

ORIGINAL



ABSTRACT*

45 FEB 20
A device for stimulating mechanosensory nerve endings can include a housing having an internal chamber and first and second openings; a membrane covering the first opening of housing, said membrane being sufficient flexibility to vibrate upon receiving vibratory stimulation from a vibratory mechanism; and a coupling mechanism at the second opening configured for being fluidly coupled to the vibratory mechanism, wherein the entire device consists of magnetically unresponsive materials. The housing can be cylindrical, or any polygon shape. The membrane can be integrated with the housing or coupled thereto, such as with adhesive. Optionally, the membrane can be removably coupled to the housing.

CLAIMS

1. A device for stimulating mechanosensory nerve endings, the device comprising:
a housing having an internal chamber and first and second openings;
a membrane covering the first opening of housing, said membrane being sufficient flexibility to vibrate upon receiving vibratory stimulation from a vibratory mechanism; and
a fluid coupling mechanism at the second opening configured for being fluidly coupled to the vibratory mechanism, wherein the entire device consists of magnetically unresponsive materials.
2. A device as in claims 1, further comprising a lid having an aperture therethrough, wherein the lid couples the membrane to the housing.
3. A device as in one of claims 1-2, wherein the coupling mechanism is located opposite of the membrane with respect to the internal chamber.
4. A device as in one of claims 1-3, further comprising a tube coupled to the coupling mechanism and capable of being coupled to the vibratory mechanism, wherein the tube has a length sufficient to extend out of a magnetic field of an MRI or MEG so that an opposite end of the tube is capable of being coupled to a component having magnetically responsive components, and where the magnetically responsive components do not react to the magnetic field.
5. A device as in one of claims 1-4, wherein the membrane has a positive vibration displacement of at least 1 mm.
6. A system for stimulating mechanosensory nerve endings, the system comprising:
a device comprising:
a housing having an internal chamber and first and second openings; and
a fluid coupling mechanism at the second opening configured for being fluidly coupled to a vibratory mechanism, wherein the entire device consists of magnetically unresponsive materials;

the vibratory mechanism configured for being fluidly coupled with the coupling mechanism; and

a magnetically unresponsive tube fluidly coupling the fluid coupling mechanism of the device to the vibratory mechanism.

7. A system for stimulating mechanosensory nerve endings, the system comprising:
a device comprising:

a housing having an internal chamber and first and second openings;

a membrane covering the first opening of housing, said membrane being sufficient flexibility to vibrate upon receiving vibratory stimulation from a vibratory mechanism; and

a fluid coupling mechanism at the second opening configured for being fluidly coupled to the vibratory mechanism, wherein the entire device consists of magnetically unresponsive materials;

the vibratory mechanism configured for being fluidly coupled with the coupling mechanism; and

a magnetically unresponsive tube fluidly coupling the fluid coupling mechanism of the device to the vibratory mechanism.

8. A system as in claim 7, wherein the vibratory mechanism is configured to oscillate fluid into and/or from the chamber so as to vibrate the membrane or to cause pressure changes in the fluid.

9. A system as in one of claims 6-8, further comprising a computing system operably coupled with the vibratory mechanism so as to control oscillation of the fluid.

10. A system as in one of claims 6-9, further comprising an MRI system or a MEG system.

11. A method for stimulating mechanosensory nerve endings, the method comprising:
providing the system as in one of claims 6-10; and

placing the first opening of the housing of the device on skin of a subject; and
oscillating fluid into and out of the housing so as to vibrate the skin.

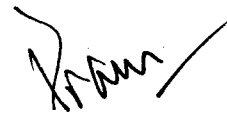
12. A method for stimulating mechanosensory nerve endings, the method comprising:
providing the system as in one of claims 7-11; and
placing the membrane of the housing of the device on skin of a subject; and
oscillating fluid into and out of the housing so as to vibrate the membrane on the skin.

13. A method as in one of claims 11-12, comprising performing the oscillating of fluid in
an MRI system or a MEG system.

14. A method as in one of claims 11-13, comprising:
placing the housing in a magnetic field;
extending the magnetically unresponsive tube out of the magnetic field
placing the vibratory mechanism outside of a magnetic field such that the vibratory
mechanism is fluidly coupled with the housing by the magnetically unresponsive tube.

15. A method as in one of the claims 11-14, comprising oscillating the fluid such that the
subject feels vibrations from the oscillating fluid.

Date: 21.02.2012



Pramod Kumar Singh
(Agent for the Applicant)

