ABSTRACT

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)

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

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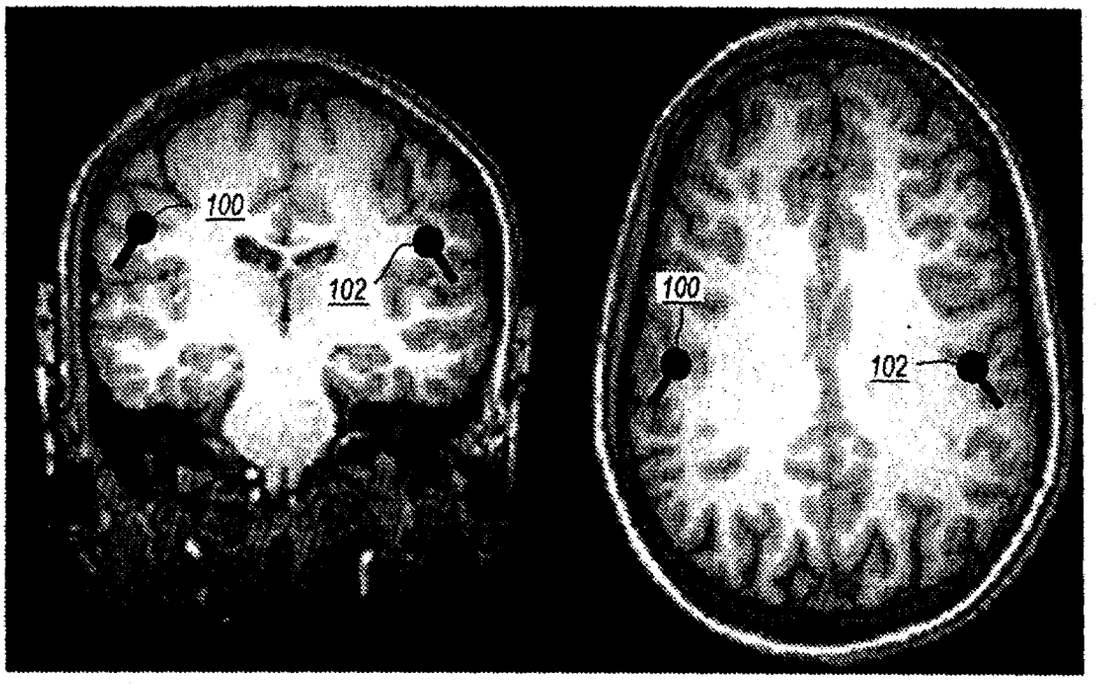

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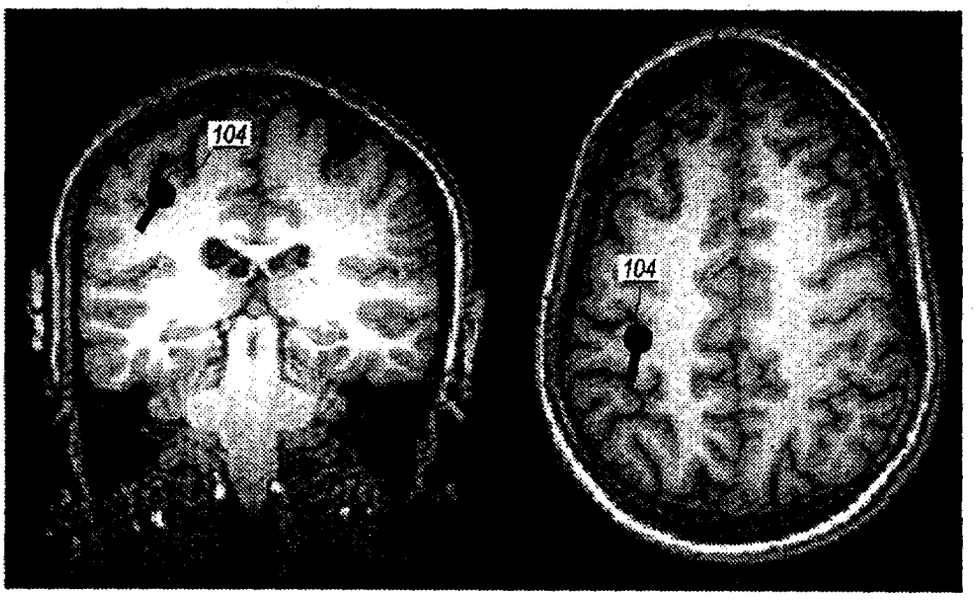

