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(72) Inventeurs/Inventors:
BOSMA, Gjalt, NL;
NOPPERT, Tiemen, NL

(73) Propriétaire/Owner:
CORDIS EUROPA N.V., NL

(74) Agent: SIM & MCBURNEY

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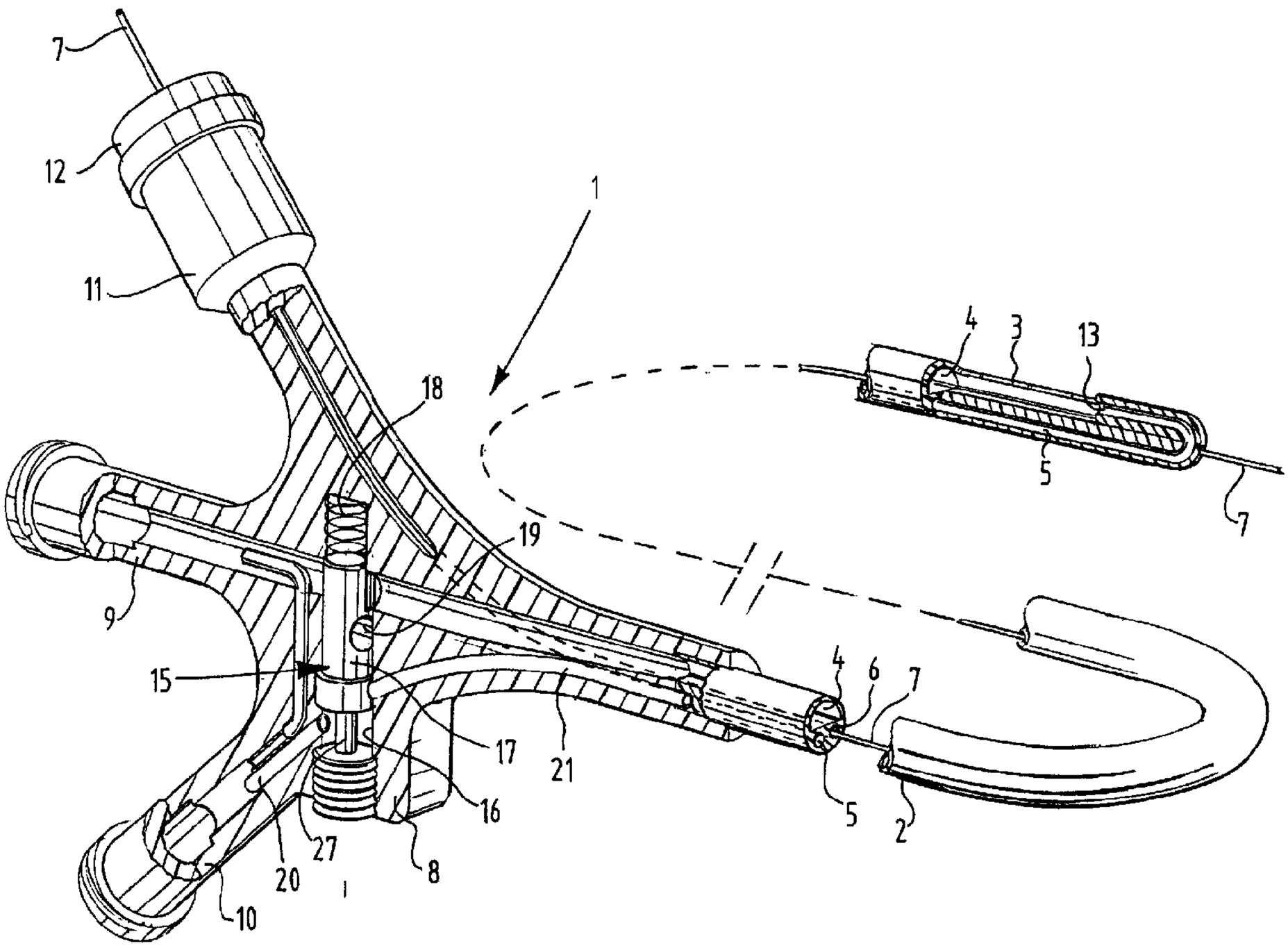
(54) Title: SUCTION CATHETER WITH HAEMOSTATIC DEVICE




