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Case Number: T 0564/07 - 3.4.01

Application Number: 02786726.6

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IPC: G06K 19/067, G10K 11/36, H03B 5/32, H03H 9/25, G10S 13/02

Language of the proceedings: EN

Title of invention:
Surface acoustic wave identification tag having enhanced data content and methods of manufacture thereof

Applicant:
RF Saw Components, Incorporated

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 123(2)

Relevant legal provisions (EPC 1973):
EPC Art. 84, 83, 54, 56

Keyword:
-

Decisions cited:
T 0614/04

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0564/07 - 3.4.01

D E C I S I O N
of the Technical Board of Appeal 3.4.01
of 7 July 2009

Appellant: RF Saw Components, Incorporated
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 15 November 2006 refusing European application No. 02786726.6 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: B. Schachenmann
Members: P. Fontenay
F. Neumann

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division to refuse the European patent application No. 02 786 726.6. The decision was based on the grounds of lack of clarity under Article 84 EPC 1973 and lack of novelty under Article 54(1) and (2) EPC 1973. An objection of insufficient disclosure (Article 83 EPC 1973) was also raised in this decision, which was dispatched on 15 November 2006.

II. The appellant (applicant) lodged an appeal against this decision by a notice of appeal received by facsimile on 17 January 2007 and paid the prescribed appeal fee on the same day. The written statement setting out the grounds of appeal was filed in due time on Monday, 26 March 2007.

In the statement of grounds, the appellant requested that the impugned decision be reversed and the application be remitted to the first instance with the order to grant a patent on the basis of the claims on which the contested decision was based.

Oral proceedings were requested in case the Board contemplated taking an adverse decision.

III. A summons to attend oral proceedings scheduled to take place on 7 July 2009 was issued.

On 3 April 2009 the Board issued a communication pursuant to Article 15(1) Rules of Procedure of the Boards of Appeal (RPBA) expressing its provisional opinion with regard to the set of claims then on file.

The attention of the appellant was drawn, in particular, to the requirements of Article 84 EPC. In the Board's view, the obligation that the independent claims be comprehensible from a technical point of view and that they indicate all the essential features of the invention was not fulfilled. *Inter alia*, the definition in claim 1 that the location of each of the reflectors was determined by a combination of both pulse position and phase position appeared to be particularly unclear.

IV. With letter dated 8 June 2009, the appellant filed a new main request and five auxiliary requests taking into account the observations of the Board in its communication of 3 April 2009.

During the oral proceedings on 7 July 2009, the appellant filed a modified set of claims 1 to 19 as a main request. It was requested that the decision of the examining division be set aside and that a patent be granted on the basis of this new main request. Alternatively, it was requested that a patent be granted on the basis of the claims filed on 8 June 2009 as first to fifth auxiliary requests.

V. Independent claim 1 of the main request relates to a surface acoustic wave identification tag. Its wording reads as follows:

"1. A surface acoustic wave, SAW, identification tag (300), comprising:

a piezoelectric substrate (310) having a SAW transducer (315) located thereon for generating a

signal having a known frequency that travels down the substrate as a SAW;

a number of reflectors (320) located on the surface of the substrate, and arranged to reflect a portion of the SAW back to the transducer to encode a number,

wherein for the known frequency each reflector is positioned at one of predetermined allowable positions, each allowable position being associated with a predetermined time shift and phase, wherein the phase has a phase step relative to a phase associated with an adjacent allowable position, to enable discrimination of overlapping reflected portions of the SAW."

Independent claim 8 defines a method of manufacturing a surface acoustic wave identification tag. Its wording reads:

"8. A method of manufacturing a surface acoustic wave, SAW, identification tag, comprising:

forming a SAW transducer on a piezoelectric substrate for generating a signal that travels down the substrate as a SAW at a given frequency;

depositing reflectors on said substrate such that the location of said reflectors encode a number by reflecting a portion of the SAW back to the transducer; and

for the known frequency, positioning each reflector at one of predetermined allowable positions, each allowable position being associated with a predetermined time shift and phase, wherein the phase has a phase step relative to a phase associated with an adjacent allowable position, to enable discrimination of overlapping reflected portions of the SAW."

Claims 2 to 6 and 9 to 19 depend, respectively, on independent claims 1 and 8.

Dependent claim 7 is directed to an object in combination with the identification tag of claim 1.

