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**Datasheet for the decision
of 4 May 2012**

Case Number: T 1622/08 - 3.4.02

Application Number: 04702790.9

Publication Number: 1586856

IPC: G01B11/00

Language of the proceedings: EN

Title of invention:
OPTICAL SENSING DEVICE

Applicant:
HAMAMATSU PHOTONICS K.K.

Headword:

Relevant legal provisions:
EPC 1973 Art. 56

Keyword:
inventive step - claim 1 (yes)

Decisions cited:

Catchword:



Case Number: T1622/08 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 4 May 2012

Appellant: HAMAMATSU PHOTONICS K.K.
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted 20 March 2008
refusing European patent application No.
04702790.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: A. Klein
Members: M. Rayner
B. Müller

Summary of Facts and Submissions

I. The applicant has appealed against the decision of the examining division refusing European patent application number 04 702 790.9 (=WO-A-2004/065899) concerning a solid state imaging device. Documents including the following have been referred to in the proceedings before the examining division:

D1 JP-A-63 266 871,
D2 JP-A-2001 141 565,
D4 US-A-2002 00 60 284.

II. In the decision under appeal, the examining division considered the subject-matter of claim 1 to differ from the disclosure of document D1 in comprising circuitry allowing photodetector read out in both x- and y dimension in parallel rather than addressing each pixel individually and reading out serially. The problem to be solved was regarded by the division as providing simple and fast read-out circuitry (see paragraph [0005] of the application) for which it considered the solution proposed in claim 1 as not inventive. The skilled person would consider parallel read-out, because throughout all fields of electronics it is well-known that parallel signal processing is necessarily quicker than serial read-out.

Moreover, document D1 discloses (cf. fig. 2) an array (ARR) comprising first (cf. fig. 8, PDA) and second (cf. fig. 8, PDB) photosensitive portions in a regular chequered pattern. In addition there are first (HS1, HS3, etc) and second (HS2, HS4, etc.) pluralities of wires which alternately contact said first and second photosensitive portions. Both wires are, in contrast to

the subject-matter of claim 1, oriented horizontally. A skilled person seeking two dimensional position detection had a direct incentive to redirect one plurality of horizontal wires known from document D1 to vertical readout because reference to document D4 shows it to make explicit reference to a two dimensional arrangement of photosensitive elements (see paragraph [0032]). The skilled person not only could but in fact would have combined the teachings of documents D1 and D4 without any inventive step. Therefore, the subject matter of claim 1 cannot be considered to involve an inventive step.

In an "Obiter Dictum" the examining division said that a reverse combination starting from document D4 as closest prior art would in fact also lead the skilled person to the subject-matter of claim 1 without any inventive step, the problem to be solved by the present invention then being regarded as providing a two dimensional array of photosensitive portions which enables performance of two-dimensional position detection in a quick and easy manner.

For the sake of completeness, it is mentioned that a combination of D1 and D2 would also lead the skilled person to the subject-matter of claim 1.

- III. The appellant requested that the decision under appeal be set aside and a patent granted on the basis of claims the same as those upon which the refusal of the examining division had been based. Oral proceedings were requested on an auxiliary basis.

- IV. In support of its case, the appellant advanced arguments including the following.

Document D1 relates to a solid-state image sensor for obtaining a two-dimensional image. As can be seen in Figure 2 of document D1, the sensor is divided into pixels, each pixel comprising two photodetectors (PD1, PD2). In order to acquire an image, it is necessary to obtain a signal identifying the received light for each pixel. The sensor uses three lines: horizontal-scanning lines (HL); vertical-scanning lines (VL); and horizontal output signal lines (HS). The only lines shown in document D1 to be connected in a non-horizontal direction are the vertical scanning lines (VL). However, all of these lines are connected to the gates of transistors and are therefore not electrically connected to a plurality of second photosensitive portions from a plurality of pixels, nor would they provide electric currents from these respective pluralities of second photosensitive portions. Only one set of lines (HS) are connected to photosensitive portions such that they carry the electric currents from the photodetectors. The lines concerned, i.e. HS1, HS3, etc. and lines HS2, HS4, etc., are all connected to photodetectors from a plurality of pixels in the same direction (i.e. horizontally). As a consequence, the arrangement is not adapted to generate luminous profiles in two dimensions. The problem to be solved by the novel features of the invention is how to provide a photodetector which can detect a two dimensional position of incident light.

