(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 January 2003 (03.01.2003)

PCT

(10) International Publication Number
WO 03/000134 A1

(51) International Patent Classification[7]: A61B 5/103, 5/16 // 5/05, A61N 1/18

(21) International Application Number: PCT/SE02/01251

(22) International Filing Date: 26 June 2002 (26.06.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0102284-7 26 June 2001 (26.06.2001) SE
0200054-5 10 January 2002 (10.01.2002) SE

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 03/000134 A1

(54) Title: APPARATUS FOR PROVIDING AN INDIVIDUALLY SCALED LEVEL INDICATION OF A SENSATION

(57) Abstract: An sensation level measuring or analysing apparatus and method comprising the steps of receiving as an input a first threshold value in the shape of a first absolute level of a physical stimulus; receiving as an input a second threshold value in the shape of a second absolute level of the physical stimulus; dividing the range between said first and second registered absolute levels of the physical stimulus into a predetermined number of steps each having a step value; registering a third absolute level of the physical stimulus that is perceived to be comparable to an experienced sensation; and assigning said third registered absolute level of the physical stimulus the value of a corresponding scale step representing a sensation measurement value.

APPARATUS FOR PROVIDING AN INDIVIDUALLY SCALED LEVEL INDICATION OF A SENSATION

Technical Field

The present invention relates generally to an apparatus for assessing the level of a sensation experienced by a person by providing a variable stimulus to the person until the applied stimulus matches the experienced sensation. More particularly, the present invention is directed to achieve such an apparatus that provides an individually scaled level indication of the sensation.

Background

When using sensation/stimulation matching for assessing the level of a sensation, there is in many applications an underlying purpose of comparing the assessed level for a person on one hand to assessments for other persons and on the other hand to assessments for the same person at different occasions. In both cases there is a need for relating the assessments to a relevant scale that enables the generation of comparable level values.

The perception of sensations is to a high degree dependent on individual conditions, i.e. the perception may vary with the varying mood or possible pathological conditions of the person. Furthermore, the perception is sometimes different dependent on the sensation/stimulation intensity, i.e. the perception may vary dependent on the mode or the magnitude of the sensation/stimulation.

In prior art, these facts have not been specifically addressed and the assessment level is usually assigned a value corresponding directly to the level of the applied stimulus. The comparing of such assessment levels between persons and between assessment with different types of stimulation, e.g. a heat stimulation compared to an electrical current stimulation, may be difficult.

Prior Art

Examples of prior art sensation/stimulation matching is found in the patent publications:

DE G 92 04 961.3 (Gebrauchmuster) to Müller;

WO 97/24068 to Laserow;

WO 01/13793 to Cefar Painmatcher AB et al; and in

WO 01/13987 to Cefar Painmatcher AB et al.

The general structure of apparatuses and methods for sensation/stimulation matching is described in the mentioned pieces of prior art.

Object of the Invention

The general object of the present invention is to solve the problem of improving the

comparability of sensation level assessments with sensation/stimulation matching apparatuses

Different aspects of the invention are directed to achieving a scaling of level values that inter alia:

- is individually adapted to each sensation assessing person and enables comparison between assessments at different occasions independent of the current personal condition;
- enables comparison of assessments with different types of stimulation; and
- enables comparison between assessment of sensation levels for different persons.

A further aspect of the invention is to achieve an apparatus and a method that enables an improved assessment of sensations and experiences other than pain.

Summary of the Invention

The inventors have realised that an objective quantification of a sensation or an experience by means of sensation/stimulation matching can be made by establishing individual frames of reference for each person and possibly also for each measurement occasion. The frame of reference is established by determining a range between detectable sensation thresholds, e.g. the perception threshold and the pain threshold or the pain threshold and the tolerance threshold. The range between the respective thresholds is typically individual and specific to each person, but varies with the physical or psychological condition of the person.

In accordance with the invention, the determined range is divided into a predetermined number of scale steps thereby achieving a relative scale. The division of the range into scale steps is carried out according to a mapping function that can be linear or non-linear. An advantageous embodiment of the invention employs a mapping function that results in the range being divided into equally distant scale steps. Since the range varies with each individual and sometimes also between different assessment occasions for the same person, the distance and the stimulation energy between the scale steps also varies with an individually varying range. When assessing a sensation level the sensation that matches a certain absolute magnitude of stimulation in terms of a stimulation scale dependent on the stimulation type, e.g. electrical current or thermal energy is first determined. Thereafter, the stimulation magnitude is mapped on the scale and the sensation level is assigned a scale value that corresponds to the magnitude of stimulation. The result is that the extent of a sensation or an experience is measured objectively according to a scale that has been adapted to the individual and the currently prevailing conditions. Thereby, different assessments are made comparable.

