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**Datasheet for the decision
of 22 January 2008**

Case Number: T 0195/06 - 3.4.01
Application Number: 94928687.6
Publication Number: 0694171
IPC: G01S 13/02, H04B 1/69
G01S 13/56

Language of the proceedings: EN

Title of invention:
Ultra-wideband radar motion sensor

Patentee:
The Regents of the University of California

Opponent:
Delphi Technologies, Inc.

Headword:

-

Relevant legal provisions:
EPC Art. 123(2), 123(3)
RPBA Art. 13(1), 13(3) (OJ EPO 2007, 536)

Relevant legal provisions (EPC 1973):

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Keyword:
"Added subject-matter resulting from deletion of features and replacement of features (yes)"
"Extension of protection (yes)"
"New requests filed during oral proceedings (not admitted)"

Decisions cited:

-

Catchword:

-



Case Number: T 0195/06 - 3.4.01

D E C I S I O N
of the Technical Board of Appeal 3.4.01
of 22 January 2008

Appellant: The Regents of the University of California
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 16 December 2005
revoking European patent No. 0694171 pursuant
to Article 102(1) EPC 1973.

Composition of the Board:

Chairman: G. Assi
Members: P. Fontenay
J.-P. Seitz

Summary of Facts and Submissions

- I. The appeal lies from the decision of the Opposition Division to revoke the European patent EP-B-694171. The decision was notified on 16 December 2005.
- II. The appellant (the patentee) filed an appeal against said decision by letter dated 3 February 2006 and paid the prescribed appeal fee on the same day. A written statement setting out the grounds of appeal was received on 21 April 2006.
- III. The appellant requested that the impugned decision be set aside and the European patent be maintained in amended form according to a main request or one of auxiliary requests I to VI, filed by facsimile on 20 December 2007 as a reaction to a communication of the Board of Appeal issued under Article 11(1) RPBA (OJ EPO 2004, 541). The appellant further requested, in the event that the Board would intend to remand the case back to the Opposition Division, that all requests acceptable under Articles 123(2) and 123(3) EPC be remanded.
- IV. Oral proceedings before the Board of Appeal took place on 22 January 2008. At the beginning of the oral proceedings, the appellant announced that it wished to have the main request and the two auxiliary requests I and II amended. Copies of these new amended requests were submitted.
- V. The respondent (the opponent) requested that the appeal be dismissed, that the amended versions of the main request and auxiliary requests I and II filed during

oral proceedings be rejected as late filed and, in the case that the Board would come to the conclusion that a request meets the requirements of Article 123(2),(3) EPC, that the case be remitted to the first instance for further prosecution.

VI Claim 1 of the granted patent reads as follows:
*"A method of using ultra-wide band (UWB) radar pulses, comprising the steps of:
transmitting said UWB radar pulses; and
receiving and processing reflected UWB radar pulses by detecting said reflected UWB radar pulses from a predetermined range and by producing a baseband detection output signal indicative of a plurality of said detected pulses,
characterized in that said method further comprises the steps of:
integrating said baseband detection output signal, thereby producing a baseband average output signal corresponding to an average of said plurality of said detected pulses; and
differentiating baseband average output signals produced at different times, thereby detecting motion."*

Claim 1 according to the main request differs from claim 1 of the granted patent essentially in that:
i) the expression "indicative of a plurality of said detected pulses" associated to the production of a baseband detection output signal has been deleted;
ii) the method further recites that "the step of detecting said reflected UWB radar pulses comprises a step of holding a plurality of said reflected UWB radar pulses over a sampling period" and in that

iii) the reference in the integrating step to "said plurality of said detected pulses" has been replaced by "said plurality of said reflected pulses".

Claim 1 according to auxiliary request I differs from claim 1 of the main request in that it specifies that the step of receiving and processing reflected UWB radar pulses applies to pulses caused by antenna ringdown.