Document D4 describes a photo-detecting apparatus having multiple photodetectors. Each photodetector generates an output which is provided to a respective integrating circuit. In other words, each photodetector has a corresponding, individual integrating circuit. No suggestion is given in document D4 about connecting

wires across a plurality of pixels in vertical direction, let alone a direction that is different from that taught by document D1. Thus, the skilled person could not (and therefore certainly would not) find any motivation to provide a plurality of second wires, connected to a plurality of pixels across a second direction. Therefore the subject matter of claim 1 is not obvious and can be considered to involve an inventive step.

The disclosures of documents D2 and D4 are similar, such that the present invention comprises an inventive step over the combination of D1 with D2, for the same reasons as it comprises an inventive step over the combination of D1 with D4. It is not therefore necessary separately to analyse the disclosures of D2.

The present invention therefore comprises an inventive step over all of the prior art.

V. Independent claim 1 according to the request of the appellant is worded as follows.

"1. Aphotodetector comprising:
a photosensitive region comprising:
a plurality of pixels (11), the pixels being arranged two dimensionally, each pixel (11) being constructed by at least one first photosensitive portion (12, 41) and at least one second photosensitive portion (13, 42), and the at least one first photosensitive portion and the at least one second photosensitive portion, each being arranged to output respective electric currents corresponding to incident light intensities, and being arranged adjacent to each other within a single plane;
a plurality of first wires (44), each first wire from said plurality of first wires being electrically connected to a plurality of first photosensitive

portions from a plurality of pixels across a first direction in said two-dimensional pixel arrangement; a plurality of second wires (47), each second wire from said plurality of second wires being electrically connected to a plurality of second photosensitive portions from a plurality of pixels across a second direction in said two-dimensional pixel arrangement, the second direction being different from the first direction;

the photodetector further comprising:

a plurality of first integrating circuits (110), each of said first integrating circuits corresponding to one of the plurality of first wires (44), and each of said first integrating circuits being arranged to convert the corresponding electric currents from the respective plurality of first photosensitive portions that are electrically connected to the respective first wire into a voltage, and to output the voltage;

a plurality of second integrating circuits (210), each of said second integrating circuits corresponding to one of the plurality of second wires (47), and each of said second integrating circuits being arranged to convert the corresponding electric currents from the respective plurality of second photosensitive portions that are electrically connected to the respective second wire into a voltage, and to output the voltage; and either further comprising:

A) a first maximum value detecting circuit (140) for detecting a maximum value of the respective voltages outputted from the plurality of first integrating circuits;

a first A/D converter circuit (180) for converting the respective voltages outputted from the plurality of first integrating circuits into digital values within an A/D conversion range from the maximum value detected by the first maximum value detecting circuit to a value

smaller than the maximum value by a predetermined value and outputting the digital values;

a second maximum value detecting circuit (240) for detecting a maximum value of the respective voltages outputted from the plurality of second integrating circuits; and

a second A/D converter circuit (280) for converting the respective voltages outputted from the second integrating circuits into digital values within an A/D conversion range from the maximum value detected by the second maximum value detecting circuit to a value smaller than the maximum value by a predetermined value and outputting the digital values

or further comprising:

B) a first minimum value detecting circuit (140) for detecting a minimum value of the respective voltages outputted from the plurality of first integrating circuits;

a first A/D converter circuit (180) for converting the respective voltages outputted from the plurality of first integrating circuits into digital values within an A/D conversion range from the minimum value detected by the first minimum value detecting circuit to a value greater than the minimum value by a predetermined value and outputting the digital values;

a second minimum value detecting circuit (240) for detecting a minimum value of respective voltages outputted from the second integrating circuits; and

a second A/D converter circuit (280) for converting the respective voltages outputted from the second integrating circuits into digital values within an A/D conversion range from the minimum value detected by the second minimum value detecting circuit to a value greater than the minimum value by a predetermined value and outputting the digital values."

There is also a claim referring to claim 1 and directed to an optical apparatus as follows.

"3. An optical apparatus comprising:
a light source for emitting light; and
a photodetector according to claim 1, wherein the photodetector is disposed so that the light emitted from the light source is incident thereupon either directly or indirectly."

