

May 15, 1962

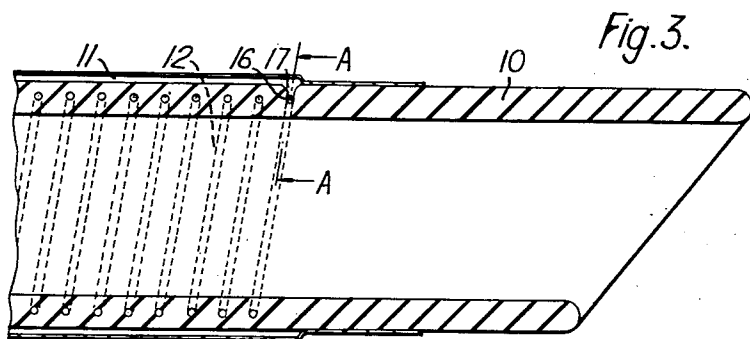
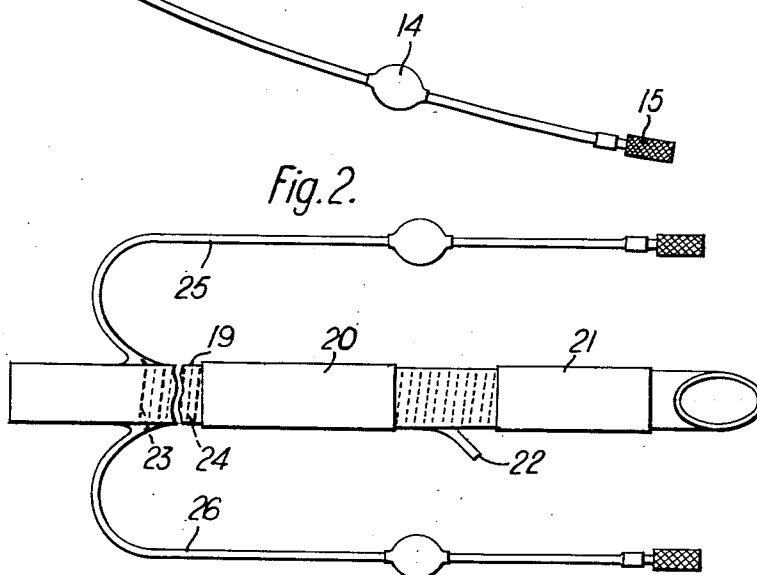
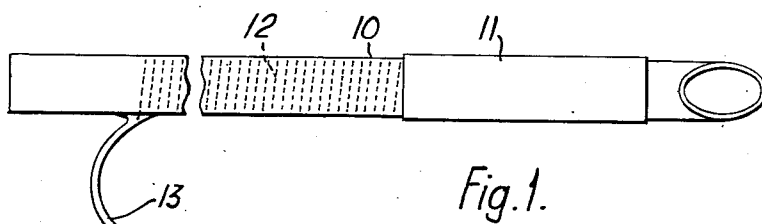
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3,034,510

CATHETERS

Filed Dec. 29, 1959

2 Sheets-Sheet 1



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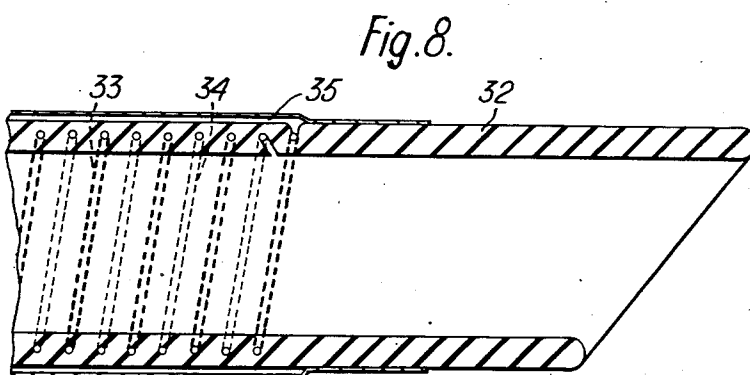
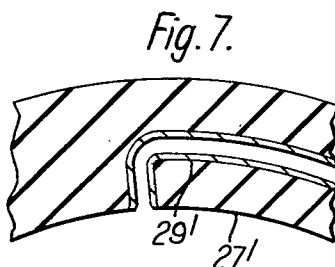
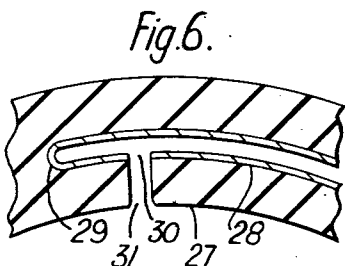
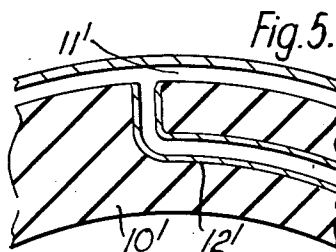
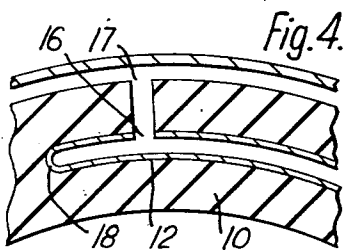
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CATHETERS