When specifically measuring the level of pain, the invention is in one embodiment applied such that the pain threshold and the tolerance threshold are detected and stored in a first phase of the assessment. The thus determined range between the pain threshold and the tolerance threshold is thereafter divided into for example 7-10 equally distant scale

steps. In a second phase of the assessment, the level of the current or the remembered pain is determined by means of sensation/stimulation matching. The matched level is then assigned a scale value corresponding to the level of the induced stimulation. It is currently believed that a number of scale steps in the range of 10 is apt for pain level assessment, since pain is a sensation for which it is difficult to discriminate between a larger number of different levels.

For assessing the level of sensations and experiences other than pain the perception threshold and the pain threshold are detected and stored for defining the scale range. In practice this range between the sensory perception threshold and the pain threshold gives the maximum scope of a sense. This is based on the assumption or perhaps even the fact that there is no sensation or experience unless it is perceived, and there is no sensation or experience that is stronger than the occurrence of pain. In the latter case, when a sensation or experience is so strong that it starts to raise pain, the pain is the dominating sensation. In other words a sensory reference frame for sensations and experiences in general is thereby achieved, despite the fact that there are in general no specific stimulation types for inducing these sensations and experiences. In fact, experiments point towards the conclusion that electrical current is an adequate form of stimulation for assessing a large number of sensation and experiences since the human body lacks receptors for electrical current.

In an embodiment of the invention arranged for measuring the level of sensations or experiences, the range between the perception threshold and the pain threshold is preferably divided into a number of scale steps in the range of about 20 or even up to the range of 40. It is however generally held that the range of 20 is to prefer since the ability to discriminate between a higher number of levels may be less developed. It is however currently believed that a division into a large number of smaller scale steps is advantageous when applying the invention in sensation/experience matching. This way sensations, feelings or experiences are quantified in real terms of energy levels.

In another embodiment of the invention, the scaling is carried out such that the stimulation in the matching phase is adapted to the scale and the stimulation is output in discrete level steps. The stimulation output is then selected for example such that the stimulation starts at the perception level for scale step one. The stimulation is then incrementally increased with a stimulation level increase corresponding to a scale step until a matched scaled value is registered or the pain threshold for the highest scale step has been reached. The stimulation according to the scale steps can alternatively be selected as e.g. the centre value of the scale step interval or e.g. the highest scale step interval value.

The determined threshold levels and the scale ranges are useful to store and compare between different assessment occasions, since further conclusions about the status of the person are possible to draw in the light of the change in threshold levels and scale ranges.

Different embodiments of the invention are applied in the sensation/stimulation matching apparatus itself as well as in a sensation level analysing apparatus. In the latter case the analysing apparatus comprises an input for the threshold levels and the matched sensation level. The processing of establishing the scale range and the scale is then typically performed in the analysing apparatus and the result may simply be presented or compared to other stored assessments for further analysis. The processing may also include automatically generated diagnosis and recommendations based on predefined rules. A convenient embodiment of the analysis apparatus would be realised by means of a specifically designed software program run on a general computer.

Brief Description of the Drawings

The invention will now be further described in conjunction with the drawings, wherein:

Fig 1 and 2 show block diagrams of the functional components of the inventive apparatus;

Fig 3 shows schematically a diagram of a mapping function in accordance with the invention; and

Fig 4 shows schematically an example of the output stimulation in one embodiment of the invention.

Detailed Description of Embodiments

Fig 1 shows a block diagram of the functional structure of embodiments of the invention. The functional structure of a sensation/stimulation matcher of this kind comprises a stimulus signal generator 102 coupled via means 106 for providing a pulsating stimulus to stimulus induction means 104, which in use are intended to be applied to the skin of a person for inducing a stimulus. A control unit 114, for example a control processor, is coupled to the stimulus signal generator 102 via an amplitude variation means 120 devised for varying the amplitude of the pulsating stimulus signal. The control unit is also coupled to the pulsating stimulus providing means 106 via a pulse width variation means 122 devised for varying the pulse width of the pulsating stimulus signal. The control unit is further coupled to a memory 116 for storing registered measurement values and control instructions for predetermined control schemes, and a display 118 for the visual presentation of an obtained measurement value or other information. The control unit is also optionally coupled to a control switch 124, e.g. a button, for starting, stopping or halting a measurement sequence at for example a perception threshold, a sensation threshold, e.g. the pain threshold, or the tolerance threshold or a sensation level. In a preferred embodiment, the apparatus is devised to stop a variation of the pulsating properties of the stimulus in response to an actuation of the control switch 124, and the apparatus is devised to keep the pulsating property at its current level. So, for example, may the patient stop an increase in amplitude or pulse width at a level which seems to

match the measured sensation and consider whether the level is correct. If the patient indeed considers the level to be correct, the patient releases his or her contact with the induction means 104. This leaves an open circuit which is detected by the apparatus, whereupon it is devised to automatically store the current value of amplitude and/or pulse width. A separate electrical circuit may be provided for the detection of an open circuit due to the patient's release of the contact with the induction means. If the halted level is not considered to be corrected, the patient may continue the increase, or variation, by releasing the button, resuming the contact or switch back to an initial switch position.

