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**Datasheet for the decision
of 8 April 2025**

Case Number: T 1114/22 - 3.2.02

Application Number: 12741053.8

Publication Number: 2731500

IPC: A61B5/048, A61B5/145

Language of the proceedings: EN

Title of invention:

PREDICTING THE LEVELS OF SUBSTANCES SUCH AS CORTISOL FROM EEG
ANALYSIS

Applicant:

Gandhi, Krishna

Headword:

Relevant legal provisions:

EPC Art. 53(c), 83, 84

RPBA 2020 Art. 11, 13(2)

Keyword:

Sufficiency of disclosure - main request, auxiliary requests
1, 2, 3, 4a (no) - auxiliary request 4b (yes)
Exceptions to patentability - method for treatment by surgery
- auxiliary request 4b (no)
Claims - clarity and support in the description - auxiliary
request 4b (yes)
Remittal - (yes)

Decisions cited:

T 2340/12, T 2006/08, T 0872/13, T 2249/16

Catchword:



Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 1114/22 - 3.2.02

D E C I S I O N
of Technical Board of Appeal 3.2.02
of 8 April 2025

Appellant:
(Applicant)

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Decision under appeal:

**Decision of the Examining Division of the
European Patent Office posted on 3 February 2022
refusing European patent application No.
12741053.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman M. Alvazzi Delfrate
Members: S. Böttcher
N. Obrovski

Summary of Facts and Submissions

- I. The applicant filed an appeal against the decision of the examining division to refuse the application.
- II. Oral proceedings before the Board took place on 8 April 2025.
- III. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request or one of auxiliary requests 1 to 3 underlying the decision under appeal, on the basis of one of auxiliary requests 4a and 4b filed during the oral proceedings before the Board, on the basis of one of auxiliary requests 4 to 7 underlying the decision under appeal, or on the basis of the claim request filed with the letter received on 17 November 2024, which should be treated as auxiliary request 8.
- IV. Claim 1 of the main request and of auxiliary request 1 reads as follows.

"A method of predicting substance levels for a substance from EEG data, comprising the steps, executed by a computer, of:
analysing EEG data to obtain the average power for each of a plurality of predetermined frequency bands;
calculating a value from the average powers derived for each frequency band, said value being calculated by combining the average powers for each frequency band by dividing and/or multiplying according to a predetermined order;
and
obtaining an estimate of the substance level from the equation:

$$Y=bX+C$$

where Y is the substance level to be predicted, X is the value and b and C are constants, wherein the substance is selected from hormones, neuro transmitters and bio markers."

V. Claim 1 of auxiliary requests 2 and 3 reads as follows:

"A method of predicting substance levels for a substance from EEG data, comprising the steps, executed by a computer, of: analysing EEG data to obtain the average power for each of a plurality of predetermined frequency bands; calculating a value from the average powers derived for each frequency band, said value being calculated by combining the average powers for each frequency band by dividing and/or multiplying according to a predetermined order; and obtaining an estimate of the substance level from the equation:

$$Y=bX+C$$

where Y is the substance level to be predicted, X is the value and b and C are constants, wherein the substance is selected from hormones and neuro transmitters."

VI. Claim 1 of auxiliary request 4a reads as follows.

"A method of predicting substance levels for a substance from EEG data, comprising the steps, executed by a computer, of: analysing EEG data to obtain the average power for each of a plurality of predetermined frequency bands; calculating a value from the average powers derived for each frequency band, said value being calculated by combining the average powers for each frequency band by dividing and/or multiplying according to a

predetermined order; and
obtaining an estimate of the substance level from the
equation:

$$Y=bX+C$$

where Y is the substance level to be predicted, X is
the value and b and C are constants, wherein the
substance is selected from hormones, neuro transmitters
and bio markers,

wherein the substance is selected from any one of
cortisol, testosterone, progesterone, and oestrogen."

