

[54] **METHOD AND APPARATUS FOR
ENDOTRACHEAL INTUBATION**

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[58] Field of Search **128/6, 351**

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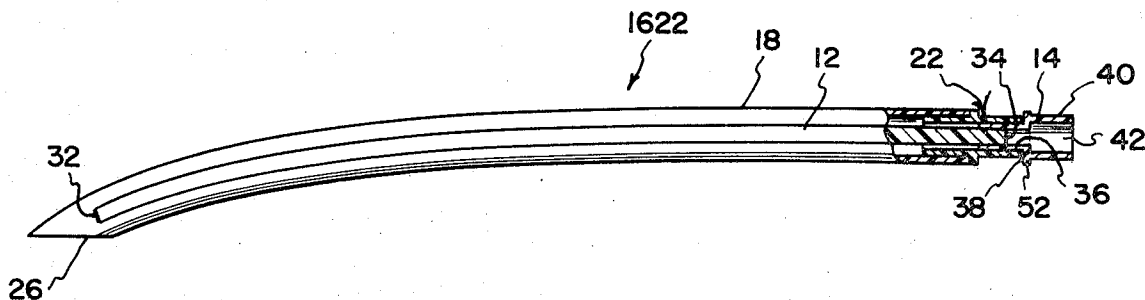
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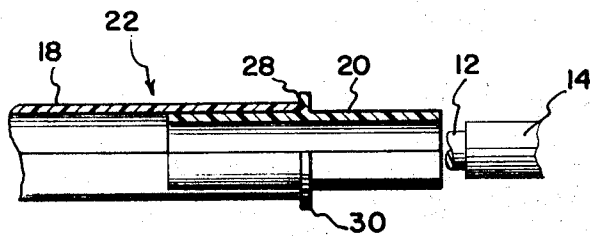
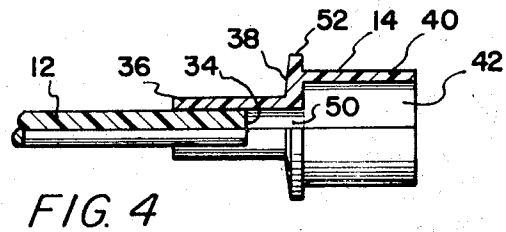
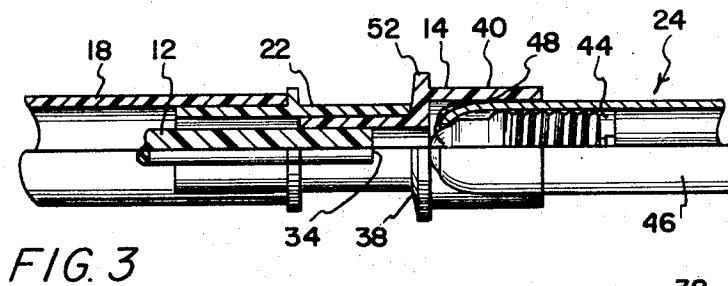
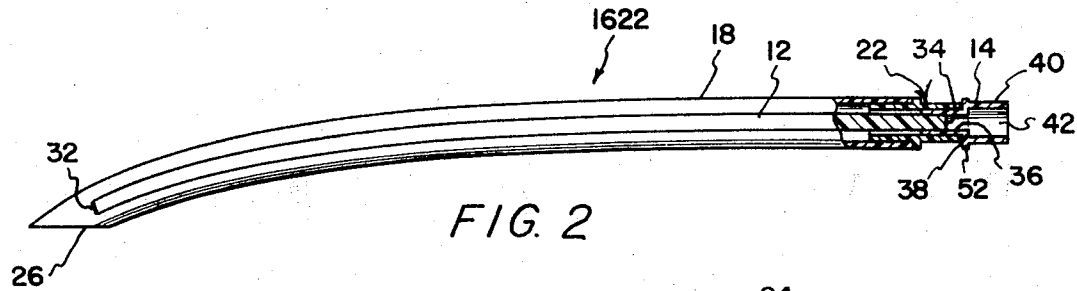
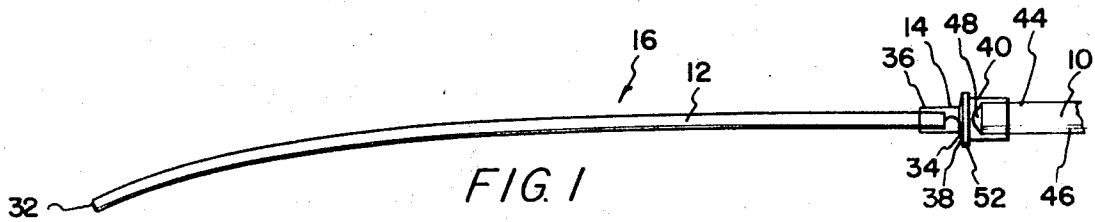
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[57] **ABSTRACT**