In the embodiment as shown in Fig 1, the means 106 for providing a pulsating stimulus further comprises means 108 for providing a pulsed current stimulus intensity, e.g. in the shape of an oscillator, and/or means 110 for providing a square waved stimulus intensity, e.g. in the shape of a square wave or a triangle wave generator, either of the means 108 and 110 being devised to provide a stimulus signal in the form of a pulsed current having a frequency in the range of 1-100 Hz. In Fig 1 is also shown a switching means, controllable by the control unit and being devised to switch between the different wave forms.

In addition to the general structure of a sensation/stimulation apparatus, the inventive apparatus further includes an analyser 130 communicatively coupled to the control unit 114 and devised for analysing the assessed levels of sensation or experience. The analyser 130 would typically comprise a scale generator and a scale value mapping function. An alternative embodiment of the inventive apparatus would comprise an output 132 for outputting matched thresholds and levels in the shape of signals or data parameters, and a separate analysing apparatus.

Fig 2 shows an embodiment of the analysing apparatus by means of a functional block diagram. The analyser 201 thus comprises an input for a first threshold value T1 and a second threshold value T2 and possibly also a third threshold value T3. More specifically the first and the second threshold values would be a perception or sensation threshold value ST, a pain threshold value PT or a tolerance threshold value TT. The threshold values are received in a scale generator 202 devised to calculate a division of the range between a first and a second threshold value into a predetermined or pre-settable number of scale steps SSN 203 . The threshold values are determined by means of sensation/stimulation matching and are indicated in some absolute unit of magnitude, for example electrical current amplitude or pulse width. The size of the scale steps is in its simplest form determined by division between the range width and the number of scale steps. Thus according to an equation corresponding to T2-T1/SSN, or expressed in the specific threshold values PT-ST/SSN or TT-PT/SSN or TT-ST/SSN.

The analyser further comprises an input for a matched sensation level MAL received in a scale value mapping function 204. The scale value mapping function 204 is communicatively coupled to the scale generator 202 via communications link 206 by

means of which the scale step size and the threshold values constituting the end points of the scale are communicated. The mapping function is also provided with the number of scale steps. For each received matched sensation level the mapping function thus determines and outputs a corresponding matched scale level value MSL, confer schematic diagram in Fig 3. A linear mapping function for the matched scale level MSL can be expressed as:

MSL = 0 if MAL=T1;

MSL = n if (n-1)*(T2-T1)/SSN < MAL =< n*(T2-T1)/SSN; where n = 1...SSN.

As mentioned above other mapping functions dependent on the matched absolute level, i.e. f (MAL) can be used for specific purposes. The mapping would be performed in generally in a manner similar to the linear mapping. The mapping can be realised by calculating the function or by means of a look-up table that is calculated once the thresholds and the scale range has been established. In this text the term mapping and mapping function is used as a comprehensive term for the steps of dividing the range between the thresholds as well as for the function for translating the matched absolute level to a matched scaled level.

Fig 4 illustrates as an example the phases of a sensation/stimulation matching in accordance with an embodiment of the invention. In operation of the invention the person that is measuring for example a sensation other than pain is asked to estimate the sensory threshold, i.e. the perception threshold 1, and the pain threshold 2 in a first phase of the sensation/stimulation matching. In the first phase the stimulation is increased following a continuous or small step incremental increase. The scale is thereafter generated automatically. In a second phase, the stimulation is started again in a first alternative I at the perception threshold level or in a second alternative II at a lower level, e.g. 0. The stimulation is in the second phase increased incrementally with stimulation level steps corresponding to the scale steps starting from or passing scale step 1 corresponding to the perception threshold and until the sensation to be measured is matched and automatically assigned a matched scaled level value on a scale of 7 scale steps in this example. The stimulation increase is in this example carried out at most until the pain threshold stimulation level has been reached. When measuring pain, the assessment is carried out in a similar manner, however operating in the range between the pain threshold and the tolerance threshold.

