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D E C I S I O N
of 23 July 1996

Case Number: T 0563/94 - 3.4.1

Application Number: 84110577.8

Publication Number: 0136588

IPC: G01T 1/29

Language of the proceedings: EN

Title of invention:

Radiation image recording and reproducing method

Patentee:

FUJI PHOTO FILM CO., LTD

Opponent:

Siemens AG

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no)"

"Routine interpretation of prior art teaching; Advantages foreseeable in use of prior art method"

Decisions cited:

-

Catchword:

-



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Boards of Appeal

Chambres de recours

Case Number: T 0563/94 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 23 July 1996

Appellant:
(Opponent)

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Representative:

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Respondent:
(Proprietor of the patent)

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office dated 2 May 1994 rejecting
the opposition filed against European patent
No. 0 136 588 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: G. D. Paterson
Members: H. J. Reich
R. K. Shukla

Summary of Facts and Submissions

I. In the present appeal the respondent is the proprietor of the European patent No. 0 136 588. Claim 1 of this patent reads as follows:

"1. A radiation image recording, read-out and reproducing method comprising steps of:

- (i) causing a radiation image storage panel containing a divalent europium activated barium fluorohalide stimulable phosphor to absorb a radiation having passed through an object or having radiated from an object and to thereby store the image of said object;
- (ii) exposing the panel to stimulating rays to read-out said image by release of the radiation energy stored therein as light to provide an electrical signal;
- (iii) detecting the emitted light;
- (iv) reproducing said image using said electrical signal, and
- (v) exposing the panel to light having a wavelength at least within the stimulation wavelength region of the phosphor to erase the radiation energy remaining therein,

characterized in that

said stimulating rays are electromagnetic waves having a wavelength within the range of 728 - 850 nm, and are supplied by a semiconductor laser or a light emitting diode."

Claim 2 is dependent on claim 1.

II. This patent was opposed by the appellant on the grounds of lack of novelty having regard to document:

E1: EP-A-0 111 892

for the designated Contracting States DE, FR and NL, having regard to Article 54(3) and (4) EPC, and lack of inventive step in view of the general knowledge of an average skilled person and the state of the art disclosed inter alia in document:

E4: US-A-4 400 619.

III. The Opposition Division rejected the opposition. It held that claim 1 of the patent as granted was **novel** with regard to document E1 because there were strong doubts as to whether the (GaAl)As laser disclosed in document E1, page 13, line 11 emits electromagnetic waves of a wavelength which should necessarily be in the claimed range taking into consideration all the further evidence cited by the opponent. According to the decision of the Opposition Division starting from the method defined by the wording of the preamble of claim 1 and disclosed in document E4, the problem to be solved could be regarded as improving the method of E4 in such a way that a high efficiency of erasure and thereby improved image quality with repeated use of the stimuable phosphor sheet is obtained. Since there is no hint in the prior art to use stimulating wavelengths larger than the upper limit (700 nm) of the disclosed preferred ranges, the Opposition Division considered - that there was an **inventive step** in exposing the phosphor to stimulating rays having a longer wavelength, i.e. within the claimed range of 728 to 850 nm, so as to release and thus erase the radiation energy stored in the trap level relatively easily.

- IV. The opponent filed an appeal against this decision, relying additionally, inter alia on document:

E13: US-A-4 258 264

cited by the Examining Division during the proceedings before the grant of the opposed patent, in order to support its submission - contrary to the view of the Opposition Division - that for stimulating emission of the energy stored in the traps of the claimed phosphor, the use of stimulating wavelengths in the range of 750 to 800 nm (i.e. within the region claimed) forms part of the prior art. Erasure of after-images by exposure to light having the stimulating wave is disclosed in document E4 by its teaching to stimulate the phosphor within the broad range from 633 nm to 1064 nm, this range covering the claimed one. A great number of the cited documents show that semiconductor lasers and light emitting diodes are generally known to emit light within the wavelength range claimed in claim 1. Hence, the subject-matter of claim 1 results from the cited prior art in an obvious way.

- V. In a communication annexed to a summons to oral proceedings, the Board informed the parties of its provisional view that:

- (a) especially in the light of the principles set out in Decision T 666/89 (OJ EPO, 495), claim 1 might be regarded as lacking novelty under Article 54(3) EPC in view of document E1;
- (b) having regard to the question of inventive step in the subject-matter of claim 1, documents E4 and E13 appear to be highly relevant.

