

[54] **ENDOTRACHEAL CATHETER WITH MEANS FOR POSITIVE VENTILATION AND STERILE TECHNIQUE**

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[58] **Field of Search** 128/202, 206, 208, 214.4, 128/348, 351

[56] **References Cited**

UNITED STATES PATENTS

2,915,063	12/1959	Cutter.....	128/214.4
3,677,262	7/1972	Zukowski.....	128/351
3,709,223	1/1973	Macalalad et al.	128/348
3,757,771	9/1973	Ruegg et al.....	128/214.4

FOREIGN PATENTS OR APPLICATIONS

824,688	12/1951	Germany	128/348
1,174,397	12/1969	United Kingdom.....	128/351

1,176,320 8/1964 Germany 128/351

Primary Examiner—Channing L. Pace

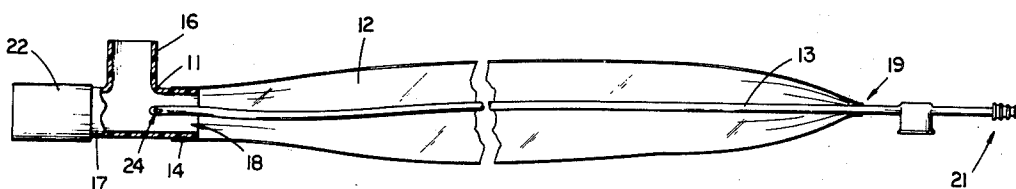
Attorney, Agent, or Firm—Woodard, Weikart Emhardt & Naughton

[57]

ABSTRACT

Endotracheal catheter apparatus providing sterile handling for a suction catheter and including ventilating apparatus to replenish the oxygen supply of the lungs after catheterization. The catheter tube is sealingly attached within a sheath or bag at a first end portion of the sheath so that the portion of the tube which is inserted into the trachea and lungs is protected by the sheath from contact with hands etc. The other end of the bag or sheath is sealingly attached to a tip member through which the catheter tube is permitted to slide. Oxygen or air is introduced through an opening in the tip member to fill the sheath so that, after and during catheterization, the sheath is inflated with air or oxygen and then may be compressed to introduce a surge of air or oxygen into the lungs.

