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D E C I S I O N
of 24 April 1997

Case Number: T 0412/96 - 3.5.1

Application Number: 89117376.7

Publication Number: 0361297

IPC: H04N 13/02

Language of the proceedings: EN

Title of invention:
Image pickup system capable of obtaining a plurality of stereo images with different base height ratios

Applicant:
NEC CORPORATION

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0412/96 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 24 April 1997

Appellant: NEC CORPORATION
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Decision under appeal: Decision of the Examining Division of the European Patent Office posted 7 November 1995 refusing European patent application No. 89 117 376.7 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: P. K. J. van den Berg
Members: A. S. Clelland
C. Holtz

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division to refuse European patent application No. 89 117 376.7 on the ground that the subject-matter of claims 1 to 3 of both the main and auxiliary requests lacked an inventive step (Articles 52(1) and 56 EPC). Inter alia the following document was cited in the decision:

D3: EP-A-0 037 530

II. On 17 January 1996 the appellant (applicant) lodged an appeal against the decision and paid the prescribed fee. On 18 March 1996 a statement of grounds of appeal was filed, with a new set of claims. A request for oral proceedings was also filed.

III. Following a communication from the Board, the appellant filed claims of first and second auxiliary requests on 24 March 1997 and 10 April 1997, respectively. Oral proceedings were held on 24 April 1997. At the oral proceedings the appellant requested that the decision under appeal be set aside and a patent granted on the basis of the following documents:

Main request:

Claims: 1 to 3, received with the grounds of appeal on 18 March 1996.

Description: pages 1 and 6 to 29, as originally filed; pages 2 to 5, received 19 April 1993;

Drawings: sheets 1 to 8, as originally filed.

First auxiliary request:

As main request, but with claims 1 to 3 received 24 March 1997.

Second auxiliary request:
As main request, but with claims 1 to 3 received 10 April 1997.

IV. Claim 1 of the main request reads as follows:

"An image pickup system for a craft (50) flying in a predetermined direction over an object zone (51), said image pickup system comprising an optical system located in said craft for producing an optical image of said object zone on a focussing area (53) of said optical system and image processing means (54) coupled to said optical system for electrically processing said optical image, said image processing means comprising:

an area sensor implemented by a photoelectric transducing member (55) including at least five photoelectric transducers associated with said focussing area for converting said optical image into partial electrical signals, at a time, representative of partial zones (51-1 to 51-n) of said object zone when said craft flies over each of said partial zones, said partial zones being in one-to-one correspondence to said photoelectric transducers (55-1 to 55-n), said photoelectric transducers being divided into forward transducers and backward transducers by a center line lying transversely of said predetermined direction, in a manner which divides said optical image into forward and backward images, said forward and said backward transducers dividing said partial electrical signals into forward electrical signals representative of said forward image and backward electric signals representative of said backward image, said forward and said backward transducers including a forward and backward transducer which are symmetrical on both sides of said center line and spaced apart by a preselected number of said photoelectric transducers, said

preselected number determining for said optical system a visual angle which covers a part of said object zone that consists of the partial zones of said preselected number;

signal processing means (65) coupled to said photoelectric transducers for processing said forward and said backward electrical signals into a plurality of stereo images defined by a plurality of base height ratios; and

means (60) for enabling designating at least two different base height ratios by producing an instruction signal indicative of at least two stereo signals to obtain at least two stereo images defined by said at least two different base height ratios, at a time, in response to a base height ratio designation signal which is transmitted from a ground station and which is for designating said at least two different base height ratios, said craft being capable of flying from a first flight position to a second flight position spaced apart from said first flight position by a distance corresponding to said preselected number of partial zones, said signal processing means comprising:

memory means (71) for memorizing said forward and said backward electrical signals as memorized forward signals and memorized backward signals; and

readout means (72) connected to said memory means and responsive to said instruction signal for reading a memorized forward signal and a memorised backward signal out of said memory means as a readout forward signal and a readout backward signal, said memorized forward signal comprising one of the forward electrical signals that is converted by said forward transducer when said craft is present at said first flight position, said memorized backward signals comprising one of the backward electrical signals that is converted by said backward transducer when said craft is present at said second flight position, said readout

forward and backward signals serving as said partial electrical signals, wherein said pair of forward and backward transducers correspond to a particular one of said two different base height ratio."

