

“SOUND AND VIBRATION TRANSMISSION APPARATUS”

Field of the Invention

[1] The present invention relates to the production of sound and
5 vibration in a personal setting. The invention has been conceived primarily
for use in a domestic setting such as a chair or a bed, but may have wider
application.

Background to the Invention

[2] It is known to use a combination of sound and low-frequency
10 mechanical vibration to provide an enhanced entertainment experience, in
conjunction with vision (for instance from a television or computer monitor).
The present invention seeks to provide an effective means of producing
such sound and vibration, preferably in a portable assembly. The present
invention also proposes uses of sound and vibration for therapeutic
15 purposes.

[3] When this specification refers to low-frequency ‘vibration’, as
opposed to sound, it will be appreciated that the vibration in question is at a
frequency up to about 200Hz. The vibration acts upon an inertial mass, thus
presenting as mechanical vibration of relatively large amplitude compared
20 with sound waves.

[4] The applicant has searched prior art records to determine the scope
of prior art in this field. Relevantly, US. Pat. No. 6,704,958, issued to Gohl,
shows a contoured foam body exhibiting underside mounted loudspeakers
detachably mounted into corresponding recesses on the underside of a
25 pillow body.

[5] Japanese Patent No. 2021818 (Fumio) is directed to a muffled alarm
device, and teaching a self-contained battery powered unit with speakers
built into a base frame, upon which a foamed cushioning body is formed.

[6] Zink, US. Pat. No. 5,179,747, teaches a pillow including a top and bottom fibrous Web defining a casing including a radio mounted within the casing.

[7] Fry, US. Pat. No. 4,862,438, teaches a combination functioning
5 pillow / audio system and in which a substantially rectangular-shaped pillow-casing.

[8] US. Pat. No. 5,713,741, issued to DeMars, teaches a storybook pillow. The pillow is designed to rest under the head of a human and includes a radio transmitter.

10 [9] US. Pat. No. 4,782,533, issued to Haynie, teaches a stereophonic pillow-speaker system which includes a rectangular foam base member.

[10] US. Pat 7,685,661 B2, issued by Mark Popilek, teaches a flat and flexible sound generating device which is capable of easily being inserted underneath an existing pillow or like cushion. The advantage of this pad is
15 that it permits selective audible music or alarm output to a user whose head is supported upon pillow, and without disturbing a partner of the user.

[11] In general, prior art in this field falls into one of three categories: headphones, in which the transmission of vibration is merely to a user's head; wearable vests; and fixed installations (for instance, into chairs).

20 [12] The present invention seeks to improve on this identified prior art by providing an apparatus which is both portable and non-intrusive.

Summary of the Invention

[13] According to one aspect of the present invention there is provided an apparatus for the provision of sound and low-frequency vibration, the
25 apparatus including at least one audio speaker and at least one vibration-producing unit, whereby the audio speaker and the vibration-producing unit are spaced from each other. The spacing of the speaker and the vibration-producing unit is sufficient that vibration-producing unit may be located

beneath a user's own cushion or pillow, with the audio speaker located outside the cushion or pillow. Advantageously, this allows for clear, unmuffled sound transmission and for the optimal transmission of vibration to a user's body, whilst ensuring maximum comfort for the user.

5 [14] The vibration unit is an electromechanical device or devices which convert electric signals into mechanical vibrations to transmit low frequency sound waves. The vibration-producing unit may be a tactile subwoofer or a tactile transducer.

[15] In a preferred embodiment, the apparatus includes attachment
10 means for connection to a cushion or pillow.

[16] In an alternative embodiment, the apparatus includes attachment means for connection to a head of bed.

[17] It is preferred that the apparatus be relatively thin and elongate. In a most preferred embodiment, the apparatus is foldable, with speaker(s) and
15 vibration production unit(s) incorporated within a thin pad structure.

[18] The vibration-producing unit may be coupled with a passive radiator.

[19] In an alternative embodiment, the vibration-producing unit may be detachable from the at least one speaker, with only an electronic connection between the two when detached. This connection may be wired or wireless.

20 [20] In both foldable and detachable versions, the speaker and vibration-producing unit may be held close to each other with the use of catches, particularly magnet catches including neodymium type permanent magnets.

[21] The magnet may include a conducive connector for the transmission of electrical signals, such as for connecting output from an amplifier to the
25 speaker(s).

[22] The conductive connector may also be used in conjunction with the magnet for charging of a battery within the apparatus.

[23] In a further embodiment, the speaker(s) may be located within headphones.

5 [24] According to a second aspect of the present invention there is provided a therapeutic device for use in patient relaxation and/or the treatment of insomnia, the therapeutic device including at least one audio speaker and at least one vibration-producing unit, whereby the audio speaker and the vibration-producing unit are spaced from each other. The
10 spacing of the speaker and the vibration-producing unit is sufficient that vibration-producing unit may be located beneath a cushion or pillow, with the audio speaker located outside the cushion or pillow.