10 Claims, 3 Drawing Figures



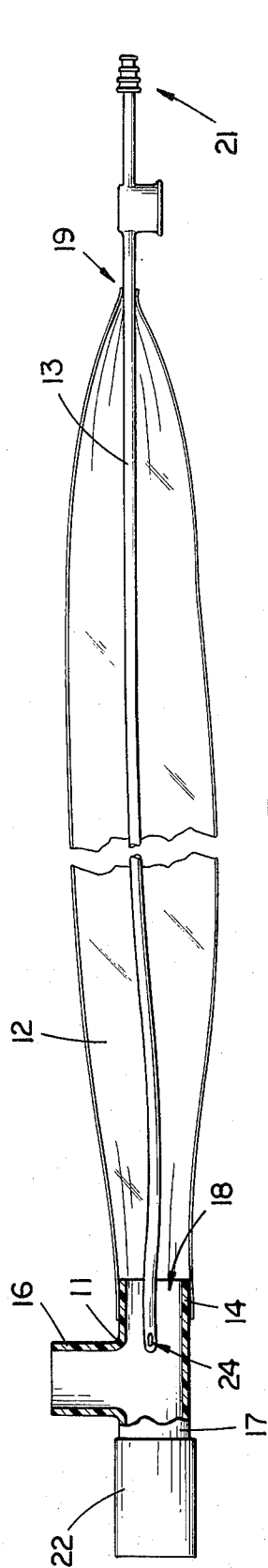


Fig. 1

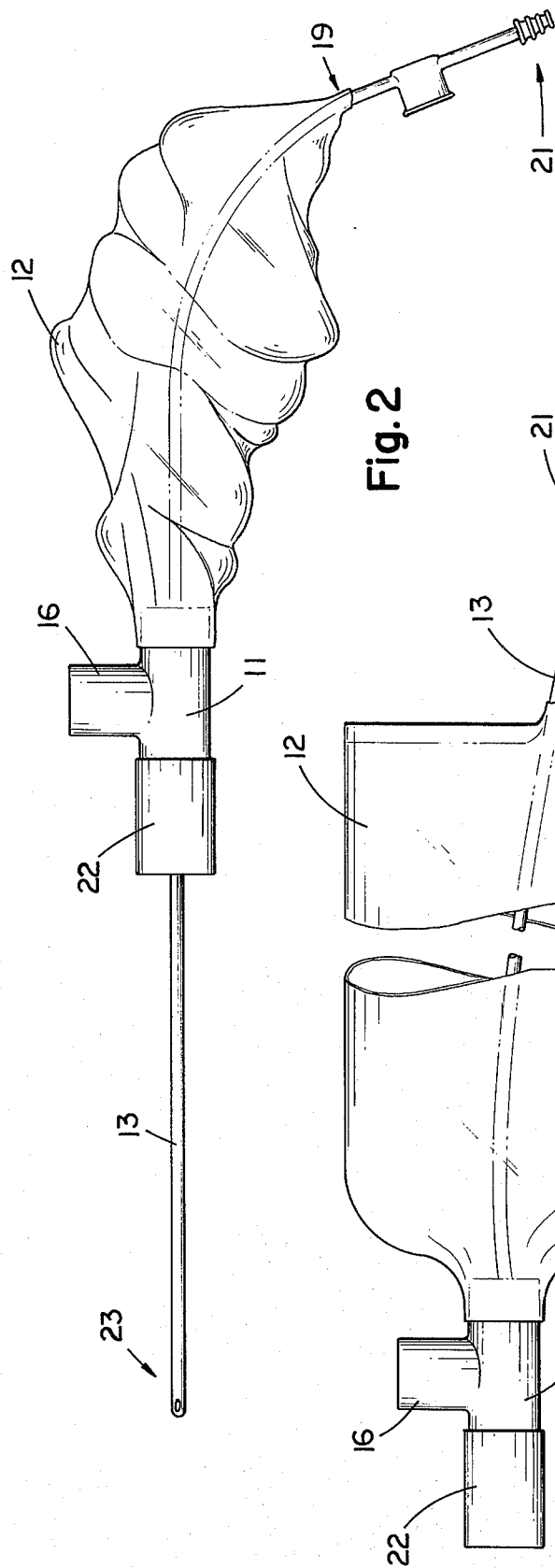


Fig. 2

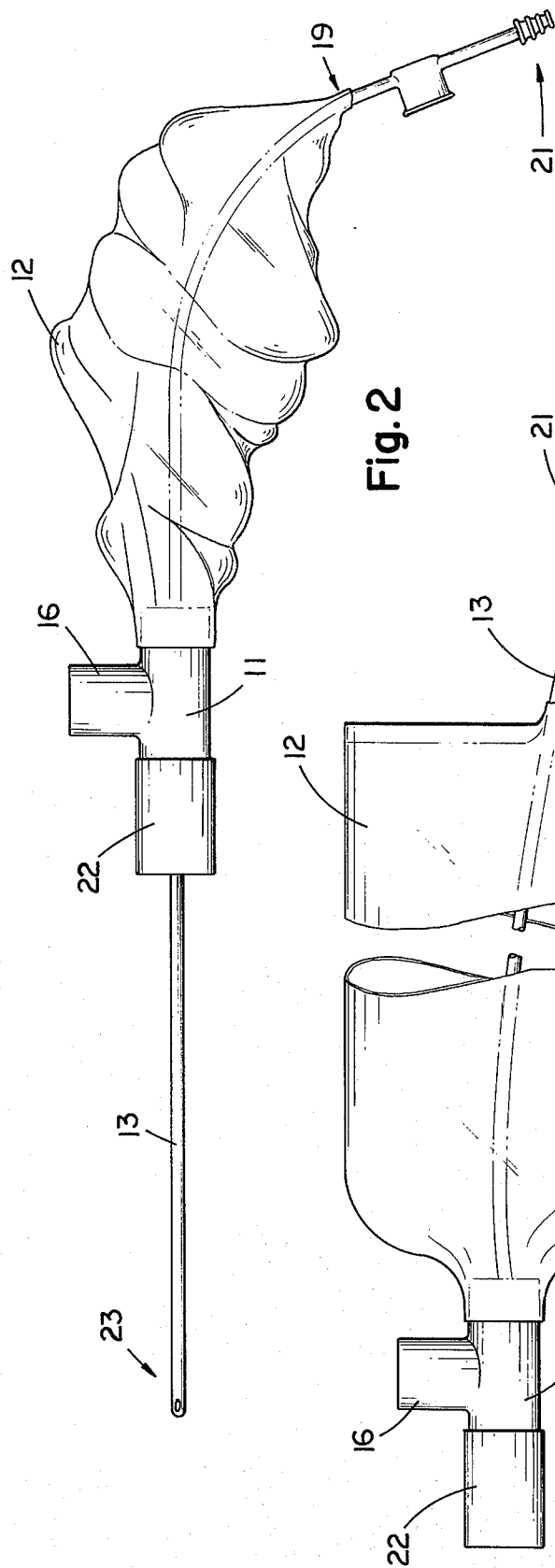


Fig. 3

ENDOTRACHEAL CATHETER WITH MEANS FOR POSITIVE VENTILATION AND STERILE TECHNIQUE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is in the field of catheter apparatus.

2. Description of the Prior Art

In the past, the procedure of suctioning of the lung has presented two major difficulties. First, it has been difficult to insert a catheter tube into the opening through which suctioning is to be done without contaminating the suction tube bacteriologically by either touching the patient or touching the catheter tube with gloves or an ungloved hand. Secondly, during suctioning within the patient's lungs, the catheter pulls the air out of the lungs causing the oxygen tension of the patient's blood to drop below safe levels. For this reason, suctioning of the lung is frequently required to be performed on successive occasions in order to remove the requisite amount of mucous and other material from the lung without endangering the patient. As an example, blood oxygen tension, measured in millimeters of mercury, within the lung is normally at a level of about 100, and this tension will often drop below 40 very rapidly due to suctioning of the air out of the lungs during the catheterization procedure.

It has been proposed in the past to provide a catheter apparatus wherein the catheter tube lies within a flexible sleeve to prevent the catheter tube from being touched. Such prior art apparatus includes an adapter which permits the guiding of the catheter tube into the orifice to be suctioned. This apparatus is described in British Pat. No. 1,174,397 issued to the National Research Development Corporation. The apparatus, as disclosed, does not show sealing the ends of the flexible sleeve nor the use of a sealed sheath or bag sized to provide adequate ventilation of the lungs after the catheterization procedure.