The functionality and the operating sequence of the sensation/stimulation matcher apparatus and the analysis apparatus is conveniently realised by means of computer program code devised to control a data processor to perform the steps of the inventive method.

Claims

1. A sensation level measuring apparatus comprising:
- a stimulator (101) devised to deliver a varying physical stimulus;
- a registration mechanism (114,116) devised to register an absolute level of the physical stimulus;
- a scaling mechanism (202) devised to divide the range between a first and a second registered absolute levels (T1,T2) of the physical stimulus into a predetermined number of steps each having a step value;
- a sensation level assessment mechanism (204) devised to assign a third registered absolute level (MAL) of the physical stimulus the value of a corresponding scale step.

2. The apparatus as recited in the preceding claim, wherein the stimulation during said registration of the third absolute level of the physical stimulus is incrementally increased in stimulation level steps corresponding to said predetermined number of steps in the stimulation range within the perception threshold and the pain threshold.

3. The apparatus as recited in any of the preceding claims, wherein the stimulation during said registration of the third absolute level of the physical stimulus is incrementally increased in stimulation level steps in the stimulation range within the perception threshold and the pain threshold.

4. The apparatus as recited in any of the preceding claims, wherein the stimulation during said registration of the third absolute level of the physical stimulus is continuously increased in the stimulation range within the perception threshold and the pain threshold.

5. The apparatus as recited in any of the preceding claims, wherein said range is divided into equidistant steps.

6. The apparatus as recited in any of the preceding claims, wherein said range is divided into steps according to a predetermined linear function.

7. The apparatus as recited in any of the preceding claims, wherein said range is divided into steps according to a predetermined non-linear function.

8. The apparatus as recited in any of the preceding claims, wherein said assigning of a scale step is performed such that each interval of the range between the thresholds is assigned a scale number corresponding to level value of the interval.

9. The apparatus as recited in any of the preceding claims, wherein said assigning of a scale step is performed in accordance with a predetermined linear mapping function.

10. The apparatus as recited in any of the preceding claims, wherein said assigning of a scale step is performed in accordance with a predetermined non-linear mapping function.

11. The apparatus as recited in any of the preceding claims, wherein said first threshold value is the perception threshold and said second threshold value is the pain threshold.

12. The apparatus as recited in any of the preceding claims, wherein said first threshold value is the pain threshold and said second threshold value is the tolerance threshold.

13. The apparatus as recited in any of the preceding claims, wherein said first threshold value is the perception threshold and said second threshold value is the tolerance threshold.

14. A sensation level measuring method comprising the steps of:
- delivering a varying physical stimulus to a person;
- detecting a first threshold value of said person by registering a first absolute level of the physical stimulus upon actuation of said person;
- detecting a second threshold value of said person by registering a second absolute level of the physical stimulus upon actuation of said person;
- dividing the range between said first and second registered absolute levels of the physical stimulus into a predetermined number of steps each having a step value;
- registering a third absolute level of the physical stimulus that is perceived to be comparable to an experienced sensation;
- assigning said third registered absolute level of the physical stimulus the value of a corresponding scale step representing a sensation measurement value.

15. The sensation level measuring method as recited in the preceding claim 14, further comprising the steps or stages of any of the preceding claims 1-13.

16. A computer program product for use in a sensation level measuring apparatus, comprising program code devised to perform the steps or functions of any of the preceding claims 1-15.

17. A sensation level analysing apparatus comprising:

- an input mechanism for receiving an absolute level value of a physical stimulus;
- a scaling mechanism devised to divide the range between a first and a second registered absolute levels of the physical stimulus into a predetermined number of steps each having a step value;
- a sensation level assessment mechanism devised to assign a third registered absolute level of the physical stimulus the value of a corresponding scale step.

18. The apparatus as recited in the preceding claim, wherein the stimulation during said registration of the third absolute level of the physical stimulus is incrementally increased in stimulation level steps corresponding to said predetermined number of steps in the stimulation range within the perception threshold and the pain threshold.

19. The apparatus as recited in any of the preceding claims 17-18, wherein the stimulation during said registration of the third absolute level of the physical stimulus is incrementally increased in stimulation level steps in the stimulation range within the perception threshold and the pain threshold.

20. The apparatus as recited in any of the preceding claims 17-19, wherein the stimulation during said registration of the third absolute level of the physical stimulus is continuously increased in the stimulation range within the perception threshold and the pain threshold.

21. The apparatus as recited in any of the preceding claims 17-20, wherein said range is divided into equidistant steps.

22. The apparatus as recited in any of the preceding claims 17-21, wherein said range is divided into steps according to a predetermined linear function.

