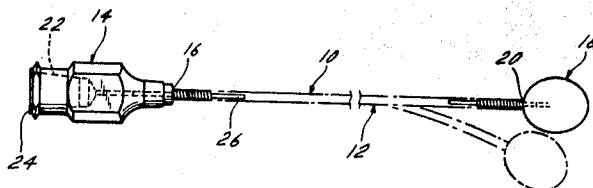


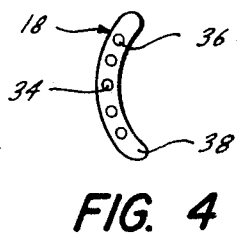
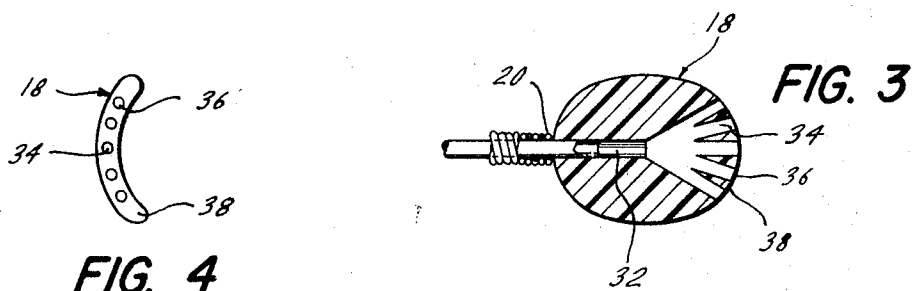
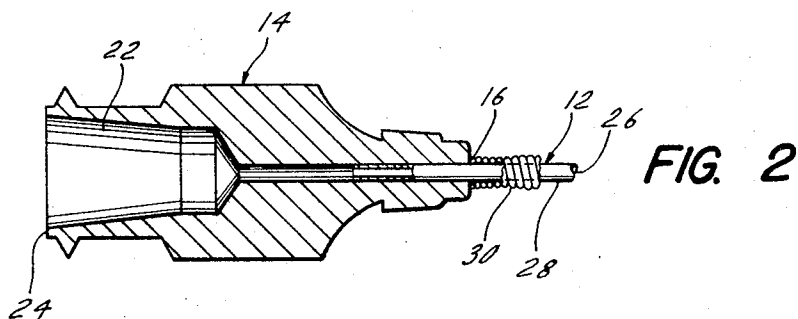
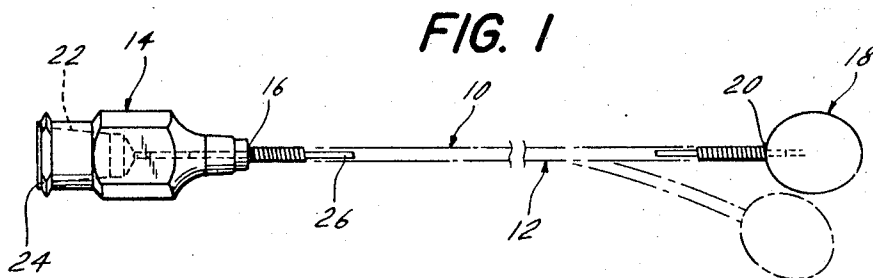
[72] Inventor **James C. Halligan**
Fair Lawn, New Jersey
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[73] Assignee **Becton, Dickinson and Company**
East Rutherford, New Jersey
a corporation of New Jersey

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Primary Examiner— L. W. Trapp
Attorney—Kane, Dalsimer, Kane, Sullivan and Smith

[54] **FLEXIBLE GAS ENDARTERECTOMY SPATULA**
3 Claims, 4 Drawing Figs.
[52] U.S. Cl. **128/303,**
128/343, 128/348
[51] Int. Cl. **A61b 17/00**
[50] Field of Search 128/303,
303.1, 221, 347, 348, 214, 215, 343

ABSTRACT: An instrument for use in gas endarterectomy procedures including a flexible cannula having one end adapted to receive a supply of gas and having a spatula at the opposite end. The spatula has a multiplicity of openings in the forward edge thereof in communication with the cannula bore, thus enabling gas to flow through the cannula and out the spatula. The flexibility of the cannula enables the instrument to be used on curved as well as straight sections of the vascular system.





