ABSTRACT OF THE DISCLOSURE

A tracheostomy tube assembly including a T-shaped swivel fitting between a tracheostomy tube insertable in the trachea of a patient and an air tube leading to a respirator. The respective tubes are threaded at their ends and receive, or are received by, openings in the fitting. Axial engagement between the protruding threads of each tube and complementary threads at the openings of the fitting prevents axial separation of the parts in the absence of simultaneous relative rotation thereof. Conversely, the parts are freely rotatable without becoming separated unless such rotation is accompanied by the application of axially-directed forces.

This invention relates to a tracheostomy tube and more particularly to a swivel type tracheostomy tube.

When a patient has difficulty breathing due to an airway obstruction or insufficient muscular function; a tracheostomy is often performed on the patient. When a tracheostomy is performed, a "window" or tracheostomy is cut in the patient's trachea and a tracheostomy tube is inserted into the trachea. The tracheostomy tube is then connected to a respirator, to provide a moderate hyperventilation of the patient.

A modified Chevalier Jackson type of tracheostomy tube, with a T-piece threaded to the top of the tube, has been found to be particularly valuable for a patient's comfort during prolonged periods of therapy. A modified tracheostomy tube is commonly connected to an air hose, from the respirator, by means of a short piece of tubing which is threaded into a central part of the T-piece. Since movement of the air hose will tend to twist and dislocate the tracheostomy tube, swivel connections are provided to connect the air hose and the T-piece to the tube.

The swivel connections, at the threaded junctions between the air hose, T-piece and Jackson type tube, are usually obtained by completely threading and then back-threading the various parts of the tracheostomy tube a full turn. Thus, the T-piece would be screwed all the way onto the Jackson type tube and then back-threaded a full turn, allowing a free swivel action. Similarly, the tubing, for the respirator air hose, is screwed completely onto the T-piece and then back-threaded a full turn.

If followed, the above method of providing a swivel connection between the various components of the modified tracheostomy tube is satisfactory. However, when a tracheostomy is being performed, the necessary back-threading of the connection is often inadvertently omitted. When the essential back-threading step is omitted, there will be a solid connection, which will not swivel, between the air hose, T-piece and Jackson type tube. Movement of the air hose will then result in a twisting and, possibly, a dislodging of the tracheostomy tube. At best, a twisting of the tracheostomy tube will be uncomfortable to the patient. At worst, a dislodging of the tracheostomy tube could result in the death of the patient.

If the various components of the tracheostomy tube assembly are back-threaded too far, movement of the air hose will result in the uncoupling of the components. Obviously the air supply to the patient, from the respirator, would then be completely cut off.

Therefore, one of the objects of this invention is to provide a novel tracheostomy tube assembly constructed so as to assure positive connection and a free swivel action between various components thereof.

Another object of the invention is to provide a modified Jackson type of tracheostomy tube assembly which will always permit free rotation of the air hose relative to the T-piece and Jackson type tube.

A further specific object of the present invention is to provide a novel tracheostomy tube assembly which is constructed for enabling various components thereof to be easily connected and disconnected without the need for tools or special fastening devices while at the time assuring a free swivel action between the parts.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description, taken in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view of the tracheostomy tube in use;

FIG. 2 is a perspective view of the tracheostomy tube;

FIG. 3 is a detail sectional view of the tracheostomy tube connections, taken along the line 3-3 of FIG. 2;

FIG. 4 is a detail sectional view of the threaded connections for the tracheostomy tube in a normal position;

FIG. 5 is a detail sectional view of the threaded connections immediately before unscrewing the connection; and

FIG. 6 is a detail sectional view of the threaded connection as the various components of the connection are being unscrewed.

Referring now to the drawings in greater detail, a tracheostomy tube assembly 10 is shown inserted into the trachea of the patient 12 in FIG. 1. The tracheostomy tube assembly 10 is connected to a respirator 14 by air hoses or tubes 16 and 18. The hose 16 interconnects the tracheostomy tube assembly 10 and an exhalation valve unit 20. The exhalation valve unit 20 is connected to the respirator 14 by the tube 18. The respirator 14 provides a source of air which is forced under a moderate pressure into the lungs of the patient through the tracheostomy tube assembly 10. The exhalation valve unit 20 permits expired air to escape into the room. The construction of the respirator and exhalation valve unit are well known and need not be described in greater detail at this time.

