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An agency of Industry Canada

CA 2197359 C 2003/07/08

(11)(21) 2 197 359

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 1997/02/12

(41) Mise à la disp. pub./Open to Public Insp.: 1997/08/22

(45) Date de délivrance/Issue Date: 2003/07/08

(30) Priorité/Priority: 1996/02/22 (1002423) NL

(51) Cl.Int.^{6}/Int.Cl.^{6} A61F 2/01, A61M 25/00

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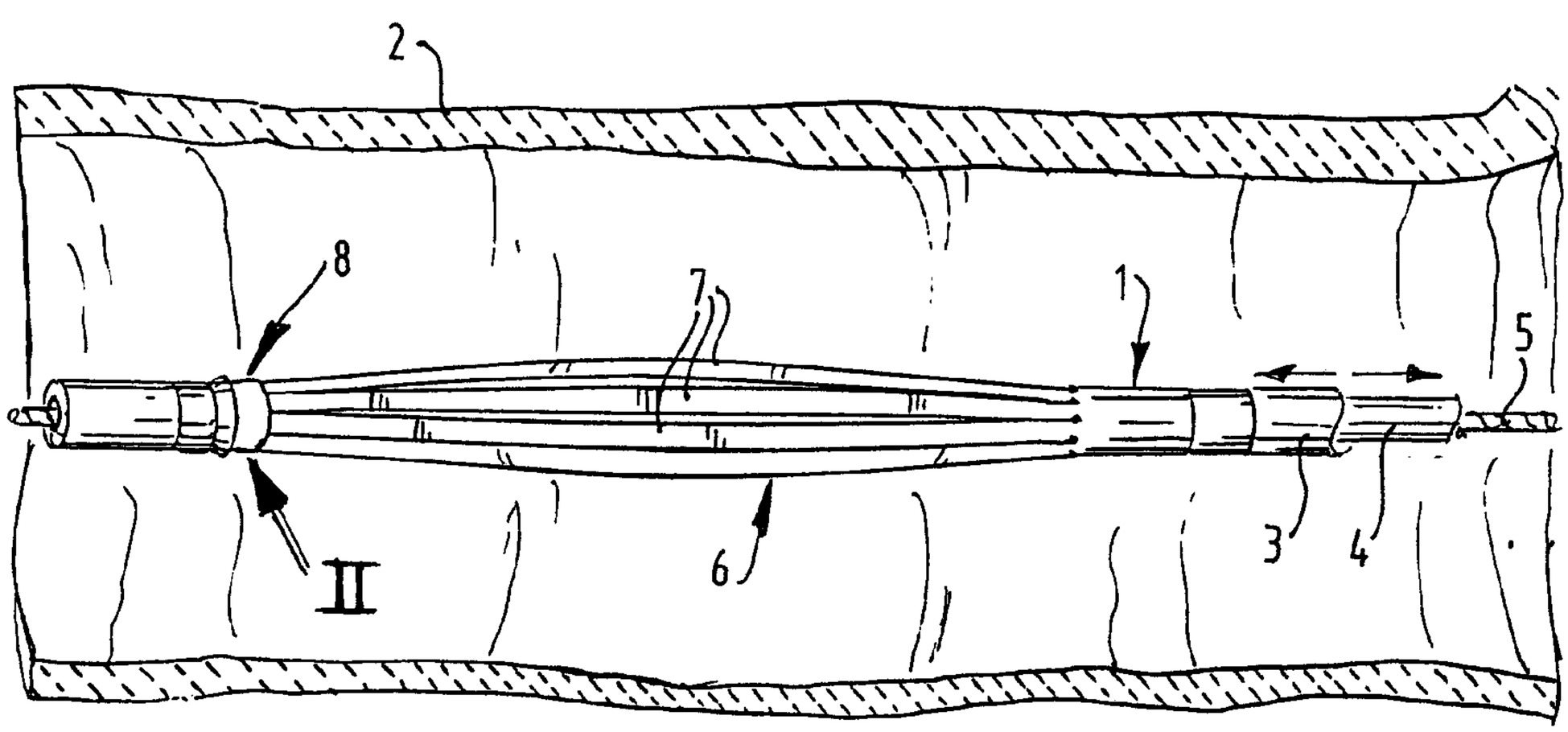
(54) Titre : CATHETER-FILTRE TEMPORAIRE
(54) Title: TEMPORARY FILTER CATHETER



(57) Abrégé/Abstract:
The invention relates to a filter catheter. This catheter comprises a tube-like basic body with a proximal and a distal end, a filter element arranged at the distal end formed by a number of strips arranged spaced out around the circumference, which are connected with both ends to the basic body. The relatively distal ends of the strips are connected in a detachable manner to the basic body by connecting means.

ABSTRACT

The invention relates to a filter catheter. This catheter comprises a tube-like basic body with a proximal and a distal end, a filter element arranged at the distal end formed by a number of strips arranged spaced out around the circumference, which are connected with both ends to the basic body. The relatively distal ends of the strips are connected in a detachable manner to the basic body by connecting means.

TEMPORARY FILTER CATHETER

The invention relates to a temporary filter catheter such as used for instance during thrombolytic treatment. In that case the filter is arranged inside the vena cava and prevents blood thrombi from circulating freely through the vascular system and finishing up in places which could endanger the health of the patient.

