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(12) **United States Patent**
Bagoisan et al.

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- (54) **ASPIRATION CATHETER**
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- 4,790,813 A 12/1988 Kensey
- 4,850,957 A 7/1989 Summers
- 4,867,156 A 9/1989 Stack et al.
- 4,950,238 A 8/1990 Sullivan
- 4,964,409 A 10/1990 Tremulis
- 4,994,067 A 2/1991 Summers
- 5,002,528 A 3/1991 Palestrant

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

- | | | | |
|----|-------------|---------|------------------|
| EP | 0693295 A1 | 1/1996 | |
| WO | WO 95/15780 | 6/1995 | |
| WO | 96/15824 | 5/1996 | A61M/29/00 |
| WO | WO 97/44082 | 11/1997 | |
| WO | WO 98/44982 | 10/1998 | |

OTHER PUBLICATIONS

"New Triple Coaxial Catheter System for Carotid Angioplasty with Cerebral Protection" Theron, et al., AJNR 11:869-874 Sep./Oct. 1990.

(List continued on next page.)

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(57) **ABSTRACT**

Aspiration catheters suitable for use in the treatment of an occlusion in a blood vessel are disclosed. These catheters are especially useful in the removal of occlusions from saphenous vein grafts, the coronary and carotid arteries, arteries above the aortic arch and even smaller vessels. The catheters of the present invention are provided in either over-the-wire or in single operator form. Radiopaque markers are preferably incorporated into distal ends of the catheters to facilitate their positioning within the body. The catheters are provided with varying flexibility along the length of the shaft, such that they are soft and flexible enough to be navigated through the vasculature of a patient without causing damage, but are stiff enough to sustain the axial push required to position the catheter properly and to sustain the aspiration pressures.

20 Claims, 6 Drawing Sheets

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/454,522**

(22) Filed: **Dec. 6, 1999**

Related U.S. Application Data

(63) Continuation of application No. 08/813,808, filed on Mar. 6, 1997, now abandoned.

(51) **Int. Cl.**⁷ **A61M 25/00**

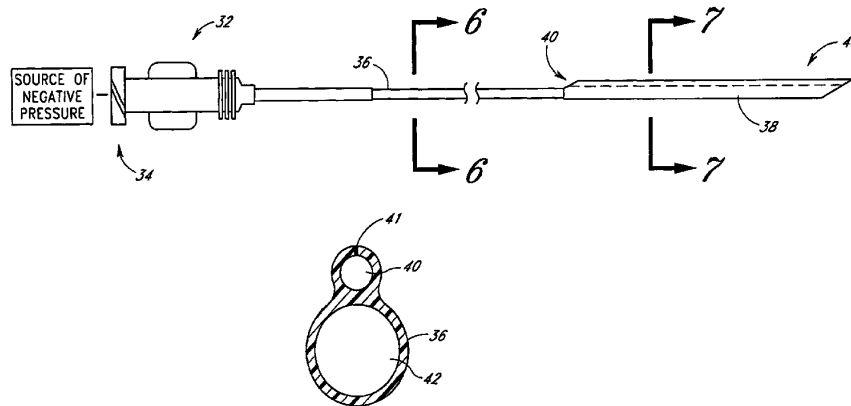
(52) **U.S. Cl.** **604/523; 604/540**

(58) **Field of Search** 604/523, 264, 604/525, 540, 96.01, 103.04; 600/585; 606/191

(56) **References Cited**

U.S. PATENT DOCUMENTS

- | | | |
|-------------|---------|---------------------|
| 3,144,868 A | 8/1964 | Jascalevich |
| 4,468,216 A | 8/1984 | Muto |
| 4,511,354 A | 4/1985 | Sterling |
| 4,573,966 A | 3/1986 | Weikl et al. |
| 4,589,412 A | 5/1986 | Kensey |
| 4,610,662 A | 9/1986 | Weikl et al. |
| 4,662,871 A | 5/1987 | Rafelson |
| 4,692,139 A | 9/1987 | Stiles |
| 4,696,668 A | 9/1987 | Wilcox |
| 4,713,060 A | 12/1987 | Riuli |
| 4,748,982 A | 6/1988 | Horzewski et al. |
| 4,754,755 A | 7/1988 | Husted |
| 4,782,834 A | 11/1988 | Maguire et al. |
| 4,784,636 A | 11/1988 | Rydell |
| 4,790,812 A | 12/1988 | Hawkins, Jr. et al. |