The tracheostomy tube assembly 10 is held in position on the patient's neck by a suitable gauze which is wrapped around the neck. The tracheostomy tube assembly has a depending tube or cannula 22 which is inserted into the trachea of the patient through a "window" or incision which has been cut in the trachea of the patient. The method of performing a tracheostomy (i.e. a tracheotomy) is well known to those skilled in the art, and does not, per se, constitute a part of this invention.

A perspective view of the tracheostomy tube assembly 10 is shown in FIG. 2. In the embodiment shown, the cannula or tube 22 is of a modified Chevalier Jackson type. The Jackson type tracheostomy tube comprises an interior cannula or tube 24 and an exterior cannula or tube 26. A collar member 28 is connected to the exterior cannula or tube 26 (see FIG. 3). The interior cannula or tube 24 is retained within the exterior cannula or tube 26 by swivel connector 30 which is mounted on the collar 28 of the exterior cannula or tube 26. The swivel connector 30 has a latching member 32 which pivots to engage the upper surface of an inner collar 34 on the
interior tube or cannula 24. Thus, the interior tube or cannula is securely connected to the exterior cannula or tube, and the entire cannula assembly 22 is inserted into the trachea of the patient.

In the common Jackson type of tracheostomy tube, the interior tube or cannula has been modified by the addition of a neck portion 36. The neck 36 has a series of threads 38 on the upper exterior surface. A T-piece or fitting 40 has interior threads 42 which permit the T-piece to be screwed on to the threads 38 of the neck 36. As will be explained more fully subsequently, the connection between the T-piece 40 and neck 36 permits the T-piece to swivel relative to the neck. A stopper 44 is removably screwed into the upper portion of the T-piece 40 to permit aspiration in a known manner.

The air hose 16 from the exhalation valve unit 20 is attached to a hose fastening member or tube 46. The exterior surface of the tube or hose fastening member 46 has a plurality of raised ridges 48 which engage the inner surface of the hose 16 to provide a firm connection between the hose 16 and the tube 46. A plurality of threads 50 are formed on the interior surface of the hose fastening member or tube 46 and are adapted to be turned onto threads 54 on a leg 52 of the T-piece 40. As will be explained in greater detail later, the joint between the threads 50 and 54 permits the hose 16 to rotate relative to the T-piece 46. In the structures of the T-piece the same size or slightly larger than the aperture in the neck of the interior tube or cannula 24, the T-piece or fitting 40 permits the air from the respirator 14 to flow into the trachea of the patient with a minimum drop in pressure. It will be apparent that the T-piece provides a solid connection between the hose and the tracheostomy tubes. The tracheostomy tube assembly 10 may be easily taken apart for cleaning and sterilization, since the various components are releasably connected together by means of the swivel connector 30 and the threaded connections of the T-piece. As previously indicated, it is important that the tracheostomy tube be not twisted within the trachea. In order to prevent such twisting within the trachea of a patient, swivel connections are provided between the T-piece and the tubes.

One swivel connection is provided between the neck portion 36 of the interior tube or cannula 24 and the T-piece or fitting 40. This swivel connection permits the air hose 16 to be moved about the vertical or longitudinal axis of the T-piece 40 without twisting the tracheostomy tubes in the trachea of the patient. The swivel connection at the neck of the interior tube or cannula 24 eliminates any possibility of this movement, of the hose 16 or respirator 14, causing a twisting of the tracheostomy tubes within the trachea of the patient.

A similar swivel connection is provided between the leg 52 of the fitting 40 and the hose fastening member or tube 46. The swivel connection between these two members permits the hose 16 to be rotated around its longitudinal axis. It will be apparent that, if the connection of the hose 16 to the exhalation valve unit 20 is tightened by twisting the hose 16, the swivel connection must be provided between the hose fastening member 46 and the T-piece 40 to keep the tracheostomy tube from being twisted around the horizontal axis of the T-piece or fitting 40.

