

**(12) STANDARD PATENT**  
**(19) AUSTRALIAN PATENT OFFICE**

(11) Application No. **AU 2007246162 B2**

(54) Title  
**A light source apparatus**

(51) International Patent Classification(s)  
**A61B 1/06** (2006.01) **A61B 17/24** (2006.01)  
**A61B 1/267** (2006.01)

(21) Application No: **2007246162** (22) Date of Filing: **2007.04.27**

(87) WIPO No: **WO07/124536**

(30) Priority Data

|                   |                   |              |
|-------------------|-------------------|--------------|
| (31) Number       | (32) Date         | (33) Country |
| <b>2006902163</b> | <b>2006.04.27</b> | <b>AU</b>    |

(43) Publication Date: **2007.11.08**

(44) Accepted Journal Date: **2014.06.05**

(71) Applicant(s)  
**COLIN DUNLOP**

(72) Inventor(s)  
**Dunlop, Colin**

(74) Agent / Attorney  
**Griffith Hack, GPO Box 4164, Sydney, NSW, 2001**

(56) Related Art  
**EP 1433413**  
**US 2004/0122292**  
**US 3532088**

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
8 November 2007 (08.11.2007)

PCT

(10) International Publication Number  
**WO 2007/124536 A1**

(51) International Patent Classification:

A61B 1/06 (2006.01) A61B 17/24 (2006.01)  
A61B 1/267 (2006.01)

(21) International Application Number:

PCT/AU2007/000539

(22) International Filing Date: 27 April 2007 (27.04.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

2006902163 27 April 2006 (27.04.2006) AU

(71) Applicant and

(72) Inventor: DUNLOP, Colin [AU/AU]; 132A Cressy Road,  
East Ryde, New South Wales 2113 (AU).

(74) Agent: GRIFFITH HACK; Level 29, Northpoint, 100  
Miller Street, North Sydney, New South Wales 2060 (AU).

(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH,  
CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES,  
FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN,  
IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR,  
LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY,  
MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS,  
RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN,  
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

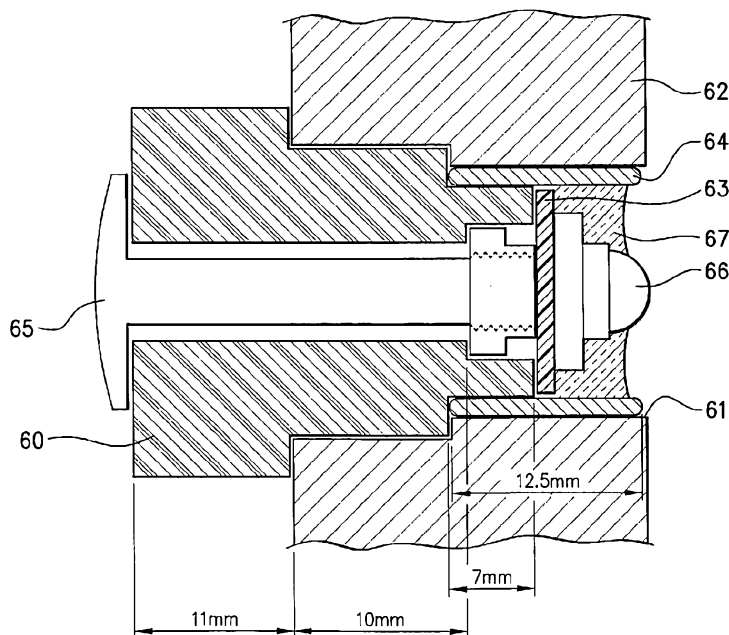
(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,  
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,  
FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL,  
PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM,  
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: A LIGHT SOURCE APPARATUS



(57) Abstract: The present invention relates to a light source apparatus for a laryngoscope. The light source apparatus is remotely operated. In an embodiment, it comprises a magnetically operated reed switch. A co-operating magnet in the laryngoscope blade actuates the reed switch when the blade is brought into proximity with the light source apparatus mounted in the laryngoscope handle.

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## A LIGHT SOURCE APPARATUS

### Field of the Invention

5 The present invention relates to a lighting apparatus and, particularly, but not exclusively, to medical applications such as a light source for a hand held laryngoscope.

