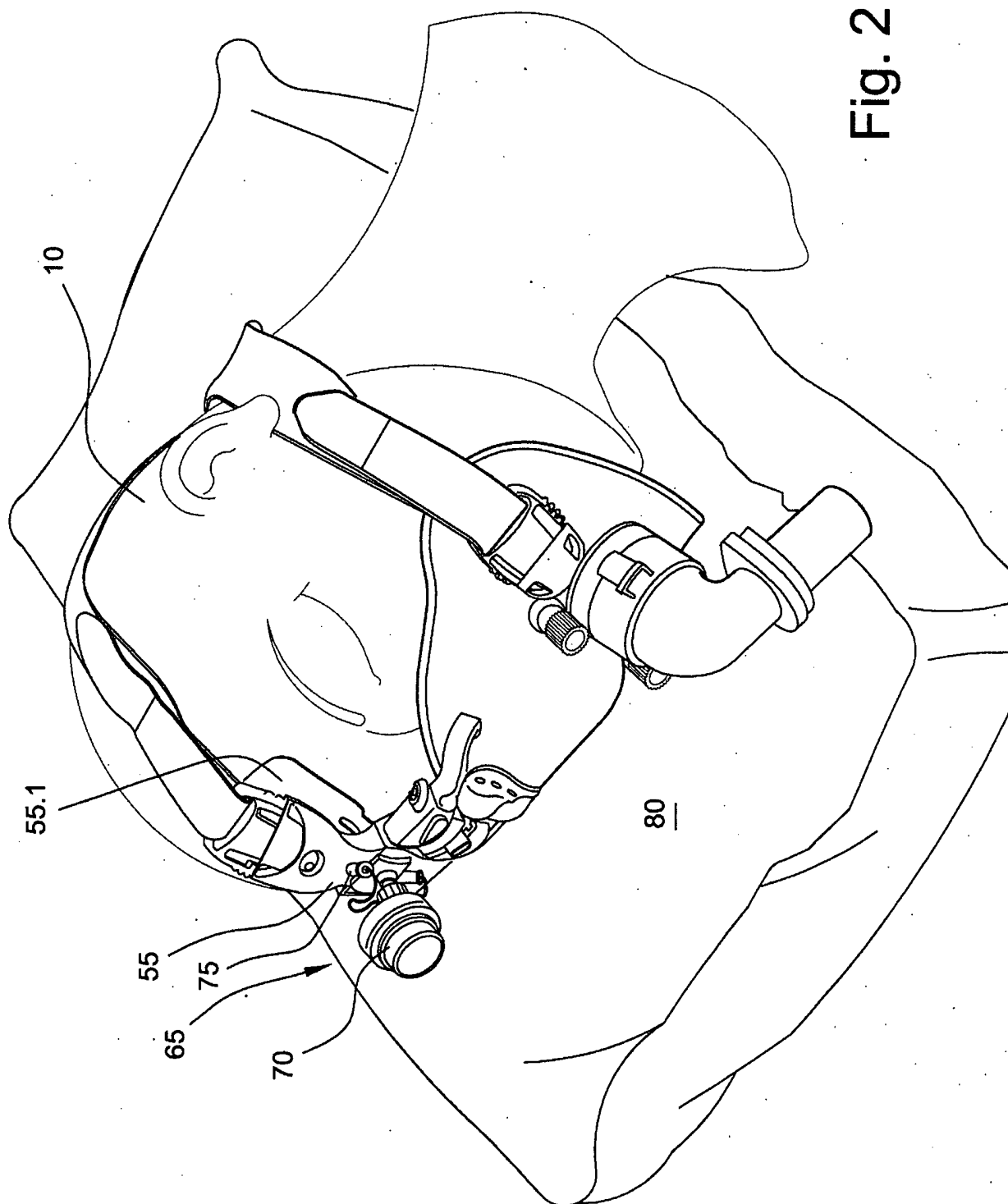


Fig. 2

