United States Patent [19]

Nozick et al.

[11] **3,923,065**

[45] **Dec. 2, 1975**

[54] **EMBOLECTOMY CATHETER**

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[22] Filed: **Sept. 9, 1974**

[21] Appl. No.: **504,116**

[52] **U.S. Cl.** ..... **128/348;** 128/325; 128/349 B

[51] **Int. Cl.²** **A61M 25/00**

[58] **Field of Search** ..... 128/348, 349 B, 349 BV, 128/350 R, 351, 241, 246, 325, 344, 328

[56] **References Cited**

UNITED STATES PATENTS

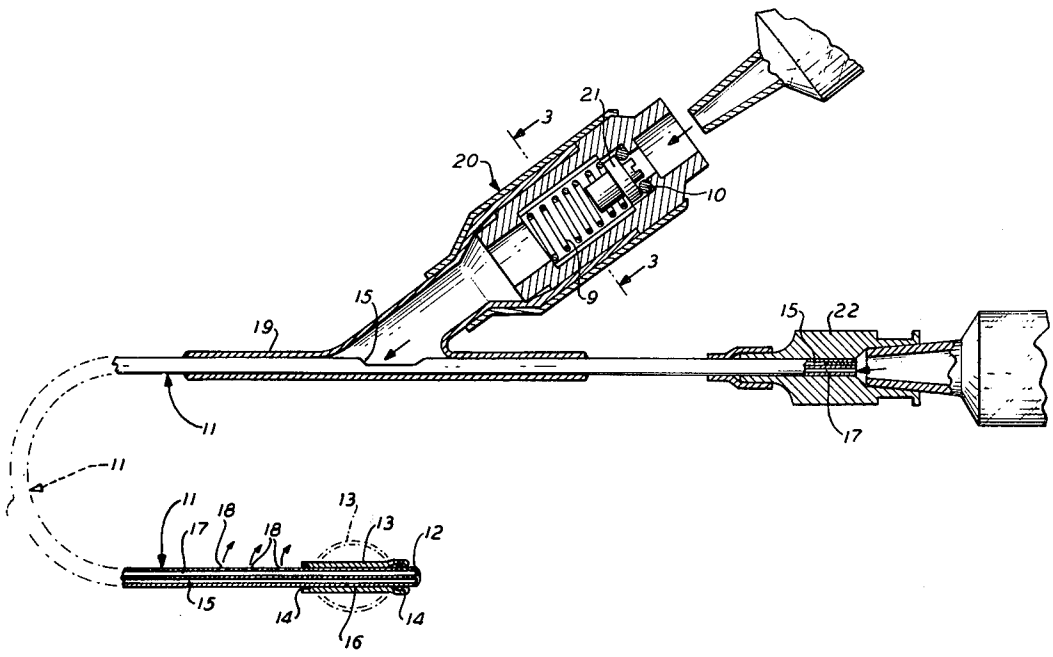
550,238	11/1895	Allen	128/241 X
3,435,826	4/1969	Fogarty	128/348
3,635,223	1/1972	Klieman	128/348
3,795,246	3/1974	Sturgeon	128/325

Primary Examiner—Dalton L. Truluck
Attorney, Agent, or Firm—Popper & Bobis

[57] **ABSTRACT**

An apparatus for driving an embolus from a blood vessel which provides a thin flexible body for insertion into a blood vessel; the body is movable from one side of an embolus to the other side of the embolus by being passed through or around it; an inflatable sleeve on the body with a passage in the body is connected with the interior of the inflatable sleeve so that fluid injected into the passage will inflate the sleeve; there is a second separate passage in the body for the insertion of fluid into the body; passages in the end of the body immediately adjacent to the inflatable sleeve are provided whereby fluid may be discharged into the blood vessel to exert fluid pressure on an embolus and urge it toward a point of discharge at the point of insertion of the catheter apparatus.

