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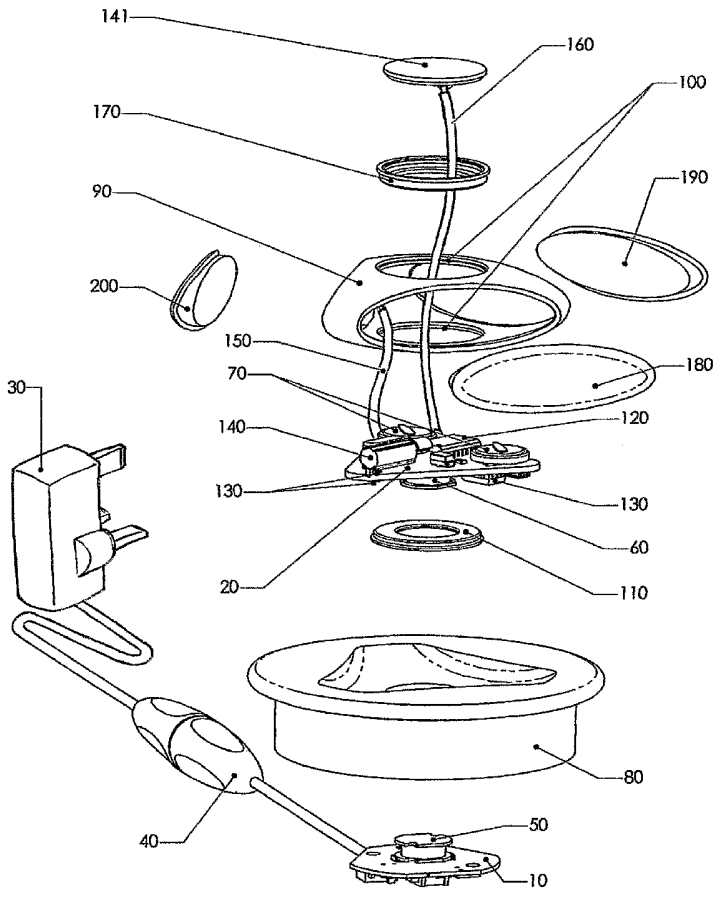

(57) Abstract: A biofeedback device comprises a tactile device having non-contiguous conducting regions on its surface separated by non-conducting regions, said conducting regions being connected to an electrical circuit which provides feedback in the form of mechanical pulses or vibrations, the frequency of said pulses or vibrations being related to the conductivity of the object being simultaneously in contact with two or more of the conducting regions, the device also having a means automatically to determine a 'rest state' or zero line, which becomes the condition at which no feedback - or predetermined baseline feedback occurs, said device provides changing feedback when the conductivity of the object in contact with two or more conducting regions changes in a positive or negative manner with respect to the 'rest state'.

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BIOFEEDBACK DEVICE

This invention relates to a biofeedback device.

Biofeedback is a technique used in many hospitals and clinics worldwide. Its use is applied to two main fields: stress management and occupational health as well as to neurophysiological and psychophysiological research. In the last 8-10 years in some countries the use of biofeedback has become commonplace in almost every practice of psychology, psychiatry and physical rehabilitation.

The technology behind biofeedback devices involves electro encephalography (EEG) which involves the measurement of brainwave patterns, electro myography (EMG) which involves the measurement of muscle tension and electrodermal response (EDR) which involves the measurement of skin conductivity or resistance.

Existing biofeedback devices are in general large pieces of apparatus, which are physically intrusive, the feedback from which is either in the form of an acoustic signal or in some other form which is in some other way also intrusive. For example some devices have analogue output meters where a needle moves across a calibrated display. Other devices use plots on paper. Alternatively a graphical representation on a visual display unit or oscilloscope is used.

For example US2003109797 uses a specific colour displayed on a monitor for the subject to verify their present physiological condition, while US5741217 utilises a biofeedback input to a computer to trigger predetermined actions that are intended to be relaxing such as an appropriate visual image or message and the playing of soft music. Another example US3648686 relies on a continuous audible tone output, while US5338276 specifies feedback means in the form of an aneroid dial or options for an analogue meter, digital readout or visual display device.

The problem which these forms of visual or audio feedback present and which the present invention overcomes is the need for either the user or an assistant attentively to sview and interpret the feedback generated. The intrusive nature of this monitoring exercise and of the associated equipment can be a distraction that hinders the focus required during the biofeedback process, the aim of which is primarily to relax and exercise control of the mind and body through considered contemplative thought or meditation. A similar conflict exists

with the use of acoustic feedback. The tones and beeps generated by the feedback process broadcast, to anyone in audible range, information about the user's condition and are often at a pitch or of a duration that irritates the user and anyone else in close proximity. The use of an earpiece can partially improve this situation but does not address the main issue.

A problem with the prior art is that at least one of the purposes of biofeedback is to provide the user with a means by which symptoms of stress, anxiety or some other behavioural, physiological, psychological or psychophysical condition can be alleviated or improved. This requires that the feedback mechanism experienced by the user should be substantially private and should not easily or inadvertently be "overheard" by third parties. In addition, it is important that a user should be positively attracted to make use of this biofeedback device and should not be adversely stressed or otherwise affected by its presence or operation. This is accomplished in the present invention by means of specific tactile qualities.

