Title: LARYNGOSCOPE ASSEMBLY WITH ENHANCED VIEWING CAPABILITY

Abstract: A laryngoscope assembly with enhanced viewing capability including a laryngoscope handle having a permanently mounted laryngoscope optical system. The laryngoscope optical system has a view tube with a leading aperture lens for affording a field of view along a deflected line of sight viewing in an operative intubation position. The laryngoscope handle includes a laryngoscope optical system securing arrangement for mechanically securing the laryngoscope optical system in the operative intubation position. The laryngoscope assembly also includes an interchangeable laryngoscope blade including a trailing view tube sleeve for slidably mounting on the view tube and a leading spatula wherein the view tube sleeve has a leading transparent window for covering the aperture lens. The laryngoscope assembly further includes a blade securing arrangement for mechanically securing the laryngoscope blade on the laryngoscope handle in the operative intubation position.
LARYNGOSCOPE ASSEMBLY WITH
ENHANCED VIEWING CAPABILITY

Field of the Invention

The invention relates to laryngoscope apparatus with enhanced viewing capability.

Background of the Invention

Commonly owned PCT International Patent Application No. PCT/IL2008/001093 entitled Laryngoscope Apparatus with Enhanced Viewing Capability published under PCT International Publication No. WO 2009/019703 illustrates and describes a laryngoscope assembly including a laryngoscope optical system for affording a field of view along a deflected line of sight for reducing patient manipulation and/or the degree of force required to achieve a good glottic view. The laryngoscope apparatus can be implemented as a laryngoscope blade with either an integral laryngoscope optical system or intended for use with a discrete optical view tube. Such laryngoscope blades can be either permanently mounted on a laryngoscope handle and pivotal between an inoperative storage position and an operative intubation position in a penknife-like manner or detachably mounted on a laryngoscope handle. Such laryngoscope blades preferably include an illumination arrangement for providing illumination light for assisting intubation and a defogging arrangement for defogging their forwardmost concave inclined prism surface. Laryngoscope optical systems for providing enhanced viewing capability during intubations are relatively expensive therefore militating against their use as disposable single use items.

Summary of the Invention

The present invention is directed towards laryngoscope assemblies including (a) a laryngoscope handle including i) a permanently mounted laryngoscope optical system having a view tube with a leading aperture lens for
enhanced viewing capability in an operative intubation position and ii) a laryngoscope optical system securing arrangement for mechanically securely the laryngoscope optical system in the operative intubation position, (b) an interchangeable laryngoscope blade including a trailing view tube sleeve for removable sliding mounting on the view tube and a leading spatula wherein the view tube sleeve has a leading transparent window for covering the aperture lens, and (c) a blade securing arrangement for mechanically securing the laryngoscope blade on the laryngoscope handle in the operative intubation position.

The laryngoscope blades of the present invention necessarily include a leading transparent window for covering an aperture lens. Suitable medical grade transparent materials include *inter alia* rigid plastic materials such as polycarbonate, and the like. The view tube sleeve and the leading spatula may or may not be formed from the same material as the leading transparent window. The laryngoscope blades can be designed as disposable single use items or intended for sterilization for multiple use. The present invention affords a more convenient arrangement for providing laryngoscope apparatus with enhanced viewing capabilities than the hitherto described arrangements by way of precluding the need sterilizing a view tube between intubations.

The permanently mounted laryngoscope optical systems are preferably pivotal on a laryngoscope handle in a penknife-like manner between an inoperative storage position and an operative intubation position. Alternatively, laryngoscope optical systems can be permanently mounted in a transverse position on a laryngoscope handle in an operative intubation position. Suitable laryngoscope optical systems include *inter alia* US Patent No. 5,873,818's optical arrangement, aforesaid WO 2009/019703's laryngoscope optical system, and the like. The laryngoscope assemblies preferably include a defogging arrangement for defogging a leading transparent window covering an aperture lens.

