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AT BE CH DE ES FR GB GR IT LI LU NL SE(71) Applicant: **Vibro Acoustics A/S**
Tommerasen 19
N-1555 Son(NO)(72) Inventor: **Skille, Olav**
Hovdingveien 98
N-7700 Steinkjer(NO)(74) Representative: **WILHELMS, KILIAN &**
PARTNER Patentanwälte
Eduard-Schmid-Strasse 2
D-8000 München 90(DE)(54) **Device for influencing the human body by sound.**

(57) A device for influence by sound on the human body (1) consisting of a closed box (6, 11) with at least one sound opening (7) in which is arranged a loudspeaker (8) being directed towards a part of said body (1), an upholstery (9) being disposed between the box (11) and the body, said upholstery at the location (10) of the loudspeaker (8) permitting air passages, means (4 or 5) for supplying low frequency signals to said loudspeaker, one or a plurality of external loudspeakers, (2), means (4) for supplying music to said external loudspeakers, and means (3, 4) to influence said low frequency signals either in step with the music or in predetermined function of the music or in predetermined rhythm. As storage medium for sound may be used a tape cassette or compact disc where at least one of the sound channels contains said influenced low frequency signal in the frequency range 30-120 Hz and the remaining sound channel(s) containing pure music.

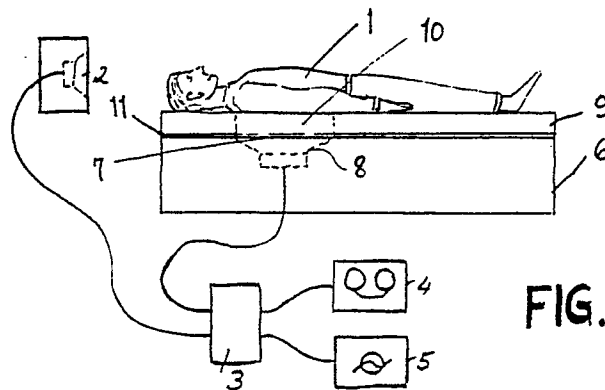


FIG. 1

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DEVICE FOR INFLUENCE BY SOUND ON THE HUMAN BODY

The present invention relates to a device for influence by sound on the human body and a storage medium, e.g. tape cassette or compact disc to be used with the device.

The present invention starts out with three basic principles within musical therapy, viz. that low (deep) tones appear relaxing, whereas high tones appear stressing, that rhythmic music appears activating, whereas non-rhythmic music appears passivating, and that high sonic level appears aggressive, whereas low sonic level appears passivating.

These basic principles have general validity, but there are exceptions. The basic principles have appeared through extensive therapeutic observation of patients over a long period.

Musical therapy is based on music being conceived by the ear through the acoustic channels of perception.

The present invention is based on that music, directly transferred to the human body through vibration receptors in the nervous system may have a greater effect, i.e. be able to provide greater muscular relaxation. By joining acoustical perception and vibrational perception into a general experience, there is according to the present invention obtained therapeutical effect which has influence both on physical and psychical sufferings related to patients. This combination is for sake of simplicity in this description denoted as vibro-acoustics.

The vibro-acoustical principle assumes best possible transfer of sound both to ear and body. The acoustic part may be taken care of by one or a plurality of good loudspeaker cabinets, or a headset. For the vibrational part, there is according to the invention proposed a device using transfer of sound from loudspeaker through air to the human body in an efficient manner.

The characteristic features of the said device for influence by sound on the human body will appear from the subsequent patent claims as well as the characteristic features of the said storage medium.

The invention is now to be described with reference to the enclosed drawings, where:

Fig. 1 illustrates the device according to the invention,

Fig. 2 illustrates in the partly exploded view that part of the device which is to provide low frequency sonic influence on the human body,

Figs. 3, 5 and 6 illustrates a second, a third and a fourth alternative embodiment, respectively, of the device shown in fig. 1, and

Fig. 4 illustrates in block diagram form the operative units being incorporated in figs. 3, 5 and 6.