Fig. 1A

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

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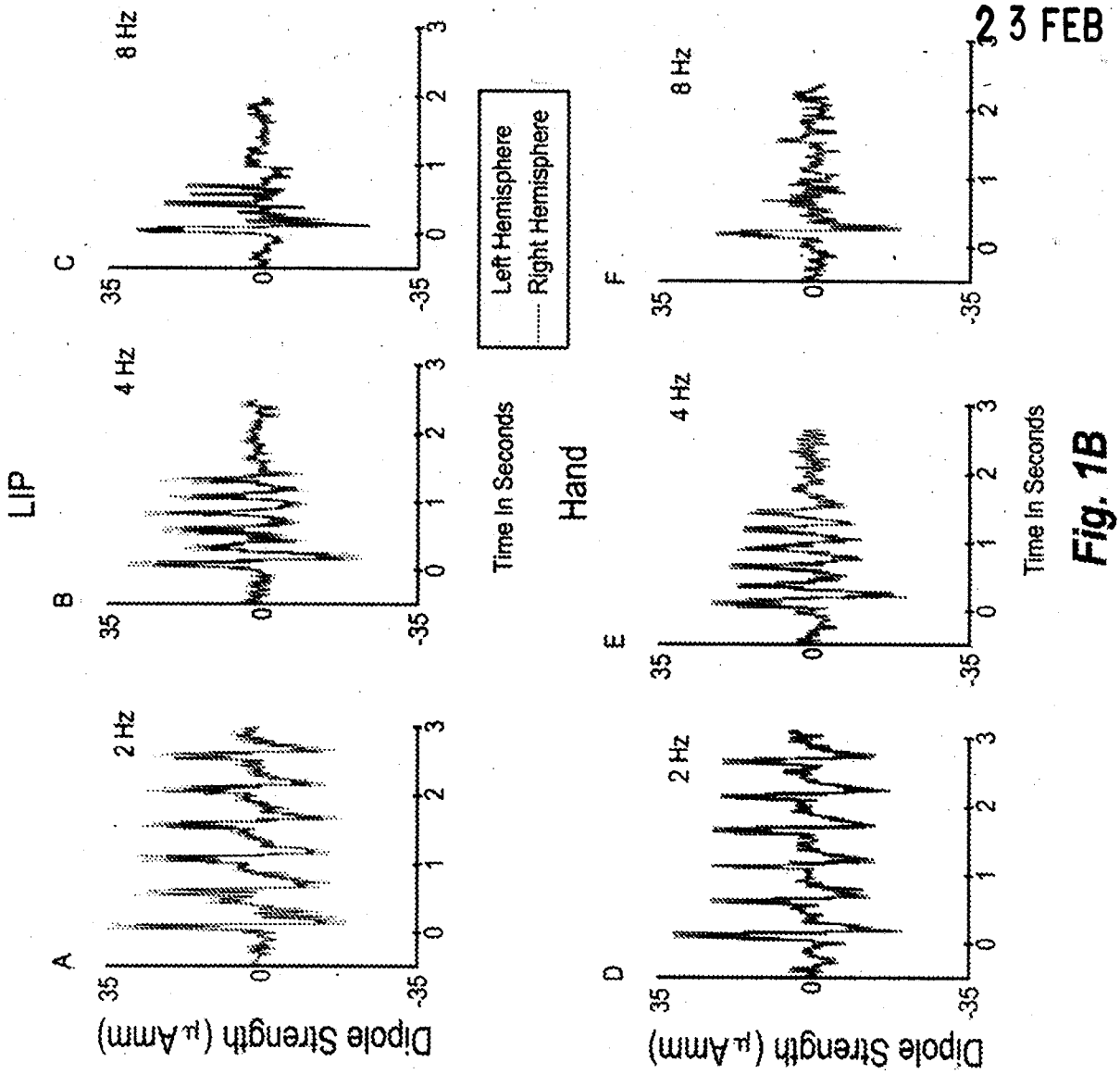

Fig. 1B

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

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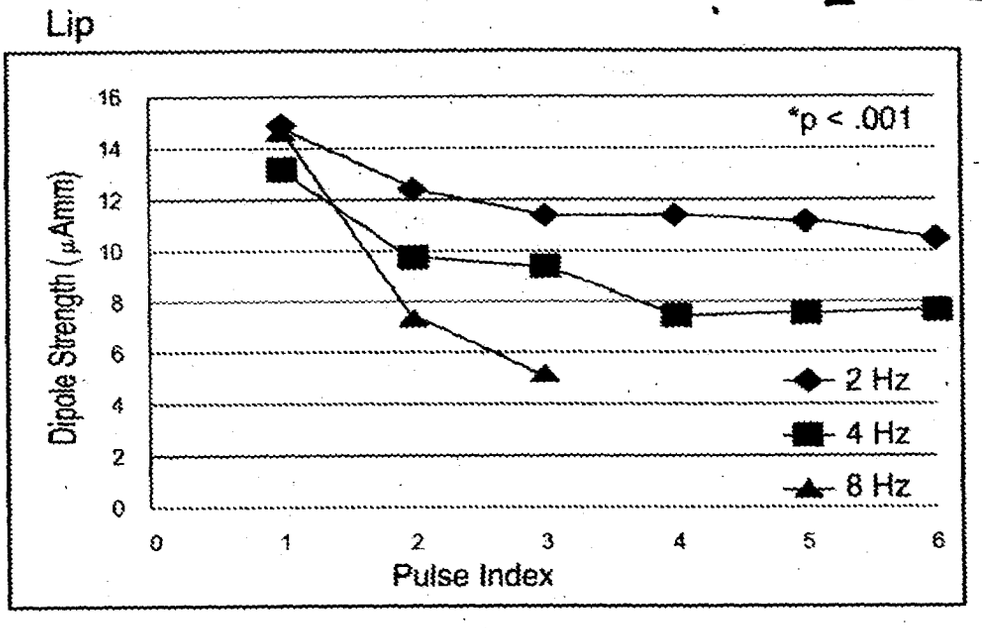