Claim 1 of the first auxiliary request differs in substance from claim 1 of the main request in that the transducing member (55) has "at least six photoelectric transducers" (cf five transducers in the main request), whilst the "different base height ratios", "stereo signals" and "stereo images" each number "at least three" (cf at least two in the main request).

Claim 1 of the second auxiliary request differs in substance from claim 1 of the first auxiliary request in specifying "at least seven photoelectric transducers".

V. The appellant argued as follows:

The invention concerned an image pickup system that could produce stereoscopic images of an object with several different perspectives, or base height ratios (using the language of the application), simultaneously. Although D3 disclosed photographing an object using a plurality of line sensors lying in different planes, different base height ratios were nevertheless not provided. Moreover, D3 did not disclose producing images with these different angles simultaneously. Rather, it disclosed individually switching the detectors required for photographing an image with a single given angle. Although D3 mentioned using the line sensors together, this did not necessarily imply that two images were produced. It could mean that several detectors were connected in parallel to produce a single lower resolution image. The reference in D3 to

simultaneous scanning in two or more converging scanning planes was intended to include the vertical plane, which was used to produce the conventional monoscopic image, rather than another pair of angled planes.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. *Added subject-matter and interpretation of claims*

2.1 The Board has considered whether the expression "at least five photoelectric transducers" in claim 1 of the main request is supported by the originally filed application. Although Figure 4 does show five transducers, these appear to be exemplary of an otherwise unspecified larger number; they are referenced 51-1, 51-(I-1), 51-I, 51-(I+1) and 51-n. However, in view of the finding below in respect of inventive step the Board has not found it necessary to decide this issue.

2.2 The expression "area sensor", used in claim 1, is not defined in the application, which shows strip photoelectric transducers such as a linear array of charge-coupled devices (CCDs), column 6, lines 46 to 50. The strips are said to be spaced, column 7, lines 22 to 26, although the number of strips is apparently such - 1001 optical images are mentioned at column 11, line 16 to column 12, line 42 - that a conventional raster scan CCD camera sensor is presumably used. The Board accordingly understands the expression "area sensor" in claim 1 to imply a continuous array of sensors as in a camera sensor.

2.3 The Board accepts the appellant's interpretation of the reference to converting an optical image on the individual transducers of the transducing member into partial electrical signals "at a time" as referring to the operation of the sensor itself and not to any other part of the data processing. The expression is interpreted as requiring that plural images be converted simultaneously.

3. *Inventive step (main request)*

3.1 The application is concerned with producing stereoscopic images of an object, located for example on the earth's surface, from a moving craft such as a satellite. The stereoscopic images are produced in known manner by photographing the object from different angles, that is, from different positions of the moving craft. As noted at point 2.3 above, for each position a plurality of transducers in the pickup unit photograph the object simultaneously. The object is first photographed by forward-looking sensors and then, after movement of the craft, by corresponding backward-looking sensors; the image data is then processed to produce stereoscopic images with different perspectives or base ratios from different sensor pairs.

3.2 It is common ground that D3 is the single most relevant prior art document. According to the description of the Figure 1 embodiment at page 3, lines 30 to 35, the image pickup system of D3 contains two line sensors Z_1 and Z_2 which record images from the strips L_1 and L_2 on the object in two scanning planes, "Abtastebenen" A_1 and A_2. The description states at page 4, lines 1 to 4 that each strip of the object is scanned twice in scanning planes A_1 and A_2 while the camera is moved relative to the object. It is clear from Figure 1 that A_1 and A_2 are converging planes, "gegeneinander geneigten Ebenen", referred to earlier in the description at page 2,

lines 2 to 4 as being required to produce a stereoscopic image. The Board accordingly concludes that the system of D3 produces a stereoscopic image by moving the camera relative to the object and scanning each strip first with a forward and then with a backward transducer to produce respective forward and backward images in the same manner as in the application.

3.3 The Figure 3 embodiment of D3 discloses exactly five line sensors, Z_1 to Z_5, which are described at page 4, lines 19 to 24 as being symmetrical about an optical axis. The pairs of sensors Z_2, Z_3 and Z_4, Z_5 are said to produce images with smaller and larger visual angles respectively. For a craft maintaining a constant height this is equivalent to two different base height ratios. Although D3 gives no details of the manner in which the signals from the line sensors are processed to derive stereo images it is self-evident that signal processing must be provided and that this will necessarily involve the storage and retrieval of signals as the craft moves from one position to the next.