On fig. 1 there is shown a human body 1 placed on a closed box 6 being provided with at least one sound opening 7 in which is arranged a loudspeaker 8 being directed towards the upper part of the body 1. an upholstery 9 has been located between the box 6 and the body 1. the portion 10 located opposite the loudspeaker 8 allowing good air passage. The top 11 of the box 6, which in the case shown forms a mattress bottom, could e.g. be made of plywood, said sound opening 7 being made in the top 11. To prevent possible damage to the loudspeaker 8, a protective grille 12 could be placed across the opening 7. In order to attenuate the radiation of sound to the surroundings and to prevent acoustical short-circuit, the foundation, i.e. the box 6, is designed as a closed box. The upholstery 9 could be made from foamed plastics or foamed rubber having closed cells. Mattresses filled with air or light spheres of plastics (e.g. styropor®) could also be visualized. In the mattress or the upholstery 9 there is as mentioned arranged a region 10 corresponding to the sound opening 7. The said region 10 could be perforated, like the opening 7, or possibly be filled with foamed plastics having large open cells, and which permits air passage. The foamed plastics will provide a certain supporting ability, in particular as it will be supported by the said protective grille, simultaneously with providing good air passage. The person is placed such that the part of the body to be influenced is lying opposite the opening 7 and the region 10. The diaphragm of the loudspeaker 8 will thereby be connected to the body 1 through the air being present in said opening 7 and the region 10. The upholstery itself will act as a sealant to make the coupling between the loudspeaker 8 and the body 1 as efficient as possible. When the loudspeaker 8 is supplied with signals of suitable frequency content and strength, the diaphragm will move and thereby put the body into low frequency movement.

An audio amplifier 3 with at least two sound channels has at least one output connected to the loudspeaker 8 and at least a second output connected to a loudspeaker 2 for music. The signals to the amplifier 3 are delivered from e.g. a tape cassette player or compact disc player 4, and from a signal generator 5. The signal generator 5 is arranged to deliver sinusoidal tones, impulses or other synthetic signals. The player 4 is able to be provided with a storage medium, e.g. tape cassette or compact disc containing suitable program material. The storage medium could have two or a plurality of sound channels, where at least one of the sound channels contains low frequency signals,

preferably in the frequency range 30/120 Hz being superimposed by music. The remaining sound channel(s) of the storage medium contain, however, only pure music. The said storage medium could be arranged to provide stereophonic or quadrophonic music. Thus, it is here and in the description below to be understood that the signal generator 5 in effect could be constituted by one or a plurality of the storage medium channels. The amplifier 3 could possibly be provided with a low pass filter (not shown) for feeding said loudspeaker 8.

Thus, it is to be understood that the loudspeaker 8 is either supplied with a pure low frequency in the frequency range 30-120 Hz, or is modulated as a function of the music being output from the loudspeaker 2, or that the sound appearing on the loudspeaker 8 contains low frequency signals within the said frequency range superimposed on the music which also appears on the loudspeaker 2. In this case the signal generator to the amplifier 3 is primarily the player 4.

By repeated tests, it has been found that the vibro-acoustic frequency range where the sound spreading in the human body appears to have the greatest effect, measured objectively and experienced subjectively lies between 30 and 120 Hz, preferably in the range 40-90 Hz. Particular good results are obtained within the octave 40-80 Hz. Outside the frequency range 30-120 Hz one will subjectively have no substantial feeling of vibrational influence.