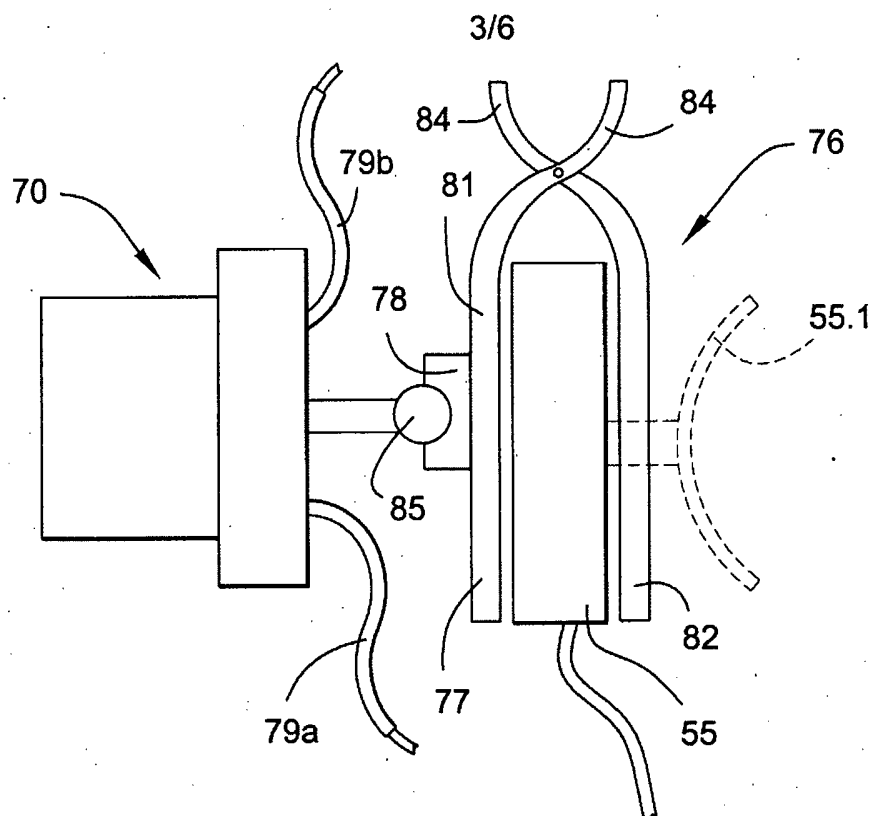


Fig. 3

