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Aktenzeichen / Case Number / N^o du recours : T 66/83 - 3.5.1

Anmeldenummer / Filing No / N^o de la demande : 79 302 386.2

Veröffentlichungs-Nr. / Publication No / N^o de la publication : 0 010 958

Bezeichnung der Erfindung: Homing system and technique for guiding a missile
Title of invention: towards a metal target
Titre de l'invention :

Klassifikation / Classification / Classement : G05 D 1/12

ENTSCHEIDUNG / DECISION

vom / of / du 6 June 1989

Anmelder / Applicant / Demandeur : E-Systems Inc.

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence : Homing systems/E-systems

EPÜ / EPC / CBE Articles 52, 56, Rule 67

Schlagwort / Keyword / Mot clé : - inventive step (yes) - substantial
procedural violation (no)

Leitsatz / Headnote / Sommaire

Europäisches
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European Patent
Office

Boards of Appeal

Office européen
des brevets

Chambres de recours



Case Number : T 66/83 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 6 June 1989

Appellant : E-SYSTEM INC.
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Dallas County, Texas 75240
USA

Representative : Jones, Alan John
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Decision under appeal : Decision of Examining Division 062 of the European Patent Office dated 16 November 1982 refusing European patent application No. 79 302 386.2 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : P.K.J. van den Berg

Members : W.B. Oettinger

F. Benussi

Summary of Facts and Submissions

- I. European patent application No. 79 302 386.2, filed on 31.10.79, publication No. 0 010 958, claiming a priority of 01.11.78 (US application No. 956 727), was refused by a decision of the Examining Division 062 of the EPO dated 16.11.82.

The decision was based on Claims 1 to 8 filed on 29.03.82

- II. The reason given for the refusal was that the use of the reflections of a harmonic frequency by a target and employed for the same purposes as in the present application is known from a radar target locator for metallic objects, as disclosed in US-A-4 053 891 (in particular its Figure 1), that, having regard to the selecting and switching of the reflected and harmonic radar signals for determining which one of these signals is to produce the error signal, the use of such a feature was known from a similar radar tracking system, as disclosed in DE-A-2 261 741 and that it would be obvious for a person skilled in the art to apply the features known from these two documents to a conventional missile guidance system.

- III. The Appellant lodged an appeal against this decision on 03.01.83 requesting cancellation of the entire decision and paid the appeal fee on 31.12.82. The Statement of Grounds was filed on 14.03.83. An affidavit by Mr Myles A. Larson in support of the Statement of Grounds was filed on 27.04.83.

- IV. In its communications of 03.09.84 and 30.05.85, the Board of Appeal informed the Appellant that the claims refused

by the Examining Division did not comprise patentable subject-matter because of lack of inventive step referring to US-A-4 053 891 and DE-A-2 261 741, i.e. on the same grounds as given by the Examining Division in their decision to refuse.

- V. In his reply of 25.09.85 to the Board's second communication, the Appellant asked to be given the opportunity to make a personal representation at the EPO.

Oral proceedings were scheduled to take place on 16.04.86.

Summons to these proceedings, with a communication of the Board of Appeal were sent to the Appellant on 17.02.86, the communication setting out once more the Board's objections concerning the lack of inventive step with respect to the then valid claims. On 19.03.86 the Appellant filed a new set of Claims 1-8 by way of his main request and three further sets of claims as auxiliary requests.

- VI. By telex, received on 07.04.86, confirmed by a letter, received 10.04.86, the Appellant informed the Board that no attendance would be made at the oral proceedings, it being felt that all his arguments had already been provided, including those in the further submission dated 17.03.86, received by the Board on 19.03.86.

Following this information, the Board cancelled the oral proceedings.

- VII. In its communication of 15.07.88 the Board recognised that Claims 1-8 of the main request of 19.03.86 comprised patentable subject-matter but that certain amendments were considered necessary.

With his reply of 31.10.88 the Appellant filed fresh Claims 1-8 and new pages 3 and 3a.