The therapeutical effect is obtained by placing the person in the most suitable manner and as close to the vibration loudspeaker, in the example shown the loudspeaker 8, as possible, and in a pleasant distance from the loudspeaker 2 delivering music. The therapeutical apparatus consist of the following previously briefly discussed parts, viz. the vibration part 6, 7, 8, 10 forming the transfer device intended to transfer sound within the vibro-acoustic frequency range,

the acoustic part in the form of one or a plurality of wide band loudspeaker cabinets 2 of HiFi-quality or a set of head-phones for transfer of music being adapted to the frequency which are used in the vibration part,

a multi channel amplifier 3 which through at least one channel transmits sinusoidal oscillations (vibration) and filtered music to the vibration part 8. Non-filtered music is sent through the other channel(s) to the loudspeaker(s) 2 delivering music, the strength of the sound being variable in step-free fashion on the respective channels,

a multi-channel tape player, preferably a conventional two-channel tape player 4, where on one track of the tape cassette there is recorded pure music intended for the music loudspeaker 2. On

the other track there is recorded a specific mixture of music and low frequency sound, e.g. sinusoidal signals. The sinusoidal signals are beating by means of a dual recording technique which is specially developed to be used with the therapeutic system, so-called superimposed sinusoidal waves, and

the signal generator 5 is arranged to be adjusted individually with regard to therapeutical effective low frequencies which are to be supplied to the loudspeaker 8, provided that these are not already supplied from the player 4.

It is here readily to be understood that although there is shown only one loudspeaker 2 and one loudspeaker 8, it will within the scope of the invention easily be visualized that two or a plurality of music loudspeakers 2, and two or a plurality of low frequency loudspeakers 8 may be used. If two or a plurality of loudspeakers 8 are used, there will be a necessity for a corresponding number of openings 7 and regions 10, respectively.

When prerecorded software is used and delivered from the player 4, the signal generator 5 is thus not required, but the signal generator 5 is required if one wishes to compose suitable software and for possible further development thereof. The signal generator may also be desirable for the object of research and for typical medical treatment.

On fig. 3 it is shown how the box of fig. 1 could be replaced by a differently designed loudspeaker box 14 with loudspeaker 8' which may be turned down about e.g. a hinge 16 from a vertical position (shown in dot-dashed line) to a horizontal position (shown in solid line). In order to ensure that the loudspeaker box 14 lies in the horizontal position, it may be secured by wire, strap or the like 15 which at one end is attached to a wall 17 similar to the hinge 16 and at its other end is attached to an outer portion of the loudspeaker box 14. When a person is to be exposed to influence of sound, the person lies down on a bench 13 of conventional design per se, possible shaped like the bench 6,9 in fig. 1. The external loudspeaker 2' could be arranged e.g. in the bench 13 itself or in some other suitable manner, e.g. such that the person 1 obtains a good stereophonic sound image therefrom. After the person 1 has thus lied down on the bench 13, either with the face upwards or downwards, the loudspeaker box 14 with the loudspeaker 8' is turned down to the horizontal position as shown in fig. 3. The loudspeaker 8' corresponds in function to the loudspeaker 8 in fig. 1. In fig. 5 is shown a variant where the person 1 sits in a reclining furniture 18 being design as a closed box, but with a sound opening for a loudspeaker 8", which in function is the same as the loudspeaker 8

in fig. 1 or the loudspeaker 8' in fig. 3. Similar to the embodiment in fig. 1, there is in front of the loudspeaker 8 provided a sound opening 7". Corresponding sound opening 7' is also found in fig. 3.

In the example of fig. 5, the external loudspeakers have been indicated by the reference numeral 2", shown here in the form of a headset. However, it is to be readily understood that the external loudspeakers may have any suitable design and/or positioning without that being considered as limitative to the scope of the invention.

In the example of fig. 6 there is shown a modification of the embodiment in fig. 5. A reclinable furniture 19 is here used being constructed in conventional manner, e.g. from a framework with surfaces for reclinement of upholstered fabric. There may be used one or a plurality of loudspeaker cabinets in order to influence the body of the person 1. In the non-limitative example of the invention, as shown, there has been used two loudspeaker cabinets 20, 21. Each of these could instead possibly have consisted of two adjacent separate loudspeaker cabinets, for possible better adaptation to the reclinable furniture. However, it is important that the loudspeaker cabinets are of closed type to prevent noise externally and to prevent acoustic short-circuit. The loudspeaker cabinets are in a known manner provided with loudspeaker 22, 23 and can be attached to the framework of the reclinable furniture by means of brackets, straps or the like.

