United States Patent

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[54] TRACHEO-BRONCHOSTOMY TUBE

4 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **128/351**
[51] **Int. Cl.** **A61m 25/00**
[50] **Field of Search** 128/348-
—351

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ABSTRACT: A tracheo-bronchostomy tube assembly that includes outer and inner flexible tubes made of preformed plastic material. The outer tube is inserted into the trachea of the user and the inner tube is inserted into the outer tube in telescopic mating relation therewith. The elongated inner tube is formed having a compound degree of curvature with the inner projecting end portion thereof lying in a plane angularly offset to that of the outer end portion. The construction is such that when the tubes are in mated relation, the inner projecting end portion of the inner tube is readily located within a selected bronchial tube of the user.

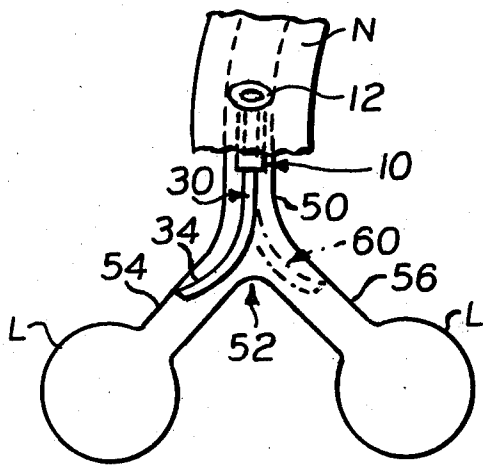

FIG. 1.

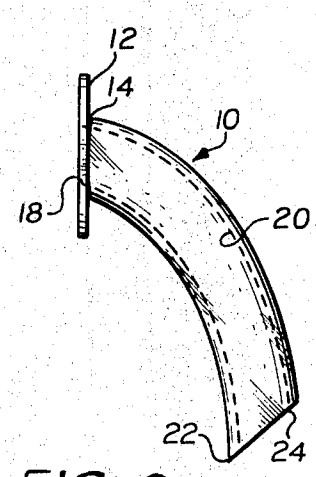

FIG. 2.

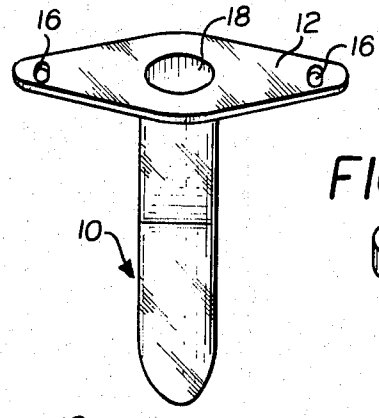

FIG. 3.

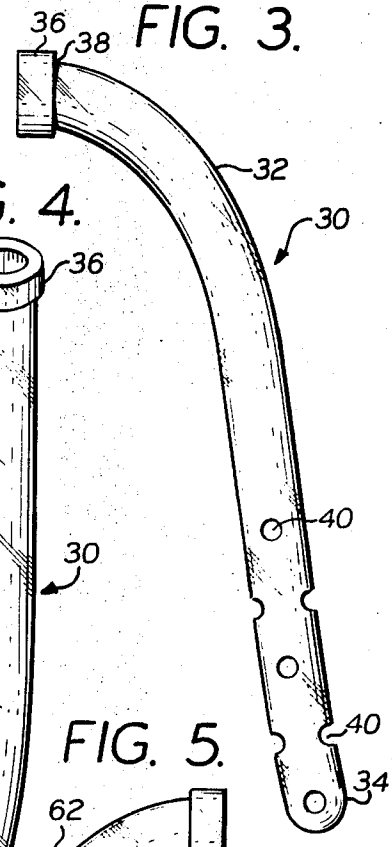

FIG. 4.

FIG. 6.