For a certain group of patients, for whom such interventions entail a high degree of risk, it may be necessary to keep such a catheter for a longer period of time, for instance for a period of more than 10 days, in place.

Commonly used filter catheters of this type comprise, arranged at a distal end of a tube-like basic body, a filter element which is made up of a number of strips arranged spaced out around the circumference and connected to the basic body, which strips can be bent outwards by moving the opposite ends towards each other in order to be brought into the operative state by doing so. The maximum period such filter catheters can stay inside the body is limited by the fact that the tissue of the wall of the blood vessel concerned, against which the strip-shaped elements are positioned, encapsulate these strips, so that the filter element grows into the tissue. Consequently such a filter can only be removed by damaging the tissue, which is obviously undesirable.

The object of an aspect of the invention is to provide a filter catheter of the type referred to, which can stay for a long period of time inside the body of the patient.

With the filter catheter according to one aspect of the present invention, the relatively distal ends of the strips which define the filter element are connected with the basic body by connecting means in a detachable manner. On removing the catheter, the distal ends of the strips are disconnected after which the filter element can be withdrawn without damaging the tissue. On withdrawal, the strips slide through the 'channels' which have been formed in the tissue surrounding the strips.

In accordance with another aspect of the present invention, there is provided filter catheter comprising: a tube-like catheter body with a proximal and a distal end; a filter element arranged at the catheter distal end, said filter element formed by a number of strips arranged spaced out around a circumference of the catheter body, and said strips having proximal and distal ends, and said strips connected to the catheter body at least at their distal ends wherein the distal ends of the strips are connected with the body by detachable connecting means; and

wherein the distal ends of the strips comprise a projection from said strip.

In one particular aspect of an embodiment the catheter body comprises an outer tube-like body and an inner tube-like body removeably received inside the outer tube-like body, and said strips connected with their proximal ends to the outer tube-like body and with their distal ends to the inner tube-like body; and wherein the connecting means are placed on the inner body and retain the distal ends of the strips by means of a clamping connection.

Disconnecting the distal ends of the strips can be done by displacing the inner tube-like body in relation to the outer tube-like body in a distal direction. By doing so a tensile force is applied to the strips, which consequently are detached from the connecting means.

In another particular aspect of an embodiment the connecting means comprise a sleeve connected to the inner tube-like body, said sleeve clamped around the distal ends of the strips. As long as a certain minimum tensile force is not applied to the strips, the sleeve retains the distal ends of the strips. As soon as this minimum tensile force is exceeded, the ends of the strips will slide from under the sleeve so that they are detached from the connecting means.

In another particular aspect of an embodiment the sleeve has been made of an elastic material. The ends of the strips are secured elastically, so that a reliable connection is maintained until the moment the connection has to be broken. Because of the elasticity of the sleeve, the disconnecting force can be administered accurately.

In another particular aspect of an embodiment the elastic material is silicone rubber.

In accordance with another aspect of the present invention, there is provided filter catheter comprising: a tube-like catheter body with a proximal and a distal end; a filter element arranged at the catheter distal end, said filter element formed by a number of strips arranged spaced out around a circumference of the catheter body, and said strips having proximal and distal

ends, and said strips connected to the catheter body at least at their distal ends wherein the distal ends of the strips are connected with the body by detachable connecting means;

wherein the distal ends of the strips comprise a projection from said strip; and

wherein the projection is formed by a wall section of said adjoining a depression in the outside surface of each strip, at a small distance from the distal end of the strip.

In accordance with another aspect of the present invention, there is provided filter catheter comprising: a tube-like catheter body with a proximal and a distal end; a filter element arranged at the catheter distal end, said filter element formed by a number of strips arranged spaced out around a circumference of the catheter body, and said strips having proximal and distal ends, and said strips connected to the catheter body at least at their distal ends wherein the distal ends of the strips are connected with the body by detachable connecting means;

wherein the catheter body comprises an outer tube-like body and an inner tube-like body removeably received inside the outer tube-like body, and said strips connected with their proximal ends to the outer tube-like body and with their distal ends to the inner tube-like body; and wherein the connecting means are placed on the inner body and retain the distal ends of the strips by means of a clamping connection; and

wherein the distal ends of the strips comprise a projection from said strip .

The invention will be explained in greater

detail in the following description with reference to the attached drawings.

Figure 1 shows the distal end of an example of an embodiment of a catheter according to the invention during the introduction thereof.

Figure 2 shows a detailed view cut through at the arrow II of figure 1.

Figure 3 illustrates the end of the catheter shown in figure 1 with the filter element unfolded.

Figure 4 shows a view corresponding to figure 3 after a relatively long stay inside the body of the patient, and where the strips are grown into the tissue.

Figure 5 illustrates the removal of the filter after disconnecting the ends of the strips.

Figure 6 shows a view corresponding to figure 2 with the ends of the strips of the filter element detached.

Figure 7 illustrates an alternative embodiment of connecting means for a catheter according to the invention.

In figure 1 the distal end-section of a catheter 1 according to a preferred embodiment of the invention is shown. The catheter 1 has been introduced into a blood vessel 2 of a patient and the filter element 6 of this catheter still has to be unfolded in order to be able to carry out the filter function.