This invention provides a biofeedback system comprising:

a biofeedback device having a sensor to detect dermal conductivity, electrical contact and insulating areas having particular tactile qualities to encourage use, which provides a feedback by means of mechanical pulses or vibrations, the frequency of which is related to dermal conductivity;

in which the tactile qualities of the device are such as to encourage a user to want to make use of, handle or play with the device; and

a means by which the device can determine the equilibrium, 'rest' or zero state of the person or object in contact with it and provide a baseline amplitude and/or frequency level of feedback pulses or vibrations (which can be none if appropriate) confirming that this state has been achieved and when conditions deviate from this baseline state can provide an altered amplitude and/or frequency level of pulses or vibrations to reflect the change; and

a charging means, which may be by direct or inductive electrical connection, by which the device can be provided with the required energy for its continued operation; and

a tethering means such that the device cannot be removed from its area of operation.

Preferred embodiments of the invention recognise that people are familiar with interpreting tactile information from their environment through touch and in particular through their fingertips and hands. This is applied to the use of the invention, and provides users with the opportunity to interpret tactile information about themselves. This invention can be used as a

reactive tool for self-knowledge and education through which changes in a person's body are rendered tangible, illustrating to the user that they have the power to alter their physiological state, which will be fed back to them by a change in the output of the invention.

During use the invention is preferably held in the hand and skin contact is made between a pair of electrical contacts on the surface of the unit.

The properties of the skin are closely linked with the sympathetic nervous system of our bodies. Changes in physical, emotional and mental states are transferred by this system of nerves and reflected as changes in the physiology of the skin. Principally, electrodermal activity is associated with sweat gland activity. Since sweat gland activity is controlled by sympathetic (autonomic) nerve activity, the measurement of conductance (or conversely resistance) is an ideal means to monitor the autonomic nervous system. These measurements are best taken at the hands and feet, the areas most densely populated with sweat glands. Sweat, which has a salt content of 0.3%, is a good conductor but sweat does not actually have to be secreted for the invention to measure a change in activity; the invention is sufficiently sensitive to register dilation of the ecrine (sweat) glands within the skin.

The invention also recognises that it is not the placement of the users state within a fixed band or recognised scale that is significant; instead it is the confirmation or indication that the person's state is changing with respect to a starting point that is important. It is the direction and amplitude of this change over which the person can exercise control.

A feedback session consists of two aspects; the calibration phase and the operation phase. At the beginning of a session the invention is removed from the charging cradle, at which point, in a preferred embodiment, the onboard circuit performs an automatic reboot of the electronic circuit. When lifted from the charger the invention no longer senses the presence of the AC magnetic field of the charger coil and a hardware circuit sensor then switches power on to the processor. The processor is not involved in this initial sequence of events. The invention will then start (boot) and the first few lines of its software code create output pulses that can be sensed by the user.Provided that the electrical contacts are not touched, the device will remain in low-power sleep mode at this time. It will be asleep in very low current mode for 98% of the time, only waking up each three seconds for a few milliseconds to see if it is being used. This particular means of operation is an aid to overall reliability because the biofeedback circuitry is switched off during charging. It also ensures

that charging time is minimised because no current is drawn by the onboard electronics whilst the invention is on charge, ensuring all the current goes into the onboard battery.

In the preferred embodiment the calibration phase is the starting point of a biofeedback session, where an operational pulse output value is assigned to the user's average skin resistance value. To achieve this, skin contact has to be made with at least two electrical contacts that provide the input to the electronic biofeedback circuit. The person must ensure that this contact is of a constant pressure and is not too light, because the aim is to ensure that the contact resistance is only a small proportion of the skin resistance that is being measured. The electronic circuit within the invention takes multiple measurements of the skin resistance / conductance value to establish an average baseline value. Calibration bands are included as part of this start-up process to accommodate variables such as high resistance dead skin layers which can vary from day to day and which also vary significantly from person to person. The first 23 pulses after a boot are not calibration pulses. They are fixed speed pulses that allow the skin contact resistance to settle. From pulse 24 to 27 inclusive, the system will automatically calibrate itself at a series of decreasing sensitivities until it succeeds in establishing a baseline value, a calibration at pulse 27 being the lowest sensitivity and the last attempt. If calibration is not successful, the pulse counter is set to 19 and the whole calibration is initiated again from high sensitivity downwards. This process will continue as necessary until pulses 24 to 30 inclusive show no change. This is considered a successful calibration for the session. This control loop within the function of the invention ensures that any rapidly changing physiological state can be nulled out of the system so that it can be used by different people without resorting to manual calibration or the support of skilled operators. Additionally, this facility identifies and accommodates the change that occurs to a user's skin contact resistance within the first 15 seconds or so of touching an item. As skin cannot breath when it is held in contact against a non-porous surface it may gradually sweat and so make a better conductive contact, causing the contact resistance to decrease substantially over this initial period, the invention effectively waits for the subject to calm down from any recent exertions and it self-calibrates as sensitively as it possibly can for any set of circumstances. This invention has an advantage over conventional biofeedback / skin contact systems as this facility means that the use of a specialist conductive gel is not required.

Once calibrated, the operational phase begins. It should be noted that the pulse or vibration frequency of the baseline output will be the same for any individual that uses the invention irrespective of their baseline value. During the operational phase, the device will

indicate deviations from the baseline value – pulsing slower when the user becomes more relaxed and pulsing faster when the user becomes more tense or anxious.

The preferred embodiment of the innovation has three operational levels and it automatically cycles between these as the user's physiological state alters. The operating levels are nominally 1, 2 and 4 beats per second. A typical operating scenario would be –

Pick up invention – when calibration has been achieved the device will beat at 2 beats per second. This is the default baseline reference.

As soon as the person begins to relax the invention will beat at 1 beat per second. Should the person then become more anxious the invention will return to beating at 2 beats per second.
If the person becomes more anxious still the invention will beat at 4 beats per second.