The laryngoscope assemblies preferably include an illumination arrangement for providing illumination at its operative intubation position.
One illumination arrangement includes *inter alia* a laryngoscope handle having a power supply and a view tube having an illumination source towards its leading aperture lens. Another illumination arrangement includes *inter alia* a laryngoscope handle having both a power pack and an illumination source and a view tube having a light transmission arrangement for conveying light from the illumination source to its leading aperture lens. Alternatively, a laryngoscope blade can be employed instead of a view tube for illumination purposes.

**10 Brief Description of Drawings**

In order to understand the invention and to see how it can be carried out in practice, a preferred embodiment will now be described, by way of a non-limiting example only, with reference to the accompanying drawings in which similar parts are likewise numbered, and in which:

- Fig. 1 is a perspective view of a dissembled laryngoscope assembly including a laryngoscope handle with a permanently mounted laryngoscope optical system and an interchangeable laryngoscope blade;
- Fig. 2 is an exploded view of Figure 1’s laryngoscope assembly;
- Fig. 3 is a perspective view showing the laryngoscope handle and its laryngoscope optical system in a blade mounting position and the sliding mounting of the laryngoscope blade on the laryngoscope handle;
- Fig. 4 is a perspective view showing the laryngoscope blade mounted on the laryngoscope handle in Figure 3’s blade mounting position;
- Fig. 5 is a perspective view showing the laryngoscope blade mounted on the laryngoscope handle in a blade securing position; and
- Fig. 6 is a perspective view showing the laryngoscope blade mounted on the laryngoscope handle in an operative intubation position.

**Detailed Description of a Preferred Embodiment of the Invention**

Figure 1 shows a laryngoscope assembly 10 including a laryngoscope handle 11 having a longitudinal axis 12 and a permanently mounted
laryngoscope optical system 13, and an interchangeable laryngoscope blade 14. The laryngoscope optical system 13 is pivotal between an inoperative storage position shown in solid lines and an operative intubation position shown in dashed lines. The laryngoscope optical system 13 includes an eyepiece 16 having an eye lens 17 and a view tube 18 with a leading forwardly inclined aperture lens 19 for affording a field of view along a deflected line of sight viewing in an operative intubation position with the view tube 18 transversely directed to the longitudinal axis 12. The laryngoscope blade 14 includes a trailing view tube sleeve 21 and a leading spatula 22 having a spatula tip 22A. The laryngoscope handle 11 includes a laryngoscope optical system securing arrangement 23 for mechanically securing the laryngoscope optical system 13 in the operative intubation position. Suitable laryngoscope optical system securing arrangements 23 include *inter alia* spring mounted ball bearing arrangements, for example, as illustrated and described in commonly owned WO 03/043484 Figure 3.

The laryngoscope assembly 10 includes a blade securing arrangement 24 for mechanically securing the laryngoscope blade 14 on the laryngoscope handle 11 in the operative intubation position. The laryngoscope assembly 10 includes a defogging arrangement 26 including an external oxygen supply 26A for providing a clear view through the laryngoscope optical system 13 in the operative intubation position. The laryngoscope assembly 10 includes an illumination arrangement 27 for providing illumination in the operative intubation position. The laryngoscope handle 11 includes a power supply 27A and the view tube 18 includes an illumination source 27B adjacent its leading aperture lens 19. The illumination source 27B is in electrical connection with the power supply 27A in the operative intubation position.

Figure 2 shows the laryngoscope handle 11 includes a handle 28 with a head 29 including a base 31 and opposite and parallel upright left and right walls 32A and 32B. The side walls 32 include a leading pair of opposite circular apertures 33. The apertures 33 are fitted with a pair permanent immovable supports 34 each having a rounded peripheral surface 36 and an
inner flat support surface 37 subtending an included 30° angle with respect to the longitudinal axis 12.