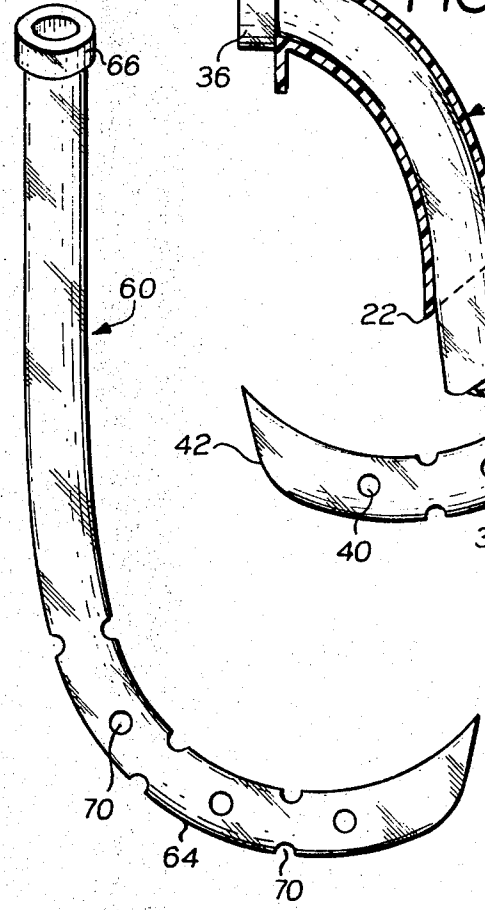

FIG. 7.

FIG. 5.

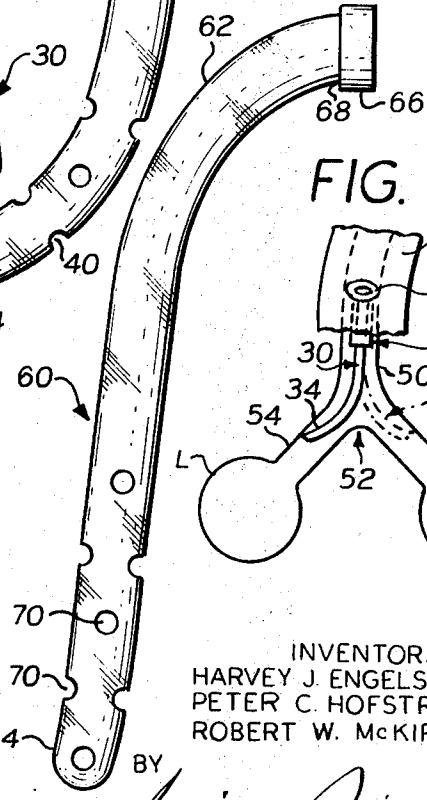

FIG. 8.

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TRACHEO-BRONCHOSTOMY TUBE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to surgical instruments and accessories, and more particularly, to a tracheo-bronchostomy tube assembly that is inserted into the trachea in the neck for permitting unhindered exchange of air and ready removal of secretions from the tracheal and bronchial tree.

2. Description of the Prior Art

Normal bronchial secretions require evacuation by cough or ciliary action. When, however, ordinary secretions become tenacious or are augmented by blood, bloody secretions or clots resulting from damage to the parenchyma, these may not be readily evacuated because of pain that the cough produces, or because of the general debilitated condition or the state of consciousness of the user. Cough and normal respiratory motion are thus suppressed and the breathing may become rapid, shallow and ineffective. In such cases, the bronchial tubes may become filled with blood or secretions so that the gases located beyond the point of obstruction are absorbed by the lungs. The portion of the subtending lung so involved is rendered airless or atelectatic, and the bacteria present therein may cause infection and result in pneumonia or pneumonitis. In other words, weakness or unconsciousness of the user, or the combination of pain with suppression of cough, retained intrabronchial secretions, and collapse of the lung results in what is called the "tramatic wet lung", a situation which requires immediate and vigorous treatment.

Furthermore, since the oxygen supply to the brain is of paramount importance to survival and normal function of that organ, an unobstructed airway to the lungs, free of blood and secretions, must be maintained. This is achieved by placement of an endotracheal tube or the performance of tracheotomy followed by suitable aspiration for withdrawal of the fluid secretions by suction. Either tracheotomy or endotracheal tube provides access to the trachea and bronchi with small rubber suction catheters to keep the airways clear of clots and secretions.

Heretofore, conventional tracheotomy tubes come in pairs, one fitted within the other. The outer tube is inserted through an opening made into the trachea by tracheotomy and is conventionally held in place by suitable means, such as a neckband. The inner tube is then slid into the outer one, and suitable locking means are employed for holding the two tubes together to prevent accidental removal thereof. The outer tube may remain in the trachea for relatively long periods, while the inner tube is removed periodically for cleaning. The disadvantage of the conventional tracheal tube above described resides in the rigidity thereof, the fact that it is formed of a fixed configuration, expensive to fabricate, and difficult to clean. While it has been proposed to fabricate the tubes of synthetic plastic materials, such tubes are still relatively rigid and present the danger of tearing or injuring the delicate trachial tissues when in use.

