BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

A		B		C	X

File Number: T 32/91 - 3.4.1

Application No.: 85 105 701.8

Publication No.: 0 166 922

Title of invention: Radiation Image Reproducing Method and Apparatus

Classification: G01T 1/29

D E C I S I O N
of 25 November 1992

Applicant: Fuji Photo Film Co., Ltd

Headword:

EPC Art. 56

Keyword: "Inventive step (yes, after amendment)"

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 32/91 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 25 November 1992

Appellant : Fuji Photo Film Co., Ltd.
210 Nakanuma Minami Ashigara-shi
Kanagawa 250-01 (JP)

Representative : Patentanwälte Grünecker, Kinkeldey,
Stockmair & Partner
Maximilianstrasse 58
W-8000 München 22 (DE)

Decision under appeal : **Decision of the Examining Division 061 of the European Patent Office dated 6 August 1990 refusing European patent application No. 85 105 701.8 pursuant to Article 97(1) EPC.**

Composition of the Board :

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

Summary of Facts and Submissions

I. European patent application No. 85 105 701.8 (publication number 0 166 922) was refused by decision of the Examining Division.

II. The reason given for the refusal was that the subject-matter of independent Claims 1 and 5 filed on 24 January 1990 did not satisfy the requirements of Articles 52 and 56 EPC having regard to documents:

D2: EP-A-0 079 751, and

D3: R.C. Gonzalez: "Digital Image Processing" Addison-Wesley Publishing Company Inc., Massachusetts USA, 4th printing, 1982, pages 183, 184, 218,

and to the general technical knowledge of a skilled person.

The Examining Division took the following view: Starting from document D2 the objective problem would be to avoid that a part of a previous radiation image which remains in a phosphor sheet even after an erasure by stimulation with an intense light beam, causes noise in the visible image reproduced in the following read-out stage. It is a common practice for the expert in the field of radiography to remove noise from image data by numerical or algebraic methods such as disclosed in document D3. The faded image of the previously recorded object being of non-statistical, additive nature, a skilled person would be able to determine the brightness factor by trial and error for multiplying the stored noise pattern before subtracting it from the image to be corrected according to the known algebraic method. Due to the fact that neither Claim 1 nor Claim 5 contains any feature which concerns

the reduction of the erasing time, such task is not accepted as the objective technical problem.

III. The Appellant lodged an appeal against the decision.

IV. With his Grounds of Appeal, the Appellant filed an amended Claim 1, clarifying that the remaining radiation image is erased by a predetermined number of following exposing steps and submitted the following arguments: According to document D2, page 2, lines 18 to 21; page 3, lines 6 to 9; page 5, lines 2 to 5 and page 5, last line to page 6, line 3, this conventional method would clearly require that the residual radiation image in the stimulable phosphor sheet is completely erased before its reuse. This would be in contradiction to the assumption of the Examining Division in the appealed decision that document D2 would teach to retain a part of the previous radiation image stored in the phosphor sheet which part is reproduced in the following read-out step. Document D2, page 9, paragraph 1, stated that either a long erasing time or a high illuminance is necessary in order to completely erase the residual radiation image. Hence, the present invention has the object to reduce the cycle time for the phosphor sheet until it may be reused after a first exposure for a second one. The envisaged object is solved in that the residual radiation image in the phosphor sheet after the read-out of the radiation image for reproducing a visible image is not completely erased but erased only to some extent. This solution would not be obvious, in particular not in view of document:

D1: US-A-4 350 998,

wherein the data of the preceding image are stored and then subtracted from those of a consecutive image in order to make visible attenuation differences in parts of the

same object. There would be no disclosure in document D1 with regard to the removal of ghost images from incompletely erased images of a different object.

V. In response to a communication of the Board of Appeal, inviting the Appellant mainly to further clarify the wording of Claims 1, 2, 4 and 5 in order to express unambiguously the claimed technical means for shortening the erasure time before a reuse of the phosphor sheet, the Appellant now requests that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:

Claims: 1 to 7 filed on 29 July 1992 with letter dated 29 July 1992.

Description: pages 3 and 12 according to EP-A-0 166 922;
pages 2, 4, 6 and 7, filed on 4 January 1988 with letter dated 4 January 1988;
pages 5 and 8 to 11 filed on 29 July 1992 with letter dated 29 July 1992.

Drawings: sheet 1/1 as originally filed on 9 May 1985.

