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TRACHEAL CANNULA

Filed May 17, 1963

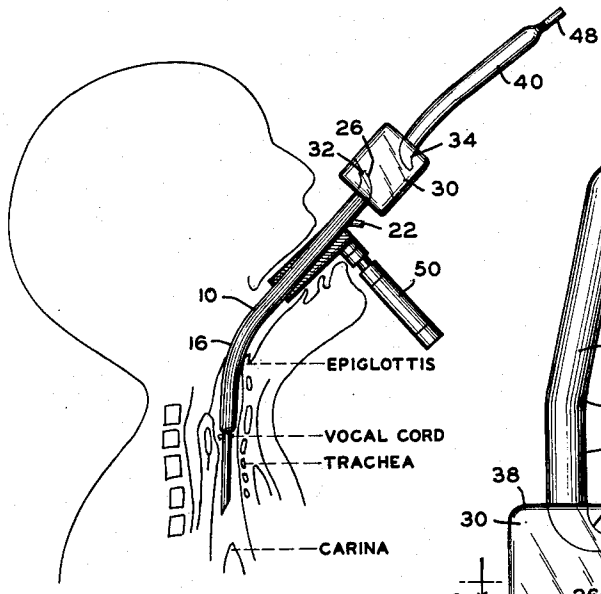


FIG. 1

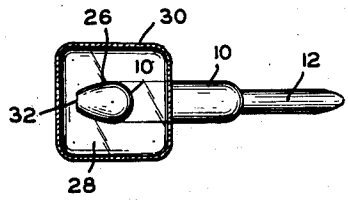


FIG. 4

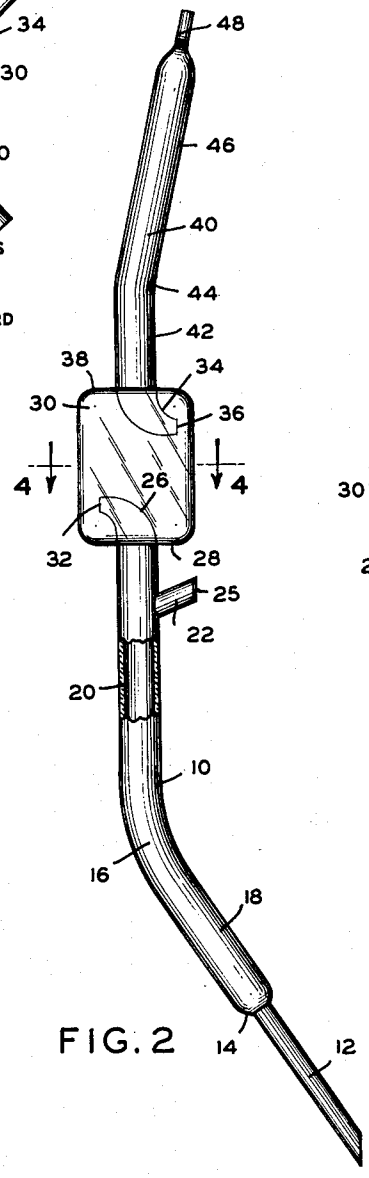
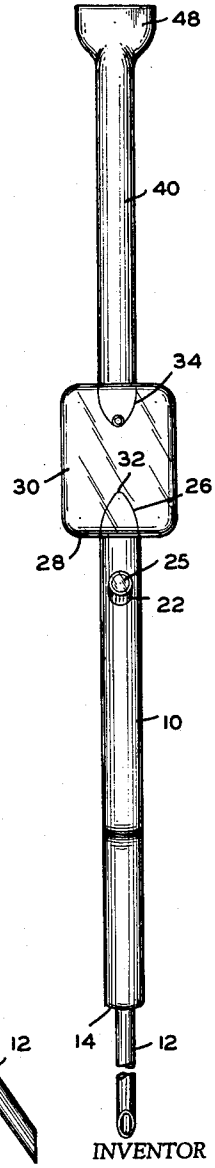


FIG. 2

FIG. 3



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TRACHEAL CANNULA

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This invention relates to a cannula for aspirating the upper portion of the respiratory tract of newly born infants, particularly with a view to removing mucus and resuscitating a newly born baby in the delivery room.

When a newly born infant is delivered and is found to have difficulty in breathing due to a congestion in the respiratory tract, prior to the present invention it has been customary in the delivery room to use long thin catheters approximately 10 to 12 inches in length, having a relatively small bore, to suck out mucus from the infant's upper respiratory system. The catheters used are usually rather firm and have very limited flexibility. In addition they are extremely difficult to clean once they have been used, especially after any portion of the mucus has hardened in the bore of the catheter.

One object of this invention is to provide a means for intubating the upper respiratory tract and for permitting the passage of large volumes of fluids, gases and liquids, rapidly and safely into or out of the respiratory tract.