Another catheter apparatus, sold by the Davol Company, comprises a regular suction catheter which is provided with a filmy sleeve extending from near the suction port of the catheter tube down over the catheter tube tip. Both this and the device disclosed in the British patent represent an advance in the sterile handling of suction catheters, but neither of these devices solve the problem of concurrent hypoxia during and after the catheterization procedure.

SUMMARY OF THE INVENTION

One embodiment of the present invention is a catheter apparatus comprising a tip member having a passageway therethrough defining a first opening and a second opening in the tip member, a compressible sheath having a first end sealingly attached to the tip member around the first opening of the passageway and having a second end, a catheter tube, slidable within the passageway, having a first end portion sealingly attached to the second end of the sheath, the tube having a first position in which it rests essentially within the sheath and a second position in which the catheter tube extends through the passageway and the second end portion of the catheter tube extends beyond the second opening of the passageway, and first means for introducing gases into the sheath, whereby subsequent compression of the sheath effects the forcing of gases in the sheath through the passageway.

It is an object of the present invention to provide a catheter apparatus which includes means for sterile handling of the catheter tube which includes ventilating apparatus to replenish the oxygen supply depleted by the catheterization procedure.

It is a further object of the present invention to provide catheter apparatus adaptable to be used with any tracheotomy tubes or endotracheal tube adapter.

It is a still further object of the present invention to provide a catheter apparatus which includes an anesthesia standard side port to permit the addition of oxygen or the use of a ventilator concurrent with and following the suctioning procedure.

