

1 LARYNGOSCOPE

2
3 Field of the invention

4
5 The present invention relates to the field of laryngoscopes having insertion sections
6 which include tube guides.

7
8 Background to the invention

9
10 Laryngoscopes are in common use for the insertion of endotracheal tubes into the
11 tracheas of patients during medical procedures. Laryngoscopes comprise a handle
12 which remains outside the patient's oral cavity, for manoeuvring the laryngoscope
13 during a procedure, and an insertion section which is extended into a patient's oral
14 cavity, towards the larynx, in use. A light source and imaging apparatus, such as a
15 series of mirrors and/or prisms, or a video camera, are provided towards the distal
16 end of the insertion section to enable the patient's trachea to be viewed by a user
17 during the intubation procedure. The insertion section may be an integral part of the
18 laryngoscope or detachably retainable on a laryngoscope body portion which
19 comprises the handle. A laryngoscope or detachably retainable insertion section may
20 be reusable or disposable. Reusable video camera apparatus may be used with a
21 reusable or disposable laryngoscope body portion and a reusable or disposable
22 insertion section. A laryngoscope, including video camera apparatus, may be entirely
23 disposable.

1 Within this specification and the appended claims, the inferior surface is the surface
2 of an insertion section which faces the patient's tongue in use. The opposite surface
3 is referred to as the superior surface. Words such as inferior, inferiorly, superior and
4 superiorly are used in corresponding senses. The words distal and distally refer to
5 being towards the end of the insertion section which extends towards a patient's
6 trachea in use and the words proximal and proximally refer to being towards the
7 person carrying out intubation in use.

8
9 In order to carry out intubation by traditional methods, using a traditional
10 laryngoscope, such as a Macintosh laryngoscope, an intubater holds the
11 laryngoscope in one hand and a sterile endotracheal tube in the other hand.
12 Endotracheal tubes typically include a gentle curve and the tube is orientated to curve
13 in the same sense as the patient's airway. The laryngoscope is then inserted into a
14 patient. Once sight of the larynx has been achieved, the endotracheal tube is
15 inserted using the other hand, along the curved arc of the tube. This two step
16 procedure, requiring insertion of the laryngoscope and then an endotracheal tube,
17 has been used successfully for many years, but it would be preferable to reduce the
18 manual complexity of the task to facilitate rapid intubation.

19
20 It has been proposed to provide laryngoscopes which include a tube guide which can
21 detachably retain and guide an endotracheal tube whilst the insertion section is
22 introduced into a patient's airway. For example, WO 04/073510 (Gandarias)
23 discloses a laryngoscope insertion section having a tube guide which extends
24 laterally from an elongate member which contains apparatus to provide an image of a
25 patient's larynx in use. Once the laryngoscope is in place and a clear view of the
26 larynx has been obtained, an endotracheal tube within the guide is advanced into a
27 patient's larynx whilst the larynx and advancing tube are monitored visually. The
28 endotracheal tube can then be detached from the insertion section whilst the insertion
29 section remains within a patient and the insertion section can be removed, leaving
30 the endotracheal tube in place.

31
32 An advantage of providing a tube guide which can retain and guide an endotracheal
33 tube is that the endotracheal tube is introduced into the airway at the same time as
34 the laryngoscope, potentially speeding up intubation. Conceivably, a nurse or other
35 member of support staff could insert the endotracheal tube into the tube guide and
36 hand the laryngoscope with retained tube guide to the intubater, or leave it where the
37 intubater can readily pick it up, speeding up intubation. However, with the

1 laryngoscope disclosed in WO 04/073510, the proximal end of an endotracheal tube
2 (i.e. the end which will remain outside a patient's airway in use) is not controlled,
3 increasing the overall volume occupied by the laryngoscope and retained
4 endotracheal tube and presenting a cumbersome appearance.

5
6 A further disadvantage of the laryngoscope disclosed in WO 04/073510 is that the
7 proximal end of a retained endotracheal tube, which is not retained within the tube
8 guide, is displaced laterally by the handle, bending the endotracheal tube laterally
9 and increasing the difficulty of inserting the endotracheal tube.

10
11 As the endotracheal tube is retained in a deep groove throughout the tube guide, so
12 that the endotracheal tube is not exposed on the surface of the tube guide, it can only
13 be manipulated by grabbing the proximal end and pushing the tube. Thus, only a
14 limited amount of control is possible. This problem is compounded in the
15 laryngoscope disclosed in US 6,655,377 (Saturn Biomedical), which has a handle
16 that engages with a received endotracheal tube by including a straight through-bore
17 through which a retained endotracheal tube extends in use. The endotracheal tube
18 within the handle is not exposed on the surface of the handle and an intubater must
19 reach quite far back, proximally of the handle, to manipulate a retained endotracheal
20 tube.

21
22 Furthermore, known laryngoscopes with tube guides retain an endotracheal tube in a
23 generally J-shaped configuration. This has two significant disadvantages. Firstly, the
24 insertion of a J-shaped insertion section into a patient's oral cavity is reasonably
25 difficult. A J-shaped insertion section normally must be tilted backwards and
26 forwards during insertion to insert the distal end, manipulate the patient's anatomy
27 and obtain a good view of the patient's larynx. It is preferable to provide a
28 laryngoscope which can be more readily inserted. Secondly, this arrangement
29 means that, when the endotracheal tube is pushed forward to advance the tube, a
30 force is developed on the superior side of the tube guide where the endotracheal tube
31 bends from being substantially straight to curved, which increases friction.

32
33 A still further disadvantage of known laryngoscopes with J-shaped insertion sections
34 is that the method of inserting the laryngoscope and advancing the endotracheal tube
35 is quite different to the traditional methods employed by intubaters using generally
36 curved insertion sections that do not require multiple positioning manoeuvres which
37 leave the intubater's other hand free to manoeuvre the endotracheal tube. It would

1 be preferable to provide a laryngoscope including a tube guide which enabled
2 intubaters to transfer the skills they have learned when using traditional
3 laryngoscopes, such as Macintosh laryngoscopes, such as the hand motion required
4 to move a curved tube along the curved path of a tube.

5
6 Accordingly, the invention aims to provide an improved laryngoscope which reduces
7 or avoids one or more of the abovementioned disadvantages of known
8 laryngoscopes.

9
10 Summary of the invention

11
12 According to a first aspect of the present invention there is provided a laryngoscope
13 comprising a handle and an insertion section which extends from the handle, wherein
14 the insertion section comprises a tube guide for retaining and guiding an
15 endotracheal tube during intubation, wherein the handle comprises at least one
16 external tube engaging formation.

17
18 As the handle comprises at least one external tube engaging formation, rather than a
19 through-bore or a narrow, deep channel retaining an endotracheal tube within the
20 body of the handle, the laryngoscope is easier to use than a laryngoscope having a
21 through-bore or a narrow, deep channel retaining an endotracheal tube within the
22 body of the handle.