Another object of the invention is to provide a disposable plastic cannula for intubating the upper respiratory tract of infants.

Still another object is to provide a cannula having means to permit the administration of oxygen through the cannula if the need for same arises.

A further object is to provide a cannula for intubating the upper respiratory tract of infants which has a built-in safety feature for automatically limiting the amount of pressure applied to the respiratory system during resuscitation of infants.

These and other objects are achieved in accordance with the present invention which will be more fully understood from the description which follows, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a more or less diagrammatic representation of the invention as assembled and positioned in treating an infant;

FIGURE 2 is an enlarged side view of a portion of the device, partly in section, looking toward plane 2—2 of FIGURE 3;

FIGURE 3 is a top view of the device of FIG. 2; and

FIGURE 4 is a view taken on plane 4—4 of FIGURE 2.

As best shown in FIGURE 2, the cannula comprises three main components, namely, a mucus trap **30** between a first lumen **10**, and a second lumen **40**. The first of these components is a tube **10** adapted to be inserted through the infant's mouth and thence into the upper respiratory tract. Tube **10** consists of a tip portion **12** approximately 4 centimeters or 1.6 inches long, this length being approximately 80% of the average length of the trachea in normal new born infants. The average length of the trachea of normal new born infants in about 5 centimeters. In premature deliveries, the infant is somewhat smaller and the usual length of the trachea is approximately 4.2 or 4.3 centimeters. The tip section **12** extends to a shoulder **14** and is preferably about 4 mm., or a No. 12 French in external diameter. Since the entire tube **10** is a thin walled tube, having walls of about 0.5 mm. in thickness, the bore is then about 3 mm. internal diameter.

At shoulder **14** the tube **10** enlarges to approximately twice the diameter of the diameter of the tip section. Shoulder **14** is designed so that when it has been inserted

to the desired extent, shoulder **14** will rest against the trachea in the region of the vocal cords, as is the practice when using the Cole tube, presently commercially available for intubation of the upper respiratory tract of young children for administration of an anesthetic.

Shoulder **14** represents a tamponade which enables the vocal cords to be effectively obstructed by the tube in order to facilitate aspiration of the lower portion of the trachea. In addition, this shoulder makes it substantially impossible to penetrate the trachea to such an extent that the trachea could be ruptured by the extreme end of the tube **10**. In other words, shoulder **14** acts as a safeguard to prevent too deep a penetration of the trachea.

At **16** in FIGURE 2 there is an elbow section in the tube **10** in order that the tube conform more closely to the normal structures that are present in the infant at the time of intubation. Elbow **16** is located near the midpoint of tube **10**, so as to comprise a smoothly curved portion connecting relatively straight sections **18** and **20** to one another, sections **18** and **20**, and elbow **16** defining the main section of tube **10**. Branching from straight section **20** is a short side arm **22**. Preferably, side arm **22** extends for about 1 cm. in an outward direction and has an internal diameter of about 4 mm. Side arm **22** is covered at its outermost end with a thin membrane **25** which can be readily ruptured with the point of a scissors or other sharp pointed instrument.

Tube **10** terminates in a bent converging section **26** which is tightly fitted into the lower wall **28** of a receptacle **30** which serves as a mucus trap. As seen in the drawings, section **26** extends upwardly and terminates in a sidewardly open tip **32**. Although a specific trap construction is shown herein, it will be appreciated that other forms of traps can be utilized, such traps being generally well known.

Tube **40** is of a diameter which is substantially the same as that of tube **10** and includes two straight portions **42** and **46** joined by a short curved section **44**. Portion **42** may terminate at the wall of trap **30** or it may be provided with an extension **34** extending upwardly from its open tip **36** through the upper wall **38** of the vessel **30**, in the same manner as extension **26**. Section **46** preferably terminates in a flattened or somewhat fishtail shape tip **48** which forms a mouthpiece so that suction can be easily applied from the mouth of the person aspirating the mucus from the infant.

It is believed that the method of using the device will be evident from the above, but in order that the same be clearly understood, the following description is appended. First a laryngoscope **50** is inserted through the mouth of the newly delivered infant, to expose the opening to the trachea. Then the tip end **12** of the device of the present invention is inserted into the mouth and passed on down past the epiglottis into the trachea. Shoulder **14** of the device arrests any further insertion of the tip once the shoulder comes into contact with the trachea in the area of the vocal cords. Suction is then applied to tip **48** and mucus present in the respiratory tract is passed up along and through tube **10** and into trap **30**.

