BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Publication in the Official Journal ~~Yes~~ / No

File Number: T 226/91 - 3.4.1

Application No.: 81 305 825.2

Publication No.: 0 053 946

Title of invention: Elongate thin-film reader

Classification: H01L 27/14

DECISION
of 10 March 1992

Proprietor of the patent: FUJI XEROX CO., LTD

Opponent: SIEMENS AG

Headword:

EPC Article 56

Keyword: "Inventive step (no)"

Headnote

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 226/91 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 10 March 1992

Appellant : (Proprietor of the patent)
FUJI XEROX CO., Ltd
No. 3-5, Akasaka 3-chome
Minato-Ku Tokyo 107 (JP)

Representative :
Prutton, Roger
Marks & Clerk
Alpha Tower
Suffolk Street Queensway
Birmingham B1 1TT (GB)

Respondent : (Opponent)
Siemens Aktiengesellschaft
Berlin und München
Postfach 22 16 34
D-8000 München 22 (DE)

Decision under appeal :
Decision of the Opposition Division of the European Patent Office dated 17 January 1991 revoking European patent No. 0 053 946 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : G.D.Paterson
Members : H.J. Reich
Y. van Henden

Summary of Facts and Submissions

I. The Appellant is owner of European patent No. 0 053 946.

Claim 1 reads as follows:

"1. A manuscript reader of the type having a photosensitive device receiving incident light from said manuscript and changing its conductive state in accordance with said incident light and a detection circuit for detecting the conductive state of said photosensitive device, said photosensitive device comprising a first electrode (5) formed on a substrate (8), a photoconductive amorphous silicon film (6) formed over said first electrode; and a second electrode (7) formed over said silicon film, one of said electrodes being transparent and receiving said incident light, characterised in that the other electrode is formed of metal and includes a thin oxide layer formed on the surface thereof, said silicon film being in contact with the thin oxide layer."

Claims 2 to 9 are dependent on Claim 1.

II. This patent was revoked by a decision of the Opposition Division on opposition by the Respondent, on the ground that the subject-matter of granted Claim 1 was lacking an inventive step having regard to documents:

D1: DE-A-2 723 914, and
D2: DE-A-2 652 436.

The Opposition Division took the view that a skilled man having to solve the problem of reducing the dark current in a manuscript reader employing a photoconductive device

comprising amorphous silicon according to document D1 has a clear motivation to apply the teaching of document D2 concerned with the same problem in a related device. Since the injection of holes from the electrode into the photoconductive material and hence the dark current are, according to document D2, reduced by providing a thin oxide layer between said electrode and said photoconductive layer, the skilled man would also use such an oxide layer between the hole-injecting electrode and the photoconductive silicon layer in a manuscript reader according to document D1 and thus arrive at a device according to Claim 1 of the contested patent.

III. The Appellant lodged an appeal against this decision.

IV. In a communication annexed to a summons to oral proceedings the parties were informed of a series of facts on which the Board based its provisional view that the opinion of the Opposition Division might possibly be followed and the subject-matter of Claim 1 be regarded in particular the obvious use of the teaching of document D2 in the closely analogous situation of the device known from document D1.

V. In a letter dated 13 January 1992 the Respondent stated that he would not attend the appointed oral proceedings.

VI. In response to the communication of the Board, the Appellant maintained granted Claim 1 as main request and filed on 25 February 1992 a new set of amended claims as auxiliary request.

Claim 1 of the auxiliary request reads as follows:

"1. A manuscript reader of the type having a photosensitive device receiving incident light from said

manuscript and changing its conductive state in accordance with said incident light and a detection circuit for detecting the conductive state of said photosensitive device, said photosensitive device comprising a first electrode (5) formed on a substrate (8), a photoconductive amorphous silicon film (6) formed over said first electrode; and a second electrode (7) formed over said silicon film, one of said electrodes being transparent and receiving said incident light, characterised in that the other electrode is formed of metal and includes a thin oxide layer formed of an oxide of said metal on the surface thereof, said silicon film being in contact with the thin oxide layer."

Claims 2 to 9 of the auxiliary request are dependent on Claim 1.

VII. Oral proceedings were duly held on 10 March 1992, at which the Respondent was not represented and at the end of which the Appellant requested that the decision under appeal be set aside and that the patent be maintained: as main request, with the text as granted; as auxiliary request, on the basis of the description and claims as filed on 25 February 1992.

VIII. In support of his main and auxiliary request, the Appellant made essentially the following submissions:

(a) The Board has too broad a view on what an expert reads into document D2. A skilled person would not be as analytical as the Board considers and would not look at the underlying principles but only at the practical technical teaching of this document.