23
24 By an endotracheal tube, we refer to an endotracheal tube suitable for use with the
25 laryngoscope. An endotracheal tube suitable for use with the laryngoscope will have
26 an external diameter which depends on the patients which the laryngoscope has
27 been adapted to intubate. The range of external diameters of endotracheal tubes that
28 are suitable for use with the laryngoscope is referred to herein as the operating range
29 of endotracheal tube external diameters.

30
31 For example, a laryngoscope for use with adult humans may, for example, be
32 adapted for use with endotracheal tubes having a minimum external diameter of
33 around 5.5mm. It may be possible to fit a smaller external diameter endotracheal
34 tube, for example a 1mm external diameter endotracheal tube intended for use with
35 newborn infants, into the tube guide, however such a tube would not be suitable for
36 use with a laryngoscope for use with adult humans and so does not have an external
37 diameter within the operating range of endotracheal tube external diameters. A

1 laryngoscope for use with adult humans may, for example, be adapted for use with
2 endotracheal tubes having a maximum external diameter of around 12.3mm.
3 Endotracheal tubes which have an external diameter in excess of the upper end of
4 external diameter in the operating range of endotracheal tube external diameters may
5 not fit into the tube guide, not be usable without substantial friction or have
6 dimensions which are inappropriate to patients having the dimensions for which the
7 laryngoscope was designed.

8
9 In the case of a laryngoscope for inserting endotracheal tubes into infant humans,
10 including new born infants, the operating range of external tube diameters may, for
11 example, be from around 1.0 to around 5.0mm. The dimensions of a laryngoscope
12 for use with infant humans, including new born infants, are typically scaled
13 proportionately from the dimensions of an insertion section for use with human adults.
14 Nevertheless, the proportions of some features, such as the thickness of the tube
15 guiding members or the dimensions of the handle may not scale proportionately.

16
17 At least one external tube engaging formation may be a tube retaining member
18 arranged to detachably retain on the handle an endotracheal tube which is received
19 by the tube guide. By "retain on the handle" we mean that at least a surface of a
20 retained endotracheal tube is on the surface of the handle. An endotracheal tube
21 recessed entirely within a groove which is deeper than the diameter of the
22 endotracheal tube and not substantially broader than the diameter of the
23 endotracheal tube is not on the handle. The tube retaining member may be suitable
24 for detachably retaining endotracheal tubes with external diameters at the upper end
25 of (and preferably also the middle, or most preferably also the lower end of) the
26 operating range of endotracheal tube external diameters on the surface of the handle.

27
28 At least one external tube engaging formation may be a tube guiding member
29 arranged to guide along the handle an endotracheal tube which is received within the
30 tube guide. By "guide along the handle" we mean that at least a surface of a retained
31 endotracheal tube extends along and is guided along at least a length of the surface
32 of the handle. An endotracheal tube recessed entirely within a groove which is
33 deeper than the diameter of the endotracheal tube and not substantially broader than
34 the diameter of the endotracheal tube does not extend along the handle. The tube
35 guiding member may be suitable for guiding endotracheal tubes with external
36 diameters at the upper end of (and preferably also the middle, or most preferably also

1 the lower end of) the operating range of endotracheal tube external diameters along
2 the surface of the handle.

3
4 By "the tube guide" we refer to the tube guide which is part of the insertion section,
5 which functions to retain and guide an endotracheal tube, and not any tube guiding
6 member which is part of the handle.

7
8 Both at least one tube guiding member and at least one tube retaining member may
9 be provided. At least one external tube engaging formation may function as both a
10 tube guiding member and a tube retaining member.

11
12 Preferably, the at least one tube engaging formation is arranged such that a retained
13 and/or guided endotracheal tube (for example, an endotracheal tube with an external
14 diameter at the upper end of, and preferably also at the middle of, and most
15 preferably also at the lower end of, the operating range of endotracheal tube external
16 diameters), may be contacted by, and preferably at least slightly pinched by, a user
17 where the endotracheal tube is retained on and/or guided along the handle.

18
19 Preferably also, the at least one tube engaging formation is arranged such that a
20 retained and/or guided endotracheal tube (for example, an endotracheal tube with an
21 external diameter at the upper end of, and preferably also at the middle of, and most
22 preferably also at the lower end of, the operating range of endotracheal tube external
23 diameters) may be contacted by, and preferably at least slightly pinched by, a user
24 where the endotracheal tube is retained on and/or guided along the handle, whilst the
25 user grips the handle.

26
27 The ability to physically contact the endotracheal tube where the retained
28 endotracheal tube is retained on and/or guided along the handle, improves the
29 manual control of the tube available to the intubater. By "pinch" we refer to the
30 possibility of at least slightly distorting the endotracheal tube by pressing it with a
31 finger or the palm of the hand, thereby facilitating better control of the endotracheal
32 tube.

33
34 Preferably, the insertion section is arranged so that an intubater can contact an
35 endotracheal tube retained by the tube guide within a patient's mouth, in use. This
36 increases the amount of control which is available to the intubater and may be
37 preferred by intubaters who have been trained to carry out intubation using traditional

laryngoscopes, who are used to being able to manipulate the endotracheal tube within the patient's mouth. The insertion section may comprise a proximal superior tube guiding member having a tube guiding surface arranged to contact and thereby guide the superior surface of an endotracheal tube retained in the tube guide and the insertion section may be arranged so that an intubater can contact an endotracheal tube retained within the tube guide within a patient's mouth, in use, distally of the tube guiding surface of the proximal superior tube guiding member. The insertion section may be arranged to that an intubater can contact one or more of the inferior or superior surfaces of an endotracheal tube retained within the tube guide within a patient's mouth, in use (e.g. distally of the distally of the tube guiding surface of the proximal superior tube guiding member, where present). The insertion section may be arranged to that an intubater can contact a lateral surface of an endotracheal tube retained within the tube guide within a patient's mouth, in use (e.g. distally of the distally of the tube guiding surface of the proximal superior tube guiding member, where present). The insertion section may be arranged so that an intubater can contact opposite inferior and superior surfaces of the endotracheal tube within a patient's mouth, in use, (e.g. distally of the distally of the tube guiding surface of the proximal superior tube guiding member, where present), to facilitate grip and enable them to gently pinch the tube.

At least one tube guiding member may comprise a groove on the external surface of the handle of the laryngoscope. By a groove we refer to either an elongate open recess or an elongate open channel between elongate raised surfaces. Where the groove is in the form of an elongate recess, the cross-section of the laryngoscope handle may be reduced or, where the shape of the laryngoscope handle is dictated by ergonomic considerations, the outer surface handle may more closely conform to a shape which is selected for ergonomic reasons.