Reasons for the Decision

1. The appeal is admissible.
2. Patentability
 - 2.1 In agreement with the examining division and the appellant, document D1 can be taken to represent the closest prior art to the subject matter defined in claim 1. In this document, as convincingly argued by the appellant, only the HS lines are outputs, which lines are, however, all arranged in the same direction. There is therefore no second direction within the meaning of claim 1, as seems to have been at least implicitly acknowledged by the examining division (see the third sentence of the second paragraph in section II of the Facts and Submissions above, which corresponds to section 8.1 of the decision under appeal). Moreover, as the appellant has pointed out a further difference is that the (first and second) wires known from document D1 do not provide electric currents from a respective plurality of photosensitive portions.
 - 2.2 The subject matter explicitly identified by the examining division as novel, namely

"circuitry allowing photodetector read out in both x- and y dimension in parallel rather than addressing each pixel individually and reading out serially"

does not faithfully reflect the wording of the claim and opens a window for misunderstanding. The reason for this is that "parallel readout" would normally be understood as reading out separate individual values of the photosensitive portions at the same time. This is not the same as

"converting the corresponding electric currents from the respective plurality of second photosensitive portions that are electrically connected to the respective {first or second} wire into a voltage".

2.3 Accordingly, the board will take the features identified in point 2.1 to be novel, rather than the subject matter identified explicitly as novel by the examining division.

2.4 The problem to be solved according to the statement of grounds for appeal is how to provide a photodetector which can detect a two dimensional position of incident light. Since a two dimensional matrix is disclosed in document D1, a two dimensional position of light can be detected, so this problem does not reflect accurately that solved by the novel subject matter.

In the board's view, the problem to be solved by the novel subject matter was correctly identified in paragraph [0005] of the application, namely

"to provide a photodetector capable of achieving a faster detecting process of two-dimensional positions as well as a simpler structure."

In particular, as referred to by appellant, luminous profiles are able to be used in the detecting process consequent to the claimed connection of a plurality of photosensitive portions. Although the examining division also identified paragraph [0005] of the application as pertinent to the problem to be solved, it inappropriately restricted the problem to providing circuitry, presumably to fit better with the its view of parallel readout, rather than the, in the board's view, untainted by the solution, more conceptual problem of providing a photodetector.

2.5 A key feature enabling use of luminous profiles is

"converting the corresponding electric currents from the respective plurality of second photosensitive portions that are electrically connected to the respective {first or second} wire into a voltage".

Even if the skilled person, based on the idea that "throughout all fields of electronics it is well-known that parallel signal processing is necessarily quicker than serial read-out", were in some undescribed way to use parallel readout as postulated by the examining division, the claimed subject matter would not be reached. This is because reading each photosensitive portion at the same time but separately, rather than a plurality of photosensitive portions in a wire direction being converted to a voltage, would simply amount to speeding up the known process but not to providing a photodetector with a faster detecting process. Enabling of use of luminous profiles requires further steps including the key feature referred to above which would only have been obvious with knowledge of the invention.

2.6 Turning to document D4, there is a reference to two dimensional detection in paragraph [0032] as pointed out by the examining division. A similar reference is made in paragraph [0096]. However, as the appellant has pointed out, each photodetector generates an output which is provided to a respective integrating circuit. Moreover no suggestion is given about connecting wires across a plurality of pixels in a direction that is different from that taught by document D1. Therefore the teaching of document D4 brings the skilled person no closer to enabling use of luminous profiles than document D1, even if a respective integrating circuit like that for the photodiodes PD in document D4 were to be provided for each photosensitive portion in document D1. Accordingly, even should the teachings of documents D1 and D4 be combined, the subject matter of claim 1 is not rendered obvious, whether Document D1 or D4 is considered as starting point is immaterial to this conclusion.

2.7 Neither document D2 nor any other document in the file come closer to the subject matter of claim 1 than documents D1 and D4 and so the positive view of the board in relation to inventive step is not affected thereby. Claims 2 and 3 include the features of claim 1 and therefore, for corresponding reasons, do not give rise to objection for lack of inventive step.

3. Procedure

3.1 In view of the foregoing and since the board sees no other bar to grant of a patent, it is considered appropriate to exercise powers within the competence of the first instance and order grant of a patent.

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 patent based on the following documents:

Description

Pages 4-24, 26-34, 36-41, 43 filed with entry into the regional phase before the EPO 1-3, 25, 35, 42 received on 25 January 2007 with the letter dated 24 January 2007,

Claims

1-3 received on 20 August 2007 with the letter dated 14 August 2007, and

Drawing Sheets

1/22 to 19/22, 21/22, 22/22 filed with entry into the regional phase before the EPO, 20/22 received on 01 August 2005 with the letter dated 29 July 2005,

with the following amendments to the above mentioned documents according to

the request dated 29 July 2005

Description, Pages 13,22,37 and the request dated 14 August 2007:

Description, Page 28.

The Registrar:

The Chairman:



M. Kiehl

A. Klein

Decision electronically authenticated