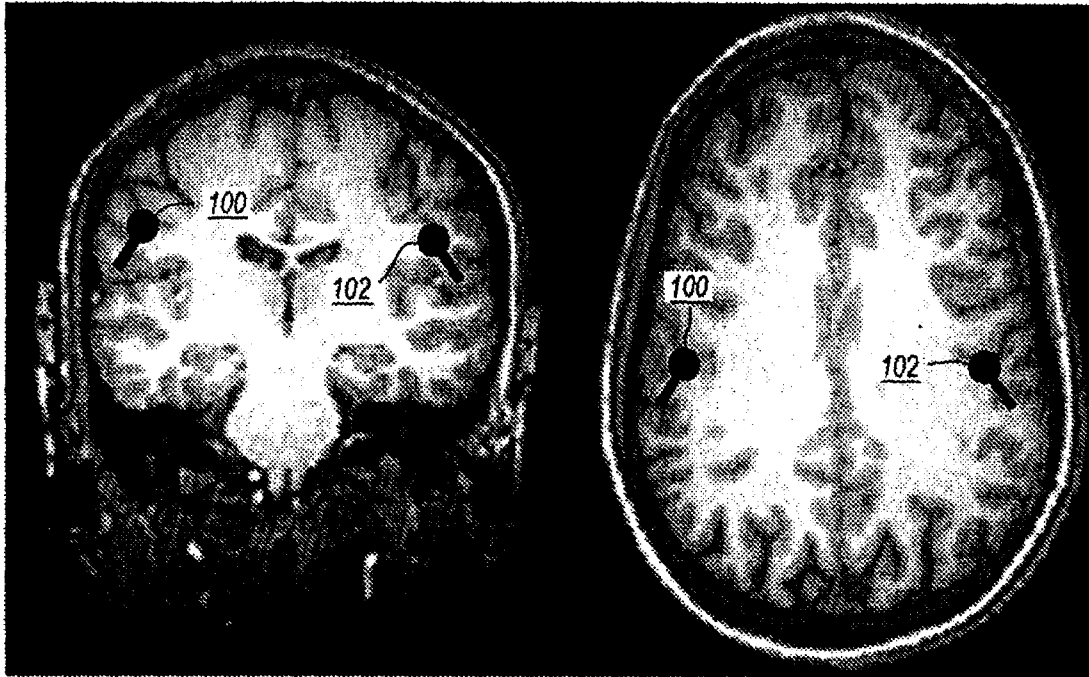
24

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

Sheet 1 of 13
ORIGINAL 1646 DELP 12

A

23 FEB 2012



B

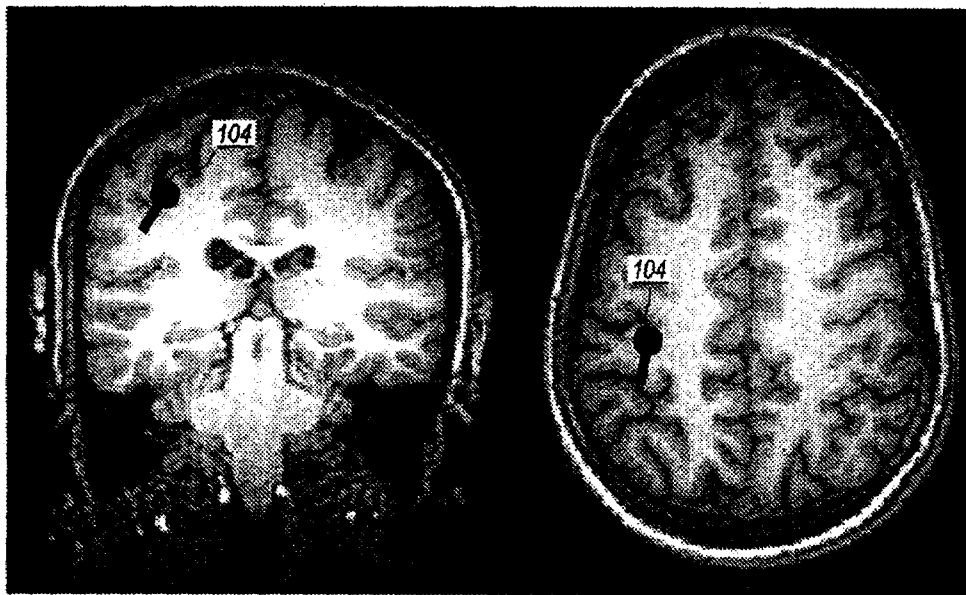


Fig. 1A

Date: 21.02.2012


Pramod Kumar Singh
(Agent for the Applicant)