At least one tube guiding member may comprise an elongate guide wall on the external surface of the handle of the laryngoscope, for contacting and thereby guiding an endotracheal tube in use. An elongate guide wall is typically generally parallel to the length of the handle. An elongate recess may be provided adjacent the elongate guide wall, so that the recess and guide wall together guide an endotracheal tube.

Preferably, the at least one tube engaging member is configured so that a retained endotracheal tube (for example, an endotracheal tube with an external diameter at the upper end of, and preferably also at the middle of, and most preferably also at the

1 lower end of, the operating range of endotracheal tube external diameters) remains at
2 least partially exposed along at least the majority of and preferably all of the length of
3 the handle.

4
5 Preferably, the at least one tube engaging member is configured so that either the
6 most inferior or most superior point on the surface of a retained endotracheal tube
7 (for example, an endotracheal tube with an external diameter at the upper end of, and
8 preferably also at the middle of, and most preferably also at the lower end of, the
9 operating range of endotracheal tube external diameters) remains exposed along at
10 least the majority of, and preferably all of, the length of the handle.

11
12 Where the tube guiding member comprises a groove, the groove is configured so that
13 an endotracheal tube (for example, an endotracheal tube with an external diameter at
14 the upper end of, and preferably also at the middle of, and most preferably also at the
15 lower end of, the operating range of endotracheal tube external diameters) guided in
16 the groove extends at least partially, and preferably predominantly, out of the groove
17 along the length of the groove. The depth of the groove may vary along the length of
18 the groove. For example, the groove may have relatively shallow ends with a
19 relatively deep section therebetween. Where the groove is an elongate recess in the
20 surface of the handle, a guided endotracheal tube will therefore extend at least
21 partially, and preferably predominantly, out from the surrounding surface of the
22 handle. The groove may have a rounded profile.

23
24 In the case of a laryngoscope for the intubation of adult humans, the depth of the
25 groove, at its deepest point, is preferably less than 6mm and more preferably less
26 than 4mm. In an endotracheal tube for the intubation of human infants, including
27 newborn infants, the depth of the groove, at its deepest point, is preferably less than
28 1mm.

29
30 Where the tube guiding member comprises an elongate guide wall, the guide wall
31 typically has a height equal to at least half of the lower end of the operating range of
32 endotracheal tube external diameters. The guide wall may, however, have a height
33 which is greater than the upper end of the operating range of endotracheal tube
34 external diameters.

35
36 Where at least one tube retaining member is provided, the at least one tube retaining
37 member is preferably arranged to detachably retain (and, where the tube retaining

1 member also functions as a tube guiding member, to guide) an endotracheal tube
2 which is received within the tube guide. Thus, a nurse or other member of support
3 staff may fit an endotracheal tube into the tube guide and retain it on the handle using
4 the at least one tube retaining member. They might then pass the laryngoscope and
5 retained endotracheal tube to an intubater, or leave it where the intubater can pick up
6 the laryngoscope and retained endotracheal tube. Preferably, the endotracheal tube
7 can be detached from the at least one tube retaining member without the
8 endotracheal tube being advanced or withdrawn within the tube guide.

9
10 Preferably, a retained endotracheal tube can be detached from the at least one tube
11 retaining member without removing the retained endotracheal tube from the tube
12 guide, such that the retained endotracheal tube is fully exposed proximally of the
13 most proximal part of the insertion section which contacts the retained endotracheal
14 tube.

15
16 The at least one tube retaining member is preferably arranged to detachably retain
17 (and, where the tube retaining member also functions as a tube guiding member, to
18 guide) an endotracheal tube which is received with the tube guide, the at least one
19 tube retaining member is preferably adapted so that a detachably retained
20 endotracheal tube can be detached from the laryngoscope in situ, within a patient,
21 before the laryngoscope is removed. Preferably, a retained endotracheal tube can be
22 detached by displacing the retained endotracheal tube generally laterally relative to
23 the laryngoscope.

24
25 The at least one tube retaining member may comprise a tube retaining surface, such
26 as a tube retaining surface of a tube retaining protrusion or, where the handle is bent,
27 a portion of the handle. The at least one tube retaining surface (e.g. a tube retaining
28 surface of a tube retaining protrusion) may be located on the handle at a location
29 such that an endotracheal tube brought into tube retaining contact with at least one
30 tube retaining surface is retained by virtue of flexural tension in the endotracheal
31 tube. Endotracheal tubes are typically inherently curved. Accordingly, the at least
32 one tube retaining surface is typically located such that a tube received within the
33 tube guide of the insertion section has to be curved by more than its integral
34 curvature to be brought into tube retaining contact with the at least one tube retaining
35 surface.

1 By retaining an endotracheal tube in flexural tension proximally of the insertion
2 section tube guide, retention of the endotracheal tube is facilitated. This is especially
3 relevant where the endotracheal tube can be detached from the laryngoscope in a
4 generally lateral direction.

5
6 The at least one tube retaining surface may be arranged to detachably retain an
7 endotracheal tube without guiding the endotracheal tube. For example, the at least
8 one tube retaining surface may be smooth, such as a smooth surface of a protrusion
9 which extends from the handle. Alternatively, the at least one tube retaining surface
10 may define a tube guiding formation, such as a groove, for example, a recess. For
11 example, the at least one tube retaining surface may be a generally smooth surface,
12 such as a smooth surface of a protrusion which extends from the handle, including a
13 recess which functions to guide a retained endotracheal tube.

14
15 By providing a handle with least one tube retaining member, an endotracheal tube is
16 retained proximally of the insertion section. This improves control of the retained
17 endotracheal tube in comparison with a laryngoscope which does not retain an
18 endotracheal tube proximally of the insertion section. It can also reduce the overall
19 bulk of the laryngoscope and retained endotracheal tube and provide a less
20 cumbersome appearance.

21
22 Typically, the tube retaining member comprises at least one tube retaining protrusion
23 which protrudes from the handle. More preferably, the at least one tube retaining
24 protrusion protrude laterally from the handle.

25
26 The at least one tube retaining protrusion may comprise a video screen support for
27 displaying images received from a video camera, which is located within or attached
28 to the insertion section, which video screen support protrudes from the handle.
29 Accordingly, the laryngoscope handle may comprise a video screen support which
30 protrudes from the handle and functions as a tube retaining protrusion. The video
31 screen support may comprise a tube retaining surface which comprises a groove for
32 guiding a retained endotracheal tube.

33
34 The at least one tube retaining protrusion may comprise a clip, such as a clip which
35 extends partially around a retained endotracheal tube, or at least partially across a
36 groove for guiding an endotracheal tube. A clip may be provided which engageably
37 extends around a retained endotracheal tube.

1
2 At least one of the tube engaging members is typically located within, or extends into,
3 the proximal half of the length of the handle, more preferably within the most proximal
4 quarter of the length of the handle and most preferably within the most proximal 10%
5 of the length of the handle.