### Background of the Invention

10 A laryngoscope is a device used to examine the larynx and its surrounding structures. A laryngoscope generally comprises a handle and a detachable blade. A source of illumination is positioned to direct light along the laryngoscope blade to illuminate the anatomical structures  
15 being viewed.

In use, the blade of the laryngoscope is inserted via the mouth into the pharynx and the light enables an inspection of the larynx and associated structures. Laryngoscopes are used for examining and diagnosing  
20 diseases of the mouth, pharynx and larynx including the vocal chords. Laryngoscopes are most commonly used for the purpose of inserting a tube through the glottis (intubating). During anaesthesia, a tube is passed via the mouth, through the larynx and into the trachea to  
25 maintain airway patency (endotracheal intubation) and permit administration of oxygen and inhalation anaesthetic. Laryngoscopes facilitate intubation by elevating the soft pallet, depressing the epiglottis and illuminating the larynx.

30 Laryngoscopes are used both in veterinary and human medicine. There are many different types of laryngoscope, and, particularly, many different shapes of laryngoscope blades.

A laryngoscope light source is conventionally powered  
35 by batteries usually mounted in the laryngoscope handle. Typically, the light source comprises a conventional incandescent bulb mounted about two thirds of the way down

the laryngoscope blade with wiring tracking back to a mechanical contact at the proximal end of the blade. Installing wiring and connections in handles is difficult, time consuming and therefore costly. The blade contact  
5 makes a mechanical and electrical connection to a contact in the top of the handle (handle contact) when the blade is fitted to the handle and locked in its operational position. The handle contact is electrically connected to the power supply (usually conventional or rechargeable  
10 batteries). Generally the light source is arranged to be switched on when the blade is fitted to the handle and "locked" in its operational position and the mechanical and the electrical connection is mechanically actuated.

Conventional light bulbs placed in the blade suffer  
15 problems with contact caused by moisture in use, and often fail. Conventional incandescent bulbs operate to provide a high light output on a small DC drive voltage, so demand a high current, with a high heat output. These requirements limit the life of an incandescent element,  
20 resulting in frequent bulb failure. Conventional filament bulbs being hot to touch can also burn mucosa.

An alternative light source arrangement incorporates an optical fibre bundle running along the blade but still uses a conventional incandescent filament bulb mounted in  
25 the handle. The bulb transmits light to the optical fibre bundle to illuminate the tip of the laryngoscope blade. An electrical connection is mechanically activated between the blade and handle, and switches the bulb. In this alternative, it can be difficult to obtain access to the  
30 bulb in the handle to change the bulb.

In addition, in both the blade mounted and handle mounted bulb variations, the incandescent light bulb is not sealed, the switch is not sealed and there are therefore difficulties in sterilising either the blade or  
35 the handle or otherwise exposing the handle to fluid as it can affect the light source and electrical circuit powering the light source.

Summary of the Invention

In accordance with a first aspect, the present invention provides a laryngoscope apparatus comprising:

a laryngoscope handle; and

5 a light source apparatus comprising:

a light source mounted by the laryngoscope handle;

10 an electrical circuit for providing power to the light source, the electrical circuit mounted by the laryngoscope handle;

a power source for providing power to the electrical circuit; and

15 a remotely operable switch for switching power to the light source, wherein the remotely operable switch is a magnetically activated switch configured to switch the electrical circuit from an off state in which no current flows in the laryngoscope apparatus to an on state in which current flows from the power source to the light source to power the light source, and wherein the magnetically activated switch is configured to be operated by a magnet mounted in a proximal part of a laryngoscope blade.

25 In an embodiment, the remotely operable switch is a reed switch, for example. The magnetically activated switch is operated by a magnet mounted in a proximal part of a laryngoscope blade, so that when the laryngoscope blade is connected to the handle and locked in position, 30 the magnetically activated switch is closed and power is provided to the light source.

In an embodiment the light source is a low power light emitting diode (LED) which provides cold light and has a long operational life compared to an incandescent 35 bulb.

In an embodiment, the light source may be electronically current or voltage driven for constant

spectral output and intensity.

In an embodiment the light source apparatus is arranged to co-operate with an optical fibre bundle mounted in a laryngoscope blade, so that light is  
5 transmitted from the light source to the optical fibre bundle.