VIII. In the Statement of Grounds and his replies to the Board's communications, the Appellant argued in essence as follows: the teachings of DE-A-2 261 741 (and the corresponding GB-1 413 976 introduced into the proceedings by the Appellant), referred to as the "German" reference, and of US-A-4 053 891, referred to as the "US" reference, are incompatible, i.e. the installations described in these references cannot be combined into one new installation.

None of the two citations concerns a homing system for guiding a missile, in which the missile is provided with a radar unit.

Both citations concern ground radar tracking systems and the guided missile homing system according to the invention is not in the same specific field.

The Appellant has repeatedly emphasised that neither of these two references comprises all the features of the invention as claimed.

In particular the switching mechanism according to the present invention for switching over from basic radar frequency to its harmonic frequency is novel and inventive.

The switching means employed in the static tracking system of the German reference is primarily range dependent which is not the case in the present invention.

In his letter dated 17 March 1986 the Appellant emphasised on page 3, under item 5(h) that the range at which

switching occurs in the missile of the invention will depend on the strength of the harmonic signal produced by the metal target and is hence not range-dependent.

Upon the Board's implicit assumption in its first communication that the ground radar station of the German citation is emitting both 8 mm short wavelength and 3,2 cm long wavelength radiations simultaneously and all the time, the Appellant alleged in his letter dated 11 February 1985, page 5, penultimate paragraph, that the second, i.e. the short range radar apparatus (8 mm), is inoperative until the target arrives within its range.

He added that this arises because the range gate circuit of the second radar apparatus is controlled by the range tracking circuit of the first radar apparatus (long range, 3,2 cm) and that thus, although the second radar apparatus may actuate the switching means, it does so under control of the range gate circuitry of the first radar apparatus and that the second radar apparatus, therefore, does not independently control the switching means.

IX. Under item 17 of the Statement of Grounds the Appellant requested a refund of the appeal fee. In its first communication of 03.09.84 the Board drew the Appellant's attention to Rule 67 EPC.

In his last letter, received 31.10.88, the Appellant gave as his reasons for requesting a refund of the appeal fee, that although the Board may be right in suggesting that there has been no procedural violation, the use of Rule 86(3) to support a total rejection after one communication from the Examining Division is seen to be a rather hard way to apply this Rule in practice.

The question of "obviousness" requires careful consideration and often this necessitates the issue of more than one official action.

The Appellant submitted that this should be the usual practice, since it would encourage applicants to look on the EPC system as providing a reasonable scope for reply without the need to encounter the far greater expense and delay of appeal procedures.

X. The Appellant requests:

Firstly: The grant of a European patent on the basis of the following items:

description: pages 1, 4 to 13 of the published application, page 2, filed on 29.03.82, and pages 3 and 3a filed on 31.10.88

drawings: Figures 1 and 2 of the published application

Claims 1-8: filed on 31.10.88.

Secondly: Refund of the appeal fee in the case the appeal is allowed.

XI. Independent Claims 1 and 7 read as follows:

1. A homing system for guiding a missile (10) towards a metal target, which missile (10) is provided with a radar unit (12) to transmit a radar signal of a predetermined frequency to the target, the metal target reflecting the radar signal and producing harmonic signals having frequencies harmonic with the radar signal, an antenna (14) to receive a reflected radar signal and harmonics from the target, antenna drive logic (54) responsive to error signals to position the antenna (14), and missile

guidance and control means (51) responsive to said error signals to correct the flight path of the missile (10) to guide the missile (10) toward the target, the system further comprising a first detector (40) responsive to the received reflected radar signal to produce a first strength signal proportional to the signal strength of the received radar signal, a second detector (34) responsive to a selected one of the harmonic signals to produce a second strength signal proportional to the signal strength of the selected harmonic signal, a switching circuit (44,56,58) connected to receive the strength signals and to route only the first strength signal to an output terminal thereof when the second strength signal is less than a preset threshold and to route only the second strength signal to the output terminal when the second strength signal has exceeded the preset threshold over a preselected period of time and an error circuit (48) for monitoring the position of the antenna (14) in a scan pattern, for receiving the strength signal from the output terminal and for supplying said error signals to the antenna drive logic (54) and to said missile guidance and control means (51) whereby, during the terminal flight phase of the missile (10), the error signals supplied to the missile guidance and control means (51) indicate the direction of the metal target relative to the missile (10), according to the position of the antenna (14) at the time the second strength signal in the scan pattern was received, so that the missile is guided onto the metal target.

