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(12) **United States Patent**
Rossi

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(54) **DEVICE FOR MEASURING IMPEDANCE OF BIOLOGIC TISSUES INCLUDING AN ALTERNATING CURRENT (AC) COUPLED VOLTAGE-TO-CURRENT CONVERTER**

A61B 5/4872; A61B 5/6897; A61B 5/6898; A61B 5/7228

See application file for complete search history.

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(21) Appl. No.: **14/480,024**

Ross, Alexander, et al., "Current source design for electrical impedance tomography," *Physiological Measurement* 24 (2003) Institute of Physics Publishing Ltd., UK, pp. 509-516.

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(65) **Prior Publication Data**

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Related U.S. Application Data

(57) **ABSTRACT**

(63) Continuation-in-part of application No. 13/033,285, filed on Feb. 23, 2011, now Pat. No. 8,909,333.

A device for measuring impedance of biological tissue may include electrodes and a voltage-to-current converter coupled to the electrodes to drive an alternating current (AC) through the tissue and sense an AC voltage. The converter may include an amplifier having first and second inputs and an output, a first voltage divider coupled to the first input, a second voltage divider coupled to the second input, a filter capacitor coupled between the output and the second voltage divider, a current limiting resistor coupled between the second input the second voltage divider, and a bypass capacitor coupled to the second input of the amplifier and in parallel with the resistor. A single-ended amplitude modulation (AM) demodulator may demodulate the AC voltage and generate a corresponding baseband voltage representing the impedance. The device may also include an output circuit to generate output signals representative of DC and AC components of the baseband voltage.

(51) **Int. Cl.**

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(52) **U.S. Cl.**

CPC **A61B 5/053** (2013.01); **A61B 5/0537** (2013.01); **G01N 33/18** (2013.01); **G01N 33/48** (2013.01); **G01R 1/30** (2013.01); **G01R 27/02** (2013.01); **Y10T 29/49007** (2015.01)

(58) **Field of Classification Search**

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18 Claims, 9 Drawing Sheets