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2 Sheets-Sheet 2



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CATHETERS

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This invention relates to catheters and endotracheal tubes.

An important requirement for catheters and endotracheal tubes is that they should have sufficient flexibility to permit smooth introduction into curved passages whilst resisting radial compression and kinking. Particularly in the case of endotracheal tubes it is essential that wall thickness be a minimum in order that there is the least possible reduction in free cross sectional area of the trachea or bronchus into which the inner end of the tube is inserted, since any reduction in area impairs ventilation efficiency.

To reduce wall thickness and to enable very pliable material to be used, it has been proposed to embody in the wall of an endotracheal tube a stiffening helix of metal or other material which offers resistance to radial compression and kinking and ensures a high rate of recovery after distortion.

For the sake of brevity the term "catheter" as used hereinafter is intended to mean a catheter, endotracheal tube or other like fluid conducting element for inserting into a body cavity.

It is an object of this invention to provide a catheter which has within the wall a reinforcing helix and in which there is provision for fluid transfer to take place between a point located, when the catheter is in use, externally of the body cavity and a point located internally of the body cavity, whilst maintaining full patency of the catheter bore.

Such fluid transfer may be required for inflating a cuff fitted at or near that end of the catheter which in use lies within the body cavity and hereinafter called the inner end. Alternatively the fluid transfer may involve withdrawal of fluid from the body cavity as for example in alveolar air sampling. As yet another alternative, the fluid transfer may involve introduction of a fluid, for example water, for admixture with the air or gas passing through the catheter.

According to this invention a catheter for insertion into a body cavity comprises a tubular member of yielding material and a reinforcing helical member embedded in the wall of the tubular member, the helical member having a bore for establishing fluid communication between points which are located, when the catheter is in use, externally and internally respectively of the body cavity.

The helical member may be of metal such as stainless steel or a cupro-nickel alloy or it may be formed from a synthetic plastic material such as nylon or from capillary glass tubing.

When the tubular helix is used for cuff inflation the terminal portion of the helix located adjacent the inner end of the catheter may be bent so that its open end is directed into the space which is enveloped by the cuff. Alternatively the bore of the helix may be closed at its inner end, for example, by fusion of the metal, glass or plastic material, and a portion of the side wall of the helix lying under the cuff may be removed to expose the bore and permit the inflating gas to pass into the cuff. It may also be necessary to remove some of the material of the wall of the catheter itself. For alveolar air sampling or for admixture of another fluid with the air or gas pass-

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ing through the catheter, the inner end of the helix is in open communication with the bore of the catheter or endotracheal tube.

At the other or outer end, the helix may be bent to project through the wall of the catheter and adapted for connection to fluid transfer means. The fluid transfer means may be a pressurising device, such as a syringe, for cuff inflation, or a suction device for alveolar air sampling or a device for forcing gas or liquid through the helix to admix at the delivery end with the air or gas passing through the catheter.

For cuff inflation a small bulb serving as inflation indicator for the cuff may be provided between the projecting end of the reinforcing helix and the pressurising device.

Depending on the function which the helical member is required to perform it may comprise either a single or a multiple helix. For example in catheters having two or more cuffs, the component helices may correspond in number to the number of cuffs, being arranged to permit separate inflation of each cuff as required. Alternatively separate elements of the helical member may be utilised for cuff inflation, for air-sampling and/or for fluid introduction.

At the outer end each element of the multiple helix projects from the wall of the catheter and is adapted for connection to the appropriate fluid transfer means.

