Concentric ring electrode research, patents, and patenting experience at the MEA lab

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Outline

- Research
  - General overview since 2016
- Patents
  - Latest developments
    - Second patent notice of allowance
    - Fourth patent pending
  - What our four patents are about
- Patenting experience
  - Before tech transfer center
  - After tech transfer center

CODE401526 electrode from Spes Medica

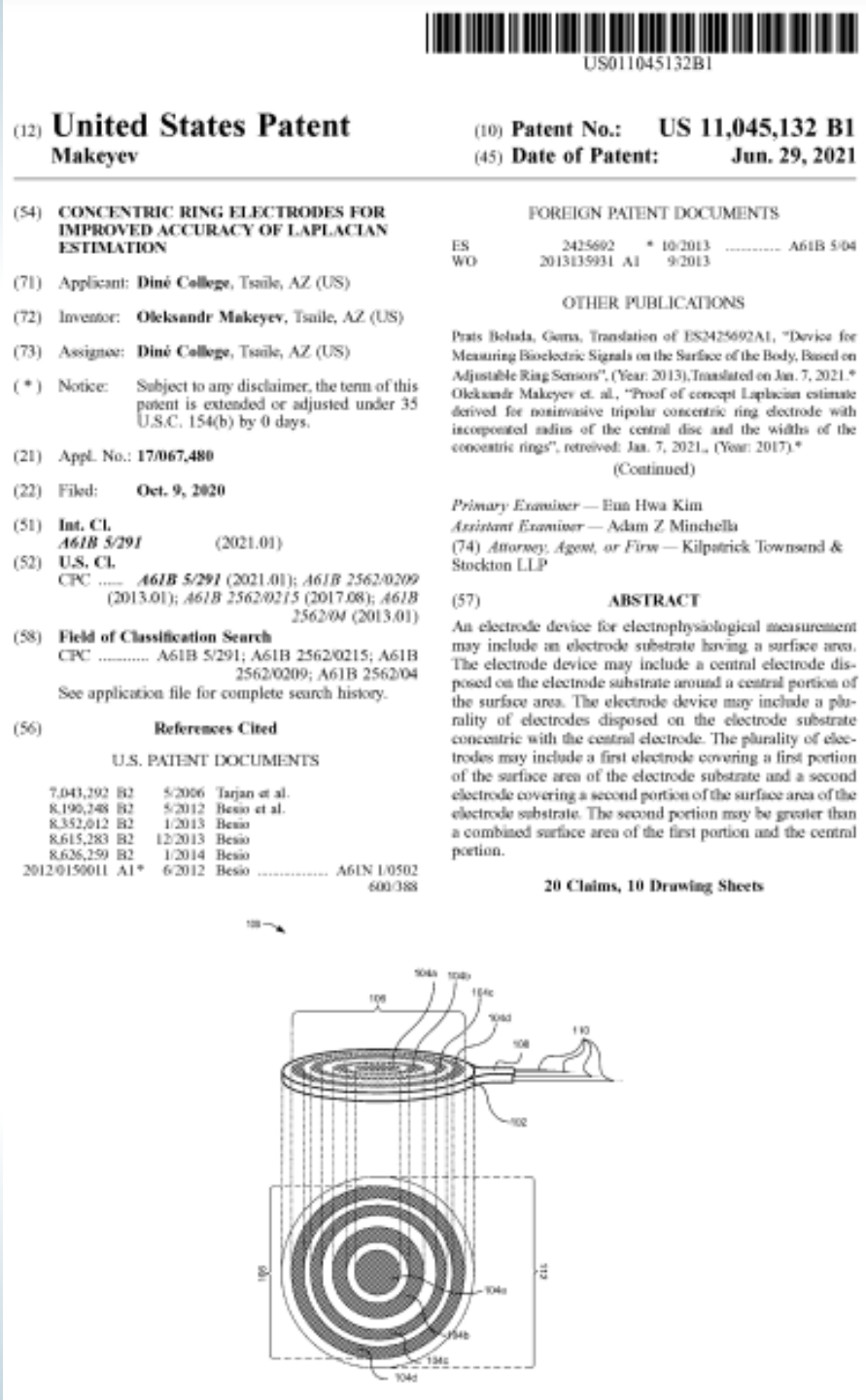
t-Interface pre-amplifiers from CREmedical