Furthermore, the heretofore known plastic or rubber catheters employed for withdrawing fluid secretions from the bronchial tubes are too flexible and cannot easily be directed into the selected bronchial tube. For example, the catheter usually passes downward in the trachea to a point above the bifurcation of the bronchi. At this point, a high degree of skill is required to selectively direct the inner projecting end of the catheter into either the right or left main stem bronchi. In such cases, it is often necessary to properly orientate and manipulate the user's head to facilitate insertion of the catheter into the selected bronchial tube. This procedure often becomes more complicated where the user is unconscious and cannot be of assistance during the insertion period so that one is never quite certain whether or not the catheter is in proper position. In addition, in the case where one lung has already been removed, the misdirected catheter may pierce and open the bronchial stump thereby causing severe internal damage, such as hemorrhage or mediastinitis. Accordingly, the inability of the surgeon to quickly insert and selectively direct the catheter into the desired bronchial tube reduces the effectiveness of heretofore known pulmonary intubation techniques.

The present invention overcomes the difficulties and disadvantages existing in such known pulmonary intubation procedures in a manner hereinafter described.

SUMMARY OF THE INVENTION

The tracheo-bronchostomy tube assembly of the present invention includes an outer flexible tube curved longitudinally and inserted into the trachea through an opening formed in the neck of the user, with said outer tube extending toward the bifurcation of the bronchial tubes. An inner elongated and flexible tube having a preformed compound degree of curvature is inserted into the outer tube in telescopic mated relation therewith. The compound curvature of the inner tube is such that the inner projecting end portion thereof lies in a plane angularly off-set to that of the outer end portion to thus locate said projecting end within a selected bronchial tube of the user for withdrawing fluid secretions therefrom.

Accordingly, an object of the present invention is to provide a tracheo-bronchostomy tube assembly wherein the outer and inner tubes are made of preformed plastic material; the inner tube having a compound degree of curvature to facilitate the selective insertion thereof into the desired bronchial tube.

Another object of the present invention is to provide a tracheo-bronchostomy tube assembly wherein the inner tube is economically made of flexible plastic material and disposable after use.

A further object of the present invention is to provide a tracheo-bronchostomy tube assembly which is fabricated of soft resilient material to substantially reduce the danger of tearing or injuring the delicate tracheal and bronchial passageways.

Another object and feature of the present invention is to provide an improved flexible tracheo-bronchostomy tube assembly which is extremely light in weight and produces a minimum degree of discomfort when in use.

A further object, feature and advantage of the present invention is to provide an improved flexible tracheo-bronchostomy tube assembly which is easily and economically manufactured and is highly efficient in use.

The above and other objects, features and advantages of the present invention will become more apparent from a consideration of the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the outer tube of the tracheo-bronchostomy tube assembly constructed in accordance with the present invention;

FIG. 2 is a front elevational view thereof;

FIG. 3 is a side elevational view of one inner tube of said assembly;

FIG. 4 is a front elevational view thereof;

FIG. 5 is a side elevational view of another inner tube of said assembly;

FIG. 6 is a front elevational view thereof;

FIG. 7 is a side elevational view, with parts in section, illustrating the telescopic and mating relation of the outer tube and one of the inner tubes; and

FIG. 8 is a schematic illustration of the tube assembly in operative relation to the tracheal-bronchial tract.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, and more particularly to FIGS. 1 and 2, numeral 10 represents the outer tube or cannula of the tracheo-bronchostomy tube assembly constructed according to the present invention. Outer tube 10 is curved longitudinally to conform to the shape of the trachea and is inserted into the trachea through an opening formed in the neck of the user. This is done in well known manner with the aid of a suita-

ble pilot or obdurator (not shown) after which the obdurator is removed. Tube **10** is provided with an integrally molded plate or flange **12** adjacent its upper or outer end **14** which fits against the neck of the user; said plate **12** serving to conceal the incision or opening at the front of the neck when tube **10** is fully inserted into the trachea and to limit the extent to which tube **10** is inserted therein. Plate **12** has a pair of transverse slots or openings **16** by means of which a suitable and conventional ribbon or neck band (not shown) may be attached for retaining the tube and plate assembly in fixed position against the neck. A central annular opening **18** is formed in plate **12** and is in communication with bore **20** of tube **10** for receiving the inner tube of the tracheo-bronchostomy tube assembly as hereinafter described. The inner or projecting end edge **22** of tube **10** is tapered, as at **24**, to facilitate its entry into the trachea.