7. A homing technique for guiding a missile towards a metal target, the technique comprising the steps of: transmitting a radar signal of a predetermined frequency towards the target whereby the target reflects the radar signal and produces harmonic signals having frequencies harmonic with the radar signal, receiving a reflected

radar signal and harmonic signals from the target, detecting the radar signal reflected from the target and producing a first strength signal proportional to the signal strength of the received radar signal, detecting a selected one of the harmonic signals to produce a second strength signal proportional to the signal strength of the selected harmonic signal, coupling only the first strength signal to an error circuit when the second strength signal is less than a preset threshold, coupling only the second strength signal to the error circuit when the second strength signal has exceeded the preset threshold over a preselected period of time, and producing error signals in response to the respective strength signal to indicate the direction of the target relative to the missile according to the position of the antenna at the time the respective strength signal in the scan pattern was received, positioning an antenna on the missile in response to the error signals and guiding the missile, during its terminal flight phase, in response to error signals produced at the time the second strength signal was received so that the missile is guided onto the metal target.

Reasons for the Decision

1. The appeal complies with Articles 106-108 and Rule 64 EPC and is, therefore, admissible.
2. Present Claims 1-8 are properly based on the application as originally filed, so no objection under Article 123(2) arises.
3. Novelty
 - 3.1 In the terminology of Claim 1, the following part of that claim is considered by the Board to represent prior art.

"A homing system for guiding a missile towards a metal target, which missile is provided with a radar unit to transmit a radar signal of a predetermined frequency to the target, the metal target reflecting the radar signal, an antenna to receive a reflected radar signal from the target, antenna drive logic responsive to error signals to position the antenna and missile guidance and control means responsive to said error signals to correct the flight path of the missile to guide the missile toward the target, the system further comprising a detector responsive to the received reflected radar signal which produces a strength signal proportional to the signal strength of the received radar signal, an error circuit for monitoring the position of the antenna in a scan pattern, for receiving the strength signal from the detector and for supplying said error signals to the antenna drive logic and to said missile guidance and control means whereby, at least during the terminal flight phase of the missile, the error signals supplied to the missile guidance and control means indicate the direction of the metal target relative to the missile, according to the position of the antenna at the time the strength signal in the scan pattern was received, so that the missile is guided onto the metal target."

- 3.2 This text in quotation marks represents common general knowledge and need not be documented. Page 1 of the description already presents a similar account of the prior art. Present Claim 1 is not in the two-part form. The Appellant has pointed out that there would have been a problem with the two-part form because, as he correctly noted, neither the German nor the US references relate to a homing system for a guided missile.

3.3 What Claim 1 effectively adds to the above described prior art according to common general knowledge consists of what was left out from Claim 1 in formulating the said part between quotation marks. This left out part can be considered as a characterising part, comprising the following features:

- (a) In response to the impinging radar signal the metal target produces harmonic signals having frequencies harmonic with the radar signal.
- (b) A further detector is provided for, which is responsive to a selected one of the harmonic signals to produce a second strength signal proportional to the signal strength of the selected harmonic signal, a switching circuit (44,56,58) connected to receive the strength signals and to route only the first strength signal to an output terminal thereof when the second strength signal is less than a preset threshold and to route only the second strength signal to the output terminal when the second strength signal has exceeded the preset threshold over a preselected period of time, the said error circuit receiving the strength signal from the output terminal.
- (c) Whereby, during the terminal flight phase of the missile (10), the error signals supplied to the missile guidance and control means (51) indicate the direction of the metal target relative to the missile (10), according to the position of the antenna (14) at the time the second strength signal in the scan pattern was received, so that the missile is guided onto the metal target.