When using the He-Ne laser (633 nm) and the ruby laser (694 nm) disclosed in E4, a skilled person is likely to be aware of the improvement in image quality and erasure efficiency when replacing stimulation at 633 nm by stimulation at 694 nm. Extrapolating the experimental results of the technical means disclosed in document E4, a skilled person may expect a further improvement beyond 694 nm in the near infrared region. Document E13, Figure 1 and column 4, lines 14 to 40 shows that the phosphor traps which are stimuable by rays having a wavelength of between 750 to 800 nm store energy for a shorter time than the traps which can be stimulated in the region from 600 to 700 nm. A skilled person might be expected to derive from such teaching that less energy remains stored in the traps which are stimuable in the range from 750 to 800 nm, and conclude therefrom in an obvious way that erasure of the corresponding after-image would be more easy. As can be seen from the documents cited by the opponent, for instance:

E9: M. J. Weber: "CRC Handbook of Laser Science and Technology", volume I, CRC Press Inc. Boca Raton, Florida, 1982, pages 179 to 213; and

E3: US-A-4 276 473,

the claimed technical means for supplying the claimed stimulating rays, i.e. semiconductor lasers and light emitting diodes (LEDs), belong to the prior art. Since the opposed patent nowhere specifies any details of the semiconductor lasers and LEDs claimed in claim 1, it appears that use is made only of their known properties.

VI. Oral proceedings were duly held on 23 July 1996. The opponent requested that the decision under appeal be set aside and that the European patent No. 0 136 588 be revoked. The proprietor requested that the appeal be dismissed and that the patent be maintained as granted.

VII. The opponent argued that the patent lacked novelty in the states De, FR and NL, and made essentially the following submissions in connection with the ground of inventive step:

- (a) The method disclosed in document E4 achieves a noise-free image from an image storage panel such as claimed in claim 1 of the opposed patent by erasing the after-image produced by the energy which remains stored in the panel after a first read-out, using the light having the stimulation wave length. It is an important fact that the teaching of document E4 is not limited to the stimulation of the panel in the visible range of the electromagnetic spectrum by He-Ne or ruby lasers (633 nm and 694 nm). Document E4, column 6, lines 19 to 25 discloses additionally the stimulation in the infrared range by using a YAG laser beam (1064 nm) as an alternative measure, and in column 4, lines 24 to 28 erasure by visible or infrared light as alternative measures. A skilled person derives from the overall disclosure of document E4 that light applied in the erasure step, necessarily comprises the applied stimulation wavelength and that erasing effect of the light is independent from the technical means producing it. Different light sources for read-out of the wanted image and for erasure of the unwanted after-image can be used as long as photons of the wavelength which stimulates read-out, are also present in the light produced by the lamp used for erasure. A skilled person cannot

derive from document E4, that any particular spectral range of the stimulating wavelengths in between 633 nm and 1064 nm is preferred, i.e. leads to an improved erasure of the after-image.

- (b) An improved erasure by a stimulating wavelength at 750 to 800 nm compared with a stimulating wavelength at 600 to 700 nm is derivable from Figure 1 of document E13. The experiments reported in said Figure 1 are intended to demonstrate that the energy stored in the traps stimuable at 750 to 800 nm fades away more easily and results in a lower relative luminescence in the read-out step. A skilled person can be expected to ascribe the quicker fading to a shorter lifetime of the traps stimuable by the longer wavelengths. In deducing from such lower lifetime the fact that in these traps less energy remains stored and can more easily be erased, a skilled person only applies his normal elementary knowledge.
- (c) Since appropriate semiconductor lasers and LEDs are known in the art, their use cannot be regarded as inventive.

VIII. The opponent's submissions on novelty and inventive step were contested by the proprietor, who argued with regard to the question of inventive step essentially as follows:

- (a) The method disclosed in document E4 aims at improving the resolution and quality of the image which is read-out from the phosphor so that no after-images are reproduced. Document E4 also discloses an erasure step, but no light source for emitting stimulating rays within the claimed range of wavelengths from 728 to 850 nm. In the method of document E4 stimulating rays are supplied by a

He-Ne and a ruby laser; see column 6, lines 21 and 22. Their respective wavelengths of 633 nm and 694 nm are chosen in full agreement with the teaching of inter alia document E3, column 6, lines 26 to 28 and 33 to 35 disclosing a preferred stimulation range of 600 to 700 nm for the phosphor claimed in claim 1, because at 600 nm the intensity of the image read-out from the phosphor, is maximum. The more the stimulating wavelength deviates from said maximum to longer wavelengths, the quicker the intensity decreases.

