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Datasheet for the decision of 17 July 2014

Case Number: T 2398/09 - 3.4.01

Application Number: 03253825.8

Publication Number: 1374948

IPC: A61N1/378, H03J3/20

Language of the proceedings: EN

Title of invention:
System and method for automatic tuning of a magnetic field generator

Applicant:
Alfred E. Mann Foundation for Scientific Research

Headword:

Relevant legal provisions:
EPC Art. 52(1), 123(2)
EPC 1973 Art. 56, 113(1)

Keyword:
Inventive step - main request, second and third auxiliary requests (no)
Intermediate generalisation
Right to be heard - non-attendance at oral proceedings

Decisions cited:
T 1704/06

Catchword:

Beschwerdekammern
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Case Number: T 2398/09 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 17 July 2014

Appellant: (Applicant)	Alfred E. Mann Foundation for Scientific Research P.O. Box 905 Santa Clarita, CA 91380-9005 (US)
Representative:	Paget, Hugh Charles Edward Mewburn Ellis LLP 33 Gutter Lane London EC2V 8AS (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 14 July 2009 refusing European patent application No. 03253825.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	H. Wolfrum
Members:	F. Neumann
	J. Geschwind

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division to refuse European patent application number 03 253 825.8. The application was refused for a lack of novelty of the independent claims of the main request on file at that time. None of the auxiliary requests were admitted into the proceedings.

II. With the statement setting out the grounds of appeal the appellant filed four sets of claims forming the basis of a main request and first to third auxiliary requests. Arguments were presented as to why the objections of the examining division no longer applied. As a precaution, oral proceedings were requested.

III. On 17 February 2014 the Board issued a summons to oral proceedings and in a communication of 27 February 2014, outlined the issues to be discussed. Reference was made in this communication to the prior art discussed in the introductory portion of the present application and to *inter alia* the following documents:

D1: US-A-5 630 836;
D8: US-A-5 193 539.

The Board indicated that claim 1 on file at that time appeared to lack novelty. Moreover, the Board suggested that even if claim 1 were to be adapted to include the features which the appellant relied upon in his arguments, it appeared unlikely that such subject-matter would be considered inventive.

IV. With letter of 17 June 2014, the appellant requested that the contested decision be set aside and that a patent be granted on the basis of a set of claims 1 to

27 filed as a main request or, alternatively, on the basis of one of the sets of claims 1-28 filed as auxiliary requests 1-3, all sets of claims being filed with the same letter of 17 June 2014. It was also requested that, should the apparatus claims of any one request be found to be allowable but not the method claims, or vice versa, an opportunity be given to submit replacement requests that contain claims directed to only the allowable apparatus/method.

V. With letter of 10 July 2014 the appellant notified the Board that he would not attend the oral proceedings. The appellant indicated that he would be prepared to accept any of the requests on file and requested the opportunity to file replacement description pages should any of the claim sets be found to be allowable.

VI. Oral proceedings were held on 17 July 2014 in the absence of the appellant.

VII. **Claim 1 of the main request** reads as follows:

"*A magnetic field generator including a tuning system (10) magnetic field generatorcomprising* [sic]*:*

a tuned circuit (16) comprising a magnetic field generating inductor (14) formed on a flexible support and a capacitor (15), the inductance value of the inductor (14) and the capacitance value of the capacitor (16) establishing a resonant frequency of the tuned circuit (16), wherein changes in the shape of said inductor (14) cause an associated change in the inductance value of the inductor (14) and therefore an associated change in the resonant frequency of the tuned circuit,

power means (18) for delivering power to the tuned circuit (16) at a reference frequency, whereby the

power delivered by the power means (18) is a function of the resonant frequency of the tuned circuit(16); and

means arranged to automatically adust the resonant frequency of the tuned circuit (16) so that it equals the reference frequency, to continually and adaptively compensate for changes in the shape of the inductor (14), in order to maximise the power transferred from the power means (18) to the tuned circuit (16) and thereby to maximise the magnetic field strength of the magnetic field produced by the inductor (14)."

Claims 2 to 18 are dependent on claim 1.