This invention relates to novel apparatus for endotracheal intubation which comprises a rigid acrylic rod sized to fit easily inside a trachea tube and extend from end-to-end thereof, and a source of illumination fastened to one end of the rod in position to direct a light beam therealong, said light source and rod cooperating to stiffen the trachea tube while illuminating the area beyond the distal end thereof. The invention also encompasses the unique method for inserting a flexible tube into the trachea which includes the steps of stiffening the tube by inserting a rigid acrylic rod therein, illuminating the area beyond the distal end of said tube by directing a light beam into the proximal end of the rod, passing the distal end of the rod thus sheathed into the larynx illuminated thereby, and removing the rod and associated light source from the proximal end of the tube while the latter remains in place.

5 Claims, 5 Drawing Figures





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METHOD AND APPARATUS FOR ENDOTRACHEAL INTUBATION

In recent years, inhalent anesthetics have become more and more widely used in the field of veterinary medicine. Their increased popularity is primarily attributable to two factors, namely, the vastly improved anesthetics themselves and the considerably less expensive machines to administer same.

One procedure employed in the administration of an inhalent anesthetic to animals is known as "endotracheal intubation" which, in lay language, means the insertion of a tube into the larynx of the patient to be anesthetized. Several different techniques are used in carrying out the above procedure, none of which is foolproof or easily mastered. An experienced veterinarian can usually insert a trachea tube faster and more easily than his non-professional assistants. However, a great deal still depends upon the manual dexterity of the individual whether he be a professional or otherwise and, in the case of small animals such as cats and the like, even the most accomplished intubator runs into difficulty.

The three factors that contribute most heavily to the aforementioned difficulties are the flexibility of the trachea tube, the absence of illumination deep inside the oral cavity, and the close quarters at the back of the throat which precludes the use of the fingers or most other instruments that would be helpful in holding the epiglottis depressed while probing for the entrance to the larynx. The smaller the mouth of the patient, the greater the problems experienced by the doctor or his assistant in carrying out the intubation procedure.

It has now been found in accordance with the teaching of the instant invention that these and other problems associated with endotracheal intubation procedures can, in large measure, be eliminated by the simple, but unobvious, expedient of rigidifying the trachea tube by inserting a stiff acrylic rod therein while, at the same time, illuminating the entrance to the larynx by directing a source of visible light into the proximal end of the rod that emerges as a beam at the far end thereof. The resulting structure is rigid enough to serve as both a tongue and epiglottis depressor thus eliminating the need for inserting the fingers or some other instrument into the patient's mouth for this purpose. This same temporary rigidification of the tube enables the operator to accurately insert the distal end thereof into the larynx without injuring the patient's throat. Equally significant, however, is the introduction of light well back into the throat where the entrance to the larynx is brightly illuminated by means of a source completely external of the patient's mouth.