Fig. 2A

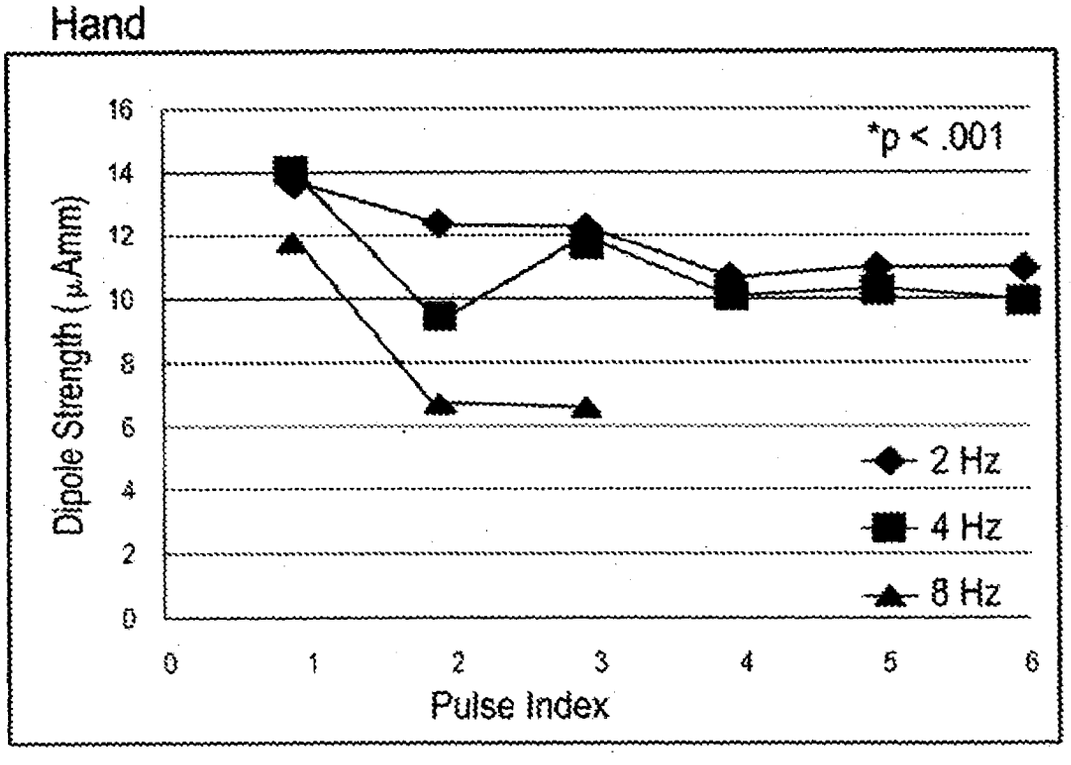

Fig. 2B

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

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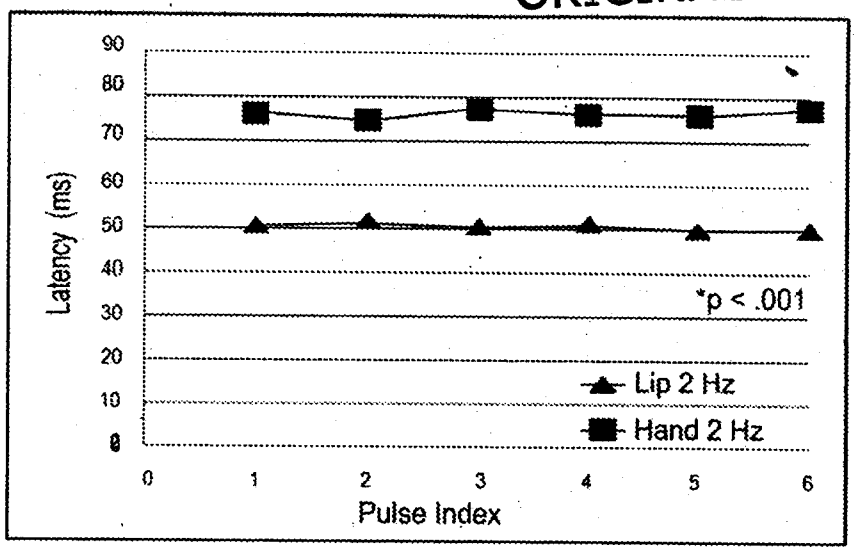