During resuscitation, it is necessary to introduce air into the respiratory system. Too aggressive insufflation could very easily cause rupture of the lung. The membrane **25** acts as a safety device in that it is so constructed as to rupture when the pressure thereon exceeds a predetermined pressure such as, for example, about 14 mm. of mercury. Therefore, when the air pressure exceeds 14 mm. of mercury, the membrane **25** automatically ruptures to release the pressure. If it is found necessary or desirable to administer oxygen to the infant, membrane **25** is punctured and a hose connected to a tank of oxygen is slipped over side arm **22**. It will be noted that this is accomplished without withdrawing the cannula, and

hence is done more expeditiously than has heretofore been possible.

If aspiration is to continue, the opening in the side arm **22** can be closed by finger pressure. Referring again to bend **16** in tube **10**, this bend assists in inserting the cannula into the thorax, and also allows easy visualization of the vocal cords past the shoulder **14**. Without the bend, the shoulder **14** frequently would obstruct vision of the narrower tip **12**.

In the described embodiment, the tube **10** has a side arm **22**. It is apparent that a cannula according to the present invention can be made without the side arm (not shown) with the resultant elimination of the safety feature and the means for introducing oxygen during resuscitation. However, according to the preferred and most advantageous structure, the side arm is included.

FIGURES 2 and 3, although enlarged as compared to FIGURE 1, show the cannula of the present invention substantially to scale. In the illustrated embodiment, the height of the trap **30**, i.e., the distance between walls **28** and **38** is about 3 cm., the vertical distance from wall **38** to the upper extremity of tip **48** is about 6 cm. and the vertical distance from wall **28** to shoulder **14** is about 8½ cm. The side arm **22** extends about 1 cm. from tube **10**.

In the illustrated embodiment, the tube **10** is shown as being formed of two generally straight sections **18** and **20** joined by a curved or elbow portion **16**. The tube **10** can also be fashioned to form a continuous curve (not shown), although the upper portion **20** can be straight with the lower portion **18** defining a continuous curve with elbow **16** (not shown). In all of these variations, tube **10** can be described as an angled tube. Desirably, the angle defined by the tube is about 140°.

Tube **10** can be made of any desirable plastic, and because of the thinness of the walls thereof, the tube is somewhat flexible, thereby minimizing the danger of breakage in the infant and also the danger of injuring the infant. The trap and the tube **40** can be made of any desirable materials such as glass or plastic, but is most preferably made of plastic so that the cannula can be made as a unitary plastic article which need be used only once, and is, therefore, disposable.

It will be apparent that the aspirating device is susceptible of considerable modification without departing from the inventive concept and hence having described what is regarded as a preferred embodiment of my invention in accordance with the patent statutes, it is not intended that it be limited except as required by the appended claims.

I claim:

1. A cannula for aspirating the upper portion of the respiratory tract of an infant comprising a first tube adapted to be inserted into the trachea, a second tube, and a mucus trap interconnecting said tubes, one of said tubes having a tubular side arm joined thereto for introducing fluid into the cannula, said side arm being closed by a rupturable membrane.

2. A cannula for aspirating the upper portion of the respiratory tract of an infant comprising a first tube adapted to be inserted in the trachea, a second tube, and a mucus trap interconnecting said tubes, one of said tubes having a tubular side arm joined thereto for introducing fluid into the cannula, said first tube comprising a main section and a tip portion of lesser diameter secured thereto, said main section merging into said tip portion so that said main section and tip portion form a continuous tube having a continuous bore, the intersection of said main section and said tip portion defining a shoulder for limiting insertion of said cannula into the trachea, the end of said main section remote from said tip portion being secured to said mucus trap.

3. A cannula according to claim 2, wherein said main section is angled.

4. A cannula according to claim 3, whereby said side arm is connected to said main section of said first tube.

5. A cannula according to claim 4, wherein said side arm is closed by a rupturable membrane.

6. A cannula according to claim 1 wherein said membrane is constructed so as to rupture when the pressure thereon exceeds a predetermined pressure.

7. A cannula according to claim 1, wherein said tubes and trap are integral with each other and are made of plastic to provide a disposable cannula.

8. A disposable cannula for aspirating the upper portion of a respiratory tract of an infant, comprising a first angled tube adapted to be inserted into the trachea, a second tube, and a mucus trap interconnecting said tubes, said first tube comprising a main section and a tip portion of lesser diameter secured thereto, said main section merging into said tip portion so that said main section and tip portion form a continuous tube having a continuous bore, the intersection of said main section and said tip portion defining a shoulder for limiting insertion of said cannula into the trachea, said main section being defined by two substantially straight sections interconnected by a curved portion, the end of said section remote from said tip portion being secured to said mucus trap, said main section having joined thereto, between said curved portion and said mucus trap, a tubular side arm for introducing fluid into the cannula, said side arm being closed by a rupturable membrane so constructed as to rupture when the pressure thereon exceeds a predetermined pressure, said tubes and trap being integral with each other and made of plastic.

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