

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

File Number: T 1/90 - 3.4.2

Application No.: 83 302 830.1

Publication No.: 0 094 843

Title of invention: Radiation image recording and read-out method and apparatus

Classification: G03B 42/02, G03B 35/14, G03C 5/17, G21K 4/00

D E C I S I O N
of 31 January 1991

Applicant:

Proprietor of the patent: Fuji Photo Film Co. Ltd

Opponent: Siemens AG.

Headword:

EPC Article 56

Keyword: "Inventive step (yes)"

Headnote



Case Number : T 1/90 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal
of 31 January 1991

Appellant :
(Opponent)

Siemens Aktiengesellschaft
Berling und München
Postfach 22 02 61
D-8000 München 22 (DE)

Representative :

Respondent :
(Proprietor of the patent)

FUJI PHOTO FILM CO., LTD
210 Nakanuma
Minamiashigara-shi
Kanagawa-ken
Japan

Representative :

Cockbain, Julian Roderick Michaelson
Frank B. Dehn & Co.
European Patent Attorneys
Imperial House
15-19, Kingsway
London WC2B 6UZ (GB)

Decision under appeal :

Interlocutory decision of the Opposition Division
of the European Patent Office dated
4 October 1989 and posted on 6 November 1989
concerning maintenance of European patent
No. 0 094 843 in amended form.

Composition of the Board :

Chairman : E. Turrini
Members : W. Hofmann
C. Payraudeau

Summary of Facts and Submissions

- I. European patent No. 0 094 843 was granted on the basis of European patent application No. 83 302 830.1.
- II. The Appellant filed a notice of opposition against the patent, requesting that it be revoked in its entirety because of lack of inventive step in view, inter alia, of the following documents:
 - (D1) DE-A-29 51 501 and
 - (D2) "Table of Laser Lines in Gases and Vapors" by Beck et al. Third Edition, Springer Verlag, 1980.
- III. The Respondent (patentee) filed new sets of claims according to a main request and an auxiliary request.
- IV. In an interlocutory decision within the meaning of Article 106(3) EPC, the Opposition Division decided that, while the main request of the Respondent was not allowable, the patent as amended in accordance with the auxiliary request of the Respondent and the invention to which it related met the requirements of the Convention.
- V. The Appellant lodged an appeal against the decision, citing the further documents
 - (D6) US-A-4 239 968,
 - (D7) "Laser Scanning and Recording for Graphic Arts and Publications", SPIE, Vol. 223 (1980), pages 44 and 62,
 - (D8) "Journal of Applied Photographic Engineering" Vol. 4, No. 4 (1978), pages 178 to 182.

VI. The Appellant implicitly requests that the decision of the Opposition Division be set aside and that the patent be revoked in its entirety.

The Respondent requests that the appeal be rejected and that the opposed patent be maintained with the claim set deemed to be allowable by the Opposition Division.

VII. The independent Claims 1 and 2 according to the request of the Respondent read as follows:

"1. A radiation image recording and read-out method including the steps of:

- (i) recording a radiation image of an object on a recording member comprising a stimuable phosphor layer by exposing said recording member to a radiation passing through the object to have the radiation absorbed in said recording member, and
- (ii) scanning said recording member carrying said radiation image stored therein with a laser beam which has a wavelength within the range capable of stimulating said stimuable phosphor and which causes said recording material to emit light in the pattern of said radiation image stored therein upon stimulation thereof, and reading out the emitted light by use of a photodetector to obtain an electrical signal corresponding to said radiation image, characterised in that the said laser beam with which said recording member is scanned has a wavelength of 514.5 nm and is produced by an Ar⁺ gas ion laser or has a wavelength of 520.9 or 530.9 nm and is produced by a Kr⁺ gas ion laser."

"2. A radiation image recording and read-out apparatus comprising:

- (i) at least one recording member (2) comprising a stimuable phosphor layer capable of absorbing a radiation 25 passing through an object (6) to store a radiation image of said object therein;
- (ii) a laser beam source (7) capable of generating a laser beam having a wavelength within a range capable of stimulating said stimuable phosphor and arranged to be capable of scanning a said recording member thereby to cause said recording member to emit light in the pattern of a said radiation image stored therein; and
- (iii) a photodetector (9) arranged to detect light emitted from said recording member on the scanning thereof with said laser beam and provided with means for converting light so detected into an electric signal corresponding to said radiation image,

characterized in that said laser beam source is an Ar^+ gas ion laser beam source arranged to emit a laser beam having a wavelength of 514.4 nm or is a Kr^+ gas ion laser beam source arranged to emit a laser beam having a wavelength of 520.9 nm or 530.9 nm."