The laryngoscope handle 11 includes a laryngoscope optical system support 41 including a base portion 42 for pivotal mounting on the supports 34 and an upper tubular portion 43 having an oxygen port 43A for snap fit sealed connection to the oxygen supply 26A. The support 41 has a trailing side 44 and a leading side 46. The eyepiece 16 is sealingly mounted on the trailing side 44. The view tube 18 is mounted in the leading side 46. The base portion 42 has a pair of opposite and parallel left and right side surfaces 47 each formed with a trailing rounded surface 48 for reciprocal movement along the rounded peripheral surfaces 36 and a track 49 extending lengthwise from the trailing side 44 to the leading side 46. The tracks 49 each have a closed track end 51 at the trailing side 44. The flat support surfaces 37 and the tracks 49 form a pair of grooves in a blade insertion position of the laryngoscope optical system 13 relative to the laryngoscope handle 11 for enabling sliding insertion of the laryngoscope blade 14 on the view tube 18.

A washer 52 is interposed between the tubular portion 43 and the view tube 18. The washer 52 has an internal surface 53 formed with a series of longitudinal directed channels 54 for enabling a flow of defogging oxygen from the oxygen port 43A along the tubular separation between the view tube 18 and the view tube sleeve 21. The washer 52 is provided with an O ring 56 for ensuring sealing between the upper tubular portion 43 and the view tube sleeve 21.

The view tube sleeve 21 includes a pair of left and right rearward directed legs 57 each with an outward directed protrusion 58. The blade securing arrangement 24 for mechanically securing the laryngoscope blade 14 on the laryngoscope handle 12 are constituted by the supports 34, the base portion 42 and the legs 57 as follows: The legs 57 are intended to be slidingly inserted into the pair of grooves formed between the supports 34 and the base portion 42 in the laryngoscope optical system 13's blade insertion position. Upward movement of the laryngoscope optical system 13 relative to the
laryngoscope handle 11 to an intermediate blade securing position between the blade insertion position and the operative intubation position lifts the legs 57 from the support surfaces 37 and locks the protrusions 58 behind the supports 34 thereby preventing sliding removal of the laryngoscope blade 14 from the laryngoscope handle 11.

The laryngoscope blade 14 is made from medical grade transparent rigid plastic material, for example, polycarbonate, and includes a transparent window 59 for covering the leading forwardly inclined aperture lens 19. The laryngoscope blade 14 is formed with an aperture 61 above the window 59 for providing a defogging oxygen flow for defogging the window 59.

Figure 3 to 6 show the use of the laryngoscope assembly 10 as follows:

A user disposes the laryngoscope optical system 13 to the blade mounting position for enabling the complete sliding mounting of the laryngoscope blade 14 onto the view tube 18. The user slides the laryngoscope blade 14 onto the view tube 18 as denoted by arrow A until the outward directed protrusions 58 abut against the closed track ends 51 and the view tube sleeve 21’s trailing end passes over the O ring 56 (see Figure 4).

The user disposes the laryngoscope optical system 13 as denoted by arrow B in Figure 4 to the blade securing position in which the outward directed protrusions 58 are locked behind the supports 34 thereby preventing removable of the laryngoscope blade 14 from the laryngoscope handle 11 (see Figure 5). The O ring 56 seals the view tube sleeve 21’s trailing end such that the user can attach the oxygen supply 26A to the oxygen port 43A for providing a defogging oxygen flow through the aperture 61 for defogging the window 59.

The user disposes the laryngoscope optical system 13 as denoted by arrow C in Figure 5 to the operative intubation position in which the blade securing arrangement 24 mechanically secures the laryngoscope blade 14 on the laryngoscope handle 11 (see Figure 6). The illumination arrangement 27 is
energized in the operative intubation system for providing illumination at a patient's laryngeal region.