- (b) Moreover, in the method according to document E4, different light sources (14 and 10 in Figure 1) are used respectively for producing the stimulating light and for erasing the remaining stored energy; see column 4, lines 3 to 7 and column 3, lines 25 to 27. From this teaching a skilled person would learn to stimulate or erase by choosing the corresponding light source appropriately. Hence, a person skilled in the art does not obtain any hint from document E4 to choose particular parameters of the stimulating rays for an improvement of the erasure of the after-image. The present invention, however, has shown that the efficiency of the erasure may be influenced by the proper choice of the wavelength of the stimulating rays. The invention suggests to use stimulating rays within the range of 728 to 850 nm. This cannot be deduced from document E4.
- (c) In document E13 the problem of erasure is nowhere mentioned. Figure 1 of document E13 discloses experimental results whereby the fading of the information stored in the phosphor, is tested during a time of 2 hours. Hence, document E13, Figure 1 and column 4, lines 14 to 40 concerns the aspect how to best re-obtain the energy stored in

the stimuable phosphor. The test result is clearly stated in column 4, lines 32 to 36, namely that it is very advantageous to stimulate in the range of 600 to 700 nm. Hence, document E13 is not suited to give any hint to the present invention. Also document E3 is silent about erasure.

- IX. At the conclusion of the oral proceedings, the decision was announced that the decision of the Opposition Division is set aside, that the appeal is allowed and that the European patent is revoked.

Reasons for the Decision

1. For the reasons set out under paragraph 2 below, the Board decided to revoke the patent on the ground of lack of inventive step. Accordingly, it is unnecessary for the Board to express any views on the submissions of the parties in relation to the ground of lack of novelty in the light of document E1 under Article 54(3) and (4) EPC.

2. *Inventive step*

- 2.1 From the closest prior art according to document E4 it is known, in the wording of the preamble of claim 1 of the patent in suit:

"A radiation image recording, read-out and reproducing method comprising steps of:

- (i) causing a radiation image storage panel (see E4, 13 in Figure 1) containing a divalent europium activated barium fluorohalide stimuable phosphor (see column 5, lines 25 to 33) to absorb a radiation having passed through an

object or having radiated from an object (12 in Figure 1) and to thereby store the image of said object (column 3, lines 56 to 66);

- (ii) exposing the panel (13) to stimulating rays (from 14) to read-out said image by release of the radiation energy stored therein as light to provide an electrical signal (column 4, lines 3 to 11);
- (iii) detecting the emitted light (column 4, lines 16 to 18);
- (iv) reproducing said image using said electrical signal (column 4, lines 18 to 20);
- (v) exposing the panel (13) to light (from 10) having a wavelength at least within the stimulation wavelength region of the phosphor to erase the radiation energy remaining therein (column 4, lines 24 to 28 and column 3, lines 52 to 56)".

2.2 Starting from the closest prior art disclosed in document E4, the objective technical problem underlying the patent in suit can be regarded as improving the efficiency of the erasure (i.e. step (v) of claim 1 mentioned above in paragraph 1.1) in order to improve the quality of the reproduced image (i.e. the result of step (iv) of claim 1) in the repeated use of the stimuable phosphor as defined in step (i) according to claim 1; see also the description of the patent in suit, column 3, lines 44 to 50. In the evaluation of an image reproduced according to the prior art method, structures which are not a part of the imaged object, can easily be recognised as such by a skilled person. On account of their specific geometrical form a skilled person will automatically attribute such artifacts to

the incompletely erased after-image of an object which has been imaged beforehand. Hence the necessity of improving the efficiency of erasure in said prior art method arises out of observable disadvantages in the use of the closest prior art. For this reason, the objective problem does not contribute to an inventive step in the subject-matter of claim 1.

- 2.3.1 The above problem is solved in that "said stimulating rays are electromagnetic waves having a wavelength within the range of 728 to 850 nm".
- 2.3.2 Document E4, column 3, lines 52 to 56 explicitly states that the light source for erasing energy remaining in the panel "has a wavelength within the range of the stimulating light wavelength and excites the radiation image conversion panel 13 to cause the panel 13 to emit light and removes the radiation energy stored therein". From such statement a skilled person derives that the erasure step basically represents a continuation of the read-out step with the only difference that the photons released during erasure are not converted into an electrical signal, i.e. not used to display the latent image stored in the phosphor. Read-out and erasure are thus based on stimulating transitions between identical optical levels of the phosphor, or more specific on the absorption of the photons having the same energy by identical metastable energy states of the phosphor (latent image) whereby these states are excited into unstable energy states which emit photons spontaneously (reproduced image). Hence, a skilled person derives from document E4, that an erasure of the particular traps which produce the after-image, can only be effected by photons having the same wavelength as the photons which stimulate the light used for the read-out of the displayed information.