VII. Claim 1 of auxiliary request 4b reads as follows.

"A method of predicting substance levels for a
substance from EEG data, comprising the steps, executed
by a computer, of:

analysing EEG data to obtain the average power for each
of a plurality of predetermined frequency bands;
calculating a value from the average powers derived for
each frequency band, said value being calculated by
combining the average powers for each frequency band by
dividing and/or multiplying according to a
predetermined order; and

obtaining an estimate of the substance level from the
equation:

$$Y=bX+C$$

where Y is the substance level to be predicted, X is
the value and b and C are constants, wherein the
substance is selected from hormones, neuro transmitters
and bio markers,

wherein the substance is cortisol."

VIII. The following documents are referred to in this
decision.

A1 Jun Soo Kwon et al., "Gamma Frequency-Range

- Abnormalities to Auditory Stimulation in Schizophrenia", Archives of General Psychiatry, November 1999, vol. 56, number 11, p. 1001-1005
- A2 Edmund G. Cape and Barbara E. Jones, "Differential Modulation of High-Frequency γ -Electroencephalogram Activity and Sleep-Wake State by Noradrenaline and Serotonin Microinjections into the Region of Cholinergic Basalis Neurons", Journal of Neuroscience, April 1998, vol. 18, number 7, p. 2653-2666
- A3 B. W. Gawali et al., "Ovarian hormones and the brain signals", Annals of Neurosciences, April 2009, vol. 16, number 2, p. 72-74
- A4 Krystal L. Parker et al., "Medial frontal \sim 4-Hz activity in humans and rodents is attenuated in PD patients and in rodents with cortical dopamine depletion", Journal of Neurophysiology, July 2015, vol. 114, p. 1310-1320
- A5 Zhiyuan Ma et al., "Characterization of electroencephalographic and biochemical responses at 5-HT promoting drug-induced onset of serotonin syndrome in rats", Journal of Neurochemistry, June 2013, vol. 125, number 5, p. 774-789
- A6 Dennis J.L.G. Schutter and Jack van Honk, "Decoupling of midfrontal delta-beta oscillations after testosterone administration", International Journal of Psychophysiology, 2004, vol. 53, p. 71-73
- A7 Erik Stomrud et al., "Slowing of EEG correlates with CSF biomarkers and reduced cognitive speed in elderly with normal cognition over 4 years", Neurobiology of Aging, 2010, vol. 31, p. 215-223
- A8 Jacobien M. van Peer, Karin Roelofs and Philip Spinhoven, "Cortisol administration enhances the coupling of midfrontal delta and beta oscillations", International Journal of Psycho-

physiology, 2008, vol. 67, p. 144-150

- A9 Robert J. Barry et al., "Electroencephalogram θ/β Ratio and Arousal in Attention-Deficit/Hyperactivity Disorder: Evidence of Independent Processes", Society of Biological Psychiatry, 2009, vol. 66, p. 398-401
- A10 Dennis J.L.G. Schutter and Jack van Honk, "Salivary cortisol levels and the coupling of midfrontal delta-beta oscillations", International Journal of Psychophysiology 55 (2005) 127-129
- A11 Başar, E., Başar-Eroglu, C., Karakaş, S., Schürmann, M., "Gamma, alpha, delta, and theta oscillations govern cognitive processes", Int. J. Psychophysiol., 2001, 39, 241-248
- A12 Gruzelier, J.H., "New advances in EEG and cognition", Int. J. Psychophysiol., 2001, 24, 1-5
- A13 Hausmann, M., Güntürkün, O., "Steroid fluctuations modify functional cerebral asymmetries: the hypothesis of progesterone mediated inter-hemispheric decoupling", Neuropsychologia, 2000, 38, 1362-1374.

IX. The appellant's arguments can be summarised as follows.

Main request and auxiliary request 1 - sufficiency of disclosure

The examining division had objected to claim 1 being too broad, as the single example of estimating the cortisol level given in the application did not suffice to allow the person skilled in the art to carry out the method claimed in claim 1. However, according to the Case Law of the Boards of Appeal II.C.7.1.4, the mere fact that a claim was broad was not in itself a ground for considering the application as not complying with the requirement for sufficient disclosure (T 2249/16).