Fig. 3A

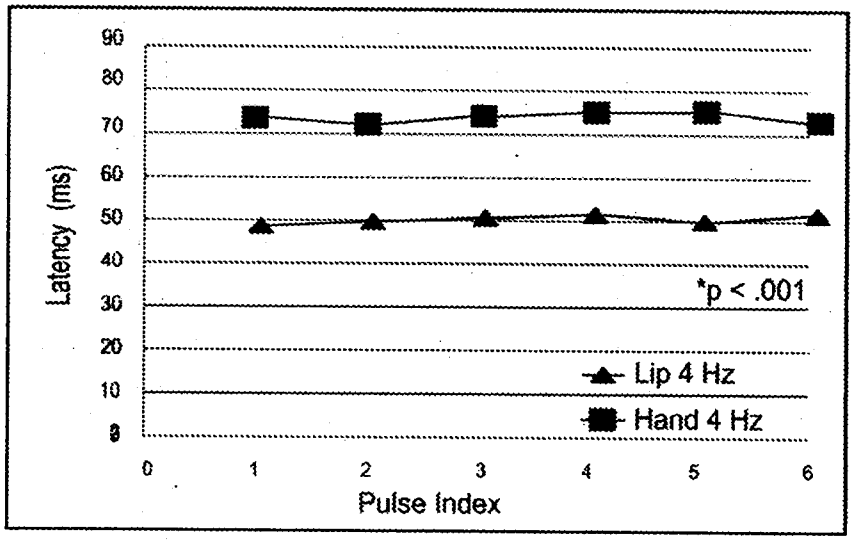

Fig. 3B

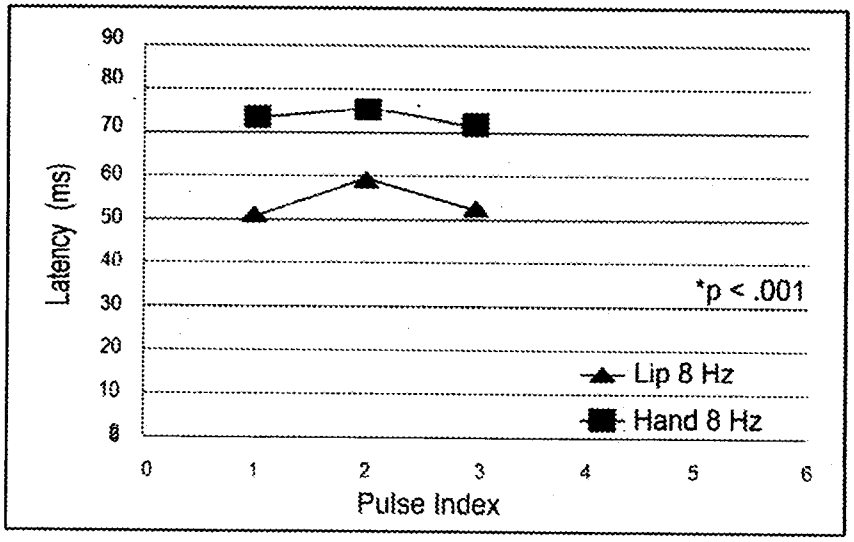

Fig. 3C

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

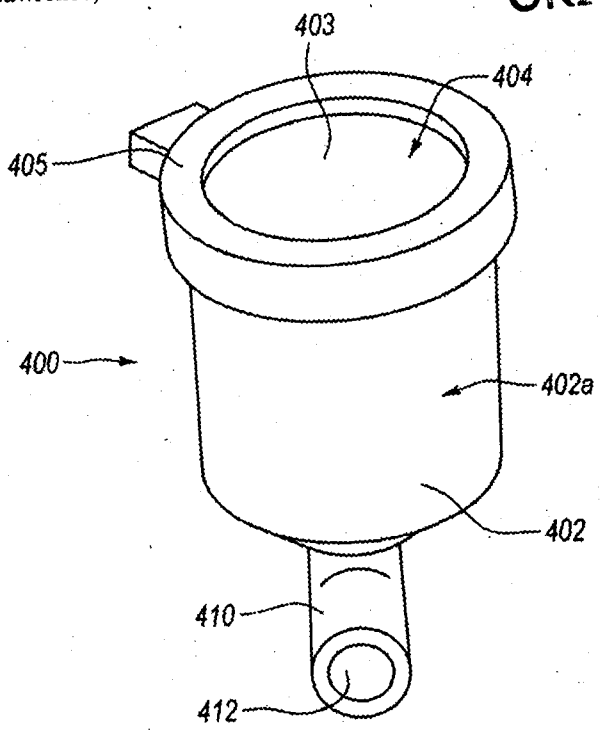

Figure 4A

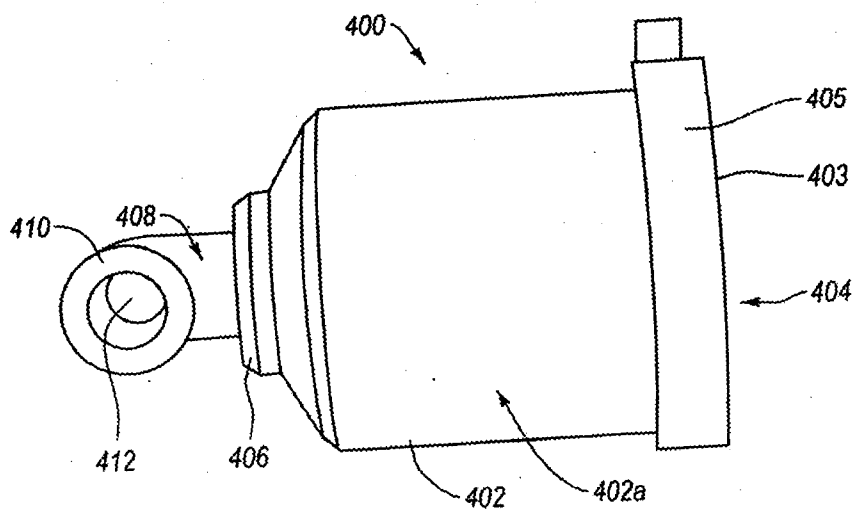

Fig. 4B

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

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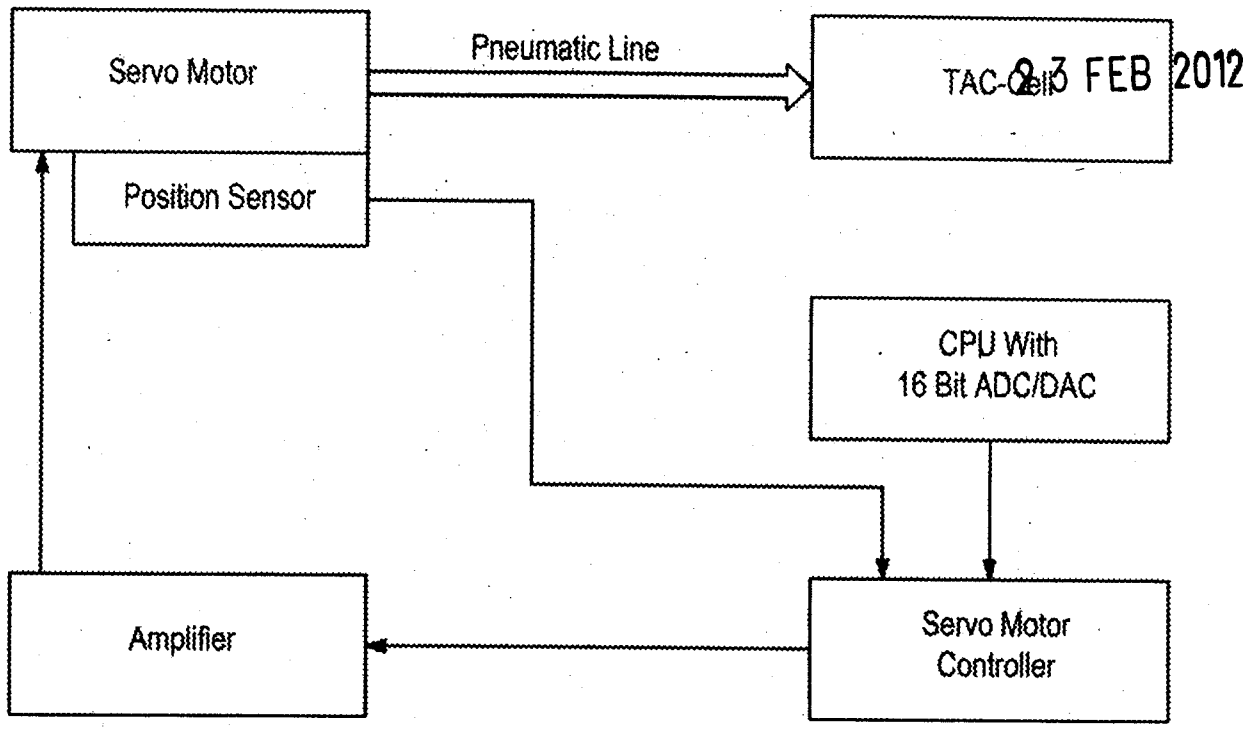