Claim 19 of the main request reads as follows:

"*A method of tuning a tuned circuit (16) in a magnetic field generator, the tuned circuit (16) comprising:*

a magnetic field generating inductor (14) formed on a flexible support; and

an adjustable capacitor (15); wherein

the values of the inductor (14) and the adjustable capacitor (16) establish a resonant frequency of the tuned circuit;

the magnetic field generator includes a power amplifier (18) having an output (21) coupled to and adapted to deliver power to the tuned circuit (16) at a preselected reference frequency;

wherein changes in the shape of said inductor (14) during use cause an associated change in the inductance value of the inductor (14) and therefore an associated change in the resonant frequency of the tuned circuit; and

the method comprises the steps of:

(1) measuring a parameter related to the power delivered to the tuned circuit (16);

(2) automatically adjusting the resonant frequency of the tuned circuit (16), to continually and adaptively compensate for changes in the shape of the inductor (14),; [sic] *and*

(3) maintaining the resonant frequency of the tuned circuit (16) at a value equal to the reference frequency."

Claims 20 to 27 are dependent on claim 19.

Claim 1 of the first auxiliary request reads as follows:

"*A magnetic field generator including a tuning system (10), the magnetic field generator (10) comprising:*

a tuned circuit (16) comprising a magnetic field generating inductor (14) formed on a flexible support and a capacitor (15), the inductance value of the inductor (14) and the capacitance value of the capacitor (16) establishing a resonant frequency of the tuned circuit (16), wherein changes in the shape of said inductor (14) cause an associated change in the inductance value of the inductor (14) and therefore an associated change in the resonant frequency of the tuned circuit,

power means (18) for delivering power to the tuned circuit (16) at a reference frequency, whereby the power delivered by the power means (18) is a function of the resonant frequency of the tuned circuit (16);

means to undertake periodic tests to monitor the power delivered to determine whether the current delivered to the power supply is less than 80% of an initially determined and stored maximum current; and

means arranged to automatically adust the resonant frequency of the tuned circuit (16) if the means to

undertake periodic tests determines that the current delivered to the power supply is less than 80% of the stored maximum current so that the resonant frequency equals the reference frequency, to continually and adaptively compensate for changes in the shape of the inductor (14), in order to maximise the power transferred from the power means (18) to the tuned circuit (16) and thereby to maximise the magnetic field strength of the magnetic field produced by the inductor (14)."

Independent **claim 19 of the first auxiliary request** is identical to claim 19 of main request, with the exception that step (1) specifies "*periodically measuring a parameter ...*".

Claims 2 to 18 and 28 are dependent on claim 1. Claims 20 to 27 are dependent on claim 19.

Claim 1 of the second auxiliary request is identical to claim 1 of the main request, with the exception that the introductory portion reads:

"*A magnetic field generator including a tuning system (10) for the control of one or more implanted microdevices, the magnetic field generator (10) comprising:*".

The wording of independent **claim 19 of the second auxiliary request** is identical to claim 19 of the main request, with the exception that the introductory portion reads:

"*A method of tuning a tuned circuit (16) in a magnetic field generator for the control of one or more*

implanted microdevices, the tuned circuit (16) comprising:".

Claims 2 to 18 and 28 are dependent on claim 1 and claims 20 to 27 are dependent on claim 19.

Claim 1 of the third auxiliary request is identical to claim 1 of the main request, with the exception that the introductory portion reads:

"*A control unit for implanted microdevices, the control unit comprising a magnetic field generator having a tuning system (10), the tuning system (10) comprising:*".

The wording of independent **claim 19 of the third auxiliary request** is identical to claim 19 of the main request, with the exception that the introductory portion reads:

"*A method of tuning a tuned circuit (16) in a magnetic field generator of a control unit for implanted microdevices, the tuned circuit (16) comprising:".*

Claims 2 to 18 and 28 are dependent on claim 1 and claims 20 to 27 are dependent on claim 19.

VIII. The arguments of the appellant, insofar as they are pertinent to the present decision, are set out below in the reasons for the decision.

Reasons for the Decision

1. The appeal is admissible.

2. Main request

2.1 Claim 1 is directed to a magnetic field generator comprising a tuned circuit made up of an inductor and a capacitor and a power means for delivering power to the tuned circuit, a magnetic field being generated by the inductor when it is energised.