In an embodiment, the light source, switch and electrical circuit are mounted together in a sealed mounting. The entire sealed mounting assembly is arranged  
10 to fit into the handle of the laryngoscope. In an embodiment, the electrical circuit includes electrical contacts arranged for connection to a power source.

In the embodiment where the light source comprises an LED, and the switch, light source and contacts are mounted  
15 in a sealed mounting, the arrangement has the advantage that the light source lasts a long time (LEDs have a relatively long lifetime) and, because the majority of parts of the arrangement are sealed, the arrangement is resistant to damage from the environment. In an  
20 embodiment, the entire assembly fits within the laryngoscope handle. The assembly can therefore be removed if it fails and replaced with a replacement assembly. Advantageously, in an embodiment, the entire sealed "assembly" can be manufactured relatively  
25 inexpensively.

The laryngoscope blade or handle or both may be disposable.

In accordance with a fourth aspect, the present invention provides a method of retrofitting an existing  
30 laryngoscope, by mounting a light source apparatus within a handle of an existing laryngoscope, whereby a laryngoscope apparatus of the first aspect of the invention is obtained.

#### 35 Brief Description of the Drawings

Features and advantages of the present invention will become apparent from the following description of

embodiments thereof, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a diagram illustrating components of a light source apparatus for a laryngoscope in accordance with an embodiment of the present invention;

Figure 2 is a diagram showing the components of Figure 1 mounted within a sealed mounting; and

Figure 3 shows a top view of a laryngoscope blade;

Figure 4 is a cross sectional view of the blade of figure 3 along the line X-X;

Figure 5 is a perspective exploded view of a laryngoscope handle and blade;

Figure 6 is a detail view of the handle and blade of figure 5;

Figure 7 is a circuit diagram of a light source apparatus for a laryngoscope in accordance with a further embodiment of the present invention; and

Figure 8 is a diagram showing components of a light source apparatus mounted within a handle of a laryngoscope in accordance with an embodiment of the present invention.

#### Detailed Description of Preferred Embodiments

Referring to the Figures, a light source apparatus in accordance with an embodiment of the present invention comprises an electrical circuit generally designated by reference numeral 1, and in this example being in the form of tracks 2 and contacts 3, 4 mounted on a printed circuit (PCB) 5. It also includes a light source 6, in this example being a light emitting diode (LED) 6. A remotely operable switch, in this example being a magnetically operable reed switch 8, is also included.

In this embodiment, a resistor 7 is included in the electrical circuit.

The PCB 5 illustrated in Figure 1 is mounted within a sealed mounting, in this embodiment being a resin potted cylinder 9 that permits passage of light from the LED. The potted polyester cylinder 9 seals the components from

the environment. Referring to Figure 2, the LED 6 is ground down (6A) so that its top surface is flush with the top surface 10 of the potted cylinder 9.

5 The potted cylinder 9 is seated within a cylindrical metal body 11 (in this embodiment the metal is brass). The body 11 includes a thread 12 and the body 11 is arranged to fit into a laryngoscope handle. The threads 12 engage with corresponding threads on the inner surface of the laryngoscope handle. A case terminal  
10 screw 13 makes contact with the electrical contact 3 and a nipple terminal screw 14 makes contact with the electrical contact 4. A nylon insulator 15 seals the base of the metal body 11.

The entire assembly fits within a laryngoscope handle  
15 and the LED 6 optically communicates with an optical fibre extending in a laryngoscope blade. The co-operating blade incorporates a magnet in its proximal end, such that when the blade is fitted to the handle, the reed switch 8 is operated and power is provided to the LED 6. Batteries  
20 seated in the lower half of the handle provide the power source.

Referring to figure 3 and 4, a laryngoscope blade 20  
is shown which includes a permanent magnet 22 housed in mounting block 23. An optical fibre bundle 24 in use  
25 guides light from LED 6 to be emitted towards the end of blade 20. The blade also includes soft palate guard 26.

Referring to figures 5 and 6, blade 20 is shown  
alongside handle 30 in a disassembled state. Handle 30 includes a rod 32 to which handle can be rotatably mounted  
30 by a snap fit of rod 32 into channel 29. When mounted to the handle 30, blade can be rotated about rod 32 to extend the blade to an operational position. This brings magnet 22 into close proximity with reed switch 8 to active the reed switch. This causes illumination of LED 6. The  
35 light from LED 6 is guided into fibre optic bundle 24.