Fig. 5

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

1646DELNP12

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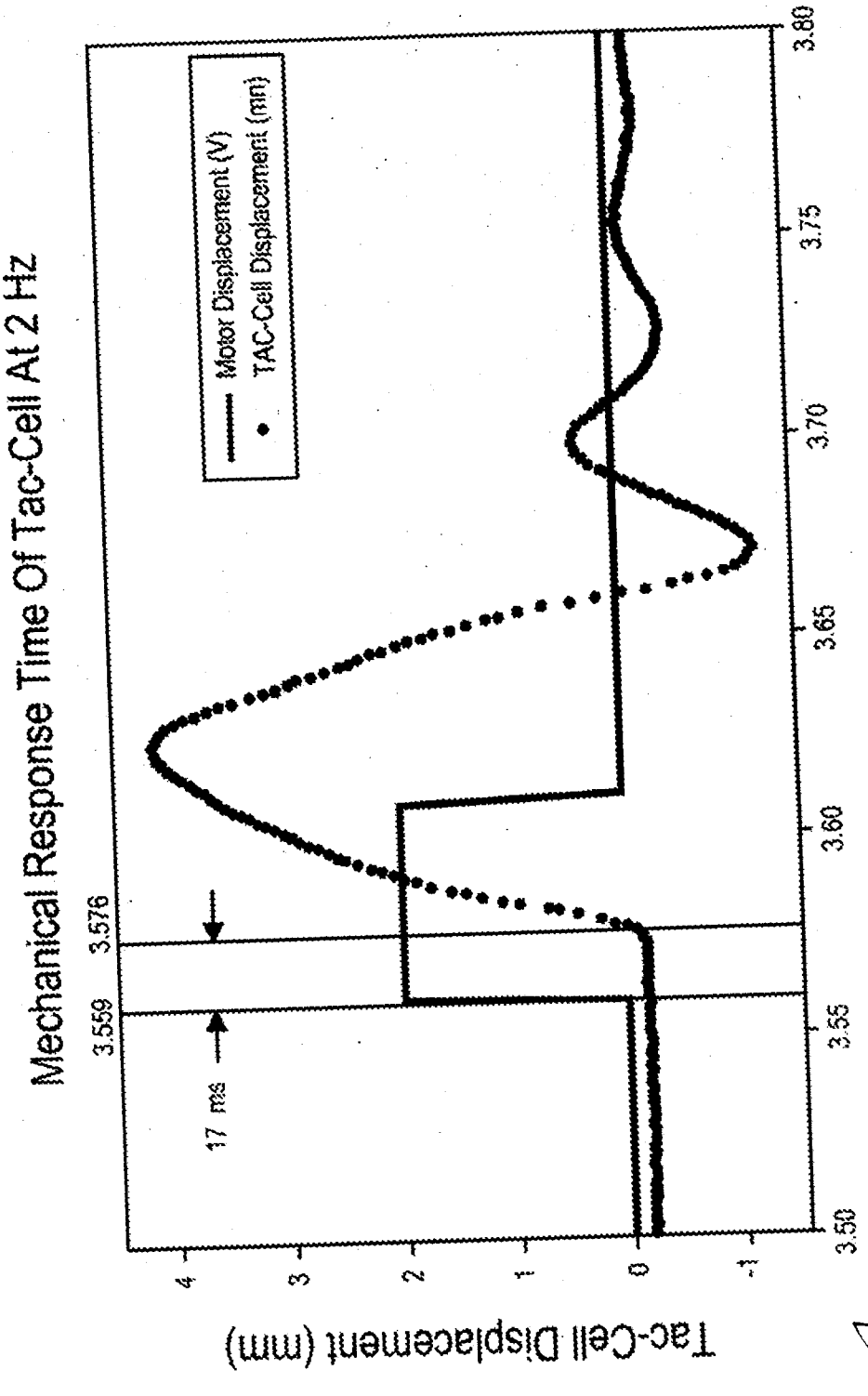