(b) Due to the fact that in document D2 amorphous silicon is only mentioned within the presentation of the prior

art on page 3, paragraph 1, and nowhere in the disclosed examples of this document which only use photoconductive layers containing amorphous selenium, document D2 would not teach how to prevent a dark current in a photoconductive layer consisting of amorphous silicon.

(c) Moreover, document D2 teaches to provide the thin oxide layer only between the transparent electrode and the photoconductive layer but not between the photoconductive layer and a metal electrode as claimed in Claim 1.

(d) Whereas in the prior art according to document D2 the oxide layer is deposited as a separate operation, Claim 1 of the auxiliary request offers the advantage to form the oxide layer of an oxide of the metal from which the non-transparent metal electrode is formed, avoiding thus the use of masking techniques and the risk that parts of the metal remain in direct contact with the amorphous silicon film.

IX. At the conclusion of the oral proceedings, the decision was announced that the appeal is dismissed.

Reasons for the Decision

1. Inventive step - Claim 1 - Main request

1.1 From document D1 there is known in accordance with the wording of Claim 1:

"A manuscript reader (D1, page 4, line 3) of the type having a photosensitive device (D1, Figure 2F and 30 in Figure 3) receiving incident light from said manuscript (9 in Figure 3) and changing its conductive state in accordance with said incident light (page 12, paragraph 3), said photosensitive device comprising a first electrode (2, 3 in Figure 2) formed on a substrate (1), a photoconductive film (7 in Figure 2, realised by a Se-As-Te- or a CdSe-layer; see page 8, line 9 and page 9, line 28 respectively) formed over said first electrode; and a second electrode (8 in Figure 2; realised by an Au- or Al-layer; see page 9, lines 7, 8 and 33), one of said electrodes (2) being transparent and receiving said incident light, characterised in that the other electrode is formed of metal (Au, Al)."

Document D1 teaches as well on page 7, paragraph 2, that as material for a photoconductive film numerous substances are known, which all can be used in connection with the invention disclosed in document D1, mentioning among 14 different explicit materials also amorphous silicon. Hence, when forming photoconductive film 7 in Figures 1 and 2 of document D1 not according to the disclosed examples 1 or 2 of document D1 of amorphous Se-As-Te (D1, page 9, line 4) or of CdSe (D1, page 9, lines 32 and 33) but of amorphous silicon (D1, page 7, lines 13 and 14), a skilled person is merely using a disclosed alternative and equivalent material.

1.2 Starting from the closest prior art according to document D1 with a photoconductive amorphous silicon film, the objective problem underlying the present invention is to provide a reader in which a reduction of the dark current level is possible. Disadvantageous levels of dark current are easily observable in practice and their reduction arises out of practical needs. Thus, the

formulation of the objective problem does not contribute to an inventive step underlying the subject-matter of Claim 1.

1.3 The objective problem is solved according to Claim 1 in that the "other (i.e. non-transparent metal)" electrode "includes a thin oxide layer formed on the surface thereof, said silicon film being in contact with the thin oxide layer."

1.4 From document D2, Figure 2 (i.e. example 5) a photosensitive device is known, wherein a metal electrode (10 in Figure 2) includes a thin oxide layer (9) formed on the surface thereof, said (photoconductive) film being in contact with the thin oxide layer.

This oxide layer is known to keep the dark current low by hindering the penetration of holes from a metal electrode into a photoconductive semiconductor layer (D2, page 4, lines 1 to 7) i.e. to achieve the identical technical aim on the basis of the same physical effect as in the patent under appeal; see EP-B1-0 053 946, column 7, lines 25-29. Hence, it has to be examined whether a skilled person would be able to recognise:

(a) that this oxide layer maintains its known effect to impede the migration of holes and thus to reduce the level of a dark current when provided on a photoconductive film which is not made of SeTeAs like in document D2 but of amorphous silicon like claimed in Claim 1, see also paragraph VIII (b) above; and

(b) which of the two electrodes (2 or 8 in Figure 2) of document D1 represents a source of holes and should therefore be covered with the oxide layer known from document D2; see also paragraph VIII (c) above.