(57) Abrégé/Abstract:
This invention relates to a suction catheter comprising a tube-like basic body with a proximal and a distal end, inside of which at least a pressure lumen and a discharge lumen extend, wherein at the distal end an opening connected with the discharge lumen and a jet nozzle connected with the pressure lumen and opening out into the discharge lumen have been arranged and wherein the catheter comprises valve means which are moveable by means of operating means between a closed position in which the pressure lumen and the discharge lumen are closed and an open position wherein both lumens are open.

**ABSTRACT**

This invention relates to a suction catheter comprising a tube-like basic body with a proximal and a distal end, inside of which at least a pressure lumen and a discharge lumen extend, wherein at the distal end an opening connected with the discharge lumen and a jet nozzle connected with the pressure lumen and opening out into the discharge lumen have been arranged and wherein the catheter comprises valve means which are moveable by means of operating means between a closed position in which the pressure lumen and the discharge lumen are closed and an open position wherein both lumens are open.

# SUCTION CATHETER WITH HAEMOSTATIC DEVICE

The invention relates to a suction catheter comprising a tube-like basic body with a proximal and a distal end, inside of which at least a pressure lumen and a discharge lumen extend. At the distal end an opening has been arranged in the basic body which is connected to the discharge lumen, and a jet nozzle which is connected to the pressure lumen and discharges into the discharge lumen.

With such a known suction catheter the jet nozzle may produce a liquid jet along the opening resulting in ejector action. Due to the suction generated at the site of the opening, for instance thrombi may be discharged.

In order to prevent blood from flowing out via the discharge lumen and the pressure lumen when the catheter is positioned inside the body of a patient but is not in use, it is known to shut off the proximal ends of the discharge lumen and the pressure lumen with valves.

When using such a known suction catheter there is a danger that liquid under pressure is introduced into the pressure line whilst the haemostatic valve of the discharge lumen is still closed. In that case the liquid under pressure supplied will enter, via the opening at the distal end, the bloodstream of the patient, which is undesirable.

The present invention is directed towards the provision of a suction catheter of the type as described in the preamble which does not have this drawback.

In accordance with one aspect of the present invention, there is provided a drainage catheter which comprises: a flexible, tubular basic catheter body defining first and second catheter lumen respectively comprising a pressure channel and a discharge channel; a

connector at a proximal end of said catheter for respectively connecting the pressure channel to a source of liquid under pressure, and the discharge channel to a discharge port; an inlet opening positioned in the side wall of said catheter adjacent the distal end thereof, said discharge channel communicating with said inlet opening, said pressure channel extending from said proximal end to a point distal of said inlet opening and then curving rearwardly to join said discharge channel at said inlet opening, said pressure channel defining a spray nozzle to direct pressurized fluid in the pressure channel across said inlet opening and into said discharge channel to create a suction adjacent said inlet opening; a first normally-closed valve positioned along the pressure channel, a second normally-closed valve positioned along the discharge channel; and an actuator coupled to both said first and second valve so that said actuator is adapted to cause said first and second valves to simultaneously move from the normally-closed positions to open positions.

As the valves open and close the pressure lumen and the suction lumen simultaneously, the discharge lumen is always open when liquid under pressure is introduced into the pressure line.

In a preferred embodiment of the invention, the drainage catheter includes a pressure detector positioned in communication with the pressure channel which, upon sensing an increase in pressure in the pressure channel, causes the actuator to open the first and second normally-closed valves.