INVENTOR
JAMES C. HALLIGAN
BY
Kane, Schinner, Kane, Sullivan & Smith
ATTORNEYS

FLEXIBLE GAS ENDARTERECTOMY SPATULA

BACKGROUND OF THE INVENTION

Atherosclerosis or "hardening of the arteries" is a disease of the vascular system which each year is responsible for a substantial number of deaths. Basically this disease may be characterized as a build-up of a wax-like plaque upon the inner surfaces of a blood carrying vessel or artery, which reaches such proportion as to block the arterial passage-way preventing the natural flow of blood therethrough.

One technique for reconstructing the section of the vascular system afflicted with atherosclerosis is to perform an endarterectomy on the section. This procedure, as presently practiced in accordance with one method, provides for the inflating of the afflicted section with a suitable inert gas such as carbon dioxide. The introduction of this gas has been found to cause the adventitia (outermost wall of the artery), to balloon out, causing a separation of the diseased inner core of sclerotic plaque from the sub-adventitia (inner layer of the outer wall). After properly severing any filamented strands extending between the plaque and sub-adventitia, the plaque may be removed in one intact section from the artery and thus permit blood to resume its normal flow through the artery.

SUMMARY OF THE INVENTION

The present invention relates to an improved gas endarterectomy instrument which simplifies the procedure for assuring the complete separation of the inner-sclerotic core from the sub-adventitia by facilitating the severing of any filamented bands or strands which continue to connect the inner core of sclerotic plaque to the arterial wall after the artery has been inflated.

It is a principal object of this invention to provide an instrument which may be used to inject additional quantities of gas proximal to any local area of inner core-adventitia connection and thus aid the dissection therebetween while simultaneously serving as a ream which may be passed along the dissection plane within the artery or vessel and thereby facilitate the eventual removal of the core from the artery.

These and other objectives and advantages are most effectively attained in accordance with the present invention by providing an instrument comprising a flexible cannula having a first end adapted to receive a supply of gas and an opposite end to which a spatula is affixed. The cannula portion of the instrument is sufficiently flexible to allow the spatula to follow the curvature of all vessels within the arterial system with which the instrument may be used. The spatula comprises a substantially saddle-shaped member the overall width of which is sufficiently small to permit its passage through the various vessels of the vascular system. The peripheral edge of the spatula is provided with at least one opening therein, and preferably with a multiplicity of openings, each such opening being in communication with the cannula bore so as to permit the flow of gas therethrough. All corners of the instrument are blunt and arcuate or rounded to prevent the accidental snagging of the instrument on healthy tissue or capillary branches during use. To provide the desired degree of flexibility, the cannula may take the form of a helically or spherically wound tube, manufactured in accordance with well known manufacturing procedures.

DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a top plan view of a gas endarterectomy instrument in accordance with the present invention;

FIG. 2 is an enlarged sectional view of the hub end of the instrument of FIG. 1;

FIG. 3 is an enlarged sectional view of the spatula end of the instrument of FIG. 1; and

FIG. 4 is an end elevational view of the spatula of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference is now made to the drawings and in particular to FIG. 1 wherein a gas endarterectomy instrument 10 in accordance with the present invention is depicted as including a flexible shank 12 having a hub 14 for connecting the instrument to a gas supply affixed to one end 16 and a spatula 18 affixed to the opposite end 20. The instrument may be made of any material inert to body fluids and compatible with insertion into the human body and in this regard stainless steel has been found to be the most satisfactory. The hub 14 and spatula 18 are affixed to the ends of shank portion 16 and 20 respectively by any suitable means although soldering has been found to be most satisfactory in conjunction with the preferred use of stainless steel.