According to auxiliary request II claim 1 further specifies that the receiving and processing step applies to pulses caused by antenna ringdown having ringing with a periodicity and includes the additional step of "generating an outer detection shell corresponding to a leading pulse of the antenna ringdown and successive inner detection shells located by the periodicity of the ringing".

Claim 1 according to auxiliary request III differs from claim 1 according to auxiliary request II in that the limitation identified above under item (ii) according to which the step of detecting said reflected UWB radar pulses comprises a step of holding a plurality of said reflected UWB radar pulses over a sampling period, has been deleted.

Claim 1 according to auxiliary request IV differs from claim 1 of the granted patent essentially in that:
iv) the expression "indicative of a plurality of said detected pulses" associated to the production of a baseband detection output signal has been replaced by the expression: "indicative of a plurality of said pulses";

- v) the method recites that "the step of producing the detection output signal comprises a step of integrating said reflected UWB radar pulses, said detection output signal corresponding to an average of said plurality of said reflected pulses" and in that
- vi) the baseband average output signal corresponds to "a further average of said plurality of said reflected pulses".

In addition to the differences identified under points (iv) and (v) above, claim 1 according to auxiliary request V differs from claim 1 of the granted patent in that the baseband average output signal corresponds to "an average of said baseband detection output signal" whereas granted claim 1 specifies that the baseband average output signal corresponds to "an average of said plurality of said detected pulses".

Claim 1 according to auxiliary request VI differs from claim 1 of the granted patent by the differences identified above under items (i) and (iii) in relation with claim 1 of the main request.

All requests include a second independent claim 2 as to an alternative method differing from the method of claim 1 essentially in that the order of the integrating and differentiating steps have been reversed. All the requests include a plurality of dependent claims dependent on both independent claims 1 and 2.

VII The amended main and auxiliary requests I and II filed at the beginning of the oral proceedings differ from the main and auxiliary requests I and II filed on

20 December 2007 in that the step "of holding a plurality of said reflected UWB radar pulses over a sampling period" in independent claims 1 and 2 of the three requests has been amended to a step "of holding each pulse of a plurality of said reflected UWB radar pulses until a successive sampling".

Reasons for the Decision

1. The appeal is admissible.
2. *Admissibility of the new requests filed during oral proceedings*
 - 2.1 The appellant requested the Board to admit the new main and auxiliary requests I and II stressing that the requests were only reflecting minor amendments made to the corresponding requests filed on 20 December 2007. Particular emphasis was put on the fact that the amendments were the same for all three requests, merely addressing clarity issues and, thus, did not affect the claimed subject-matter as such.
 - 2.2 However, as put forward by the respondent, the step of "holding a plurality of said reflected UWB radar pulses over a sampling period" is not equivalent to the modified step "of holding **each pulse of** a plurality of said reflected UWB radar pulses **until a successive sampling**". The new wording refers to an alternative holding process and cannot be considered as a mere clarification of the subject-matter claimed in relation with the main and auxiliary requests I and II as filed on 20 December 2007. In fact, the expression "holding a

plurality of reflected UWB radar pulses" implies that some of the reflected pulses are held over a sampling period whereas the amendment recites that one single pulse is held over a sampling period.

Moreover, it results from the file that the position defended by the appellant so far consisted precisely in that the step of holding did apply to a plurality of pulses and was followed by a step of integrating the baseband detection output signal. This view developed before the first instance department was later reiterated in the notice setting out the grounds of appeal. Evidence provided in the form of diagrams illustrating the waveform of the signals at various points of the circuit of Figure 4 of the patent in suit were filed in support of this argumentation.

The modified wording of the claims does not appear to be consistent with the analysis of the circuit of Figure 4 developed so far by the appellant and on which much emphasis has been put. As stressed by the respondent, this new line of argumentation would require that its strategy be revised which could only be achieved by discussing the issue with its client.

The amendments made to the independent claims of the three requests thus create *de facto* a fresh case.