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

Sheet 2 of 13

ORIGINAL

1646 DEW 19

23 FEB 2012

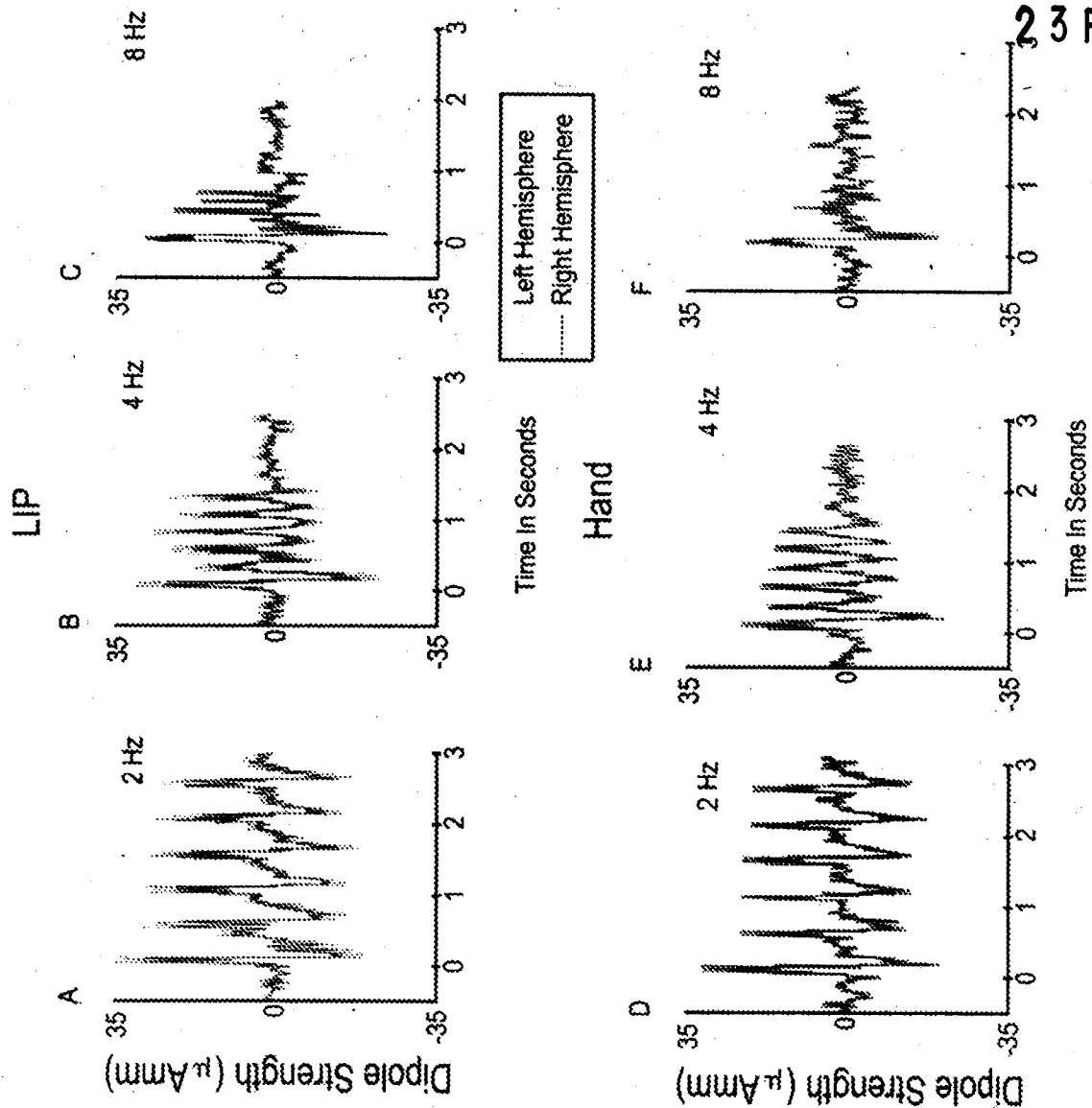


Fig. 1B

Date: 21.02.2012

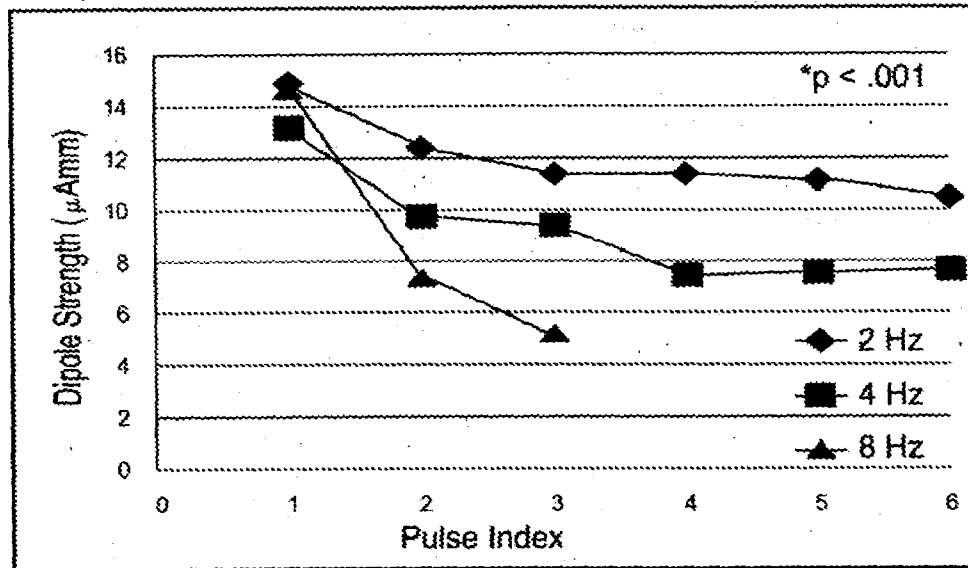
[Signature]
Pramod Kumar Singh
(Agent for the Applicant)

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

ORIGINAL

16460012

Lip



23 FEB 2012

Fig. 2A

Hand

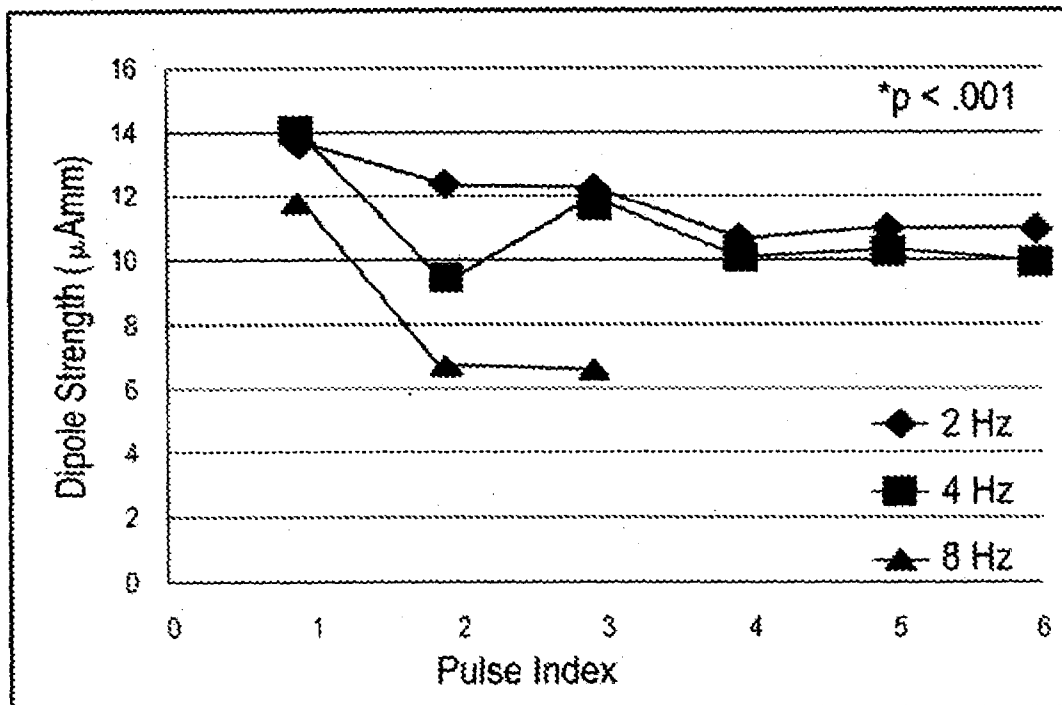


Fig. 2B

Date: 21.02.2012

Pram
Pramod Kumar Singh
(Agent for the Applicant)