- 3.4 None of the cited documents comprises the combination of features of Claim 1 nor of Claim 7.

The subject-matter of these claims is, therefore, novel.

4. Inventive step

- 4.1 The invention as claimed in Claim 1 seeks to exploit the physical phenomenon under (a) for having the missile guided during its terminal flight phase exclusively by the harmonic reflections from the target according to feature (c), utilising for that purpose the further detector and the associated switching circuit according to feature (b).

- 4.2 The view of the Board can be summarised as follows:

- (i) contrary to the opinion of the Appellant, the Board is convinced that a person skilled in the art, dealing with homing systems comprising radar equipped missiles must be expected to acquire and use the knowledge available on radar systems as such;
- (ii) from the US reference it is known to employ the fact that the non-linear characteristics of some targets cause radar reflections containing mainly frequencies which are higher harmonics of the radar carrier frequency that is emitted, by receiving selectively solely one such harmonic frequency;
- (iii) from the German reference it is known in tracking radar to distinguish between long and short range operations and to switch from long to short range

to a higher radar carrier frequency to achieve higher detecting resolution.

4.3 Because of (i) it may, prima facie, be considered as obvious to a person skilled in the art, who wishes to detect targets of the sort mentioned in (ii) to combine the two known concepts of (ii) and (iii), i.e. by choosing the higher short range frequency of (iii) to be one of the harmonics of the emitted radar carrier frequency, taking into account that the U.S. reference, mentioned in (ii) indicates as targets to which its method can be applied, e.g. missiles and aircraft, in general, man-made metal objects, and that it would not make any difference whether the combination of the known concepts according to (ii) and (iii) were applied to, e.g. a tracking radar ground station or to the radar unit placed in a guided missile and used for its homing in view of (i).

The Appellant has emphasised on several occasions that the systems according to the German and the U.S. citation respectively are incompatible, that in particular the German reference uses essentially two separate radars.

The Board agrees to this insofar that it seems not possible to superimpose the one system upon the other one without making any changes to each of them.

4.4 With regard to feature (b) of Claim 1, the Appellant has emphasised on several occasions that the German reference uses a switching circuit controlled by a range tracking unit in one of the two radars to supply appropriate angle tracking error signals to the antenna servos.

That the switching means employed in the static tracking system of the German reference is primarily range dependent which is not the case in the present invention.

That the range at which switching occurs, in the missile of the invention, will depend on the strength of the harmonic signal, produced by the metal target and is hence not range-dependent (Appellant's letter dated 17 March 1986, p. 3, item 5(h)).

- 4.5 The phrase in the German reference reading "said switching means being controllable by said second radar apparatus" (GB 1 413 976, page 1, lines 73-74, and page 6, lines 104-105), the said second radar apparatus working with the 8 mm-short wavelength radiation, and in particular the phrase on page 6, lines 40-43 of the same document, reading "The switching is preferably effected by a control signal generated by the conical scan radar apparatus when the target is within its range", that apparatus being once more the 8 mm-short range radar apparatus, and a similar phrase on page 3, lines 58-62 leads the Board to the interpretation that in the German reference the criterion for the switching over from 3,2 cm to 8 mm radar would be the detection of the 8 mm short wavelength reflections from the target by the 8 mm radar apparatus, during the flight of the target into the direction of the ground radar station, assuming that the ground radar station is emitting both 8 mm-short wavelength and 3,2 cm long wavelength radiations simultaneously and all the time.
- 4.6 At an earlier occasion, the Appellant alleged, in respect of the German reference that the second or short range 8 mm radar apparatus is inoperative until the target arrives within its range (letter dated 11 February 1985, page 5, penultimate paragraph).

However, if this allegation is interpreted as meaning that before the target's arrival within that range, the 8 mm radiations are not emitted at all, there is no basis for

such an assumption in that reference. From this document it follows clearly that the 8 mm transmitter 58 is driven by synchronisation pulses (s_1) delivered by the same pulse generator (and thus all the time) as those (s) driving the 3.2 cm transmitter 15 (GB-A-1 413 976, page 5, lines 47-52 and page 4, lines 6-12). Therefore, the Board's interpretation as given under foregoing item 4.5 is held to be correct.