6
7 Preferably, at least one of the tube engaging members which functions as a tube
8 retaining member (and optionally also as a tube guiding member) is typically located
9 within, or extends into, the proximal half of the length of the handle, more preferably
10 within the most proximal quarter of the length of the handle and most preferably
11 within the most proximal 10% of the length of the handle. This provides better control
12 of the proximal end of the endotracheal tube.

13
14 At least one tube engaging formation may comprise a tube guiding member which
15 protrudes from the handle to contact the inferior or superior surface of a retained
16 endotracheal tube. At least one said tube guiding members may be provided
17 adjacent to a groove. At least one said tube guiding members may have an incurvate
18 tube contacting surface to retain and guide an endotracheal tube.

19
20 The laryngoscope may be arranged to keep an endotracheal tube retained in the tube
21 guide continuously curved (preferably curved by more than its integral curvature)
22 from the most proximal location where the laryngoscope contacts a retained
23 endotracheal tube to the most distal location where the laryngoscope contacts the
24 superior surface of retained endotracheal tube. This facilitates intubation as the
25 endotracheal tube can be easier to guide into a patient's trachea where it is curved
26 along the length of the tube guide. This arrangement also reduces friction in
27 comparison to a J-shaped tube guide. Furthermore, the hand motion required to
28 move a curved tube along the curved path of the tube corresponds to the hand
29 motion which takes place when inserting an endotracheal tube using a conventional
30 (e.g. Macintosh) laryngoscope, enabling an intubater to use similar skills to those
31 developed with conventional laryngoscopes.

32
33 In order to facilitate the retention of an endotracheal tube along a curved path and to
34 facilitate intubation, the insertion section is preferably continuously curved at least
35 from the proximal location where it contacts a retained endotracheal tube to the most
36 distal location where it contacts the superior side of a retained endotracheal tube.
37 The curvature may be constant or vary along the curved path.

1
2 Preferably, the laryngoscope is arranged such that (in the case of a laryngoscope for
3 use in the intubation of adults), the straight line distance from the most proximal
4 location where the laryngoscope contacts a retained endotracheal tube to the most
5 distal location where the laryngoscope contacts the superior side of a retained
6 endotracheal tube is at least 200mm, more preferably 220 to 240mm. This
7 maximises the distance along which a retained endotracheal tube is maintained in a
8 continuous curve. Proportionately smaller sizes could be employed for use with
9 human infants.

10
11 Preferably, the laryngoscope is arranged such that a retained endotracheal tube, of at
12 least one external diameter (typically the largest diameter in an operating range of
13 external diameters, e.g. 12.3mm in the case of a laryngoscope for use in the
14 intubation of adults) is curved by at least 90°, and preferably at least 100°, at least
15 115° or at least 135° between the most proximal location where the laryngoscope
16 contacts a retained endotracheal tube and the most distal location where the
17 laryngoscope contacts the superior side of a retained endotracheal tube. This
18 maximises the arc along which a retained endotracheal tube is maintained in a
19 continuous curve. The laryngoscope may contact the superior surface of a retained
20 endotracheal tube at most proximal location where the laryngoscope contacts a
21 retained endotracheal tube.

22
23 Preferably, the laryngoscope is arranged to retain an endotracheal tube under
24 flexural tension from the most proximal location where the tube guide contacts a
25 retained endotracheal tube to the most distal location where the tube guide contacts
26 the superior surface of a retained endotracheal tube. Preferably, the laryngoscope is
27 arranged to retain an endotracheal tube under flexural tension from the most proximal
28 location where the tube guide contacts the superior surface of a retained
29 endotracheal tube to the most distal location where the tube guide contacts the
30 superior surface of a retained endotracheal tube. This facilitates retention of an
31 endotracheal tube. This is of particular benefit where the insertion section tube guide
32 is laterally opening and arranged to allow the removal of a retained endotracheal tube
33 in a lateral direction, as it allows the number and size of tube guiding members which
34 define the tube guide to be minimised, reducing the bulk of the insertion section. The
35 tube guide may also be more open on its lateral side than would otherwise be the
36 case. This is also of particular benefit where the endotracheal tube extends along a

1 lateral side of the handle such that a retained endotracheal tube can be removed in a
2 generally lateral direction.

3
4 Preferably, the laryngoscope (typically, the insertion section tube guide or a tube
5 guiding member extending from the handle) also contacts the inferior surface of a
6 retained endotracheal tube intermediate the most proximal and most distal locations
7 where the tube guide contacts the superior surface of a retained endotracheal tube,
8 such that a retained endotracheal tube exerts a superior force at the most proximal
9 and most distal locations where the tube guide contacts the superior surface of a
10 retained endotracheal tube and an inferior force at the said location where the tube
11 guide contacts the inferior surface of a retained endotracheal tube. The use of at
12 least three points of contact facilitates grip, resisting lateral movement. Preferably,
13 the laryngoscope is arranged such that inferior and superior surfaces of endotracheal
14 tubes with at least some external diameters in the operating range of external
15 diameters contact the laryngoscope in at most four locations, and preferably at most
16 three locations. This reduces friction when the endotracheal tube is advanced.

17
18 The laryngoscope may be arranged such that the path described by a retained
19 endotracheal tube from the tube guide to the most proximal location where it contacts
20 the handle has at least some lateral extent. However, the laryngoscope may be
21 arranged such that the path described by a retained endotracheal tube from the tube
22 guide to the most proximal location where it contacts the handle is substantially within
23 a plane. This means that the retained endotracheal tube is curved in only one
24 direction, reducing lateral bending forces and friction. Preferably, the laryngoscope
25 may be arranged such that the path described by a retained endotracheal tube from
26 the tube guide to the most proximal location where it contacts the handle is
27 substantially parallel to the centre line of the laryngoscope. By the centre line we
28 refer to the direction which will be in the midsagittal plane in use. This arrangement
29 reduces the friction experienced by a retained endotracheal tube when it is advanced
30 towards a patient's trachea and means that a relatively natural motion, similar to that
31 used with conventional laryngoscopy, is employed to advance the retained
32 endotracheal tube into a patient's trachea. This arrangement is of particular benefit
33 where the endotracheal tube is retained on the outside of the handle enabling an
34 intubater to conveniently touch and advance the endotracheal tube. The external
35 surface of the handle may comprise a planar tube contacting surface which extends
36 parallel to the centre line of the laryngoscope.

1 Preferably, the tube guide is arranged to hold a section of an endotracheal tube so
2 that it extends along at least some, and preferably at least the majority, of the length
3 of the insertion section. The tube guide is preferably a laterally opening tube guide
4 from which a retained endotracheal tube may be removed in a generally lateral
5 direction. Typically, the at least one tube engaging formation is provided on the side
6 of the laryngoscope where the tube guide opens.