Claims 3 to 10 are dependent on Claim 2.

VIII. The arguments presented by the Appellant are in substance as follows.

Document D1 discloses a method and a device for reading out an image recorded in a stimulable phosphor plate comprising scanning with a laser. The wavelength of the laser beam may lie in the range from 500 nm to 800 nm, and the 647 nm line of a Kr laser is mentioned as an example. Since (according to document D2) the 647 nm line is a Kr^+ line, the Kr laser is actually a Kr^+ laser, and, therefore, documents D1 and D2 disclose the use of a gas ion laser and a wavelength range from 500 to 800 nm.

Document D6 (the corresponding Japanese application of which is mentioned in document D1 on page 13, lines 12 to 13) discloses that the optimum wavelength range is between 500 and 700 nm and that the efficiency is increased if radiation of short wavelength is used. Looking for short wavelength Kr lines within the range between 500 and 700 nm, a person skilled in the art will be led to the claimed lines of 530 and 520 nm since the number of lines in this region is relatively small.

Since the use of gas ion lasers is generally known from document D7 (and the use of an Ar ion laser for scanning X-ray pictures from document D8), a person skilled in the art will in addition to Kr lasers also consider an Ar^+ laser. From the two dominant wavelengths of 488 and 514 nm the expert will choose the one lying within the short wavelength part of the range 500 to 700 nm, i.e. 514 nm.

Thus, the characterising features of Claims 1 and 2 are obvious.

Moreover, Figure 3 of document D6 shows that there is optical stimulation also below 600 nm.

IX. The Respondent's arguments may be summarised as follows.

The Appellant's interpretation of document D6 is erroneous. Document D6 makes no suggestion whatsoever that the efficiency of stimulation of the phosphor is increased when, within the wavelength range of 500 to 700 nm, beams of short wavelength are preferred. In the paragraph bridging columns 5 and 6 and in the next paragraph, document D6 only states that it is desirable to use a visible-ray (i.e. shorter wavelength) stimuable phosphor rather than an infrared ray stimuable phosphor because the infrared ray stimuable phosphor shows remarkable fading. It does not deal with a preference for certain wavelengths within the visible range of 500 to 700 nm. Moreover, Figure 3 of document D6 indicates to a person skilled in the art that the readout efficiency at for example 514.5 nm is much lower than at 600 nm.

As acknowledged in the decision of the Opposition Division, the invention claimed in the opposed patent is based on the finding that the dependence of the readout efficiency on the wavelength of the stimulating rays changes according to the stimulation energy. Thus, when a laser beam having a high output is used, a higher readout amount may be obtained by selecting a laser beam having a wavelength shorter than 600 nm. None of the cited documents contains any suggestion of this fact.

Even if the man skilled in the art were to combine the teachings of documents D1, D2 and D6 there would still be no suggestion leading the skilled man to the 520.9 and 530.9 nm Kr⁺ lines.

Regarding the feature concerning the Ar⁺ 514.5 nm line, document D7, although mentioning this line, advocates no

specific use for it. There is nothing in this document or in document D6 that would suggest to the skilled man its combination with document D1.

Document D8 mentions an Ar ion laser, but not the 514.5 nm line.

Reasons for the Decision

1. The appeal is admissible.
2. Claims 1 and 2 under consideration are based on granted Claims 1 and 3 in combination with granted Claims 2 and 4 (original Claims 1 to 4). The specific Ar⁺ and Kr⁺ laser lines specified in Claims 1 and 2 are disclosed in column 6, lines 16 to 17 of the patent specification (original page 11, lines 18 to 20).

Claims 3 to 10 correspond to granted Claims 5 (with amendments corresponding to those made in Claims 1 and 2) and 7 to 13 (original Claims 5 and 7 to 13).