The sealed assembly may be utilised in any laryngoscope. In one embodiment the assembly is suitable



for disposable laryngoscopes, as the assembly is relatively inexpensive.

5 In another embodiment, existing laryngoscopes may be retrofitted by adapting existing laryngoscope handles to receive the assembly and modifying blades to incorporate a magnet to activate the switch.

The assembly may also be used with laryngoscopes arranged for multiple use. The assembly may easily be replaced if the light source apparatus fails.

10 Because the assembly is sealed, it is substantially protected from the environment.

In the above embodiment, the remotely operable switch is a reed switch. Any other type of remotely operable switch may be used and the present invention is not  
15 limited to use of a reed switch.

Figure 7 shows a circuit diagram for a further embodiment of the present invention. This circuit also includes a magnetically operable reed switch 8 and an LED 6. A power source (the battery in the laryngoscope  
20 handle) is designated by reference numeral 50. A diagram of a magnet 51 is shown to illustrate operation of the reed switch 8. In the described embodiment, magnet 51 corresponds to magnet 22 in the laryngoscope blade. In this embodiment, the circuit also includes a current or  
25 voltage driver 52 for providing constant spectral output and intensity of the LED 6.

Figure 8 is a diagram of a top part of a laryngoscope handle showing one way in which a light source assembly in accordance with an embodiment of the invention may be  
30 mounted within the laryngoscope handle. A delrin insert 60 is mounted proximate an opening 61 in the brass laryngoscope head 62. A PCB 63 mounting the components of the light source apparatus is mounted within the opening 61. Brass tube 64 surrounds the opening. A  
35 bolt 65 secures the light source apparatus. The LED 66 is mounted within the opening and a clear polyester resin 67 fills the opening, allowing 1 mm approximately of LED to

be exposed. The opening 61 is therefore sealed off and the componentry within the opening is sealed from the environment.

5 Note that where dimensions are included, they are for the purposes of example only, and different embodiments of the invention may have different dimensions.

It can be seen that embodiments of the invention may have at least the following advantages:

- Longevity - LED cold light source
- 10 • Low power consumption
- Non-contact micro switch
- Durable - no moving parts
- Sealed electronics - waterproof
- Handle can be disinfected
- 15 • Cost effective - modular PCB construction

The light source apparatus of the present invention is suitable for use in devices other than laryngoscopes including hand held torches, medical auroscopes, ophthalmoscopes, vaginoscopes and transilluminators.

20 In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" is used in an inclusive sense, 25 i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made 30 to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

35

## CLAIMS:

1. A laryngoscope apparatus comprising:  
a laryngoscope handle; and  
5 a light source apparatus comprising:  
a light source mounted by the laryngoscope handle;  
an electrical circuit for providing power to the light source, the electrical circuit  
10 mounted by the laryngoscope handle;  
a power source for providing power to the electrical circuit; and  
a remotely operable switch for switching power to the light source, wherein the remotely  
15 operable switch is a magnetically activated switch configured to switch the electrical circuit from an off state in which no current flows in the laryngoscope apparatus to an on state in which current flows from the power  
20 source to the light source to power the light source, and wherein the magnetically activated switch is configured to be operated by a magnet mounted in a proximal part of a laryngoscope blade.
- 25 2. The apparatus in accordance with Claim 1, wherein the magnetically activated switch is a reed switch.
3. The apparatus of Claim 1 or Claim 2, wherein the light source is a light emitting diode (LED).
4. The apparatus of Claims 1, 2 or 3, wherein the light  
30 source apparatus is configured to co-operate with an optical fibre mounted in the laryngoscope blade, so that light is transmitted from the light source to the optical fibre.
5. The apparatus of any one of the preceding Claims,  
35 further comprising a sealed mounting which mounts the light source, the switch, and the electrical circuit together to form a sealed assembly which fits into the

laryngoscope handle.

6. The apparatus of any one of the preceding Claims,  
wherein the light source is current or voltage driven and  
configured to provide constant spectral output and  
5 intensity.

7. The apparatus of any one of the preceding Claims,  
wherein the laryngoscope blade includes a magnet  
configured to actuate the remotely operable switch, the  
magnet being mounted in the proximal part of the  
10 laryngoscope blade.

