

[54] INTUBATION DEVICE FOR THE
INHALATION OF GASSES

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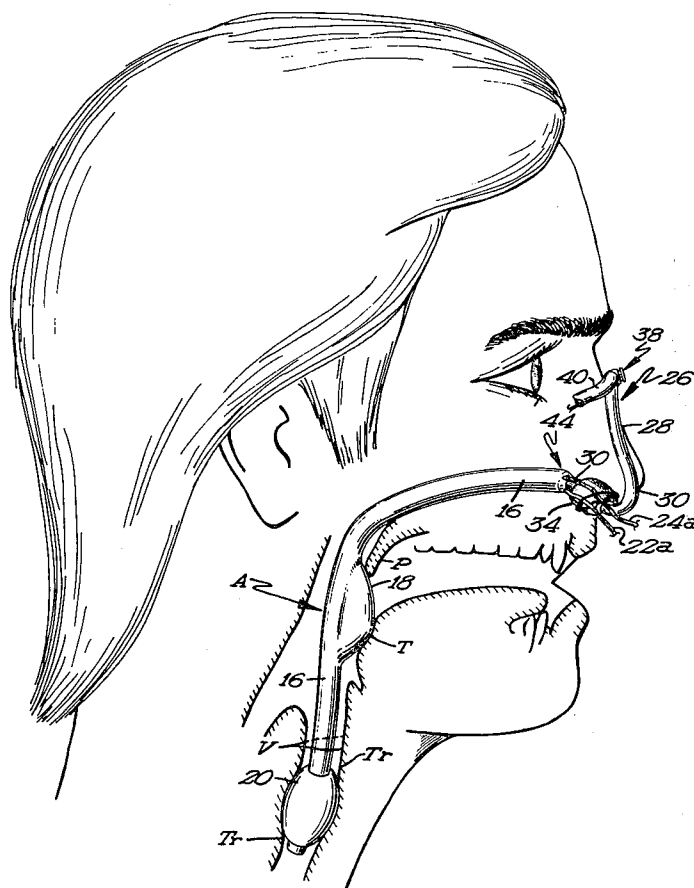