3.4 The Board further understands D3 to suggest the provision of multiple stereoscopic images with different base height ratios "at a time", ie simultaneously. D3 refers at page 2, lines 28 to 32 to a simultaneous scanning of two or **more** converging scanning planes ("eine gleichzeitige Abtastung in zwei oder mehreren zueinander geneigten Abtastebenen"). At page 4, lines 15 to 17, reference is made to using the detectors Z_1 to Z_5 **together** in fixed planes ("Die Zeilendetektoren können zusammen für die Abtastung in

fest vorgegebenen Abtastebenen verwendet werden"). The Board takes this to mean that the object is scanned with all the possible angles, which in the case of five sensors implies two different base height ratios simultaneously as claimed.

3.5 The subject-matter of Claim 1 of the main request includes the following features not known from D3:

(a) the transducer is an "area sensor";
(b) the base height ratios are designated by a signal from a ground station.

3.6 As noted at point 2.2 above, the expression "area sensor" implies the use of a camera sensor. D3 does not disclose any particular kind of sensor, although the implication of the mechanical movement of the sensors in Figure 2 is that discrete sensor strips are used; no specific construction is suggested in connection with Figure 3. A craft intended for surveillance and being capable of stereo imaging could be expected also to make provision for instantaneous imaging; in the Board's view the skilled person, starting out from the disclosure of D3, would find it obvious to make use of the sensor strips of an "area sensor" intended for instantaneous imaging also for stereo imaging.

3.7 As regards feature (b), it appears self-evident that if there is a choice of sensors then the required perspective must be designated remotely, that is from a ground station. The passage at page 4, lines 18 to 24 of D3 suggests that as an alternative to using the line sensors together only one or some may be used, with the provision of switching of the relevant sensors ("Es ist jedoch auch möglich, nur einen oder einige der

Zeilendetektoren für eine Abtastung zu verwenden. Zu diesem Zweck ist eine Einrichtung zum Anschalten ...vorgesehen"). No invention would in the Board's view be involved in switching pairs of strips to enable different base height ratios to be selected.

3.8 The appellant argued that D3 does not suggest using more than one pair of angled planes at a time. The correct interpretation of the above-mentioned reference to two or more converging scanning planes was said to be one pair of angled planes plus the vertical plane which is used to produce a conventional monoscopic image. Moreover, the reference at page 4, lines 18 to 20 to switching to connect the appropriate sensor strips ("Einrichtung zum Anschalten der betreffenden Zeilendetektoren"), meant that images from the different pairs of sensors were not produced at the same time. The reference to using the sensors together was said to mean that the detectors could be connected in parallel to reduce the resolution of the single stereoscopic image. The Board, however, considers that these interpretations of the disclosure of D3 go against the plain meaning of the text and are not supported by any disclosure in the document.

3.9 The subject-matter of claim 1 of the main request accordingly lacks an inventive step.

4. *Inventive step (first auxiliary request)*

4.1 Claim 1 of the first auxiliary request adds to claim 1 of the main request an additional sensor which provides an additional base height ratio and a corresponding stereo signal and stereo image. The appellant argued that the system of D3 cannot reproduce stereo images with three base height ratios. The Board accepts that D3 only discloses the provision of two base height ratios; however, once the skilled person has derived

from D3 the idea of providing two base height ratios, no invention is required to extend the idea further to three or even more base height ratios, given that the sensor strips are part of a camera sensor.

4.2 The subject-matter of claim 1 of the first auxiliary request accordingly lacks an inventive step.

5. *Inventive step (second auxiliary request)*

5.1 Claim 1 of the second auxiliary request adds a seventh sensor. D3 discloses at Figure 3 the provision of sensor strips in pairs, together with a central, vertical plane sensor. The skilled person, having appreciated that more than two pairs could be provided, would have no reason to drop the central sensor.

5.2 The subject-matter of claim 1 of the second auxiliary request accordingly lacks an inventive step.

6. There being no other requests, it follows that the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl P. K. J. van den Berg