

[54] **GUIDE FOR GROWING BLOOD VESSELS OR THE LIKE**

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[51] Int. Cl. **A61f 1/24, A61b 17/11**

[58] Field of Search **3/1, DIG. 1; 128/334 R, 334 C, 128/1 R**

[56] **References Cited**

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[57] **ABSTRACT**

A device for guiding growth of blood vessels or the like for use in the surgical repair of impaired blood vessels or like tissues. A flexible inner perforated tube having an outside diameter approximately equal to the inside diameter of the severed blood vessel is located inside an outer imperforate flexible tube having an inside diameter approximately equal to the outside diameter of the severed blood vessel. The severed ends of the blood vessel are positioned between the inner and outer tube ends in spaced relationship, whereby blood can flow through the perforated tube to the space between the inner and outer tubes to promote growth and subsequent joining of the severed blood vessel ends.

4 Claims, 7 Drawing Figures

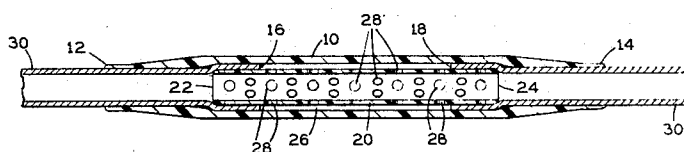


FIG. 1

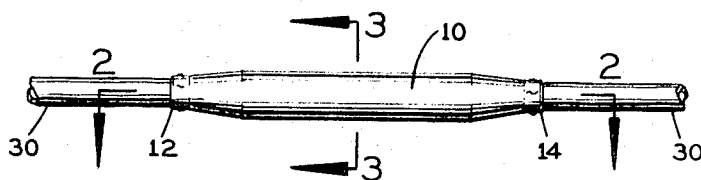


FIG. 2

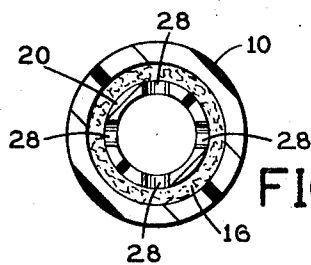
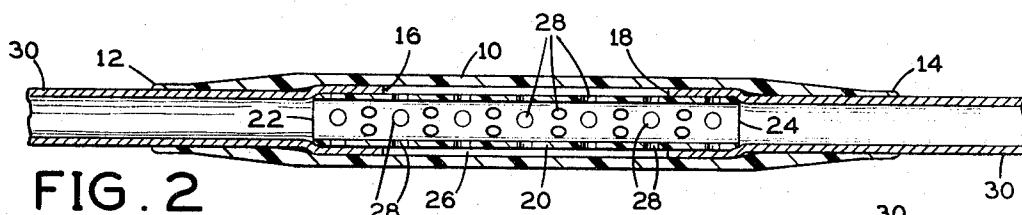