- 2.3 Article 13(1) RPBA (OJ EPO 2007, 536) recites that:
"Any amendment to a party's case after it has filed its grounds of appeal or reply may be admitted and considered at the Board's discretion. The discretion shall be exercised in view of inter alia the complexity of the new subject matter submitted, the current state

of the proceedings and the need for procedural economy."

Article 13(1) RPBA, thus, allows the Board to exercise its discretion in favour of the appellant when admitting the main and auxiliary requests I to VI filed on 20 December 2007 as a reaction to the communication of the Board dated 25 September 2007. These requests were namely addressing comments and objections raised in this communication and were filed sufficiently in advance in order for the respondent and the Board to consider them.

However, the filing of the new main and auxiliary requests I and II by the appellant at the beginning of the oral proceedings confronted the respondent and the Board with a fresh case that needs to be carefully analyzed. Moreover, these late requests cannot be considered to constitute a reaction to submissions of the respondent since no such submissions had been made following the filing by the appellant on 20 December 2007 of its new requests.

In conclusion, the new requests create a fresh case which the Board or the respondent cannot reasonably be expected to deal with without adjournment of the oral proceedings.

- 2.4 Pursuant to Article 13(3) RPBA the requests filed during the oral proceedings as main and auxiliary requests I and II are rejected as inadmissible. According to the appellant's intention, the main and auxiliary requests I and II filed on 20 December 2006 remain on file.

3. *Main request*

3.1 The expression "indicative of a plurality of said detected pulses" associated in claim 1 of the granted patent to the production of a baseband detection output signal has been deleted in claim 1 according to the main request.

3.1.1 According to the patentee, this deletion would remain without consequences on the extent of protection conferred by the claim since the deleted information would still derive implicitly from the wording of claim 1 as amended. The feature of the baseband detection output signal should not be considered in isolation but read in the context of the entire claim. In particular, the step in the claimed method of "integrating said baseband detection output signal, thereby producing a baseband average output signal corresponding to an average of said plurality of said reflected pulses" would necessarily imply that the baseband detection output signal is indeed indicative of a plurality of said detected pulses.

3.1.2 At a first sight, since the integration step provides a result corresponding to an average of the plurality of the reflected pulses, it may indeed appear that this information should also be contained in the input signal, i.e. in the baseband detection output signal before integration. However, the claim wording merely implies that the average output signal "corresponds" to an average of the plurality of the reflected pulses. The question to be answered is therefore whether the expression "indicative of a plurality of said detected

pulses" with regard to the input of the integration step can be deleted because it can still be derived from the baseband average detection output signal corresponding to an average of the plurality of the reflected pulses. It is therefore indispensable to define the precise meaning of the term "indicative" as it appears in claim 1 of the granted patent.

3.1.3 In the context of claim 1 of the granted patent the term "indicative" implies that the occurrence of the various detected pulses would still be identifiable in the baseband detection output signal. This interpretation is confirmed by the present disclosure and in particular by the embodiment disclosed in relation with Figure 4. More specifically, the sample/hold stage of the circuit illustrated in Figure 4 generates an output signal at the junction C1, D1 (or C2, D2) which is the result of an holding phase, corresponding to capacitor C1 (or C2) charging according to a large time constant, followed by a short period during which the capacitor C1 (or C2) discharges according to a much smaller time constant (cf. paragraph [0039] of the description). Since the discharging periods are controlled by the application of a gate pulse applied at a predetermined repetition frequency (PRF), the baseband detection output signal defines a succession of raising portions interrupted at regular intervals, corresponding to the intervals separating the emitted pulses, by abruptly falling short signal portions which durations correspond to the duration of the gate pulses.

It follows that the feature in claim 1 of the granted patent that the baseband detection output signal is

indicative of a plurality of the detected pulses implies the possibility of identifying in the baseband detection output signal the successively received pulses. In other terms, the spectrum of said signal must have been sufficiently broad in order to permit the identification of the various detected pulses. The amended version of claim 1 would, however, also encompass baseband output signals of a narrower band which would not reflect the succession of detected pulses but merely correspond to one parameter of these pulses (e.g. their amplitude).