As in fig. 5, the person 1 may be use headphones 2" as external loudspeaker.

It is also understood that the external loudspeakers 2' in fig. 3 could have been replaced by headphones.

In fig. 4 there is in a block diagram form shown the functional structure of the devices in figs. 3 and 5, however, corresponding to what has been shown in fig. 1.

At an institution for multi-handicapped patients having impaired psychic development, it was discovered that vibro-acoustical treatment gave a spasm resolving effect at a frequency about 40 Hz. The spasm resolving effect was so dominant that the patients were more easily available for manipulating physiotherapy thereafter, or under vibro-acoustical influence.

Control tests were made with opening angle of the spastic limbs with and without the use of music. It is clearly shown a marked difference of the opening angle as a result of the influence of music and without the influence of music.

The present device was also tried used on the following conditions:

Rett's syndrom: The "plucking" movements reduced in frequency. The patient could even fall into sleep and it was observed a noticable relaxative

effect. (Rett's syndrom named after Dr.med Adreas Rett of Austria).

Autism: Contact rejecting patients were so conserned about the effect of vibration the they could allow the personnel to give more skin contact/skin simulation that without this influence. One could here visualize the contours of therapy scheme were adaptation to contact under vibro-acoustical influence could be transferred to situations where the music could be gradually attenuated or possibly could dissappear.

Spastic conditions: Effect as indicated above, the clear spasmolytical effect in the lower frequency regions.

Vibro-acoustical influence was also attempted on personnel at the institution for different conditions of discomfort. It was here observed the following:

Neck/shoulder-pains: Such pains, either caused by myalgic type, or as a result of stress of different cause, was eased substantially at particular frequencies, in particular about 68 Hz. Repeated treatments, up to 10 treatments of 30 minutes each, proved to provide relief of longer duration.

Lumbago: Pains in the lower back region were relieved at particular frequencies, in particular about 50 Hz. For pains caused by muscular tensions, it was observed relief of longer duration upon repeated treatments.

Menstrual pains: Such pains and premenstrual tensions or the like proved to be relievable by using a particular frequency, in particular 52 Hz. Treatments each day in the "acute" phase as well as once per week in the middle phase, repeated over 2-3 periods appeared to provide effect of longer duration.

Asthma: Vibro-acoustical treatment around 50 Hz appeared to provide an effect which aids the patient to depart with phlegm from the air passages.

During tests carried out on persons in a local area, it was observed the following:

Stress-induced depression: A dramatic positive effect was observed after the first treatment which lasted for approximately 30 minutes. The positive effect is dependent on both frequency (68 Hz) and the choice of music. The successful treatment was terminated after 10 treatments. During the last treatments there was used a variety of frequency ranges and activating music.

Athletic injuries: The treatment has provided a good result. Both acute muscular trauma and post-operative convalescence has reacted positively to the sequence 40/60/80/60/40 Hz with approximately 6 minutes duration per frequency. Muscles and tendons in tensioned state are released and are stretchable with laser discomfort than without vibro-acoustical treatment.

Reumatism: Long-term treatment (10 to 20 treat-

ments) with frequency 68 and 86 Hz has provided a lasting improvement for patients with reumatic pains and/or damage due to wear. The treatment was provided daily or every other day with duration of 30 minutes.

Cramp conditions: Upon cramp in a muscle it was observed a dissolvment of the cramp condition at a frequency 40/60 Hz after approximately 2 minutes. General stress-discomfort. Tuned frequency and music in an environment shielded from the outside world during a period of 30 minutes provided stress-dissolving effect and appeared to supply the person with new vitality.

The above observations are of purely empirical kind, based on the observations made by the therapist together with the descriptions by the test persons of the experiencies they have had during and after the treatments.