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

ORIGINAL

164612

23 FEB 2012

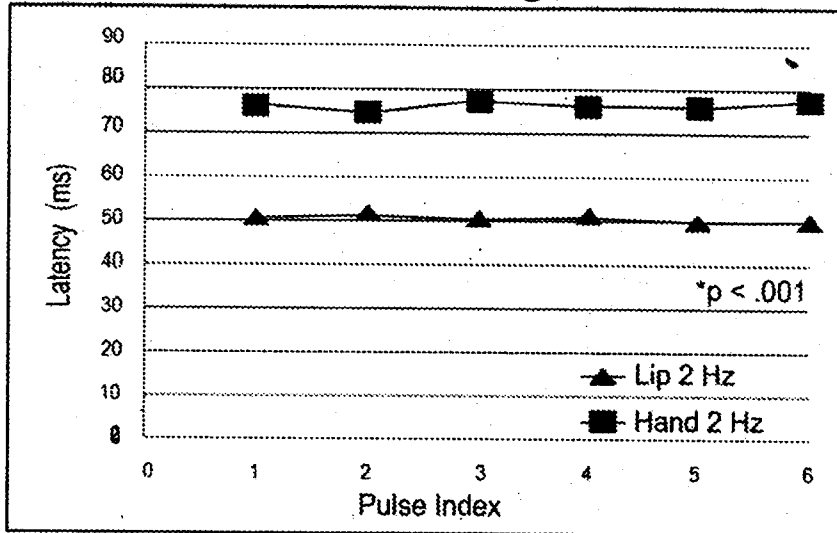


Fig. 3A

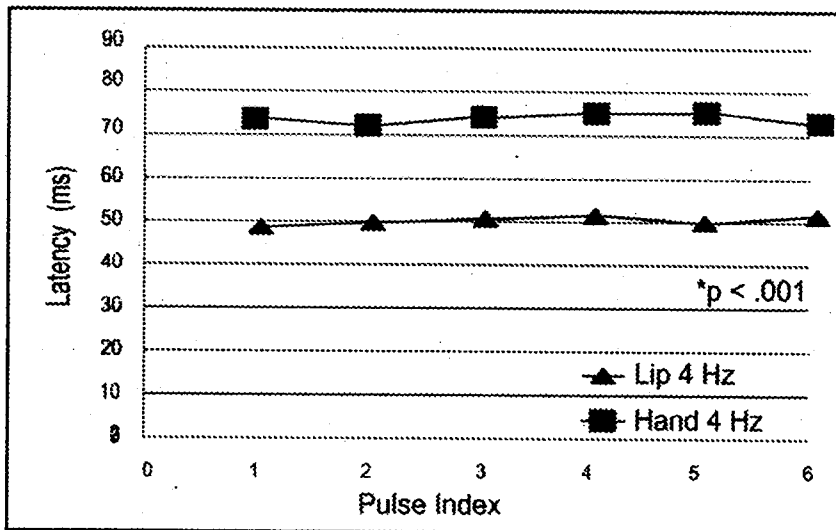


Fig. 3B

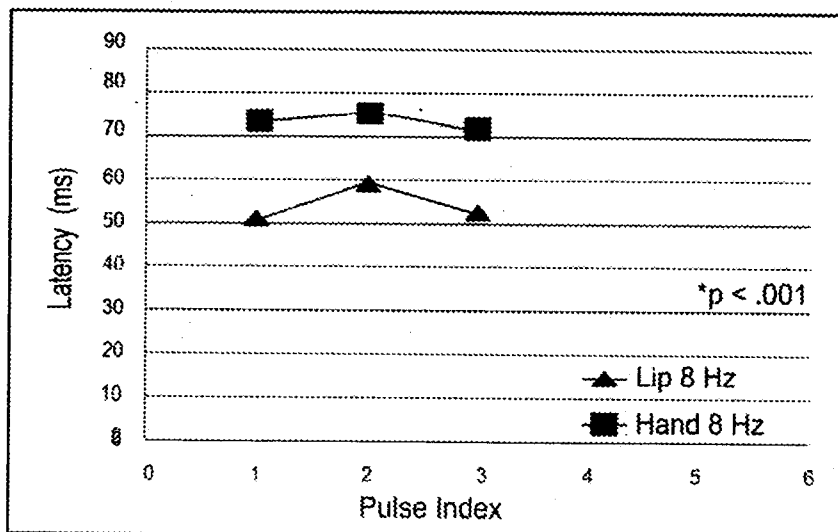


Fig. 3C

Date: 21.02.2012

Pramod
Pramod Kumar Singh
(Agent for the Applicant)

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

ORIGINAL

1 6 4 6 1 2

23 FEB 2012

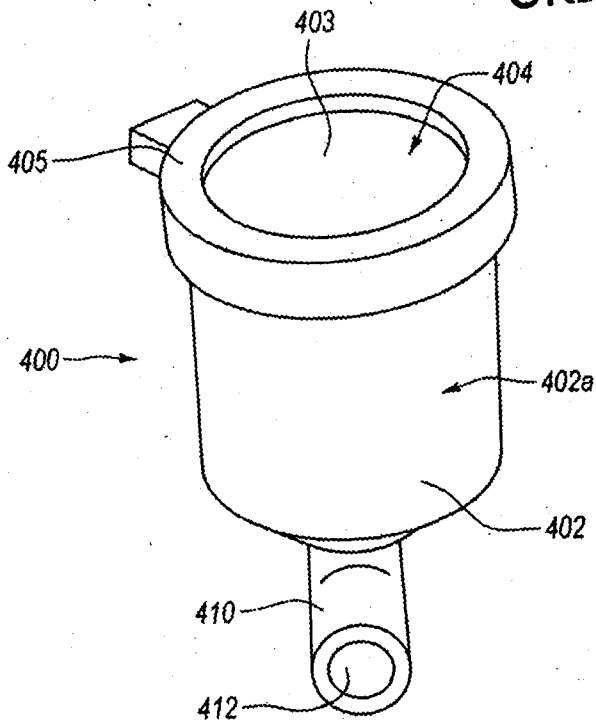


Figure 4A

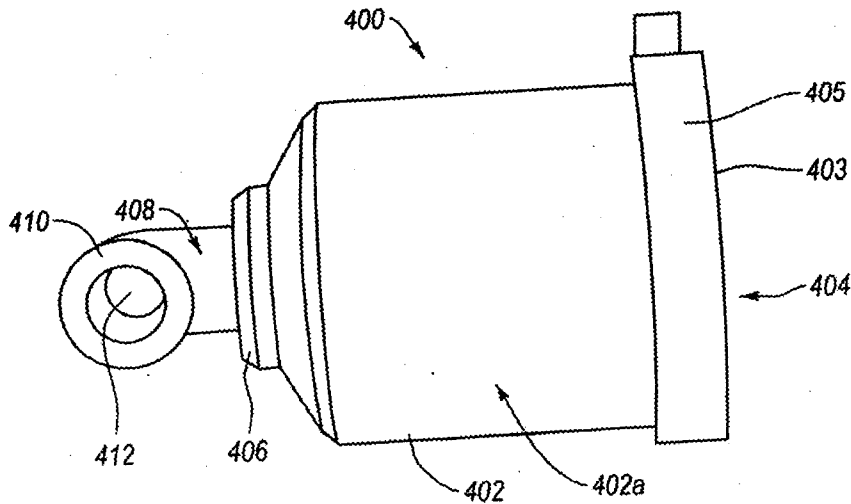


Fig. 4B

Date: 21.02.2012

Pram
Pramod Kumar Singh
(Agent for the Applicant)