The first and second valves may be each formed of a movable bar which intersects the pressure channel and

discharge channel respectively in a direction approximately transverse to the axis of the pressure channel and discharge channel respectively; each movable bar being formed such that when the movable bar is in a first position the bar resists flow of fluid through the pressure channel and the discharge channel respectively, and when each movable bar is moved to a second position the movable bar is adapted to permit substantially unrestricted flow of fluid through the pressure channel and discharge channel respectively.

In addition, the movable bars may be directly connected to each other, the actuator being connected to one of the movable bars so that said actuator causes both of the movable bars to slide simultaneously.

The drainage catheter further may include a spring positioned at one end of the directly connected movable bars to bias the movable bars in a closing direction to cause the first and second valves to be normally biased toward closed positions.

The actuator may comprise a cylindrical member, one of the movable bars takes the form of a cylindrical piston which slidably engages the cylindrical member, and the cylindrical member intersects the pressure channel, so that when the fluid pressure in the pressure channel increases the cylindrical piston is caused to move, thereby causing both of the first and second valves to move from normally-closed positions to open positions.

The invention will be explained in greater detail with reference to the attached drawings.

Figure 1 illustrates in a partly broken away perspective view a preferred embodiment of the catheter according to the invention whilst the valve means are

closed.

Figure 2 shows a view corresponding to Figure 1 with the valve means open.

The catheter 1 illustrated in Figure 1 comprises a tube—like basic body 2. Three lumens have been formed inside the basic body 2; a pressure lumen 5, a discharge lumen 4 and a guide wire lumen 6.

At the distal end of the basic body 2 an opening 3 has been formed which is connected with the discharge lumen 4. At the distal end of the catheter the pressure lumen 5 ends in a jet nozzle 13. Liquid under pressure supplied via the pressure lumen 5 leaves the jet nozzle 13 in the form of a powerful jet, which is directed inwards along the opening 3 in the discharge lumen 4. Due to this jet there will be an ejector action which generates suction at the opening 3, which can be used to remove for instance blood clots via the discharge lumen 4.

When positioning the catheter 1, the guide wire lumen 6 is used for the passage of the guide wire 7.

At the proximal end of the catheter 1 a connecting member 8 has been arranged, inside of which the connections with the lumens have been received. For the sake of clarity this connecting member 8 has been illustrated in figure 1 whilst rotated, in relation to the basic body 2, a quarter turn to the left. Via a channel 23 in the connecting member 8, the discharge lumen 4 is connected with the discharge connection 9. The pressure lumen 5 is connected with a pressure connection 10 via channel sections 20 and 21. The guide wire channel 7 is connected with the guide wire connection 11. This

guide wire connection 11 has been provided with an anti-haemostatic-device 12 known as such, which prevents blood from flowing out via the guide wire channel whilst using the catheter 1.

The discharge connection 9 and the pressure connection 10 have both been provided with Luer-lock connections.

Inside the connecting member 8 valve means 15 have been received which can open and close the pressure lumen and the discharge lumen simultaneously.

With the preferred example of an embodiment illustrated, the valve means 15 comprise a slide 17, movable to and fro, received inside a channel 16 formed inside the connecting member. The channel 16 has been closed off with a plug 22. As can be seen in the figures, the slide 17 is, at its end turned away from the screw plug 22, acted upon by a helical spring 18. The latter pushes the slide 17 into the closed position illustrated in figure 1, in which both the discharge lumen and the pressure lumen have been blocked. The slide has been provided with a distance pin 27 with which the slide 17 is positioned against the screw plug 22 when closed.

As can be seen in figure 1, in closed position the slide 17 leaves the relatively proximal section 20 of the pressure lumen free and closes the relatively distal section 21 of the pressure lumen off. In this state consequently no blood can leak away via the discharge lumen 4 or the pressure lumen 5 from the connections 9 , 10 respectively.

As the relatively proximal section 20 of the pressure lumen is connected to that side of the slide 17 opposite to the side of the slide which is acted upon by the spring 18, the slide 17 will be pushed upwards against the force exerted by the spring 18, when via the pressure connection 10 liquid under pressure is supplied.