If the person becomes anxious after calibration of the invention, it will beat at 4 beats per second.
As the person begins to relax the invention will beat at 2 beats per second. If further relaxation occurs the invention will beat at 1 beat per second.

Additional operational bands can be included as part of the function.

Referring now to Figure 1. a preferred embodiment consists of two electronic circuits, the charging unit circuit 10 and the handheld biofeedback circuit 20. The charging circuit includes a regulated mains power supply 30 with an inline plug and socket type connection 40 to a surface mounted electronic circuit. This circuit consists of a power high-frequency oscillator driving into a ferrite cored coil mounted on one side of the circuit board 50.This sets up a strong AC magnetic field, which is sensed by a corresponding ferrite cored coil 60 mounted on the handheld biofeedback circuit. The combination of the regulated power supply and the two coils inductively charges the rechargeable surface mounted button cells 70 (preferably these are of a high charge density type, such as Nickel/Metal Hydride (NiMH) that power the handheld biofeedback circuit. This enables recharging to take place automatically whenever the handheld biofeedback device is placed on to the charger and the charger is connected to a power supply. The spatial relationship between the two coils 50, 60 is critical to the charging regime; they must remain concentric and the distance between them

should ideally be kept to a minimum to ensure that the cells 70 are charged to their full potential. This relationship is controlled by the design of the housings of both the charger 80 and the biofeedback device 90. It is the last fraction of the charge cycle that is the most significant. The output voltage is increased slightly, but this last fraction of the charge provides a disproportionally large increase in operational time. Unclad versions of the circuit boards 10, 20 will charge across an air gap greater than 2mm but this maximum separation distance drops significantly when the coils are shrouded with metal, but importantly, it does not drop significantly when an insulating material is placed around or between them.

A preferred embodiment has a sterling silver shell 90 that houses the handheld biofeedback circuit 20, the cylindrical coil for inductively charging 60 sits concentrically within a much larger round hole 100 that passes through the shell. This hole ensures that issues relating to conflicting magnetic fields are avoided; the gap between the metal shell and the coil is covered and filled with an insulating material 110.

The rechargeable onboard cells 70 with a combined voltage typically of 3V power two principal items, the processor 120 via a voltage regulator 130, and the pulse generation device 140. The processor 120 contains a software application that controls the function of the invention. The pulse generation device 140, which in the preferred embodiment is a small electric motor with an eccentric weight attached to its shaft, is run in short bursts of 60 milliseconds to generate the tactile pulse that the user feels. An alternative pulse generator would be a solenoid. Each motor burst is long enough to make at least one complete turn as this has the benefit of providing a pulse in all possible directions or planes. With a motor run duration of less than one revolution this is not achieved, as there is no control over the starting position of the weight. Prolonged motor runs detract from the pulse effect as the motor start up inertia becomes less evident relative to the duration of the run. Low battery performance is improved by suppressing the motor with multiple capacitors 130.

The software in the invention has several functions to perform;

It must perform the complex function of calibration against the variables and difficulties presented by human skin, different users; it must cope with day-to-day humidity changes and it must do this without the aid of conductive medical gel.

It also monitors the skin resistance between the two electrodes and assigns a value that the system can use to drive the pulse generator. This value has to be interpreted against two threshold points low and high, the calibration process has previously set the threshold points according to all the circumstances it has detected. Pulse generator operation frequencies are chosen according to these threshold decisions.

It must enable the invention to go into and return from sleep mode such that the battery life can be prolonged and the device does not require an off switch.

A preferred embodiment consists of the biofeedback circuit board in the form of an equilateral triangle with a radius at each corner 20, this is contained within a housing consisting of two silver components 90, 141 that also serve as the electrical contacts for the input from the persons skin via conductive connections 150, 160 that join the conductive housing components 90, 141 to the circuit board. Contrasting details manufactured from insulating materials such as leather, timber, stone, ceramic or polymer resin provide the rest of the housing. These items include an insulating component 170 between the two conductive elements 90, 140 and finger pads 180,190, 200. The form of this embodiment is such that it can be toyed with in the hand.

Referring now to Figure 2. In elevation the silver unit has a hollow elliptical profile 210 with a small depression 220, 230 at each end of the minor axis, in plan view this profile has been revolved through 360deg. The resultant disc has then had three segments 240, 250, 260 removed from the perimeter at an angle of 120deg, the location of these segments are where finger pads 180, 190, 200 manufactured in an insulating material are placed. A hole passes through the hollow silver shell on the line of the minor axis. At one end this is filled with an insulating ring 170 and a silver disc 141, at the other end an insulating cover 110 following the original profile of the section is placed. The coil 60 on the hand held biofeedback circuit board is located at this point. The handheld invention nests into a corresponding location in the charging unit housing, this allows the coils 50, 60 to be orientated appropriately and controls the relative distance 270 between them, ensuring that it is 2mm or less and also provides the spatial relationship between the two units that allows the biofeedback unit to be easily removed from the charger with one hand.

Referring now to Figure 3. another preferred embodiment for use within institutional, clinical and hospital environments for therapeutic purposes is a version that uses both conductive 290 and non-conductive 300 elastomer and polymer mouldings to contain the electronic circuit 20 and to achieve the necessary conductive and insulating properties, the contrasting tactile qualities are achieved by moulding or applying texture and form to these materials. Use of these materials will allow the unit to function as required but will also limit potential damage to the invention and its surroundings, including people, if the unit is thrown or dropped. The form of the object can be of a shape that is appealing or pacifying to the person, for example if that were to be a child the shape could be that of a butterfly 321, a

ladybird 322, or a cartoon / clown character 323 or any graphical interpretation of an item that occurs in nature. A tethering device 310 is also employed, this can be fixed to the person, the base charging unit, an alternative power source or to a fixed object to prevent the invention from being removed, thrown or used as a weapon. A timer option 320 to establish the length of sessions may also be incorporated.