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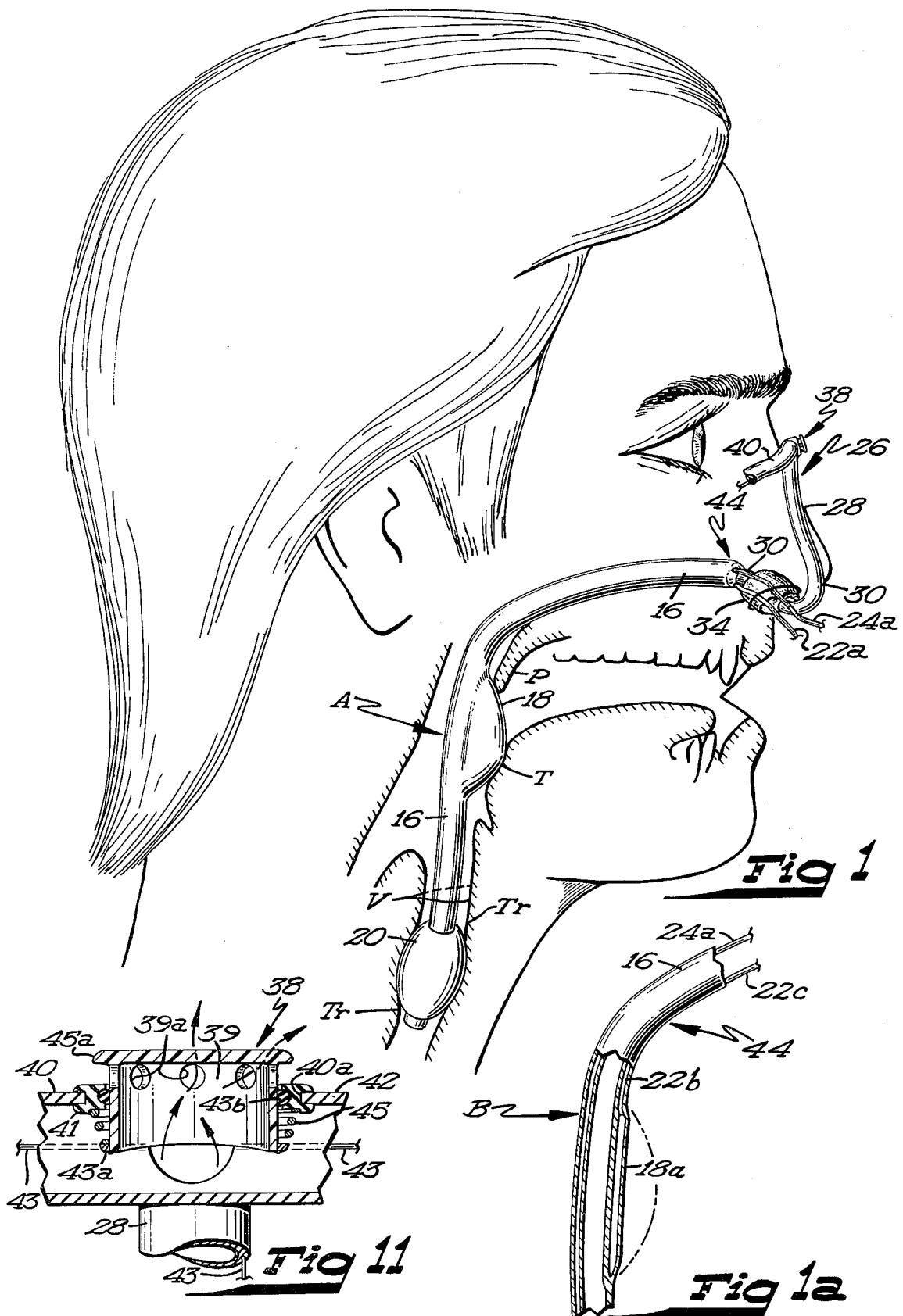
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