8. The apparatus of any one of the preceding Claims,  
further comprising a battery and a current or voltage  
driver in electrical communication with the electrical  
circuit.

15 9. The apparatus of any one of the preceding Claims,  
further comprising:

a laryngoscope blade configured to be movable with  
respect to the handle when attached to the handle,  
wherein there remotely operable switch is configured  
20 to switch the electrical circuit between the off  
state to the on state in response to movement of the  
blade and handle with respect to each other when the  
blade and the handle are attached to each other.

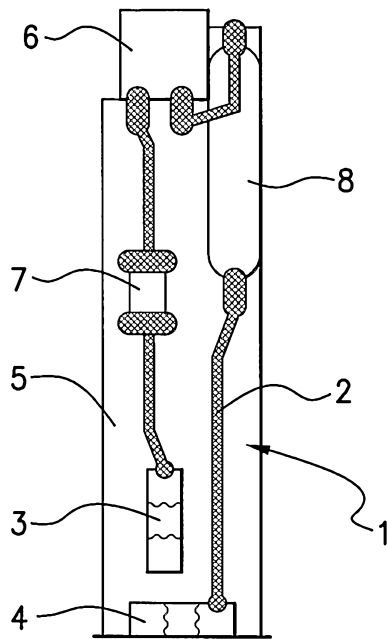
10. A method of retrofitting an existing laryngoscope,  
25 the method comprising:

mounting a light source apparatus within a handle of  
an existing laryngoscope, whereby a laryngoscope  
apparatus according to Claim 1 is obtained.

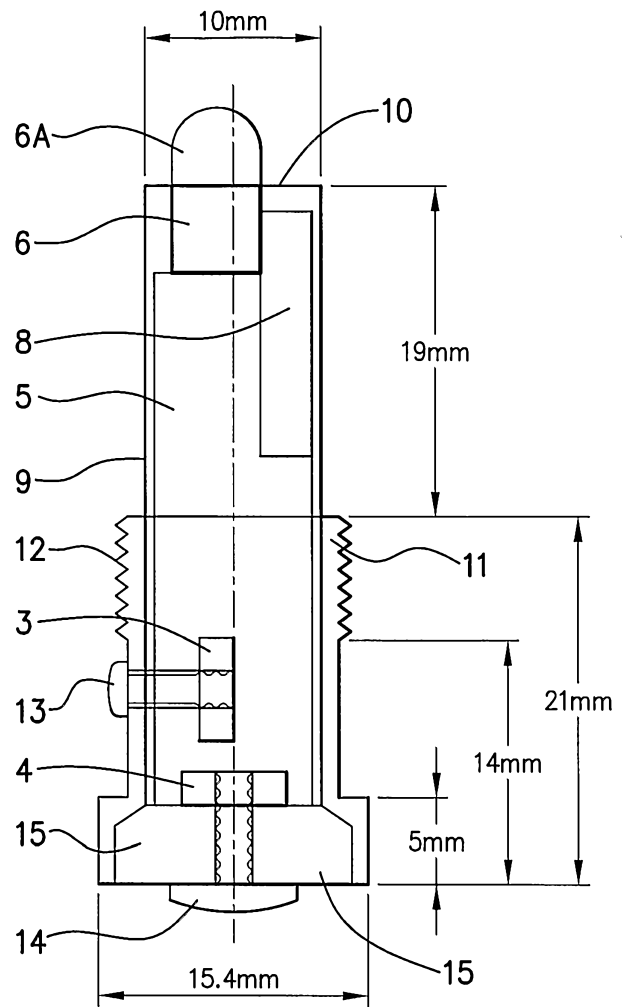
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11. A laryngoscope blade including a means for actuating a remotely operable switch of a light apparatus in accordance with any one of Claims 1 to 9.
12. A laryngoscope blade in accordance with Claim 11, the means for actuating the remotely operable switch being a magnet mounted in a proximal part of the laryngoscope blade.
13. A laryngoscope mounting a light apparatus in accordance with any one of Claims 1 to 9.
14. A laryngoscope in accordance with Claim 13, being a single use disposable laryngoscope.
15. A method of retrofitting an existing laryngoscope, by mounting a light apparatus in accordance with any one of Claims 1 to 9 within the handle of the existing laryngoscope.
16. A light apparatus for a laryngoscope, including a light source, an electrical circuit for providing power to light source, and a switch for switching power to the light source, the light source, electrical circuit and switch being mounted within a sealed mounting, forming a sealed assembly.
17. A laryngoscope including a light source, the light source being arranged to be activated by magnetic, or electromagnetic means.
18. A light source apparatus for a hand held medical apparatus, comprising a light source, an electrical circuit for providing power to the light source, and a remotely operable switch for switching power to the light source.