2.2 The closest prior art is represented by document D8 which concerns a microstimulator designed to be implanted into the human body. The implanted microstimulator receives both energy and control information from a modulated, alternating magnetic field (see the abstract and column 2, lines 34-65). This alternating magnetic field is produced by a magnetic field generator which is located outside the body (see Figure 1; column 4, lines 20-31). The magnetic field generator comprises a tuned circuit made up of a magnetic field generating inductor 1 and associated capacitors (column 4, lines 37-41). The inductance value of the inductor and the capacitance value of the capacitor(s) establish a resonant frequency of the tuned circuit (column 4, lines 37-41). The magnetic field generator of D8 also comprises a power means for delivering power to the tuned circuit at a reference frequency (column 4, lines 58-63). It is textbook physics that the power delivered by the power means will be a function of the resonant frequency of the tuned circuit.

D8 does not explicitly disclose that the inductor 1 is formed on a flexible substrate. Nevertheless, the Board considers this to be implied in view of the fact that the coil of Figure 1, which at least partially encompasses a limb or body part, may be a pancake type coil disposed on the surface of the skin (column 4, lines 53-56). Figure 1 illustrates how this inductor

coil may be wrapped around the arm of a patient. Due to the fact that the inductance value of a conducting coil depends on the geometrical parameters of the coil, any changes in the shape of the inductor will cause an associated change in the inductance value thereof and therefore an associated change in the resonant frequency of the tuned circuit.

The Board notes that D8 is not acknowledged in the present application, but in the section entitled "Background of the Invention" a known magnetic field generator is discussed which corresponds to the above-described generator of D8. In particular, explicit reference is made to the flexibility of the substrate on which the inductor is formed (page 2, last line to page 3, line 9 of the application as originally filed).

2.3 The magnetic field generator of claim 1 is distinguished from the magnetic field generator of D8 in that means are arranged to continually and adaptively compensate for changes in the shape of the inductor by automatically adjusting the resonant frequency of the tuned circuit so that it equals the frequency at which power is delivered to the tuned circuit.

2.4 The technical effect of this difference is that the power transferred from the power means to the tuned circuit is maximised and consequently the magnetic field strength of the magnetic field produced by the inductor is maximised.

The Board notes that these effects - which are set out in claim 1 - are the inevitable consequences of the claimed automatic adjustment of the resonant frequency

of the tuned circuit and, as such, do not serve to further limit the claimed subject-matter.

2.5 Starting from the magnetic field generator of D8, it may be seen that the objective technical problem to be solved is the provision of a means to maintain maximum power coupling even when the flexible inductor changes shape during use.

2.6 Although the available prior art contains no specific guidance to adjust the resonant frequency of the tuned circuit in response to changes in the inductance value of the coil, it can be seen from document D8 that an effort is made to match the resonant frequency of the tuned circuit to the frequency of the power signal applied thereto. Specifically, D8 mentions that if the tuned circuit is tuned to resonate at the frequency of the resultant alternating magnetic field, which of course reflects the frequency of the signal applied to the tuned circuit, then "*little power would be lost in the transmission process*" (column 4, lines 37-41).

Document D1 also discloses a transcutaneous energy and information transmission system (Abstract; Figures 1 and 2 and the corresponding portions of the description) which comprises an externally-located primary coil which can be inductively coupled to a secondary coil contained in the implanted device. D1 makes clear at column 5, lines 46-51 that "*[t]he frequency of the alternating voltage is chosen to be substantially at the resonant frequency of primary tuned circuit*". This frequency matching ensures maximum power transfer from the power supply to the tuned circuit and hence maximum magnetic field strength generated at the inductor.

These teachings reflect the general knowledge of the skilled person that maximum power transfer between the power supply and the tuned circuit occurs when the resonant frequency of the tuned circuit is matched to the frequency of the signal applied to the tuned circuit.

The skilled person would therefore understand that an attempt should be made to maintain the resonant frequency of the tuned circuit at the frequency value of the alternating power signal.