2.3.3 As follows from the above, erasure is a mere photon-phosphor interaction. Its efficiency depends on the optical properties of the phosphor and on the energy of the photons, but not on the technical means producing the photons. Therefore, in the Board's view, the features defined by the remaining wording of the characterising part of claim 1, i.e. that said stimulating rays... "are supplied by a semiconductor laser or a light emitting diode" do not contribute to the solution of the objective problem, i.e. to improve the efficiency of erasing after-images. This finding is consistent with the description of the invention which nowhere discloses any embodiments or further details of the semiconductor lasers and light emitting diodes claimed. The only information is given in the original description, page 10, lines 12 to 15 and reads: "Particularly preferred is a semiconductor laser, because its size is small, it can be driven by small electric power, and its power can be easily stabilised by the direct modulation". Exploitation of such properties effects only constructional advantages of the device for carrying out the claimed method. Furthermore, there is no evidence that the claimed light sources contribute, either independently or in conjunction with one or more of the other features claimed, to the solution of said objective problem. Therefore, the Board follows the established jurisprudence of the EPO in such cases and does not consider the claimed light sources in the assessment of inventive step.

2.3.4 The elementary considerations in paragraph 2.3.2 above show that the invention as claimed consists in more efficiently erasing after-images by using for the read-out of the latent image to be displayed traps of the phosphor, i.e. metastable levels which can be stimulated to release their energy, by photons having wavelengths from 728 to 850 nm.

2.4 In deriving from the disclosure of document E4 the working principle of the erasing procedure used in the method of document E4, such as set out in paragraph 1.3.2 above, a skilled person, in the Board's view, only uses his basic knowledge. This working principle is based on quenching the remaining density of information storing metastable states subsequently by the same excitation process as in the read-out step. Hence, a skilled person is held to be able to derive from document E4 that an effective erasure of the after-image is bound to photons having the stimulating wavelength. The fact that document E4 discloses different technical means for read-out and erasure does not detract from this analysis. It is evident for a skilled person that lamps for read-out must produce a light beam with an extremely small and sharply defined cross section in order to scan pixels, and that lamps for erasure are more advantageous when they produce a light beam with such a large cross section that the total area of the panel is illuminated at the same time. In view of such different needs for the size of the beam cross section the present invention also uses different types of lamps for read-out and erasure; see the patent under appeal, column 7, lines 28 to 50. For the above reasons, the Board does not accept the proprietor's submission in paragraph VIII-(b) above.

2.5 Contrary to the proprietor's submission in paragraph VIII-(a) above, the cited text of document E4, column 6, lines 21 and 22 is part of the following complete sentence: "The light source 14 may emit light having a band spectrum or monochromatic light like a He-Ne laser beam (633 nm), a YAG laser beam (1064 nm), a ruby laser beam (694), and the like"; see column 6, lines 19 to 22. The proprietor's contention that the preferred range of stimulating wavelengths stops at 700 nm can therefore not be regarded as relevant. Document E4 clearly discloses stimulation in the

infrared region and teaches that all three lasers are equally preferred alternatives. On the basis of the disclosure of document E4 a skilled person, in the Board's view, can reasonably expect that energy stored in the claimed type of phosphor can also be released for reproducing the image by photons having a wavelength between the experimentally verified ones, i.e. between 694 nm and 1064 nm.

- 2.6 A skilled person concerned with finding a solution for a technical (objective) problem is presumed to know the technical developments in the relevant technical field, and to be aware of properties of technical means which have been experimentally verified. Hence, a skilled person faced with the obvious problem of improving the efficiency of the erasure in the method of document E4, would be aware of the teaching disclosed in document E13, Figure 1 and column 4, in particular lines 30 to 32 which read: "This means that the energy decay (concerning the type of phosphor as claimed in claim 1; see document E13, column 5, line 10) at the level where the stored energy is stimulated by rays of 750-800 nm is much greater than that of 600 to 700 nm". The technical conclusion which was drawn in document E13 from these experimental results (i.e. to reduce fading of the latent image stored in the phosphor by stimulating the phosphor at wavelengths from 600 to 700 nm) would not prevent a skilled person from realising the logical inversion of the experiment, namely that less energy remains stored in the levels which are stimuable at 750 to 800 nm. In order to recognise the technical consequence of the experiment, i.e. that erasure of the after-image is more easy with stimulating photons having a wavelength from 750 nm to 800 nm, a skilled person, in the Board's view, does not resort to any intellectually discontinuous thinking of creative and thus inventive merit. In view of the generally known physical laws such as the higher