In the open position illustrated in figure 2, a transverse channel 19 in the slide 17 has been moved in line with the channel 23 inside the connecting member 8,

forming the continuation of the discharge lumen 4. The cross-section of the transverse channel 19 is equal to the cross-section of the channel 23, so that in the open position there will be no resistance to flow. The material sucked up through the opening 3 can consequently be removed freely via the discharge lumen 4 and the channel section 23 from the discharge connection 9.

At the same time the discharge lumen 4 is opened the slide 17 is moved away from the entrance of the relatively distal section 21 of the pressure lumen, so that the liquid under pressure supplied via the connection 10 can flow freely via the relatively proximal section 20 to the relatively distal section 21 and then via the pressure lumen 5 to the jet nozzle 13.

To assist the flow in the discharge lumen an auxiliary pressure channel 25 has been formed in the connecting member 8 of which the outlet 26 is directed towards the connecting member 9. Via this auxiliary pressure channel 25 part of the liquid under pressure supplied through the pressure connection 10 flows away in the direction indicated by the arrows, as a result of which a liquid jet is formed at the outlet 26 of the auxiliary pressure channel 25, reinforcing the flow in the discharge lumen 4 as referred to above.

As soon as the supply of liquid under pressure via the pressure connection 10 is closed off, the slide 17 will be pushed into the closed position illustrated in figure 1 due to the action of the spring 18, in which at the same time the pressure lumen and the discharge lumen are closed off, so that no blood can leak away via the lumens in an undesirable manner.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A drainage catheter which comprises:

a flexible, tubular basic catheter body defining first and second catheter lumen respectively comprising a pressure channel and a discharge channel;

a connector at a proximal end of said catheter for respectively connecting the pressure channel to a source of liquid under pressure, and the discharge channel to a discharge port;

an inlet opening positioned in the side wall of said catheter adjacent the distal end thereof, said discharge channel communicating with said inlet opening, said pressure channel extending from said proximal end to a point distal of said inlet opening and then curving rearwardly to join said discharge channel at said inlet opening, said pressure channel defining a spray nozzle to direct pressurized fluid in the pressure channel across said inlet opening and into said discharge channel to create a suction adjacent said inlet opening,

a first normally-closed valve positioned along the pressure channel, a second normally-closed valve positioned along the discharge channel, and

an actuator coupled to both said first and second valve so that said actuator is adapted to cause said first and second valves to simultaneously move from the normally-closed positions to open positions.

2. A drainage catheter as defined in claim 1, which includes a pressure detector positioned in communication

with the pressure channel which, upon sensing an increase in pressure in the pressure channel, causes the actuator to open the first and second normally-closed valves.

3. A drainage catheter as defined in claim 2, wherein said first and second valves are each formed of a movable bar which intersects the pressure channel and discharge channel respectively in a direction approximately transverse to the axis of the pressure channel and discharge channel respectively; each movable bar being formed such that when the movable bar is in a first position the bar resists flow of fluid through the pressure channel and the discharge channel respectively, and when each movable bar is moved to a second position the movable bar is adapted to permit substantially unrestricted flow of fluid through the pressure channel and discharge channel respectively.

4. A drainage catheter as defined in claim 3, wherein each of the movable bars are slidably mounted to move in a direction approximately transverse to the axis of the pressure channel and discharge channel respectively.

5. A drainage catheter as defined in claim 4, wherein said movable bars are directly connected to each other, the actuator being connected to one of the movable bars so that said actuator causes both of the movable bars to slide simultaneously.

6. A drainage catheter as defined in claim 5, including a spring positioned at one end of the directly connected to

movable bars to bias the movable bars in a closing direction to cause the first and second valves to be normally biased toward closed positions.

7. A drainage catheter as defined in claim 6, wherein the actuator comprises a cylindrical member, one of the movable bars takes the form of a cylindrical piston which slidably engages the cylindrical member, and the cylindrical member intersects the pressure channel, so that when the fluid pressure in the pressure channel increases the cylindrical piston is caused to move, thereby causing both of the first and second valves to move from normally-closed positions to open positions.