It will be immediately understood that the sound box with upholstery shown on the drawings is only meant to serve as an example to elucidate the invention without thereby representing any limitation of the invention as defined in the subsequent patent claims. Thus, the devices shown could be designed in any suitable manner to provide the best possible effect on the patients.

In addition to the said storage medium for sound, it should be remarked that a beating sinusoidal tone is made by recording on top of a primary frequency a secondary frequency having a deviation of 0.2 to 2 Hz. "The beat velocity" should be preset and should be tuned to the quality of the music which is required to be used in addition to the low frequencies. The beat program is then recorded on one of the two tracks on the storage medium, e.g. a tape cassette, sound-on-sound with the selected, preferably filtered, music. Pure music is recorded on the other track. As previously mentioned, one could possible visualize using e.g. all four tracks on the tape cassette by using a sound head adapted thereto to improve the reproduction of sound (e.g. 2-channels), and possibly to extend the beat program.

Claims

1. A device for influence by sound on the human body (1), comprising at least a closed box (6, 11; 14; 18) with at least one sound opening (7; 7'; 7'') in which is arranged a loudspeaker (8; 8'; 8'') being directed towards a part of said body, an upholstery being disposed between said box (6, 11; 14; 18) and the body (1), said upholstery at the location(s) (10) of said loudspeaker(s) being so arranged that air passage is permitted, **characterized in** means (4; 5) for supply of low frequency signals to said loudspeaker (8; 8'; 8''), one

or a plurality of external loudspeakers (2; 2'; 2''), means (4) for supplying music to said external loudspeaker(s) and means (3, 4) to influence said low frequency signals either in step with the music or in predetermined function of the music or in a predetermined rhythm.

2. A device according to claim 1, **characterized in** that said low frequency signals are in the range between 30 and 120 Hz, preferably 40-90 Hz.

3. A device according to claim 1 or 2, **characterized in** that said means for supplying said low frequency signals is a signal generator (5) which selectively can provide sinusoidal signals, pulses or other synthetic signals.

4. A device according to claim 1, **characterized in** that said means (4) for supplying music is constituted by a tape cassette player or compact disc player.

5. A device according to claim 1, 2 or 4, **characterized in** that said means (4) for supplying low frequency signals is constituted by said tape cassette player or compact disc player.

6. A device according to claim 4 or 5, **characterized in** that there is associated with said supplying means an amplifier (3), possibly incorporating a low-pass filter.

7. A device according to claim 1, **characterized in** that said box (6, 11) is designed as a resting bench.

8. A device according to claim 1, **characterized in** that said box (14) is pivotably connected to a wall (17) and arranged to be turned down from vertical into a horizontal position.

9. A device according to claim 1, **characterized in** that said box (18) forms a recliner-like piece of furniture.

10. A device according to claim 1, **characterized in** that said box(es) (20, 21) being installed on the bottom side of the reclinement faces of a recliner (19) known per se.

11. Storage medium, such as a tape cassette or compact disc to be used with the device according to one or a plurality of the claims 1, 2, 4-6, **characterized in** that at least one of the sound channels of the storage medium contains low frequency signals in the frequency range 30-120 Hz which are influenced either in step with music or in a predetermined function of the music or in a predetermined rhythm, and that the remaining sound channel(s) of the storage medium contains pure music.