Examples of various embodiments of the invention are illustrated in the drawings in which

FIG. 1 is a perspective view of an endotracheal tube having a single cuff,

FIG. 2 is a perspective view of an endotracheal tube having two cuffs for insertion into the trachea and into one of the bronchi respectively,

FIG. 3 is an enlarged longitudinal section of the end of the endotracheal tube of FIG. 1 showing a portion of the cuff,

FIG. 4 is a fragmentary section, still further enlarged, taken along the line A—A of FIG. 3,

FIG. 5 is a similar fragmentary section showing an alternative arrangement by which the bore of the helical member opens into the cuff,

FIGS. 6 and 7 are fragmentary sections of endotracheal tubes suitable for air sampling or fluid injection and,

FIG. 8 is a longitudinal section of a cuffed endotracheal tube provided with two stiffening helices, one adapted for cuff inflation and the other for air sampling or fluid injection.

Referring to FIG. 1 and FIG. 3, a tubular member 10 is provided near the end which is intended to be inserted into the trachea with a cuff 11, and embedded in the wall of the member 10 is a hollow stiffening helix 12. The bore of the helix opens at one end into the cuff 11 and at the other end into a short length of tubing 13 provided with a small indicator bulb 14. A connection 15 adapted to receive a syringe is inserted into the other end of the tubing 13. As shown in FIGS. 3 and 4, an opening 16 is formed in the wall of the helix 12 adjacent the end underlying the cuff 11 and aligned with the opening 16 is a passage 17 formed in the wall of the tube 10 to permit passage of inflating gas to the cuff. The end 18 of the helix 12 is sealed.

In an alternative arrangement shown in FIG. 5, the end of the helix 12' is not sealed and the end is bent outwards through the wall of the tube 10' to open into the cuff 11'.

In FIG. 2, an endotracheal tube 19 is provided with two cuffs 20 and 21 for insertion into the trachea and a bronchus respectively, a hook 22 being provided to rest on the bronchial fork and ensure correct location within the patient. Embedded in the wall of the tube 19 are two hollow helices 23 and 24, the turns of which alternate,

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the bore of helix 23 opening into cuff 20, and the bore of helix 24 opening into cuff 21. The other ends of the helices lead into the inflating connections 25 and 26.

FIGS. 6 and 7 show alternative arrangements, corresponding to those shown for cuffed tubes in FIGS. 4 and 5, by which the bore of the stiffening helix communicates with the lumen of an endotracheal tube. In FIG. 6, the tube 27 is provided with a helix 28 the end 29 of which is sealed, an opening 30 in the wall of the helix registering, with a passage 31 formed in the wall of the tube 27 which opens into the lumen. In FIG. 7, the end of the helix 29' is directed inwardly to open into the lumen of the tube 27'.

Referring to FIG. 8, the endotracheal tube 32 is provided with two hollow stiffening helices 33 and 34, the bore of helix 33 opening into a cuff 35 and the bore of helix 34 opening into the lumen of the tube.

In any of the endotracheal tubes described, the stiffening helix may be incorporated in the tube during the conventional dipping process by which such tubes are manufactured. In the embodiments illustrated in FIGS. 4 and 6, the passages 17 and 31 may conveniently be formed by inserting a plug into openings 16 and 30 during dipping, which is subsequently removed after curing.

I claim:

1. A catheter for insertion into a body cavity comprising a tubular member of yielding material, an inflatable cuff surrounding said member adjacent one end thereof, a reinforcing helical member embedded in the wall of the tubular member having its axis substantially coincident therewith, the helical member having a bore, the wall of the helical member having an opening through which the bore communicates with the interior of the cuff

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and a second opening which is located, when the catheter is in use, externally of the body cavity, through which the bore is adapted to communicate with means for supplying gas under pressure to the cuff; said bore of the helical member communicating with the inflatable cuff through a passage formed in the wall of the tubular member.

2. A catheter for insertion into a body cavity comprising a tubular member of yielding material and a reinforcing helical member embedded in the wall of the tubular member with its axis substantially coincident therewith, the helical member having a bore, the wall of the helical member having an opening located, when the catheter is in use, internally of the body cavity, through which the bore communicates with the lumen of the tubular member and a second opening located, when the catheter is in use, externally of the body cavity through which the bore of the helical member is adapted to communicate with fluid transfer means; said bore of the helical member communicating with the lumen of the tubular member through a passage formed in the wall thereof.

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