The procedure for inserting the tube becomes a simple one wherein the operator merely inserts the rod with the source of illumination connected to the proximal end thereof into the trachea tube preparatory to making the insertion of the latter. Then, once the insertion has been accomplished, the rod and attached light source are withdrawn from the tube while leaving it in place in the patient's trachea. Finally, the anesthesia machine is connected to the proximal end of the tube in place of the aforementioned illuminated rod subassembly.

It is, therefore, the principal object of the present invention to provide a novel apparatus for endotracheal intubation.

A second objective of the invention herein disclosed and claimed is the provision of a unique method for introducing a flexible trachea tube into a patient.

Another object of the within described invention is to provide a means for illuminating the back of a patient's throat from a light source external thereof while using the conductor for the light beam as a stiffening member for a flexible trachea tube.

Still another objective is the provision of endotracheal apparatus which has sufficient temporary rigidity to depress both the patient's tongue and epiglottis while insertion of the flexible tube into larynx is being accomplished.

An additional objective of the invention forming the subject matter hereof is the provision of a method for endotracheal intubation which is simple, foolproof and easily mastered by even unskilled technicians.

Further objects are to provide apparatus for inserting trachea tubes that is non-toxic, relatively inexpensive, compatible with existing inhalation-type anesthesia machines, rugged, safe, versatile, compact, easy to service and repair, and one that is even decorative in appearance.

Other objects will be in part apparent and in part pointed out specifically hereinafter in connection with the description of the drawings that follows, and in which:

FIG. 1 is a side elevation of the subassembly that includes the rod and connector on the proximal end thereof, such subassembly being shown connected to a self-contained source of illumination, portions of the latter having been broken away to conserve space;

FIG. 2 is a side elevation of the subassembly that includes the rod, rod connector, trachea tube and tube coupling, the area where all four of the aforesaid elements are joined together having been broken away and shown in diametrical section;

FIG. 3 is a fragmentary side view to an enlarged scale showing the elements of the entire endotracheal assembly connected together in assembled relation, the lower half having been shown in elevation while the upper half is in radial section;

FIG. 4 is a fragmentary detail to an enlarged scale, part of which is in section and part in elevation, showing the connection between the rod and its connector; and,

FIG. 5 is a fragmentary detail similar to FIG. 4 and to the same scale, partly in section and partly in elevation, showing the tube and tube coupling with the rod connector and fragment of the rod positioned for insertion into the latter.

Reference will now be made to the drawings for a detailed description of the present invention and, initially, to FIG. 1 for this purpose wherein the source of illumination 10 has been shown connected into the proximal end of the subassembly that includes rod 12 and its connector 14, the latter subassembly having been designated in a general way by numeral 16. Similarly, in FIG. 5, the conventional subassembly that includes the flexible trachea tube 18 and the coupling 20 on the proximal end thereof that is already used to releasably fasten same to the gas delivery tube (not shown) of an inhalation-type anesthesia machine (also not shown) has been referred to in a general way by numeral 22. FIG. 2 shows the subassembly 1622 that comprises a combination of the aforementioned subassemblies 16 and 22, whereas, FIG. 3 shows the complete endotra-

cheal intubation assembly that includes subassembly 1622 of FIG. 2 along with light source 10, such having been assigned reference numeral 24.

The trachea tube and coupling subassembly 22 as revealed most clearly in FIG. 5 includes an elongate transparent flexible tube 18 having the distal end thereof which enters the opening in the patient's larynx cut on the bias as shown at 26 in FIG. 2. These tubes are fabricated from one of the severable moldable plastic materials that are both non-toxic and flexible enough to bend easily yet remain resistant to collapse. They must, of course, be sufficiently heat-resistant to undergo sterilization and non-reactive in the presence of the various chemical compounds used in inhalation anesthesia. The tube must also, for obvious reasons, be relatively safe and non-abrasive to the touch so as to not injure or abrade the delicate throat tissues. These tubes come in several sizes adapted to pass easily into the entrance to the larynx and on down into the tracheas of various different animal species while still admitting a sufficient volume of gaseous anesthetic to anesthetize the animal and maintain this condition until the particular procedure requiring anesthetization is complete.