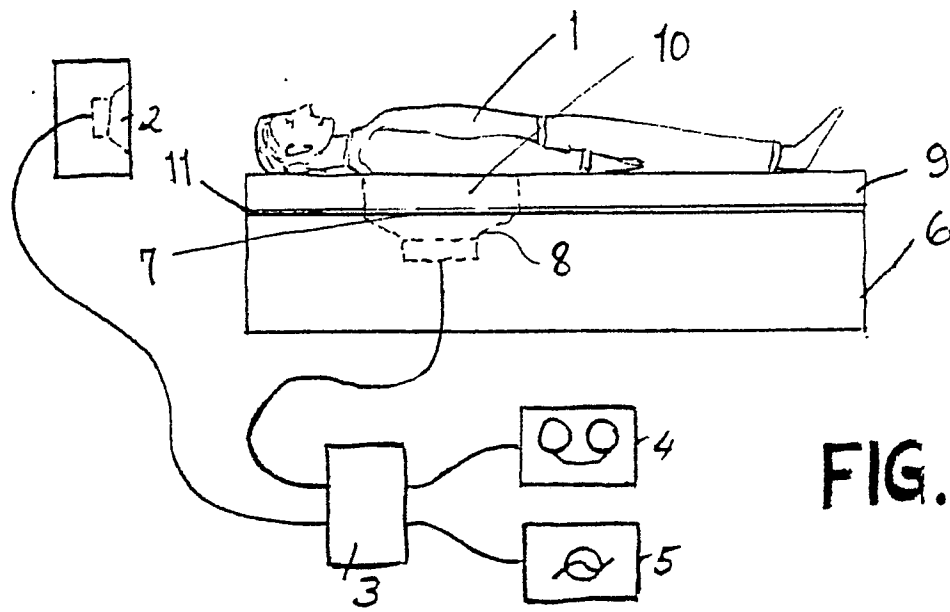


FIG. 1

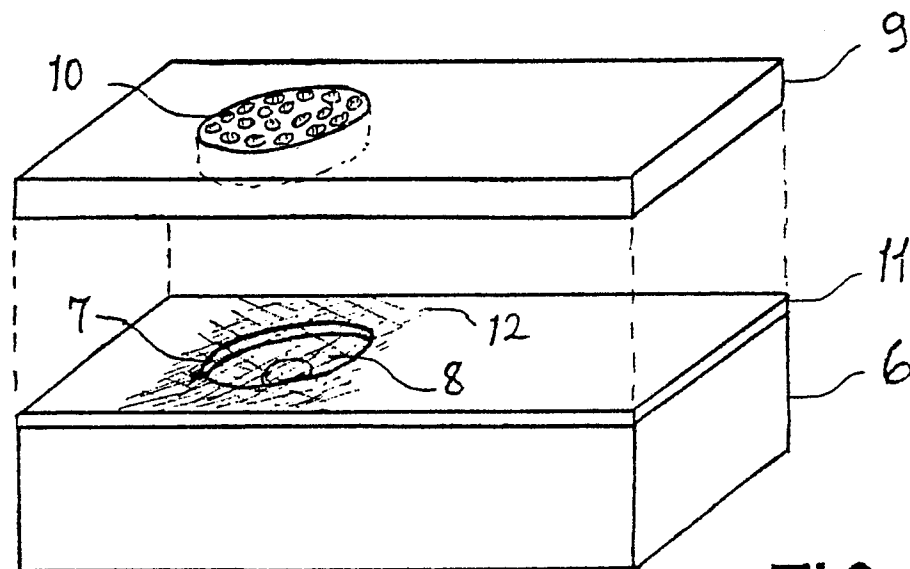


FIG. 2

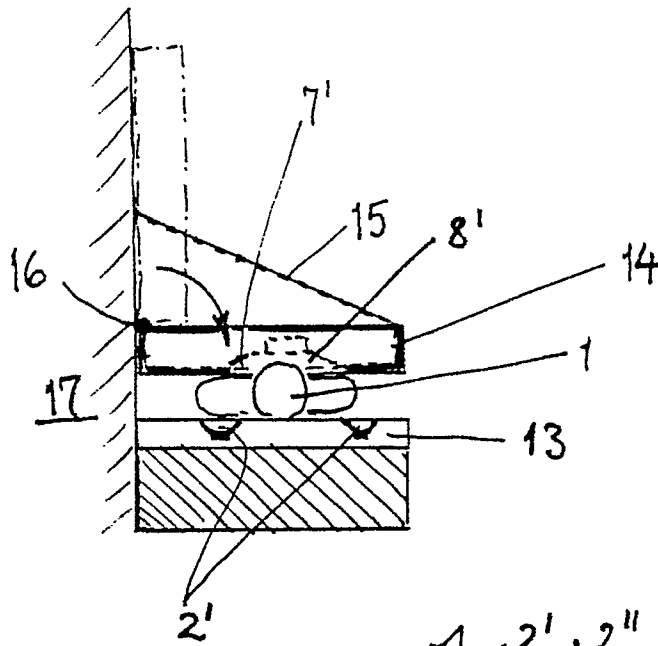


FIG. 3

