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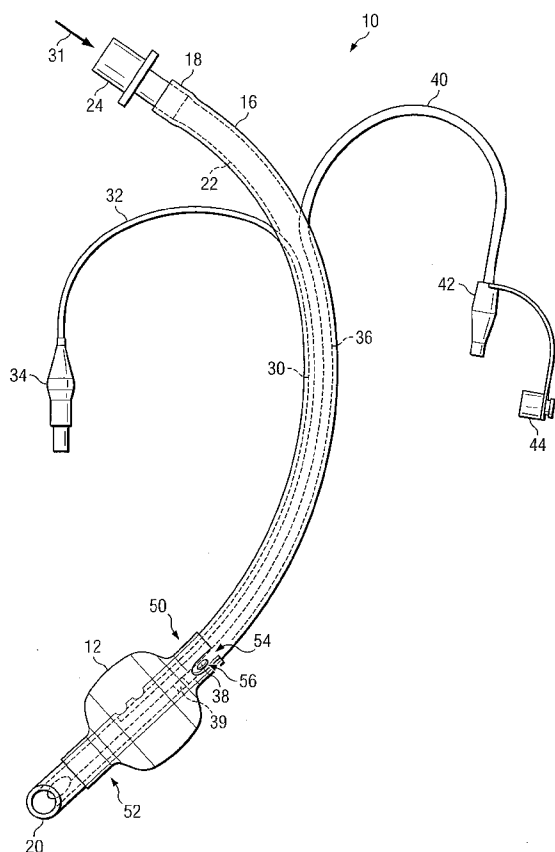
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(54) Title: MEDICAL TUBE INCLUDING AN INFLATABLE CUFF HAVING A NOTCHED COLLAR



(57) Abstract: A medical device (10) includes a tubular body
(16) configured to communicate gas and an inflatable cuff (12)
coupled to the tubular body at least by a collar (50). The tubular
body includes an opening (38). The collar includes a notch (54)
positioned relative to the opening in the tubular body such that a
passageway (56) extends through at least a portion of the notch
and at least a portion of the opening.

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MEDICAL TUBE INCLUDING AN INFLATABLE CUFF HAVING A NOTCHED COLLAR

TECHNICAL FIELD

The present disclosure relates generally to the field of medical devices, e.g., a
5 medical tube including an inflatable cuff having a notched collar.

BACKGROUND

Conventional methods of endotracheal intubation involve the insertion of a tubular
device, e.g., an endotracheal tube, into the trachea. The endotracheal tube typically
passes through the trachea and terminates above the carina, allowing gases to be directed
10 through the tube and into the lungs.

A primary objective of this type of treatment is the mechanical ventilation of a
subject's lungs, which may be required or appropriate due to the subject's medical
condition. In order to create the air pressure necessary to artificially ventilate the lungs,
the passageways around the tube are typically sealed, which may be accomplished, e.g.,
15 using an inflatable cuff provided around the tube. With the tube in place, the cuff is
typically located within the trachea about 3-5 centimeters above the carina. The cuff may
then be inflated to expand and seal against the wall of the trachea, thereby preventing
gases being pumped into the lungs from backing up around the tube.

Although this method of treatment has been relatively successful, problems
20 remain. For example, with cuffed endotracheal tubes, secretions may collect proximate
the cuff, providing a site for the possible accumulation of pathogens. Various methods
have been devised for removing such secretions. For example, a small opening may be
provided above the cuff with an associated suction lumen. Fluids and/or solids (e.g.,
secretions) can be periodically or continuously removed through the opening and lumen
25 by suction.

SUMMARY

In accordance with one embodiment of the present disclosure, a medical device
may include a tubular body configured to communicate gas and an inflatable cuff coupled
to the tubular body at least by a collar. The tubular body may include an opening and the

collar may include a notch positioned relative to the opening such that a passageway extends through at least a portion of the notch and at least a portion of the opening.

In accordance with another embodiment of the present disclosure, a method of attaching an inflatable cuff to a tubular body of a medical tube may be provided. The method may include forming a notch in a collar of an inflatable cuff, mounting the inflatable cuff on a tubular body having an opening, and positioning the notch in the collar relative to the opening in the tubular body such that a passageway extends through at least a portion of the notch and at least a portion of the opening.

In accordance with another embodiment of the present disclosure, a method of attaching an inflatable cuff having a collar to a tubular body of a medical tube is provided. The method may include mounting the inflatable cuff on the tubular body, and forming a notch in the collar of the mounted cuff.

In accordance with another embodiment of the present disclosure, a medical device may include conveying means for channeling gas to an area of the body, sealing means for sealing said conveying means against the wall of a body cavity, and attaching means for attaching said sealing means to said conveying means, wherein the attaching means includes a collar having a notch.

In accordance with another embodiment of the present disclosure, a method for intubation may be provided. The method may include inserting a tube into the body cavity, wherein the tube includes an inflatable cuff coupled to a tubular body at least by a collar, the collar including a notch positioned relative to an opening in the tubular body such that a passageway extends through at least a portion of the notch and at least a portion of the opening. The method may further include inflating the cuff within a body cavity and conveying gas to an area of the body through the tubular body.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 illustrates a medical tube including an inflatable cuff having a notched collar, in accordance with an example embodiment of the disclosure;

FIGURES 2A-2C are enlarged views of inflatable cuffs having notched collars, in accordance with various example embodiments of the disclosure;

FIGURES 3A-3B illustrate inflatable cuffs having bands used to help secure a cuff collar to a tubular body, in accordance with example embodiments of the disclosure;

FIGURES 4A-4E illustrate an example method of attaching an inflatable cuff having a notched collar to a tubular body of a medical tube, in accordance with one embodiment of the disclosure;

FIGURES 5A-5E illustrate an example method of mounting an inflatable cuff on a tubular body of a medical tube and forming a notch in the cuff and an opening in the tubular body, in accordance with one embodiment of the disclosure;

FIGURE 6 is a flow diagram of a method of intubation of a medical tube having a cuff with a notched collar, in accordance with one embodiment of the disclosure;

FIGURES 7A-7B illustrate various locations of a suction opening formed in a tubular body of a medical tube relative to an inflatable cuff mounted on the tubular body, according to example embodiments;

FIGURES 8A-8B illustrate various locations of an open-ended notch formed in an inflatable cuff mounted on a medical tube, according to example embodiments; and

FIGURE 9 illustrates the positioning of an enclosed notch formed in a collar of an inflatable cuff mounted on a medical tube, according to an example embodiment.