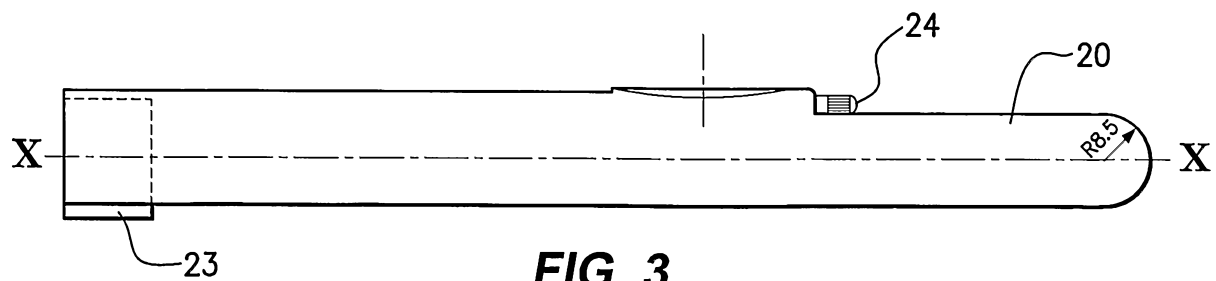
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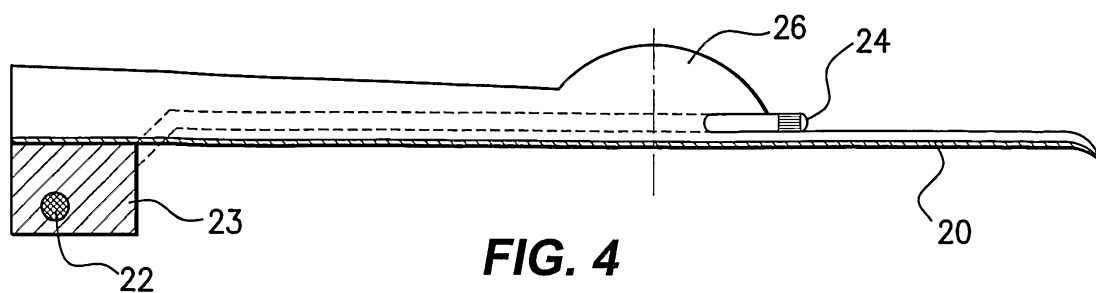
**FIG. 1**