3.1.4 Consequently, the information according to which the baseband detection output signal is indicative of a plurality of the detected pulses does not implicitly derive from the wording of claim 1 according to the main request. It follows that the deletion of this feature leads to an extension of the claimed subject-matter contrary to the requirements of Article 123(3) EPC.

3.2 The feature in claim 1 of the main request according to which the step of detecting the reflected UWB radar pulses comprises a step of holding a plurality of the reflected UWB radar pulses over a sampling period is, according to the appellant, supported by the embodiment of Figure 4 in association with the example values of the circuit elements C1, C2, R1 and R2 referred to in the description.

Particular reference was also made to document US-A-5345471 incorporated by reference in the original PCT application from which the present patent originates. In the appellant's view, it resulted from a comparison

of the circuit disclosed in Figure 2B of US-A-5345471 with the circuit of Figure 4 of the patent in suit that US-A-5345471 was particularly relevant when analysing the behaviour of the circuit of Figure 4 of the patent in suit.

- 3.2.1 The Board notes that US-A-5345471, as a consequence of the deletion during the examination phase of the statement concerning the incorporation by reference, does not form part of the patent specification as such. However, its teaching may well constitute evidence illustrating specific aspects of the invention insofar that these aspects may indeed be directly derived from said teaching. These aspects may relate to effects achieved by the circuit or to its behaviour under specific conditions. The situation is different as regards the terminology used in US-A-5345471. In particular, the statements that capacitors C1 and C2 form signal integrators (cf. column 3, lines 57, 58) or that the waveform of Figure 3A approximates the integrated average of the difference between the gate pulse generator input and the signal input (cf. column 5, lines 10-12) are not sufficient to establish that an integrating or averaging process does indeed take place. Essential, in this respect, is whether the charging and discharging process taking place in C1 and C2 actually constitutes an integrating or averaging process, giving these terms the meaning they normally have in the field of electronic circuits, independently of the terminology actually used throughout US-A-5345471.

3.2.2 Concerning the values of the circuit elements indicated in the patent in suit, it is acknowledged, as put forward by the appellant, that a capacitor C1 (or C2) of 22 pF and a resistor R3 (or R4) of 10 MΩ gives a time constant ($R3 \cdot C1$) of 220 μs, substantially larger than the pulse repetition interval PRI of 1 μs. However, the Board cannot agree that the time constant defining the charging behaviour of capacitor C1 (or C2) during the periods following the application of the gate pulse, implies that the holding is actually performed over 220 pulses. This approach makes abstraction of the effects resulting from the application of the gate pulses which directly affects the amplitude of the signal at the junction C1, D1.

According to the appellant, the application of the gate pulse will lead to a partial discharge of the capacitor C1 (or C2), which is defined by a time constant ($R_t \cdot C1$ or $R_t \cdot C2$) of 1500 ps in the embodiment referred to above. The fact that this discharge would only be partial directly results from the short gate pulse width compared to the time constant of 1500 ps, as confirmed by the discussion of Figure 2B in US-A-5345471 (cf. column 3, lines 57-62).

However, the fact that the discharge of the capacitors C1 and C2 is only partial and that the low point of the signal following the application of the gate pulse would still have memory of the signal preceding said application is not sufficient to support the feature of holding a plurality of the reflected UWB radar pulses as recited in claim 1 of the main request.

The analysis put forward by the appellant could even be reversed. The fact that the discharge process is only partial also implies that the charge actually held by capacitors C1 and C2 during the holding periods represents a fraction only of the previously reflected radar pulses and not the reflected pulses as such as required by the present wording of claim 1.

3.2.3 The further evidence provided by the appellant in the form of Exhibit 1 reproducing the waveforms obtained at certain points of the circuit of Figure 4 of the patent in suit when realised in accordance with values of the circuit elements indicated in paragraph [0039] is not convincing since these signals refer to the initial charging process taking place in capacitors C1 and C2 and which result from the application of the BIAS potential.