Referring to Figure 4., a further embodiment of the invention, potentially for use by sports people as an aid to mental training is portable and includes a timer with a stopwatch facility 330 which can be used independently or in conjunction with the tactile feedback invention for timed sessions. This embodiment of the invention may also include a heart or pulse monitor and a means of attachment such as a replaceable self adhesive pad 340 or a strap 310 that allows the user to wear or fix the invention to their body. Preferably the on-board battery in this embodiment is of a large capacity relative to the requirements of the electronic components, as this will allow many prolonged operational sessions without the need for recharging. The preferred embodiment includes a switch 350 to isolate the electrical contacts for the biofeedback facility. This embodiment may also include a visual display device 360 that enables graphical, textual and colour representations of a biofeedback session, this display may also be used by the other functions of the device such as a stopwatch, timer, pulse or heart rate monitor all of which can be used in conjunction with the invention. Alternatively this embodiment may be a disposable device intended for single or limited use.

Referring to Figure 5., a further embodiment of the invention allows for multiple users of the invention to participate individually or collectively in tactile response biofeedback sessions with the intention of understanding mental compatibility and the synchronisation of team members and as an aid to team training. This may also provide the basis of a competitive game where players are in mental combat with each other to achieve a particular goal. This embodiment may include a means of communication between the units 370 either hard wired or with a type of wireless telemetry technology where the information about each persons biofeedback session can be relayed to other users or to a common base unit for analysis or comparative purposes. With this embodiment the multiple biofeed devices clip 380 into the base unit for transportation and storage.

It is recognised that any examples used in the above descriptions are for illustrative purposes and should not be taken to limit or otherwise restrict the teaching of this invention.

Claims

1. A biofeedback system comprising:

a physiological input from a user to an electronic circuit and an output which comprises a mechanical pulse or series of pulses, the magnitude of which can be sensed by touch; further comprising:

a first unit, in which an electrical input related to the electrical conductivity or resistance between two or more electrically conductive contacts is provided to an electrical circuit;

in which a logic means interprets the input value and assigns an appropriate output response, said response being manifest as a mechanical movement of all or part of the device; and

a second unit, which provides electrical energy to the first unit.

2. A device according to claim 1 in which the logic means is a hardware device such as a silicon chip.

3. A device according to claim 1 in which the logic means is a software program running on a microprocessor or similar device.

4. A device according to claim 1 in which the second unit provides electrical energy to the first unit by inductive means.

5. A device according to claim 1 in which the second unit provides electrical energy to the first unit by direct conductive means.

6. A device according to claim 5 in which the second unit is connected to the first unit by a plug and socket connection means.

7. A device according to claim 5 in which the second unit is permanently wired to the first unit.

8. A device according to any one the preceding claims in which the mechanical movement is of such a magnitude that it can be sensed by touch as a pulse or beat.

9. A device according to any one of the preceding claims in which the conductive contacts are made of metal.

10. A device according to claim 9 in which the metal is a precious metal such as gold, silver or platinum.

11. A device according to claim 9 in which the metal is a utilitarian metal such a stainless steel or aluminium.

12. A device according to any of claims 9-11 in which a metal is electroplated on to another metal.

13. A device according to any of claims 9-11 in which a metal is electroplated on to an insulator.

14. A device according to claims 1-8 in which the conductive contacts are made of a transparent conductor.

15. A device according to any of claims 1-8 in which the insulating regions are made of natural substances such as, but not limited to wood or leather.

16. A device according to any of claims 1-8 in which the insulating regions are made of polymeric materials such as rubbers, plastics and resins.

17. A device according to claim 16 in which the insulating regions are substantially transparent.

18. A device according to any of claims 1-8 in which the insulating regions are made of mineral materials such as glass or quartz.

19. A biofeedback system containing an automatic calibration system, which obviates the need for manual calibration, comprising:

an input value related to the electrical conductivity or resistance between two or more electrically conductive contacts to provide an electrical circuit;

in which a logic means is used to interpret the input value relative to a series of defined calibration bands to establish a calibration of the electrical input relative to the predefined outputs of the system.

20. A device according to claim 19 in which the logic means is a hardware device such as a silicon chip.

21. A device according to claim 19 in which the logic means is a software program running on a microprocessor or similar device.

22. A device according to any of claims 19-21 further comprising a means by which the system automatically calibrates itself at a series of decreasing sensitivities until calibration is achieved.

23. A device according to claim 22 in which the calibration process is automatically repeated, should calibration not be achieved at the first or any subsequent attempt.

24. A device according to any of claims 19-23 in which the calibration process starts automatically at the beginning of a biofeedback session when a user makes contact with the input electrodes.

25. A device according to any of claims 19-24 in which the unit operates at an initial dynamic state following the calibration phase irrespective of the magnitude of the input value.

26. A device according to any of claims 19-25 in which the initial dynamic state has an output value of zero.

27. A device according to any of claims 19-26 in the dynamic tactile output can deviate from an initial dynamic state to a different level, reflecting changes in the physiological input from the user.