VI. The following documents are of importance for the present decision:

D1: DE-A-196 22 154;
D2: US-A-6 121 892;
D4: US-B-6 208 062;
D5: W.-E. Bulst et al., "State of the Art in Wireless Sensing with Surface Acoustic Waves", Siemens AG, Munich, Industrial Electronics Society, 1998, IECON '98. Proceedings of the 24th Annual Conference of the IEEE, Aachen, Germany, 31 Aug.-4 Sept. 1998, pages 2391-2396.

VII. In the context of this decision, reference is made to the provisions of the EPC 2000, which entered into force as of 13 December 2007, unless the former provisions of the EPC 1973 still apply to pending applications. In this latter case, the citation of Articles or Rules is followed by the indication "1973" (cf. EPC, page 4, "citation practice").

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 EPC 1973 and Rule 64 EPC 1973. It is, thus, admissible.

2. *Main request - Amendments*

In the following, all references to the original disclosure apply to the published PCT application WO-A-03/052682.

2.1 Claim 1 of the main request differs from claim 1 as originally filed, firstly, in that the claim specifies that the SAW transducer is for generating a signal having a known frequency that travels down the substrate as a SAW and in that the reflectors are arranged to reflect a portion of the SAW back to the transducer. Secondly, the concept of "slots arranged on the substrate by pulse position and phase position" has been abandoned and replaced in new claim 1 by the reference to "allowable positions". Thirdly, said allowable positions are defined with regard to the known frequency generated by the transducer and the relationship existing between adjacent positions. Finally, the claim has been further amended by specifying the technical effect obtained by the claimed configuration, namely the ability to discriminate overlapping reflected portions of the SAW.

2.2 The amendment concerning the signal generated by the transducer is directly derivable from the indication on page 17, lines 15-20, of the published application according to which "*When the transducer 315 is electrically connected to a means for obtaining an interrogation signal from a reader (e.g. via an antenna), a signal having a known frequency and amplitude is generated that travels down the substrate 310 as a surface acoustic wave or SAW*". The Board holds,

in this respect, that the absence of reference to the known amplitude in the claim is allowable, since this parameter is not, as such, essential for the invention.

The indication in the passage bridging pages 17 and 18 supports the mention of the reflectors being arranged to reflect a portion of the SAW back to the transducer.

2.3 The definitions of the term "slot" derivable from the original application are not consistent. On the one hand the term "slot" is used to define certain locations on the substrate among which the reflectors are to be distributed (cf. page 21, lines 3-16; page 27, lines 14, 15). On the other hand, the reference to "time lengths" (cf. page 21, lines 22-24; page 22, lines 27-31; page 24, lines 21-24) suggests that the notion of slot also encompasses a certain area or "window" on the substrate the width of which corresponds to the distance travelled by the acoustic wave during said time length. A further ambiguity associated with the term slot results from the fact that it is used to define purely abstract entities (potential positions for the reflectors) as well as, in the use of "empty slots", structural elements to be deactivated to form a set of reflectors when manufacturing the tag (cf. page 35, lines 15-24).

The replacement of the term "slot" by the term "allowable position" avoids the ambiguities resulting from the original wording. It is employed in the claims according to the main request as a synonym for a location at which a reflector may be placed as part of encoding some data element; such an allowable position has a unique SAW propagation delay with respect to the

transducer. This definition corresponds, in effect, to the first definition given to the term "slot" on page 21, lines 7-11. A further support for the concept of "allowable positions" is identified in the notion of "allowable pulse position(s)" (cf. page 24, lines 12-19), which notion implies the existence of corresponding allowable positions on the substrate.

2.4 The definition of the allowable positions may be derived, for example, from the statements on page 25, lines 6-10, or page 26, lines 28-31. In fact, despite the inconsistent terminology used in the description to define the "phase step", which is also defined as a "phase angle" (page 26, line 1), "stepping angle" (page 26, line 3; "phase increment" (page 26, lines 8 and 13) or "phase shift" (page 27, line 3), it is clear from the description in its entirety that these terms are all used in order to define the same concept. The allowable positions for the reflectors are determined such that in the case that adjacent allowable positions are indeed occupied by reflectors, a "phase step" between the reflected portions of the SAW to be received by the transducer is provided, whereby the "phase step" is equivalent to the phase difference required between directly successive reflected pulses in order to enable discrimination.

The ability of the claimed tag to enable discrimination of overlapping reflected portions of the SAW, which results from the distribution of the reflectors among allowable positions as recited in claim 1, is addressed in the original description on page 25, lines 15-19, and page 26, lines 7-16.

