



US006981972B1

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

(10) **Patent No.:** **US 6,981,972 B1**
(45) **Date of Patent:** ***Jan. 3, 2006**

(54) **APPARATUS FOR TREATING VENOUS INSUFFICIENCY USING DIRECTIONALLY APPLIED ENERGY**

(75) Inventors: **Brian E. Farley**, Los Altos, CA (US); **Michael D. Laufer**, Menlo Park, CA (US); **Dawn A. Henderson**, Palo Alto, CA (US); **Douglas M. Petty**, Pleasanton, CA (US); **Mark P. Parker**, San Jose, CA (US)

(73) Assignee: **VNUS Medical Technologies, Inc.**, San Jose, CA (US)

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/483,969**

(22) Filed: **Jan. 18, 2000**

Related U.S. Application Data

(60) Division of application No. 08/811,820, filed on Mar. 4, 1997, now Pat. No. 6,033,398, which is a continuation-in-part of application No. 08/610,911, filed on Mar. 5, 1996, now Pat. No. 6,036,687, and a continuation-in-part of application No. 08/717,994, filed on Sep. 26, 1996, now Pat. No. 6,033,397, and a continuation-in-part of application No. 08/720,209, filed on Sep. 26, 1996, now Pat. No. 6,139,527.

(51) **Int. Cl.**
A61B 17/38 (2006.01)

(52) **U.S. Cl.** **606/27; 606/32; 604/20; 604/113**

(58) **Field of Classification Search** 604/107, 604/104, 105, 106, 19-21, 113; 607/1, 2, 607/96, 101, 103, 122; 606/27, 40, 41, 32, 606/31

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

373,399 A 11/1887 Hamilton
659,409 A 10/1900 Mosher
833,759 A 10/1906 Sourwine
985,865 A 3/1911 Turner, Jr.

(Continued)

FOREIGN PATENT DOCUMENTS

DE 3516830 11/1986

(Continued)

OTHER PUBLICATIONS

Electrofulguration for Varicose Veins, The Medical Letter on Drugs And Therapeutics, Jul. 12, 1968, vol. 10, No. 14, Issue 248, p. 54.

(Continued)

Primary Examiner—Cris L. Rodriguez

(74) *Attorney, Agent, or Firm*—Fulwider Patton Lee & Utecht, LLP

(57) **ABSTRACT**

A catheter introduces electrodes in a vein for a minimally invasive treatment of venous insufficiency by the application of energy to cause selective heating of the vein. The catheter is positioned within the vein to be treated, and the electrodes on the catheter are moved toward one side of the vein. RF energy is applied in a directional manner from the electrodes at the working end of the catheter to cause localized heating and corresponding shrinkage of the adjacent venous tissue, which may include commissures, leaflets and ostia. Fluoroscopy or ultrasound may be used to detect shrinkage of the vein. After treating one section of the vein, the catheter can be repositioned to place the electrodes to treat different sections of the vein until all desired venous valves are repaired and rendered functionally competent.

35 Claims, 8 Drawing Sheets