7
8 The insertion section preferably comprises an elongate member having a lateral tube
9 guide extending laterally therefrom. Typically, the tube retaining formation is
10 provided on the same side of the laryngoscope as the lateral tube guide.

11
12 The elongate member may comprise imaging apparatus, such as an imaging device
13 (e.g. a camera) or image conduction apparatus (such as at least one fibre optic cable
14 or at least one reflective surfaces) for imaging a patient's larynx in use. The elongate
15 member may comprise illumination apparatus, such as a light source, including a
16 bulb or at least one fibre optical cable through which light may be conducted, for
17 illuminating a patient's laryngopharynx in use. The elongate member may conduct at
18 least one cable therein, such as electrical wires which relay signals from an imaging
19 device and/or provide power to an imaging device and/or light source, where present.

20
21 The elongate member may define a bore therein, which typically extends from the
22 proximal end of the elongate member, which may be a through-bore or which may be
23 enclosed at a distal end. The bore may be configured to receive imaging apparatus
24 and/or illumination apparatus. The bore may be configured to receive an elongate
25 insertion section retaining member which includes the imaging apparatus and/or
26 illumination apparatus. Where the bore is enclosed at a distal end, the elongate
27 member is preferably liquid tight to prevent contamination of imaging apparatus
28 and/or illumination apparatus enclosed therein. The imaging apparatus and/or
29 illumination apparatus and/or strengthening member are preferably attached to the
30 body of the laryngoscope.

31
32 The elongate member may be adapted to removably retain imaging apparatus.
33 Accordingly, the elongate member may be disposable but adapted to removably
34 retain reusable imaging apparatus. Reusable imaging apparatus typically comprises
35 a video camera (e.g. a CCD or CMOS video camera), a transmitter, which may be
36 wired or wireless, for transmitting video signals to a receiver for use in displaying
37 images during intubation, and a power supply, which may be a wired connection, a

1 wireless power supply (for example, an inductive power transfer system) or a battery
2 or capacitor.

3
4 Typically, the insertion section extends at an angle of at least 20°, and preferably at
5 least 30°, and more preferably around 40° to the central axis of the handle.

6
7 Preferably, the handle has a proximal end, which is towards a user in use, and a
8 distal end, and the insertion section extends from the distal end of the handle.

9 Typically, the insertion section has a proximal end, towards the handle, and a distal
10 end which extends into a patient's laryngopharynx in use. The tube guide typically
11 extends distally from the proximal end of the insertion section. Typically, the insertion
12 section has an inferior surface which is adapted for contact with a patient's tongue in
13 use, and an opposed superior surface and the tube guide comprises inferior and
14 superior tube guide walls which extend along the edge of at least a part of the inferior
15 and superior surfaces of the tube guide. Preferably, the superior tube guide walls
16 comprise separate proximal and distal portions.

17
18 The laryngoscope may be adapted to be used in a single intubation. Accordingly, the
19 laryngoscope may comprise a handle, insertion section and imaging apparatus (such
20 as a camera) which are adapted to be used in a single intubation. Thus, the
21 laryngoscope may be entirely disposable.

22
23 According to a second aspect of the present invention there is provided a
24 laryngoscope comprising a handle and an insertion section which extends from a
25 distal end of the handle, the handle and insertion section being adapted to detachably
26 retain and guide an endotracheal tube along a lateral side of the insertion section and
27 handle such that a retained endotracheal tube is continuously curved from the most
28 proximal location where the handle contacts the retained endotracheal tube to the
29 most distal location where the insertion section contacts the superior side of a
30 retained endotracheal tube.

31
32 Preferably, the insertion section and handle each comprise external tube guiding
33 members which detachably retain and guide an endotracheal tube along a lateral
34 side of the insertion section and handle such that a retained endotracheal tube is
35 continuously curved from the most proximal location where the handle contacts the
36 retained endotracheal tube to the most distal location where the insertion section
37 contacts the superior side of a retained endotracheal tube.

Typically, the insertion section includes at least two external tube guiding members, one of which is arranged to contact and guide the superior surface of a received endotracheal tube and one or which is arranged to contact and guide the inferior surface of a received endotracheal tube, and the handle comprises at least one of the external tube guiding members.

Preferably, the laryngoscope is arranged such that, for endotracheal tubes with a range of external diameters within the operating range of endotracheal tube external diameters, a retained endotracheal tube is held in flexural tension from the most proximal location where the laryngoscope contacts a retained endotracheal tube to the most distal location where the insertion section contacts the superior surface of a retained endotracheal tube.

Preferably, the laryngoscope is arranged such that, for endotracheal tubes with a range of external diameters within the operating range of endotracheal tube external diameters, a retained endotracheal tube is held in flexural tension from the most proximal location where the laryngoscope contacts the superior surface of a retained endotracheal tube to the most distal location where the insertion section contacts the superior surface of a retained endotracheal tube.

Preferably, the most proximal location where the laryngoscope contacts a retained endotracheal tube (and preferably also the most proximal location where the laryngoscope contacts the superior surface of a retained endotracheal tube) is in the proximal half (preferably the proximal quarter by length and most preferably the most proximal 10% by length).

Preferably, the tube guiding members are arranged to enable a retained endotracheal tube to be separated from the handle and insertion section within a patient without the laryngoscope being withdrawn.

At least one tube guiding member may comprise a groove.

At least one tube guiding member of the insertion section may constitute a tube guide according to the first aspect of the invention. At least one tube guiding member of the handle may constitute an external tube engaging formation according to the first aspect of the present invention which functions as both a tube guiding member and a

1 tube retaining member. Further preferred features of the second aspect of the
2 invention correspond to those discussed above in relation to the first aspect of the
3 invention.

4
5 Thus, the invention extends in a third aspect to a kit of parts comprising a insertion
6 section and a laryngoscope body which comprises a handle, wherein the
7 laryngoscope body and the insertion section comprise co-operating formations to
8 enable the insertion section to be removeably attached to the body, wherein the
9 insertion section comprises a tube guide for retaining and guiding an endotracheal
10 tube during intubation and the handle comprises at least one tube engaging
11 formation, the laryngoscope body and insertion section being arranged to form a
12 laryngoscope according to the first or second aspect of the invention when the
13 insertion section is removeably attached to the body.

14
15 The co-operating formations may comprise an elongate insertion section retaining
16 member which extends from the handle of the laryngoscope body and a bore within
17 the insertion section which is adapted to removeably receive the elongate insertion
18 section retaining member. The elongate insertion section retaining member may
19 comprise optical apparatus adapted to enable a user to view a patient's trachea in
20 use, for example a light source and video camera. The insertion section may be
21 disposable.

22
23 Further optional features correspond to those discussed above in relation to the first
24 aspect of the invention.