DETAILED DESCRIPTION OF THE DRAWING

Selected embodiments of the disclosure may be understood by reference, in part, to FIGURES 1-9, wherein like numbers refer to same and like parts. The present disclosure is broadly concerned with medical tubes (e.g., endotracheal, tracheostomy, or oropharyngeal tubes or other tubes or catheters) adapted to be intubated into one or more passageways (e.g., the trachea and/or pharynx) of a subject in connection with a medical procedure. For example, certain embodiments are directed toward endotracheal tubes inserted into a subject's trachea to facilitate mechanical ventilation of the subject's lungs. Certain embodiments include tubes having an improved configuration for periodic

removal of fluids and/or solids that collect adjacent an inflatable cuff used to seal, secure and/or position the tube against the tracheal wall. The inflatable cuff may include a notched collar, which may be advantageous or desirable. As used throughout this document, the term "subject" may include any human or other animal.

5 Turning now to the drawings, FIGURE 1 illustrates an example medical tube 10 including an inflatable cuff 12 having a notched collar, in accordance with an example embodiment of the disclosure. Tube 10 may include a tubular body 16 having an open proximal end 18 and an open distal end 20. Tubular body 16 may define a gas-conveying passageway 22 for mechanical ventilation of a subject. Proximal end 18 may include a
10 connector 24 configured for attachment to a mechanical ventilator (not shown).

 During intubation of tube 10, cuff 12 may be at least partially collapsed. Once properly in place, cuff 12 may be inflated via an inflation lumen 30 formed in or otherwise associated with tubular body 16. Inflation lumen 30 may be coupled to an inflation line 32 terminating in a fixture 34 that allows inflation of cuff 12 via inflation
15 lumen 30.

 Tubular body 16 may also include a suction lumen 36 formed in or otherwise associated with tubular body 16. Suction lumen 36 may include an opening 38 extending through the wall of tubular body 16 through which secretions or other matter accumulated on or proximate cuff 12 may be removed. In this embodiment, suction lumen 36 extends
20 to the distal end 20 of tubular body 16 and includes a sealing plug 39. In other embodiments, suction lumen 36 may terminate before the distal end 20 of tubular body 16 (e.g., just beyond opening 38) or may terminate at opening 38. As shown, an exterior suction tube 40 may be communicatively coupled to lumen 36 for removing secretions or other matter through opening 38, as discussed below in greater detail. Suction tube 40
25 may include an end fixture 42 including a cap 44.

 Inflatable cuff 12 may be mounted on tubular body 16 adjacent distal end 20 of tubular body 16. Cuff 12 may be mounted on tubular body 16 by one or more collars and/or other suitable means. In the example embodiment shown in FIGURE 1, cuff 12 may be mounted on tubular body 16 by a first collar 50 and a second collar 52. First
30 collar 50 may include a notch 54 positioned relative to opening 38 in tubular body 16 such that a passageway 56 extends through at least a portion of notch 54 and at least a portion of opening 38. Passageway 56 may provide a path for secretions or other matter

proximate cuff 12 to flow into suction lumen 36 for removal. As used herein, a “notch” may refer to any hole, opening, or cutout, which may have any suitable configuration or shape (e.g., U-shaped, V-shaped, arc-shaped, circular, elliptical, ovoid, square, rectangular, octagonal, hexagonal, etc.), may be open-ended (e.g., an open-ended cutout
5 from an edge of first collar 50) or enclosed (e.g., a hole), and may be formed in any suitable manner before, after, or during the mounting of cuff 12 on tubular body 16.

Cuff 12 may comprise any type of inflatable cuff. For example, cuff 12 may be a high volume, low pressure cuff; a low volume, high pressure cuff; or a low volume, low pressure cuff. Cuff 12 may have any suitable shape, size, and/or configuration, and may
10 be formed from any one or more materials. For example, cuff 12 may be manufactured from any suitable polymeric or other material, e.g., PVC (polyvinyl chloride), polyurethane, polyisoprene, and/or silicone.

To insert and/or position tube 10 in the trachea, tube 10 may be inserted down the trachea to a point just above (e.g., about 3 cm above) the carina. Cuff 12 may then be
15 inflated by pumping air into cuff 12 through inflation line 32 and inflation lumen 30. Typically, inflation air may be provided by a syringe inserted into fixture 34. In some situations, inflation of cuff 12 to a pressure of 25-30 cm H₂O (or any other clinically appropriate pressure level) may act to seal cuff 12 against the inner wall of the trachea, thus effectively sealing the trachea to prevent gas (e.g., gas pumped into the lungs
20 through tube 10) from backing up around tube 10. Additionally, or alternatively, cuff 12 may act to secure or position tube 16 within the trachea.

Proximal end 18 of tubular body 16 may be attached to a ventilator using connector 24 for mechanical ventilation of the subject. Following intubation, fluid secretions and/or other matter may accumulate near the proximal end of cuff 12. These
25 secretions may carry bacteria or other pathogens in an environment suitable for pathogen growth. Accordingly, the secretions may be periodically or continuously removed through passageway 56, lumen 36, and suction tube 40. Cap 44 may be removed and fixture 42 may be connected to a suction machine (not shown) for removing the secretions; alternately, a syringe may be used for this purpose.

30 FIGURES 2A-2C are enlarged views of cuffs 12 having a notched collar 50, in accordance with various example embodiments of the disclosure. In each embodiment, cuff 12 is shown in its inflated state with collars 50 and 52 at respective ends of cuff 12

for attaching cuff 12 to tubular body 16 having a suction opening 38. Collar 50 may include a notch 54 positioned relative to opening 38 such that passageway 56 extends through at least a portion of notch 54 and at least a portion of opening 38, such that secretions or other matter may flow into suction lumen 36 through passageway 56.

5 For example, FIGURE 2A illustrates a cuff 12a including a collar 50a having a notch 54a that is generally U-shaped and open-ended.

As another example, FIGURE 2B illustrates a cuff 12b including a collar 50b having a notch 54b that is generally V-shaped and open-ended.

As another example, FIGURE 2C illustrates a cuff 12c including a collar 50c
10 having a notch 54c that is an enclosed hole. Hole 54c may have any suitable shape and/or size relative to opening 38. For example, in some embodiments (e.g., where hole 54c is formed before mounting cuff 12c on tubular body 16), hole 54c may be larger than opening 38, e.g., to facilitate the alignment of hole 54c with opening 38 to form passageway 56. In other embodiments (e.g., where hole 54c is formed after cuff 12c is
15 mounted on tubular body 16), hole 54c may have the same size and shape as opening 38. In other embodiments, hole 54c may be smaller than opening 38.

The embodiments shown in FIGURES 2A-2C are examples only. As discussed above, notch 54 may refer to any hole, opening, or cutout, which may have any suitable configuration or shape (e.g., U-shaped, V-shaped, arc-shaped, circular, elliptical, ovoid,
20 square, rectangular, octagonal, hexagonal, etc.), may be open-ended (e.g., an open-ended cutout from an edge of first collar 50) or enclosed (e.g., a hole), and may be formed in any suitable manner before, after, or during the mounting of cuff 12 on tubular body 16.

