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Titre de l'invention : Photoelectric converter

Klassifikation / Classification / Classement : H01L 27/14

ENTSCHEIDUNG / DECISION

vom / of / du 15 May 1990

Anmelder / Applicant / Demandeur : Canon Kabushiki Kaisha

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 123(2) EPC

Schlagwort / Keyword / Mot clé : "Admissible amendments - Main and 1st and 2nd Auxiliary requests: no; 3rd Auxiliary request: yes"

Leitsatz / Headnote / Sommaire

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Case Number : T 509/89 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 15 May 1990

Appellant : Canon Kabushiki Kaisha
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Tokyo, Japan

Representative : Beresford, Keith Denis Lewis
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Decision under appeal : Decision of Examining Division 048 of the European Patent Office dated 3 February 1989 refusing European patent application No.84 304 517.0 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : K. Lederer
Members : J. Roscoe
L. Mancini

Summary of Facts and Submissions

I. European patent application No. 84 304 517.0 (publication No. 0 132 076) was refused by decision of the Examining Division.

II. The reason for the refusal was that the application, which at the time comprised a set of 60 claims, did not meet the requirements of Art. 123(2) EPC in that Claim 1 had been amended in such a way as to extend its subject-matter beyond the content of the application as filed.

In particular, Claim 1 was considered to define a generalised transistor structure not restricted to bipolar phototransistor structures but encompassing as well different transistor types such as MOS transistors which were not disclosed in the application documents as originally filed.

III. The Appellant lodged an appeal against this decision.

IV. Oral proceedings were held before the Board, at the end of which the Appellant requested that the appealed decision be set aside and, as a main request, that the case be remitted to the Examining Division for further prosecution on the basis of an amended Claim 1 presented at the oral proceedings, which reads as follows:

"1. A photoelectric converter for providing an output signal which varies as a function of light energy received thereby, comprising a light sensitive transistor (Fig. 1a, 1b) having a control electrode region (6) adapted to accumulate carriers in response to the received light energy while in a floating condition, and main electrode regions (1,7); and a conductive member (8,21) having capacitance and connected to one of said main electrode

regions (7) so that upon forward biassing of the junction between the control (6) and said one (7) main electrode regions an output signal dependent upon said accumulated carriers may be produced as a voltage across the capacitance of said conductive member (8,21); characterised in that the control electrode region (6) is coupled independently of the other said main electrode region (1) to a potential source (Vr) which effects said forward biassing."

The Appellant further submitted eight auxiliary requests to the effect that the case be remitted to the Examining Division for further prosecution on the basis of Claim 1 in accordance with the successive first to fifth auxiliary requests as remitted at the oral proceedings or of Claim 1 in accordance with the sixth to eighth auxiliary requests as filed on 26 April 1990.

Claim 1 in accordance with Appellant's first auxiliary request reads as follows:

"1. A photoelectric converter for providing an output signal which varies as a function of light energy received thereby, comprising a bipolar light sensitive transistor (Fig. 1a, 1b) having a base region (6) adapted to accumulate carriers in response to the received light energy while in a floating condition, and collector and emitter regions (1,7); and a conductive member (8,21) having capacitance and connected to the emitter region (7) so that upon forward biassing of the junction between the base (6) and the emitter (7) regions, an output signal dependent upon said accumulated carriers in the base region (6) may be produced as a voltage across the capacitance of the conductive member (8,21); characterised in that the base region (6) is coupled independently of said collector region (1) to a potential source (Vr) to effect said forward biassing."

Claim 1 in accordance with Appellant's second auxiliary request reads as follows:

"1. A photoelectric converter for providing an output signal which varies as a function of light energy received thereby, comprising a light sensitive transistor (Fig. 1a, 1b) having a control electrode region (6) adapted to accumulate carriers in response to the received light energy while in a floating condition, and main electrode regions (1,7); a thin insulative layer (3) adjacent said control electrode region (6); an electrode (9) adjacent said insulative layer (3); and a conductive member (8,21) having capacitance and connected to one of said main electrode regions (7) so that upon forward biassing of the junction between the control (6) and said one (7) main electrode regions an output signal dependent upon the accumulated carriers may be produced as a voltage across the capacitance of the conductive member (8,21); characterised in that the control electrode region (6) is capacitively coupled by said insulative layer (3) and said electrode (9) to a potential source (Vr) which effects said forward biassing."