Further objects and advantages shall be apparent from the following detailed description and accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a catheter apparatus according to the present invention with a portion removed and showing the catheter tube within an inflated sheath.

FIG. 2 shows the apparatus of FIG. 1 in which the sheath is deflated and compressed, with the catheter tube extended through the tip member, such as for catheterization.

FIG. 3 is a view partly in section of the apparatus of FIG. 1 without the sheath inflated and with a portion removed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring in particular to the figures, there is shown a catheter apparatus including tip member 11, bag or sheath 12, and catheter tube 13. Tip member 11 includes hollow arms 14, 16 and 17, the interiors of which are in communication with one another (FIG. 3). Arm 14 includes opening 18, within which the insertion or tip end 23 of catheter tube 13 rests when catheterization is not in progress as shown in FIG. 3. One end of sheath 12 is sealed in an airtight manner around the outside of arm 14 of tip member 11. The seal may be effected by an appropriate adhesive or heat seal or other standard technique.

The other end of sheath 12 is sealed in a similar airtight fashion around the outside of catheter tube 13 at location 19 (FIG. 3). As can be seen, most particularly in FIG. 3, communication with the atmosphere within sheath 12 is constrained to be through the openings within arms 16 and 17 of tip member 11 due to the sealing of the two ends of sheath 12 as described. Normal suctioning, draining and other apparatus are connected at end 21 of catheter tube 13 during the catheterization procedure. An adapter tube 22 is fitted snugly over arm 17 of tip member 11, and tube 22 extends beyond the end of arm 17, the adapter tube being sized to receive

an appropriate connector from a patient's tracheotomy tube.

In operation, endotracheal toilet is effected by disconnecting the ventilator or oxygen supply from the endotracheal tube connector of the patient and connecting the ventilator or oxygen output to arm 16 of tip member 11, which is an anesthesia standard 15 millimeter connection to conveniently permit the addition of oxygen or the use of a ventilator concurrent with the catheterization procedure. Adapter tube 22 has a 22 millimeter outside diameter and 15 millimeter inside diameter and is fitted snugly over the endotracheal tube connector of the patient. Other adapter tubes, as well as various endotracheal tube connectors, are contemplated to be used with the present catheter apparatus. Sheath 12 is then compressed and catheter tube tip 23 extended through and beyond the opening in arm 17 of tip member 11 as shown in FIG. 2. For catheterization, of course, the inserted end 23 of catheter tube 13 is extended into a lung of the patient, such as through an endotracheal tube. Thereupon, catheter tube 13 is utilized through standard techniques to irrigate and wash out the lungs of patients having pulmonary edema or to remove pus or blood secretions that need to be removed from the patient's lungs. It can be seen that by handling catheter tube 13 at the portions which are shielded by sheath 12 during the insertion procedure for catheter tube 13, the sterile condition of the catheter tube portion which is inserted into the patient's lungs is maintained.

After endotracheal toilet, catheter tube 13 is removed from the patient and replaced in its position as shown in FIG. 1. The oxygen or air from the oxygen supply or ventilator attached to arm 16 of tip member 11 inflates sheath 12 during and after catheter tube 13 is removed from the patient, as shown in FIG. 1. To preclude a low blood oxygen tension in the patient's lungs following the catheterization procedure, sheath 12 is then compressed, thereby forcing its contents into the lungs of the patient, providing ventilation of the patient's lungs. Bag or sheath 12 surrounding catheter tube 13 is designed and sized to hold adequate gas volume to properly ventilate the lungs of the patient after suctioning has been completed through catheter tube 13. This gives an immediate replacement of the air in the lung that greatly reduces the hazard of hypoxia.

This means for ventilating also avoids the bacteriological hazard inherent in the use of an "ambu" bag type of follow-up ventilation. The "ambu" bag notoriously is never cleaned from patient to patient or over the course of time, so that it could present a severe bacteriological hazard. With the present apparatus, however, the patient is permitted to have his own ventilation environment at all times.