In some embodiments, notch 54 may allow suction opening 38 to be positioned in close proximity to an inflatable portion 60 of cuff 12 and/or to a transition between collar
25 50 and inflatable portion 60 of cuff 12. Such positioning may facilitate the removal of secretions or other matter that may collect near inflatable portion 60 and/or the transition between collar 50 and inflatable portion 60 through passageway 56.

Collars 50 and 52 may be elastically stretched around tubular body 16, which may substantially secure collars 50 and 52 to tubular body 16. In some embodiments, all or
30 portions of collars 50 and/or 52 may be bonded to tubular body 16 in any suitable manner. For example, in one embodiment, collars 50 and/or 52 may be bonded to an outer surface of tubular body 16 using a cyclohexanone solvent bond that may dissolve

portions of collar 50/52 and tubular body 16 such that the surfaces of each become intermingled.

As another example, a band or ring 70 may be positioned around collar 50 to secure or help secure collar 50 to tubular body 16. In some embodiments, all or a portion of notch 54 extends through band 70. For example, FIGURE 3A illustrates an example embodiment in which a band 70 extends around collar 50 and notch 54 extends through band 70 such that passageway 56 extends through band 70, collar 50, and tubular body 16. In other embodiments, notch 54 does not extend through band 70. For example, FIGURE 3B illustrates an example embodiment in which a band 70 extends around collar 50 but notch 54 does not extend through band 70.

Band 70 may have any suitable shape, size, and/or thickness, and may be located at any position along the length of collar 50 relative to notch 54. Band 70 may be made from the same material as cuff 12 or from any other suitable material. Band 70 may be secured to or around collar 50 in any suitable manner. For example, band 70 may be an elastic band secured around collar 50 by elastic forces. As another example, band 70 may be coupled to collar 50 using any suitable heat treatment (e.g., using RF, hot air, or ultrasonic techniques). As another example, band 70 may be secured to or bonded with collar 50 using a solvent.

In some embodiments, a second band, which may or may not be similar to band 70, may be positioned around collar 52 to secure or help secure collar 52 to tubular body 16.

In some embodiments, e.g., the embodiment shown in FIGURE 3B, band 70 may act as a spacer to help prevent opening 38 from contacting and becoming occluded by the tracheal wall (during suctioning or otherwise), which occlusion may cause irritation and/or rubbing of the tracheal wall that can result in inflammation, scarring, stenosis, and/or have other undesirable effects. Alternatively, or in addition to band 70, one or more spacers may be provided on cuff 12 and or tubular body 16 to help prevent opening 38 from becoming occluded. For example, one or more spacing members may be formed integral to, or coupled to, inflatable portion 60 and/or collar 50 to help prevent the occlusion of opening 38. As another example, one or more spacing members may be formed integral to, or coupled to, tubular body 16 to help prevent the occlusion of opening 38. For instance, in some embodiments, tubular body 16 may include one or

more projections located proximate opening 38, e.g., as described in co-pending PCT Application No. PCT/US2005/016577, filed May 11, 2005.

FIGURES 4A through 4E illustrate an example method of attaching a cuff 12 having a notched collar 50 to a tubular body 16 of an endotracheal tube, in accordance with one embodiment of the disclosure. FIGURE 4A shows cuff 12, which may include inflatable portion 60 and collars 50 and 52 at respective ends of cuff 12. As shown in FIGURE 4B, a notch 54 may be formed in collar 50. As discussed above, notch 54 may have any suitable shape, size, and/or configuration, and may be formed in any suitable manner.

As shown in FIGURE 4C, cuff 12 with notched collar 50 may be mounted on tubular body 16. Cuff 12 may be mounted on tubular body 16 in any suitable manner, e.g., by manually or automatically inserting an end of tubular body 16 through the openings defined by collars 50 and 52, or in any other suitable manner. As shown in FIGURE 4D, cuff 12 may be positioned on tubular body 16 such that notch 54 is positioned relative to opening 38 to define passageway 56 extending through both notch 54 and opening 38. In addition, cuff 12 may be positioned on tubular body 16 such that suction opening 38 is positioned proximate inflatable portion 60 of cuff 12.

FIGURE 4E shows cuff 12, having been mounted on tubular body 16 as shown in FIGURES 4A-4D, in an inflated state. In this example embodiment, collars 50 and 52 are secured to tubular body 16 such that collars 50 and 52 do not inflate, while inflatable portion 60 inflates outwardly. Collars 50 and/or 52 may be secured to tubular body 16 in any suitable manner, e.g., by being elastically stretched around tubular body 16 and/or by being permanently secured by solvent bond, heat treatment (e.g., using RF, hot air, or ultrasonic techniques) or in any other manner.

FIGURES 5A-5E illustrate an example method of mounting an inflatable cuff 12 on a tubular body 16 of a medical tube and forming a notch 54 in the cuff 12 and an opening 38 in the tubular body 16, in accordance with one embodiment of the disclosure.

FIGURE 5A shows cuff 12, which may include inflatable portion 60 and collars 50 and 52 at respective ends of cuff 12. As shown in FIGURE 5B, cuff 12 may be mounted on tubular body 16. Cuff 12 may be mounted on tubular body 16 in any suitable manner, e.g., by manually or automatically inserting an end of tubular body 16 through the openings defined by collars 50 and 52, or in any other suitable manner. As shown in

FIGURE 5C, cuff 12 may be positioned on tubular body 16 such that collar 50 overlies an area of tubular body 16 through which an opening 38 may be suitably formed. For example, cuff 12 may be appropriately positioned relative to sealing plug 39 located in suction lumen 36 (discussed above with reference to FIGURE 1). In some embodiments, collars 50 and/or 52 may be bonded to tubular body 12, e.g., as described above with reference to FIGURE 4D.

Once cuff 12 is positioned and/or bonded to tubular body 16, notch 54 and opening 38 may be formed in collar 50 and tubular body 16, respectively, in any suitable manner, thereby forming passageway 56. For example, in some embodiments, as shown in FIGURE 5D, notch 54 and opening 38 (and thus passageway 56) may be formed by cutting (e.g., by punching, drilling, or otherwise cutting) across a side of tubular body 16, in a direction perpendicular to the page with reference to FIGURE 5D (i.e., in the direction indicated by arrow 80 in FIGURE 5E). In some embodiments, such cutting may form a circular or ovoid notch 54 and a circular or ovoid opening 38. In other embodiments, notch 54 and opening 38 (and thus passageway 56) may be formed by cutting (e.g., by punching, drilling, or otherwise cutting) perpendicularly through a side of collar 50 and tubular body 16 (i.e., in a direction indicated by arrow 82 in FIGURE 5D).