Referring briefly to FIG. 2 it is noted that hub 14 is adapted to be securely coupled to a gas source. In this regard, and in order to facilitate the coupling and removal of the instrument from the gas supply, the hub may be fitted with Luer type fitting as shown. A bore 22 extends inwardly from the free end 24 of hub 14 and communicates with the center bore 26 which extends the length of shank portion 12.

Shank portion 12 may comprise a single elongated hollow flexible member, or, as depicted in this preferred embodiment may comprise two concentric tubes. The inner tube 28 serves to contain the gas supply while the outer tube 30 serves to protect the inner tube. In this regard, the inner tube 28 may be produced of relatively thin material so as to obtain the desired degree of flexibility while the outer tube may be helically or spherically wound so as to maintain the necessary degree of flexibility. This provides the instrument with sufficient strength to withstand the rigors of use while at the same time allowing it a great degree of flexibility.

As was previously mentioned, a spatula 18 is affixed to shank end 20 opposite hub 14. Spatula 18, which is depicted in FIGS. 3 and 4, comprises a saddle-shaped member although the present invention is not limited to spatulas of this configuration. A manifold 32 is provided within spatula 18 communicating with the bore 26 of inner tube 28. It should be noted that this bore also communicates with bore 22 in hub 14. A multiplicity of passageways 34 are also provided in the spatula and serve to communicate the manifold with the leading edge of the spatula so that when a supply of gas is connected to the hub portion and permitted to flow through the shank of the instrument streams of gas will emanate through the various openings 36 in the forward peripheral edge 38 of the spatula. It should be noted that for some purposes spatula configurations other than that described herein may be required and such configurations are also within the scope of the present invention. The size of the spatula should be such as to enable its introduction within the arterial system of a human being. For practical purposes, the width of the spatula may range between $\frac{1}{8}$ and $\frac{7}{16}$ inch.

The endarterectomy instrument of the present invention is utilized in accordance with a surgical technique for treating an artery or vessel afflicted with atherosclerosis. In this regard the afflicted section is isolated from the remainder of the vasculature by suitable clamps and thereafter multiple injections of carbon dioxide gas are introduced into the sub-adventitia. The depth of penetration of the gas injecting needle determines the location of the dissecting plane, that is the plane at which the inner core will separate from the adventitia. The introduction of the gas has the effect of dissecting the inner surface of the outer or adventitia layers of the wall of the artery from the diseased inner core. However, it has been found that filamented strands may still serve to connect the diseased inner core and outer wall. To sever these strands, short longitudinal arteriotomies are made through the vessel in a standard manner, thus exposing the inner afflicted core. The gas endarterectomy instrument of the present invention may then be passed down through the vessel along all the surfaces of the exposed diseased core thus insuring the complete freedom of the core from the remainder of the artery. In this

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regard the present instrument was designed for the purpose of providing a gas endarterectomy instrument flexible enough to follow the curvature of any vessel or artery upon which the procedure may be required. This includes the right and left coronary arteries, the femoral-popliteal artery and collateral arteries, and the carotid artery. The present invention enables the separation of the media from the intima in both straight or curved vessels. After the spatula has been passed down the vessel, and the inner core has been completely freed, the inner core is transected distally and proximally and extracted from the artery. The arteriotomies may then be closed in the standard fashion and the clamps removed.

It should be understood that the gas endarterectomy procedure technique discussed herein does not form a part of the present invention and that the present application is directed only at instrumentation which facilitates this technique. It should be further understood that modifications may be made in the illustrated and described embodiment of

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my invention without departing from the invention as set forth in the accompanying claims.

I claim:

1. An instrument useful in endarterectomy procedures comprising: a flexible shank having an internal longitudinal bore therethrough; means for coupling said instrument to a supply of gas affixed to one end of said shank; and, a spatula affixed to the opposite end of said shank, said spatula having at least one opening therein in communication with said shank internal bore.

2. The invention in accordance with claim 1 wherein said shank portion comprises a first cannula surrounded by and disposed within a second supporting cannula wherein said internal bore comprises the bore of said first cannula.

3. The invention in accordance with claim 2 wherein said second supporting cannula comprises an elongated tube formed of a single spirally wound strand.

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