ORIGINAL

164612

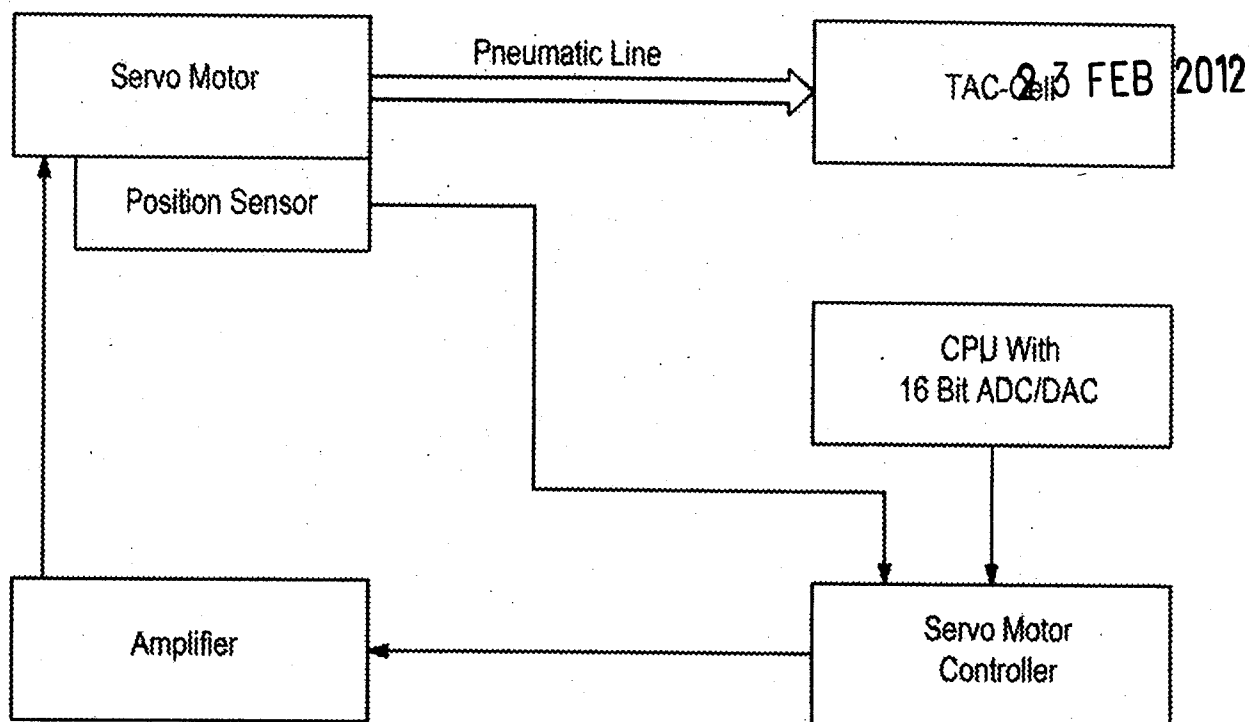


Fig. 5

Date: 21.02.2012

Pramod
Pramod Kumar Singh
(Agent for the Applicant)

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

164612

23 FEB 2012

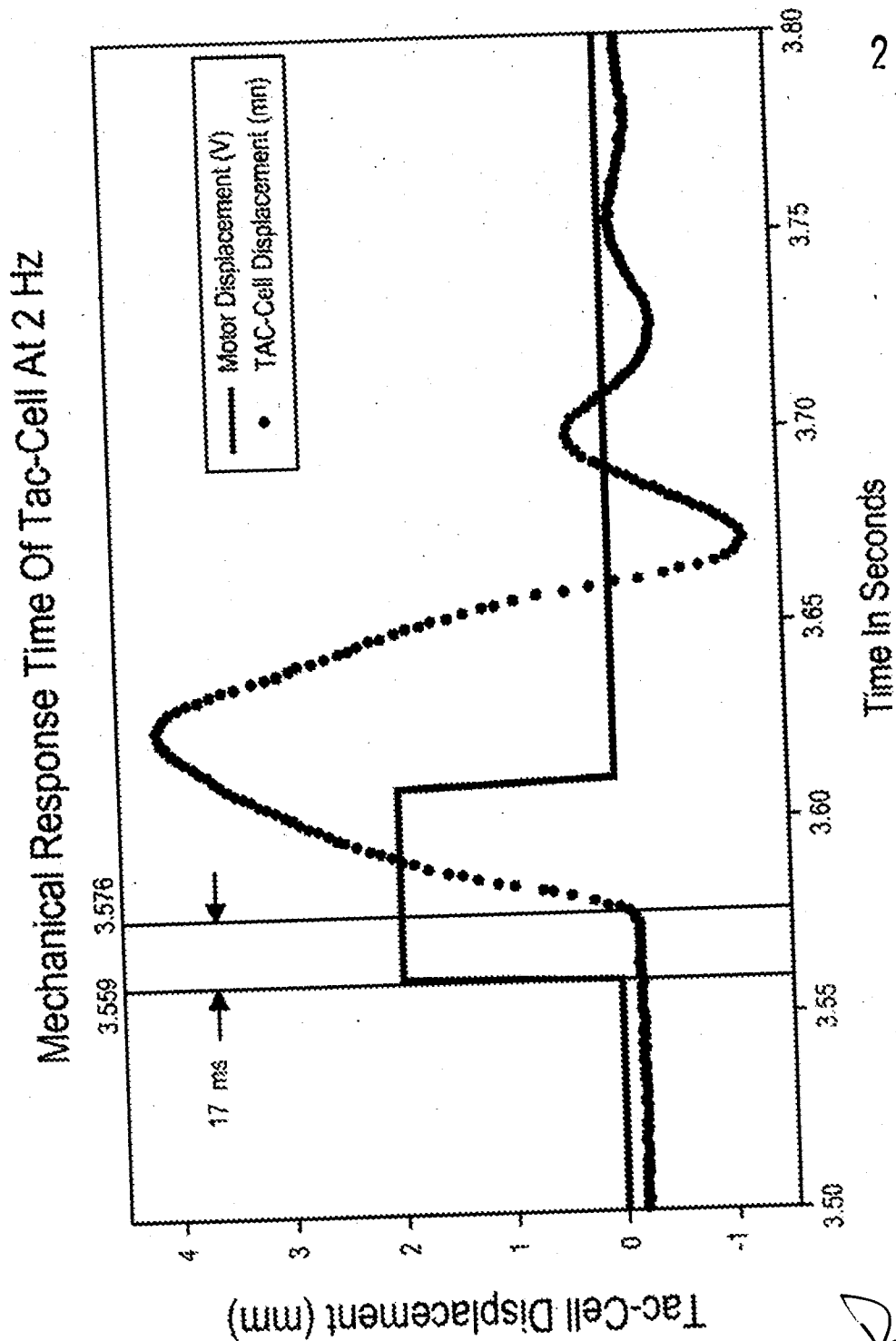


Fig. 6

Date: 21.02.2012

Pramod Kumar Singh
(Agent for the Applicant)