Claim 1 in accordance with Appellant's third auxiliary request reads as follows:

"1. A photoelectric converter for providing an output signal which varies as a function of light energy received thereby, comprising a bipolar light sensitive transistor (Fig. 1a, 1b) having a base region (6) adapted to accumulate carriers in response to the received light energy while in a floating condition, and collector and emitter regions (1,7); a thin insulative layer (3) adjacent said base region (6); an electrode (9) adjacent said insulative layer (3); and a conductive member (8,21) having capacitance and connected to the emitter region (7)

so that upon forward biassing of the junction between the base (6) and the emitter (7) regions, an output signal dependent upon said accumulated carriers in the base region (6) may be produced as a voltage across the capacitance of the conductive member (8,21); characterised in that the base region (6) is capacitively coupled by said insulative layer (3) and said electrode (9) to a potential source (Vr) to effect said forward biassing."

V. In support of the allowability of his requests, the Appellant submitted essentially the following arguments.

(a) The admissibility under Article 123(2) EPC of an independent claim which is limited neither to the use of a bipolar transistor, nor to capacitive coupling of the control electrode region to a potential source through an insulated layer and an electrode, is the only issue under dispute as concerns present main and first and second auxiliary requests.

(b) A number of the independent claims as originally filed were not explicitly limited to the use of specific transistor technologies nor to the provision of specific means for controlling the potential of the control electrode region. Accordingly, the subject-matter of these originally filed claims also encompassed photoelectric converters including for instance MOS transistors operating as light sensitive elements or connected in such a way as to control the potential of the control electrode regions. The scope of Claims 1 in accordance with the main and first and second auxiliary requests cannot therefore extend beyond that of the claims as originally filed.

(c) The ability of the converter of the disclosed invention to operate as well with transistor types other than the bipolar type clearly follows from the description as originally filed, which in particular refers to both CCD and MOS-type image pickup devices in its introductory portion and further envisages the use of "any other suitable systems" instead of one or two bipolar transistors (page 60, lines 2 to 5).

(d) The optional character of the capacitive coupling of the control electrode region also clearly follows from the original application documents since, in particular, no such capacitive coupling is provided for the base of light sensitive transistor (412) in the embodiment shown on Fig. 36.

In addition, the similarity of the operation of the capacitive coupling means when used either for read-out or for refreshing purposes is clearly apparent from the original application documents, in particular from Fig. 14 and 15(a) which show that one electrode (9',151) capacitively coupled to the base of one light sensitive transistor (152) and a second electrode (120,150') capacitively coupled to the base of a vertically adjacent transistor (152') can be simultaneously connected to a potential source for simultaneously refreshing a matrix line which has just been read out and reading out the next line. Since furthermore the application documents also disclose the possibility of using a number of alternative coupling means instead of a capacitive coupling for performing the refreshing operation, such as bipolar transistors (Fig. 18(b); Fig. 19), diodes (Fig. 20(b)) or field effect transistors (Fig. 21(b); Fig. 23(c)), the skilled person will

readily deduce that these alternative coupling means may as well be used in lieu of a capacitive coupling for performing the read-out operation.

Moreover, originally filed Claim 17 did not recite any capacitive coupling means whatsoever, such capacitive coupling means being defined only in subordinate Claims 22 and 23 appended to Claim 17, which indeed is a standard way of indicating optionality of a feature.

In addition, the wording of originally filed process Claim 42 did not require either that the capacitor recited therein be actually used in the step of forward biassing the control electrode region in the read-out operation.

(e) Finally, it results from the findings in the earlier decisions of the Boards of Appeal T 66/85 (OJ EPO, 1989, 167), T 260/85 (OJ EPO, 1989, 105) and T 416/86 (OJ EPO, 1989, 308) that the optionality of certain features or the definition of a general function performed by a disclosed specific feature need not be explicitly described but that they may be implicit in the original application documents.

Reasons for the Decision

1. The appeal is admissible.

2. **Main request**

2.1 Independent Claim 1 in accordance with Appellant's main request is distinguished from any originally filed independent claim inter alia in that:

(a) the control electrode region is specified to be coupled "independently of the other said main electrode region" to a potential source which effects the forward biassing of the junction between the control and the other main electrode regions during read-out of the signal, whilst the originally filed independent claims either specified that the potential of the control electrode region is controlled through an electrically insulating region located between that control electrode region and an electrode (Claims 1, 33 and 42) or did not comprise any feature directed to the coupling of the control electrode region (Claims 17 and 43); and

(b) the claim now encompasses photoelectric converter structures including a single transistor only, comprising no more than three distinct electrode regions and not necessarily of the bipolar type, whilst the originally filed independent claims either required that the structure at least comprised four successive layers of specified conductivity type and impurity concentration (Claims 1 and 42) or that it formed a double transistor structure (Claims 17 and 33) or that the transistor was of the bipolar type (Claim 43).