3 Claims, 3 Drawing Figures



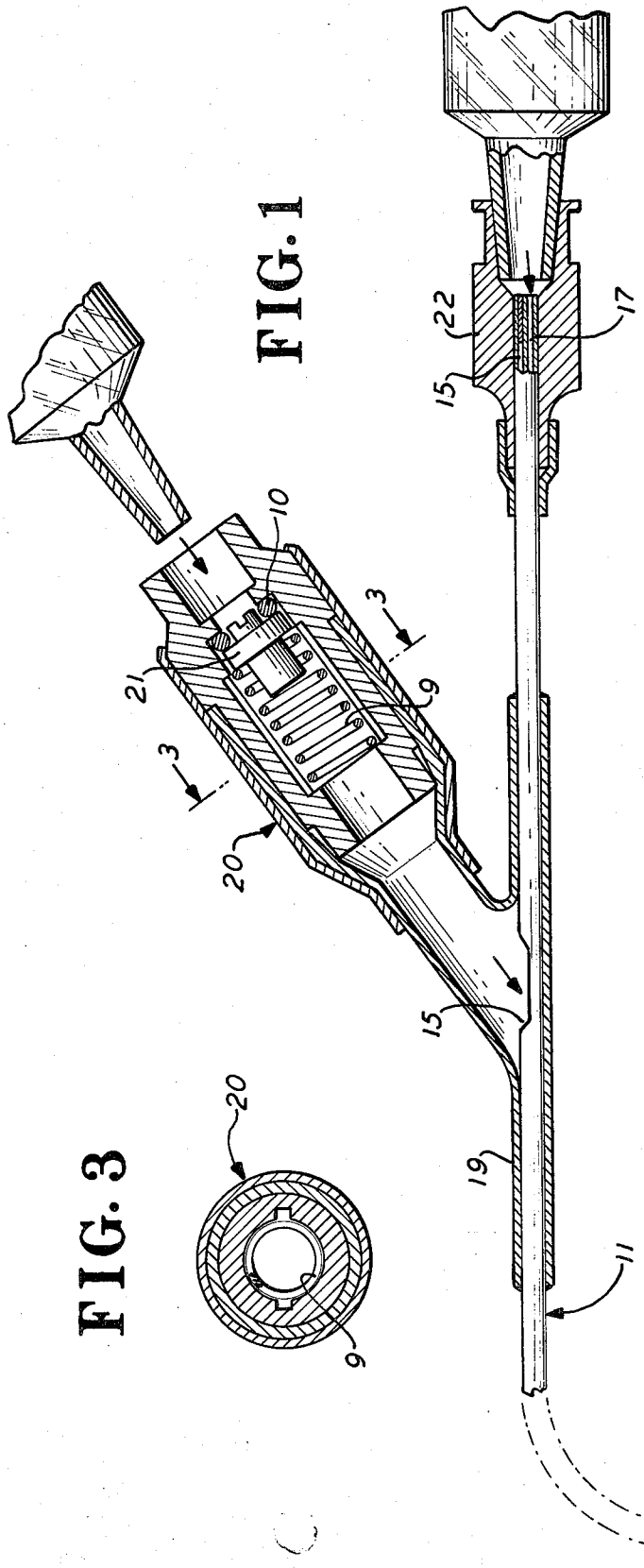


FIG. 1

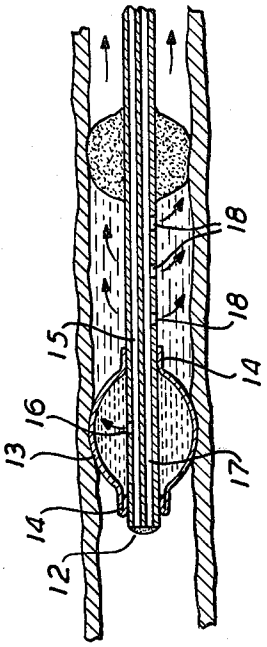
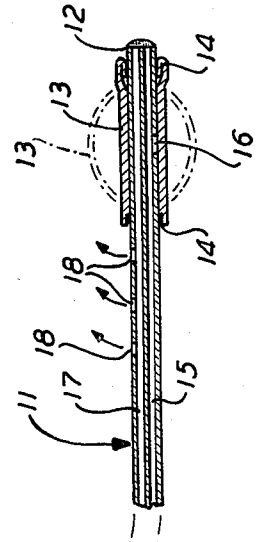