Furthermore, the examining division's finding was not based on serious doubts, substantiated by verifiable facts (Case Law of the Boards of Appeal II.C.9.3). In the absence of such verifiable facts, an objection of lack of sufficient disclosure was not justified (T 872/13). According to the Case Law of the Boards of Appeal (Case Law of the Boards of Appeal III.G. 5.1.2.c), it was up to the Examining Division to substantiate the objection raised (T 2340/12). There was also a confusion between Articles 83 and 56 EPC in the second paragraph on page 7 of the decision under appeal, where reference was made to "a doubtful expectation of success", which was a concept relating to inventive step.

The application disclosed on page 2, lines 24 to 26, the general principle that variations in EEG power correlated with changes in substance level and that this correlation could be used to predict levels of that substance in the body. The correlation between frequency bands of the EEG and several hormones, neurotransmitters or biomarkers was within the common general knowledge of the person skilled in the art, as supported by documents A1 to A13.

The application further disclosed an example of the claimed method for the substance cortisol (page 11, line 11, to page 16, line 9). Furthermore, clear directions had been provided in respect of other substances, which would enable the person skilled in the art to provide the measurement method set out in claim 1 by routine testing and without undue burden (T 2006/08). The skilled person merely needed to consider a limited number of frequency bands. To find the ones for which there was a correlation with the substance level, a database could be consulted (page 4,

lines 1 and 2). The question of how to multiply or divide the frequency bands did not involve a large number of combinations and required only the application of simple mathematical operations of multiplication and division. In order to select the predetermined order for determination of the constants b and C, a linear regression would have to be performed (page 9, line 19, to page 11, line 9; page 18, lines 20 to 27). According to the Case Law of the Boards of Appeal (II.C.6.7), a reasonable amount of trial and error was permissible when it came to sufficiency of disclosure.

Hence, the disclosure in the application was sufficient to enable the person skilled in the art, using common general knowledge, to carry out the invention over the whole scope claimed.

Auxiliary requests 2 and 3 - sufficiency of disclosure

According to claim 1 of auxiliary requests 2 and 3, the substance was selected from hormones and neurotransmitters but not from biomarkers. Hence, the claimed method related to only a limited number of substances.

Documents A1 to A13 cited by the applicant were scientific articles which disclosed that several hormones and neurotransmitters interacted with EEG data. The documents contained information on the predetermined frequency bands to be selected for specific substances. According to the Case Law of the Boards of Appeal (I.C.2.8.3), common general knowledge of the person skilled in the art could be reflected in a multitude of scientific publications reporting on research in a technical field. It also had to be taken

into account that quantitative neurophysiology was a distinct scientific field.

Hence, the correlation between frequency bands of the EEG and the level of a hormone or neurotransmitter was within the common general knowledge of the person skilled in the art. Furthermore, it was mentioned in the description of the application (page 18, lines 18 to 27) that the general methodology of the invention was applicable to other hormones and neurotransmitters.

Hence, the application provided sufficient information to enable the person skilled in the art, taking into account his or her common general knowledge, to carry out the method of claim 1 without undue burden.

Auxiliary request 4a - admittance

Despite the fact that it had been filed at a late stage, auxiliary request 4a should be admitted into the proceedings. The amendments made in claim 1 were compatible with the principle of procedural economy, as the substances were further limited to only a few hormones, to overcome the objection of insufficient disclosure. The request did not give rise to new objections.

Taking into consideration the information provided in documents A3, A6, A8 and A10 on the hormones mentioned in claim 1, the person skilled in the art was able to carry out the method of claim 1 without undue burden.

Auxiliary request 4b - admittance and sufficiency of disclosure

Auxiliary request 4b addressed all the issues raised by

the Board. Moreover, the request did not give rise to any new objections. It should therefore be admitted.

Request for reimbursement of the appeal fee

Given that there had been a substantial procedural violation by the examining division, the appeal fee should be reimbursed. The right to be heard had not been adhered to in the examination proceedings. This was because the decision under appeal had been taken without considering all the information on file. In particular, the examining division had disregarded the information in the application as filed regarding testosterone and table 1, as well as the additional evidence filed as annexes by the then applicant.