The amendments to the description only concern an acknowledgment of the prior art and adaptations to the wording of present Claims 1 and 2.

Thus, the amendments to the patent do not contravene Article 123 (2) and (3) EPC.

3. Novelty

- 3.1 Document D1 discloses a radiation image recording and read-out method of the type specified in points i) and ii) of present Claim 1, i.e. in particular a method including the steps of recording the radiation image of an object in

a stimuable phosphor layer and scanning said phosphor layer carrying the radiation image stored therein with a laser beam which has a wavelength capable of stimulating the phosphor so that it causes the phosphor layer to emit light in the pattern of the radiation image stored therein, and reading out the emitted light by use of a photodetector to obtain an electric signal corresponding to the radiation image (cf. in particular Claim 1 and page 14, paragraph 3).

For stimulating the phosphor layer a laser beam having a wavelength of 500 to 800 nm, in particular 600 to 700 nm, is used (cf. page 14, lines 6 to 11). As indicated on page 14, lines 11 and 12; page 25, lines 5 to 7; page 26, last but one line; page 28, lines 7 and 8; and page 29, line 20, the laser may be a He-Ne laser (633 nm) or a Kr laser (647 nm) (the latter line actually being a Kr+ line, cf. document D2).

Neither an Ar+ laser, nor any one of the laser lines 514.5 nm (Ar+), 520.9 nm (Kr+) or 530.9 nm (Kr+) is mentioned in document D1.

- 3.2 Document D6 also discloses a radiation image recording and read-out method comprising the steps i) and ii) specified in present Claim 1. The preferred wavelength range for the stimulating rays is 500 to 700 nm (cf. e.g. column 5, lines 52 and 58 and Claims 3 and 8), and examples of light sources and spectral lines are He-Ne laser (633 nm), YAG laser (1064 nm) and ruby laser (694 nm) (cf. column 5, lines 32 to 39 and Claims 5 and 10).

Neither Ar+ or Kr+ lasers, nor any of the lines 514.5 nm, 520.9 nm or 530.9 nm are mentioned in document D6.

It should be noted that the Board does not share the Appellant's view (cf. page 5, third paragraph of his Grounds of Appeal) that documents D1 and D6 have to be seen as one document. In document D1, a reference to the Japanese patent application 53-84744 (which corresponds to document D6) is only contained on page 13, lines 12 and 13, and relates only to the definition of one particular phosphor composition out of several compositions mentioned as being applicable. The reference does not relate to other features of the image read-out device, e.g. the light source or the wavelength to be used.

- 3.3 Document D2 is a table of laser lines, in particular of Ar and Kr and their ions. It does not give any application for these laser lines.
- 3.4 Document D7 mentions ion lasers, in particular Ar⁺ and Kr⁺ lasers, and, among other spectral lines, the Ar⁺ line 514.5 nm. It discloses the application of these lasers and laser lines e.g. in the graphic arts.

The possibility of using them for stimulating stimuable phosphor layers is not mentioned.

- 3.5 Document D8 describes the use of an Ar ion laser beam (page 181, right hand column) for reading out an optical image. However, the image to be read out is not recorded in a stimuable phosphor layer, but in a photoconductor-insulator structure. Specific lines are not mentioned.
- 3.6 The other documents, mentioned in the European search report or in the opposition procedure, do not come closer to the present subject-matter.

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

The same is true for the apparatus according to Claim 2 since Claim 2 contains essentially the same features as Claim 1.

4. Inventive step

4.1 The closest prior art is constituted by document D1 which, for stimulating the stimuable phosphor layer, mentions a laser beam of a wavelength in the range of 500 to 800 nm. The example referring to the Kr (or Kr+) laser (page 14, line 12) is restricted to the production of the 647 nm line. Document D1 cannot be interpreted as disclosing the use of a Kr+ laser for the whole wavelength range from 500 to 800 nm.

A similar disclosure without, however, mentioning a Kr laser, is contained in document D6.

The problem to be solved in relation to prior art such as constituted by document D1 is to provide a radiation image read-out method (and apparatus) in which the image can be quickly read out at a high read-out efficiency (column 4, lines 1 to 5 of the patent specification).

No contribution to inventive step can be seen in the appreciation of this problem per se since fast operation and high efficiency are principally always desired in technical apparatus.