The catheter 1 comprises an outer tube-like body 3 inside of which an inner tube-like body 4 has been received in a movable manner. The inner tube-like body has a lumen through which a guide wire 5 extends when positioning the catheter and in particular the filter element 6 thereof.

In the case of the example of this preferred embodiment the filter element 6 is formed by a number of strips, which are made up of sections of the wall of the outer tube-like body 3, which are separated from one another by longitudinal cuts.

The relatively proximal ends of the strips 7, that is to say the ends of these strips on the right-hand side as seen in figure 1, form a whole with the outer tube-like body 3.

The relatively distal ends 10 of the strips 7 are connected to the inner tube-like element in a detachable manner by connecting means 8. The connecting means 8 retain the distal ends 10 of the strips 7 by means of a clamping connection. This clamping connection is obtained because the connecting means 8 comprise a sleeve 11 made of an elastic material, for instance silicone rubber.

The sleeve 11 has been fixed to the catheter by means of a layer of cured plastic material 13, for instance a cured epoxy. The end-section 14 of the catheter 1 has preferably been made of a soft material in order to achieve a maximum atraumatic action when introducing the catheter.

As can be seen in figure 2, a marking ring 12 has been arranged around the inner tube-like body 4 and a second marking ring has been arranged around the outer tube-like body 3. Both rings have for instance been made of gold to make the position of the filter element clearly visible on an X-ray screen in a catheterisation laboratory.

Figure 3 shows the unfolded, operative state of the filter element 6. This state is brought about when the catheter 1, and in particular the filter element 6, has been manoeuvred in the target position inside the blood vessel 2. The guide wire 5 can then be removed.

In order to unfold the filter element 6, the inner tube-like body 4 is moved in relation to the outer tube-like body 3 in a proximal direction. As a result the ends of the strips 7 are moved towards each other, so that these strips bend outwards until they make contact with the wall of the blood vessel 2. The connecting means 8 retain the ends of the strips 7 in a reliable manner.

When the catheter is left inside the body with the filter element unfolded in this manner for a longer period of time, tissue 20 will start growing around strips 7 positioned against the wall of the blood vessel 2. The strips 7 form 'passages' as it were inside this

tissue 20. The state in which the strips 7 have grown together with the tissue has been illustrated in figure 4. When in this situation the catheter would be removed just like that, the tissue grown around the strips 7 would have to be torn, with all the attendant risks.

With the catheter described here, the distal ends 10 of the strips 7 are detached from the connecting means 8 however before the catheter is removed.

Detaching the said distal ends is simply done by moving the inner tube-like element 4 in relation to the outer tube-like element 3 in a distal direction. The elastic sleeve 11 is then slid off the distal ends 10 of the strips 7, as a result of which these ends 10 are released in the manner illustrated in the figures 5 and 6.

When the catheter is subsequently removed, the strips 7 will slide easily through the passages 21 formed inside the tissue 20, without any damage being done to this tissue 20. In other words, the catheter can be removed without problems and without trauma.

As can be seen in the figures 2, 5 and 6, the ends 10 of the strips 7 are provided with a projection which ensures a good grip of the sleeve on the ends 10.

Figure 7 shows a somewhat different embodiment of the strips 7, in which case the projections, indicated here with the reference number 25, are formed by a depression 24 in the outside surface of each strip 7 at a small distance from the distal end thereof. The depth of the depression 24 is equal to the thickness of the sleeve 11, so that the outside surface of the catheter with the strips 7 is even and smooth in the connected state.

The invention is not limited to the embodiment shown and described herein. Specifically the connecting means with which the relatively distal ends of the strips are connected with the basic body can be embodied in other ways than shown. The distal ends of the strips can be connected by adhesives, pre-cut areas, hooks, and so on and so forth. Also the end-section 14 can be embodied

such that it is directly connected to the elastic sleeve 11, so that end-section 14 and ring 4 and element 13 form one element.

WHAT IS CLAIMED IS:

1. Filter catheter comprising: a tube-like catheter body with a proximal and a distal end; a filter element arranged at the catheter distal end, said filter element formed by a number of strips arranged spaced out around a circumference of the catheter body, and said strips having proximal and distal ends, and said strips connected to the catheter body at least at their distal ends wherein the distal ends of the strips are connected with the body by detachable connecting means; and

wherein the distal ends of the strips comprise a projection from said strip.

2. Filter catheter as claimed in claim 1, wherein the catheter body comprises an outer tube-like body and an inner tube-like body removeably received inside the outer tube-like body, and said strips connected with their proximal ends to the outer tube-like body and with their distal ends to the inner tube-like body; and wherein the connecting means are placed on the inner body and retain the distal ends of the strips by means of a clamping connection.

3. Filter catheter as claimed in claim 2, wherein the connecting means comprise a sleeve connected to the inner tube-like body, said sleeve clamped around the distal ends of the strips.