Moreover, the examining division had acted with a mind desirous of misunderstanding and had deviated from the guidelines as regards whether a surgical step was part of the method claimed in dependent claims 7 and 8.

The patent had been misunderstood and misquoted and, in view of all this, the examining division's behaviour had simply been ridiculous.

Reasons for the Decision

1. Subject-matter of the application

The application relates, in an example described in detail, to a method and apparatus for measuring (predicting) the level of cortisol in the body of a person from electroencephalogram (EEG) data of that person.

The purpose of this method is to provide a non-invasive measurement technique for measuring the level of cortisol in the body.

The method comprises the steps of analysing an EEG with regard to various frequency bands to obtain an average power for each of a plurality of predetermined frequency bands (selected from the bands delta, theta, alpha, beta, SMR, high beta and gamma). In the example, the predetermined frequency bands are the theta, alpha, delta and SMR bands, which have a correlation with increasing or decreasing levels of cortisol (page 5, lines 18 to 19, and page 3, lines 31 to 33, of the description as originally filed). The average powers for these frequency bands are then combined by dividing or multiplying according to a predetermined order, to calculate a value X from which an estimate Y of the cortisol level is obtained from the equation $Y=bX+C$. The constants b and C have been determined on the basis of data obtained in a study which was conducted on 23 healthy participants and a regression line plotted to the data. In the embodiment described in the application, the constants are $b = 227.51$ and $C = 1.1899$ (page 15, lines 28 to 31).

2. Main request and auxiliary request 1 - sufficiency of disclosure
- 2.1 The wording of claim 1 of the main request and auxiliary request 1 is identical. According to claim 1 (and the corresponding apparatus claim 14), the level of any hormone, neurotransmitter or biomarker in the body of a person can be predicted from an analysis of EEG data of that person.

2.2 In order to perform the claimed method in a reproducible way, the person skilled in the art needs to know, for each hormone, neurotransmitter or biomarker of which the level is to be determined, which predetermined frequency bands are to be considered, the order in which the average powers for each frequency band are combined by dividing and/or multiplying, and which values for the constants b and C are to be chosen.

To determine these parameters, the person skilled in the art would first have to perform EEG measurements on a plurality of subjects (for instance at least 100 subjects, see page 9, lines 25 to 27, of the description). As mentioned on page 18, lines 20 to 27, of the description, one factor influencing the measurements is the location of acquiring EEG activity (a single location or multiple locations). Hence, the appropriate location would have to be chosen by trial and error.

Shortly before and after the EEG measurements, the actual level of the substance would have to be measured a number of times from saliva or other bodily fluids of each of the subjects (page 9, lines 31 to 35; page 12, lines 10 to 14).

Then, a fast Fourier transform would have to be conducted on each of the EEG measurements to provide average power values for each frequency band (delta, theta, alpha, SMR, beta, high beta and gamma) (page 6, lines 1 to 8; page 12, lines 31 to 35).

For each subject and for each measurement time, the average power for each frequency band would have to be plotted against the corresponding substance levels. The

person skilled in the art would then have to establish by trial and error whether the average power of any of the frequency bands changed with the substance levels at any measurement time, and select those (page 10, lines 7 to 19; page 13, lines 1 to 6) as the predetermined frequency bands.

The average powers of the identified frequency bands would have to be divided and multiplied in a large number of possible different ways to provide a plurality of ratios or single values (page 10, lines 21 to 31). Each of these ratios would have to be plotted against the measured substance levels and, again by trial and error, the ratio giving the best fit to a straight line would have to be selected. The constants b and C could then be calculated as the slope and the Y-intercept of this line.

It is mentioned in the description that the boundaries of the frequency bands may vary and that by varying the boundaries a better correlation may be achievable (page 3, lines 25 to 29; page 11, lines 6 to 9). Hence, selection of the appropriate boundaries of the frequency bands already involves a considerable amount of trial and error.

Thus, to find the parameters needed for predicting the level of a substance from EEG data, the person skilled in the art would have to perform extensive experimentation resembling a research programme. This is unduly burdensome.