FIG. 2

FIG. 3



EMBOLECTOMY CATHETER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to embolectomy catheters and particularly to embolectomy catheters having separate passages therein, one for inflating a sleeve on the external surface on the distal end of the catheter, and the other for discharging a fluid behind an embolus so as to drive it toward a point of discharge.

2. Prior Art

The formation of an embolus in a blood vessel is a continuous threat to the security of the person wherein the embolus is formed. Numerous means have been devised for removing the embolus, because if it is not attended to, it may move to a critical site where it will deprive the body of blood and cause severe damage to that portion of the body. The problem has been dealt with in various ways as for example the embolectomy catheter of Klieman, U.S. Pat. No. **3,635,223** issued Jan. **18, 1972;** Fogarty, U.S. Pat. No. **3,467,102** of Sept. **16, 1969;** Fogarty, U.S. Pat. No. **3,435,826** of Apr. **1, 1969.** The use of many devices has been attended with the possibility of damage to the blood vessels, difficulty of use, and failure to accomplish the objective of removal of the embolus. There are other disadvantages.

SUMMARY OF THE INVENTION

It has been found that an embolectomy catheter can be devised which is easy to use, which does not drag the embolus through the blood vessel, that does not require the user to drag a ballon through the blood vessel, that readily deflates, and surely moves the embolus toward discharge. In this embolectomy catheter, there is a first discrete passage with is entirely separate from a second passage; the first passage inflates an inflatable sleeve; the second passage discharges a liquid behind the embolus so as to exert pressure upon it and move it toward a discharge point.

THE DRAWINGS

These objects and advantages as well as other objects and advantages are achieved by the device shown by way of illustration in the drawings in which:

FIG. 1 is a vertical sectional view of the embolectomy catheter showing the separate discrete fluid passages therein and the connections for separately inserting fluid therein;

FIG. 2 is a vertical sectional view of the embolectomy catheter inserted in a blood vessel with the sleeve inflated; and

FIG. 3 is a cross-sectional view taken on the line 3—3 in FIG. 1 looking in the direction of the arrows.

PREFERRED EMBODIMENT

Referring now to the drawings in detail, our embolectomy catheter provides a thin flexible body **11,** which is externally smooth so that it may easily be inserted into a blood vessel and move through it. It has a generally circular cross-section. Near the sealed distal end **12** of this body **11,** a generally tubular sleeve **13** is applied and sealed thereto at both ends **14.** This sleeve **13** is made of thin, light material which is elastic and capable of being inflated like a balloon. The body **11** has two separate and distinct passages thereto which do not communicate with each other. The first passage **15** has

an orifice **16** which communicates with the interior of the sleeve. The second passage **17** has a plurality of orifices **18** immediately adjacent to the sleeve. Thus, fluid injected into the first passage **15** will cause the inflation of the sleeve in the manner of a balloon as shown by the dotted line in FIG. **1.** Liquid injected into the second passage **17** will pass out of the several orifices **18** immediately behind the sleeve **13.** The sleeve **13** is located immediately adjacent to the distal end **12** of the body **11.**

