US005653727A

United States Patent [19]

Wiktor

[11] Patent Number: 5,653,727

[45] Date of Patent: *Aug. 5, 1997

[54] **INTRAVASCULAR STENT**

[75] Inventor: **Dominik M. Wiktor**, Cranford, N.J.

[73] Assignee: **Medtronic, Inc.**, Minneapolis, Minn.

[*] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,133,732.

[21] Appl. No.: **588,496**

[22] Filed: **Jan. 18, 1996**

Related U.S. Application Data

[63] Continuation of Ser. No. 872,737, Apr. 22, 1992, Pat. No. 5,192,060, which is a continuation of Ser. No. 327,286, Mar. 22, 1989, Pat. No. 5,153,732, which is a continuation-in-part of Ser. No. 107,686, Oct. 19, 1987, Pat. No. 4,886,062.

[51] **Int. Cl.**[6] **A61B 17/00**

[52] **U.S. Cl.** **606/195**; 623/1; 606/191

[58] **Field of Search** 604/96, 104–105; 606/191–192, 194–195; 623/1, 11

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,774,596	11/1973	Cook .
3,868,956	3/1975	Alfidi et al. .
4,038,703	8/1977	Bokros .
4,130,904	12/1978	Whalen .
4,300,244	11/1981	Bokros .
4,319,363	3/1982	Ketharanathan .
4,402,307	9/1983	Hanson et al. .
4,503,569	3/1985	Dotter .
4,531,933	7/1985	Norton et al. .
4,553,545	11/1985	Maass et al. .
4,580,568	4/1986	Gianturco .
4,604,762	8/1986	Robinson .
4,619,246	10/1986	Molgaard-Nielsen et al. .
4,647,416	3/1987	Seller, Jr. et al. .
4,649,922	3/1987	Wiktor .
4,655,771	4/1987	Wallsten .
4,665,918	5/1987	Garza et al. .
4,681,110	7/1987	Wiktor .
4,705,517	11/1987	DiPisa, Jr. .
4,733,665	3/1988	Palmaz .
4,739,762	4/1988	Palmaz .
4,760,849	8/1988	Kropf .
4,762,128	8/1988	Rosenbluth .

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

0183372	6/1986	European Pat. Off. .
837122	4/1952	Germany .
37-310774	of 1962	Japan .
38-214264	of 1963	Japan .

OTHER PUBLICATIONS

Charnsangavej, Chusilp, MD, et al., "Stenosis of the Vena Cava: Preliminary Assessement of Treatment with Expandable Metallic Stents" *Radiology*, Nov. 1986, pp. 295–298.

Schatz, Richard A, MD, et al., "Balloon–expandable intracoronary stents in the adult dog" *Circulation* 76(2):450–7 Aug. 1987.

Sigwart, Ulrich MD, et al. "Intravascular Stents to Prevent Occlusion and Restenosis after Transluminal Angioplasty" *New Eng J Med* 316(12):701–6. Mar 19, 1987.

(List continued on next page.)

Primary Examiner—Michael Buiz
Assistant Examiner—Nancy Mulcare
Attorney, Agent, or Firm—Daniel W. Latham; Harold R. Patton

[57] **ABSTRACT**

A medical device for use in the interior of a body lumen including a catheter and a radially expandable stent mounted on the catheter. The radially expandable stent is in the form of a hollow cylinder defined by a sequence of spaced apart wire elements with each of the wire elements extending 360 degrees around the cylinder and the wire elements having extendible, sinusoidal zig-zags lying flat with respect to the cylinder. The zig-zags are shaped in a generally longitudinal direction along the cylinder at one point and then reverse their direction so that the zig-zags may open as the wire element is expanded. The adjacent wire elements are flexibly connected together in an end-to-end fashion by helical winding.

42 Claims, 6 Drawing Sheets