4. Filter catheter as claimed in claim 3, wherein the sleeve has been made of an elastic material.

5. Filter catheter of claim 4 wherein the elastic material is silicone rubber.

6. Filter catheter comprising: a tube-like catheter body with a proximal and a distal end; a filter element

arranged at the catheter distal end, said filter element formed by a number of strips arranged spaced out around a circumference of the catheter body, and said strips having proximal and distal ends, and said strips connected to the catheter body at least at their distal ends wherein the distal ends of the strips are connected with the body by detachable connecting means;

wherein the distal ends of the strips comprise a projection from said strip; and

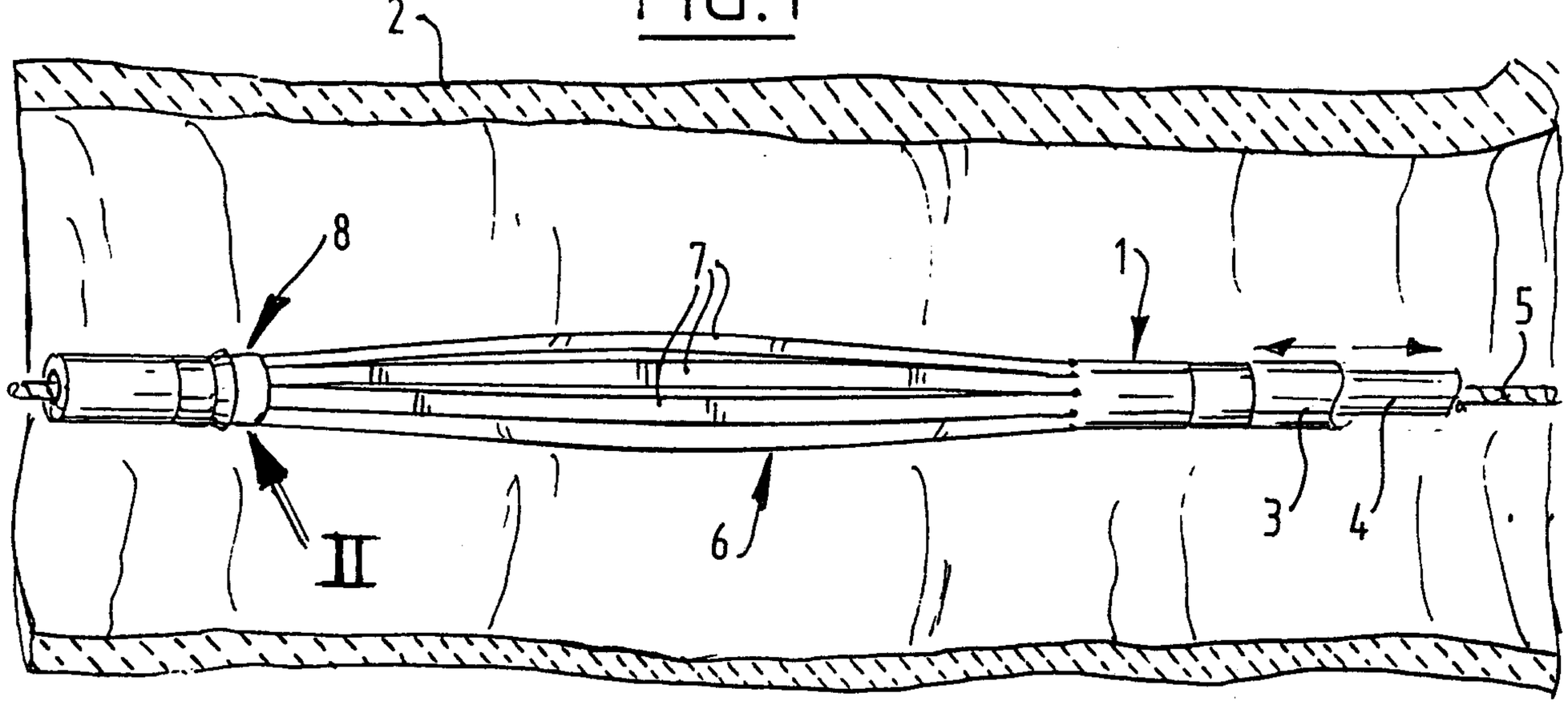
wherein the projection is formed by a wall section of said adjoining a depression in the outside surface of each strip, at a small distance from the distal end of the strip.

7. Filter catheter comprising: a tube-like catheter body with a proximal and a distal end; a filter element arranged at the catheter distal end, said filter element formed by a number of strips arranged spaced out around a circumference of the catheter body, and said strips having proximal and distal ends, and said strips connected to the catheter body at least at their distal ends wherein the distal ends of the strips are connected with the body by detachable connecting means;

wherein the catheter body comprises an outer tube-like body and an inner tube-like body removeably received inside the outer tube-like body, and said strips connected with their proximal ends to the outer tube-like body and with their distal ends to the inner tube-like body; and wherein the connecting means are placed on the inner body and retain the distal ends of the strips by means of a clamping connection; and

wherein the distal ends of the strips comprise a projection from said strip.