FIG. 3

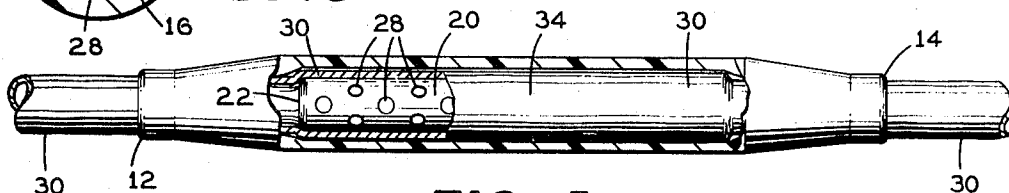


FIG. 4

FIG. 5

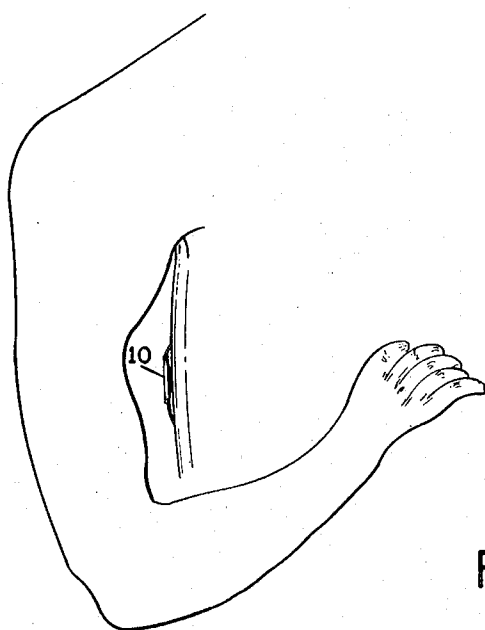
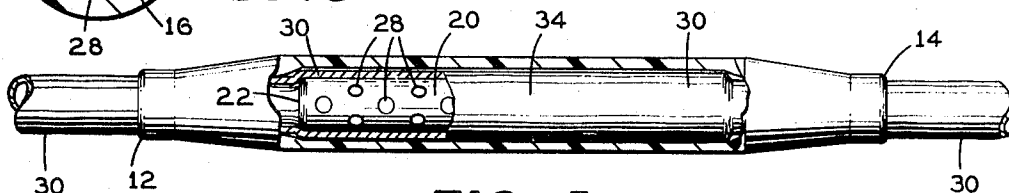


FIG. 6

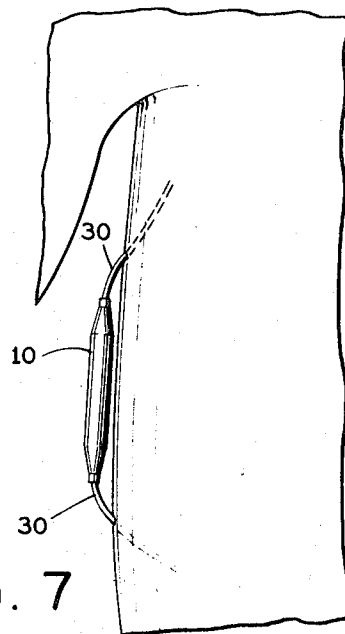


FIG. 7

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GUIDE FOR GROWING BLOOD VESSELS OR THE LIKE

BACKGROUND OF THE INVENTION

It is common at the present time for surgeons to replace impaired sections of blood vessels with plastic tubing. It is believed to be more desirable to replace a cut out section of a blood vessel with natural blood vessel tissue, but it would be difficult to obtain a sufficient length of blood vessel from a healthy area of the patient. Specifically, if a length of healthy blood vessel were cut say from a vessel in the patient's arm to repair another blood vessel in the patient's chest, the arm blood vessel would become too short in some cases.

SUMMARY OF THE INVENTION

The present invention provides a device for guiding growth of blood vessels so that an impaired section of blood vessel may be cut out, and either the remaining blood vessel may be grown through the guide to the appropriate length, or a new length of blood vessel may be grown in another portion of the patient and then transplanted to replace the diseased or impaired blood vessel.

Accordingly, it is an object of the present invention to replace impaired blood vessel tissue with natural blood vessel tissue by growth of new tissue.

Another object of the invention is to provide a guide in which new blood vessel tissue may be grown.

A further object of the invention is to provide a guide which may be affixed to the ends of a blood vessel from which a section has been cut out so that new blood vessel tissue will grow through the guide and join to repair the blood vessel.

Another object of the invention is to provide a guide which may be attached to cut ends of a blood vessel in a healthy section of the body so that new blood vessel tissue may be grown through the guide, removed, and transplanted to a region where impaired blood vessel tissue has been surgically removed.

Another object of the invention is to provide a guide which keeps blood flowing to the ends of a blood vessel which are growing in the guide.

Although the invention is being described as applied to blood vessels, it may be useful in other applications.

Other objects of this invention will appear from the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

ON THE DRAWINGS

FIG. 1 is a view of a guide in accordance with the invention as applied to a blood vessel;

FIG. 2 is an enlarged, sectional view taken along line 2—2 of FIG. 1 and viewed in the direction of the arrows;

FIG. 3 is an enlarged, cross-sectional view taken along line 3—3 of FIG. 1 and viewed in the direction of the arrows;

FIG. 4 shows a blood vessel, partly cut away to reveal internal clotting or fatty tissue buildup;

FIG. 5 is an enlarged view, partly in section, showing the ends of a severed blood vessel after they have grown and joined each other in the guide;

FIG. 6 is a pictorial view illustrating how the guide may be used to grow a length of blood vessel at a healthy region of the body to be later transplanted to replace an impaired section of blood vessel; and

FIG. 7 is an enlargement of a portion of FIG. 6.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