Fig. 6

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

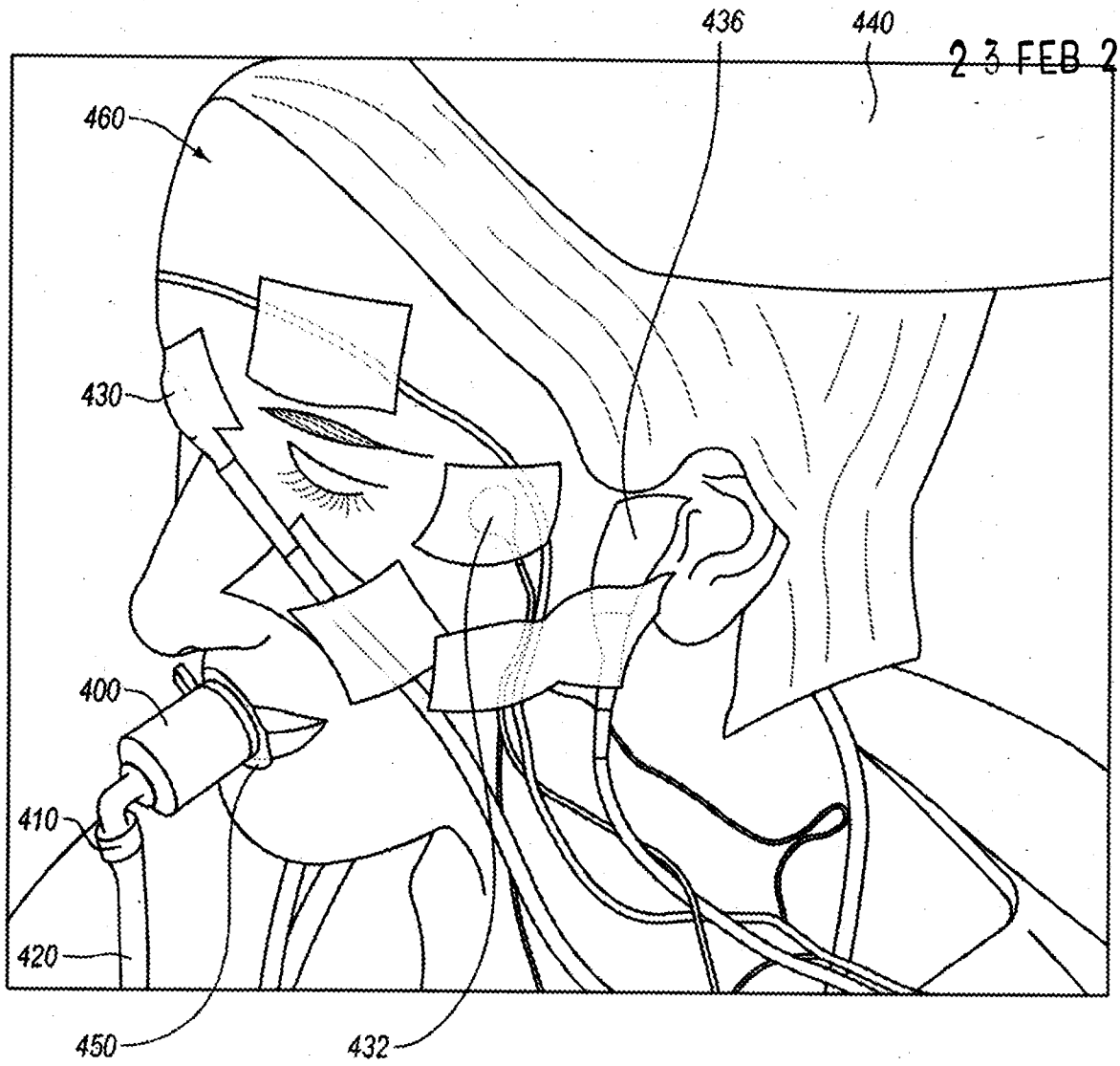

Fig. 7

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

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Fig. 8

Date: 21.02.2012

Pramod Kumar Singh
(Agent for the Applicant)

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

ORIGINAL

1646DELNP12

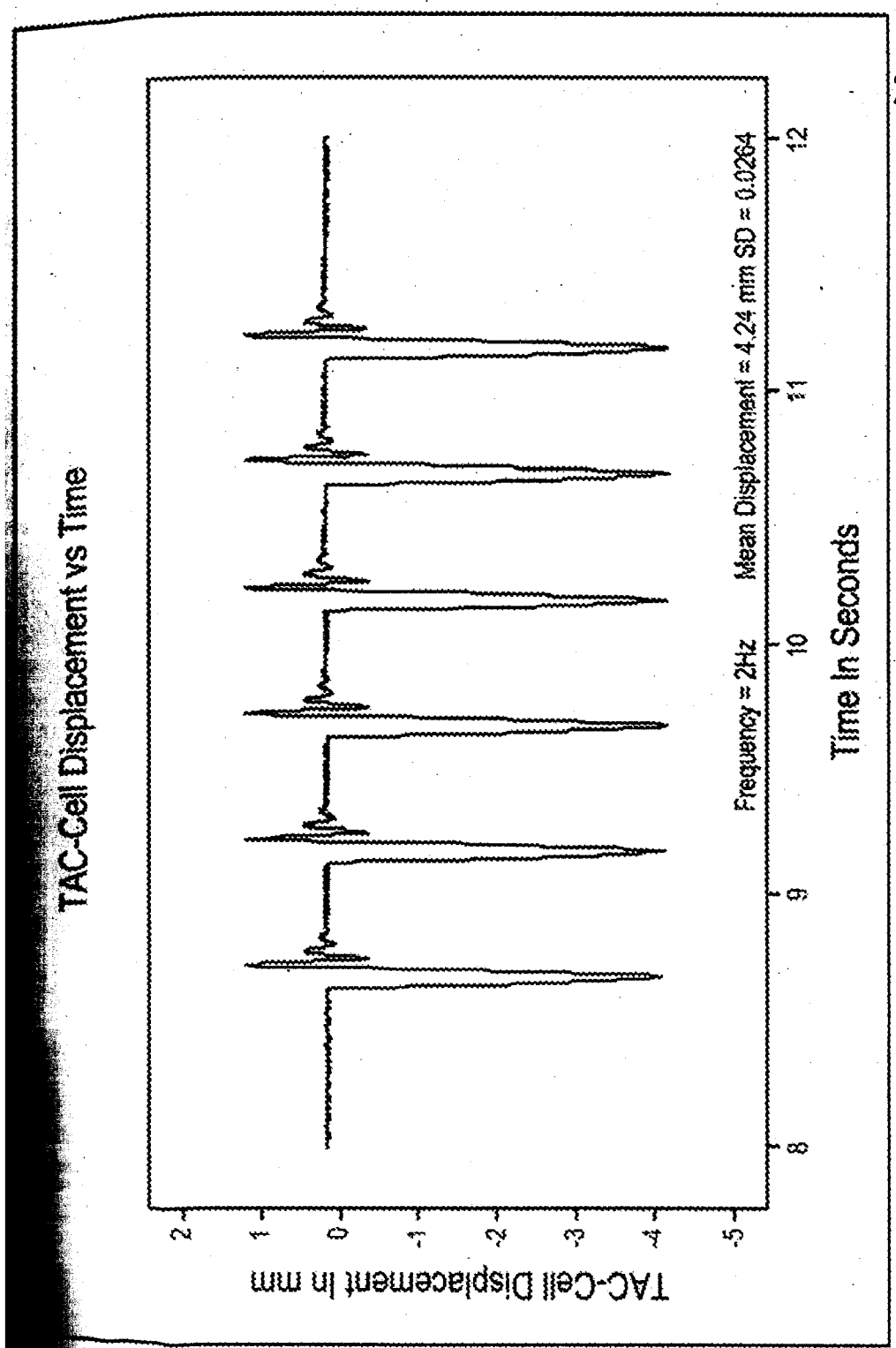

Fig. 9A

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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