[25] According to a third aspect of the present device there is provided a method of inducing relaxation and/or treating insomnia, the method including
15 the steps of providing stimulus including providing sound through at least one audio speaker, and providing a low-frequency mechanical vibration through at least one vibration-producing unit. The low-frequency vibration is preferably in the range of 0 to 200Hz, and most preferably in the range of 20 to 120Hz.

20 [26] Preferably the method includes the further steps of monitoring a patient's responses, and altering the provided stimulus in accordance with the patient's responses.

Brief Description of the Drawings

[27] It will be convenient to further describe the invention with reference
25 to preferred embodiments of the present invention. Other embodiments are possible, and consequently the particularity of the following discussion is not to be understood as superseding the generality of the preceding description of the invention. In the drawings:

[28] Figure 1 is a schematic view of a sound-and-vibration apparatus in accordance with a first embodiment of the present invention, shown in an unfolded configuration;

[29] Figure 2 is a schematic view of the sound-and-vibration apparatus of Figure 1, shown in a folded configuration;

[30] Figure 3 is a schematic view of a sound-and-vibration apparatus in accordance with a second embodiment of the present invention, shown in an unfolded configuration; and

[31] Figure 4 is a schematic view of a sound-and-vibration apparatus in accordance with a third embodiment of the present invention, shown in a detached configuration.

Detailed Description of Preferred Embodiments

[32] Referring to the Figures, Figure 1 shows a sound-and-vibration apparatus 10 suitable for use in a bed.

[33] The sound-and-vibration apparatus 10 is mounted on base 12, which is formed from a flexible plastic material.

[34] The sound-and-vibration apparatus 10 includes a vibration transducer 14 which is located within a cushioned central panel 16. In the embodiment shown, the central panel 16 is formed from a soft foam such as a polyurethane foam, with a fabric cover. In a preferred embodiment, a thin, elastic, semi-rigid plate can be embedded within the central panel 16 to assist in the transmission of vibration.

[35] The vibration transducer 13 may be coupled with a passive radiator (not shown).

[36] Foldable spacer pads 18 are located on either side of the central panel 16. The spacer pads 18 are generally formed by the base 12, which is simply covered by a fabric cover. The spacer pads include elasticized strips

20 to assist in folding of the apparatus 10. The spacer pads 18 each include a central seams 22 across which the spacer pads 18 can fold.

[37] The sound-and-vibration apparatus 10 includes two audio speaker enclosures 26 located at either end of the apparatus 10, spaced from the
5 central panel 16 of the spacer pads 18. Each speaker enclosures 26 has a speaker 28 located centrally of the enclosure 26. The speaker enclosures 26 are connected to the spacer pads 18 by means of outer seams 24.

[38] It will be appreciated that the sound-and-vibration apparatus 10 may be placed such that the central pad 16 is beneath or within a pillow or
10 cushion (not shown), with the speakers 28 located outside the pillow. Indeed, if the central pad 16 were sufficiently soft it could be located atop a pillow, with perhaps only a cover such as pillowcase between it and a user.

[39] Each speaker enclosure 26 has a catch mechanism, such as a neodymium type permanent magnet 30, located on an inner edge thereof.
15 The speaker catch mechanism is arranged to cooperate with a corresponding catch mechanism such as complementary magnet 32 located on the outside of the central pad 16.

[40] The sound-and-vibration apparatus 10 can be moved into a folded configuration as shown in Figure 2 by folding of the apparatus 10 at the
20 central seams 22 and outer seams 24. In this configuration the magnets 30 attach magnetically to their associated complementary magnet 32 to hold the speaker enclosures 26 next to the central pad 16.

[41] Figure 3 shows a sound-and-vibration apparatus 50 suitable for use in a chair.

25 [42] In the apparatus 50 of Figure 3, the speaker enclosures 28 are spaced by a gap element 52. Spacer pads 18 extend laterally from the gap element 52, with a central pad 16 containing a vibration transducer 14 located at a far end of the spacer pads 18.

[43] The apparatus 50 of Figure 3 includes an additional inner seam 54 located between the gap element 52 and the spacer pads 18. By folding the seams 22, 24, 54 associated with the spacer pads 18 the apparatus 50 can be brought into a folded configuration similar to that of Figure 2, with the
5 central pad 16 located atop the gap element 52.

[44] It will be appreciated that signals can be provided to the vibration transducer 14 and speakers 28 by a wired connection or by a wireless connection. They can be arranged to associate with any suitable electronic device, including mp3 player, SD card slot, USB memory slot, digital /
10 analogue or high voltage audio amplifier (mono, stereo, 2.1, 5.1 or 7.1), Bluetooth audio streaming module, FM radio, infrared remote control, low-pass / high-pass or band-pass filters, and the like.