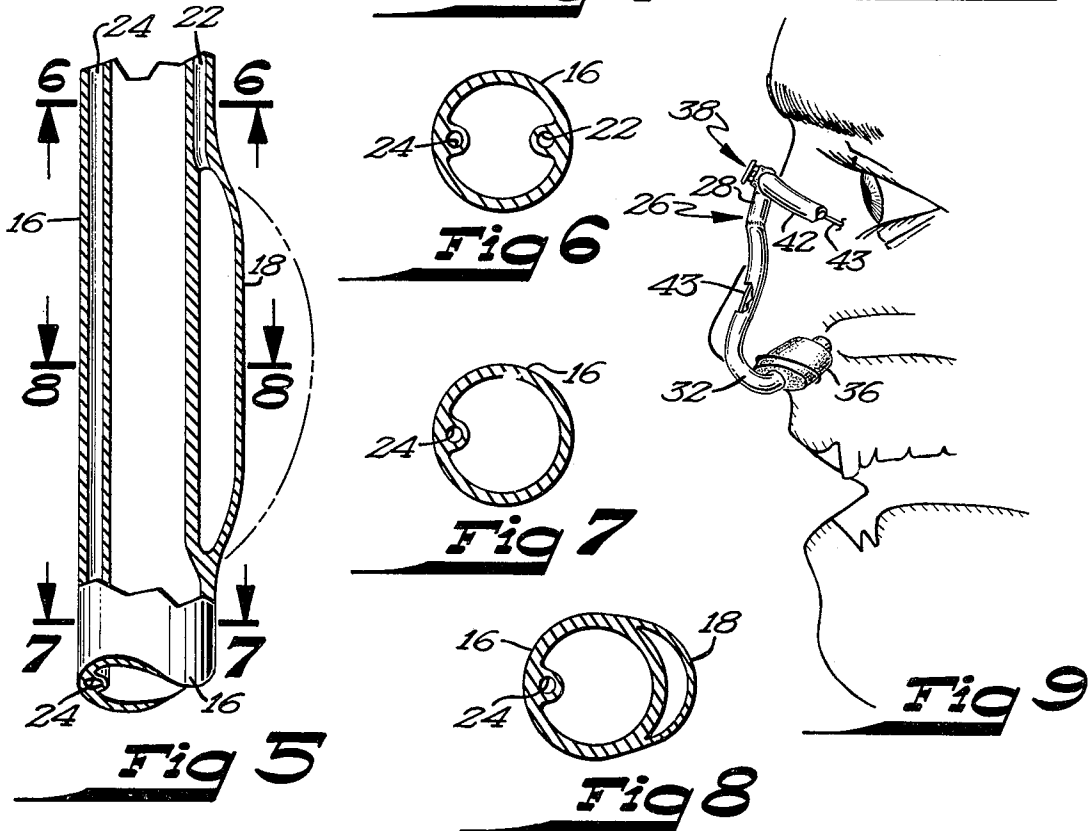
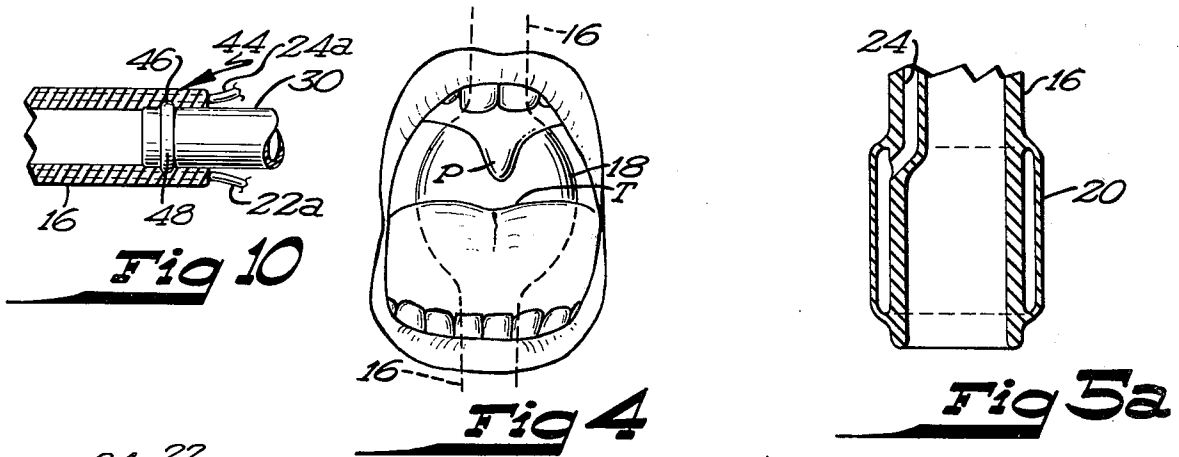
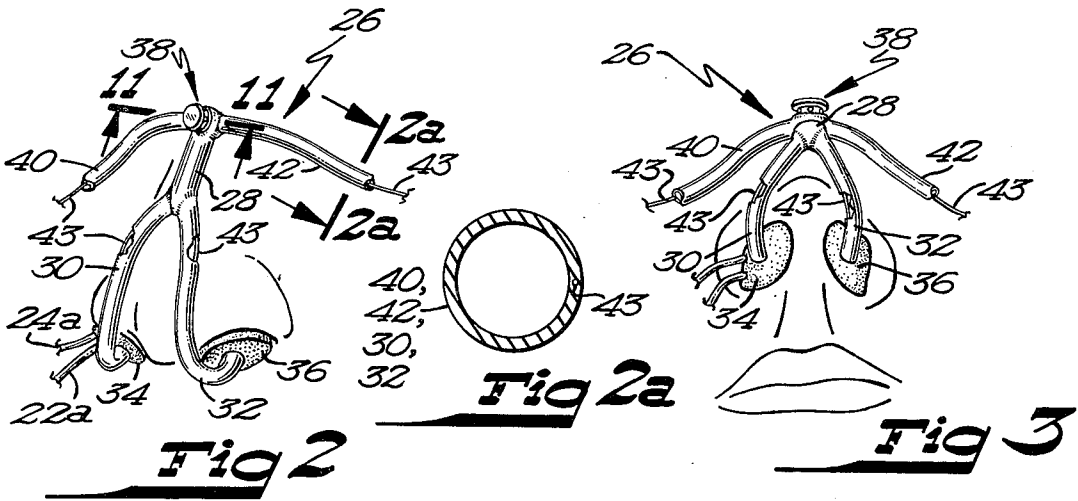
[57] ABSTRACT