25
26 According to a fourth aspect of the present invention, there is provided a method of
27 preparing a laryngoscope for an intubation procedure, comprising fitting an
28 endotracheal tube to the tube guide of a laryngoscope according to the first aspect of
29 the present invention and engaging the tube guide with the at least one tube
30 engaging formations of the laryngoscope body.

31
32 Where the laryngoscope is a laryngoscope according to the first aspect of the present
33 invention, at least one of the external tube engaging formations is preferably a tube
34 guiding member. The method will typically further comprise replacing the insertion
35 section with an alternative disposable insertion section before carrying out a further
36 intubation. Alternatively, multiple intubations may be carried out using new, typically
37 sterilised, laryngoscopes.

1
2 According to a fifth aspect of the present invention, there is provided a method of
3 preparing a laryngoscope for an intubation procedure, comprising fitting an
4 endotracheal tube to the tube guide of a laryngoscope according to the second
5 aspect of the present invention and engaging the tube guide with the plurality of tube
6 guiding members.

7
8 Description of the Drawings

9
10 An example embodiment of the present invention will now be illustrated with
11 reference to the following Figures in which:

12
13 Figure 1 is a lateral view of a laryngoscope, without a retained tube;

14
15 Figure 2 is a lateral view of the laryngoscope of Figure 1, with a retained tube;

16
17 Figure 3 is a lateral view of an alternative laryngoscope, without a retained tube;

18
19 Figure 4 is a cross-section through A-A';

20
21 Figure 5 is a lateral view of the laryngoscope of Figure 3, with a retained tube;

22
23 Figure 6 is a side view of an alternative laryngoscope, without a retained tube;

24
25 Figure 7 is a side view of the laryngoscope of Figure 6, with a retained tube;

26
27 Figure 8 is a side view of an alternative laryngoscope, without a retained tube;

28
29 Figure 9 is a side view of the laryngoscope of Figure 8, with a retained tube;

30
31 Figure 10 is a side view of an alternative laryngoscope, without a retained tube;

32
33 Figure 11 is a lateral view of the laryngoscope of Figure 10, without a retained tube;

34
35 Figure 12A is a cross-section through B-B in the laryngoscope of Figures 10 and 11;

36
37 Figures 12B to 12L are cross-sections through alternative laryngoscope handles;

Figure 13 is a side view of an alternative laryngoscope, with a retained large diameter tube;

Figure 14 is a side view of the laryngoscope of Figure 13, with a retained small diameter tube; and

Figures 15 to 20 are side views of alternative laryngoscopes.

Detailed Description of an Example Embodiment

With reference to Figure 1, a laryngoscope shown generally as 1 comprises an elongate handle 2, which is ergonomically shaped to facilitate grip by a user, and an elongate disposable insertion section 4, which is removeably attachable to the handle. The disposable insertion section includes an elongate lateral tube guide which is arranged to retain an endotracheal tube along the majority of the side of the insertion section and which is defined by a proximal superior tube guide portion 6, a distal superior tube guide portion 8, and an inferior tube guide portion 10. A video screen 12 is supported by a video screen retaining arm 14 which protrudes laterally from the handle. The underside of the video screen 16 is smooth.

The body of the laryngoscope includes a protrusion (not shown) which fits demountably into a bore (not shown) which runs within the insertion section. The protrusion supports a light source and video camera at the distal end thereof (not shown). Cables running along the length of the protrusion provide power to the light source and the camera and relay data signals back to the handle. The insertion section is at least partially transparent to enable the video camera to observe images viewed through the insertion section. In use, the video screen displays images observed by the video camera.

Figure 2 illustrates the same laryngoscope retaining an endotracheal tube 18. The endotracheal tube is fitted so that it is retained by the protruding video screen retaining arm, which functions as a tube retaining member. Although the endotracheal tube is inherently curved, it is bent by more than its natural curvature and so, as the endotracheal tube is resilient, it is retained by the resulting force between the video screen retaining arm and the bent tube. Accordingly, the retained endotracheal tube is in flexural tension from the most proximal location where it

1 contacts the laryngoscope to the most distal location where the laryngoscope
2 contacts the superior surface of the endotracheal tube. The retained endotracheal
3 tube is curved between where it contacts the video screen retaining arm (the most
4 proximal location where the laryngoscope contacts the superior surface of a retained
5 endotracheal tube) and the distal superior tube guiding portion (the most distal
6 location where the laryngoscope contacts the superior surface of a retained
7 endotracheal tube). Because the endotracheal tube remains curved, the resistance
8 of friction to insertion of the endotracheal tube into a patient's trachea is reduced.
9 However, the retained endotracheal tube is curved such that it remains within a
10 plane, which is parallel to a patient's midsagittal plane in use, and does not curve
11 laterally. Accordingly, the retained endotracheal tube is advanced into a patient
12 generally along its own curved path. Not only is this a natural movement for an
13 intubator who is trained using conventional laryngoscopes, the avoidance of lateral
14 curvature reduces friction.

15
16 The video camera and light source facilitate the insertion of an endotracheal tube
17 which is retained in the guide into a patient's trachea. After intubation, the
18 endotracheal tube can be displaced laterally from the tube guide and separated from
19 the insertion section within a patient.

20
21 Figures 3 through 5 illustrate an alternative laryngoscope further including a shallow
22 groove 20 which functions as a tube guiding member, guiding a retained
23 endotracheal tube. The groove is shallow such that a retained endotracheal tube
24 predominantly extends from the surrounding handle surface. An intubator can hold
25 the endotracheal tube against the handle with their grip. Because the tube is retained
26 in flexural tension, no guiding member is required to resist lateral movement of the
27 endotracheal tube relative to the handle. The endotracheal tube can easily be
28 removed from contact with the video screen retaining protrusion by an intubator in
29 use and advanced. Because the groove is shallow, the groove does not function to
30 retain the endotracheal tube. As the tube is exposed, an intubator can readily grip
31 the endotracheal tube with their spare hand. The handle is shaped such that an
32 intubator can extend their grip around an endotracheal tube within the groove as well
33 as at least the majority and perhaps all of the handle. The groove also functions to
34 indicate where an endotracheal tube should be located when it is loaded and the path
35 of curvature it should take.

1 In the embodiment illustrated in Figures 6 and 7, an endotracheal tube is retained
2 along a path which is broadly along the length of the handle, with some lateral extent.
3 The protruding video screen retaining arm (functioning as a protrusion) includes a
4 shallow groove 22 so that the protrusion both retains and guides the endotracheal
5 tube. As shown in Figures 6 and 7, the insertion section comprises an elongate
6 member 5 within which the bore runs and from which the tube guiding members
7 extend laterally.

