



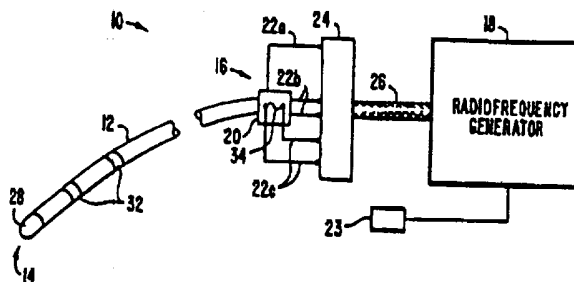
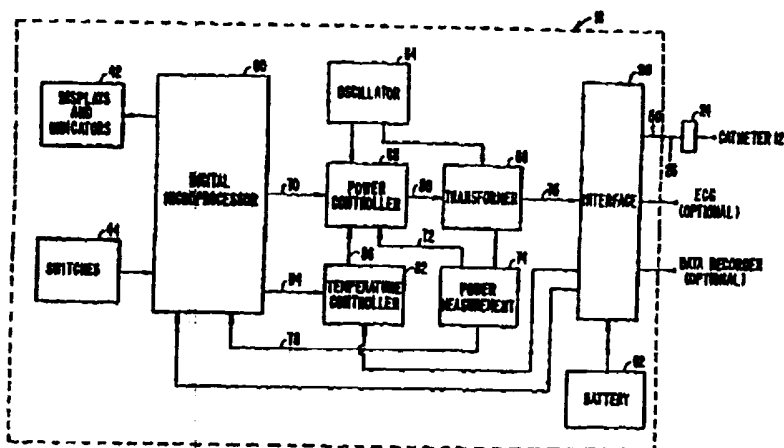
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| (51) International Patent Classification <sup>6</sup> :<br><b>A61B 17/39</b>  | <b>A3</b>   | (11) International Publication Number: <b>WO 95/18576</b><br>(43) International Publication Date: 13 July 1995 (13.07.95) |
| (21) International Application Number: PCT/US95/00026<br>(22) International Filing Date: 4 January 1995 (04.01.95)<br>(30) Priority Data:<br>08/179,558        10 January 1994 (10.01.94)        US<br>(71) Applicant: MEDTRONIC CARDIORHYTHM [US/US]; 130<br>Rio Robles, San Jose, CA 95134-1806 (US).<br>(72) Inventors: STRUL, Bruno; 918 Bautista Court, Palo Alto,<br>CA 94303 (US). LADD, Kevin, C.; 825 Crompton Road,<br>Redwood City, CA 94061 (US).<br>(74) Agents: DUTHLER, Reed, A. et al.; Medtronic, Inc. MS301,<br>7000 Central Avenue N.E., Minneapolis, MN 55432 (US). | (81) Designated States: AU, CA, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).<br><br><b>Published</b><br><i>With international search report.</i><br><i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i><br><br>(88) Date of publication of the international search report:<br>31 August 1995 (31.08.95) |   |

(54) Title: RADIOFREQUENCY ABLATION SYSTEM

## (57) Abstract

A system for delivering radiofrequency energy to ablate tissue comprises a radiofrequency generator and an intravascular catheter. The catheter includes a radiofrequency ablation electrode and a temperature sensor within its distal end and may also include an additional electrode for ECG endocavitary mapping, or HIS. Delivery of power to the ablation monopolar electrode may then be controlled based on electrode temperature using a cascade feedback control system wherein analog temperature controller adjusts the set point to a secondary power controller. Alternatively, power delivered to the patient can be controlled directly based on a power set point. A sinusoidal RF signal is provided to avoid energy attenuation and the sinusoidal RF signal may be pulsed to avoid buildup of coagulum on the catheter tip while providing high power to create large lesions. A verification circuit checks the continuity of circuits in a disposal catheter.



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# INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/US 95/00026

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 A61B17/39

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category * | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
|------------|--|-----------------------|
| X          | WO,A,93 20770 (CARDIORHYTHM) 28 October 1993<br>cited in the application<br>ref. sign 84, 86,<br>see abstract; figures 4,1,3<br>see page 13, line 23 - line 25<br>see page 14, line 17 - line 27 | 5-9                   |
| A          | ---  | 1-4                   |
| A          | WO,A,91 16859 (BOSTON SCIENTIFIC CORP.) 14 November 1991<br>ref sign 81, 84, 86, 92, 90, 96, 50, and 94<br>see abstract; figure 12<br>---  | 1-9                   |
| A          | WO,A,93 08755 (EP TECHNOLOGIES) 13 May 1993<br>see figure 3<br>-----   | 1-9                   |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

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- "P" document published prior to the international filing date but later than the priority date claimed

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- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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- "&" document member of the same patent family

Date of the actual completion of the international search

24 April 1995

Date of mailing of the international search report

28.07.95

Name and mailing address of the ISA

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PAPONE, F

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 95/ 00026

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-10: Ablation system with RF generator, catheter, temperature sensor, power controller and set point.
2. Claims 11-14: Verification circuit, current source, current sensor.
3. Claims 15-18: Alternative power control signal.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-10

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 95/00026

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                      | Publication<br>date              |
|---|---------------------|---|----------------------------------|
| WO-A-9320770                              | 28-10-93            | AU-B- 4280293<br>EP-A- 0634910                  | 18-11-93<br>25-01-95             |
| WO-A-9116859                              | 14-11-91            | US-A- 5122137<br>EP-A- 0528868<br>JP-T- 6500476 | 16-06-92<br>03-03-93<br>20-01-94 |
| WO-A-9308755                              | 13-05-93            | AU-A- 3067292<br>EP-A- 0566725<br>US-A- 5383874 | 07-06-93<br>27-10-93<br>24-01-95 |