23. The apparatus as recited in any of the preceding claims 17-22, wherein said range is divided into steps according to a predetermined non-linear function.

24. The apparatus as recited in any of the preceding claims 17-23, wherein said assigning of a scale step is performed such that each interval of the range between the thresholds is assigned a scale number corresponding to level value of the interval.

25. The apparatus as recited in any of the preceding claims 17-24, wherein said assigning of a scale step is performed in accordance with a predetermined linear mapping function.

26. The apparatus as recited in any of the preceding claims 17-25, wherein said assigning of a scale step is performed in accordance with a predetermined non-linear mapping function.

27. The apparatus as recited in any of the preceding claims 17-26, wherein said first threshold value is the perception threshold and said second threshold value is the pain threshold.

28. The apparatus as recited in any of the preceding claims 17-27, wherein said first threshold value is the pain threshold and said second threshold value is the tolerance threshold.

29. The apparatus as recited in any of the preceding claims 17 28, wherein said first threshold value is the perception threshold and said second threshold value is the tolerance threshold.

30. A sensation level analysing method comprising the steps of:
- receiving as an input a first threshold value in the shape of a first absolute level of a physical stimulus;
- receiving as an input a second threshold value in the shape of a second absolute level of the physical stimulus;
- dividing the range between said first and second registered absolute levels of the physical stimulus into a predetermined number of steps each having a step value;
- registering a third absolute level of the physical stimulus that is perceived to be comparable to an experienced sensation;
- assigning said third registered absolute level of the physical stimulus the value of a corresponding scale step representing a sensation measurement value.

31. The sensation level analysing method as recited in the preceding claim 30, further comprising the steps or stages of any of the preceding claims 17-29.

32. A computer program product for use in a sensation level analysing apparatus, comprising program code devised to perform the steps or functions of any of the preceding claims 17-31.

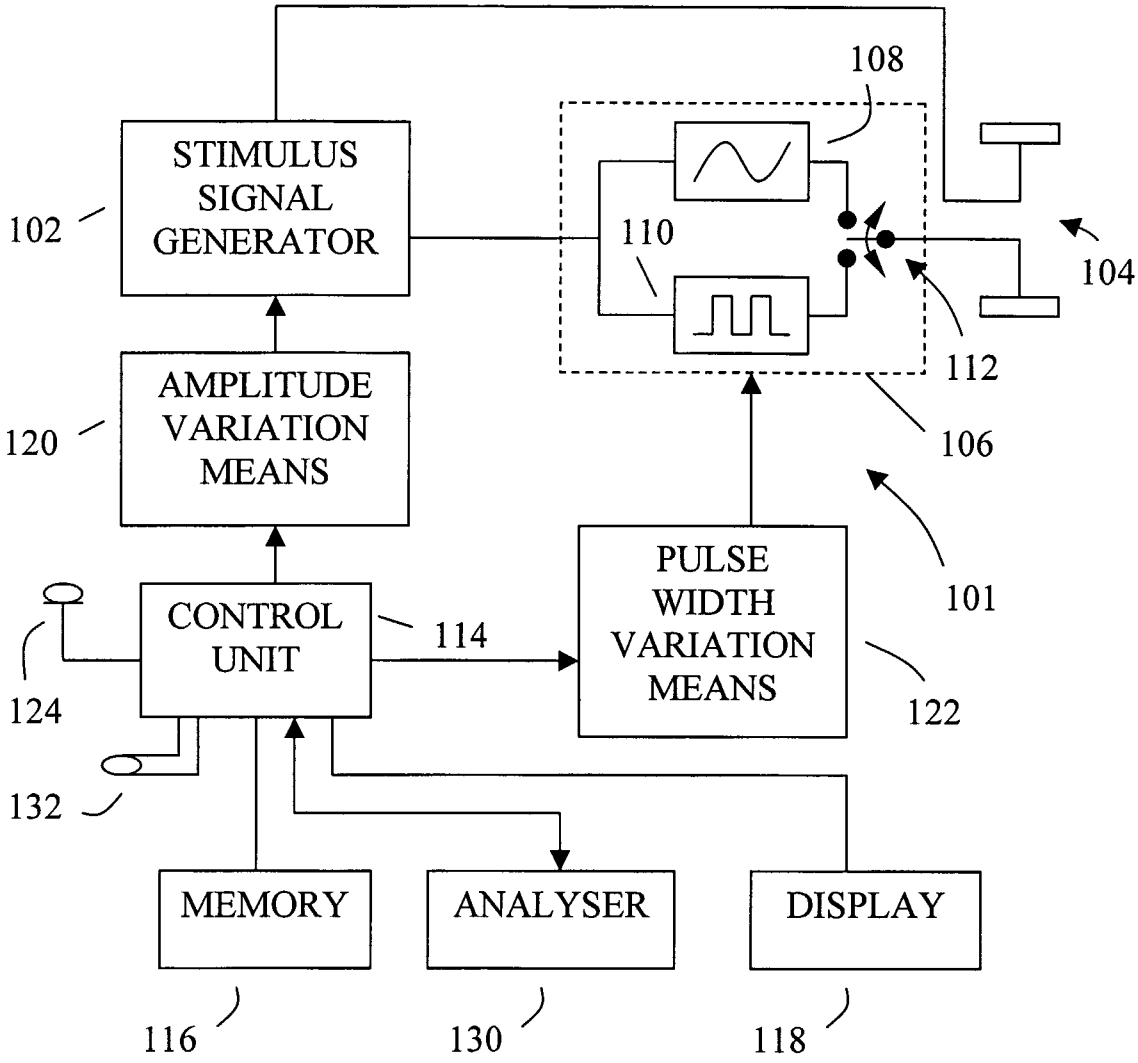
108
STIMULUS SIGNAL GENERATOR
102
110
104
112
AMPLITUDE VARIATION MEANS
120
106
PULSE WIDTH VARIATION MEANS
101
CONTROL UNIT
114
124
122
132
MEMORY
ANALYSER
DISPLAY
116
130
118

