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Aktenzeichen / Case Number / N^o du recours : T 751/89 - 3.4.1

Anmeldenummer / Filing No / N^o de la demande : 85 200 580.0

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Bezeichnung der Erfindung: Charge-coupled device

Title of invention:

Titre de l'invention :

Klassifikation / Classification / Classement : H01L 27/14

ENTSCHEIDUNG / DECISION

vom / of / du 4 September 1990

Anmelder / Applicant / Demandeur : N.V. Philips' Gloeilampenfabrieken

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

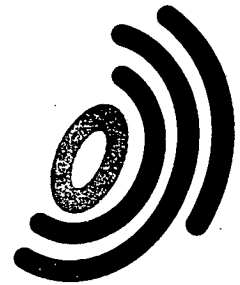
Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Art. 56

Schlagwort / Keyword / Mot clé : "Solved problem no hindrance to test and
apply known alternative solutions; obvious
interchange of equivalents"
"Inventive step (No)"

Leitsatz / Headnote / Sommaire



Case Number : T 751/89 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 4 September 1990

Appellant : N.V. Philips' Gloeilampenfabriken
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Decision under appeal : Decision of Examining Division 048
of the European Patent Office dated
11 August 1989 refusing European
patent application No. 85 200 580.0
pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : K. Lederer
Members : H.J. Reich
L.C. Mancini

Summary of Facts and Submissions

I. European patent application 85 200 580.0 (publication number 0 159 758) was refused by a Decision of the Examining Division in respect of Claim 1 filed on 30 November 1988.

II. The reason given for the refusal was that Claim 1 did not satisfy Articles 52(1) and 56 EPC with regard to documents:

D3: US-A-4 178 614 and

D4: US-A-4 131 950.

It would be obvious to a skilled person to arrive at the subject-matter of Claim 1 by making an analogue use of the "accordeon" read-out technique known from document D3 in the clearly compatible densely packed starting configuration existing in the charge transfer register of the charge coupled device known from document D4, because the teaching of document D3 would be applicable irrespective of the injection mechanism employed to introduce the charge packets into the register.

III. The Appellant lodged an appeal against this decision.

IV. Oral proceedings were held before the Board during which the obviousness of the subject-matter of Claim 1 in view of documents D3 and D4 was discussed, and at the end of which the Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of Claim 1 filed on 10 November 1989 with the following amendments:

in line 19 "characterised in that" is replaced by "and", in line 25 "and" is replaced by "characterised"; Claims 2 and 3 as published; and the published description adapted to new Claim 1.

V. Claim 1 reads as follows:

"A charge coupled device comprising a semiconductor body having a surface-adjointing semiconductor region in which a charge transport channel for storing and transporting information-representing discrete charge packets is defined, which device further comprises a system of clock electrodes which are located above the charge transport channel and which are connected to means for supplying clock voltages for transporting the said charge packets from a first position in the charge transport channel to a second position in such a manner that per n successive clock electrodes only one charge packet is present, n being an integer and larger than or equal to two, the charge transport channel further being provided with a number of parallel inputs which each corresponds to at least one of the said clock electrodes, a separated row of charge storage means being present adjacent to the said charge transport channel and being connected to the charge transport channel via said parallel inputs for storing a row of charge packets which may be introduced in parallel into the charge transport channel via said parallel inputs, the distance between two adjacent parallel inputs being about equal to m electrodes, m being an integer, smaller than n and at least 1, and means are provided by means of which during the introduction of charge packets voltages are supplied to the clock electrodes, at least at the area of the said first position in the charge transport channel a potential profile being obtained of potential wells mutually separated by potential barriers, under each clock electrode associated with one parallel

input a potential well being formed in which a charge packet can be stored, characterized in that the said means for supplying clock voltages for transporting the introduced charge packets supply such clock voltages that, viewed in the charge transport direction, first only the first charge packet is shifted over a distance of at least one electrode, after which only the first and then the second charge packet are shifted simultaneously over the same distance, etc., wherein each time after a preceding charge packet has been shifted over the said distance, a next charge packet participates in the n-phase charge transport until also the last charge packet participates in the n-phase charge transport."

Claims 2 and 3 are referred back to Claim 1.