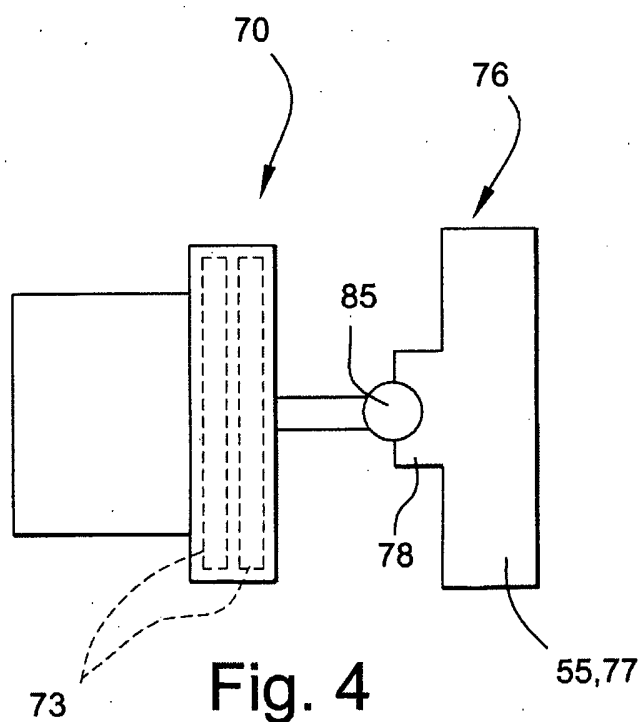
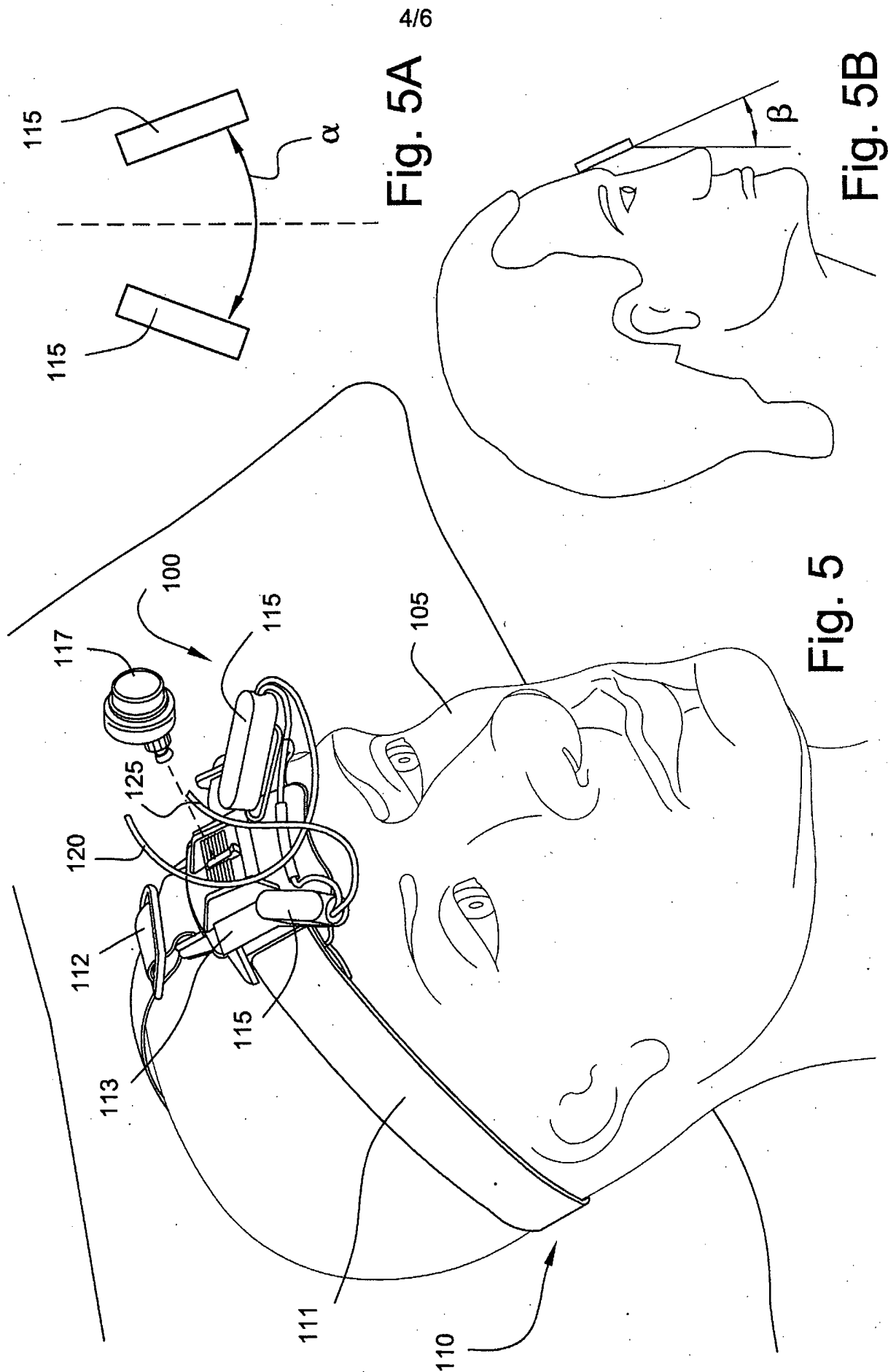