FIG. 1

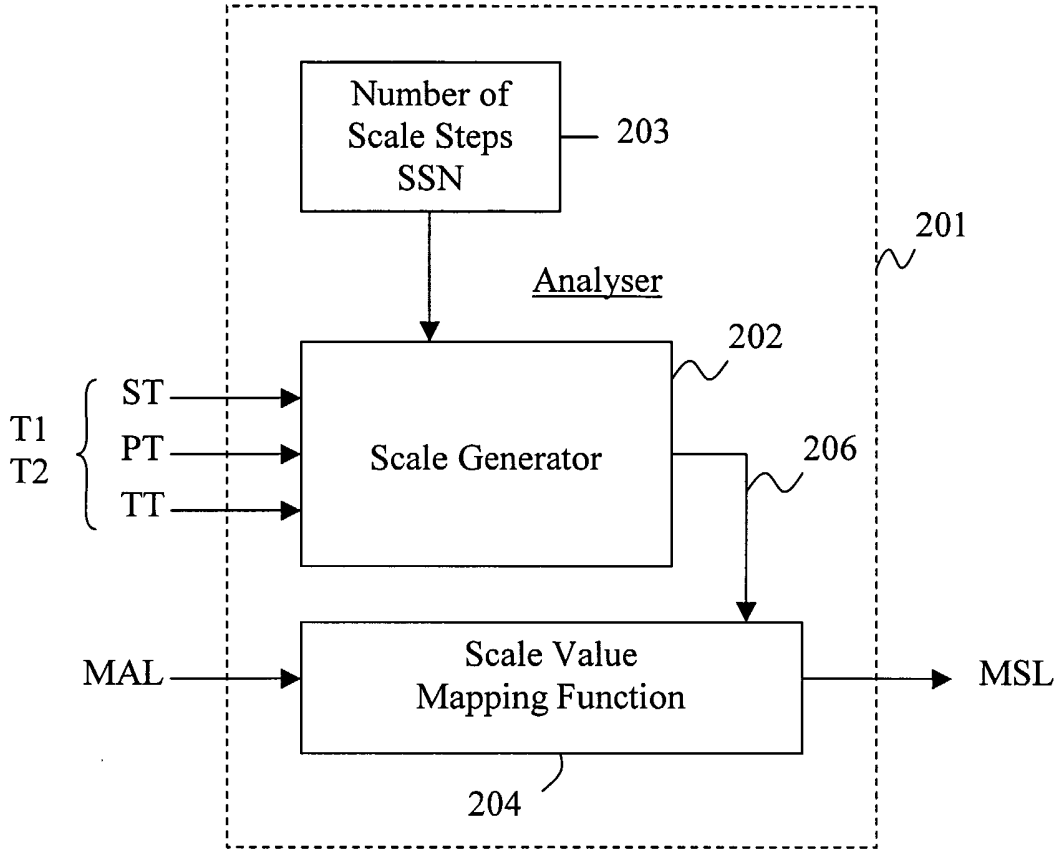
Number of
Scale Steps
SSN
203
201
Analyser
202
ST
PT
TT
T1
T2
Scale Generator
206
MAL
Scale Value
Mapping Function
MSL
204