The swivel connections at the neck 36 of the interior cannula or tube 24 and the leg 52 of the T-piece or fitting 40 are both in the same manner. Considering a swivel connection formed at the leg member 52 of the T-piece or fitting 40 in greater detail, it will be seen that the interior threads 50 of the tube fastening member 46 are positioned to the left, in FIG. 3, of the exterior threads 54 of the leg 52. As the hose fastening member 46 is screwed or threaded onto the leg 52, the threads 50 will run past the threads 54 on the leg member 52. The threads will thus become disengaged from each other and slide into the position shown in FIG. 3. With the threads in the position shown in FIG. 3, when the tube or hose 16 is rotated about its longitudinal axis, the threads 50 and 54 will not be engaged, but will merely slide on the exterior surface of the fastening member 46. The interior threads 50 of the leg member 52 of the fitting 40 are in the normal position with the hose fastening member 46 completely threaded onto the leg member 52 of the fitting 40. The leg member 52 has a smooth guiding surface 56, located between an upstanding wall 58 of the fitting 40 and the threads 54. The smooth guiding surface 56 is somewhat larger than the length of the threads 50 which slide on the surface 56. The hose fastening member 46 is retained in a telescopic relationship with the leg member 52 by the protruding threads 50 and 54. The threads in the position shown in FIG. 4, when the thread ends are in the normal position, the threads 50 and 54 will not engage the threads 54. The hose fastening member 46 will merely swivel or slide telescopically relative to the fitting 40 and will not become disconnected from the fitting 40.

If the hose fastening member 46 is pulled to the right from the position shown in FIG. 4, the innermost end of the inwardly protruding threads 50 will abut the innermost end of the outwardly protruding threads 54 (see FIG. 5). It will be apparent that this abutting of the ends of threads 50 and 54 will prevent a mere pulling of the hose 16 and the hose fastening member 46 from disconnection from the hose fastening member 46 from the leg member 52 of the fitting 40. To disconnect the hose 16 and hose fastening member 46 from the fitting 40, it is necessary to pull the hose fastening member 46 to the right so that the threads 50 abut the threads 54, as shown in FIG. 5. The hose fastening member 46 must then be rotated counterclockwise relative to the fitting 40, to cause the threads 50 to engage the threads 54. Further rotation of the hose fastening member 46 relative to the fitting 40 will result in the hose fastening member becoming unscrewed from the fitting 40 (see FIG. 6).

The swivel connection between the fitting 40 and the neck 36 of the inner cannula or tube 24 is formed in a similar manner. The threads 42 on the interior of the fitting 40 are screwed or threaded onto the threads 38, of the neck 36, to connect the fitting 40 to the neck of the interior cannula or tube 24. When the fitting 40 has been completely screwed onto the neck 36, the threads 38 and 42 will be disengaged and assume a telescopic relationship. Threads 38 will slide on a smooth guide surface 60 of the neck 36. In this position, any rotation of the fitting 40 about its vertical or longitudinal axis will be transmitted to the tracheostomy tubes. However, the fitting 40 and neck 36 will be retained in their telescopic relationship by the protruding threads 38 and 42.

As previously explained, when the fitting 40 is pulled vertically, the interior end portions of the threads 38 and 42 will abut each other and prevent the fitting 40 from being pulled off of the neck portion 36 of the tracheostomy tube 42. To disconnect the fitting 40 from the neck of the tracheostomy tube, it is necessary to pull the fitting 40 upward and to turn it counterclockwise relative to the threads 38 and 42. The fitting 40 may then be unthreaded from the neck 36 of the tracheostomy tube in the normal manner.

It should be noted that the exterior diameter of the threads 38 is only slightly smaller than the interior diameter of the fitting 40. Similarly, the exterior diameter of
the threads 54 is only slightly smaller than the interior diameter of the tube 46. Thus, any air leakage between the threads and the fitting will be negligible.

**METHOD OF OPERATION**

For purposes of affording a more complete understanding of the invention, it is advantageous now to provide a functional description of the mode in which the component parts thus far identified operate. When a tracheotomy is to be performed, the equipment is assembled by connecting the respirator 14 to the inhalation valve unit 20 by means of the air hose 18. The air hose 16 from the inhalation valve unit 20 is attached to the hose fastening member or tube 46.

The fitting 40 is then screwed to the hose fastening member 46. The screwing is continued until the threads 54 are threaded beyond, and out of engagement with, the threads 50 of the hose fastening member. The tracheotomy tube or inner cannula 24 is then connected to the fitting 40 by screwing the threads 42 onto and past the threads 50 of the inner cannula or tracheotomy tube 24. When the fitting 40 has been thus connected to the hose fastening member 46 and tracheotomy tube or inner cannula 24, all joints or connections will be formed between the fitting 40, hose 16, and the tube 24.