3.2.4 It follows that the original patent application considered on its own or in combination with the later evidence submitted by the appellant and referring to the waveform appearing at the junction of C1 and D1 cannot support the feature that the step of detecting the reflected UWB radar pulses comprises a step of holding a plurality of the reflected UWB radar pulses over a sampling period. The corresponding amendments in claim 1 of the main request therefore contravene the requirements of Article 123(2) EPC.

3.3 The reference in the integrating step of claim 1 of the granted patent to "said plurality of said detected pulses" has been replaced in claim 1 of the main request by a reference to "said plurality of said reflected pulses".

3.3.1 The Board does not concur with the appellant's view when it argued that the terms "reflected" and "detected" would be equivalent when interpreted in the context of the claim. The step in claim 1 of "receiving and processing reflected UWB radar pulses by detecting said reflected UWB radar pulses from a predetermined range" defines the relationship which exists between these two types of pulses. In particular, this step establishes that the detection process applies to specific pulses, namely UWB radar pulses reflected from a predetermined range. This statement therefore implies that the detected pulses must indeed incorporate those signals which have been reflected from a predetermined range but does not imply that they incorporate these reflected signals only.

The embodiments of the invention show that this is just not the case. The opening of a sampling gate at a fixed adjustable delay after the emission of a transmit pulse permits the selection of a time window during which all the signals received by the antenna shall be sampled. While this configuration permits a precise determination of the periods during which signals should be sampled, it does not permit any discrimination between the various signals actually received by the antenna. In particular, all signals received by the antenna during the sampling period defined by the sampling gate and the adjustable delay shall be sampled and processed. These signals may thus also include, in addition to the signals reflected from a predetermined range, signals emitted by other sources or signals generated by the UWB radar source from other ranges; i.e. ranges for which the two-way time of

flight of the pulse would correspond to a multiple of the sampling delay. This is in particular true since the receiver antenna 38 and the receiver 40 (Figure 1) are UWB components which can detect signals over a broad spectrum encompassing hundreds of megaHertz.

It follows that the signals actually received and processed in accordance with the embodiments of the invention will not be limited to UWB pulses which have been reflected from a predetermined range but will include additional components. Thus, the detected signals and the signals reflected from a predetermined range cannot be considered as being equivalent as put forward by the appellant.

- 3.3.2 The indication in claim 1 that the baseband average output signal corresponds to an average of the plurality of the reflected pulses implies that the possible additional components of the detected pulses which do not pertain to the reflected pulses would have been filtered out of the detected pulses.

The original application documents, however, do not support this step of a further filtering of the detected signal. The amendment refers therefore to fresh subject-matter contrary to the requirements of Article 123(2) EPC.

- 3.4 To sum up, it is to be concluded that claim 1 of the main request is not allowable because:
- i) the deletion of the expression "indicative of a plurality of said detected pulses" associated in the version of claim 1 of the granted patent to the production of a baseband detection output signal leads

to an extension of the protection contrary to the requirements of Article 123(3) EPC;

ii) the further limitation recited in claim 1 that the "step of detecting said reflected UWB radar pulses comprises a step of holding a plurality of said reflected UWB radar pulses over a sampling period" has no support in the original application documents and is therefore contrary to the requirements of Article 123(2) EPC and

iii) the replacement in the integrating step of claim 1 of the granted patent of "said plurality of said detected pulses" by "said plurality of said reflected pulses" introduces fresh subject-matter and therefore contravenes the requirements of Article 123(2) EPC.

4. *Auxiliary requests I to IV and VI*

4.1 The objections which have been identified above in relation with claim 1 according to the main request also apply, at least partially, to claim 1 according to auxiliary requests I to IV and VI.

4.2 In particular, the extension of protection resulting from the deletion of the expression "indicative of a plurality of said detected pulses" also applies to claim 1 of auxiliary requests I to III and VI which therefore offend Article 123(3) EPC.