28. A biofeedback system comprising:

a physiological input from a user to an electronic circuit and an output which comprises a mechanical pulse or series of pulses, the magnitude of which can be sensed by touch; further comprising:

a first unit, in which an electrical input related to the electrical conductivity or resistance between two or more electrically conductive contacts is provided to an electrical circuit;

in which a logic means interprets the input value and assigns an appropriate output response, said response being manifest as a mechanical movement of all or part of the device; and

a second unit, which provides electrical energy to the first unit; and

an automatic calibration system, which obviates the need for manual calibration, comprising:

an input value related to the electrical conductivity or resistance between two or more electrically conductive contacts to provide an electrical circuit;

in which a logic means is used to interpret the input value relative to a series of defined calibration bands to establish a calibration of the electrical input relative to the predefined outputs of the system.

29. A device according to claim 28 in which the logic means is a hardware device such as a silicon chip.

30. A device according to claim 28 in which the logic means is a software program running on a microprocessor or similar device.

31. A device according to any of the above claims in which there is a plurality of input electrodes for use by an individual.

32. A device according to any of claims 1-30 in which there is a plurality of input electrodes for use by multiple users.

33. A device according to claim 32 in which there is a plurality of dynamic tactile pulse generation output devices that operate corresponding to the plurality of user inputs.

34. A biofeedback system according to any of the above claims where an output can be connected to a secondary graphical or acoustic output device.

35. A biofeedback system according to any of claims 1-33 in which the input and / or the output can be recorded or logged.

36. A biofeedback device where the electronic circuitry within the biofeedback device automatically reboots when it is removed from the corresponding charging facility.

37. A device according to any of the above claims in which the biofeedback device includes a tether to prevent the unit from being stolen, thrown or used as a weapon or otherwise removed from its intended location.

38. A device according to any of the above claims where the housing is manufactured from a combination of conductive and non-conductive elastomers or polymers.

39. A device according to any of the above claims where the housing is manufactured from pressure sensitive elastomers or polymers.

40. A biofeedback system in which the housing is substantially transparent.

41. A biofeedback system where the form of the object and the visible component parts are detailed such that it can provide a pacifying and appealing function to the user, such as the form of a butterfly, a ladybird, a clown or cartoon character or any interpretation of a naturally occurring item or an appealing abstract design.

42. A biofeedback system where the tactile qualities of the component parts are such that they can provide a pacifying and appealing function to the user.

43. A biofeedback system of any of the above claims where the housing is manufactured from a combination of silver or another precious metal and non-conductive (insulating)

tactile elements produced from stone, ceramic, glass, timber and / or leather.

44. A self-contained biofeedback device that requires no external connection that is fixed to the user with a self-adhesive pad which may or may not be replaceable.

45. A disposable biofeedback device intended for single or limited use which can be discarded when the on-board power source is discharged.