Research: MEA lab since 2016

- 3 NSF TCUP SGR awards for a total of $600,000;
  - Fourth funding proposal is currently in review;
- 4 patents (one issued, one about to be issued, one pending and one divisional application submitted);
- 9 journal and 13 conference proceedings papers;
- 7 undergraduate Research Assistants published their research including journal papers;
- Awards, tutoring for Diné College students, running activities for local school students at STEM festivals, etc.

Patents

- First patent issued to a Tribal College or University.
- Issue fee for the second one (16/417,422) submitted on 10/11/24.
- Two more are pending with the most recent one (18/911,107) filed on 10/9.



US011045132B1

(12) **United States Patent**
Makeyev

(10) **Patent No.: US 11,045,132 B1**
(45) **Date of Patent: Jun. 29, 2021**

(54) **CONCENTRIC RING ELECTRODES FOR IMPROVED ACCURACY OF LAPLACIAN ESTIMATION**

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(73) Assignee: **Diné College**, Tsaile, AZ (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.

(21) Appl. No.: **17/067,480**

(22) Filed: **Oct. 9, 2020**

(51) **Int. Cl.**
A61B 5/291 (2021.01)

(52) **U.S. Cl.**
CPC ***A61B 5/291*** (2021.01); *A61B 2562/0209* (2013.01); *A61B 2562/0215* (2017.08); *A61B 2562/04* (2013.01)

(58) **Field of Classification Search**
CPC A61B 5/291; A61B 2562/0215; A61B 2562/0209; A61B 2562/04
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

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Oleksandr Makeyev et. al., "Proof of concept Laplacian estimate derived for noninvasive tripolar concentric ring electrode with incorporated radius of the central disc and the widths of the concentric rings", retreived: Jan. 7, 2021,, (Year: 2017).*
(Continued)

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(57) **ABSTRACT**

An electrode device for electrophysiological measurement may include an electrode substrate having a surface area. The electrode device may include a central electrode disposed on the electrode substrate around a central portion of the surface area. The electrode device may include a plurality of electrodes disposed on the electrode substrate concentric with the central electrode. The plurality of electrodes may include a first electrode covering a first portion of the surface area of the electrode substrate and a second electrode covering a second portion of the surface area of the electrode substrate. The second portion may be greater than a combined surface area of the first portion and the central portion.

20 Claims, 10 Drawing Sheets

Patents

- What our four patents are about
  - First: assuming that all the recording surfaces have the same width and/or radius how to optimize the distances between them to maximize the Laplacian estimation accuracy.
  - Second: assuming that we can modify the width and/or radius of the recording surfaces how to distribute them to maximize the Laplacian estimation accuracy.
  - Third: how to design pre-amplifiers that allow changing Laplacian estimation coefficients for specific electrode.
  - Fourth: divisional application from the first one – how to calculate the optimal Laplacian estimation coefficients for a specific electrode geometry.

Patenting experience

- In general
  - Comprehensive set of policies and procedures which had to be created (mostly) from scratch first;
  - Dealing with United States Patent and Trademark Office;
  - Getting legal counsel on board.

- Before tech transfer center
  - Funding patent related costs and fees via inventor's external awards;
  - Bayh-Dole Act reporting;
  - Individual Board of Regents resolutions supporting each patent application.

Patenting experience

- Journey so far
  - Over $1.3 million awarded from SBA and EDA, more is pending;
  - Funded: setting up and operations (including legal costs and fees) for the first year; renovations (center and computer lab/maker space) at Tsaile Campus library; hardware and software; building planning.

- After tech transfer center
  - Paying for ongoing patenting costs and fees is simply a matter by getting the approval from the PI.

Thank you!

Questions?