Thus, notch 54 and opening 38 may be formed substantially simultaneously by cutting (e.g., punching, drilling, or otherwise cutting) through both collar 50 and tubular body 16. However, in other embodiments, notch 54 and opening 38 may not be formed substantially simultaneously. For example, notch 54 and opening 38 may be formed by separate cutting processes.

FIGURE 5E illustrates cuff 12 rotated 90 degrees from the views of FIGURES 5A-5D, in order to illustrate a top view of notch 54 and opening 38. In this example embodiment, one or both of notch 54 and opening 38 may have an ovoid shape, which may result from the cross-cutting process discussed above (i.e., cutting in the direction indicated by arrow 82). In addition, cuff 12 is shown in FIGURE 5E in an inflated state.

In some embodiments (e.g., where a single cutting process using a single bit or punch member is used to form both notch 54 and opening 38), notch 54 and opening 38 may have the same size and shape. In other embodiments (e.g., where multiple cutting processes are used to form notch 54 and opening 38, or where a dual-diameter bit or

punch member is used to form notch 54 and opening 38), notch 54 may have a different shape and/or size than opening 38.

As discussed above, passageway 56 may extend through at least a portion of notch 54 and at least a portion of opening 38. Notch 54 may be partially or fully aligned with opening 38. Notch 54 may be said to be fully aligned with opening 38 if either (a) none of notch 54 directly overlies a material (i.e., non-opening) portion of tubular body 16, or (b) none of opening 38 directly underlies a material (i.e., non-notch) portion of collar 50. Notch 54 may be said to be partially aligned with opening 38 if both (a) a portion of notch 54 directly overlies a material (i.e., non-opening) portion of tubular body 16, and (b) a portion of opening 38 directly underlies a material (i.e., non-notch) portion of collar 50.

According to another embodiment, a method of forming notch 54 may include mounting a cuff 12 having no notched cuff portion 54 on a tubular body 16 that already includes an opening 38. Cuff 12 may be positioned on tubular body 16 such that collar 50 is aligned over opening 38. Once cuff 12 is appropriately positioned, notch 54 may be formed in collar 50 (e.g., by any suitable cutting process) such that a passageway 56 extends through at least a portion of notch 54 and at least a portion of opening 38 for removing secretions or other matter proximate cuff 12.

FIGURE 6 is a flow diagram of a method of intubation of a tube having a cuff with a notched collar, in accordance with one embodiment of the disclosure. At step 100, a tube may be inserted into a subject's trachea. The tube may have a tubular body and an inflatable cuff having a notched collar positioned over a suction opening in the tubular body to form a secretion-removal passageway for removal of secretions or other matter via a suction lumen. The tube may have any suitable additional features, e.g., a Magill curve to facilitate intubation. At step 102 the inflatable cuff may be inflated to seal, secure, and/or position the tubular body against the tracheal wall. At step 104, gas may be conveyed (e.g., from a gas source) through the tubular body to an area of the subject's body (e.g., the lungs). At step 106, secretions or other matter proximate the inflatable cuff may be removed by suction through the secretion-removal passageway and suction lumen.

The order of the steps discussed above can vary according to various embodiments. For example in some embodiments, gas may be conveyed through the

tubular body prior to sealing/securing the tube to the tracheal wall using the inflatable cuff.

FIGURES 7A-7B illustrate various locations of opening 38 relative to cuff 12, according to example embodiments. Opening 38 may be located in any suitable location relative to collar 50 and/or inflatable portion 60 of cuff 12. For example, at least a portion of opening 38 may be located at any position along a length extending from a first end 86 of collar 50 to a second end 88 of collar 50. First end 86 of collar 50 may be located at or proximate a transition between collar 50 and inflatable portion 60.

FIGURES 8A-8B illustrate various locations of an open-ended notch 54, according to example embodiments. Open-ended notch 54 may be located in any suitable location on collar 50. For example, a first end 90 of notch 54 closest to inflatable portion 60 may be located at any position along a length extending from first end 86 of collar 50 to second end 88 of collar 50. In some embodiments, first end 90 of notch 54 may be spaced sufficiently apart from first end 86 of collar 50 to provide sufficient material around collar 50 for securing collar 50 to tubular body 16. For example, as shown in FIGURE 8B, first end 90 of notch 54 may be spaced sufficiently apart from first end 86 of collar 50, indicated as distance A, to provide sufficient material around collar 50 for securing collar 50 to tubular body 16. For example, in some embodiments, distance A may be at least 0.050 inches. In one embodiment, distance A may be about 0.0625 inches.

FIGURE 9 illustrates the positioning of an enclosed notch 54 formed in collar 50, according to an example embodiment. Enclosed notch 54 may be located in any suitable location on collar 50. In some embodiments, notch 54 may be spaced sufficiently apart from first end 86 and/or second end 88 of collar 50 to provide sufficient material on one or both sides of notch 54 for securing collar 50 to tubular body 16.

For example, as shown in FIGURE 9, a first end 94 of notch 54 may be spaced sufficiently apart from first end 86 of collar 50, indicated as distance B, to provide sufficient material around collar 50 for securing collar 50 to tubular body 16. In some embodiments, distance B may be at least 0.050 inches. In one embodiment, distance B may be about 0.0625 inches.

As another example, a second end 96 of notch 54 may be spaced sufficiently apart from second end 88 of collar 50, indicated as distance C, to provide sufficient material

around collar 50 for securing collar 50 to tubular body 16. In some embodiments, distance C may be at least 0.050 inches. In one embodiment, distance C may be about 0.0625 inches.

5 It will be appreciated that while the disclosure is particularly described in the context of endotracheal tubes, the apparatuses, techniques, and methods disclosed herein may be similarly applied in other contexts. For example, similar principles may be applied to a variety of other surgical and/or medical tubes having inflatable cuffs, e.g., tracheostomy tubes, oropharyngeal tubes, or other medical tubes or catheters. Additionally, it should be understood that various changes, substitutions and alterations
10 can be made herein without departing from the spirit and scope of the disclosure as illustrated by the following claims.

WHAT IS CLAIMED

1. A medical device, comprising:
a tubular body configured to communicate gas, the tubular body including an opening; and
an inflatable cuff coupled to the tubular body at least by a collar;
wherein said collar includes a notch positioned relative to the opening in the tubular body such that a passageway extends through at least a portion of the notch and at least a portion of the opening.
2. A medical device according to Claim 1, further comprising a suction lumen extending along at least a portion of the tubular body and in fluid communication with the opening in the tubular body.
3. A medical device according to Claim 1, wherein:
the inflatable cuff includes another collar; and
the inflatable cuff is coupled to the tubular body at least by the two collars.
4. A medical device according to Claim 1, wherein the notch and the opening are fully aligned.
5. A medical device according to Claim 1, wherein the notch and the opening are partially aligned such that at least a portion of the notch overlies a material portion of the tubular body and at least a portion of the opening underlies a material portion of the collar.
6. A medical device according to Claim 1, wherein:
the inflatable cuff includes an inflatable portion;
the collar has a first end adjacent the inflatable cuff and a second end; and
an edge of the notch closest to the second end of the collar is at least 0.05 inches from the second end of the collar.