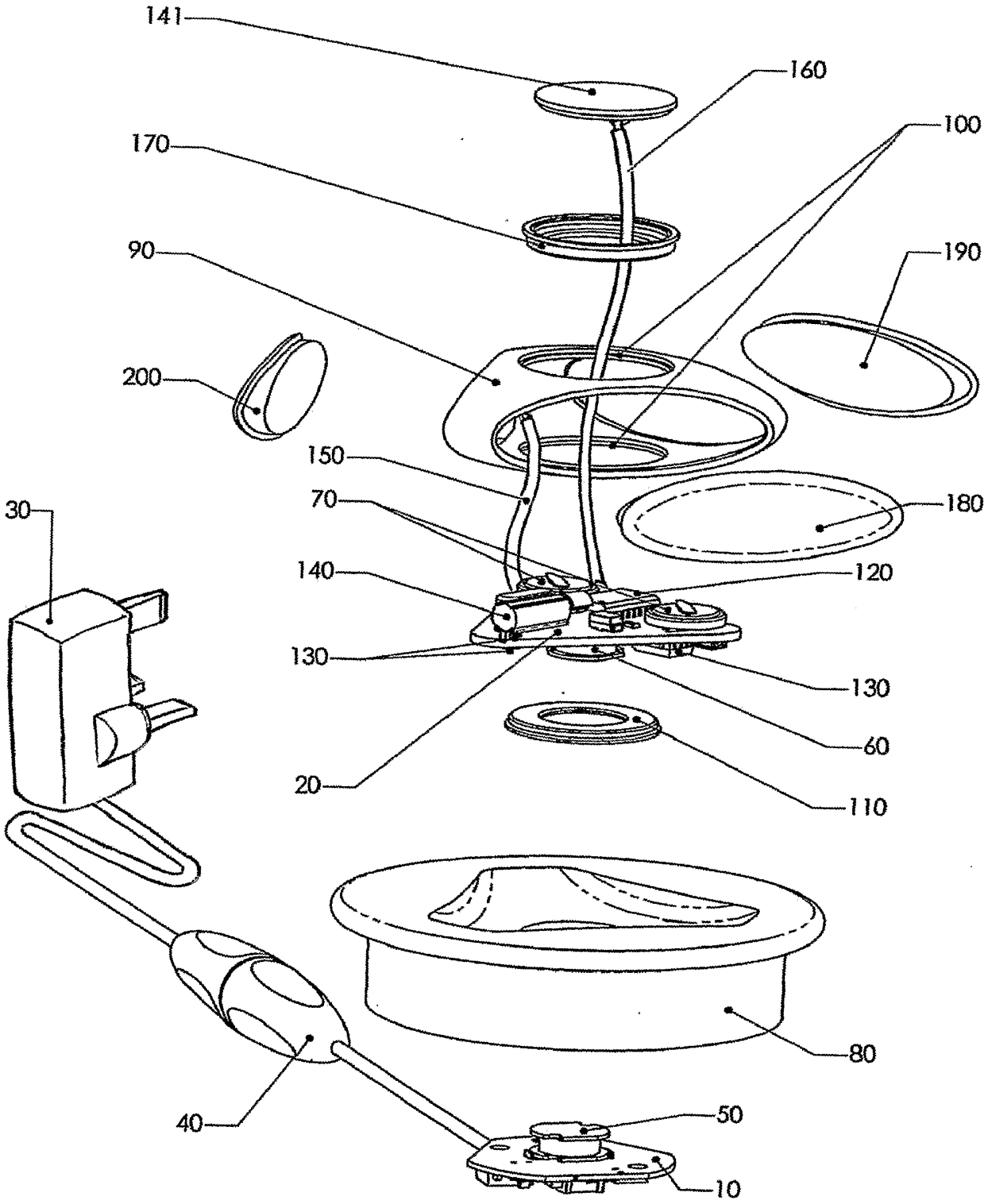
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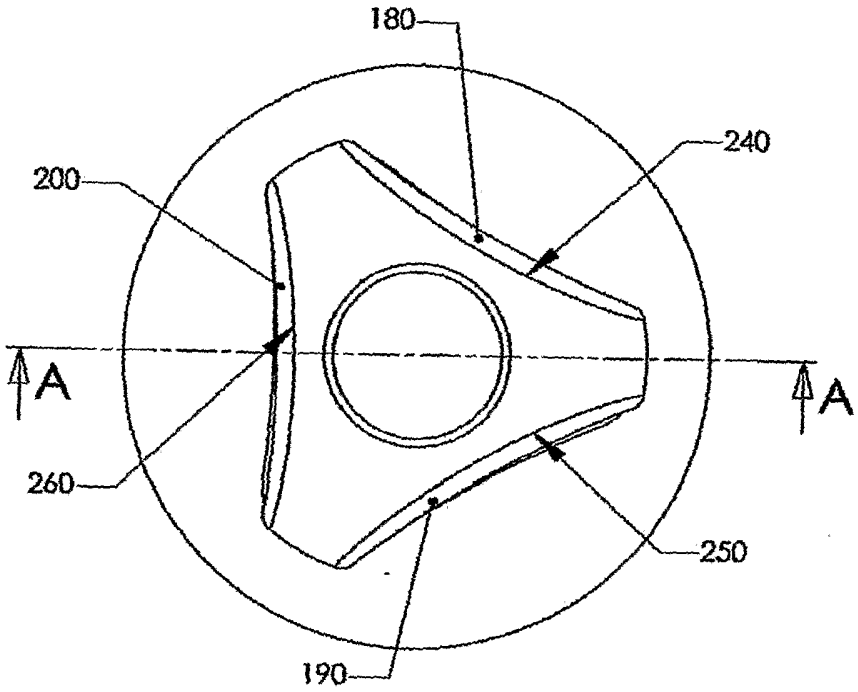
Fig 1.