[45] Figure 4 shows a sound-and-vibration apparatus 60 where the central pad 16 can be largely detached from the spacer pads 18, with the
15 only connection being via a control cable 62. The arrangement is such that the control cable 62 can be removed when the central pad is engaged with the spacer pads 18 by means of the magnets 30, 32. An additional electrically conductive connector 64 is located adjacent the magnets 30, 32 to allow the passage of electrical signals between the spacer pads 18 and
20 the speaker enclosures 26.

[46] As an alternative to the apparatus of Figure 4, the connection between the central pad 16 and speaker enclosures 26 when detached may be a wireless connection.

[47] The sound-and-vibration apparatus 10 may be associated with a
25 sleep sensor (not shown) such as an accelerometer to be worn by a patient. The sleep sensor can provide data to a controller regarding the sleep state of the patient. The controller, which may be configured in a smartphone, tablet or laptop computer or similar based therapy application, analyzes the sleep stage data and based on the data controls music and vibration related
30 variables such as amplitude of the vibration and music, music sounds types,

vibration frequencies, amplitude and frequency modulation and sequences. Multiple layers of vibration frequencies can be generated simultaneously and mixed with relaxing sound and music. Digital Signal processing algorithms are used to analyze the measured sleep wellness measurements data and

- 5 control algorithms are used to control the sound and vibration output parameters.

[48] The sleep sensor used may be an optical heart pulse measurement based wristband device or other similar biosensors capable of measuring sleep or relaxation.

- 10 [49] Modifications and variations as would be apparent to a skilled addressee are deemed to be within the scope of the present invention. For instance, the connection of a vibration producing unit to an existing audio speaker system to create the present invention is considered to be within the scope of the invention.

Claims

1. An apparatus for the provision of sound and low-frequency vibration, the apparatus including at least one audio speaker and at least one vibration-producing unit, whereby the audio speaker and the vibration-producing unit are spaced from each other.
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2. An apparatus for the provision of sound and low-frequency vibration as claimed in claim 1, wherein the spacing of the speaker and the vibration-producing unit is sufficient that vibration-producing unit may be located beneath or within a user's own cushion or pillow, with the audio speaker
10 located outside the cushion or pillow.
3. An apparatus for the provision of sound and low-frequency vibration as claimed in claim 1 or claim 2, wherein the apparatus includes attachment means for connection to a cushion or pillow.
4. An apparatus for the provision of sound and low-frequency vibration
15 as claimed in claim 1 or claim 2, wherein the apparatus includes attachment means for connection to a head of bed.
5. An apparatus for the provision of sound and low-frequency vibration as claimed in any preceding claim, wherein the apparatus is foldable, with speaker(s) and vibration production unit(s) incorporated within a thin pad
20 structure.
6. An apparatus for the provision of sound and low-frequency vibration as claimed in any one of claims 1 to 4, wherein the vibration-producing unit is detachable from the at least one speaker.
7. An apparatus for the provision of sound and low-frequency vibration
25 as claimed in any preceding claim, wherein the vibration-producing unit and the at least one speaker may be arranged next to each other by the use of a catch mechanism
8. An apparatus for the provision of sound and low-frequency vibration as claimed in claim 7, wherein the catch mechanism incorporates a magnet.

9. An apparatus for the provision of sound and low-frequency vibration as claimed in claim 8, wherein the magnet is a neodymium type permanent magnet.
10. An apparatus for the provision of sound and low-frequency vibration as claimed in claim 8 or claim 9, wherein the magnet includes a conductive connector for the transmission of electrical signals.
11. An apparatus for the provision of sound and low-frequency vibration as claimed in claim 10, wherein the magnet and conductive connector are used for the charging of a battery within the apparatus.
12. An apparatus for the provision of sound and low-frequency vibration as claimed in any preceding claim, wherein the speaker(s) are located within headphones.
13. An apparatus for the provision of sound and low-frequency vibration as claimed in any preceding claim, wherein the vibration-producing unit is coupled with a passive radiator.
14. A therapeutic device for use in patient relaxation and/or the treatment of insomnia, the therapeutic device including at least one audio speaker and at least one vibration-producing unit, whereby the audio speaker and the vibration-producing unit are spaced from each other.
15. A therapeutic device as claimed in claim 14, wherein the spacing of the speaker and the vibration-producing unit is sufficient that vibration-producing unit may be located beneath a cushion or pillow, with the audio speaker located outside the cushion or pillow.
16. A method of inducing relaxation and/or treating insomnia, the method including the steps of providing stimulus including providing sound through at least one audio speaker, and providing a low-frequency mechanical vibration through at least one vibration-producing unit.

17. A method of inducing relaxation and/or treating insomnia as claimed in claim 16, wherein the low-frequency vibration is in the range of 0 to 200Hz.

5 18. A method of inducing relaxation and/or treating insomnia as claimed in claim 17, wherein the low-frequency vibration is in the range of 20 to 120Hz.

10 19. A method of inducing relaxation and/or treating insomnia as claimed in any one of claims 16 to 18, wherein the method includes the further steps of monitoring a patient's responses, and altering the provided stimulus in accordance with the patient's responses.