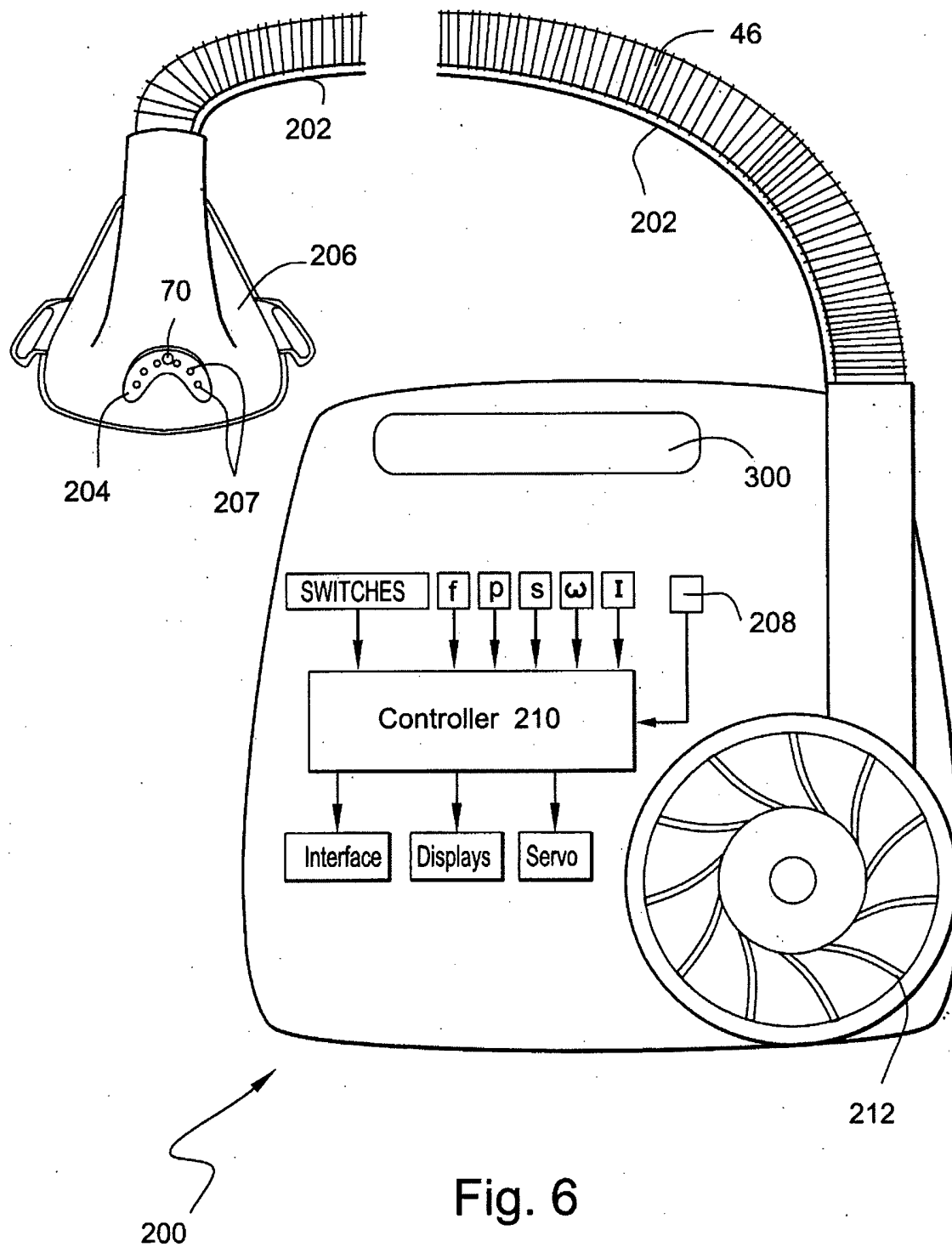