7. A medical device according to Claim 6, wherein the edge of the notch closest to the second end of the collar is about 0.0625 inches from the second end of the collar.

8. A medical device according to Claim 1, wherein:
the inflatable cuff includes an inflatable portion adjacent a first end of the collar;
and
an edge of the notch closest to the first end of the collar is at least 0.05 inches from the first end of the collar.

9. A medical device according to Claim 8, wherein the edge of the notch closest to the first end of the collar is about 0.0625 inches from the first end of the collar.

10. A medical device according to Claim 1, further comprising a band extending at least partially around the collar to help secure the collar to the tubular body.

11. A medical device according to Claim 1, wherein the notch is open-ended.

12. A medical device according to Claim 1, wherein the notch comprises an enclosed hole.

13. A medical device according to Claim 1, wherein the notch is substantially V-shaped.

14. A medical device according to Claim 1, wherein the notch is substantially U-shaped.

15. A medical device according to Claim 1, wherein the notch has a substantially rectangular shape.

16. A medical device according to Claim 1, wherein the notch has a substantially square shape.

17. A medical device according to Claim 1, wherein the notch has a substantially circular shape.

18. A medical device according to Claim 1, wherein the notch has a substantially ovoid shape.

19. A medical device according to Claim 1, wherein the notch has a substantially elliptical shape.

20. A medical device according to Claim 1, wherein the notch in the collar and the opening in the tubular body have substantially similar shapes.

21. A medical device according to Claim 1, wherein the notch in the collar and the opening in the tubular body have different shapes.

22. A medical device according to Claim 1, wherein the notch in the collar and the opening in the tubular body have substantially similar sizes.

23. A medical device according to Claim 1, wherein the notch in the collar and the opening in the tubular body have different sizes.

24. A medical device according to Claim 1, wherein the medical device comprises an endotracheal tube.

25. A medical device according to Claim 1, wherein the medical device comprises a tracheostomy tube.

26. A medical device according to Claim 1, wherein the medical device comprises an oropharyngeal tube.

27. A medical device according to Claim 1, wherein the medical device comprises a catheter.

28. A method of attaching an inflatable cuff to a tubular body of a medical tube, the method comprising:

forming a notch in a collar of an inflatable cuff;
mounting the inflatable cuff on a tubular body having an opening; and
positioning the notch in the collar relative to the opening in the tubular body such that a passageway extends through at least a portion of the notch and at least a portion of the opening.

29. A method according to Claim 28, further comprising bonding the collar of the inflatable cuff to the tubular body.

30. A method according to Claim 28, further comprising positioning a band at least partially around the collar to help secure the collar to the tubular body.

31. A method according to Claim 28, wherein the notch is open-ended.

32. A method according to Claim 28, wherein the notch comprises an enclosed hole.

33. A method according to Claim 28, wherein the notch has a substantially circular shape.

34. A method according to Claim 28, wherein the notch has a substantially ovoid shape.

35. A method of attaching an inflatable cuff having a collar to a tubular body of a medical tube, the method comprising:

mounting the inflatable cuff on the tubular body; and
forming a notch in the collar of the mounted cuff.

36. A method according to Claim 35, further comprising bonding the collar of the inflatable cuff to the tubular body.

37. A method according to Claim 35, further comprising positioning a band at least partially around the collar to help secure the collar to the tubular body.

38. A method according to Claim 35, wherein:
the inflatable cuff further includes another; and
the inflatable cuff is mounted on the tubular body at least by the two collars.

39. A method according to Claim 35, further comprising forming an opening in the tubular body, wherein the notch in the collar is positioned relative to the opening in the tubular body such that a passageway extends through at least a portion of the notch and at least a portion of the opening.

40. A method according to Claim 35, further comprising forming an opening in the tubular body substantially simultaneously with the forming of the notch in the collar.

41. A method according to Claim 40, further comprising forming the opening in the tubular body and the notch in the collar by cutting completely across a side of the collar and the tubular body to form a circular or ovoid opening and a circular or ovoid notch.

42. A method according to Claim 40, wherein the notch in the collar and the opening in the tubular body are formed such that a passageway extends through at least a portion of the notch and at least a portion of the opening.

43. A method according to Claim 35, wherein the notch is open-ended.

44. A method according to Claim 35, wherein the notch comprises an enclosed hole.

45. A method according to Claim 35, wherein the notch has a substantially circular shape.

46. A method according to Claim 35, wherein the notch has a substantially ovoid shape.

47. A medical device, comprising:
conveying means for channeling gas to an area of the body;
sealing means for sealing said conveying means against the wall of a body cavity;
and
attaching means for attaching said sealing means to said conveying means,
wherein the attaching means includes a collar having a notch.