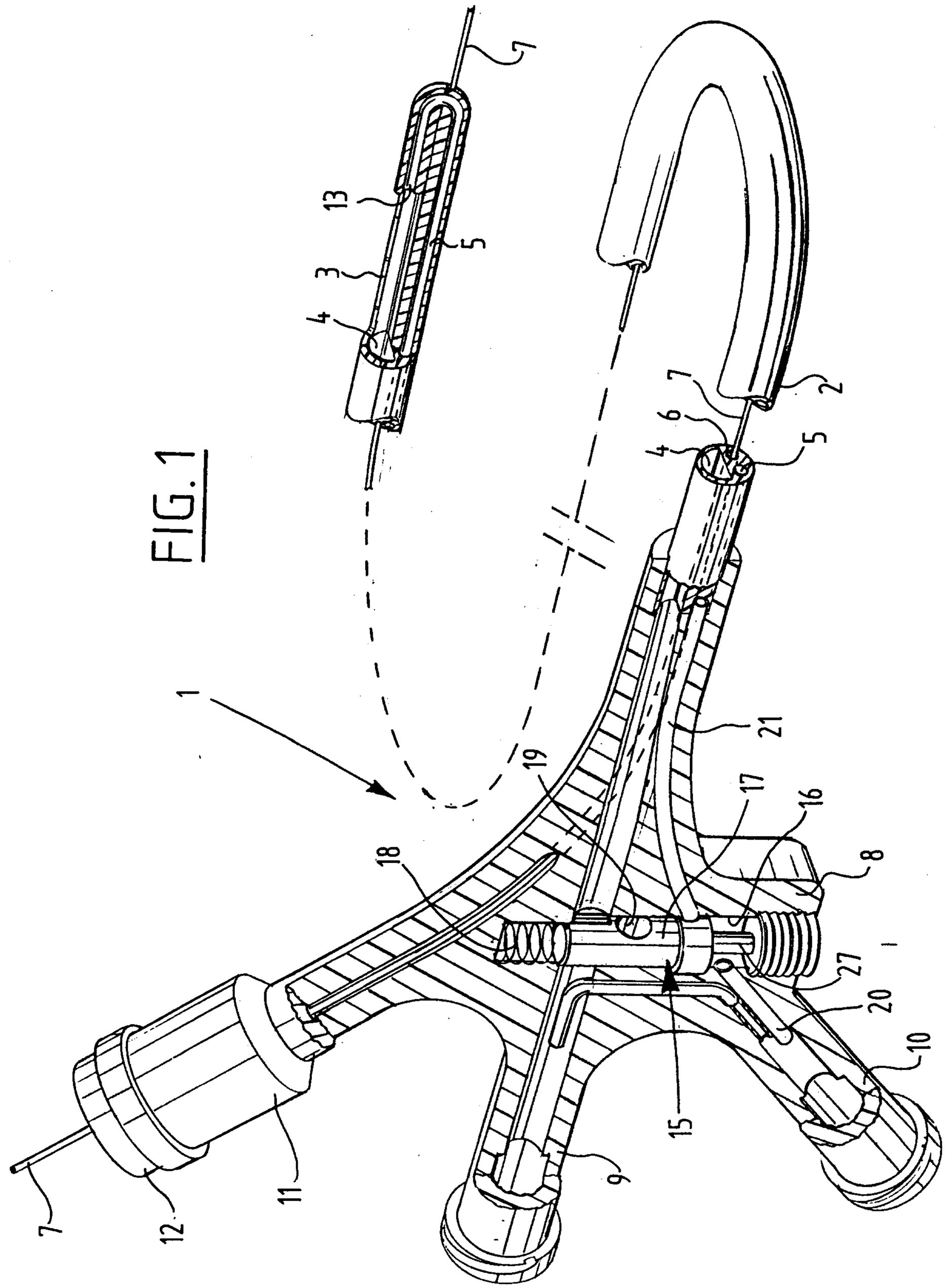



FIG.1