4.7 The Appellant went on, in his earlier submission, by saying that the range gate circuit of the second radar apparatus is controlled by the range tracking circuit of the first radar apparatus and that thus, although the second radar apparatus may actuate the switching means, it does so under control of the range gate circuitry of the first radar apparatus and that the second radar apparatus, therefore, does not independently control the switching means.

This is indeed the case (GB, page 3, lines 46-62).

However, in this respect it is noted, that the embodiments described in the present application with reference to Figures 1 and 2 also employ a range gate (72, 56) in the second or short range radar receiver (18, 22, 30, 32, 34) which can, in one embodiment (Figure 2), be controlled (via 82, 84) also by a signal appearing in the first radar receiver (20, 24, 36, 38, 40).

So, although Claim 1 does not mention any range gates at all, the feature of the German citation indicated here by the Appellant is also comprised in the present invention as disclosed in the description of the present application.

Therefore, the invention as disclosed is not distinguished from the German citation by not comprising that feature.

In fact, the Board has arrived at the view that the criteria for switching over from long wave to short wave signals according to the invention is not only amplitude dependent (i.e. dependent on the amplitude of the short wave radar target reflections), but also time dependent, i.e. dependent on range, as defined by the range gate of the third harmonic target signal receiver part.

4.8 Regarding this aspect of the invention, the Board has considered the following:

4.9 In respect of the criterion for controlling switch-over (by S_1) from the 3.2 cm radar apparatus to the 8 mm radar apparatus, the German citation firstly refers generally to "when the target being tracked by the first radar apparatus arrives within the range of the second radar apparatus" (GB, page 3, lines 40-46) and a similar if-condition (page 6, lines 35-37).

This can be interpreted as a preset range at which the switch is actuated. Such preset range would be determined by the temporal position of the range gate as it is provided by the 3.2 cm radar apparatus (range servo 41-47, 51, 54, 20, 36).

4.10 More specifically, however, the German reference refers to switching being preferably effected "in response to a control signal derived from" (page 3, lines 58-61) or "by a control signal generated by" (page 6, lines 41-43) the 8 mm radar apparatus.

This reference can be interpreted in several ways.

One way of interpreting it would correspond to the aforementioned interpretation and would mean that the criterion for switchover is a preset range, derived from the temporal position of the range gate as it is applied (at 67/68) to the 8 mm radar receiver.

Another possible way of interpretation would relate to the output signal of the 8 mm radar receiver (e.g. at 71). That is, that as soon as the 8 mm radar receiver detects the target, its output signal occurs for the first time and is used to switch over from the 3,4 cm radar receiver to the 8 mm radar receiver.

As in any radar receiver, the 8 mm target reflection would have to pass a predetermined threshold level before being detected. But, strictly speaking, the criterion for switchover is still of a temporal nature owing to the fact that the said "range" where the target appears is predetermined by the temporal position of the range gate (applied at 67/88), as is the case according to the invention as disclosed.

4.11 Formally, it is true that there is no express disclosure in the German reference of a particular significance of a signal detection threshold for the criterion for appearance of the target within the range of the second radar apparatus, but the Board considers that it is implicit to the passages of the German reference cited in item 4.10.

Therefore, the invention as claimed is not distinguished over the prior art according to the German reference, by the criterion for switching over from long wave to short wave target reflections reception. [Contrary to an earlier communication from the Board.]

4.12 Nevertheless the fact remains that the invention according to Claim 1 combines, for a homing system, the teachings of two documents which describe apparatuses which in their details are incompatible (i.e. the German reference and the US-citation).

Although, as indicated under foregoing item 4.3, the combination of the concepts underlying these two documents might be obvious to a skilled person, the Board finds that in order to arrive at the invention as claimed, an effort has to be made which goes clearly beyond the normal considerations of a person skilled in the art and it seems only with hindsight that he can arrive at the invention as claimed, when he starts from the said two citations.