An intubation device for inhalation of gases including a cannula connected to an endotracheal tube having a first inflatable member mounted thereon for sealing contact with the base of the tongue, the soft palate and lateral pharyngeal walls together with a fluid supply tube for inflating the first inflatable member. A second inflatable member mounted on the tube for sealing contact with the trachea with a fluid supply tube for inflating the second inflatable member and a device for connecting one of the leads of the cannula to the outer end of the tube. An oro-pharyngeal tube having a single inflatable barrier for sealing contact with the base of the tongue, soft palate and lateral pharyngeal walls together with a fluid supply tube for inflating the inflatable barrier and a device for connecting one of the cannula leads to the other end of the tube.

9 Claims, 14 Drawing Figures







INTUBATION DEVICE FOR THE INHALATION OF GASSES

SUMMARY

The invention is in the field of the administration of anesthetics and/or oxygen for surgical procedures with access to the oral cavity, face and neck in two environments which are (I) the operating room of a hospital and (II) an oral surgery office or an out patient clinic in either case where the level of anesthesia is relatively light compared to that of the operating room.

Currently used in environment (I) above is an endotracheal tube with an inflatable cuff at the lower end which positions below the vocal chords, the cuff forming a barrier between the oral cavity and the tracheo-bronchial tree which prevents aspiration of blood, bone, tooth fragments, wire, etc. As the tube exits from the nose a hardware connection is required. This with the supply of anesthetic located behind the head of the patient requiring the hardware to pass up over the nose and head. This arrangement restricts access to the premaxillary area (upper front jaw) and puts excessive forces on the soft tissues of the nose which frequently produce trauma. Such a tube with the aforementioned inflatable cuff provides no barrier between the oral cavity and oro-pharynx and unknown foreign matter and surgical debris in that area can pass into the trachea when the cuff is deflated. To remedy such a situation it is common to put a moist sponge around the tube in the area of the oro-pharynx to prevent debris from gaining access to areas of the oro-pharynx; however, debris can become trapped without notice in the sponge or can bypass the sponge without notice thereby gaining access to the oro-pharynx and trachea when sponge and tube are removed.

Currently as to environment (II) above, the level of anesthesia is much lighter and anesthetic is delivered only by a mask; no tube is placed into the trachea. The nasal mask, which is totally outside the respiratory tract, provides nothing to maintain a reliable and patent airway or to maintain an effective barrier between the oral cavity, oro-pharynx, and the trachea. Effective sealing of the mask against the surface of the face is difficult to achieve and impossible to maintain during longer procedure due to movement of the patient. An effective seal between the patient and the anesthetic delivery apparatus is important in order to prevent escape of anesthetic gases and oxygen into the operatory environment and to prevent the patient's inspiration of atmospheric air (thus diluting the effect of the administered anesthetics or oxygen). With a mask a "gauze curtain" is used to partition the oral cavity from the oro-pharynx. This "gauze curtain" is adequate for short duration surgery but it is inadequate for longer procedures because it acts as a trap for debris, is moved by actions of the patient, operator or assistants which causes openings allowing aspiration of debris into the lungs. The "gauze curtain" also becomes saturated with blood and saliva thereby allowing fluids to pass through it into the upper respiratory tract. Also when the patient moves, the mask seal against the face is broken. In addition, the mask severely limits surgical access to the anterior portion of the maxilla.

It is generally an object of the invention to provide mechanisms for the elimination of the above difficulties while providing adequate and efficient inhalation of an-

esthetics and oxygen under both environments (I) and (II) above.

It is an object of the invention to provide an anesthetic nasal cannula which replaces the currently used nasal mask in environment (II) above. It also replaces the hardware for attaching the gas supply tube to the anesthetic machine in environment (I) above, all of which does away with trauma to the nose and improves access to the surgical fields of the face and oral cavity.

Further, the cannula is combined with the endotracheal tube for operation in environment (I) above with the attendant benefits herein set forth. The tubular portions of the cannula have soft bendable wires that take a fix molded in the wall thereof whereby the portions may be formed to accommodate contours of the face.

In addition, the nasal cannula provides a positive air seal with the nose for more efficient administration of gases in environment (II) above.

It is a further object of the invention to provide a nasopharyngeal tube having an inflatable barrier which forms an effective barrier between the oral cavity and the oro-pharynx with the tube connected to the above mentioned cannula for use in environment (II) above. The barrier contacts the base of the tongue, the soft palate and the tonsils or if no tonsils, the mucosa of the tonsillar fossae when inflated and does away with the conventional "gauze curtain" and its deficiencies. The naso-pharyngeal tube is used with the cannula as set forth herein.