1646DELNP12

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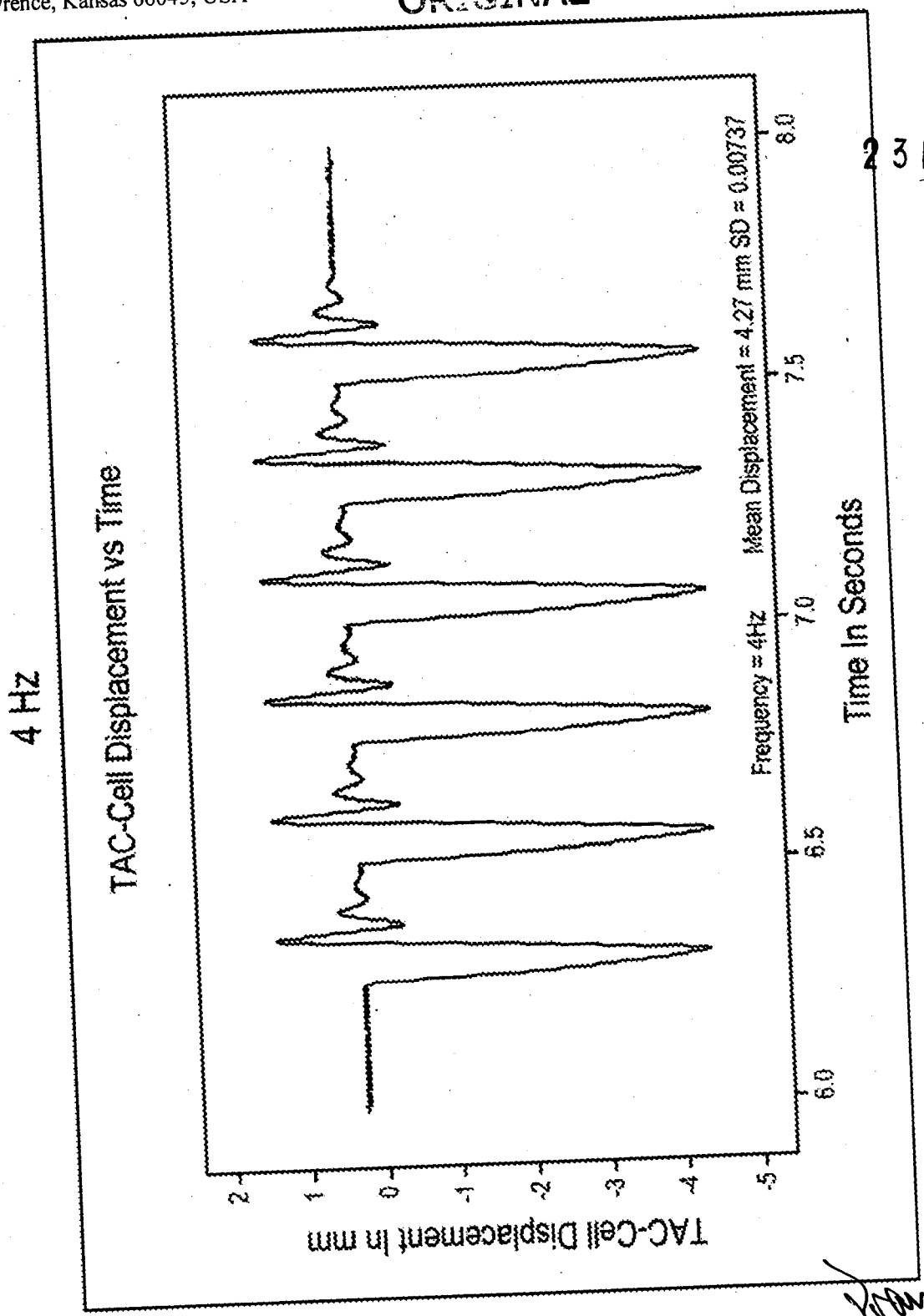