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

Sheet 8 of 13

ORIGINAL

1646 DEHP 12

23 FEB 2012

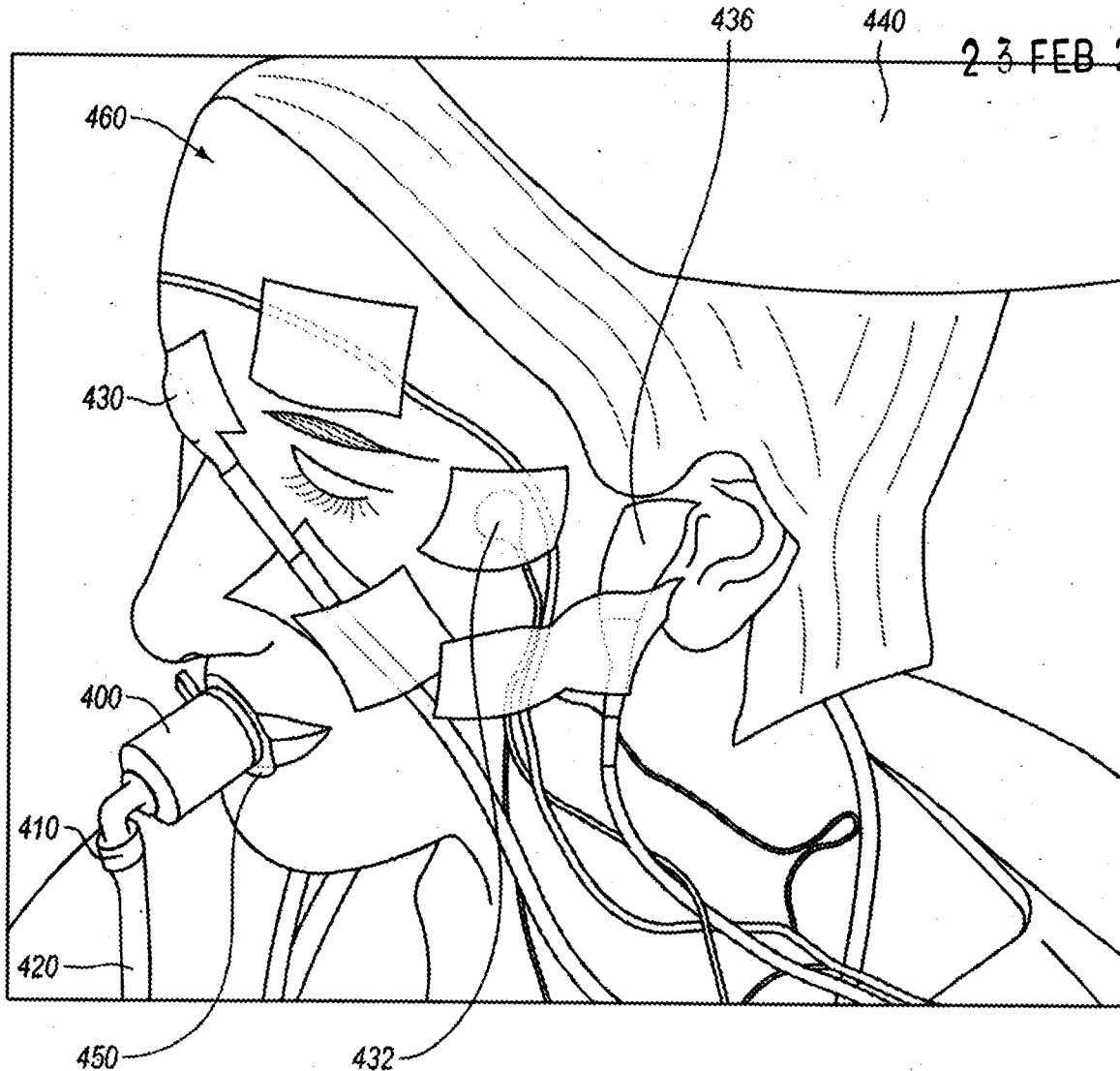


Fig. 7

Frank

Date: 21.02.2012

Pramod Kumar Singh
(Agent for the Applicant)

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

ORIGINAL.

1646 DMP 12

23 FEB 2012

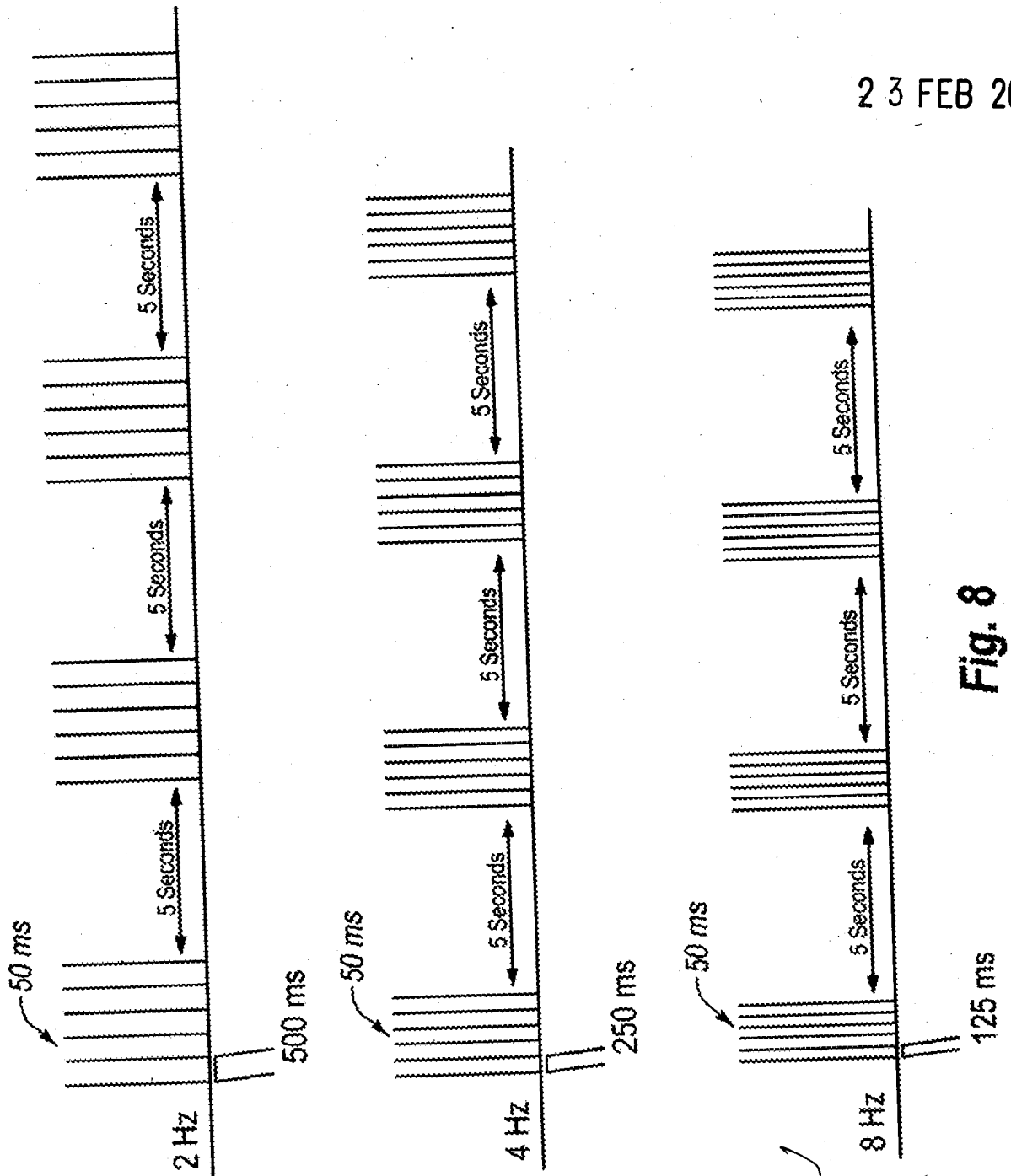


Fig. 8

Date: 21.02.2012

Pramod Kumar Singh
(Agent for the Applicant)

33

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
745 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