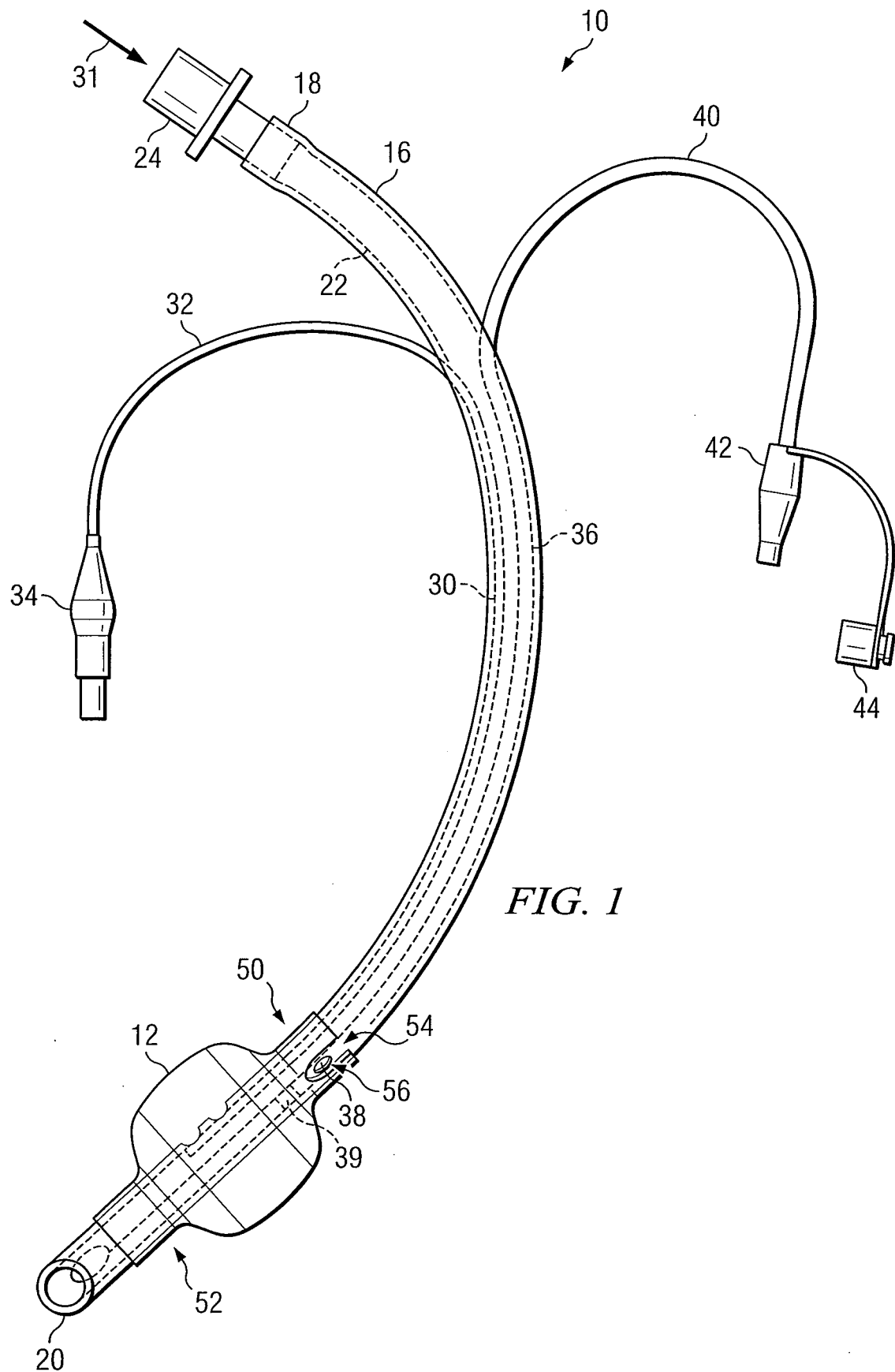
48. A method for intubation, comprising:
inserting a tube into a body cavity, wherein the tube comprises an inflatable cuff coupled to a tubular body at least by a collar, the collar including a notch positioned relative to an opening in the tubular body such that a passageway extends through at least a portion of the notch and at least a portion of the opening;
inflating the cuff within the body cavity; and
conveying gas to an area of the body through the tubular body.

49. A method according to Claim 48, wherein the body cavity comprises the trachea.

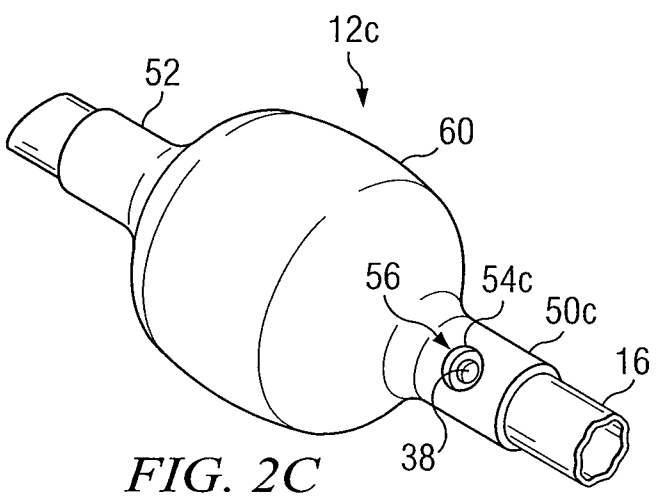
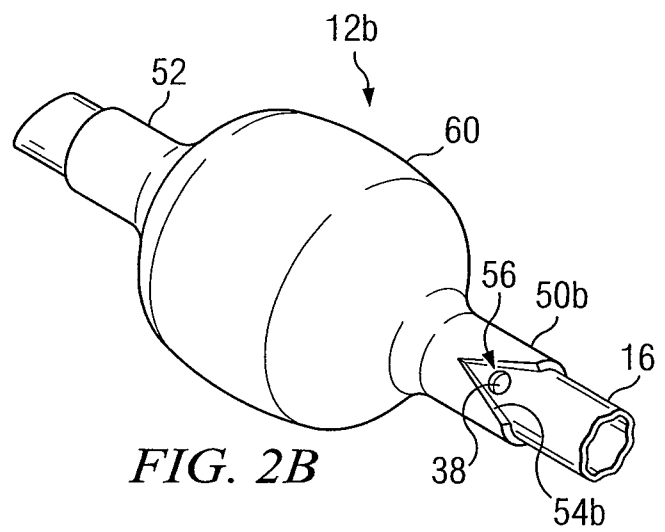
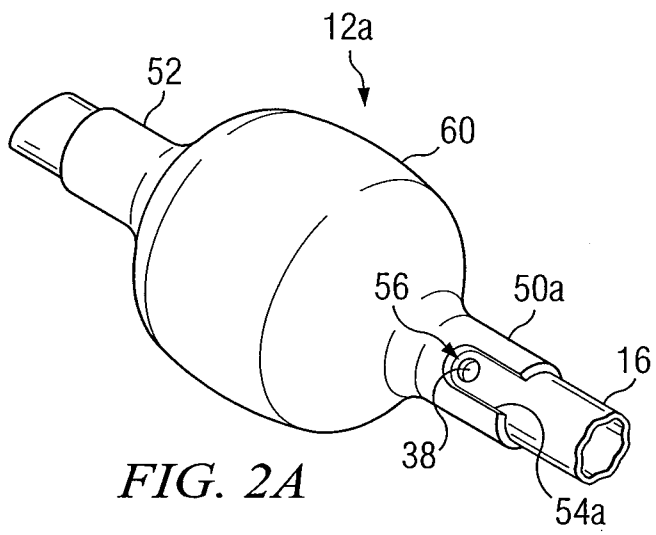
50. A method according to Claim 48, wherein inflating the cuff occurs before conveying gas through the tubular body.