Referring to FIGS. **3** and **4**, numeral **30** represents the elongated flexible inner tube or cannula which is adapted to be inserted into outer tube **10** in telescopic and mating relation. In this connection, inner tube **30** can be considered as a catheter for subsequently withdrawing fluid secretions from the selected bronchus, or can serve as a guide or sleeve for the insertion of a longer catheter. The outer or upper end portion **32** of tube **30** is curved longitudinally to substantially conform to the curvature of outer tube **10** whereas the inner or projecting end portion **34** of tube **30** is curved laterally to one side of longitudinally curved end portion **32**. In other words, inner tube **30** is fabricated to have a preformed compound degree of curvature so that when the respective tubes **10** and **30** are in telescopic and mated relation, as shown in FIGS. **7** and **8**, the outer end portion **32** of tube **30** has a degree of curvature substantially similar to that of outer tube **10** so as to be characterized as lying in a given plane, and the inner projecting end portion **34** of tube **30** has a preformed degree of curvature lying in a plane angularly offset to said given plane to locate projecting end portion **34** within the right bronchial tube of the user. A collar **36** is integrally molded adjacent the outer end **38** of tube **30**; said collar **36** abutting the plate **12** when the tubes are in mated relation to limit the extent to which tube **30** can be inserted into outer tube **10**. The projecting end portion **34** of tube **30** is provided with a plurality of openings or perforations **40** spaced in the wall thereof to thereby establish supplemental communication with the tracheal-bronchial tract for withdrawing fluid secretions therefrom. The projecting end edge **42** of tube **30** is tapered similar to tapered edge **24** of outer tube **10**, to facilitate its entry into the outer tube.

Suitable means (not shown) are provided to maintain tubes **10** and **30** releasably locked to each other when they are in mated relation. Such locking means are conventional, for example, in standard tracheotomy tube assemblies and hence, have not been described in detail since they form no part of the present invention.

The internal diameter of outer tube **10** is just slightly larger than the external diameter of inner tube **30** so that inner tube **30** is slidably insertable into outer tube **10**. The tubes **10** and **30** are molded of flexible plastic material, such as a plasticized vinyl copolymer resin or other well known thermoplastic resins, which are light in weight and which are resistant to attack by the mucous or other glandular secretions of the body, and which are nonreactive to the mucosa to minimize inflammation and any discomfort to which the user might be subjected. In the preferred embodiment, the outer tube **10** may be formed having a degree of stiffness somewhat greater than that of inner tube **30** so as to serve as a guide or sleeve for preventing inner tube **30** from injuring or damaging the posterior wall of the trachea. In this connection, the compound preformed degree of curvature of inner tube **30** requires that said tube be formed of a soft plastic material to prevent injury to the lower trachea and bronchial tube when the inner projecting end portion **34** thereof emerges from the inner projecting end **22** of outer tube **10** and travels downwardly through the trachea and into the desired bronchial tube.

Referring to FIGS. **7** and **8**, outer tube **10** is illustrated as having been inserted into the trachea **50** through an opening formed in neck N. Inner tube **30** is then inserted into outer tube **10** whereby the deformable projecting end portion **34** thereof is constrained to a curvature comparable to that of outer tube **10**. When end portion **34** emerges from the inner projecting end **22** of outer tube **10**, said end portion **34** will then be constrained by the walls of trachea **50** as it travels downwardly therethrough. At such time as end portion **34** reaches the bifurcated portion **52** of the bronchi leading to either the right or left bronchial tubes **54** and **56** respectively, said portion **34** will substantially reassume its normal preformed curvature and enter the upward opening of right bronchial tube **54**. In such position, collar **36** abuts plate **12** of outer tube **10** whereby the respective tubes are now in mated relation and conventional locking means are engaged to securely hold inner tube **30** within outer tube **10**. Suitable suctioning apparatus can now be attached to collar **36** for communication with inner tube **30** for withdrawing fluid secretions from right bronchial tube **54** and the lower portion of trachea **50**; said secretions entering the bore of inner tube **30** through the projecting open end thereof and the plurality of openings **40**. It will be appreciated that the tube assembly described above can readily be used for purposes of artificial aeration by administering positive pressure through the tube assembly to the lungs L by means of suitable breathing apparatus. Accordingly, positive pressure may be administered to right bronchial tube **54** via the bore of inner tube **30** and adequate ventilation may be maintained in left bronchial tube **56** via the openings **40**, should occlusion develop in trachea **50** proximal to the bifurcation of the bronchi. Furthermore, suitable mucolytic or other medicinal agents may be transported through inner tube **30** and introduced into right bronchial tube **54** for reducing sputum viscosity therein.

