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(54) **ELECTROCARDIOGRAM ANALYZER**

(71) Applicants: **UNIVERSITY OF TSUKUBA**,
Tsukuba-shi, Ibaraki (JP); **NIHON KOHDEN CORPORATION**,
Shinjuku-ku, Tokyo (JP)

(72) Inventors: **Akihiko Nogami**, Tsukuba (JP); **Koji Takizawa**, Tokyo (JP)

(73) Assignees: **UNIVERSITY OF TSUKUBA**, Ibaraki (JP); **NIHON KOHDEN CORPORATION**, Tokyo (JP)

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(56) **References Cited**

U.S. PATENT DOCUMENTS

2009/0281441 A1 11/2009 Zhang et al.
2010/0268059 A1* 10/2010 Ryu A61B 5/042
600/407

(Continued)

FOREIGN PATENT DOCUMENTS

WO 9502995 A1 2/1995
WO 9510225 A1 4/1995
WO 9605768 A1 2/1996

OTHER PUBLICATIONS

Extended European Search Report dated Dec. 22, 2016, by the European Patent Office in counterpart European Application No. 16178933.4.

(Continued)

Primary Examiner — Carl H Layno
Assistant Examiner — Erin M Piatecki
(74) Attorney, Agent, or Firm — Sughrue Mion, PLLC

(57) **ABSTRACT**

An electrocardiogram analyzer includes a first acquiring section that acquires a body surface electrocardiogram of a subject, a second acquiring section that acquires an intracardiac electrocardiogram of a ventricle of a heart of the subject, and an analyzing section that performs a frequency analysis on the intracardiac electrocardiogram and includes a range setting section that sets an analysis time range of the frequency analysis in the intracardiac electrocardiogram based on a unit waveform of the body surface electrocardiogram, and a calculating section that, in the analysis time range, performs the frequency analysis on the intracardiac electrocardiogram, and that calculates an index value indicating a ratio of local abnormal ventricular activities in the intracardiac electrocardiogram.

16 Claims, 9 Drawing Sheets