In the Board's view, neither of the above amendments (a) and (b) brought to the independent claims is admissible under Art. 123(2) EPC since, for the

following reasons, they add to present Claim 1 subject-matter which extends beyond the content of the application as filed.

2.2 No explicit reference to an "independent" coupling of the control electrode region with respect to the other main electrode region during reading out of the signal dependent upon the accumulated carriers can be found anywhere in the original description and claims, and the presence of such explicit reference was not alleged by the Appellant either.

Neither could the Board find in the original application documents any clear implicit disclosure of a means for controlling the potential of the main electrode during the read-out operation other than through a control electrode separated from the control electrode region by an electrically insulating region. In particular, apart from the embodiment of Fig. 36, all other embodiments specifically disclosed with reference to the drawings exhibit such capacitive coupling of the base region during read-out, and Fig. 36 relied upon by the Appellant does not disclose a different means for coupling the base region of any of the transistors (412 and 413) during the read-out operation either. Indeed, Fig. 36 relates to an embodiment in which a bipolar light sensitive transistor (412) is associated to a bipolar read-out transistor (413); the light sensitive transistor (412) comprises a base which, apparently, is only controlled by a MOS transistor (416) which, just as the similar MOS transistor (417) connected to the base of the read-out transistor (413), is referred to in the description as a "refreshing" transistor (page 143, lines 25 and 26). There is however no indication in the description that the refreshing transistor (416) could as well be used for forward biassing of the base of the light sensitive transistor (412) during read-out. Quite on the contrary, the mode of

operation of the embodiment shown in Fig. 36 is stated in the description to be substantially the same as that described before (page 144, lines 1 to 3), in which a capacitor designated by the reference (411) in Fig. 33(c) and shown also in the Figs. 34 and without reference 35 is used for applying a positive voltage to the base of the read-out transistor (413) in the read-out operation (page 142, lines 3 to 10). Accordingly, Fig. 36 cannot be considered to provide an implicit but clear teaching that the MOS transistor (416), which is not connected to the same control line as capacitor (411), should be used as a means for independently coupling the base of transistor (412) in the read-out procedure.

Furthermore, whilst it is not denied that coupling of the base region through bipolar or MOS transistors and diodes is an effective alternative to capacitive coupling when used in the refreshing operation, the description consistently emphasises the effectiveness of that alternative for achieving "high-speed" refreshing and cannot therefore without hindsight be considered to disclose as well the use of the same alternative in place of the capacitive coupling still used in these embodiments for the read-out operation (page 90, lines 9 to 12; page 97, lines 6 to 9; page 102, lines 5 to 8 or page 105, lines 9 to 13).

Finally, with regard to Appellant's submission that the optionality of the capacitive coupling of the base region was made apparent to the skilled person by the fact that independent Claim 17 as originally filed did not include any feature relating to controlling the potential of the base, whilst the capacitive coupling thereof was defined only in dependent Claims 22 and 23, it is pointed out that the complete absence of a feature having a certain unmentioned function from an originally filed independent claim to a device, combined with reference in a claim

dependent thereon to a particular structure for performing the unmentioned function is deemed not to constitute an implicit disclosure of the device comprising alternative structures for performing that function.

2.3 Similarly, the application documents as originally filed do not contain any explicit disclosure of a photoelectric converter of a non-bipolar type. Indeed, the specific embodiments disclosed with reference to the drawings consistently comprise only bipolar photoelectric converters, and both the general statement in the description that the photoelectric converter of the present invention is basically characterised in that photo-excited carriers are stored in a floated base region and the broad wording of independent Claim 33 can hardly be considered to disclose the use of any other transistor type than the bipolar as a light sensitive element.

The Board cannot find any implicit disclosure of the use of different transistor types either in the mere reference made in the introductory portion of the description to CCD and MOS type image pickup devices which are cited only for the purpose of acknowledging the prior art, nor can the passage relied upon by the Appellant on page 60, lines 2 to 5 of the description, according to which any other suitable system may be used instead of one or two bipolar transistors, be construed as providing an unambiguous disclosure of the use of non-bipolar transistors as light sensitive elements. Indeed, the preceeding sentence refers to the problem of obtaining high output voltages from the photoelectric converter (page 59, line 23 to page 60, line 2), and accordingly the quoted passage should be interpreted as being directed to the possibility of using additional bipolar transistors or suitable systems in the output stage of the device, not as light sensitive elements. This is confirmed by the following sentence in which the use of a (single) bipolar transistor is said to

solve the problem of 1/f noise caused by the final stage MOS transistor amplifier of the conventional CCD image pickup device.