VI. Independent Claims 1 and 5 read as follows:

"1. A method of reproducing a radiation image in a radiation image recording and reproducing system in which object image recording is conducted by exposing a stimulable phosphor sheet (5) to a radiation passing through an object (4) to have a n'th radiation image of an object stored in the stimulable phosphor sheet (5), image read-out is conducted by scanning the stimulable phosphor sheet (5) carrying the radiation image stored therein by stimulating rays which cause the stimulable

phosphor sheet to emit light in proportion to the stored radiation energy and by photo-electrically detecting (7) the emitted light to obtain an electric image signal, a visible image is reproduced by use of the electric image signal, and which further comprises exposing the phosphor sheet to an erasing radiation and re-using the stimulable phosphor sheet,
characterized in that the method comprises the steps of:

i) storing the electric image signal obtained by said image read-out of the n'th radiation image in a storage means

ii) exposing the stimulable phosphor sheet after the read-out of the n'th radiation image such that still a predetermined ratio of the n'th radiation image remains stored in the phosphor sheet, and which remaining image is erased by a predetermined number (v) of subsequent later steps (n+v) in which the phosphor is exposed to the erasing radiation

iii) reading-out an n+1'th radiation image stored in said stimulable phosphor sheet (5) after n+1'th object image recording on the same stimulable phosphor sheet (5), thereby obtaining an electric image signal after the n+1'th image recording,

iv) multiplying the electric image signal obtained by said storing the image read-out of the n'th radiation image in a storage means by a predetermined constant α and substracting this multiplied electric image signal from said electric image signal after the n+1'th image recording, and

v) reproducing a visible image of a radiation image recorded by the n+1'th image recording only on the basis

of the electric image signal obtained by said subtraction in step iv) (wherein n denotes an arbitrary natural number).

5. An apparatus for reproducing a radiation image in a radiation image recording and reproducing system in which object image recording is conducted by exposing a stimulable phosphor sheet (5) to a radiation passing through an object (4) to have a radiation image of the object stored in the stimulable phosphor sheet (5), image read-out is conducted by scanning the stimulable phosphor sheet carrying the radiation image stored therein by stimulating rays which cause the stimulable phosphor sheet (5) to emit light in proportion to the stored radiation energy and by photo-electrically detecting (7) the emitted light to obtain an electric image signal, a visible image is reproduced by use of the electric image signal, the stimulable phosphor sheet (5) after the image read-out is exposed to an erasing radiation and is re-used for the radiation image recording,

characterized in that the apparatus comprises:

a) a storage means (9) for storing the electric image signal obtained by said image read-out,

b) a multiplication means (11) for multiplying said electric image signal stored in said storage means by a predetermined constant α,

c) a subtraction means (12) for subtracting the electric image signal obtained by multiplying an electric image signal stored in said storage means and corresponding to the image read out of the n'th radiation image by said predetermined constant α by said multiplication means, from an electric image signal obtained by an image read-

out conducted after n+1'th object image recording on the same stimulable phosphor sheet (5), and

d) a reproduction means (8) for reproducing said visible image on the basis of an output image signal of said subtraction means (12)."

Claims 2 to 4 are dependent on Claim 1 and Claims 6 and 7 are dependent on Claim 5.

Reasons for the Decision

1. Claim 1 comprises the subject-matter of original Claims 1 and 2 and features derived from the original description, page 6, lines 12 to 21; page 9, lines 8, 9; page 9, line 19 to page 10, line 16 and page 11, lines 1 to 10. Claims 2 and 3 correspond to original Claims 3 and 4. Claim 4 is based on features disclosed in the original description page 11, line 20, to page 12, line 10. Claim 5 contains in addition to its original wording characteristics disclosed in the original description, page 9, line 23 to page 10, line 9. Claims 6 and 7 correspond to original Claims 6 and 7. The amendments of the description are in line with Rules 27(1)(b) and (c) EPC. There is, therefore, no objection under Article 123(2) EPC to the current set of application documents.

2. Novelty

2.1 Document D2 describes a method and an apparatus for reproducing a radiation image which respectively comprise only the features defined by the pre-characterising portions of Claim 1 or Claim 5. In this conventional method and apparatus the memory does not store "the

electric image obtained by the image read-out" as claimed but only its peak value which corresponds to the maximum intensity of the residual image in the phosphor sheet. From this peak value an erasure exposure amount setting value is determined for a complete erasure of the residual radiation image in the phosphor sheet before its reuse. Thus, no noise from the nth image recording is left in the phosphor sheet, and in the conventional method and apparatus the visible image of the n+1'th image recording is reproduced without any subtraction directly from the electrical signal of the photo-electrically detected light emitted from the phosphor sheet.