FIG.1



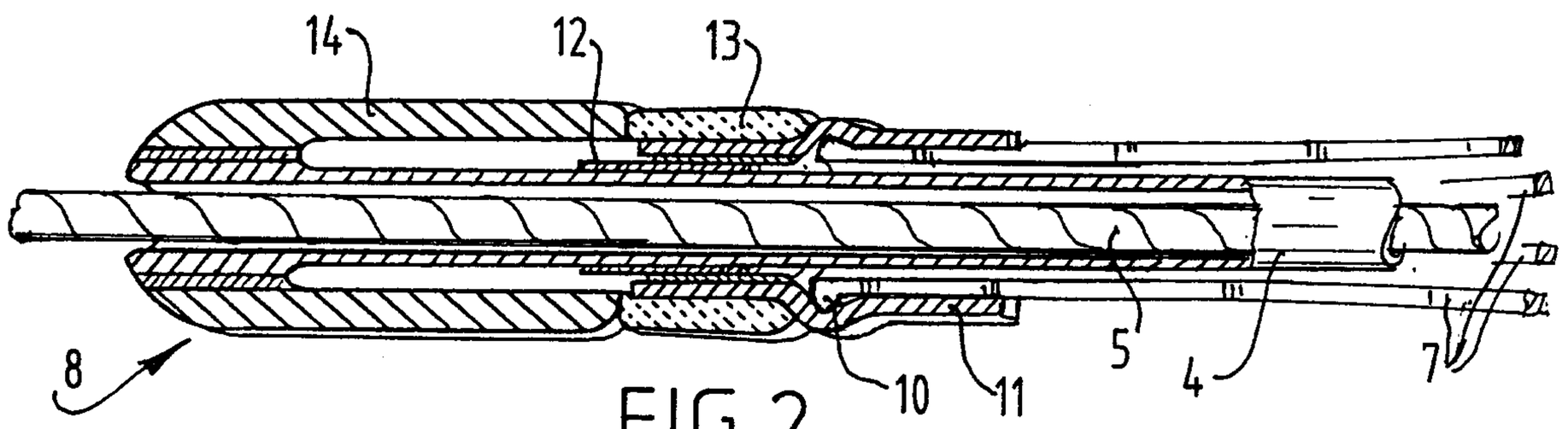


FIG.2

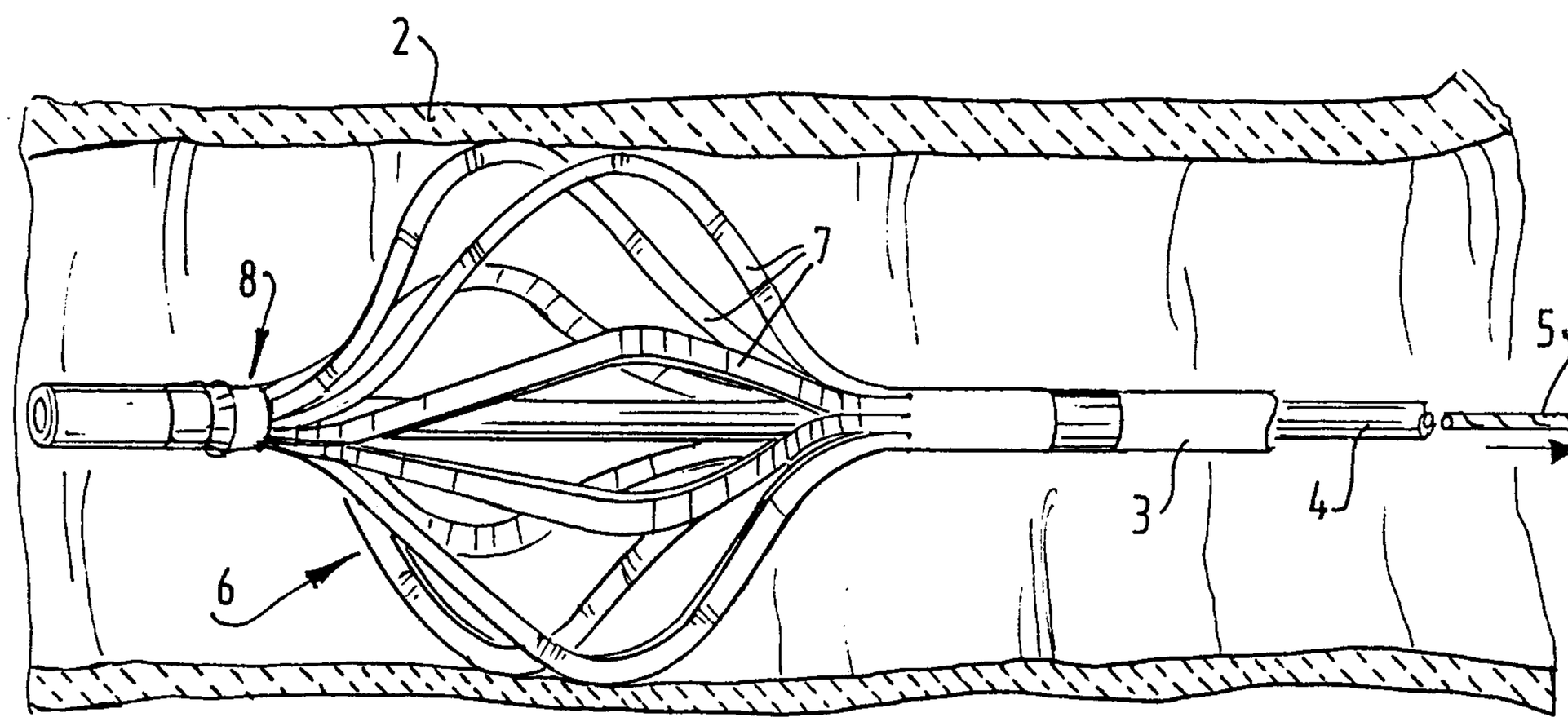


FIG.3