- 2.3 Only in respect of the hormone cortisol does the application as filed disclose which frequency bands should be selected as predetermined frequency bands (theta, alpha, SMR and delta), the order in which they

should be divided (page 5, lines 18 to 22, of the description), and how the constants b and C should be derived for establishing the regression line equation (page 15, lines 28 to 31). The parameters had been determined from a study conducted on 27 subjects (page 5, lines 18-22, and page 11, line 11, to page 15, line 14).

- 2.4 The appellant argues that the experiments that would have to be conducted require only routine steps and that the number of frequency bands that would have to be taken into consideration is limited; that this does not impose an undue burden on the person skilled in the art; and furthermore that the frequency bands which correlate with the level of a particular substance can be retrieved from a database.

However, an undue burden is placed on the person skilled in the art by the, in total, excessive number of experiments that have to be performed and the amount of trial and error involved. For each individual hormone, neurotransmitter or biomarker of which the level is to be predicted, the person skilled in the art would have to perform the above-mentioned research programme to determine the necessary parameters.

- 2.5 Moreover, the appellant did not provide any evidence that databases for retrieving information on the suitable frequency bands were a matter of common general knowledge of the person skilled in the art. Documents A1 to A13 merely disclose that some substances or medical conditions significantly affect the EEG. However, the knowledge that there is a relationship between EEG activity and a substance or condition does not relieve the person skilled in the art of the large number of experiments to find the

parameters of claim 1.

- 2.6 It is correct that the mere fact that a claim is broad is not in itself a ground for considering an application as not complying with the requirement for sufficient disclosure. However, in the present case, the issue to be considered is not merely the breadth of the claim. In the main request and auxiliary request 1, the method is to be carried out for a large number of different substances, while the description provides a concrete teaching of how to carry out the invention for only one of said substances, namely cortisol. In fact, as can be concluded from page 18, lines 20 to 27 of the description, the disclosed experimental settings and the parameters that are obtained to predict the level of cortisol cannot be transferred to other substances. On the contrary, as set out above, for every other substance the person skilled in the art would have to choose the experimental settings for obtaining the parameters by trial and error.
- 2.7 In view of the lack of disclosure in the application concerning a number of substances that are included in claim 1, there is no need, and indeed there is no way, to provide further verifiable facts to throw said disclosure into doubt. The finding of insufficient disclosure is thus justified.
- 2.8 Therefore, claim 1 of the main request and of auxiliary request 1 does not disclose the claimed invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 83 EPC).
3. Auxiliary requests 2 and 3 - sufficiency of disclosure

- 3.1 Claim 1 is identical in auxiliary requests 2 and 3, and differs from that of the main request in that the biomarkers have been deleted from the list of possible substances.
- 3.2 While the deletion of biomarkers narrows down the scope of the claim, the remaining alternatives "hormones and neurotransmitters" still cover a very large number of possible substances for which, even taking into account the common general knowledge of the person skilled in the art, the application does not provide an enabling disclosure, contrary to the requirements of Article 83 EPC.
- 3.3 As mentioned above, the knowledge that there is a relationship between certain EEG frequency bands and a substance, which is exemplified by documents A1 to 13, does not relieve the person skilled in the art of the unreasonable number of experiments to find the parameters of claim 1 for each of the hormones and neurotransmitters included in the claimed method.
- 3.4 Hence, claim 1 of auxiliary requests 2 and 3 does not disclose the claimed invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 83 EPC).
4. Auxiliary request 4a - admittance
- 4.1 The appellant filed auxiliary request 4a during the oral proceedings before the Board.

Pursuant to Article 13(2) RPBA, any amendment to a party's appeal case made at this stage of proceedings will, in principle, not be taken into account unless there are exceptional circumstances, which have been

justified with cogent reasons by the party concerned.

The appellant did not put forward any cogent reasons justifying exceptional circumstances. Moreover, the Board disagrees with the appellant's argument that the amended auxiliary request was clearly allowable and thus conducive to procedural economy.