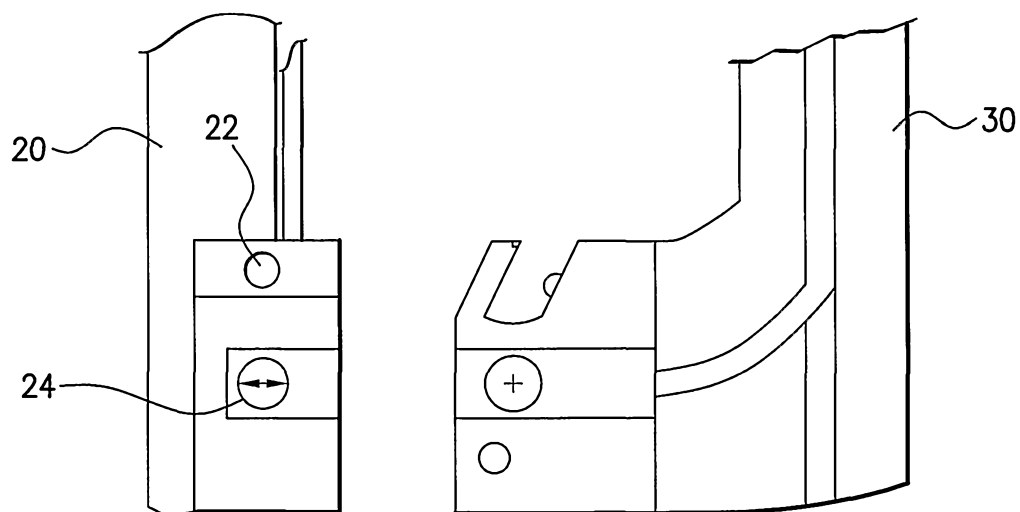
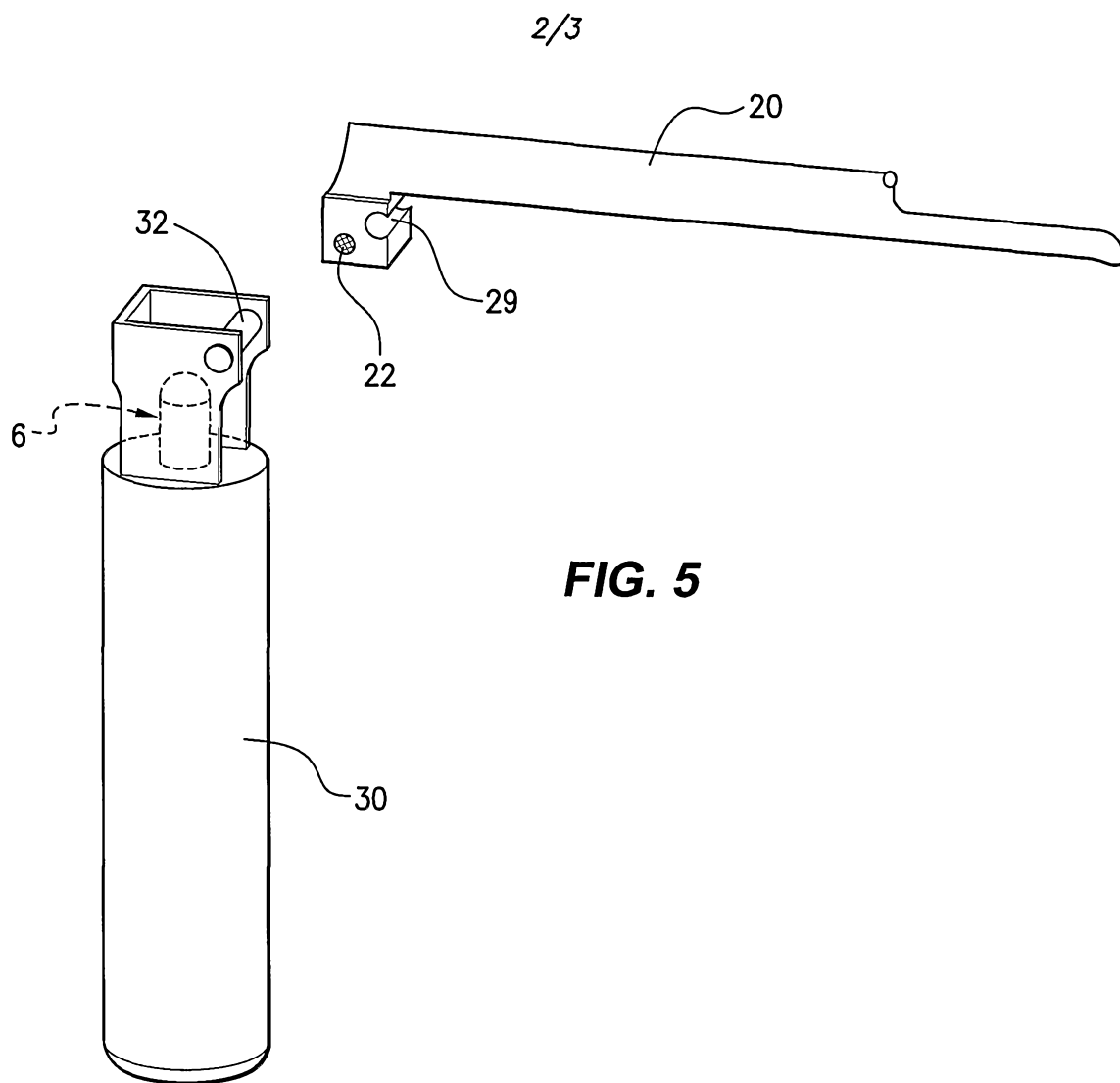
**FIG. 2**