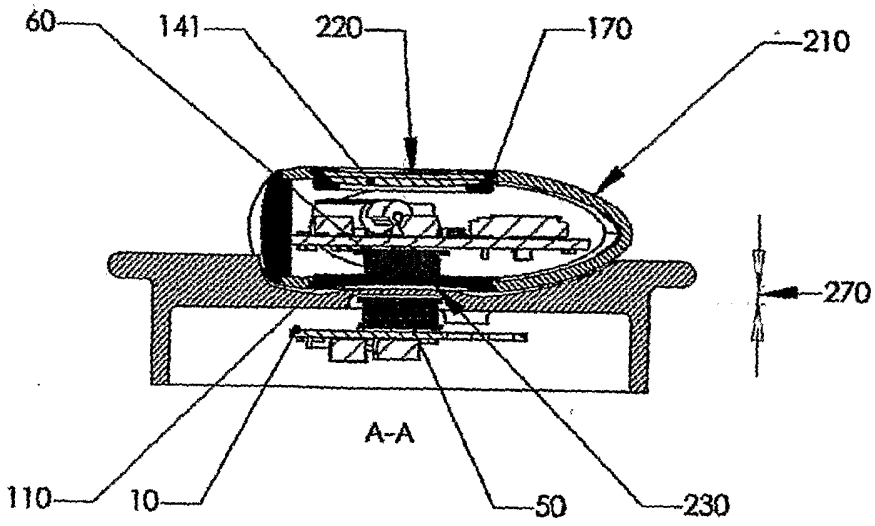


Fig. 2

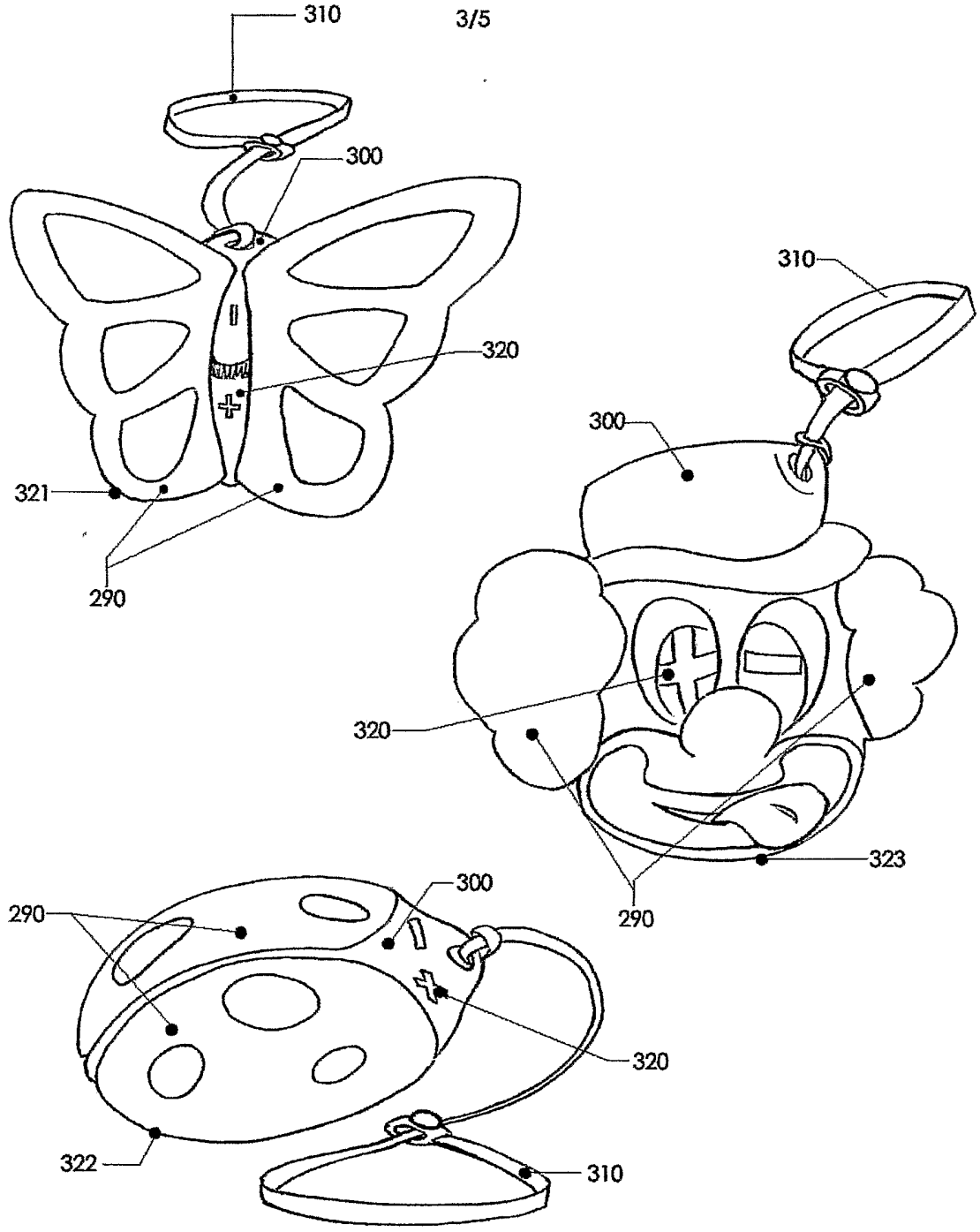


Fig 3.

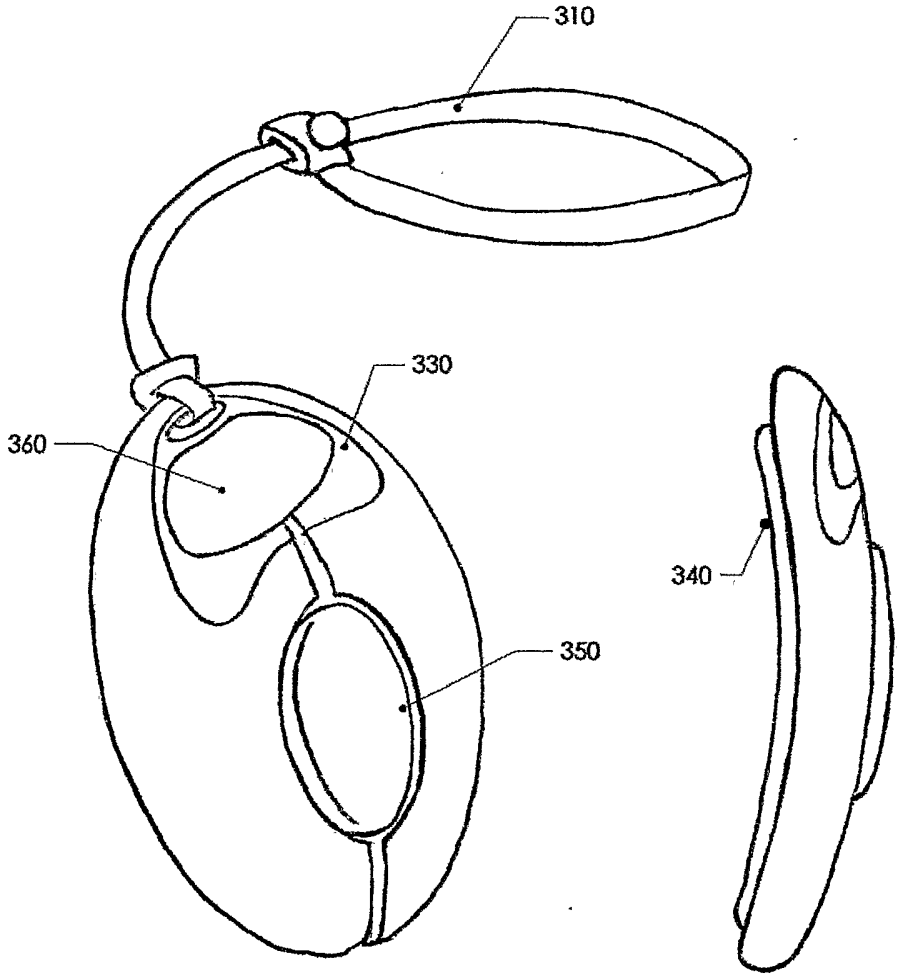


Fig 4.