- 4.2 Claim 1 of auxiliary request 4a differs from that of the main request in that the substance of which the level is predicted is selected from any one of cortisol, testosterone, progesterone and oestrogen.
- 4.3 The amendments made in this request do not *prima facie* overcome the objection to sufficiency of disclosure, since the application does not *prima facie* contain an enabling disclosure for the substances testosterone, progesterone and oestrogen. For each of these hormones, the above-mentioned research programme involving a considerable amount of trial and error would have to be conducted.
- 4.4 The appellant referred to documents A3, A6, A8 and A10 and pointed out that A6, which discussed the effect of testosterone on the beta-delta frequency bands, was mentioned on page 2, lines 10 to 15, of the description of the application. However, none of these documents includes sufficient information to *prima facie* relieve the person skilled in the art of the unreasonable number of experiments which must be conducted to find the required parameters.
- 4.5 Furthermore, the appellant did not demonstrate that there were exceptional circumstances justifying the filing of this request at such a late stage of the

proceedings.

4.6 Consequently, the Board exercises its discretion under Article 13(2) RPBA not to admit auxiliary request 4a into the appeal proceedings.

5. Auxiliary request 4b

5.1 In claim 1 of this request, also filed during the oral proceedings before the Board, the substance has been limited to cortisol. Claim 1 is thus limited to a specific substance which was already considered in the decision under appeal and in the Board's communication of 10 May 2024. The amendment does not therefore introduce any new issues following said communication. Moreover, it *prima facie* meets the requirements of Articles 83 and 53(c) EPC. Hence, taking into account the *ex parte* nature of the present appeal proceedings, the Board decides to admit it into the proceedings.

5.2 The method to predict the level of cortisol from EEG data according to claim 1 has been sufficiently disclosed in the description of the application, which explains the frequency bands that can be used and how they can be combined (page 12 and table 1), together with a procedure to obtain the constants b and C (page 15). Thus, the requirements of Article 83 EPC are met.

5.3 Due to the deletion of claims 7 and 8, auxiliary request 4b also overcomes the objection pursuant to Article 53(c) EPC raised by the Examining Division. Moreover, the claims of auxiliary request 4b meet the requirements of Article 84 EPC because they are clear and supported by the description.

6. Remittal to the Examining Division

There are no further grounds for refusal left for the Board to review on appeal.

The Examining Division did not assess novelty and inventive step in its decision.

In view of the primary object of the appeal proceedings to review the decision under appeal in a judicial manner (Article 12(2) RPBA), there are special reasons within the meaning of Article 11 RPBA for remitting the case to the Examining Division for further prosecution under Article 111(1) EPC.

7. Request for reimbursement of the appeal fee

7.1 According to Rule 103(1)(a) EPC the reimbursement of the appeal fee is ordered if such reimbursement is equitable by reason of a substantial procedural violation. A substantial procedural violation is an objective deficiency in the procedure before the department of first instance, not in the application of substantive law by that department.

7.2 The appellant's request for reimbursement of the appeal fee is based on the allegation that the Examining Division had misinterpreted (and misquoted) the application and had taken the decision under appeal without considering all the evidence on file. However, the alleged misinterpretation of the application concerns a (possible) error of judgment rather than a deficiency in the conduct of the procedure and therefore does not constitute a "procedural" violation, let alone a substantial one. The same is true for the alleged deviation from the guidelines in regard to

whether a surgical step was part of the method claimed in dependent claims 7 and 8, and the allegedly inappropriate use of the phrase "doubtful expectation of success" in the context of sufficiency of disclosure. As to the alleged failure to consider all the information on file, the Board notes that the decision under appeal addresses in detail the arguments made by the appellant, together with the evidence provided in support of said arguments (pages 8 to 10) and the information in the application in table 1 and in relation to testosterone (page 7, first full paragraph). The correctness of the conclusions drawn by the Examining Division on the basis of said evidence is again a matter of judgement in the application of substantive law, which cannot constitute a procedural violation.

Hence, the issues raised by the appellant do not justify reimbursement of the appeal fee.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Examining Division for further prosecution.
3. The request for reimbursement of the appeal fee is refused.

The Registrar:

The Chairman:



A. Chavinier-Tomsic

M. Alvazzi Delfrate

Decision electronically authenticated