US 6,849,068 B1

U.S. PATENT DOCUMENTS

5,026,384 A 6/1991 Farr et al.
5,053,023 A 10/1991 Martin
5,059,178 A 10/1991 Ya
5,078,688 A 1/1992 Lobodzinski et al.
5,087,265 A 2/1992 Summers
5,135,484 A 8/1992 Wright
5,135,531 A 8/1992 Shiber
5,163,905 A 11/1992 Don Michael
5,163,906 A 11/1992 Ahmadi
5,167,239 A 12/1992 Cohen et al.
5,167,623 A * 12/1992 Cianci et al. 604/43
5,184,627 A 2/1993 de Toledo
5,192,291 A 3/1993 Pannek, Jr.
5,195,955 A 3/1993 Don Michael
5,221,256 A 6/1993 Mahurkar
5,221,270 A 6/1993 Parker
5,250,060 A 10/1993 Carbo et al.
5,267,958 A 12/1993 Buchbinder et al.
5,273,527 A * 12/1993 Schatz et al. 604/43
5,279,546 A 1/1994 Mische et al.
5,286,253 A 2/1994 Fucci
5,318,576 A 6/1994 Plassche, Jr. et al.
5,322,508 A 6/1994 Viera
5,328,480 A * 7/1994 Melker et al. 604/164
5,336,205 A 8/1994 Zenzen et al.
5,342,306 A 8/1994 Don Michael
5,349,950 A 9/1994 Ulrich et al.
5,358,472 A 10/1994 Vance et al.
5,370,609 A 12/1994 Drasler et al.
5,376,071 A 12/1994 Henderson
5,376,084 A 12/1994 Bacich et al.
5,395,311 A 3/1995 Andrews
5,405,321 A * 4/1995 Reeves 604/44
5,405,322 A 4/1995 Lennox et al.
5,405,341 A * 4/1995 Martin 604/284
5,415,636 A 5/1995 Forman
5,419,774 A 5/1995 Willard et al.
5,423,742 A 6/1995 Theron
5,431,673 A 7/1995 Summers et al.
5,439,000 A 8/1995 Gunderson et al.
5,449,343 A 9/1995 Samson et al.
5,451,206 A 9/1995 Young
5,451,209 A 9/1995 Ainsworth et al.
5,460,610 A 10/1995 Don Michael
5,462,529 A 10/1995 Simpson et al.
5,476,450 A 12/1995 Ruggio
5,478,309 A 12/1995 Sweezer et al.

5,492,763 A 2/1996 Barry et al.
5,496,346 A 3/1996 Horzewski et al.
5,500,180 A 3/1996 Anderson et al.
5,569,182 A 10/1996 Twardowski et al.
5,569,204 A 10/1996 Cramer
5,569,215 A * 10/1996 Crocker 604/264
5,578,018 A 11/1996 Rowland et al.
5,634,897 A 6/1997 Dance et al.
5,662,671 A 9/1997 Barbut et al.
5,695,507 A * 12/1997 Auth et al. 604/22
5,695,519 A 12/1997 Summers et al.
5,700,252 A 12/1997 Klingenstein 604/280
5,713,849 A 2/1998 Bosma et al.
5,743,883 A 4/1998 Visconti
5,766,211 A 6/1998 Wood et al.
5,769,868 A * 6/1998 Yock 606/194
5,772,642 A 6/1998 Ciamacco, Jr. et al.
5,792,118 A * 8/1998 Kurth et al. 604/246
5,807,311 A * 9/1998 Palestrant 604/28
5,814,064 A 9/1998 Daniel et al.
5,827,229 A * 10/1998 Auth et al. 604/171
5,830,196 A * 11/1998 Hicks 604/280
5,833,644 A * 11/1998 Zadno-Azizi et al. 604/52
5,849,016 A 12/1998 Suhr
5,921,971 A * 7/1999 Agro et al. 604/280
6,019,350 A 2/2000 Gelbfish
6,066,100 A * 5/2000 Willard et al. 600/452
6,095,990 A * 8/2000 Parodi 600/585
6,129,708 A * 10/2000 Enger 604/103.04
6,152,909 A * 11/2000 Bagaioisan et al. 604/523
6,159,195 A * 12/2000 Ha et al. 604/500