2.7 As noted above, it is an inherent property of flexible inductors that any change in the shape of the inductor will cause a change in the inductance value thereof. The skilled person would therefore know that when the flexible inductor described in D8 is applied to a contoured body part, the inductance value, and hence the resonant frequency of the tuned circuit of which the inductor is a part, will change. The same holds true when movement of the body part to which the inductor is applied causes the inductor to flex.

In an attempt to maintain maximum power coupling, it would be obvious to the skilled person that any change in inductance brought about by the deformation of the inductor should be compensated for by a counter-adjustment of the resonant frequency of the tuned circuit so as to maintain the resonant frequency at the same frequency as the signal applied from the power source. In situations in which a continuous change in inductance is to be expected (as is the case when a flexible inductor is applied to a moving body part), the Board is of the opinion that the skilled person would consider automating the adjustment process so as to be able to react appropriately to continuous changes

in the inductance of the flexible inductor. No inventive step can be seen in the decision to automate this adjustment.

2.8 The appellant considered that the multiple steps leading from the closest prior art to the claimed subject-matter each required hindsight of the invention, and that this, in itself, was indicative of an inventive step. Moreover, the appellant argued that the prior art contained no teaching which would guide the skilled person to automatically adjust the tuned circuit. In particular, the appellant argued that the skilled person would not recognise that a deterioration in the power coupling might result from placing the flexible inductor on a non-flat surface. In view of this, the appellant considered that the claimed subject matter could not be considered obvious.

2.9 The Board cannot agree with the appellant that the skilled person would not recognise that the flexing of the inductor would lead to a deterioration in the power coupling. Although the prior art does not address this problem, it is common knowledge that the inductance value of a conducting coil depends on the geometrical parameters of the coil. Any changes in the effective dimensions of the coil, as will be the case when the loop is flexed, will therefore lead to a change in the inductance value thereof. This change in inductance value will lead to a change in the resonant frequency of the tuned circuit. Since this change causes a mis-match between the resonant frequency of the tuned circuit and the frequency of the power source, the power coupling will deteriorate. This is all text book physics and belongs to the general knowledge of the skilled person. In view of these basic facts, it is obvious that the resonant frequency of the tuned

circuit must be adjusted to compensate for changes in the shape of the inductor in order to maintain maximum power coupling. The only feature of claim 1 which goes beyond a straightforward deductive process is the provision of a means arranged to **automatically** adjust the resonant frequency of the tuned circuit. As argued above, an automatic adjustment would be obvious in view of the fact that the inductance value changes continuously when the inductor is applied to a moving body part.

2.10 The subject-matter of claim 1 therefore derives from the magnetic field generator of D8 in an obvious manner and cannot be considered as comprising an inventive step (Article 52(1) EPC, Article 56 EPC 1973).

3. First auxiliary request

3.1 Having regard to claim 1 of the first auxiliary request, the Board notes that the "*means to undertake periodic tests*" and the "*means arranged to automatically adjust the resonant frequency*" are an intermediate generalisation of the detailed description of the testing and adjustment means given on pages 16 to 17 and 23 to 25 of the originally filed application. Here, a microcontroller (not just an unspecified "*means*") is arranged to monitor whether the current supplied to the power amplifier lies below (preferably) 80% of an initially determined and stored maximum current (page 16, last paragraph; page 23, second paragraph). If this is the case, the microcontroller performs a switching through a capacitor bank, causing the capacitance to be varied in a stepwise manner throughout a specified range of values, whilst monitoring the value of the power amplifier current at each capacitor setting. If any of the switch settings

gives rise to a power amplifier current above 80% of the stored maximum value, the microcontroller sets the capacitance value accordingly (page 16, last paragraph to page 17, second paragraph; page 24, last paragraph to page 25, second paragraph). On page 26, a further embodiment is described in which, in addition to the stepwise capacitance changes, the inductance is also changed in a stepwise manner with the same aim of determining which of the switch settings gives rise to a power amplifier current above 80% of the stored maximum value (page 26, second paragraph).