VI. In support of his request, the Appellant argued essentially as follows:

- (1) Due to the fact that document D4 offers already a solution to the problem underlying the present application - i.e. to increase the horizontal resolution (pixel density) of the information in a charge coupled device - it would not be obvious to a skilled person to further on pursue this problem and to combine the teachings of documents D4 and D3; see document D4, column 1, lines 4 to 21, and column 2, lines 17-29.
- (2) The "accordeon" read-out technique applied in the charge coupled device known from document D3 solves a problem which is different from the present application, to wit the increase of the vertical resolution; see document D3, column 2, lines 57-60.

- (3) Despite the wording of document D3, column 11, paragraph 2, a skilled person would not generalise the teaching of document D3. In particular, document D3 does not hint at increasing the horizontal resolution by the "accordeon" read-out technique but states explicitly that during part of the horizontal line time (of a commercial television system) "a row is shifted serially out of the C register in conventional fashion"; see document D3, column 5, line 66 to column 6, line 1.

- (4) Moreover, starting from the device known from document D4, in which the horizontal resolution is increased by introducing the charge packets from every second pixel into a second charge transfer register, the present application teaches in the following different direction: By applying the "accordeon" read-out technique an increase of horizontal resolution can be obtained with only one register.

Reasons for the Decision

1. The appeal is admissible.

2. There is no objection to the claim as far as Article 123(2) EPC is concerned.

3. **Novelty**
 - 3.1 From document D4 (in particular Figure 1 with the corresponding description) there is known, as admitted by the Appellant, a charge coupled device as defined in the precharacterising part of Claim 1; see the charge transport channel (register) 6; the clock electrodes 8 to

11; the means for supplying the clock voltage at 27 to 30; the separate row of charge storage means 20; and column 8, lines 32-35 in combination with Figures 4A to 4D at transfer time τ_2 with regard to the voltage supply to the clock electrodes during the introduction of charge packets into the charge transport channel, wherein potential wells are mutually separated by potential barriers.

The subject-matter of Claim 1 differs from this prior art in the read-out mechanism defined in the characterising part of Claim 1. The prior art device does not use the "accordeon" technique but transfers each second charge packet from a first transport channel into a second transport channel and thereafter simultaneously reads-out serially both channels in a conventional way, i.e. with an empty potential well between each charge packet to be transported right from the beginning of the read-out step, whereas in the "accordeon" technique said empty potential wells are successively created during the read-out steps itself.

- 3.2 The charge coupled device known from document D3 makes - not contested by the Appellant - use of the "accordeon" read-out technique as defined in the characterising part of Claim 1, but differs from the subject-matter of Claim 1 in a feature claimed in its preamble: The known "separated row of charge storage means" (i.e. a column of the A-register of Figure 10 of D3) is not connected to the charge transport channel (i.e. a column of the B-register) "by a number of parallel inputs", but serially by only one input. Hence, the mutual geometrical configuration of said "separated row of charge storage means" (pixels) and said "charge transport channel" is different in the present patent application and in the known device. In the prior art known from document D3 the separated row of charge storage means (pixels) does not face in parallel its

related charge transport channel but lies in line with it. This geometrical arrangement is part of a frame transfer type device, wherein the "accordeon" read-out technique is used to vertically transfer charges from a two dimensional pixel array (A-Register) into a two dimensional storage array (B-Register) and from this storage array into a linear shift register (C-Register), whereby individual rows of the stored information are subsequently read-out horizontally, forming the video signals for the subsequent rows on a television screen (D3, column 5, line 66 to column 6, line 5).

3.3 ESR-document EP-A-0 128 615 (D2) and document EP-A-0 106 286 (D1) cited by the Examining Division represent a prior art according to Article 54(3) EPC. The devices described in both said documents have no charge transfer channel with a plurality of parallel inputs.