51. A method according to Claim 48, further comprising suctioning matter that collects proximate the inflatable cuff.

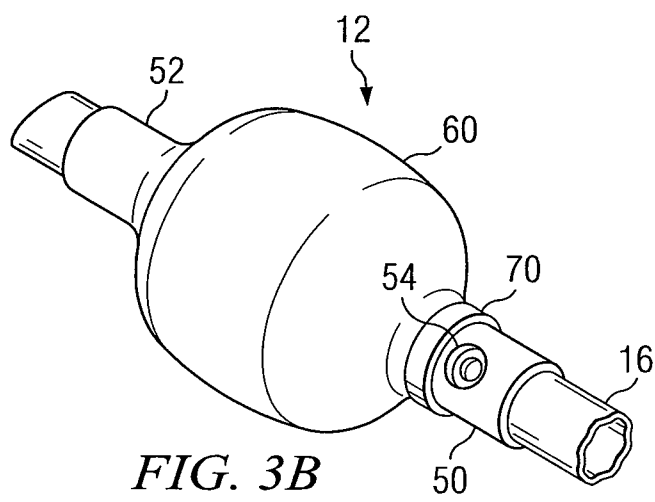
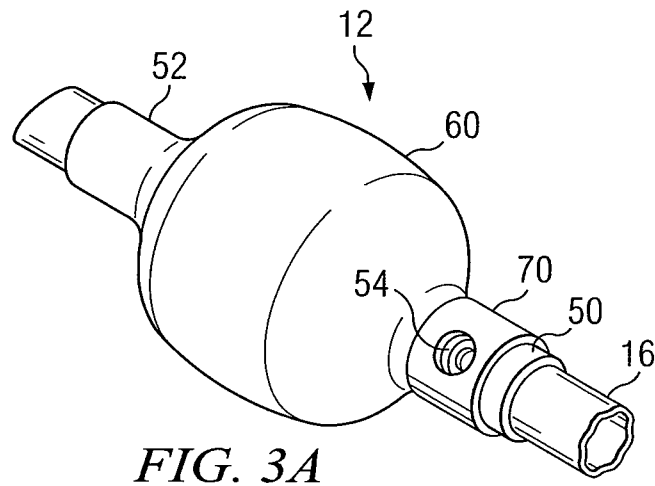
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3/6



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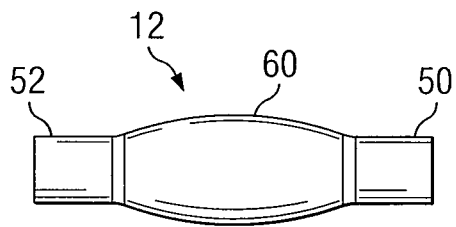


FIG. 4A

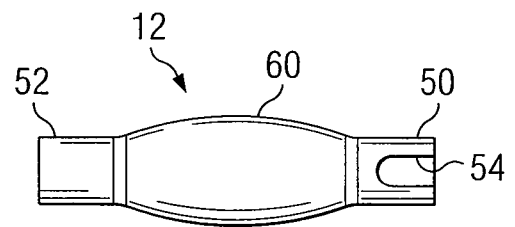


FIG. 4B

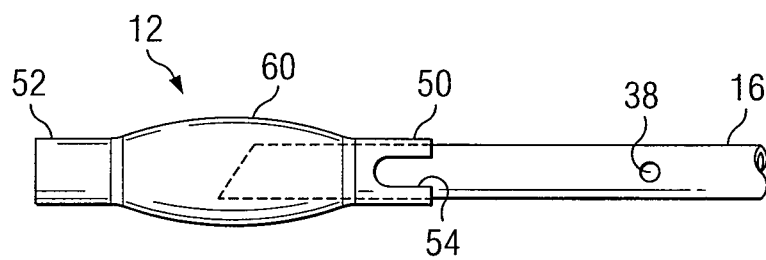


FIG. 4C

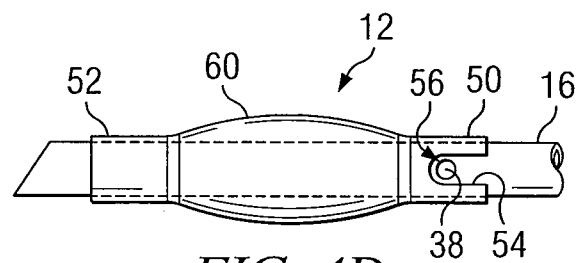


FIG. 4D

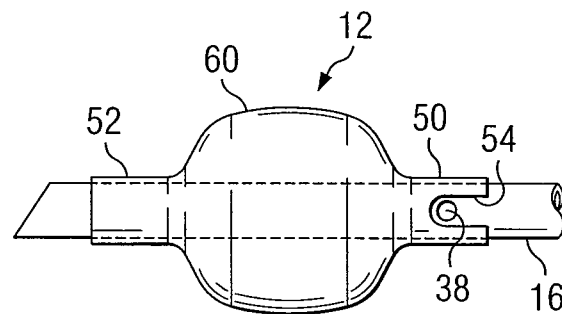


FIG. 4E

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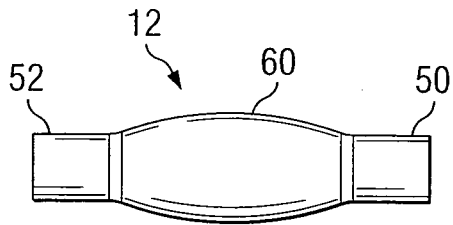