It is a still further object of the invention to provide for use in environment (I) above the cannula together with a naso-endotracheal tube having the inflatable oro-pharyngeal barrier and an inflatable cuff on the lower end of the tube which when inflated blocks the trachea just below the vocal chords. This allows free access to all surgical fields, gives a patency of airway and seal of airway against leak, gives an effective partition between oral cavity and oro-pharynx, and provides positive locking between the endotracheal tube and the nasal-cannula which connects the endotracheal tube and the nasal-cannula which connects the endotracheal tube to the anesthetic machine. Presently all connections to the currently used naso-endotracheal tube are "friction grip" only with no positive locking capabilities.

For a light plane of anesthesia as used in environment (II), the cannula by itself may be used instead of the conventional mask with its attendant problems. The benefits are, when compared to the use of a mask, free access to intra-oral surgical fields, the cannula stays in place providing a seal much better than a nasal mask and the compressible nose bulbs on the cannula provide an effective seal for the device preventing leaking of anesthetic gases into the operatory and the patients inhalation of room air.

In the drawings forming part of this application:

FIG. 1 is a side elevational view of a human head with the intubation device embodying the invention in operative position with portions of the head broken away and the oropharyngeal barrier and the endotracheal tube cuff inflated.

FIG. 1a illustrates a portion of the nasopharyngeal tube at the area of the oro-pharyngeal inflatable barrier a portion of which is in section.

FIG. 2 is a perspective view of the nose-engaging portion of the nasal cannula in position on a nose partially shown.

FIG. 2a is an enlarged sectional view on the line 2a—2a of FIG. 2.

FIG. 3 is a bottom plan view of that shown in FIG. 2.

FIG. 4 is a front elevational view of the upper inflatable cuff in inflated position shown in operative position in contact with the soft palate and the base of the tongue with the mouth fully open.

FIG. 5 is a longitudinal sectional view of a portion of the nasal-pharyngeal tube showing the inflatable oropharyngeal barrier deflated in full lines and shown inflated in broken lines.

FIG. 5a is a sectional view on the line 5a—5a of FIG. 1.

FIG. 6 is a sectional view on the line 6—6 of FIG. 5 with the barrier in a collapsed condition.

FIG. 7 is a sectional view on the line 7—7 of FIG. 5.

FIG. 8 is a sectional view on the line 8—8 of FIG. 5.

FIG. 9 is a side elevational view of the nasal cannula of FIGS. 2 and 3 in position on a human head.

FIG. 10 is a sectional view of the connection of the intubation tube with one of the cannula nose leads.

FIG. 11 is a sectional view on the line 11—11 of FIG. 2.

ENDOTRACHEAL TUBE

Referring to the drawings in detail, the intubation device A for inhalation of anesthetics and oxygen for use in the operating room of a hospital as environment (I) includes in one form the endotracheal tube 16 which has formed intermediate the ends thereof the oropharyngeal inflatable barrier 18 and adjacent the lower end thereof is formed the inflatable endotracheal barrier 20 which surrounds the tube 16. The tube 16 is of such a length that in use the barrier 20 is positioned at a point below the vocal chords illustrated as V and such a tube may be referred to as a naso-endotracheal tube.

The barrier 18 is actually an expandable enclosed and enlarged formation on the tube, and the wall of the tube 16 has the conduit 22 internally and longitudinally thereof and in communication with the inside of the barrier 18. Connected to the conduit 22 is the external ancillary tube 22a for injection of air into inflatable barrier 18 by a hand syringe or other source of air whereby the barrier may be inflated when in operative position. The barrier 18 is so positioned on the tube 16 so that it contacts the soft palate P, the base of the tongue T and the mucosa of the tonsillar fossae when inflated.

The wall of the tube 16 is formed with a second conduit 24 internally and longitudinally thereof which extends to the inflatable cuff 20 and which leads to a second external ancillary tube 24a for injection of air into inflatable cuff 20 by the means above described whereby the cuff may be inflated in the manner above and as indicated in FIGS. 1 and 4. The inflated cuff 20 in operative position as in FIG. 1 seals the trachea Tr. The length of the tube 16 is such that it accommodates a person with a relatively large head and may be adjusted for proper position of the barriers 18 and 20 by moving the tube in or out of the nose.