2.5 Independent claim 8 according to the main request is based on original claim 25 and differs from this previous version of the claim by amendments corresponding to those which have been introduced in relation to claim 1. Claim 8 has been further amended by specifying the step of positioning each reflector at one of predetermined allowable positions, which feature may be derived from the passage of the description on page 35, lines 15-19.

2.6 Dependent claims 2 to 7 are based on original claims 3, 5, 8, 9, 12 and 11, respectively. Likewise, dependent claims 10 to 19 are supported by original claims 27 to 36, respectively. The wording of the claims has been further amended for reasons of clarity and so as to be consistent with the modified independent claims. Dependent claim 9 finds its support in the notion of "group of slots" in original claim 25.

2.7 Consequently, the modified version of the claims according to the main request does not contain subject-matter extending beyond the content of the application as originally filed (Article 123(2) EPC).

3. *Main Request - clarity*

3.1 By specifying that each reflector is positioned at one of predetermined allowable positions and by defining said allowable positions by reference to a "known frequency" generated by the transducer, the relationship existing between adjacent allowable positions has been clarified in both independent claims 1 and 8. Although these allowable positions do not constitute, as such, structural elements of the

claimed tag, the relationship which is to exist between said positions leads by reference to concrete limitations as to the distribution of the reflectors on the substrate. It follows from the description that the distribution of the reflectors indeed constitutes the key element in order to permit discrimination between reflected portions of the SAW in case such reflected signals would overlap; such overlap would namely result from the proximity of reflectors in view of the pulse width of the signal generated by the transducer.

Although the "known frequency" or "given frequency" referred to, respectively, in claims 1 and 8 does not constitute an inherent feature of the transducer since the bandwidth of the signal generated depends, *inter alia*, on the interrogation signal generated by an external reader, the Board is satisfied that the requirements of Article 84 EPC 1973 as to clarity are met. As ruled in point 2.4 of the Reasons in decision T 614/04, concerning the examination of clarity, "*the aspect whether a device having the concrete features of claim 1 and used with a wavelength not fulfilling the mentioned conditions falls within the scope of claim 1, is irrelevant during the examination of a patent application. [...] The Board considers that in an optical device comprising features dependent upon wavelength it is appropriate to introduce this dependence in a generalised way, e.g. by definition of a grating period as a function of wavelength...*". Applied to the present case, this teaching implies that the fact that a tag having the concrete features of claim 1 could possibly be used with an external reader generating a signal with a frequency for which the relationship between the reflectors on the substrate

and consequently the associated discriminating effect would not be provided, is not a valid criteria to justify a lack of clarity of the claimed subject-matter. As stressed in decision T 614/04, it is essential that "*if a predetermined wavelength is selected, the remaining features can be adapted to provide the required function...*", which is the case for the SAW identification tag of claim 1: the knowledge of the frequency permits to determine, for a selected phase step, the allowable positions and accordingly the position of the encoding reflectors.

3.2 The indication that the location of the reflectors was determined by pulse position and phase position, which feature had been objected to by the examining division in the contested decision, has been deleted in new claims 1 and 8 of the main request. The reflectors are defined in new claims 1 and 8 by reference to allowable positions, which allowable positions are "associated" with predetermined time shifts and phases. This definition takes due account of the fact that the phase indeed depends on the time shift and, in addition, that both parameters are essential for the kind of modulation to be carried out according to the invention.

3.3 The Board is further convinced by the submissions of the appellant according to which the spacing rules disclosed in the description in order to avoid interferences between pulses reflected by adjacent reflectors did not define essential features of the invention and, as such, did not need to be introduced in independent claims 1 and 8.

As argued by the appellant, in its reply dated 8 June 2009, spacing rules are only required in certain circumstances of potentially strong interferences between a plurality of reflected portions of the SAW. This problem only occurs when the length of the pulse generated by the transducer is large in view of the distance separating adjacent allowable positions so as to generate potential interferences between a large number of portions of the SAW reflected by closely located reflectors, thus rendering the claimed discriminating configuration ineffective. In fact, such interferences would occur when the time length of the emitted pulse leads to at least two reflected portions of the SAW being nearly in phase or out of phase.

It is, however, established jurisprudence of the boards of appeal that independent claims do not need to address all possible circumstances which would affect the functioning of a claimed device or process which, under normal circumstances, appears satisfactory.