In each of these embodiments, the microcontroller is not only arranged to undertake periodic tests to monitor the current delivered to the power amplifier and to automatically adjust the resonant frequency of the tuned circuit to the reference frequency (as currently defined in claim 1), but, as part of the automatic adjustment, is also arranged to perform a further well-defined testing procedure in which the power amplifier current at various capacitor settings is monitored in order to establish which capacitor setting gives rise to a power amplifier current above the predetermined threshold of 80% of the stored maximum current. These features have been omitted from claim 1 of the first auxiliary request. The Board has found no disclosure in the originally filed application documents of any other types of testing and adjustment procedures which would provide a basis for the generalisation now appearing in claim 1 of the first auxiliary request. By virtue of the fact that the generalised wording now encompasses adjustment procedures which were not originally disclosed, this amendment infringes Article 123(2) EPC.

4. Second and third auxiliary requests

4.1 Claim 1 of the second auxiliary request includes reference to the fact that the tuning system of the magnetic field generator is "*for the control of one or more implanted microdevices*". Apart from this modification, the wording of claim 1 of the second auxiliary request is identical to the wording of claim 1 of the main request.

Claim 1 of the third auxiliary request defines "*A control unit for implanted microdevices, the control unit comprising a magnetic field generator having a tuning system*", the tuning system being defined as comprising all of the features of the magnetic field generator appearing in claim 1 of the main request.

4.2 In view of the prior art disclosed in D8, the reasoning presented with regard to claim 1 of the main request applies equally to claim 1 of each of the second and third auxiliary requests. In particular, the magnetic field generator discussed D8 is disclosed as being for the provision of control information to implanted microstimulators (column 2, lines 54-56). The Board fails to see how the introductory wording of claim 1 of either of the second or third auxiliary requests is distinguished from this known prior art.

4.3 Neither claim 1 of the second auxiliary request nor claim 1 of the third auxiliary request may therefore be considered to comprise an inventive step (Article 52(1) EPC, Article 56 EPC).

5. In view of the above findings, none of the requests is allowable.

6. The method claims

6.1 For the sake of completeness it is added that independent method claim 19 of none of the requests may be considered as comprising an inventive step for reasons corresponding essentially to the reasons set out above for the independent apparatus claims of the main request and second and third auxiliary requests.

6.2 The independent method claims merely define the steps involved in the automatic tuning of a tuned circuit. In view of the above conclusion that it would be obvious to provide means to automatically adjust the resonant frequency of the tuned circuit in the magnetic field generator of D8 in order to maintain the resonant frequency at a value equal to the frequency of the signal applied from the power source, the definition of a corresponding method for doing so must also be seen as obvious. The fact that claim 19 of all requests includes a step in which a parameter related to the power delivered to the tuned circuit is (periodically) measured does not change this finding. The monitoring of a parameter related to the power coupling is an obvious measure to determine when an adjustment of the resonant frequency is required.

6.3 Although D8 does not explicitly mention that the magnetic field generator disclosed therein comprises an **adjustable** capacitor and a power amplifier, as is defined in claim 19 of each request, these details are considered to be of such trivial nature that their inclusion cannot be considered as contributing to an inventive step.

6.4 Thus, the condition under which the appellant requested to be given the opportunity to file a request

containing just the (allowable) method claims has not arisen.

7. Right to be heard

It is established case law that, in the situation in which the appellant submits new claims after oral proceedings have been arranged but does not attend those proceedings, the Board can refuse the new claims for substantive reasons, even if the claims have not been discussed before. This is particularly the case if an examination of these substantive reasons is to be expected in the light of the prevailing legal and factual situation (see, e.g., T1704/06).

In the present case, it was clear from the Board's communication of 27 February 2014 that novelty and inventive step would be discussed at the oral proceedings. The Board's observations in that communication with regard to novelty and inventive step were made on the basis of the claims which were on file at that time. D8 was mentioned in that communication but it was only during the oral proceedings, when the amended claims were being assessed, that D8 was actually identified as the closest prior art.

Nevertheless, by absenting himself from the oral proceedings, the appellant effectively chose not to take the opportunity to orally present observations and counter-arguments with respect to the objections raised by the Board against the new claims. In such cases, the right to be heard is not infringed since the appellant indeed had the opportunity to attend the oral proceedings and to address the concerns of the Board (Article 113(1) EPC 1973). In such cases the appellant is treated as relying only on its written case (see

Article 15(3) of the Rules of Procedure of the Boards of Appeal).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

R. Schumacher H. Wolfrum

Decision electronically authenticated