CANNULA

With reference to the drawings, the numeral 26 designates an anesthetic nasal cannula which includes the tubular central portion 28 which terminates in the first tubular lead 30 and the second tubular lead 32 which branch off the central portion. The cannula is used in

both environments (I) and (II). Positioned on the end of the lead 30 is the compressible collar 34 and positioned on the end of the lead 32 is the compressible collar 36. The collars 34 and 36 are made of a sponge rubber material or the like and the same engage with a frictional fit within the nostrils of the nose.

The upper end of the cannula central portion 28 terminates in a one-way exhaust valve 38 and from the valve extends the first and second supply tubes 40 and 42, respectively.

The valve 38 includes the cylindrical cap member 39 which has the openings 39a formed in the wall thereof. At the juncture of the supply tubes 40 and 42 and the central portion 28 is formed the circular opening 40a in which is mounted the annular double slotted ring 41. The outer slot of the ring 41 engages at the edges of the opening 40a and positioned in the inner slot of the ring is the O-ring 43b which has sealing engagement with the outer wall surface of the cap member 39.

The cap 39 has formed on the lower end thereof the annular flange 43a and positioned between the flange 43a and the ring 41 is the coil spring 45 which urges the cap into a closed position with the top annular flange 45a of the cap into contact with ring 41. In operation the valve opens when the patient exhales and closes when the patient inhales. The supply tubes 40 and 42 lead to a conventional pressurized source of anesthesia and oxygen not shown.

The tubular portions 28, 30, 32, 40 and 42 of the cannula have soft bendable wires 43 molded in the walls which take a fix whereby portions of the tubular portions of the cannula may be formed to accommodate contours of the face.

NASALPHARYNGEAL TUBE

Further provided is an intubation device B which includes the nasalpharyngeal tube 44, particularly FIG. 1a which includes the inflatable barrier 18a identical to barrier 18 and having an air supply conduit 22b identical to supply conduit 22. The tube 44, however, does not require nor have the conduit 24 of the tube 16. The length of the tube 44 is such that the barrier 18a on the lower inner end contacts the soft palate P and the base of the tongue T when inflated as does the barrier 18. The length of the tube 44 is such that it accommodates a person with a relatively large head and may be adjusted by moving the tube in or out of the nose. The tube 44 has on its outer end a connection the same as with tube 16 with a cannula lead 30 or 32 as shown in detail in FIG. 10. The lead not used is plugged with any conventional plug. The nasalpharyngeal tube is used in environment (II) above referred to such as out patient clinic or oral surgery office and used with the cannula 26. Connected to the conduit 22b is the external ancillary tube 22c for injection of air into the inflatable barrier 18a by a hand syringe or other source of air.

OPERATION

The cannula 26 is used by the general dentist, e.g., for inhalation of nitrous oxide to produce relative analgesia (relief of pain only) for general dental procedure with which the patient is conscious and can cough up debris. The supply lines 40 and 42 are hooked up to conventional anesthetic machine and the compressible collars of the leads 30 and 32 are positioned within the nostrils of the nose. This allows administration of an an-

algnesia without the trauma of a face mask and the difficulties encountered as heretofore set forth.

The cannula 26 is also used by the oral surgeon when performing short duration procedures under intravenous anesthesia (unconscious) which gives relief of pain where the patient is unconscious or under conditions when oxygen is needed with the patient not fully under the effect of the anesthesia.

Further, the inhalation therapist may use the cannula 26 to administer oxygen to, e.g., coronary patients or any patient requiring oxygen.

As to use of the cannula 26 by the oral surgeon, the patient is anesthetized by intravenous anesthetics and upon the loss of consciousness gas is turned on and the cannula applied as set forth above. The tubular portions of the cannula are then formed to adapt to the contours of the face.

As to use of the naso-pharyngeal tube B, the same is used by the oral surgeon only and the steps for use are as follows: the patient is given intravenous anesthetics to produce unconsciousness of the patient. The naso-pharyngeal tube B is then lubricated and a syringe is attached to the supply tube 22c. The tube 44 is then inserted through a nostril of the nose to substantially four-fifths of its length. The gas is then turned on. Then one of the cannula leads is engaged and locked onto the outer end of the tube 44. A plug is then inserted into the end of the remaining cannula lead to occlude it. Next the tube 44 is inserted fully as in FIG. 1. The cannula tubular portions are then formed to adapt to the contours of the face. The barrier 18a is then inflated by means of the supply tube 22c to appropriate volume so that it forms a positive seal on the soft palate, the base of the tongue and the tonsils or if the tonsils are removed the mucosa of the tonsillar fossae.