Fig. 2

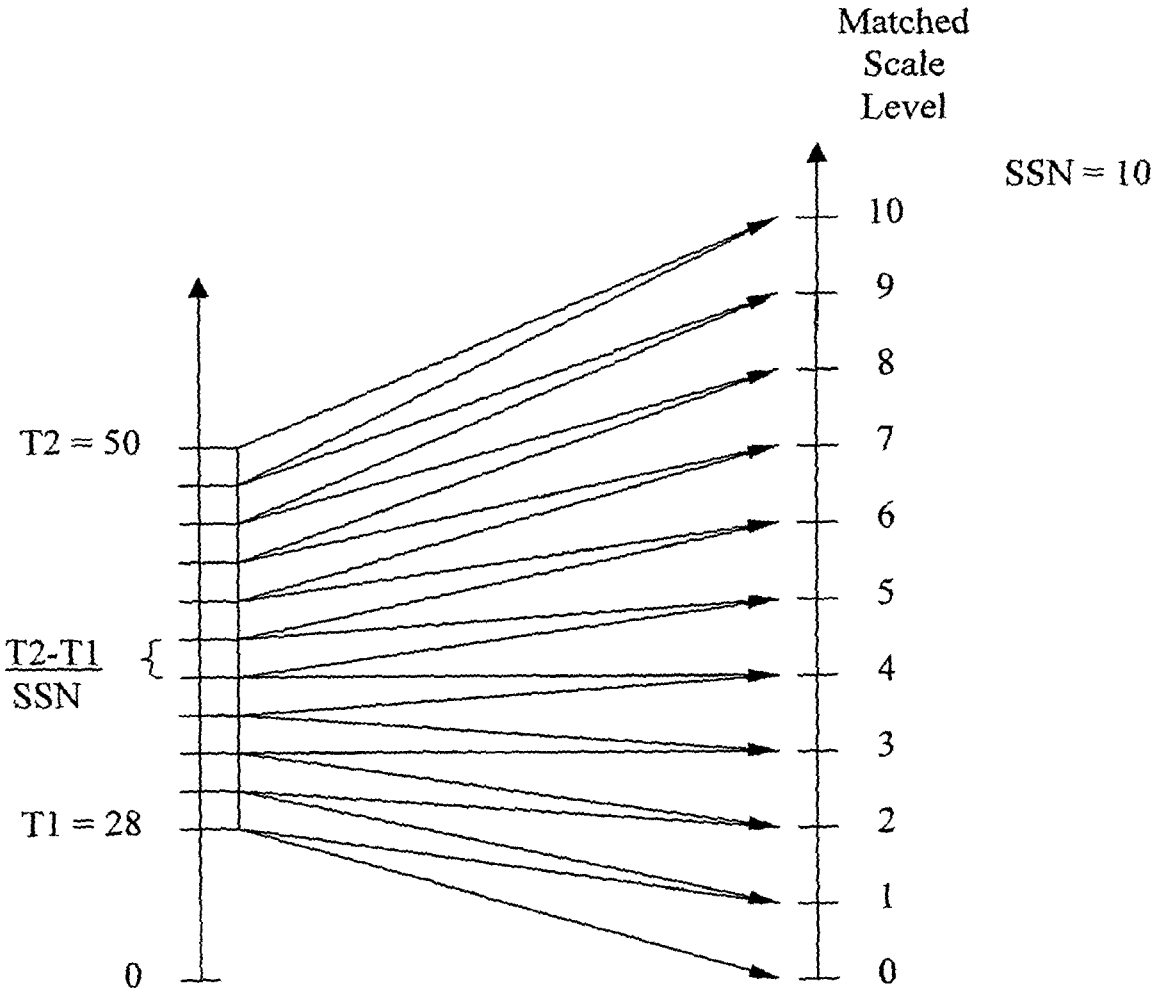
Matched
Scale
Level
SSN = 10
10
9
8
7
6
5
4
3
2
1
0
T2 = 50
T2-T1
SSN
T1 = 28
0

