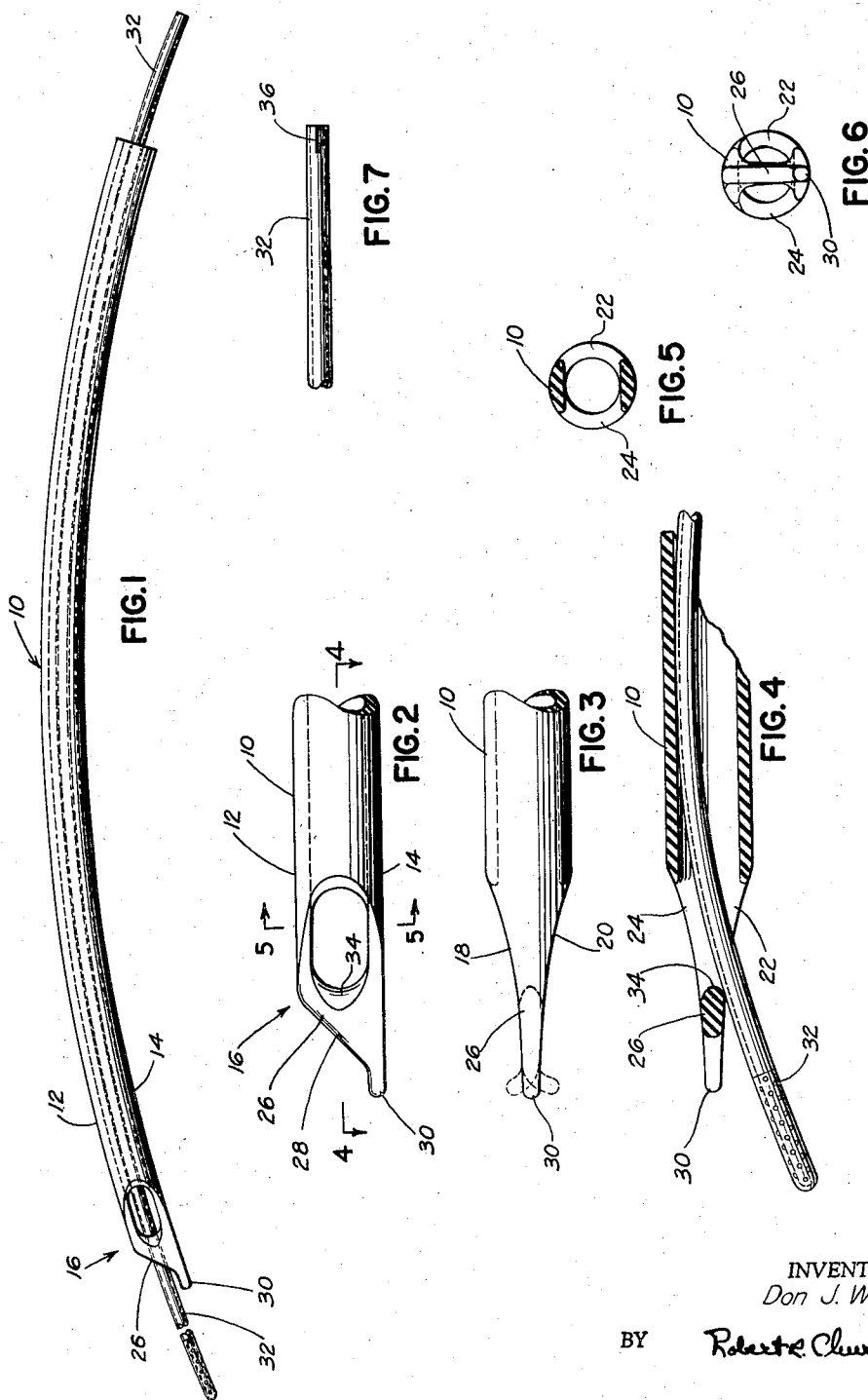


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D. J. WEEKES
ENDOTRACHEAL TUBE
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INVENTOR.
Don J. Weekes
BY *Robert Churchill*

ATTORNEY

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ENDOTRACHEAL TUBE

Don J. Weekes, Brookline, Mass.

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6 Claims. (Cl. 128—351)

This invention relates to an endotracheal tube.

The invention has for an object to provide a novel and improved endotracheal tube for administering general anesthesia and which is characterized by a novel distal end portion designed to facilitate intubation and which is adapted to be introduced into the larynx with minimum liability of injury or damage to the vocal chords.

Another object of the invention is to provide a novel and improved endotracheal tube of non-traumatic structure having a tip or leading end portion adapted to flex when an obstruction is encountered during intubation whereby to prevent traumatic injury to the larynx.