AS SHOWN ON THE DRAWINGS

A guide in accordance with a preferred embodiment of the invention includes an outer, imperforate tube 10 which is applied at tapered, flexible end portions 12 and 14 over the outside of the ends 16 and 18 of a severed blood vessel. The guide also includes a perforated tube 20 which is smaller in diameter than tube 10 and has ends 22 and 24 which are applied inside the ends 16 and 18 of the blood vessel. The tube 20 is sufficiently smaller in outside diameter than the inside diameter of tube 10 that there is a space 26 between the two tubes where the ends 16 and 18 of the blood vessel can grow together and join. The holes 28 in the perforated tube 20 provide a path through which blood can flow from the inside of the blood vessel to the space 26 so as to keep blood circulating about the ends 16 and 18 of the blood vessel and thus promote growth of the blood vessel and joining of the ends after they have grown together.

Both of the tubes 10 and 20 are flexible and are preferably made of plastic material such as nylon. The ends 12 and 14 of tube 10 taper down from the thicker midportion of the tube so that the ends 12 and 14 are very thin and flexible. This allows the ends 12 and 14 to be sutured to the blood vessel. The ends 22 and 24 of tube 20 may also be sutured to the blood vessel. Alternatively, one or both of the tubes may be left unsutured, particularly if the blood vessel is immobilized. It is also possible to provide a sanitary covering (not shown) over the outside of tube 10 merely for protective purposes.

As previously mentioned, the guide may be applied to a blood vessel where an impaired section of the vessel has been cut out to allow the ends of the blood vessel to grow together through the guide and join in the guide. FIG. 4 illustrates a blood vessel 30 which has an obstruction, such as a clot or fatty tissue, at the center section 32. The center section 32 may be removed surgically, and then the guide applied in the manner shown in FIG. 2. The ends of the blood vessel grow together in the space 26 nourished by blood supplied through the apertures 28 until the ends join to again form a continuous blood vessel 30 in the manner illustrated in FIG. 5. A portion of the guide is cut away in FIG. 5 to reveal the blood vessel 30 and the point where the two ends of the blood vessel have joined at 34. The guide may be used in an alternate manner. It is assumed that a blood vessel, say in the chest of the patient, has an impaired section 32 shown in FIG. 4. Rather than cutting this section out at the beginning of the procedure, an alternate procedure is followed. A blood vessel (vein or artery) is exposed at a healthy region of the body, say at a patient's side as shown in FIGS. 6 and 7, and the blood vessel is cut once, and the guide comprising tubes 10 and 20 is applied to the severed ends of the blood vessel in the manner shown in FIG. 2. The guide remains in this condition while the blood vessel grows in the guide and the ends of the blood vessel join together in the guide. This effectively grows a new section of blood vessel which is then cut out of the original blood vessel of the patient's side. This original blood vessel is sewn back together. The impaired section 32 of the blood vessel 30 is cut out and the new length of blood vessel which has been grown on the patient's side is transplanted or transferred to the blood vessel 30 by suturing the ends together. The guide may be entirely removed from the new section of blood vessel before it is transferred, or part of the guide may be removed, or the guide may remain entirely on the blood vessel.

There may be other ways of employing the guide of the invention. For example, it may be possible to grow vessels or tubes other than blood vessels in the guide. However, the primary utility of the invention is believed to be in the growth of blood vessels.

Having thus described my invention, I claim:

1. A device for guiding and promoting growth of a severed blood vessel in a living body, said device comprising a first thin-walled and flexible imperforate tube having an inside diameter about the same as the outside diameter of the blood

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vessel and having end portions adapted to fit closely over the outside of the blood vessel, a second thin-walled and flexible tube having an outside diameter about the same as the inside diameter of the blood vessel and having end portions adapted to fit closely inside the blood vessel, said second tube being located inside said first tube in use and separated therefrom by a space equal to or slightly larger than the thickness of the blood vessel, said first and second tubes being made from a material suitable for contact with a blood vessel, and said second tube having aperture means therein for supplying blood from the severed blood vessel to the space between said

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tubes to promote growth of the ends of the severed blood vessel through said space until said ends join.

2. The guide device as claimed in claim 1 in which said end portions of said first tube taper down from a central portion of said tube to a substantially thinner dimension at the tips of said tube.

3. The guide device as claimed in claim 1 in which said first and second tubes are made of plastic.

4. The guide device as claimed in claim 3 in which said plastic comprises nylon.

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