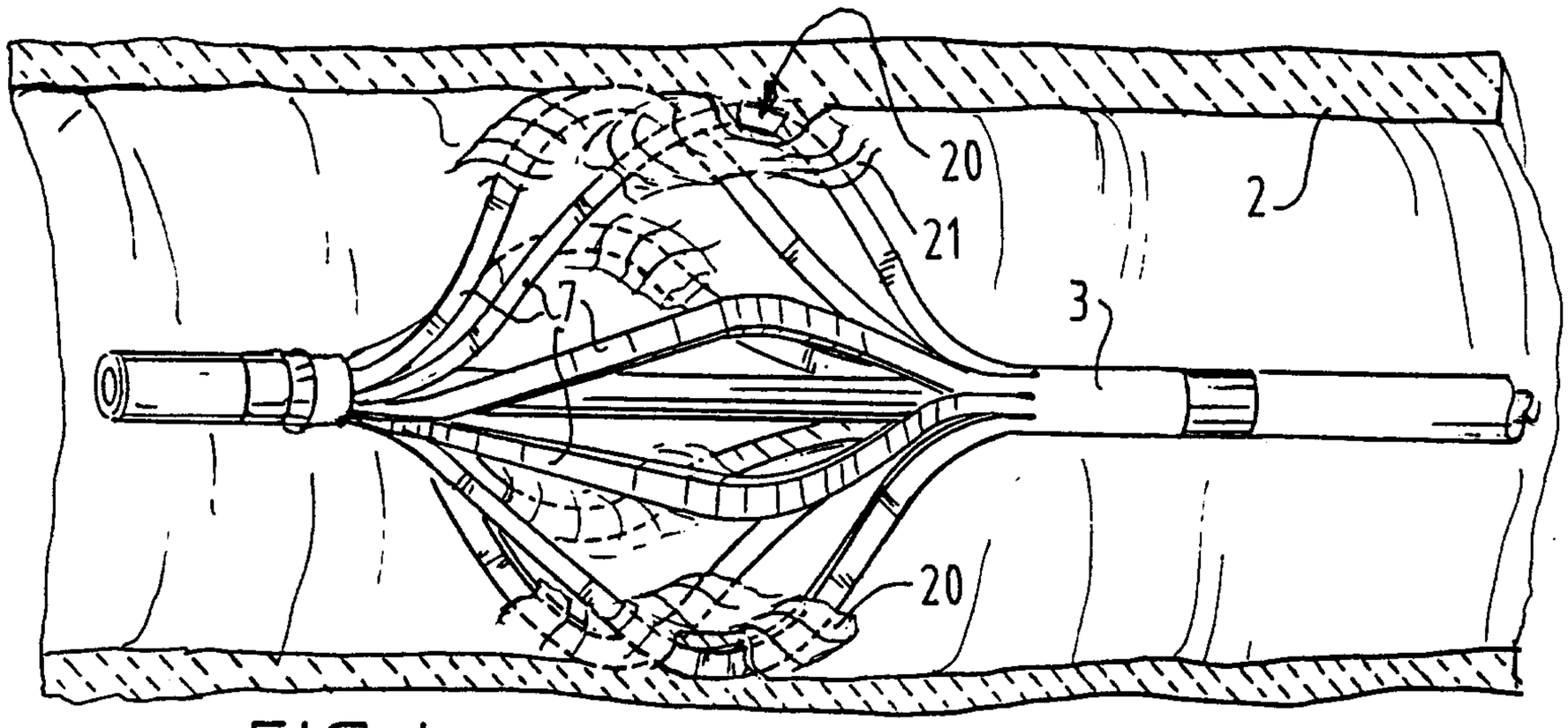


FIG.4

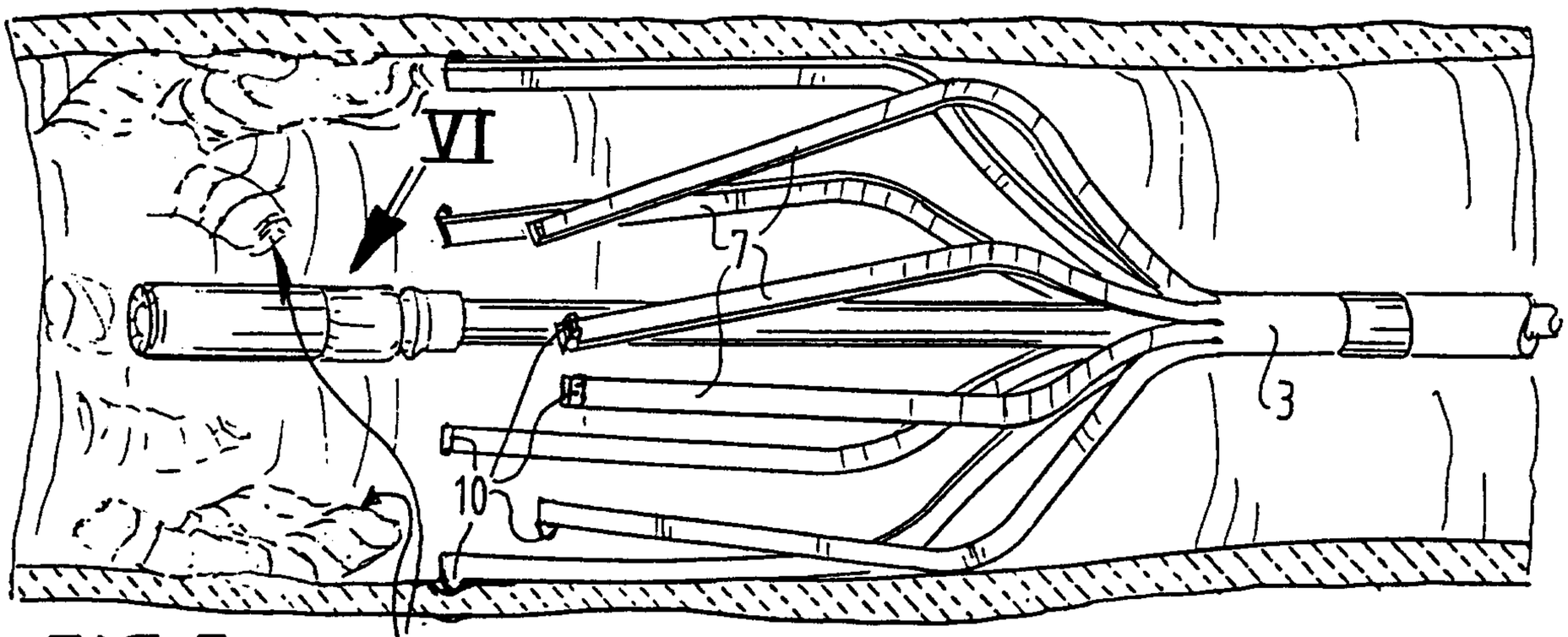


FIG.5