transition probability from a less stable energy state, a skilled person would expect that the energy stored in the energy states which are stimuable at 750-800 nm, can be more easily quenched. The Board is satisfied that a skilled person would derive from Figure 1 of document E13 at least the fact that the intensity of the light released from the phosphor - and thereby also the efficiency of the erasure - depends on the wavelength of the stimulating rays. Therefore, a skilled person would have a technical motive to test and to compare the efficiency of the erasure obtainable by the technical means disclosed in document E4, as a function of their stimulating wavelengths. For the above reasons, the proprietor's submissions as set out in paragraph VIII-(c) above are not accepted by the Board.

- 2.7 According to the description of the application as filed on which the patent in suit is based, the invention comprised stimulating wavelengths from "640 nm to 900 nm (original description, page 5, line 14)", preferably "670 nm to 850 nm (original description, page 7, line 24)" and light sources comprising "a ruby laser, a semiconductor laser, a glass laser, a YAG laser, a Kr gas ion laser, a dye laser and a light emitting diode (728 nm) (original description, page 10, lines 6 to 8)". During the proceedings before the Examining Division prior to grant of the patent in suit, the definition of the invention in claim 1 was narrowed to wavelengths from 728 nm to 850 nm, and light sources in the form of semiconductor lasers and light emitting diodes (in particular in order to establish novelty). Hence, as a consequence of such limitation, curves A and B in Figure 2 of the patent in suit show examples of the invention only within the claimed range from 728 nm to 850 nm. Outside this range, curves A and B show the sensitivity of the stimulation I_0 and the efficiency of

the erasure I_0/I obtainable by the method of, for example, document E4 in using the disclosed supply means such as the He-Ne laser (633 nm) and the ruby laser (694 nm).

2.8 Thus when comparing the erasure efficiency obtainable from the technical means disclosed in document E4, in particular at 633 nm and at 694 nm, a skilled person would become aware of the improvement in image quality and erasure efficiency when replacing stimulation at 633 nm by stimulation at 694 nm. A mere extrapolation of the teaching obtainable by the technical means disclosed in document E4, i.e. that erasure has a higher efficiency at longer wavelengths, leads a skilled person to reasonably expect a further improvement beyond 694 nm. Hence, in the Board's view, a skilled person would systemically test the stimulation between 639 nm (ruby) and 1064 nm (YAG) in order to verify his expectations. During such routine work he would arrive at the solution claimed in claim 1 in an obvious way. Figure 2 of the patent in suit establishes that beyond 690 nm the efficiency of erasure improves continuously with longer wavelengths on both sides of the limits of the claimed range. Therefore, the claimed definition of wavelengths within the limits 728 and 850 nm as such is not inventive. The limits of the range have been chosen arbitrarily.

2.9 The Board would not arrive at a different conclusion on the basis of the proprietor's definition of the technical aim of the invention and the hitherto not considered features in the characterising part of claim 1. A He-Ne, ruby or YAG laser such as disclosed in document E4 is known to have large dimensions. Semiconductor lasers and light emitting diodes (emitting inherently light within the range claimed in claim 1; see for instance document E9 or E3) are known to be small in size. Use of this property is also

recommended in the description of the patent in suit; see column 7, lines 35 and 36. The fact that the construction of a device for carrying out the claimed method can be simplified when replacing a large He-Ne, YAG or ruby laser by a small semiconductor laser or light emitting diode, is a foreseeable advantage in an obvious analogous use of said small light sources. Thereby, a skilled person would automatically realize the advantage of an improved efficiency of the erasure.

- 2.10 For the above reasons, in the Board's judgment, claim 1 lacks an inventive step within the meaning of Article 56 EPC, and claim 2 falls because of its dependency on an unallowable claim 1.

Order

For these reasons it is decided that:

1. The decision of the Opposition Division is set aside.
2. The appeal is allowed, and the European patent is revoked.

The Registrar:

The Chairman:

M. Beer

G. D. Paterson