3.4 Dependent claims 2 to 7 and 9 to 19 are considered to be clear and consistent with independent claims 1 and 8. For these reasons, the Board is satisfied that the requirement of Article 84 EPC 1973 as to clarity is met by the claims of the main request.

4. *Main Request - Sufficiency of disclosure*

In the contested decision, the examining division questioned the sufficiency of disclosure considering that the wording of claims 1 and 13 underlying the decision in suit implied that the parameters of pulse position and phase position, required to determine the

location of the reflectors on the substrate, were independent. Since the phase position is, however, directly dependent on the pulse position the claimed definitions contained an inherent contradiction which made it practically impossible for the skilled person to carry out the invention.

The amended wording of claims 1 and 8 of the main request excludes the interpretation relied upon by the examining division in its refusal. Since the Board is further convinced that the description contains sufficient information to enable the skilled person to implement the invention over the whole scope of the claim, it concludes that the requirements of Article 83 EPC 1973 are met.

5. *Main Request: Novelty - Inventive step*

5.1 Novelty

5.1.1 Documents D2, D4 and D5 concern SAW identification tags. Although referring to phase modulation, the systems disclosed in these documents rely on a principle fundamentally different from the one underlying the present application. As submitted by the appellant in its written submissions and reiterated during the oral proceedings before the Board, in these known systems, the phase information actually contains the informational code (cf. D2, column 1, lines 48-51; column 2, lines 45-49; D4, column 9, lines 23-29; column 9, line 55 - column 10, line 15; D5, page 2392, left hand column, third paragraph; Figure 3) whereas, according to the present invention, the phase modulation is only required to enable discrimination of

possibly overlapping reflected portions of the SAW; in contrast to the prior art, the phase information does not carry any information relating to the code.

5.1.2 Applying the strict standards of "photographic novelty", the Board had to decide when deciding on the novelty of independent claim 1 of the main request whether at least one of the available prior publications disclosed all the concrete limitations actually derivable from its wording. The limitation of the examination to solely the concrete (structural and functional) features derivable from the claim's wording means that the provision of "allowable positions" in claim 1 of the main request is to be disregarded. However, the technical effect achieved by the reflectors when located at their actual positions, namely the ability to discriminate overlapping reflected portions of the SAW, must be taken into account.

It follows that the claimed tag would only be anticipated if a prior art document discloses in combination all the concrete structural features of claim 1 and if one of the two following conditions is met:
(i) the prior art tag, when used as disclosed, provides the same concrete technical effect as the claimed tag, i.e. enables discrimination of overlapping reflected portions of the SAW;
(ii) it is capable - under appropriate conditions - of providing such effects.

D2 and D5 both disclose a SAW identification tag with a piezoelectric transducer on a substrate and a number of reflectors located on said substrate so as to reflect a

portion of the SAW back to the transducer in order to encode a number, as recited in claim 1 (cf. D2, column 2, lines 27-34; column 3, lines 54-63; D5, page 2392, section "Reflective Delay Lines").

Concerning the technical effects produced by these known tags, in view of the first alternative (i) cited above, it is evident from the statement in column 1, lines 60-64 in D2 or from Figure 3 in D5 that the tags disclosed in said documents are used under such conditions that no overlap between reflected portions of the SAW occurs. The technical effect of enabling discrimination of overlapping reflected portions of the SAW is therefore disclosed neither in D2 nor in D5.

Concerning the second issue (ii) whether the tags according to D2 or D5 would nevertheless be capable of providing the claimed effect under particular circumstances, it is necessary to investigate the behaviour of such tags when interrogated by external readers generating wider pulses leading to effectively overlapping reflected portions of the SAW. This situation would, for example, correspond to a response of the tag as illustrated in Figure 3 of D5 but with pulse widths being at least 2 or 3 times larger that those actually illustrated. The Board notes that a distinction between overlapping neighbouring pulses having the same phase information, as would be the case for example with the two first pulses of Figure 3 in D5, would not be possible; the constructive interference which results from the signals overlapping renders a discrimination between signals *de facto* impossible. Similarly an overlap of signals being out of phase as, for example, illustrated by the third and

fourth pulses of Figure 3, would lead to a destructive interference making discrimination unfeasible.

Even if it can be argued that some tags according to the teaching of D2 or D5 have, depending on the encoded number, a configuration excluding adjacent reflectors being in or out of phase, and would thus enable overlapping reflected portions of the SAW to be distinguished from each other on the basis of their phase, the Board notes that the reflectors would then not be arranged to encode a number in the manner defined in claim 1. In fact, under such circumstances, the encoding scheme relied on in D2 or D5 would not make it feasible to attribute the (discriminated) signals to one or the other adjacent reflectors, thus making a decoding of the information impossible.