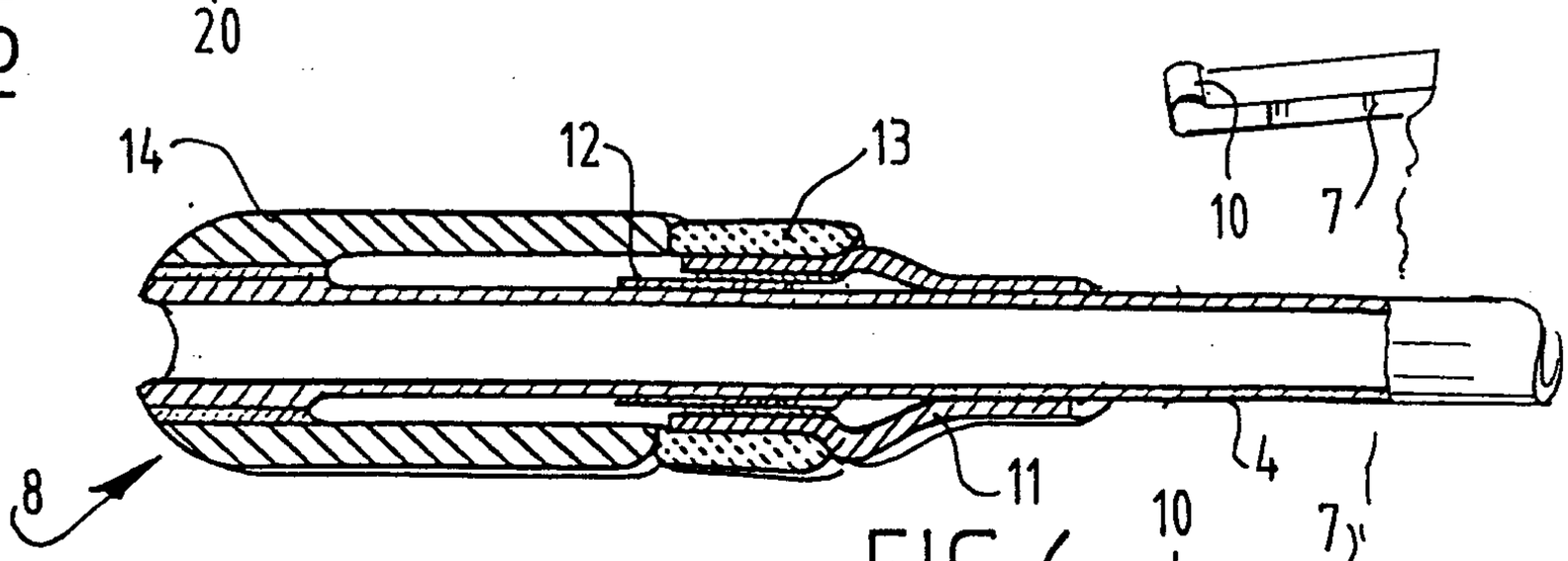


FIG.6

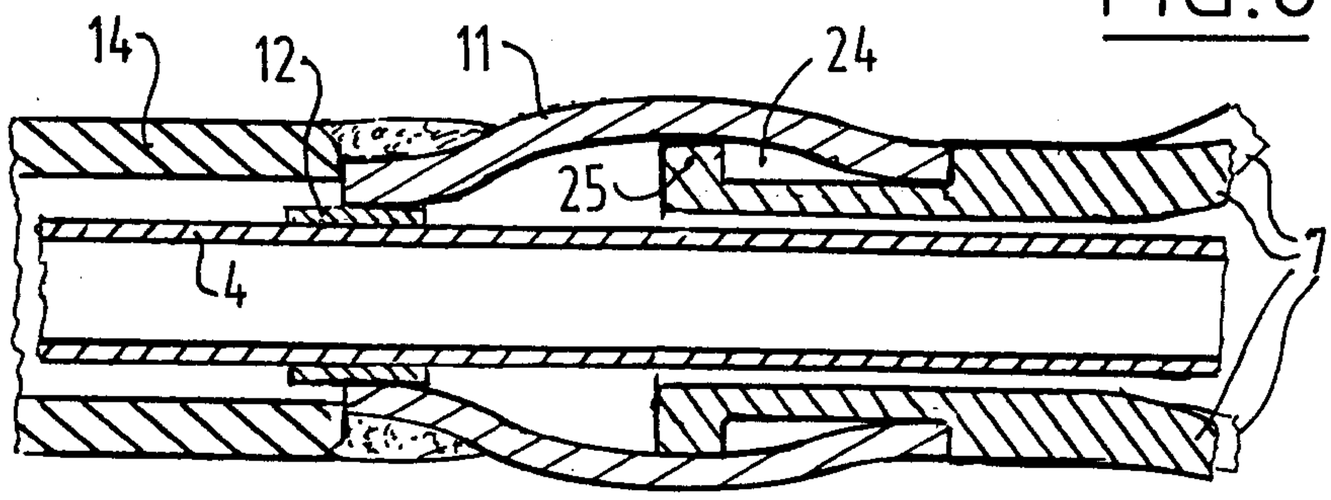
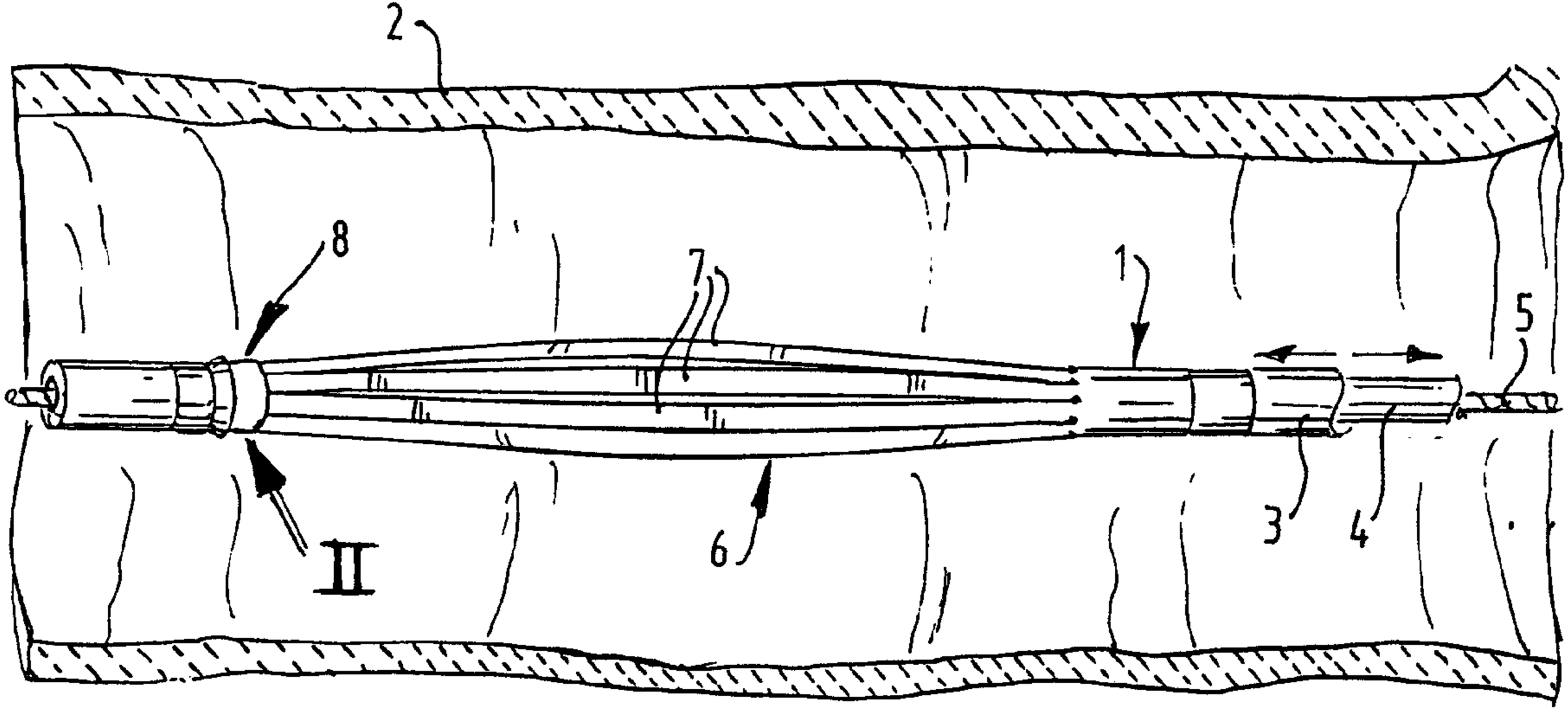


FIG.7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II
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