A further object of the invention is to provide a novel and improved endotracheal tube of the character specified having a catheter tube associated therewith which is adapted to extend through and beyond the inner or distal end of the endotracheal tube.

With these general objects in view and such others as may hereinafter appear, the invention consists in the endotracheal tube hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings illustrating the preferred embodiments of the invention:

Fig. 1 is a side elevation of an endotracheal tube embodying the present invention;

Fig. 2 is an enlarged detail view of the novel end portion;

Fig. 3 is a plan view of the same;

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 2;

Fig. 5 is a cross sectional view taken on the line 5—5 of Fig. 2;

Fig. 6 is a front elevation of the novel end portion; and

Fig. 7 is a plan view detail of a catheter tube shown in Fig. 1.

In general the present invention contemplates an endotracheal tube for administering general anesthesia and which is provided with a novel distal end or tip structure of a shape such as to facilitate intubation and to be substantially non-traumatic and which is particularly designed to enable it to pass through the larynx with minimum liability of injury to the vocal chords.

Prior endotracheal tubes of which I am aware are provided with a relatively sharp curved end made by slicing or cutting the tube at an angle resulting in a relatively sharp leading edge portion. The tube material which may comprise rubber or plastic tubular material is supplied in coil form so that when unwound from the coil the tube is provided with a set curvature corresponding generally to the curvature the tube assumes during intubation either orally or intranasally. Such prior tubes were cut to form the distal end along an inclined plane either on the right or left hand side of the tube relative to the set curvature in accordance with the preference of the operator.

In accomplishing the usual intubation through a Flagg or other open laryngoscope it is often impossible to

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visualize the entire larynx, and only the posterior of the arytenoids are seen. As a result one of the problems associated with intubation when using such prior endotracheal tubes is the frequent occurrence of improper intubation effecting traumatic injury to the larynx caused by the relatively sharp and rigid character of the distal end of such prior tubes. Other conditions which may occur as a result of improper intubation are the development of granulomas and contact ulcers of the larynx.

In accordance with the present invention the distal end of the endotracheal tube is tapered on two sides relative to the set curvature of the tube in plan elevation terminating in a solid vertically central transverse strut defining with the tapered sides two elliptical openings communicating with the interior or orifice of the tube. In side elevation the central strut follows an inclined plane from the upper side of the tube terminating at its lower portion in a relatively small straight extension with the lower surface coextensive with the underside of the tube and providing a flexible tip rounded at its leading end. Such relatively small and flexible tip extension is adapted to flex or mushroom to one side or the other when meeting with an obstruction during intubation whereby to prevent traumatic injury to the larynx and to assist in properly guiding the tube into the trachea.

In practice a catheter tube is also usually employed with the endotracheal tube which may be extended through and beyond the distal end of the endotracheal tube. In order to facilitate passage of the catheter tube through either the left or right hand opening of the endotracheal tube the edge of the transverse strut defining the ends of the openings may be tapered and rounded. The catheter tube is also made from coiled tubing which acquires a set curvature so that when inserting the catheter tube it may be initially extended at the set curvature conforming to the curvature of the endotracheal tube until it reaches the strut portion whereupon slight rotation of the catheter tube will direct the same through the right or left hand opening as desired. A mark provided at the outer end of the catheter tube aligned with the upper curved surface may be provided to indicate the position of the inner end of the tube, and rotation of the tube to move the mark in one direction or the other will effect passage of the tube through the opening desired.

It will be understood that the outer end of the endotracheal tube will be operatively connected to an anesthesia machine, and the outer end of the catheter tube may be operatively connected to a conventional suction device in the usual manner.

Referring now to the drawings, 10 indicates the present endotracheal tube which may comprise a suitable plastic tubular material, such as vinyl plastic, or a natural or synthetic rubber of suitable diameter which diameter may vary in accordance with the size and age of the patient upon which it is to be used. The tube 10, as illustrated, is provided with a set curvature, the upper surface of the tube relative to the set curvature being indicated at 12 and the lower surface at 14. The novel distal end indicated generally at 16 may be molded to provide a tapering end portion defined by tapered surfaces on two opposed sides 18, 20 relative to the set curvature to provide an opening 22, 24 on each side of the tube, the tapered end terminating in a transverse inclined central strut 26 defining the forward ends of the openings 22, 24. As illustrated in Fig. 2, the inclined surface 28 of the transverse strut 26 is disposed a short distance forwardly of the side openings defined thereby and extends from the upper surface 12 of the tube forwardly and downwardly terminating at its lower end in a relatively small straight tip or leading end portion 30 extending parallel to the tube, the underside of the tip 30 being coextensive with the lower surface

14 of the tube 10. The inclined surface 28 may and preferably will be rounded to provide a smooth edge, and the tip portion 30 may also be rounded at the leading end and along its longitudinal edges.