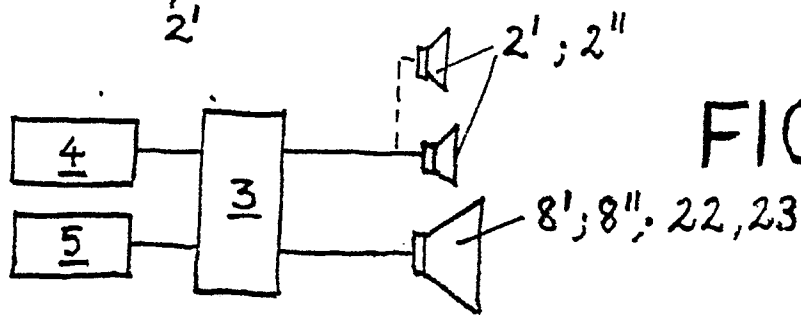


FIG. 4

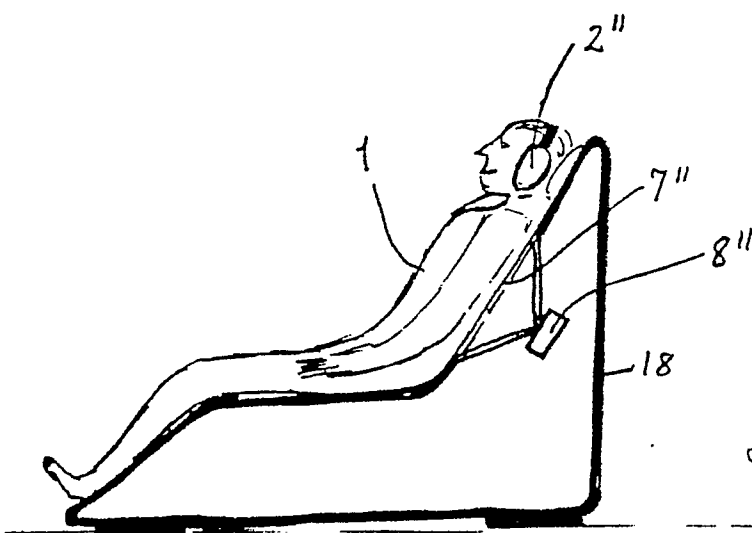


FIG. 5

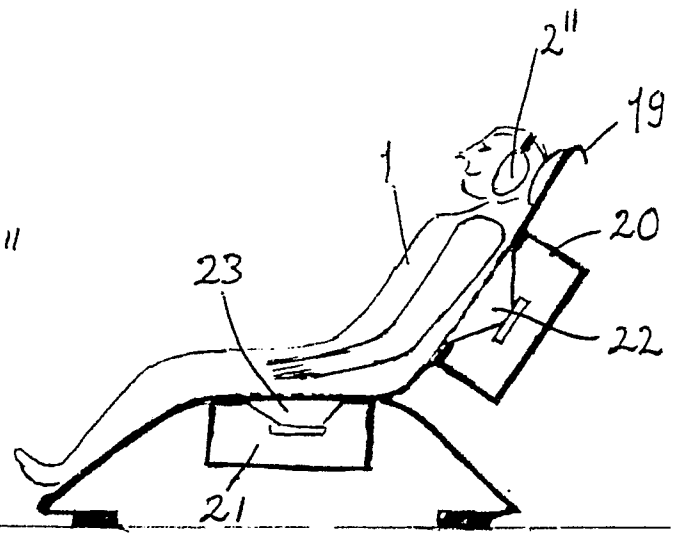


FIG. 6