While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications, and other applications of the invention can be made within the scope of the appended claims.
CLAIMS:

1. A laryngoscope assembly with enhanced viewing capability comprising:
   (a) a laryngoscope handle having a longitudinal axis and including
   i) a permanently mounted laryngoscope optical system having a view tube with a leading aperture lens for affording a field of view along a deflected line of sight viewing in an operative intubation position with said view tube transversely directed to said longitudinal axis, and
   ii) a laryngoscope optical system securing arrangement for mechanically securing said laryngoscope optical system in said operative intubation position;
   (b) an interchangeable laryngoscope blade including a trailing view tube sleeve for slidably mounting on said view tube and a leading spatula wherein said view tube sleeve has a leading transparent window for covering said aperture lens; and
   (c) a blade securing arrangement for mechanically securing said laryngoscope blade on said laryngoscope handle in said operative intubation position.

2. The assembly according to claim 1 wherein said interchangeable laryngoscope blade including said leading transparent window is formed from transparent rigid plastic material.

3. The assembly according to either claim 1 or 2 wherein said laryngoscope optical system is pivotal between a blade mounting position in which said laryngoscope blade is slidingly mounted on said view tube and said operative intubation position in which said blade securing arrangement mechanically secures said laryngoscope blade on said laryngoscope handle.

4. The assembly according to any one of claims 1 to 3 wherein said laryngoscope blade is sealingly mounted on said laryngoscope handle in said
operative intubation position and includes an aperture for providing a defogging flow for defogging said leading transparent window.

5. A laryngoscope handle for use in a laryngoscope assembly according to any one of claims 1 to 4.

6. A laryngoscope blade for use in a laryngoscope assembly according to any one of claims 1 to 4.
INTERNATIONAL SEARCH REPORT

International application No. PCT/IL 12/00151

A. CLASSIFICATION OF SUBJECT MATTER

| IPC(8) - A61 B 1/267 (2012.01) | USPC - 600/185 |

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)

| IPC(8) - A61 B 1/267 (2012.01) | USPC - 600/185 |

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

| IPC(8) - A61 B 1/267 (2012.01) | USPC - 600/185-200 |

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PubWEST (PGPB, USPT, EPAB, JPAB); Google (Patents, Scholar, Web)

Search Terms: Laryngoscope, view, optic, video, camera, lens, distal, leading, aperture, prism, deflect, bent, bend, adjust, line, sight, tube, lumen, channel, passage, secure, attach, couple, handle, grip, blade, sleeve, sheath, window, plastic, pivot, swivel, rotate.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>US 2007/0167686 A1 (MCGRATH) 19 July 2007 (19.07.2007) Abstract; Fig. 1-2; Para [0038]-[0040], [0045]</td>
<td>1-3</td>
</tr>
<tr>
<td>Y</td>
<td>US 5,873,818 A (ROTHFELS) 23 February 1999 (23.02.1999) Abstract; Fig. 1-6; col 2, ln 18-31 , col 2 , ln 41-64</td>
<td>1-3</td>
</tr>
<tr>
<td>Y</td>
<td>US 4,958,624 A (STONE et al.) 25 September 1990 (25.09.1990) Fig. 1-3, 7; col 2, ln 32 to col 3, ln 20</td>
<td>3</td>
</tr>
<tr>
<td>A</td>
<td>US 2010/0261967 A1 (PACEY et al.) 14 October 2010 (14.10.2010) Abstract; Fig. 1-20B; Para [0043]-[0065]</td>
<td>1-3</td>
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<tr>
<td>A</td>
<td>US 2001/0014768 A1 (KAPLAN et al.) 16 August 2001 (16.08.2001 ) Abstract; Fig. 1-8; Para [0030], [0032]-[0034], [0040]-[0044], [0051]</td>
<td>1-3</td>
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Further documents are listed in the continuation of Box C.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed
  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  "&" document member of the same patent family

Date of the actual completion of the international search: 31 July 2012 (31.07.2012)

Date of mailing of the international search report: 17 AUG 2012

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Form PCT/ISA/2 10 (second sheet) (July 2009)
This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [ ] Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. [ ] Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [X] Claims Nos.: 4-6 because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

This International Searching Authority found multiple inventions in this international application, as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

[ ] The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

[ ] No protest accompanied the payment of additional search fees.