5.1.3 In D4, the phase encoding is obtained by providing "delay pads" or, more generally, "wave perturbation elements" along the path of the acoustic wave in order to impart a characteristic encoding to the signal (cf. column 9, line 55 - column 10, line 4; column 26, lines 36-63). Although reflectors are also employed in some of the embodiments disclosed in D4, their function is - in contrast to the claim definition - not to encode a number, this function being exclusively performed by the wave perturbation elements, but to direct the acoustic wave along a desired path (cf. Figures 19A-19C and 21).

5.1.4 Document D1 is even more remote from the present invention and does not *inter alia* disclose the feature of a number of reflectors located on the surface of the substrate and arranged to reflect a portion of a SAW

back to the transducer to encode a number. In D1, the information is encoded by the design of the transducer i.e. by the distance separating opposite fingers of the transducer and by the respective apertures defined by the facing portions of opposite fingers.

5.1.5 The SAW identification tag of claim 1 is therefore new. Since claim 8 includes all manufacturing steps required to manufacture a tag as actually defined in claim 1, its subject-matter is also new.

5.2 Inventive step

5.2.1 As emphasized in column 1, line 60 to column 2, line 7, in D2, configurations relying on phase modulation in order to encode information must be constructed in such a way that reflected pulses can be reliably separated, thus allowing the information in the response signal to be reliably resolved. This view is further confirmed, insofar as phase modulation is relied on for encoding information, by the analysis made above in relation with D5 and the question of the adaptability of the tags disclosed therein to permit discrimination between overlapping reflected portions of the SAW.

Consequently, the Board concludes that the teaching of D2 or D5 leads away from a use of tags relying on phase modulation for encoding information with wide interrogating pulses which would lead to possibly overlapping reflected portions of the SAW. For these reasons these known tags do not qualify as closest prior art.

The tags disclosed in D4 and D1 rely on a construction fundamentally different from the one actually claimed. They also rely on a different encoding technique. For these reasons neither D4 nor D1 appear to constitute suitable starting points when addressing the inventive merits of the present invention.

5.2.2 The Board considers that identification tags relying on conventional pulse position modulation (PPM), as discussed on page 19, line 4 to page 21, line 2, of the present application or relying on amplitude modulation as referred to in D2, column 1, lines 36-47, or D4, page 2392, left hand column, second paragraph, illustrate the closest prior art.

5.2.3 The identification tag of claim 1 differs from these known tag configurations by the distribution of the reflectors on the substrate.

5.2.4 The specific distribution of reflectors, defined in claim 1 by reference to allowable positions on the substrate, enables discrimination of overlapping reflected portions of the SAW.

This effect solves the problem of limited data density encountered with the tags of the prior art, as acknowledged in the description on page 20, lines 20-25. Similarly, for a given number of bits to be encoded, the claimed tag solves the problem associated with large substrates by allowing compacter structures to be obtained.

5.2.5 Document D2 expressly addresses in column 2, lines 3-7, the problem associated with long substrates. The

solution proposed in D2 differs, however, from the one proposed in the present application and relies on the use of a diverter in order to redirect the acoustic wave along a desired path. Likewise, document D4 proposes to use reflectors or trackchangers to direct the acoustic wave along desired paths.

These solutions seek to make the best use of the available space on the substrate and differ in their conception and principle from the solution actually claimed which, by contrast, seeks to permit a higher density of encoding reflectors on a given substrate.

None of available prior art suggests to solve this problem by phase-modulating signals to be reflected in such a way as to permit discrimination between potentially overlapping reflected portions of the SAW. The mere fact that phase modulation was known, as such, for encoding purposes (cf. D2, D5) does not render the use of this modulation for a different purpose, namely discrimination, obvious.

5.2.6 The above argumentation applies mutatis mutandis to the method of claim 8 as to the method of manufacturing a SAW identification tag.

The subject-matter of claims 1 and 8 is hence inventive in the sense of Article 56 EPC 1973.

6. It follows from the above considerations that a patent can be granted on the basis of the main request. There is thus no need to consider the auxiliary requests.

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 with the order to grant a patent based on claims 1 to 19 filed at the oral proceedings as main request, with the description and the drawings to be adapted.

The Registrar: The Chairman:

R. Schumacher B. Schachenmann