8
9 In the embodiment illustrated in Figures 6 and 7, a retained endotracheal tube is not
10 retained in a plane and is instead curved in a lateral direction. Figures 8 and 9
11 illustrate an alternative laryngoscope in which a retained endotracheal tube extends
12 in a plane, parallel to the centre line 24 of the laryngoscope. This arrangement is
13 advantageous in that lateral curvature in the retained endotracheal tube is avoided,
14 reducing friction during insertion. Furthermore, the movement required to advance
15 the endotracheal tube along its curved path is more natural and better resembles the
16 motion required during intubation with conventional laryngoscopes.

17
18 Figures 10 to 12A illustrates an alternative laryngoscope which does not include a
19 handle mounted video screen, comprising a protrusion 26 which extends laterally
20 from near the distal end of the handle and includes a groove 28 on a distal side
21 thereof for retaining and guiding an endotracheal tube. The handle has a smooth
22 lateral side, on the same side of the laryngoscope as the protrusion and tube guide,
23 enabling a tube to be retained on the laryngoscope parallel to the centre line of the
24 laryngoscope, in a plane.

25
26 The handle may alternatively or additionally comprise a guide wall for guiding an
27 endotracheal tube. Figures 12B through 12J illustrate cross-sections through
28 alternative laryngoscope handles, including various combinations of grooves 28 and
29 guide walls 30. In each of Figures 12B through 12J, an endotracheal tube with an
30 external diameter at the lower end of an operating range of endotracheal tube
31 diameters (5.5mm in the case of an insertion section for use with an adult human)
32 can be touched by a user whilst they grip the handle. Figures 12K and 12L illustrate
33 handles without tube guides in at least one cross-section.

34
35 Figures 13 and 14 illustrate alternative laryngoscopes with tube retaining formations
36 which can readily retain endotracheal tubes with different diameters. This
37 embodiment does not include a proximal superior tube retaining member. As the

1 retained tube extends from the surface of the handle, it can readily be grasped by an
2 intubator and they can grip the handle and hold an endotracheal tube against the
3 handle at once.

4
5 Figures 15 to 20 illustrate various alternative embodiments in which the laryngoscope
6 includes at least one tube guiding member which extends laterally from the handle of
7 the laryngoscope and functions to retain and guide an endotracheal tube. The tube
8 guiding members may contact the superior side of a retained endotracheal tube (30A,
9 30B, 30E) or the inferior side (30D) and may contact a retained endotracheal tube in
10 the distal half of the handle (30D), the proximal half of the handle (30C, 30E) or the
11 middle of the handle (30B). An elongate groove 20 may be provided in combination
12 with the tube guiding members.

13
14 In the examples described above and illustrated with reference to Figures 1 to 20, the
15 laryngoscope comprises a body and removeable detachable disposable insertion
16 section. Alternatively, the laryngoscope and insertion section may be permanently or
17 semi-permanently joined. The laryngoscope with permanantly or semi-permanantly
18 joined insertion section may be disposable.

19
20 Further modifications and variations may be made within the scope of the invention
21 herein disclosed.

Claims

1. A laryngoscope comprising a handle and an insertion section which extends from the handle, the insertion section comprising a tube guide for retaining and guiding an endotracheal tube during intubation, wherein the handle comprises at least one external tube engaging formation.
2. A laryngoscope according to Claim 1 wherein at least one external tube engaging formation is a tube guiding member arranged to guide along the handle an endotracheal tube which is received within the tube guide.
3. A laryngoscope according to Claim 2, wherein the at least one tube guiding member comprises a groove on the external surface of the handle of the laryngoscope.
4. A laryngoscope according to Claim 3, wherein the at least one groove is configured so that a guided endotracheal tube remains at least partially exposed along at least the majority of the handle.
5. A laryngoscope according to Claim 3 or Claim 4, wherein the at least one groove is configured so that either the most inferior or the most superior point on the surface of a guided endotracheal tube remains exposed along at least the majority of the length of the handle.
6. A laryngoscope according to any one of Claims 3 to 5, adapted for use in the intubation of human adults, wherein the depth of the at least one groove is less than 6mm at its deepest point.
7. A laryngoscope according to any one of Claims 2 to 6, wherein at least one tube guiding member is an elongate tube guiding wall.
8. A laryngoscope according to any one preceding Claim, wherein the handle is configured so that it can be grasped during intubation with the intubaters hand in contact with the endotracheal tube.
9. A laryngoscope according to any one preceding Claim, wherein the at least one tube engaging formation is arranged such that a retained and/or guided

1 endotracheal tube is contactable by a user where the endotracheal tube is
2 retained on and/or guided along the handle, whilst the user grips the handle.

3
4 10. A laryngoscope according to Claim 9, wherein the at least one tube engaging
5 formation is arranged such that a retained and/or guided endotracheal tube is
6 pinchable by a user where the endotracheal tube is retained on and/or guided
7 along the handle, whilst the user grips the handle.

8
9 11. A laryngoscope according to any one preceding Claim, wherein at least one
10 external tube engaging formation is a tube retaining member arranged to
11 detachably retain on the handle an endotracheal tube which is received within
12 the tube guide.

13
14 12. A laryngoscope according to Claim 11, configured such that the endotracheal
15 tube can be detached from the at least one tube retaining member without the
16 endotracheal tube being advanced or withdrawn within the tube guide.

17
18 13. A laryngoscope according to Claim 11 or Claim 12, configured such that a
19 retained endotracheal tube can be detached from the at least one tube
20 retaining member without removing the retained endotracheal tube from the
21 tube guide, such that the retained endotracheal tube is fully exposed
22 proximally of the most proximal part of the insertion section which contacts the
23 retained endotracheal tube.

24
25 14. A laryngoscope according to any one of Claims 11 to 13, wherein the at least
26 one tube retaining member comprises a tube retaining surface.

27
28 15. A laryngoscope according to Claim 14, wherein the at least one tube retaining
29 surface is located on the handle at a location such that an endotracheal tube
30 brought into tube retaining contact with at least one tube retaining surface is
31 retained by virtue of flexural tension in the endotracheal tube.

32
33 16. A laryngoscope according to Claim 15, wherein at least one tube retaining
34 surface is typically located such that a tube received within the tube guide of
35 the insertion section has to be curved by more than its integral curvature to be
36 brought into tube retaining contact with the at least one tube retaining surface.