Also, the fact that Claim 1 as originally filed did not comprise any explicit limitation to bipolar transistors cannot necessarily be construed as suggesting the use of different transistor types. In particular, transistor structures including four successively contiguous semiconductor regions of the conductivity type and impurity concentration set out in the claim are common in, if not exclusive to, the bipolar transistor technology, so that, in view of this and the absence of any suggestion to the contrary in the rest of the application documents, Claim 1 as originally filed is held by the Board to be implicitly limited to photoelectric converters embodying this technology.

2.4 The remaining arguments put forward by the Appellant could not convince the Board of the allowability of Claim 1 under Art. 123(2) EPC.

It should be noticed that when taking into consideration the original claims in assessing the admissibility of amendments under Art. 123(2) EPC, it is their information content which is decisive and not their legal effect (scope), which is relevant only for the purpose of Art. 123(3) EPC. Indeed, the mere presence in an original set of claims which are broad in scope cannot in itself provide a proper basis under Art. 123(2) for any amended claim of restricted scope.

Finally, the Board agrees with Appellant's submission based on the decisions T 66/85, T 260/85 and T 416/86 that an amendment which is not explicitly supported by the original application documents may be allowable under Art. 123(2) EPC, but only if the subject-matter resulting

from the amendment is implicitly disclosed in these documents. In the present instance, however, no such implicit disclosure of the subject-matter of amended Claim 1 could be found in the original application documents, for the reasons indicated above.

2.5 For these reasons, Appellant's main request cannot be allowed.

3. **First and Second Auxiliary Requests**

Claim 1 in accordance with Appellant's first and second auxiliary requests respectively comprise the amendments (a) and (b) defined in paragraph 2.1 above, which, for the reasons indicated, are not admissible under Art. 123(2) EPC.

Accordingly, Appellant's first and second auxiliary requests cannot be allowed either.

4. **Third Auxiliary Request**

4.1 Claim 1 in accordance with Appellant's third auxiliary request does not include the amendments objected to in connection with Appellant's main and first and second auxiliary requests.

Furthermore, Claim 1 in accordance with the third auxiliary request is distinguished from originally filed Claim 43 by the addition of a number of features which are adequately supported by the original description.

In particular, there is no objection to the fact that the claimed converter does not comprise a high resistivity or low impurity concentration semiconductor region since the absence of such region is supported by original Claim 33, which is directed to a photoelectric converter comprising

light sensitive transistors, each of which is required to have only three semiconductor regions, the high resistivity (low impurity concentration) region of each transistor being an optional addition referred to in Claims 34 and 35 respectively. The provision of a "conductive member having capacitance" connected to one of the main electrode regions is supported by page 29, lines 8 and 9 of the original description, where conductor 8, which features in embodiments with and without the high resistance region, is thus identified.

Accordingly, Claim 1 in accordance with Appellant's third auxiliary request does not offend against the provisions of Art. 123(2) EPC.

4.2 The refusal of the present application by the Examining Division was based on the sole ground of non-compliance of Claim 1 in its then valid version with the requirements of Art. 123(2) EPC.

The Examining Division has not yet issued a reasoned statement on the patentability of the subject-matter of Claim 1, taking into account in particular the limitation made to its scope by the Appellant just before the application was refused and directed to the capacitive coupling of the control electrode region to a potential source during the read-out operation through an electrode and an insulative layer.

For these reasons, the Board deems it appropriate to make use of the powers conferred on it by Art. 111(1) EPC to remit the case to the Examining Division for further prosecution.

For avoidance of doubt, it is emphasised that in the procedure before the Board for the sake of expediency and in view of the number of claims actually on file when the

application was refused and the number of auxiliary requests made by the Appellant, the Board has limited itself to the consideration of one independent claim for each request only. However, this does not in itself bar the Appellant from re-introducing dependent and additional independent claims where appropriate, during further prosecution of the application.

5. Since Appellant's third auxiliary request can be allowed, his subsequent fourth to ninth auxiliary requests need not be further considered by the Board.

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 for further prosecution on the basis of Claim 1 in accordance with Appellant's third auxiliary request as presented at the oral proceedings of 15 May 1990.

The Registrar: The Chairman:

P. Martorana K. Lederer