4.3 The objection raised under Article 123(2) EPC relating to the introduction in claim 1 of the main request of the feature according to which the "step of detecting said reflected UWB radar pulses comprises a step of holding a plurality of said reflected UWB radar pulses

over a sampling period" applies similarly to claim 1 of the auxiliary requests I and II.

4.4 Finally, the objection raised under Article 123(2) EPC and resulting from the replacement in claim 1 of the granted patent of the expression "said plurality of said detected pulses" by "said plurality of said reflected pulses" also applies to claim 1 of auxiliary requests I to IV and VI.

5. *Auxiliary request V*

5.1 As regards the introduction in claim 1 of the feature that "the step of producing the baseband detection output signal comprises a step of integrating said reflected UWB radar pulses, said detection output signal corresponding to an average of said plurality of said reflected pulses", the appellant refers to the passage in document US-A-5345471, column 5, lines 10-15 and more specifically to the statement according to which "Further averaging occurs in the differential amplifier".

In his view, since this passage referred indirectly to the circuit illustrated in Figure 2B in US-A-5345471, the comments relating to this circuit configuration should apply *mutatis mutandis* to the equivalent circuit disclosed in Figure 4 of the patent in suit.

5.2 While the Board agrees that the effects provided by the circuit of Figure 2B in US-A-4345471 would, in principle, also be provided by the circuit of Figure 4 in the patent in suit, at least insofar that the circuit configurations are indeed identical, it

observes that the use of a particular wording in order to define specific effects or behaviour of the circuit must correspond to these effects. In other words, the choice of the wording should reflect the reality when being given the meaning it has in the relevant art.

5.3 In the present situation the Board is not convinced that the use of the terms "average" or "averaging" in column 5, lines 10-15 of US-A-5345471 is indeed appropriate to define the waveform illustrated in Figure 3A in US-A-5345471. It appears therefore indispensable to refer to the actual behaviour of the circuit illustrated in Figure 4 of the patent in suit in order to decide whether the detection output signal indeed corresponds to an average of said plurality of said reflected pulses.

5.4 The Board notes, in this respect, that the original description does not contain any explicit support for the new step introduced in claim 1. The appellant, however, submits that the numerical values recited in paragraph [0039] of the patent specification, which concerned the various components to be used in the circuit, necessarily implied that an averaging step occurred before the signal was input to the integrator 46. Particular emphasis was again put on the fact that the lower point reached by the signal following the application of the gate pulse did not correspond to a full discharge of the capacitor C1 but rather had memory of the previous pulses. In particular, the appellant underlined that the time constant of 1500 ps which governed the discharge of the capacitor was quite large compared to a pulse width of the order of one ns

so that the information collected from previous reflected pulses was not lost.

The Board agrees that the time constants referred to by the appellant do not permit a complete discharge of the capacitors C1 and C2. However, this finding is not sufficient to establish that the signal at the junction C1, D1 would correspond to an average of the plurality of the reflected pulses.

5.5 Although the signal defined as "1st integrated response" in Exhibit 1, drawn up by the inventor of the present invention and produced by the appellant with its statements of grounds, indeed shows that a kind of integration is obtained at the junction C1, D1, the Board adheres to the view expressed by the respondent that this signal was the mere result of the charging process taking originally place in the capacitor C1 and resulting from the application of the BIAS potential.

5.6 Moreover, the reference in this added feature to "said reflected pulses" is also constituting added subject-matter for the reasons developed above under point 3.3 in relation with claim 1 of the main request.

5.7 The Board thus concludes that the introduction in claim 1 of the auxiliary request V of the additional feature that "the step of producing the baseband detection output signal comprises a step of integrating said reflected UWB radar pulses, said detection output signal corresponding to an average of said plurality of said reflected pulses" does not derive in a direct and unambiguous manner from the original disclosure. This

amendment therefore contravenes the requirements of
Article 123(2) EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar

The Chairman

R. Schumacher

G. Assi