37

- 1 17. A laryngoscope according to any one of Claims 11 to 16, wherein the at least
2 one tube retaining surface is arranged to detachably retain an endotracheal
3 tube without guiding the endotracheal tube.
4
- 5 18. A laryngoscope according to any one of Claims 11 to 17, wherein the at least
6 one tube retaining surface defines a tube guiding formation.
7
- 8 19. A laryngoscope according to any one of Claims 11 to 18, wherein the at least
9 one tube retaining member comprises at least one tube retaining protrusion
10 which protrudes from the handle.
11
- 12 20. A laryngoscope according to Claim 19, wherein the at least one tube retaining
13 protrusion protrudes laterally from the handle.
14
- 15 21. A laryngoscope according to Claim 19 or Claim 21, wherein the at least one
16 tube retaining protrusion comprises a video screen support for displaying
17 images received from a video camera which is located within or attached to
18 the insertion section.
19
- 20 22. A laryngoscope according to any one preceding Claim, wherein the at least
21 one tube engaging member is configured so that a retained endotracheal tube
22 remains at least partially exposed along at least the majority of the length of
23 the handle.
24
- 25 23. A laryngoscope according to any one preceding Claim, wherein the at least
26 one tube engaging member is configured so that either the most inferior or
27 most superior point on the surface of a retained endotracheal tube remains
28 exposed along at least the majority of the length of the handle.
29
- 30 24. A laryngoscope according to any one preceding Claim, where at least one of
31 the said at least one tube engaging members is located within, or extends
32 into, the proximal half of the handle.
33
- 34 25. A laryngoscope according to any one preceding Claim, wherein at least one
35 tube engaging formations comprise a tube guiding member which protrudes
36 from the handle to contact the inferior or superior surface of a retained
37 endotracheal tube.

- 1
2 26. A laryngoscope according to any one preceding Claim which is arranged to
3 keep an endotracheal tube retained in the tube guide continuously curved
4 from the most proximal location where the laryngoscope contacts a retained
5 endotracheal tube to the most distal location where the laryngoscope contacts
6 the superior surface of retained endotracheal tube.
7
- 8 27. A laryngoscope according to Claim 26, wherein the insertion section is
9 preferably continuously curved at least from the proximal location where it
10 contacts a retained endotracheal tube to the most distal location where it
11 contacts the superior side of a retained endotracheal tube.
12
- 13 28. A laryngoscope according to Claim 26 or Claim 27 for use in the intubation of
14 adults wherein the straight line distance from the most proximal location
15 where the laryngoscope contacts a retained endotracheal tube to the most
16 distal location where the laryngoscope contacts the superior side of a retained
17 endotracheal tube is at least 200mm.
18
- 19 29. A laryngoscope according to any one of Claims 26 to 29, arranged such that a
20 retained endotracheal tube, of at least one external diameter within an
21 operating range of external diameters, is curved by at least 90° between the
22 most proximal location where the laryngoscope contacts a retained
23 endotracheal tube and the most distal location where the laryngoscope
24 contacts the superior side of a retained endotracheal tube.
25
- 26 30. A laryngoscope according to any one preceding Claim, arranged such that the
27 path described by a retained endotracheal tube from the tube guide to the
28 most proximal location where it contacts the handle is substantially within a
29 plane.
30
- 31 31. A laryngoscope according to Claim 30, arranged such that the path described
32 by a retained endotracheal tube from the tube guide to the most proximal
33 location where it contacts the handle is substantially parallel to the centre line
34 of the laryngoscope.
35
- 36 32. A laryngoscope according to any one preceding Claim, adapted to be used in
37 a single intubation.

- 1
- 2 33. A laryngoscope according to any one preceding Claim, wherein the tube
- 3 guide is arranged to hold a section of an endotracheal tube so that it extends
- 4 along at least some and preferably at least the majority of the length of the
- 5 insertion section and the tube guide is a laterally opening tube guide from
- 6 which a retained endotracheal tube may be removed in a generally lateral
- 7 direction.
- 8
- 9 34. A laryngoscope according to Claim 33, wherein the insertion section
- 10 comprises an elongate member having a lateral tube guide extending laterally
- 11 therefrom and the at least one tube retaining formation is provided on the
- 12 same side of the laryngoscope as the lateral tube guide.
- 13
- 14 35. A laryngoscope according to any one preceding Claim, wherein the insertion
- 15 section extends at an angle of at least 20° to the central axis of the handle.
- 16
- 17 36. A laryngoscope comprising a handle and an insertion section which extends
- 18 from a distal end of the handle, the handle and insertion section being
- 19 adapted to detachably retain and guide an endotracheal tube along a lateral
- 20 side of the insertion section and handle such that a retained endotracheal
- 21 tube is continuously curved from the most proximal location where the handle
- 22 contacts the retained endotracheal tube to the most distal location where the
- 23 insertion section contacts the superior side of a retained endotracheal tube.
- 24
- 25 37. A laryngoscope according to Claim 36, arranged such that, for endotracheal
- 26 tubes with a range of external diameters within an operating range of
- 27 endotracheal tube external diameters, a retained endotracheal tube is held in
- 28 flexural tension from the most proximal location where the laryngoscope
- 29 contacts the superior surface of a retained endotracheal tube to the most
- 30 distal location where the laryngoscope contacts the superior surface of a
- 31 retained endotracheal tube.
- 32
- 33 38. A laryngoscope according to Claim 36 or Claim 37, wherein the insertion
- 34 section and handle each comprise external tube guiding members which
- 35 detachably retain and guide an endotracheal tube along a lateral side of the
- 36 insertion section and handle such that a retained endotracheal tube is
- 37 continuously curved from the most proximal location where the handle

1 contacts the retained endotracheal tube to the most distal location where the
2 insertion section contacts the superior side of a retained endotracheal tube.

3
4 39. A laryngoscope according to Claim 38, wherein the insertion section includes
5 at least two external tube guiding members, one of which is arranged to
6 contact and guide the superior surface of a received endotracheal tube and
7 one or which is arranged to contact and guide the inferior surface of a
8 received endotracheal tube, and the handle comprises at least one of the
9 external tube guiding members.

10
11 40. A laryngoscope according to Claim 38 or Claim 39, wherein the tube guiding
12 members are arranged to enable a retained endotracheal tube to be
13 separated from the handle and insertion section within a patient without the
14 laryngoscope being withdrawn.

15
16 41. A kit of parts comprising a insertion section and a laryngoscope body which
17 comprises a handle, wherein the laryngoscope body and the insertion section
18 comprise co-operating formations to enable the insertion section to be
19 removeably attached to the body, wherein the insertion section comprises a
20 tube guide for retaining and guiding an endotracheal tube during intubation
21 and the handle comprises at least one tube engaging formation, the
22 laryngoscope body and insertion section being arranged to form a
23 laryngoscope according to any one preceding Claim when the insertion
24 section is removeably attached to the body.

25
26 42. A method of preparing a laryngoscope for an intubation procedure, comprising
27 fitting an endotracheal tube to the tube guide of a laryngoscope according to
28 any one of Claims 1 to 40 and engaging the tube guide with the at least one
29 tube engaging formation of the laryngoscope body.

30
31 43. A method according to Claim 42, wherein at least one of the external tube
32 engaging formations is a tube guiding member.

33
34 44. A method of preparing a laryngoscope for an intubation procedure, comprising
35 fitting an endotracheal tube to the tube guide of a laryngoscope according to
36 any one of Claims 36 to 40.