The coupling 20 comprises, in the particular form shown, a short section of rigid tubing whose distal end is sized to telescope into the proximal end 28 of the trachea tube 18. The proximal end of this same coupling ordinarily couples in much the same manner to the gas delivery tube of an inhalation-type anesthesia machine. As illustrated, the coupling is encircled intermediate its ends by an annular rib 30 that defines a stop abutting the trachea tube on the distal face thereof and the aforementioned gas delivery tube on its proximal face.

The aforementioned elements are, as previously mentioned, old in the art and the only novelty claimed therefor is in combination with the subassembly 16 that includes the rod 12 and its connector 14 which is further combined with light source 10 to produce the endotracheal assembly 24. Before proceeding with a detailed description of the latter assembly, however, it will be well to first examine subassembly 16 for which purpose reference will now be made to FIGS. 1 and 4 where it is most clearly revealed.

Rod 12 is relatively rigid and will not bend under its own weight or that of the trachea tube even though supported at only one end. It will, however, bend some under load while remaining stiff enough to depress a patient's tongue or epiglottis or both when sheathed within the trachea tube. The outside diameter of the rod is such as to slip easily inside the tube while its length is such as to extend substantially all the way to the distal end 26 of the latter. The tip 32 is preferably blunted so that it will not injure the delicate throat tissues in case it accidentally comes into contact therewith although, under ideal circumstances, the tip should remain recessed slightly inside the distal end of the tube as shown in FIG. 2 so as to remain covered thereby at all times the intubation procedure is being carried out.

The rod may be straight although experience has shown that a slight downward curve aids in its insertion. This modest curvature also has the advantage of keeping the operator's hand down below his line of sight while he locates the entrance to the patient's larynx and passes the far end of the assembly 24 therethrough.

Probably the single most important characteristic of the rod is its ability to receive a beam of light from a

source of illumination 10 located at the proximal end 34 thereof and conduct same to its far end 32 without scattering said beam en route so it can illuminate the back of the patient's oral cavity containing the entrance to the larynx through which the tube must be passed. The tube must, therefore, be fabricated from a material possessing this light conducting ability, namely, the family of clear acrylic plastics. This property of being able to confine and conduct a light beam to a remote location is, of course, inherent in such materials and it extends to conducting light easily around such modest bends as are shown in rod 12. Nevertheless, the aforementioned property is significant to the present invention and an opaque rod or even a transparent or translucent one that will not conduct light in the manner of the acrylics will not satisfy the requirements of the instant endotracheal apparatus any more than an externally located lamp or flashlight would.

Connector 14 is of simple construction and in some ways resembles coupling 20. In the particular form illustrated, it comprises a molded part having a proximally-extending tubular neck 36 whose outer cylindrical surface is sized to telescope into the distal end of coupling 20 with a frictional fit as shown in FIGS. 2 and 3. The inner cylindrical surface of neck 36, on the other hand, is sized to accept the distal end of rod 12 which is preferably fastened therein more or less permanently with a suitable adhesive or the like so that there is no danger of its coming loose from the connector and escaping into the patient's body out the distal end of tube 18.

The tubular neck 36 of the connector 14 has a distally-facing annular shoulder 38 at the rear end thereof that separates it from proximally-opening cup-shaped chamber 40, the interior of which defines a socket 42 of a size and shape adapted to receive and removably fasten onto the barrel 44 of the flashlight 46 whose bulb 48 shines into the proximal end of the rod 12. Of course, the source of illumination 10 can take many forms other than that of flashlight 46, however, sources other than those operating at low voltages pose certain shock hazards that must be guarded against. Also, those sources regardless of voltage that require a conductor are far more inconvenient for the operation to use than those self-contained battery-operated units commonly known as flashlights, the so-called "penlight" version of which has been illustrated. Such a miniaturized battery powered unit is ideally suited for use as a part of the apparatus forming the subject matter of the present invention because of its compactness, lightweight and safety.