4.2 According to present Claim 1, this problem is solved by scanning the recording member with a laser beam produced by an Ar+ or a Kr+ gas ion laser and having one of the wavelengths 514.5 nm (Ar+), 520.9 nm (Kr+) or 530.9 nm (Kr+).

The subject-matter of the patent in suit is based on the discovery that the known curve (see for example document D6, Figure 3) relating to the dependence of the read-out efficiency of the stimuable phosphor on the wavelength of the stimulating rays and having a maximum at about 620 nm, is not correct for all levels of luminous intensity of the stimulating radiation, but develops an even higher maximum at shorter wavelengths if the level of luminous intensity is increased to those values typically obtained with Ar and Kr ion lasers.

This fact has already been stressed in the patent specification (cf. Figure 1 and column 3, lines 43 to 65, column 5, lines 28 to 37, column 6, lines 13 to 17, and column 7, line 32 to column 8, line 30), in the letter of 7 October 1988 of the Respondent (page 2, point 6), in the minutes of the oral proceedings held on 4 October 1989 before the Opposition Division (paragraph bridging pages 4 and 5) and in the decision of the Opposition Division of 6 November 1989 (paragraph bridging pages 5 and 6). This has not been contested by the Appellant, and the Board also sees no reason to doubt these results obtained by the inventors of the patent.

By using an Ar⁺ or a Kr⁺ laser as a light source the method according to Claim 1 thus modifies the efficiency curve so as to have a short wavelength maximum, and the chosen wavelengths of the stimulating laser lines correspond to the maximum of the efficiency curve thus obtained.

- 4.3 Neither these laser lines nor the above-mentioned idea behind their use are mentioned in documents D1 or D6, so that a person skilled in the art had no reason to specially choose these lines.

The Board also agrees with the opinion of the Respondent that the passage in column 6, lines 14 and 15 of document D6 cannot be interpreted as giving preference to the short wavelength end of the 500 to 700 nm wavelength range for the stimulating beam. When reading the whole paragraph containing this passage and the preceding paragraph, it is clearly apparent that they only relate to the selection of the type of phosphor (visible ray stimuable) and not to the wavelengths to be used for stimulation.

On the contrary, the efficiency curve shown in Figure 3 of document D6 indicating a sharp decline of efficiency from about 600 nm towards shorter wavelengths would not let it seem promising to go to this end of the indicated wavelength range.

- 4.4 None of the further documents D2, D7 and D8 relates to the stimulation of a stimuable phosphor, and - even for this reason alone - none of them could, therefore, contribute any suggestion as to how in the method known from document D1 (or D6) the stimulation of the phosphor could be performed more effectively.

There is no doubt that Ar⁺ and Kr⁺ lasers and the laser lines 514.5 nm, 520.9 nm and 530.9 nm specified in the present Claim 1 are known per se. However, this fact is not sufficient to render the use of these laser lines obvious in the context of a method as known from document D1 or D6.

- 4.5 It is true that getting a higher beam intensity than with a He-Ne laser (which may be quite generally desirable) could have been expected from gas ion lasers, and one of the examples given in document D1 is a Kr⁺ laser. However, by selecting the special wavelengths 514.5 nm, 520.9 nm or 530.9 nm out of the known wavelength range, a further, unexpected effect is achieved.

- 4.6 The further documents cited in the European search report and during the opposition procedure do not come closer to the claimed subject-matter and cannot either contribute anything to rendering this subject-matter obvious.
- 4.7 The Board therefore comes to the conclusion that the subject-matter of Claim 1 involves an inventive step in the sense of Article 56 EPC.

The same reasons apply to apparatus Claim 2 which contains essentially the same features as Claim 1. The subject-matter of Claim 2, therefore, also involves an inventive step.

The dependent Claims 3 to 10 are allowable by virtue of their dependence on allowable Claim 2.

5. The opposition grounds set out in Article 100(a) EPC as put forward by the Appellant, therefore, do not prejudice maintenance of the patent in amended form with the claim set deemed to be allowable by the Opposition Division.

Order

For these reasons, it is decided that:

The appeal is dismissed:

The Registrar:

The Chairman:

P. Martorana

E. Turrini