The inner tube or cannula 24 is now ready to be inserted into the outer tube or cannula 26. The outer tube or cannula is first positioned in the trachea of the patient. The collars 28 of the outer tube or cannula 26 is firmly secured to the neck of the patient to retain the outer tube or cannula in place. The inner tube or cannula 24 is then inserted into the outer tube or cannula 26 and the pivotal connection member 32 pivoted to lock the inner tube or cannula in position within the outer tube or cannula 26.

It will be apparent that the tracheotomy tube assembly 10 permits the respirator 14 and exhalation unit valve to be moved relative to the patient without causing the patient undue discomfort. The tracheotomy tubes will not be twisted in the trachea of the patient, due to the relative movement of the respirator 14 because of the swivel connections formed at the joints between the fitting 40 and the tracheotomy tubes and air hose. A tracheotomy tube assembly of this type greatly increases the comfort of the patient during the recovery therapy and facilitates movement of the patient and respirator unit from one location to another. If the swivel connections between the air hose 16 and tracheotomy tubes 24 and 26 were omitted, the patient would be caused severe discomfort and the tracheotomy tube assembly possibly become dislodged from the trachea of the patient whenever the air hose 16 was rotated either relative to the horizontal or the vertical axis of the fitting 40 of the tracheotomy tube assembly.

While a particular embodiment of the invention has been shown, it should be understood, of course, that the invention is not limited thereto, since many modifications may be made; and it is, therefore, contemplated to cover by the appended claims any such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A tracheotomy tube assembly comprising a tube having a free end portion adapted to be inserted into the trachea of a patient and being provided at its opposite end thereof with an externally threaded portion having laterally protruding threads, a fitting having a cylindrical chamber therein of larger axial and lateral dimensions than said externally threaded portion and having an axial opening communicating with said chamber, said tube extending through said opening and having its externally threaded portion received within said chamber for rotational and axial movement therein, said fitting being provided at said opening with an internally threaded portion having inwardly protruding threads engageable with the threaded portion of said tube to prevent axial separation of said fitting and tube in the absence of simultaneous relative rotation thereof, said threaded portions of said tube and fitting being threaded engageable upon simultaneous axial and rotational movement to permit unthreading and separation of said tube and fitting, said fitting also having a tubular leg member providing a passage communicating with said chamber, and a respirator air tube connected to said leg member and communicating with said passage and chamber.

2. A tracheotomy tube assembly comprising a tube adapted to be inserted into the trachea of a patient and being provided at one end thereof with an externally threaded portion having laterally protruding threads, a fitting having a cylindrical chamber therein of larger axial and lateral dimensions than said externally threaded portion and having an axial opening communicating with said chamber, said tube extending through said opening and having its externally threaded portion received within said chamber for rotational and axial movement therein, said fitting being provided at said opening with an internally threaded portion having inwardly protruding threads engageable with the threaded portion of said tube to prevent axial separation of said fitting and tube in the absence of simultaneous relative rotation thereof, said threaded portions of said tube and fitting being threaded engageable upon simultaneous axial and rotational movement to permit unthreading and separation of said tube and fitting, said fitting also having a tubular leg member providing a passage communicating with said chamber, and a respirator air tube connected to said leg member and communicating with said passage and chamber.

3. A tracheotomy tube assembly comprising a tube having a free end portion adapted to be inserted into the trachea of a patient and being provided at its opposite end thereof with an externally threaded portion having laterally protruding threads, a fitting having a cylindrical chamber therein of larger axial and lateral dimensions than said externally threaded portion and having an axial opening communicating with said chamber, said tube extending through said opening and having its externally threaded portion received within said chamber for rotational and axial movement therein, said fitting being provided at said opening with an internally threaded portion having inwardly protruding threads engageable with the threaded portion of said tube to prevent axial separation of said fitting and tube in the absence of simultaneous relative rotation thereof, said threaded portions of said tube and fitting being threaded engageable upon simultaneous axial and rotational movement to permit unthreading and separation of said tube and fitting, said fitting also having a tubular leg member providing a passage communicating with said chamber, and a respirator air tube connected to said leg member and communicating with said passage and chamber.

4. The structure of claim 2 in which said leg member extends outwardly from said fitting at a generally right angle with respect to the axis of said chamber.

5. The structure of claim 2 in which said fitting is generally T-shaped in configuration.

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