Fig. 3

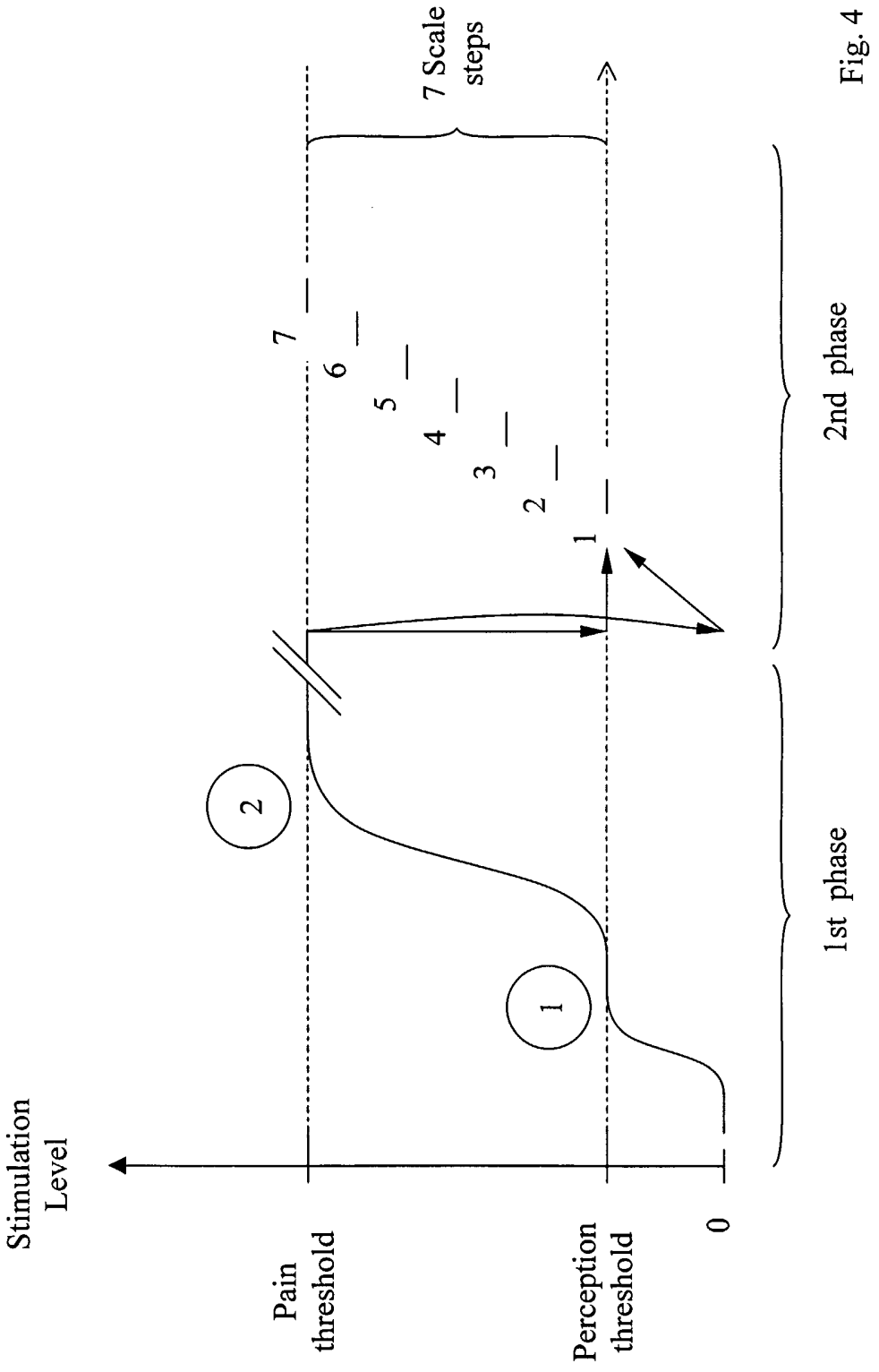
Stimulation Level
Pain threshold
Perception threshold
0
1
2
7 Scale steps
1
2
3
4
5
6
7
1st phase
2nd phase

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/01251

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61B 5/103, A61B 5/16 // A 61 B 5/05, A 61 N 1/18
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)

IPC7: A61B, A61N

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ, MEDLINE, BIOSIS, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Boll. Soc. It. Biol. Sper., 1990, N. 6. vol. LXVI p. 529-536, Ferracuti S. et al: "LA STIMOLAZIONE ELETTRICA DELLA POLPA DENTARIA NELLA VALUTAZIONE DELL'EFFETTO CENTRALE DEGLI ANALGESICI, see abstract in english page 534-535 --	1-32
A	US 4844091 A (L. BELLAK), 4 July 1989 (04.07.89), column 4, line 21 - column 5, line 17 --	1-32
A	WO 0113793 A1 (CEFAR PAINMATCHER AB ET AL), 1 March 2001 (01.03.01), page 4, line 36 - page 5, line 17 -- --------	1-32

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 Sept 2002	02 -10- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Frida Plym Forshell/mj Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/01251

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4844091 A	04/07/89	NONE	
WO 0113793 A1	01/03/01	AU 6702800 A	19/03/01
		AU 7510300 A	19/03/01
		EP 1221892 A	17/07/02
		SE 9902960 D	00/00/00
		WO 0113987 A	01/03/01