Firstly, he has to realise that the teachings of the US-citation could be useful for a homing system.

Secondly, he would have to consider that for long range he would not be able to use the harmonic target reflections, because they are still too weak.

Thirdly, as a consequence, he would have to realise that when using the normal radar frequency he would have to switch over his receiver from normal radar frequency to harmonic frequency reception.

Finally, in view of this third consideration, he would know from the German citation that it was already known to use long wavelength for long-range detection and short wavelength for short-range detection and how to switch from the first to the second.

Although the German citation teaches him all this, he would have to realise that the harmonic reflections he wishes to use would have to take the place of the 8 mm

short-range reflections of the German citation, which are not the result of normal frequency radar signals impinging on the target, as in the invention and in the US-citation, but which result from 8 mm radar frequency emitted by a separate radar apparatus.

The Board concludes that all these considerations in combination constitute more than can be expected from a person skilled in the art without any inventive activity on his part, although each of these considerations, taken separately, might seem obvious.

Therefore, the practical realisation of the invention as comprised in Claim 1 implies, in the opinion of the Board, an inventive step within the meaning of Article 56 EPC.

5. Similar considerations lead to the allowability of independent Claim 7.

No objection arising against the dependent claims which specify further details of the subject-matters of the independent claims they refer to, Claims 1-8, filed on 31.10.88 are allowable.

6. Although the present appeal will be allowed, the Appellant's request for a refund of the appeal fee will be refused.

The Appellant has given no grounds which might identify a substantial procedural violation as required by Rule 67 EPC to justify a refund of the appeal fee. In Item 14 of the Statement of Grounds of Appeal, the Appellant noted his preparedness to consider any further amendments which might assist, if necessary, in obtaining grant of the application. Then Item 14 continued by stating that in the circumstances that the present application was rejected

after only one report from the Examining Division, this had meant that the Applicant had been denied the opportunity to discuss the case further with the Examining Division and the possibility of further amendments.

Although the Board feels sympathy with the remarks made by the Appellant in his last letter, as cited under the foregoing item IX of this decision, the Board takes the view that the very fact that the application was rejected after only one report from the Examining Division, as such, does not constitute a "substantial procedural violation" in the sense of Rule 67 EPC, because according to Rule 86(3) EPC:

"After receipt of the first communication from the Examining Division, the Applicant may, of his own volition, amend once the description, claims and drawings, provided that the amendment is filed at the same time as the reply to the communication".

In the present case, the Applicant had availed himself of this opportunity.

Rule 86(3) continues "No further amendment may be made without the consent of the Examining Division". This sentence clearly states that allowance for further amendments (after the first one mentioned) is left to the discretion of the Examining Division.

In this case, the Examining Division had used this discretion by rejecting the application after reply to its first communication, in that way not offering the applicant another opportunity for amendment.

On the basis of Rule 86(3), the Examining Division is entitled to do so.

In order to find out whether in this particular case the Examining Division nevertheless actually committed a substantial procedural violation, it has to be investigated whether there were any grounds in this particular case because of which the rejection by the Examining Division immediately after the reply to their first communication has to be considered as not justified.

It seems to the Board of Appeal that such grounds do not exist. In its first communication dated 23.12.81, the Examining Division had given, in a comprehensive way, detailed technical grounds why they thought original Claims 1-12 not allowable because of lack of inventive step. Moreover, in paragraph 1 of that communication they also added that in their view the description did not contain anything patentable either.

The Board is of the view that if the Applicant's reply to such a first communication is such that it does not alter the Examining Division's opinion as to the lack of inventive step of the subject-matter claimed and judged upon already in the first communication, it seems entirely legitimate for the Examining Division to reject the application after the first communication.

Moreover, in this particular case, the Examining Division explained on page 4 of their decision to reject, why the Applicant's reply had not convinced them to the contrary.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a European patent on the basis of the application documents according to foregoing item X of this decision.
3. The appeal fee will not be refunded.

The Registrar

The Chairman

F. Klein

P.K.J Van den Berg