Sheet 10 of 13

ORIGINAL

164612

23 FEB 2012

TAC-Cell Displacement vs Time

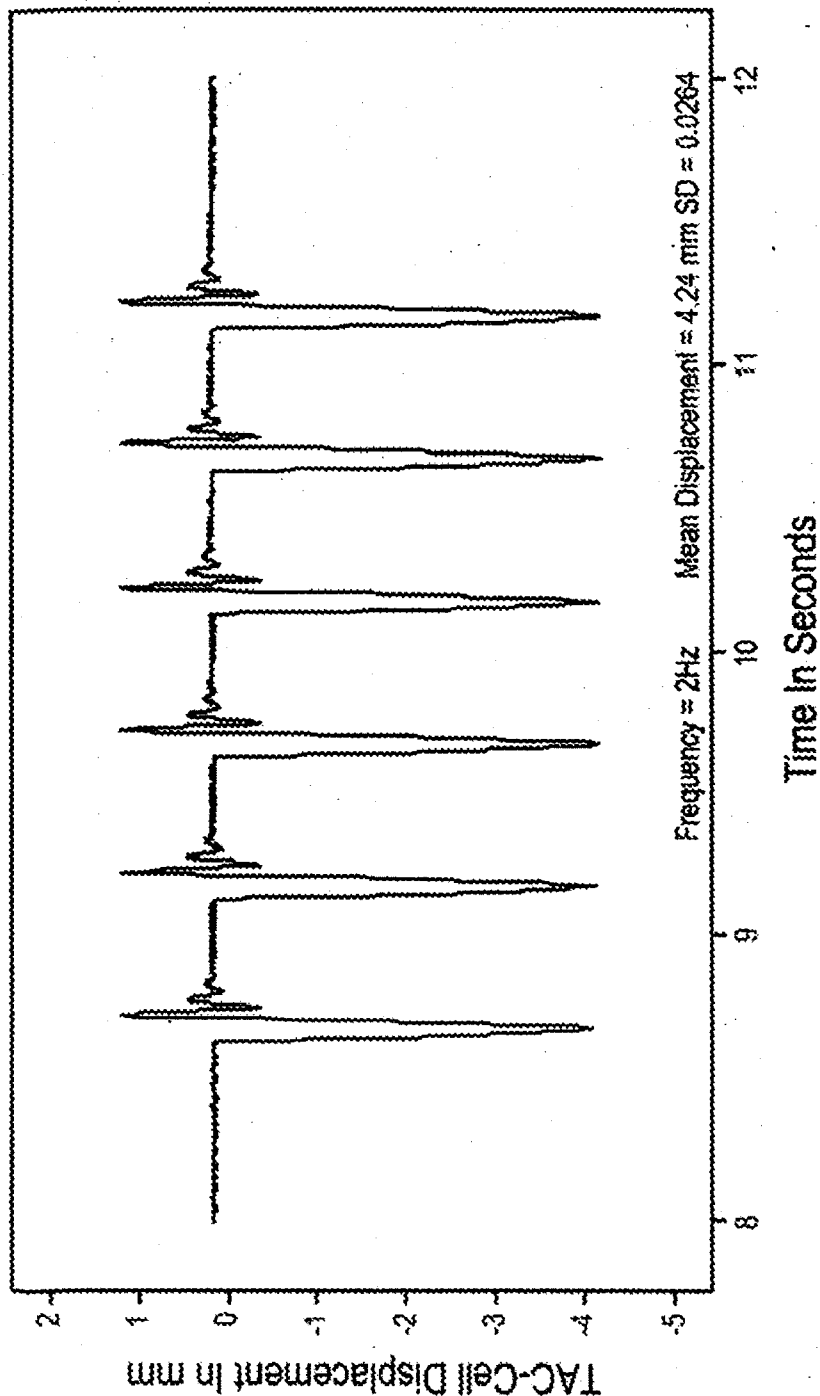


Fig. 9A

012

Pramod
Pramod Kumar Singh
(Agent for the Applicant)