3.4 The subject-matter of Claim 1 is, therefore, novel in the sense of Article 54 EPC.

4. Inventive step

4.1 Starting from the nearest prior art as described in document D4, the objective problem underlying the present application is to indicate an alternative way of realising an increased resolution in the transport direction of a charge transport channel in a charge coupled device, which channel has a multitude of parallel inputs. The Board cannot follow the Appellant's views (see point VI-1) that an already solved technical problem excludes any subsequent attempt of an expert to solve this known problem in a different way. The Board is rather convinced that in practice the search for alternative solutions is part of a skilled person's normal routine activities. In particular, an existing solution of a technical problem in

the Board's opinion is no reason for an expert not to observe further on the progressing technical development of his own field. It is, on the contrary, held to be one of the usual tasks of an expert who works in a developmental department to test for his own purposes the usability of new alternative techniques recently developed in his particular technical field for some different purpose. An expert can, furthermore, be expected to apply a known alternative in analogous situations, if this application appears desirable to him for reasons which result from needs of the industrial practice. Moreover, the Board follows the permanent jurisdiction of the Boards of Appeal when regarding it as obvious to relate two technical teachings with one another if they are both known in the same technical field; see point VI-1 above.

4.2 The Appellant is followed in his view that in the device known from document D3, the "accordeon" read-out technique is used in order to increase the vertical resolution (within a column of a two dimensional display). However, in the Board's opinion this particular technical purpose does not prevent a skilled person from recognising that the "accordeon" read-out technique is a technical means for increasing the resolution in the transport direction of the charge packets in the charge transport channel of a register independently from the fact whether this transport direction is vertical or horizontal; see point VI-2 above.

4.3 In the fact that for the read-out step of the C-Register in the device known from document D3 the "accordeon" technique is not applied - see point VI-3 above - the Board can neither see a prejudice nor a technical difficulty that would prevent a skilled person from understanding that this technique can be effectively applied also when the transport direction of the charge

packets is turned by 90 degrees. An expert will rather explain the use of the conventional read-out fashion of the C-Register by the need to read-out the row-information of this register within part of the horizontal line time of television (see document D3, column 5, line 66 to column 6, line 5), the conventional simultaneous serial read-out being quicker than the "accordeon" technique (see document D3, column 2, lines 65-67).

4.4 Furthermore, the Board regards a skilled person to be able to deduce from document D3 that the functioning of the "accordeon" read-out technique is not at all influenced by any measures and means which effect the charge packet transport into each neighbouring potential well of the transport channel before the start of the "accordeon"-like read-out. In the Board's opinion, a skilled person will find out without any difficulties that the charge packet distribution at the end of transfer time τ_2 in the device of document D4 with potential wells and charge packets under clock electrodes 9 and 11 (Figures 4B and 4D of document D4) and with potential barriers under clock electrodes 8 and 10 (Figures 4A and 4C of document D4) is analogous to and compatible with the charge packet distribution in register B of document D3 at time "t_D" in Figure 11. On the basis of the above facts, a skilled person will recognise that the "accordeon" read-out technique according to document D3 and the second transport channel (7) according to document D4 represent equivalent technical means as far as higher resolution is concerned. The necessary measures for an interchange of said known equivalents in the device known from document D4 are self-evident to an expert. Also the Appellant has put forward no technical facts demonstrating that it would surpass a skilled person's normal abilities to keep gate 31 of the device according to document D4 closed, to provide means for supplying to its clock electrodes 8 to

11 the potential supply programme of shift register 86 in Figure 10 of document D3, to find out that gate 31, paths 33 and register 7 in Figure 1 of document D4 lose their function and, consequently, to omit them; see point VI-4 above.

- 4.5 For the reasons set out above, the Board considers the skilled person able to see that the "accordeon" read-out technique described in document D3 and the second transport channel (7) used in the device known from document D4 represent equivalent measures with regard to an increase of the resolution of a register in transport direction of the charge packets. Other known properties of the "accordeon" technique - such as for instance its longer read-out time - lead to foreseeable consequences which a skilled person may accept. The arrival at the subject-matter of Claim 1 by an interchange of both these equivalents produces neither surprising effects nor technical difficulties and is, therefore, held to be obvious to a person skilled in the art.
- 4.6 Therefore, in the Board's judgement, the subject-matter of Claim 1 lacks an inventive step within the meaning of Article 56 EPC.
5. As set out above, Claim 1 is not allowable with regard to Articles 52(1) and 56 EPC. Claims 2 and 3 are not allowable either, since they are dependent on unallowable Claim 1.

Order

For these reasons, it is decided that:

The Appeal is dismissed.

The Registrar:

The Chairman:

M. Beer

K. Lederer