Although it is possible, with children, to provide sufficient oxygen through arm 16 from a ventilator to provide the necessary ventilation after suction, in an adult the oxygen flow meters at most bedsides have limits of 15 to 20 liters per minute, which allows the supplying of some oxygen but not in a quantity comparable to the good breath-type volume which can be applied in one surge by compressing sheath 12. Sheath 12 preferably is designed to deliver about 500 cubic centimeters of air or gas and consequently is designed to hold somewhat more than that.

In practice, if a ventilator is connected to the opening in arm 16, the check valve in the ventilator line pre-

vents leakage from sheath 12 through the opening in arm 16 when sheath 12 is compressed for ventilating the patient through arms 14 and 17. Similarly, if an oxygen line from a flow meter is coupled to the opening in arm 16, the back pressure in the flow meter will be sufficient that the pressure buildup, when sheath 12 is compressed, will send the air from the compressed sheath 12 into the patient's lungs rather than allowing it to leak through the opening in arm 16. Also, the loss of air through catheter openings 24, catheter tube 13 and end portion 21 of the catheter tube is so minimal that sufficient air from sheath 12 is provided for proper ventilation and it is not necessary to pinch off catheter tube 13 during compression of sheath 12 for proper ventilation. However, catheter tube 13 may be easily pinched at the same time as sheath 12 is compressed in order to effect more complete closure of the system.

The catheter apparatus is preferably of sufficient length to suction both tracheotomy airways and nasal pharyngeal airways, which would include a catheter tube 13 of 20 or more inches in length. The catheter tube 13 is preferably the same as existing prior art catheter tubes, while sheath 12 is a thin transparent plastic film sealed at one end to catheter tube 13 and at the other end to arm 14 of tip member 11, as described above. Tip member 11 is a rigid plastic material and the use of water resistant paper for the tip member is also contemplated.

While there have been described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation in the scope of the invention.

What is claimed is:

1. Catheter apparatus comprising:

a tip member having a passageway therethrough defining a first opening and a second opening in the tip member;

a compressible sheath having a first end sealingly attached to the tip member around the first opening of the passageway and having a second end;

a catheter tube, slidable within the passageway, having a first end portion sealingly attached to the second end of the sheath, the tube having a first position in which it rests essentially within the sheath and a second position in which the catheter tube extends through the passageway and the second end portion of the catheter tube extends beyond the second opening of the passageway; and

first means for introducing gases into the sheath, whereby subsequent compression of the sheath effects the forcing of gases in the sheath through the passageway.

2. The apparatus of claim 1 in which the sheath is a flexible material.

3. The apparatus of claim 1 in which the first means includes a third opening to the passageway in the tip member, the third opening being couplable to a source of gas.

4. The apparatus of claim 3 in which the sheath is a flexible material.

5. The apparatus of claim 4 which further comprises an adapter tube attached to the tip member over the second opening of the passageway, the adapter tube being sized to receive snugly a tracheotomy tube connector.

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6. The apparatus of claim 5 in which the compressible sheath includes a volume of at least 500 cubic centimeters when inflated.

7. The apparatus of claim 6 in which the catheter tube is at least 20 inches in length.

8. A method of catheterizing and ventilating the lungs of a patient comprising the steps of:

coupling a tip member having a passageway there-through to an airway of the patient;

inserting a catheter tube, initially essentially within a compressible sheath which is sealingly attached at one end of the tube and at the other end to the tip member around an opening to the passageway, through the passageway and airway into the lungs of the patient by manipulating the catheter tube at portions which are within the sheath, thereby compressing the sheath;

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performing a catheterization procedure through the catheter tube;

removing the catheter tube from the lungs and airway of the patient, thereby re-extending the sheath;

introducing gas into the sheath; and

compressing the sheath to force gas from the sheath into the lungs of the patient through the passageway and airway.

9. The method of claim 8 which comprises, before the step of coupling the tip member to an airway, the step of coupling a source of gas through an opening in the tip member to the passageway.

10. The method of claim 8 which comprises, after the step of coupling the tip member to an airway, the step of coupling a source of gas through an opening in the tip member to the passageway.

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