OTHER PUBLICATIONS

ANGIOJET LF 140 Rapid Thrombectomy Catheter Brochure, Possis Medical, Inc., Publication No. 102301-001-02, 9/95.
ANGIOJET F 105 Rapid Thrombectomy Catheter Brochure, Possis Medical, Inc., Publication No. 10232-001-002, 9/95.
EPO Office Action Communication received in Application No. 98 907 741.7, dated Jun. 3, 2003.
EPO Office Action Communication received in Application No. 98 907 741.7, dated Apr. 2, 2004.
PCT International Preliminary Examination Report received in Application No. PCT/US 98/04494, dated Jun. 11, 1999.
PCT International Search Report received in Application No. PCT/US 98/04494, dated Mar. 6, 1998.

* cited by examiner

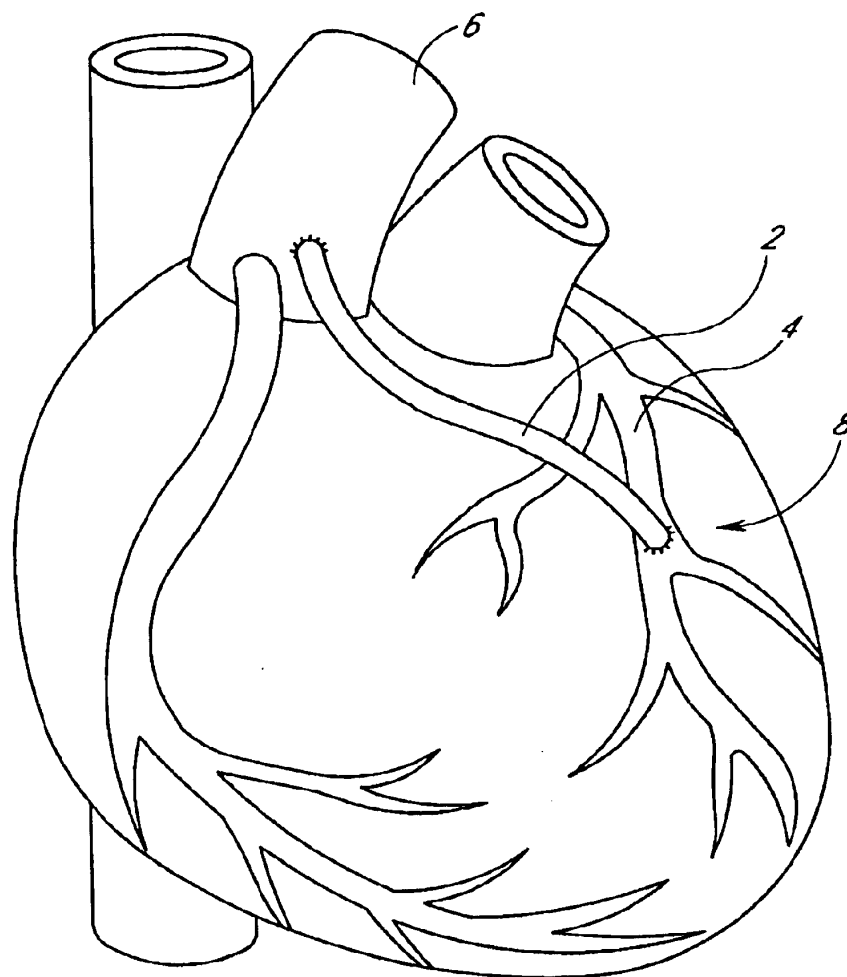


FIG. 1

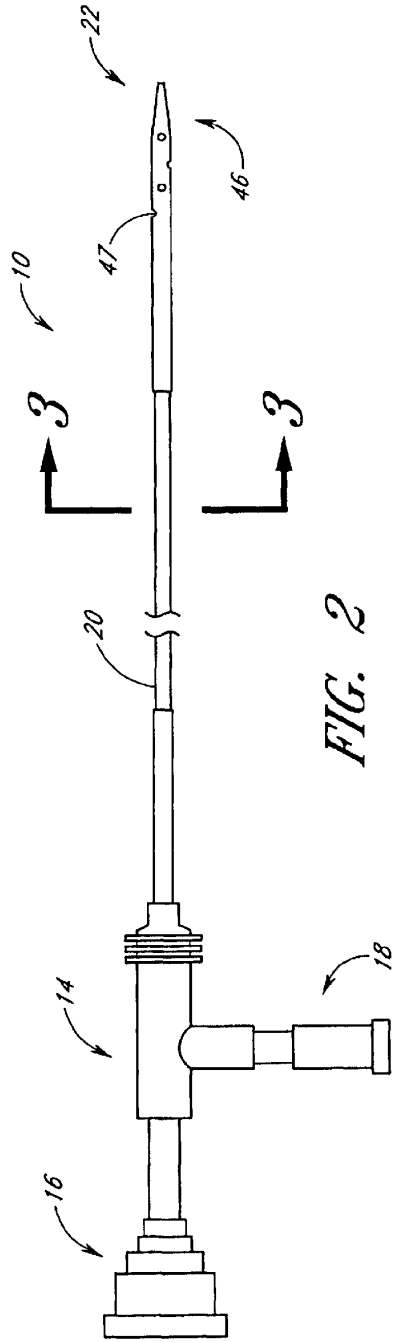


FIG. 2

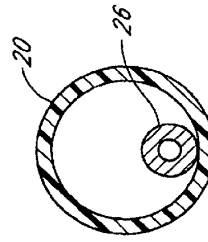


FIG. 4

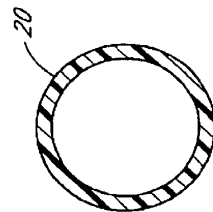


FIG. 3

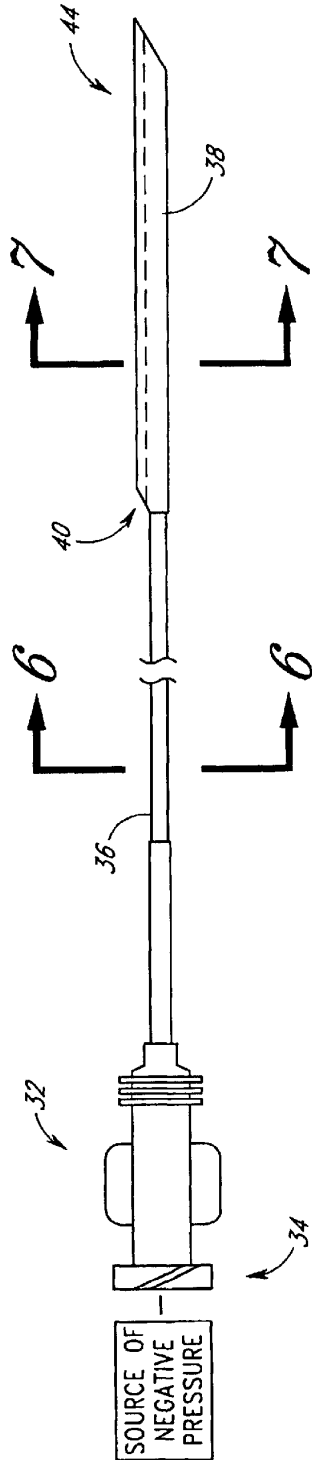


FIG. 5

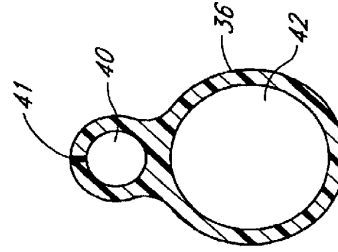


FIG. 7B

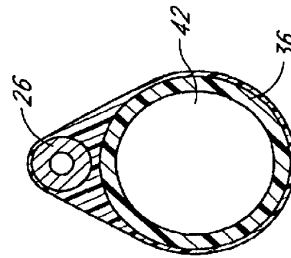


FIG. 7A

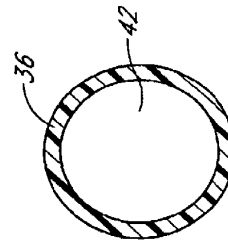


FIG. 6

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