34

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

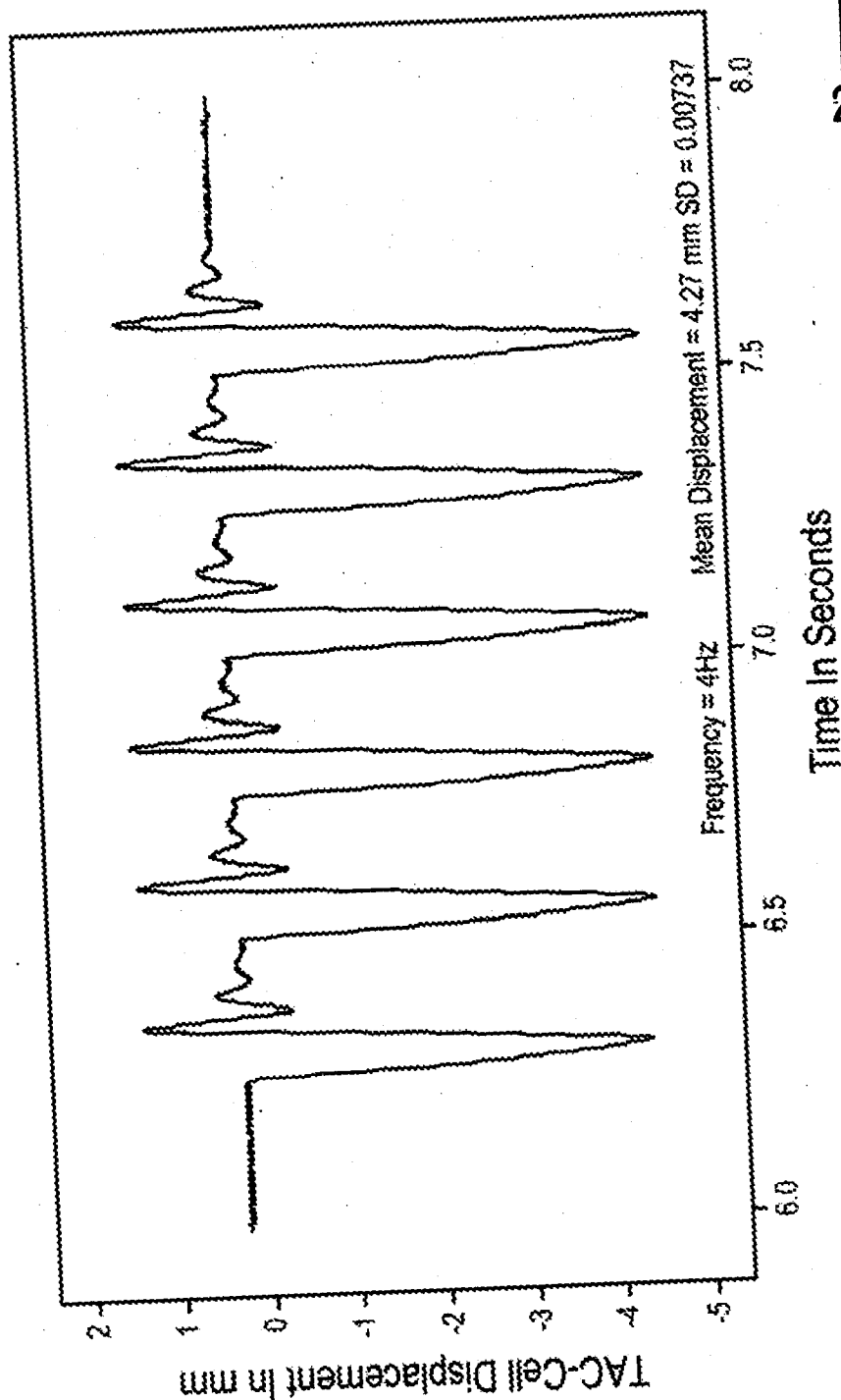
Sheet 11 of 13

ORIGINAL

1646DEHP12

4 Hz

TAC-Cell Displacement vs Time



23 FEB 2012

Fig. 9B

Date: 21.02.2012

Pramod
Pramod Kumar Singh
(Agent for the Applicant)

Name and address of the Applicant:
THE UNIVERSITY OF KANSAS
245 Strong Hall, 450 Jayhawk Boulevard
Lawrence, Kansas 66045, USA

35
ORIGINAL

Sheet 12 of 13

1646 DEHP 12

23 FEB 2012

8 Hz

TAC-Cell Displacement vs Time

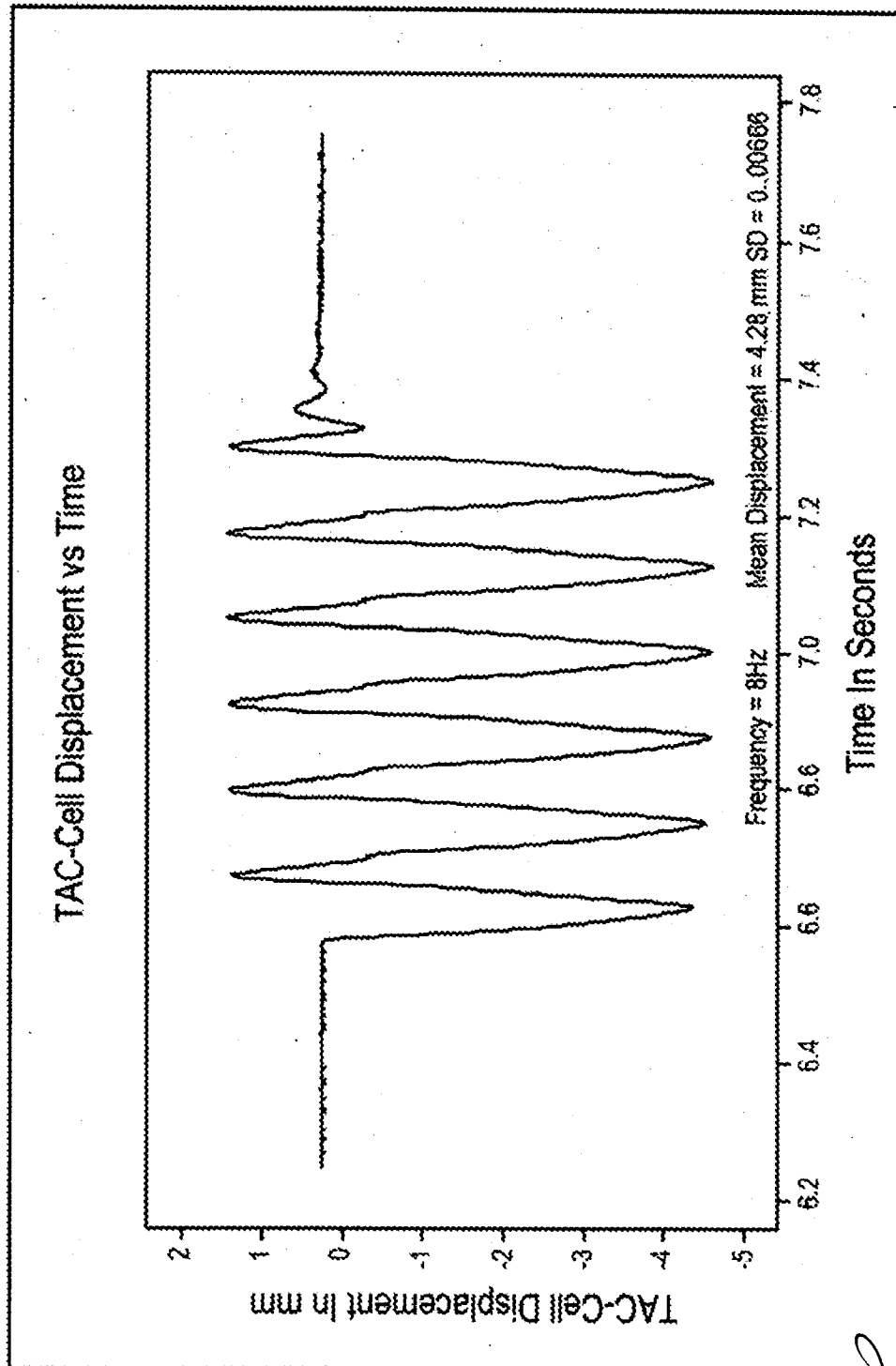


Fig. 9C

Date: 21.02.2012

Pramod Kumar Singh
(Agent for the Applicant)

ORIGINAL 36

1646 DELP 12

Figure 1 is a line graph titled "Averaged Channel Data" for a "Face" stimulus. The y-axis is labeled "MGFP" (Mean Grating Firing Probability) and ranges from 0 to 180. The x-axis is labeled "Time in Seconds" and ranges from 0 to 4.2. A secondary y-axis on the left is labeled "STIM" (Stimulus) and ranges from 140 to 180. The stimulus is represented by a square wave that alternates between 140 and 180. The MGFP is represented by a line with circular markers. The MGFP shows a sharp peak at 0.5 seconds, followed by a series of smaller peaks at 1.5, 2.5, 3.2, 3.7, and 4.2 seconds. The peaks at 1.5, 2.5, 3.2, 3.7, and 4.2 seconds are labeled with their corresponding MGFP values: 100, 105, 110, 115, and 120 respectively. The peak at 0.5 seconds is labeled with its corresponding MGFP value: 180. The stimulus is labeled with its frequency: 2 Hz, 4 Hz, and 8 Hz.

Fig. 10

Pramod Kumar Singh
(Agent for the Applicant)