The novel distal end portion 16 thus constructed is designed to thread its way between the vocal chords even though they are not visualized during intubation, and the relatively small and substantially cylindrical leading tip portion 30 is adapted to flex to one side or the other if more than the usual resistance is encountered whereby to avoid traumatic injury to the vocal chords and to guide the tip through the larynx and into the trachea, the tube assuming a substantially medial position therein. As indicated, the edges of the openings 22, 24 may be rounded to provide smooth edge surfaces. The openings 22, 24 may be of any suitable length, preferably about one and one-half to two times the inside diameter of the tube, and the width of the openings may be substantially equal to the inside diameter of the tube as shown.

As indicated in Figs. 1 and 4, a catheter tube 32, also having a set curvature, is usually employed with an endotracheal tube and is extended through and beyond the distal end 16 for the purpose of removing excess mucus, and in practice the inner end of the catheter tube is normally extended and directed into one or the other of the bronchial tubes disposed to the left or to the right of the trachea. In order to facilitate passage of the end of the catheter tube 32 through one or the other of the openings 22, 24 of the endotracheal tube, the inner edge 34 of the strut which defines the forward edges of the openings 22, 24 is preferably rounded and tapered, as shown, to serve as a guide for the catheter tube in a direction to enter the left or right hand bronchial tube. The slight set curvature of the catheter tube facilitates passage of the inner end of the tube in the direction desired by merely applying a slight twisting rotation to the outer end of the tube. Thus, rotation of the outer end in a clockwise direction will divert the inner end through the left hand opening 22, and conversely, rotation in a counterclockwise direction will divert the inner end through the right hand opening 24. A mark 36 placed at the outer end of the catheter tube in longitudinal alignment with the upper surface of the tube relative to its set curvature, as shown in Fig. 7, may serve as an indicator to show the position of the inner end of the tube so that the catheter tube may be rotated in the direction desired.

While the preferred embodiment of the invention has been herein illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:

1. An endotracheal tube comprising an elongated tube having a distal end tapered on two opposed sides and terminating in a transverse strut, openings in said tapered sides communicating with the tube, said strut having a forwardly and downwardly inclined surface terminating in a relatively small and substantially straight tip por-

tion adapted to flex when more than the usual resistance is encountered during intubation.

2. An endotracheal tube comprising an elongated tube having a distal end tapered on two opposed sides and terminating in a central transverse strut, openings in said tapered sides communicating with the tube, said strut defining the forward ends of said openings, the leading portion of said strut having a forwardly and downwardly inclined surface terminating in a relatively small flexible extension.

3. An endotracheal tube comprising an elongated flexible tube having a set curvature and provided with a distal end tapered on two opposed sides relative to said curvature and terminating in a central transverse strut, openings in said tapered sides communicating with the tube, said strut defining the forward ends of said openings, the leading portion of said strut having a forwardly and downwardly inclined surface relative to the upper and lower tube surfaces of said set curvature and terminating in a relatively small flexible extension coextensive with said lower tube surface.

4. An endotracheal tube as defined in claim 3 wherein the surfaces of said central strut defining the forward ends of said openings are rounded and tapered to facilitate passage of a catheter tube therethrough.

5. An endotracheal tube comprising an elongated flexible tube having a set curvature and provided with a distal end tapered on two opposed sides relative to said curvature and terminating in a central transverse strut, openings in said tapered sides communicating with the tube, said strut defining the forward ends of said openings, the leading portion of said strut having a forwardly and downwardly inclined surface relative to the upper and lower tube surfaces of said set curvature and terminating in a relatively small flexible extension coextensive with said lower tube surface, and a catheter tube inserted within the endotracheal tube, said catheter tube also having a set curvature corresponding to the curvature of the endotracheal tube, and a mark on the outer end of said catheter tube aligned longitudinally with the upper curved surface of said catheter tube to serve as a guide for rotating said catheter tube in a direction to effect passage of the same through the distal opening desired, the inner surface of said central strut defining the forward ends of said openings being rounded and tapered to facilitate passage of the catheter tube through the opening desired.

6. An endotracheal tube comprising an elongated tube having a distal end tapered on two opposed sides in plan elevation and terminating in a relatively narrow central strut, openings in said opposed sides communicating with the tube, said strut having a forwardly and downwardly inclined surface in side elevation terminating in a relatively small flexible extension.

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