At the ventral end **19** of the body **11,** the body **11** is bifurcated to separate the first and second passages **15,** 17. The first passage terminates in a valve **20** which a syringe may be applied for the introduction of fluid; the valve **20** will capture and hold fluid in the first passage **15.** A sealing deflectable plug **21** will retain the fluid in the first passage **15.** The plug **21** is seated on an O-ring **10,** being urged into such engagement by a spring **9.** The fluid in the first passage **15** will cause the sleeve **13** to be distended and remain distended until the plug **21** is unseated sufficiently to allow entrapped fluid in the first passage **15** to flow out. When fluid in the first passage **15** inflates the sleeve **13** as a balloon, it blocks the passage in a blood vessel in which the catheter is inserted. Such valves **20** are well known in the surgical appliance industry and readily available. The second passage **17** terminates in a standard tip **22** wherein a syringe may be inserted for the purpose of injecting fluid into the second passage **17,** to flow out of the orifices **18** into a blood vessel **23.**

The use of the embolectomy catheter is as follows:

The flexible body **11** is inserted into a slit in a blood vessel **23** and is moved toward an embolus. A clamp is applied to the blood vessel at an appropriate position to cut off the flow of blood to the blood vessel. The distal end of the flexible body **11** will be urged through the blood vessel and will pass around the embolus **24** or may pierce the embolus **24** and proceed to a position wherein the sleeve is beyond the embolus. The sleeve **12** may then be inflated by the injection of fluid into the first passage **15,** thereby to inflate the sleeve **13** behind the embolus **24.** The valve **20** retains the fluid in the first passage **15** so that the sleeve **13** stays in an inflated state, so that the inflated sleeve **13** will dam or block fluid injected behind the embolus flowing out of the second passage **17.** Fluid is then injected into the second passage **17** and the fluid passes out of the orifices **18** behind the embolus **24.** The fluid propels the embolus toward the point of insertion of the catheter into the blood vessel where the embolus **24** is discharged from the blood vessel **23.** The body **11** is flexible; the sleeve **13** is soft and it has sufficient resiliency so that it will collapse when fluid pressure in the second passage **17** is relieved, but nevertheless will sustain tension against the walls of the blood vessel **23** when the sleeve **13** is inflated, and it will also close off any flow of blood or any flow of fluid until the embolus **24** has been removed.

In cases where a person has a shunt installed in his body to enable the frequent periodic attachment to a dialysis apparatus, the present catheter is particularly useful to remove an embolus that may form at the site of the shunt. If perchance, a catheter with hooked enlargements were to be used at the site of the shunt to remove an embolus, the enlargements might disconnect the shunt from the blood vessel. The present catheter being moved, does not present this kind of prob-

lem. The risk of such an occurrence is vastly reduced by the use of our smooth embolectomy catheter, which does not append upon hooking the embolus to remove it, but functions to flush an embolus out of a blood vessel.

What is claimed:

1. An embolectomy catheter comprising:

a. a thin, elongated flexible body insertable in a blood vessel, and dimensioned to fit therein,

b. separate, discrete first and second passages in the body,

c. a generally tubular expandable sleeve sealed at both ends around the distal portion of the body, the sleeve normally lying close to the body and concentric therewith along its enitre length,

d. a passage communicating from the inside of the sleeve through the wall of the body to the first passage in the body, whereby the tubular sleeve may be expanded by fluid applied to the first passage, and may be contracted by relieving fluid pressure applied to the first passage,

e. the second passage having a discharge orifice adjacent to the distal end of the body before the sleeve, whereby fluid injected into the second passage may be discharged therefrom,

f. a first fitting connected to the first passage, for introducing fluid into the first discrete passage,

g. valve means at the first fitting for retaining and releasing a fluid inserted into the first passage, whereby the sleeve may be inflated and deflated,

h. a fitting connected to the second passage for receiving a fluid, whereby such fluid so received may pass through the second passage and be discharged from a discharge orifice,

i. the discharge orifice in the second passage being positioned immediately adjacent to the inflatable sleeve and thereby to release fluid to drive an embolism away from the sleeve when it is inflated.

2. An embolectomy catheter comprising:

a. the device according to Claim **1**, and

b. the body bifurcated at the ventral end to separate the discrete first and second passages.

3. An embolectomy catheter comprising:

a. the device according to Claim **1**, and

b. the body having a generally circular crosssectional area, and a generally smooth external surface before the sleeve.

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