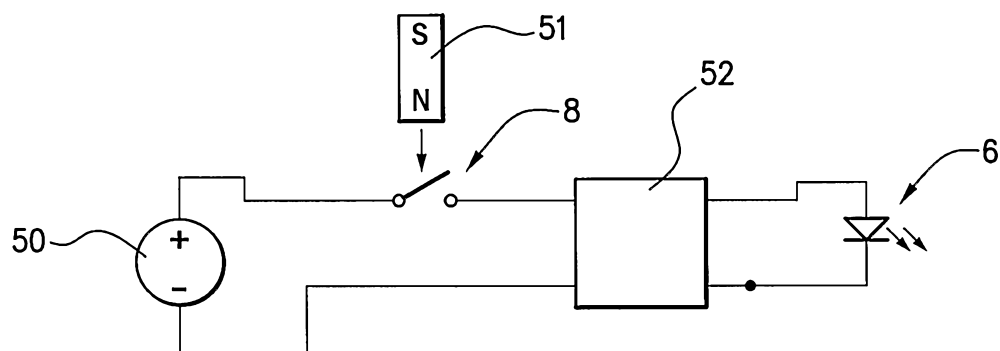
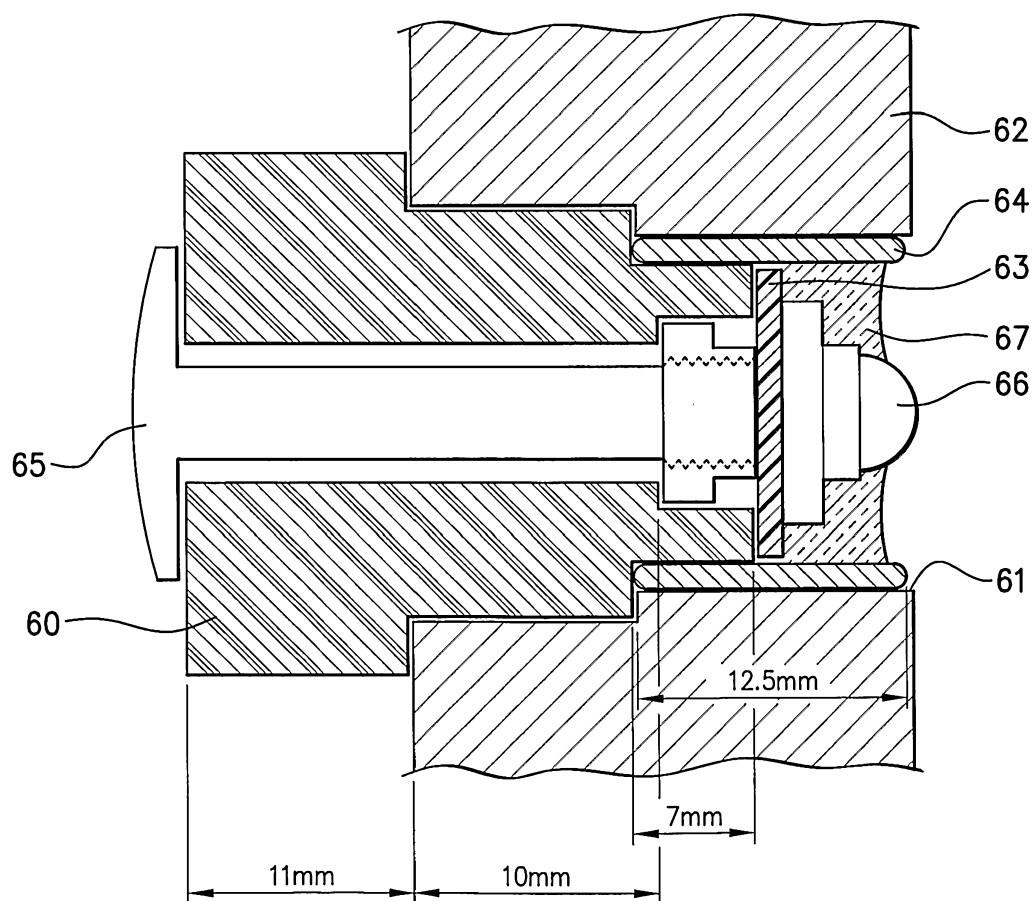
**FIG. 3**



**FIG. 4**



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**FIG. 7****FIG. 8**