As to use of the naso-endotracheal tube A with the cannula in environment (I) the steps are as follows: first the patient is placed on a table and anesthetized intravenously. The patient is paralyzed with a suitable skeletal muscle paralytic agent and then is oxygenated using a face mask. The tube 16 is lubricated and inserted through the nose into the oro-pharynx. The vocal chords are then visualized by using a laryngoscope whereby the tube may be properly aimed. The tube is then inserted between the vocal chords with the barrier 20 just beyond the vocal chords and into the trachea. The gas is then turned on. One lead of the cannula is connected to the tube 16 and locked thereon with the other lead of the cannula blocked by a plug. The tubular portions of the cannula are adapted to the contours of the face as previously set forth. The barrier 20 is then inflated by means of the supply tube 22 and the barrier 18 is inflated by supply tube 22a. The surgeon may then go to work.

The barrier 20 is a back up to the barrier 18 in the event foreign material gets past barrier 18. The barrier 18 provides a seal far more reliable than a conventional surgical "gauze curtain" heretofore referred to. A conventional "gauze curtain" becomes saturated with blood and loses its seal with the base of the tongue and soft palate.

I claim:

1. An intubation device for inhalation of gases comprising in combination:

- a. a cannula including a central tubular portion having at the lower end

- b. first and second tubular leads extending from the lower end thereof,
 - c. means for sealing at least one of the outer end portions of the leads within the nose,
 - d. a one-way exhaust valve carried by said central tubular portion,
 - e. means for supplying gases to said central tubular portion,
 - f. an endotracheal tube connected to one of said leads for insertion into the nose and down into the trachea,
 - g. said tube having a first inflatable member mounted thereon for sealing contact with the base of the tongue, the soft palate and lateral pharyngeal walls when inflated,
 - h. means for inflating said first inflatable member,
 - i. a second inflatable member mounted on said tube at the lower end thereof for sealing contact with the trachea inferior to the vocal chords,
 - j. means for inflating said second inflatable member, and
 - k. means connecting one of said leads of said cannula to the outer end of said tube.
2. The device of claim 1 in which said means for sealing of the outer end portion of the cannula leads within the nose is a compressible bulb carried by each of the leads.
3. The device of claim 2 in which said means for supplying anesthetic or the like to said central tubular portion includes first and second supply tubes connected to a source of gas.
4. The device of claim 3 in which
- a. said means for inflating said first inflatable member includes a first conduit formed in the wall of said tube and communicating with the interior of said first inflatable member the outer end of said first conduit terminating in
 - b. an air supply tube.
5. The device of claim 4 in which
- a. said means for inflating said second inflatable member includes a second conduit formed in the wall of said endotracheal tube and communicating with the interior of said second inflatable member.
6. An intubation device for inhalation of gases comprising in combination:
- a. a cannula including a central tubular portion having at the lower end,
 - b. first and second tubular leads extending from the lower end thereof,
 - c. means for sealing each of the outer end portions of the leads within the nose,
 - d. a one-way exhaust valve carried by said central tubular portion,
 - e. means for supplying gases to said central tubular portion,
 - f. an oro-pharyngeal tube connected to one of said tubular leads for insertion into the nose and down into the oro-pharynx,
 - g. said tube having an inflatable member mounted thereon for sealing contact with the base of the tongue, soft palate and lateral pharyngeal walls when inflated,
 - h. means for inflating said inflatable member, and
 - i. means connecting one of said leads of said cannula to the outer end of said tube.
7. The device of claim 6 in which said means for sealing the outer end portions of the cannula leads within

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the nose is a compressible bulb carried by each of the leads.

8. The device of claim 7 in which said means for supplying a gas to said central tubular portion includes first and second supply tubes connected to a source of gas. 5

9. The device of claim 8 in which

a. said means for inflating said inflatable member in-

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cludes a conduit formed in the wall of said tube and communicating with the interior of the inflatable member, the outer end of said conduit terminating in

b. an air supply tube.

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