1.5 Document D2 teaches on page 6, lines 5 to 9, explicitly that the hole migration preventing oxide layer and the photoconductive layer may be interposed by any further layer which causes no injection holes. It needs no particular analytical capacities but only normal expert knowledge to verify that this statement clearly means that the suppression of the hole migration is a volume effect of the oxide layer which effect is independent from properties of the adjoining barrier layer between oxide layer and photoconductive film, i.e. that the effect of suppressing a dark current is not influenced by particular properties of the chosen photoconductive film material. Moreover, the above statement does not impede the skilled person's mind in the form of a prejudice, making him believe that the oxide-selenium barrier of the disclosed example is the physical cause of the observed dark current suppression and thus the technical means to be applied. In the Board's view, it only needs a normal logical thinking to derive from the above statement in document D2 that the dark current suppression is caused by the low p-conductivity values of an oxide. The p-conductivity within the volume of an oxide-layer is generally known to remain unchanged in view of particular properties of materials outside the oxide volume. Hence, a skilled person only applies his basic knowledge in a normal and logic way when learning from the above statement in document D2 that the known oxide layer and its known inherent technical effect to suppress dark currents, can be used in connection with various photoconductive film materials. Contrary to the Appellant's view in point VIII (a), no abstraction of facts disclosed in document D2 into "principles" is necessary in order to learn from this document how to reduce dark currents in the manuscript reader disclosed in document D1. The identical technical means and its identical inherent technical effect such as

directly disclosed in document D2 lead - when used in analogous way in the reader of document D1 - to the subject-matter claimed in Claim 1.

1.6 The fact that the Al-electrode 8 in example 5 of document D2 has a small thickness and is therefore semi-transparent, does not influence the further property of this thin aluminium layer to be a source from which holes may be injected into the photoconductive film. Also in example 4 of the revoked patent Al is used as material for the "other", i.e. non-transparent electrode. In the Board's view, a skilled person remains within his normal capacity when realising that dark currents are independent from incident photons and that each prospective source of holes has to be blocked off from the photoconductive layer, also when it is positioned outside the absorption way of the incident light. Moreover, the explicit teaching of document D2, page 3, last paragraph, that the oxide layer has to be interposed between the photoconductive layer and the signal electrode, in the Board's view, guides a skilled person directly to the oxide layer position in Claim 1 on top of the "other" electrode. When interpreting Claim 1 in the light of the description according to Article 69 EPC, the claimed "other electrode" represents the signal electrode with the positive polarity of the bias voltage; see Figures 2 and 3. Hence, the skilled person will exclusively arrange the oxide layer position according to the hole migration direction caused by the bias polarity. Electrode 8 of document D1 having the positive bias polarity (see D1, Figure 3) would lead a skilled person to recognise electrode 8 as the prospective source of holes in the dark current and to provide the oxide layer between electrode 8 and photoconductive layer 7, i.e. in a position which corresponds to the one claimed in Claim 1.

For the above reasons, the Board regards a skilled person to be able to find out the appropriate position of the hole migration suppressing oxide layer on the basis of his normal school knowledge. The shift of the oxide layer position from the surface of the transparent electrode in document D2 to the surface of the non-transparent electrode in document D1 thus represents, in the Board's view, an adaptation measure which is to be expected from a skilled person, when making use of the dark current suppressing technique of document D2 in the manuscript reader of document D1.

1.7 For these reasons the Board considers that the subject-matter of Claim 1 of the main request is the result of using the teaching of document D1 including an exchange of equivalents known from document D1 and of an analogous use of the teaching of document D2 in the reader of document D1, which has to be regarded as obvious. Therefore, in the Board's judgment, Claim 1 of the main request lacks an inventive step within the meaning of Article 56 EPC.

2. Claims 2 to 9 of the main request fall because of their dependency on Claim 1.

3. Inventive step - Claim 1 - Auxiliary request

3.1 Claim 1 of the auxiliary request narrows the subject-matter of Claim 1 of the main request to the fact that the thin oxide layer shall be formed

"of an oxide of said metal"

i.e. of an oxide of the same metal of which the "other", i.e. non-transparent, electrode is formed.

3.2 There is no evidence before the Board that the above mentioned selection of the oxide material gives rise to any unexpected effects. The advantages submitted according to paragraph VIII (d) above, i.e. that such a selection would allow to realise the oxide layer by an oxidising treatment of the non-transparent metal electrode surface itself, and that such oxidising treatment effects homogenously the total exposed electrode surface, in the Board's view, are generally known and thus foreseeable to a skilled person. In particular in view of the fact that the advantageous properties of a selection according to paragraph 3.1 above are generally known, the Board considers the limitation of the material of the hole migration suppressing oxides to oxides of the adjoining cathode metal - as claimed according to the additional subject-matter of Claim 1 of the auxiliary request - to be obvious to a skilled person.

3.3 For the reasons stated above, the Board regards the subject-matter of Claim 1 of the auxiliary request as the result of the obvious measures set out in paragraph 1.7 above and of the obvious selection of known materials as set out in paragraph 3.2 above.

Therefore, Claim 1 of the auxiliary request is considered to lack an inventive step within the meaning of Article 56 EPC.

4. Claims 2 to 9 of the auxiliary request fall because of their dependency on Claim 1.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Beer G.D. Paterson