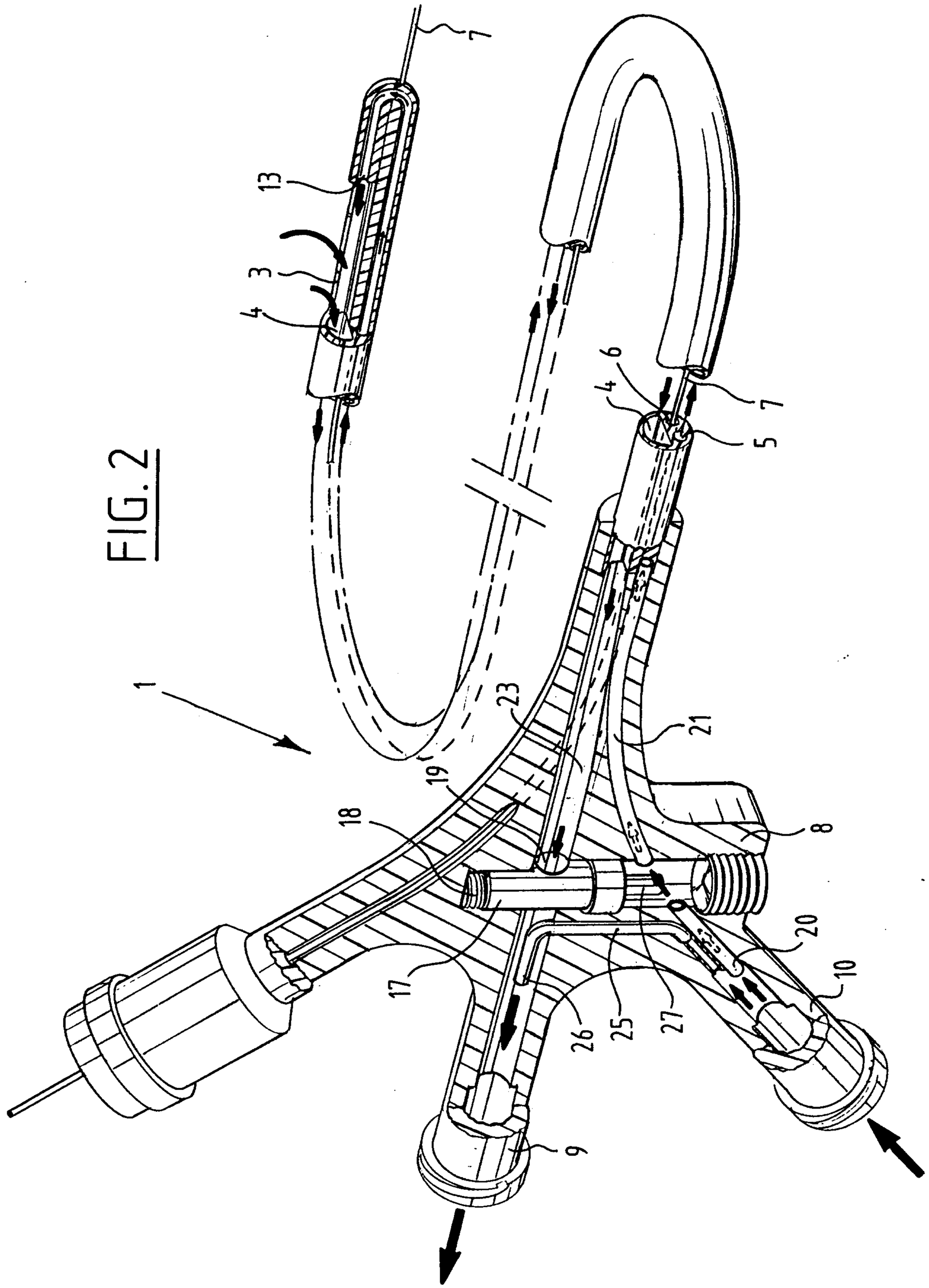
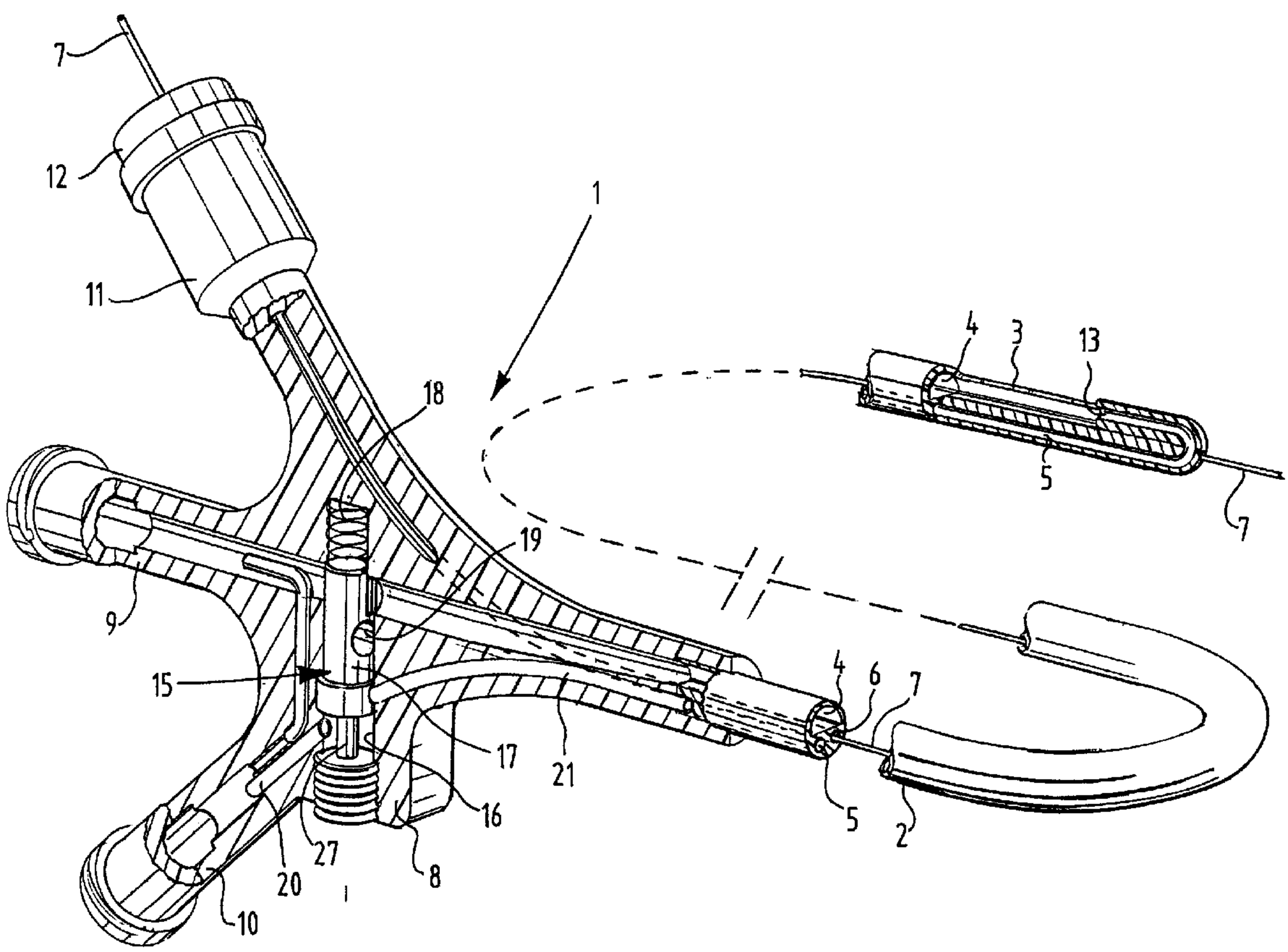



FIG. 2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