2.2 Document D1 describes a device for differential image determination which uses a video memory as part of a recursive filter so that only one memory space is required for a video image. For this purpose the image information is multiplied with a weighting factor α, added to the stored information multiplied by a factor $1-\alpha$, restored and subtracted from the unmultiplied image information. Document D3 deals with the theory of image restoration. The remaining documents cited in the European Search Report or during the granting procedure do not come closer to the subject-matter of Claim 1.

2.3 Thus, the subject-matter of independent Claims 1 and 5 is considered novel in the sense of Article 54 EPC.

3. Inventive step

3.1 Starting from the nearest prior art according to document D2 the objective problem underlying the present invention is to indicate a method and an apparatus which allow the reuse of a stimulable phosphor sheet for undisturbed radiation image reproduction, i.e. to eliminate any information of the n'th image in the reproduction of the

n+1'th image - without the necessity to expose the phosphor sheet to a large amount of light for long periods; see the original description, page 3, line 22 to page 4, line 7.

3.2 The gist of the measures in the claimed solution according to method Claim 1 is defined in claimed step ii) wherein it is explicitly stated that only part of the n'th image stored in the phosphor sheet is erased. This incomplete erasure shortens the cycle time of the phosphor sheet for its reuse and is balanced by eliminating the remaining n'th image information from that of the recorded n+1'th image via subtraction measures as defined in steps i) and iv) of Claim 1. The technical means which solve the above objective problem are those which substitute the complete erasure of the nearest prior art, i.e. the storage, multiplication and subtraction means as defined in paragraphs a), b) and c) of Claim 5.

3.3 In the Board's view, none of the ESR documents suggests to shorten the cycle time for preparing the reuse of a phosphor sheet by maintaining part of the disturbing information stored. Such a basic concept can in particular not be derived from the conventional technique disclosed in document D2 which teaches to reuse a phosphor sheet clear of disturbances.

Moreover, also the particulars of the above basic principle are not obvious to a skilled person, such as forming the exact analogue of the incompletely erased information outside the phosphor sheet in the image recording and reproducing system and subtracting this analogue from the phosphor sheet read out during its subsequent use.

Document D1 describes a subtraction step exclusively for the technical aim to produce a differential image, i.e. contrast differences in the same object (for instance due to the time dependent flow of a contrast medium). Document D2 teaches that in image restoration additive noise can be removed by subtracting it from a degraded picture, if its local distribution is known. Any improvement or modification of the informational content of a picture does not render it obvious to use the identical measures for accelerating the reusability of a phosphor sheet in a radiation image recording and reproducing system. Hence, the claimed particular technical use of the general teaching of document D3 is regarded not to be obvious for a skilled person. It is held to surpass his normal capacities to mentally associate additive noise of known distribution in a degraded picture with the incompletely erased information in a phosphor sheet. In particular document D3 does not suggest to form the analogue of additive noise to be subtracted by storing the n'th image simultaneously with its readout for reproduction in a separate additional storing means outside the phosphor sheet, to adapt the externally stored intensities to the readout of incompletely erased ones and to foresee the subtraction during reuse of the phosphor sheet. In the method disclosed in document D2, only the maximum intensity - i.e. one pixel of the preceding image - is stored for determining the exposure time for complete erasure.

3.4 For the reasons indicated above in paragraphs 3.1 to 3.3 the subject-matter of independent Claims 1 and 5 is considered to involve an inventive step in the sense of Article 56 EPC.

4. Thus, Claims 1 and 5 are allowable under Article 52(1) EPC. Dependent Claims 2 to 4 and 6 and 7 concern particular embodiments of the method claimed in Claim 1 and of the apparatus claimed in Claim 5 respectively and are, therefore, likewise allowable.

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 European patent on the basis of the following documents:

Claims:	1 to 7 filed 29 July 1992;
Description:	pages 3 and 12 according to EP-A-0 166 922, pages 2, 4, 6 and 7 filed 4 January 1988, pages 5 and 8 to 11 filed 29 July 1992;
Drawings:	sheet 1/1 filed on 9 May 1985.

The Registrar: The Chairman:

M. Beer G.D. Paterson