The light from bulb 48 passes distally from socket 42 directly into the proximal end 34 of rod 12 through the central opening 50 that exists where the tubular neck and said socket merge into one another. The annular rib 52 that borders shoulder 34 circumferentially is primarily a fingerhold to give the operator a better grip on the subassembly 16 as well as the entire assembly 24.

Now, in order to carry out the intubation procedure in accordance with the teaching of the method forming the subject matter hereof, the initial step is to take the rod 12 and connector 14 of FIG. 4 and insert them into the subassembly 22 of FIG. 5 by passing the rod through the coupling 20 into tube 18 far enough for said coupling and connector to interengage as shown in FIGS. 2 and 3. The flashlight 46 is next actuated to turn on lamp 48 preparatory to inserting the barrel 44

thereof into the socket 42 of the connector. This completes the endotracheal apparatus as shown in FIG. 3 and it is ready for the operator to use in carrying out the intubation procedure. Once he has located the fully illuminated entrance to the larynx and passed the distal end 26 of tube 18 therethrough into proper position, the flashlight 46 can be extinguished and disconnected from subassembly 16 (rod 12 and its connector 14), whereupon, the latter subassembly can be withdrawn from the subassembly 22 of FIG. 5 leaving the latter in place in the patient. The coupling 20 of subassembly 22 can then, of course, be connected up to the gas delivery tube of the anesthesia machine in the usual manner.

Following use, all of the elements of the assembly can be disconnected from one another and sterilized except for the rod and coupling which preferably remain permanently fastened together. In the preferred form of the invention all of the elements with the exception of flashlight 46 are clear and transparent so that any obstruction, source of contamination or other foreign object will be readily visible to the user.

What is claimed is:

1. Endotracheal intubation apparatus which comprises: an elongate flexible trachea tube having the distal end thereof adapted for insertion into a patient's larynx; a rigid acrylic rod sized to fit into said trachea tube and extend therethrough to a point adjacent said distal end thereof; and, a source of visible light adapted to be connected to the proximal end of the rod, said light source and rod cooperating with one another with said rod inside the tube to stiffen the latter while illuminating the area beyond the far end thereof.

2. The apparatus as set forth in claim 1 in which: a tubular coupling is mounted on the proximal end of the trachea tube adapted for connection to the gas delivery tube of an inhalation-type anesthesia machine; a connector is fastened to the proximal end of the rod, said

connector having its front end adapted to telescope into the proximal end of the tubular coupling and the proximal end thereof formed to provide a proximally-opening socket; and, in which the source of illumination is detachably mounted within the socket in the proximal end of the connector.

3. The subassembly for use in combination with an elongate flexible trachea tube having a tubular coupling on the proximal end thereof adapted for connection to the gas delivery tube of an anesthesia machine, which comprises: an elongate rigid acrylic rod sized to fit inside the trachea tube and extend therethrough substantially to the distal end thereof; and, a source of illumination detachably connected to the proximal end of the rod, said source of illumination and rod cooperating with one another upon insertion of said rod into the tube to stiffen the latter while illuminating the area beyond the distal end thereof.

4. The subassembly as set forth in claim 3 which includes: a connector attached to the proximal end of the rod, said connector having the distal end thereof formed to telescope into the proximal end of the coupling on the proximal end of the trachea tube, and said connector having a proximally-opening socket on the proximal end thereof shaped to detachably receive the source of illumination.

5. The improved method of endotracheal intubation which comprises the steps of: stiffening a trachea tube by inserting a rigid acrylic rod therein all the way to the distal end thereof that first enters the patient; illuminating the area beyond the distal end of the tube by directing a beam of light into the proximal end of the rod; passing the distal end of the rod thus sheathed into the larynx illuminated thereby; and, removing the rod and light source from the tube while leaving the latter in place within the larynx.

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