FIG. 5A

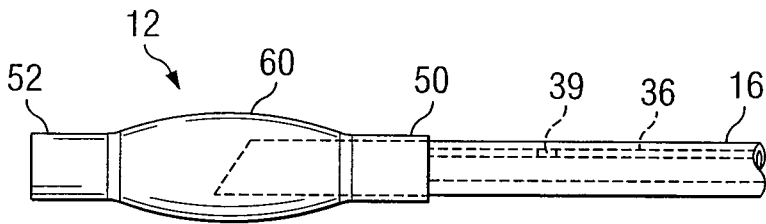


FIG. 5B

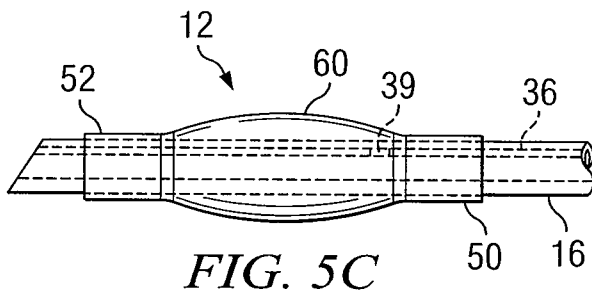


FIG. 5C

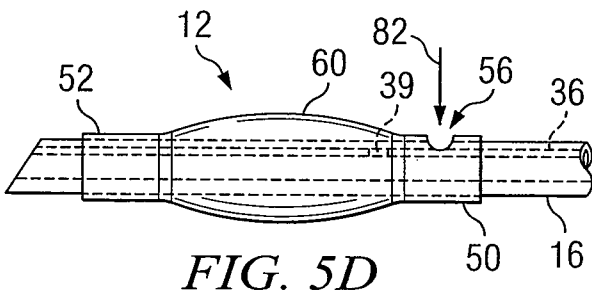


FIG. 5D

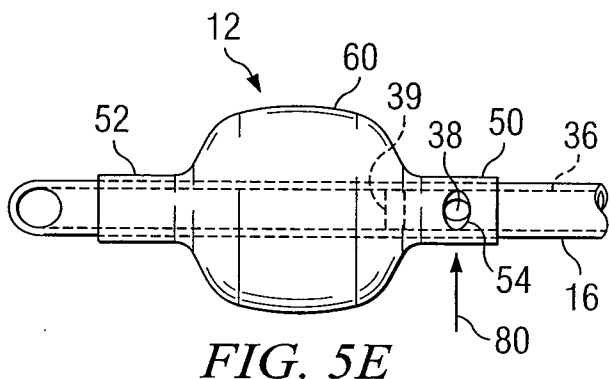


FIG. 5E

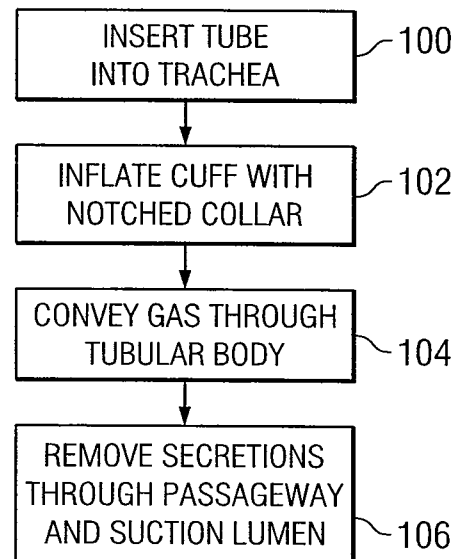


FIG. 6

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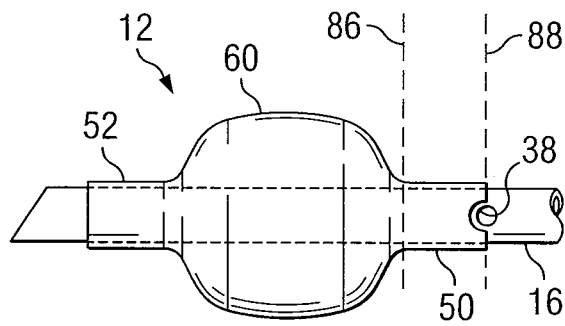


FIG. 7A

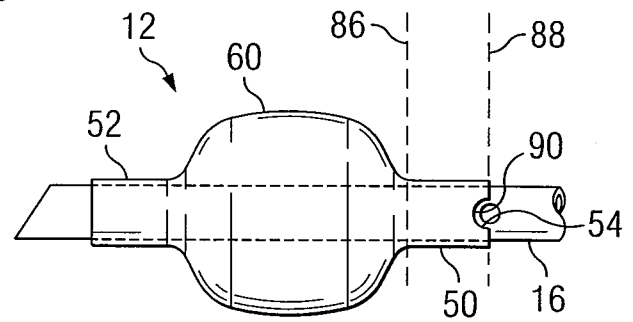


FIG. 8A

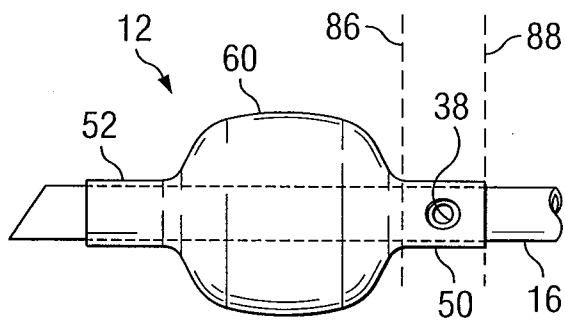


FIG. 7B

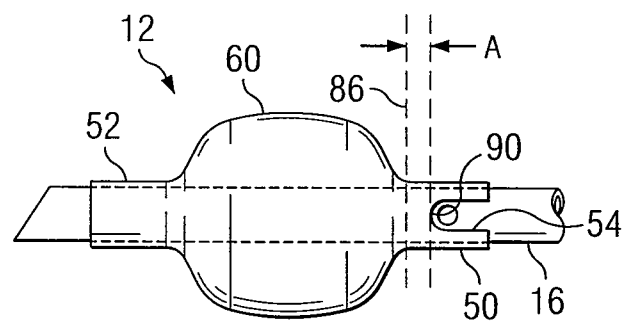


FIG. 8B

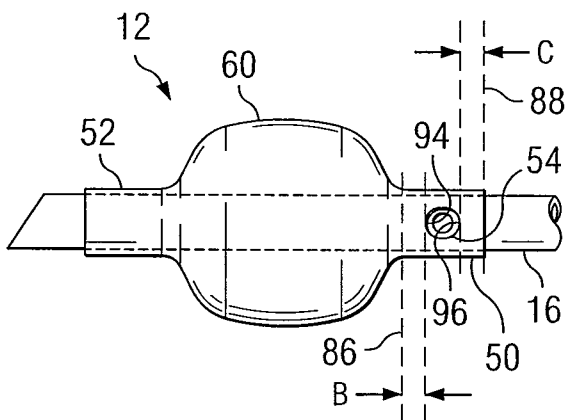


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2007/073597

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61M16/04 A61M25/00
ADD. A61M25/10

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)

A61M

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 328 615 A (PALAZZO MARK GEORGE ANTHONY [GB]; SONI NEIL [GB]) 3 March 1999 (1999-03-03) page 6, line 13 - page 7, line 10 figure 3	1-47
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document 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

Z document member of the same patent family

Date of the actual completion of the international search

9 November 2007

Date of mailing of the international search report

20/11/2007

Name and mailing address of the ISA/

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Fax: (+31-70) 340-3016

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Azaïzia, Mourad

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2007/073597

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 2005/112796 A (NELLCOR PURITAN BENNETT INC [US]; COLBURN JOEL C [US]; CLEMENT DOUGLAS) 1 December 2005 (2005-12-01) cited in the application the whole document	1-47
A	EP 0 489 507 A (SMITHS INDUSTRIES PLC [GB]) 10 June 1992 (1992-06-10) the whole document	1-47
A	US 4 840 173 A (PORTER III JOHN W [US]) 20 June 1989 (1989-06-20) the whole document	1-47
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A	US 2004/255951 A1 (GREY CHRISTOPHER [US]) 23 December 2004 (2004-12-23) the whole document	1-47

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2007/073597

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

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.: 48-51
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery and/or therapy
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. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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 allsearchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an 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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2007/073597

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