Fig. 4



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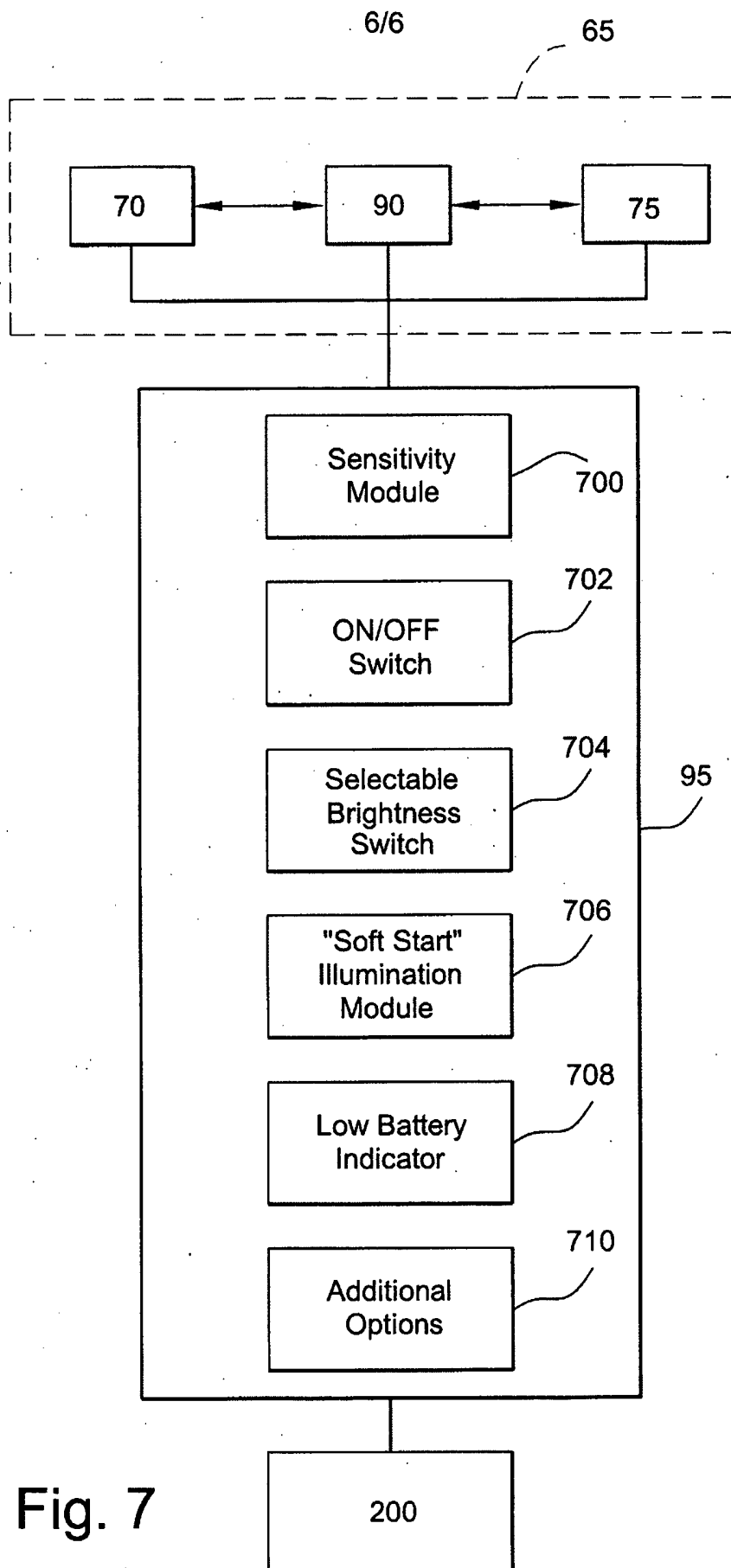


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2005/000704

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. ⁷: A61B 5/11, A61M 16/06, F21L 4/00

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)

DWPI IPC A61B, A61M, F21L, G08B +keywords: light, position, sensor, head and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,272,764 A (HERR et al) 9 June 1981 Abstract	41, 43, 44
X	US 5,923,263 A (RODRIGUEZ) 13 July 1999 Abstract	41, 43, 44
X	US 2001/0054963 A1 (CHEUNG) 27 December 2001 Abstract	41, 43, 44
X	US 5,522,092 A (STREB et al) 4 June 1996 Abstract	41, 43, 44

☒ Further documents are listed in the continuation of Box C

☒ 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	"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
"E" earlier application or patent but published on or after the international filing date	"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
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"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
6 June 2005

Date of mailing of the international search report **14 JUN 2005**

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2005/000704

C (Continuation).

DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Patent Abstracts of Japan, JP 2001155538 A (MATSUSHITA ELECTRIC WORKS LTD) 8 June 2001 Abstract	41-44
A	WO 2001/043804 A1 (COMPUMEDICS SLEEP PTY. LTD.) 21 June 2001 Abstract and page 11 lines 14 to 16	
A	US 4,802,485 A (BOWERS et al) 7 February 1989 Abstract	
A	US 2002/0165462 A1 (WESTBROOK et al) 7 November 2002 Abstract and paragraph 58	
A	US 5,081,447 A (ECHOLS) 14 January 1992 Abstract and column 2 lines 51 to 52	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2005/000704

This Annex lists the known "A" publication level 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 Cited in Search Report		Patent Family Member			
US	4272764				
US	5923263	WO	0021052		
US	2001054963				
US	5522092	CA	2132365		
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WO	0143804	AU	12932/01	CA	2394217
		EP	1237613	US	2004163648
US	4802485				
US	2002165462	AU	2002246880	EP	1353594
		US	2005027207	WO	02065901
US	5081447				
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.					
END OF ANNEX					