In accordance with the present invention, another inner tube **60** is provided for withdrawing secretions from left bronchial tube **56**. Referring to FIGS. **5** and **6**, inner tube **60** is substantially similar to inner tube **30** and has the upper end portion **62** thereof curved longitudinally to conform to the curvature of outer tube **10**. The inner projecting end portion **64** of tube **60** is curved laterally to one side of longitudinally curved end portion **62**. In other words, inner tube **60** is similarly fabricated to have a preformed compound degree of curvature and distinguishes from inner tube **30** in that the respective inner projecting end portion **64** and **34** thereof are curved laterally to opposite sides of their respective longitudinally curved end portions **62** and **32**. Accordingly, it is now apparent that whereas inner tube **30** is illustrated as being in communication with right bronchial tube **54**, inner tube **60** is intended to be used and placed in communication with left bronchial tube **56**. Tube **60** is also provided with an integrally molded collar **66** adjacent the outer end **68** thereof and with a plurality of openings **70** spaced in the wall of inner projecting end portion **64**; said features corresponding to those similarly provided for inner tube **30** and functioning in a like manner. When tube **60** is inserted into outer tube **10**, in place of inner tube **30**, the projecting end portion **64** thereof will substantially reassume its normal preformed curvature upon reaching the bifurcated portion **52** of the bronchi and enter the upward opening of left bronchial tube **56**. It will be readily appreciated that the various features described in connection with the use of inner tube **30** apply equally as well to inner tube **60** when it is used in association with left bronchial tube **56**.

Accordingly, there is now provided a tracheo-bronchostomy tube assembly whereby each of the inner tubes **30** and **60** is formed having a compound degree of curvature to facilitate the selective insertion thereof into the desired bronchial tube; thereby overcoming the difficulties and disadvantages heretofore existing in known pulmonary intubation techniques.

The tubes can be manufactured economically, are interchangeable and are thus readily disposable after use, thereby eliminating the cleaning and sterilization operations normally required on reusable catheter tube assemblies.

While a specific embodiment of the invention has been shown and described in detail, it will be readily understood and appreciated that various changes or modifications thereof may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

We claim:

1. A tracheo-bronchostomy device comprising:

a. a flexible outer tube having a degree of curvature lying in a given plane for insertion into the trachea of a user and extending toward the bifurcation of the bronchi;

b. a flexible inner tube having a length greater than that of the outer tube and having a compound degree of curvature for insertion into said outer tube;

c. the outer end portion of the inner tube having a degree of curvature lying in said given plane when said tubes are in telescopic and mating relation; and

d. the inner projecting end portion of the inner tube having a degree of curvature lying in a plane angularly offset to said given plane to locate said projecting end within a selected bronchial tube of the user.

2. The tracheo-bronchostomy device as recited in claim 1, wherein the outer tube has a degree of stiffness somewhat greater than that of the inner tube; the inner tube being formed of a soft plastic material and preformed to provide the degree of curvature of the outer and inner end portions thereof.

3. The tracheo-bronchostomy device as recited in claim 2, wherein the inner projecting end portion of the inner tube is deformable when inserted into the outer tube to constrain said projecting end portion to a curvature comparable to that of the outer tube and thereafter being free to substantially reassume its normal curvature.

4. The tracheo-bronchostomy device as recited in claim 3, wherein the inner projecting end portion of the inner and outer tubes respectively are tapered; the projecting end portion of the inner tube having a plurality of openings in the wall thereof for supplemental communication with the tracheal-bronchial tract.