Fig. 9B

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

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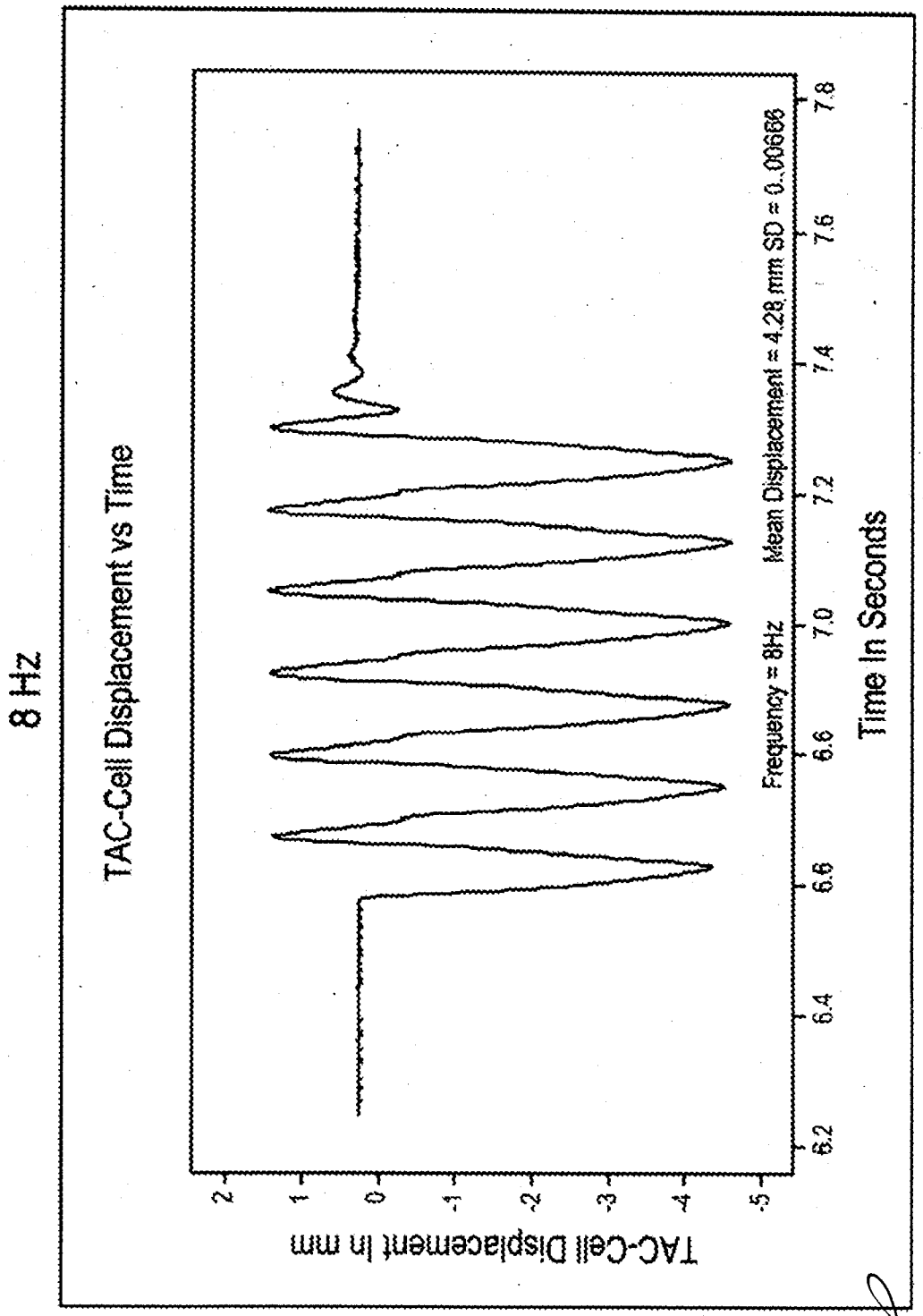

Fig. 9C

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

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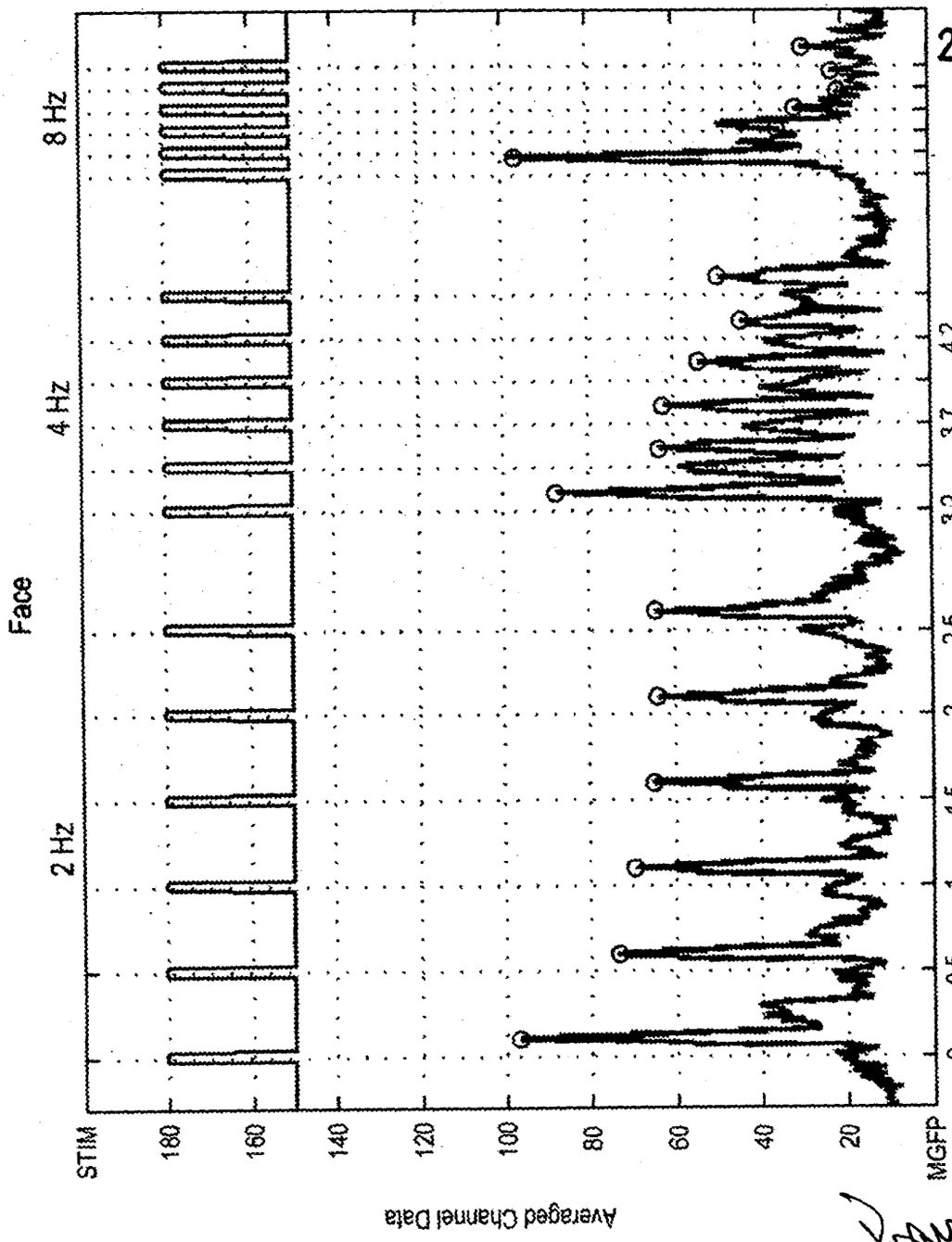

Fig. 10

Date: 21.02.2012

Pramod Kumar Singh
(Agent for the Applicant)