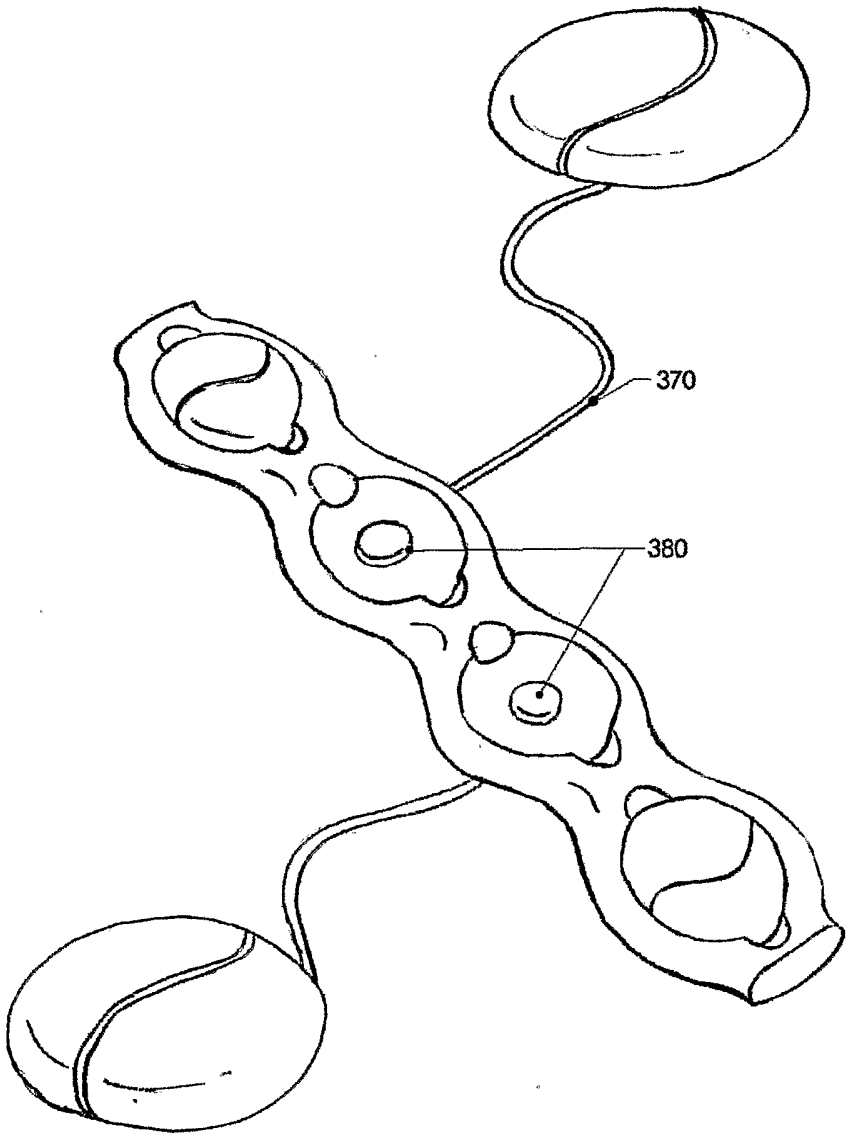


Fig. 5

INTERNATIONAL SEARCH REPORT

PCT/GB2004/003539

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 605 038 B1 (PACIONE CHRISTOPHER D ET AL) 12 August 2003 (2003-08-12) column 1, line 55 - column 2, line 60 column 21, line 9 - column 23, line 5 column 24, lines 18-20 claims 1-3,7,14,47,50,51	1-5, 7-11,16, 31,34, 35,38
Y		12-15, 17,18
A		19-30, 37,39,43
	----- -/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 October 2004	19. 01. 2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Rivera Pons, C

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

PCT/GB2004/003539

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 792 047 A (COGGINS GEORGE) 11 August 1998 (1998-08-11) column 2, line 51 - column 3, line 1 column 4, line 35 - column 5, line 3 column 5, lines 19-24 column 5, line 57 - column 6, line 17 claims 1,7,9-13	1,3,5-8, 32,33
Y	WO 03/014684 A (INNIS PETER CHARLES ; SPINKS GEOFFREY MAXWELL (AU); WALLACE GORDON GEO) 20 February 2003 (2003-02-20) the whole document	12-15, 17,18
A	GB 2 378 762 A (INNER TEK LTD) 19 February 2003 (2003-02-19) abstract	1
A	US 4 110 918 A (FEE JAMES F ET AL) 5 September 1978 (1978-09-05) the whole document	1

INTERNATIONAL SEARCH REPORT

/GB2004/003539

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-35,37-39, 43

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-35,37-39,43

   A biofeedback system for outputting a mechanical movement in response to an electrical input relating to the electrical conductivity of a part of the user.

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2. claim: 36

   A biofeedback system which reboots automatically when taken out of a charging facility.

   ---

3. claim: 40

   A biofeedback system with a transparent housing.

   ---

4. claims: 41,42

   A biofeedback system where the parts are such that provide a pacifying and appealing function to the user.

   ---

5. claim: 44

   A biofeedback system self-contained, fixed to the user with a self-adhesive pad.

   ---

6. claim: 45

   A disposable biofeedback device, to be discarded after the battery is discharged.

INTERNATIONAL SEARCH REPORT

on patent family members

PCT/GB[redacted]004/003539

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