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**D E C I S I O N**  
of 24 January 1995

**Case Number:** T 0515/93 - 3.5.1

**Application Number:** 85306030.9

**Publication Number:** 0179554

**IPC:** H04N 1/23

**Language of the proceedings:** EN

**Title of invention:**  
Continuous tone recording system

**Patentee:**  
MINNESOTA MINING AND MANUFACTURING COMPANY

**Opponent:**  
Océ-Nederland B.V.  
Dr.-Ing. Rudolf Hell GmbH  
Fuji Photo Film Co., Ltd.

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 54(2), 56, 100(a)

**Keyword:**  
"Cited conference proceedings (published late) replaced by oral description in conference (prior art) - not decided"  
"Inventive step (no) - Obvious application of a plurality of individually known measures independently solving the same or even different problems"

**Decisions cited:**  
T 0068/85, T 0622/89

**Catchword:**  
-



Case Number: T 0515/93 - 3.5.1

**D E C I S I O N**  
of the Technical Board of Appeal 3.5.1  
of 24 January 1995

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**Decision under appeal:**

Decision of the Opposition Division of the  
European Patent Office dated 26 March 1993  
revoking European patent No. 0 179 554 pursuant to  
Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** P. K. J. van den Berg  
**Members:** W. B. Oettinger  
G. Davies

### Summary of Facts and Submissions

- I. The Appellant is the Patentee of European patent No. 0 179 554 granted on patent application No. 85 306 030.9 which was filed, claiming a priority of 27 August 1984, on 23 August 1985.

The appeal contests the Opposition Division's decision of 26 March 1993, following three admissible oppositions invoking the ground mentioned in Article 100(a) EPC, to revoke the patent.

In the opposition procedure, twenty documents were cited (by Opponents OI, OII, OIII) including, *inter alia*, the following:

- OI.1: K.A. Butters et al, "A high resolution (5.7 micron) laser film printer", Proceedings of SPIE, vol. 498 "Laser Scanning and Recording" (1984), 19-26, [subsequently referred to as OI.1(P)]
- OII.1: DE-A-2 827 074 (& GB-A-2 002 197),
- OIII.11: JP-A-58-106953, considered in form of an English translation thereof [as filed by OIII],
- OI.3: US-A-4 257 053,
- OIII.12: L. Beiser et al, "Laser-Beam Recorder for Color Television Film Transfer", Journal of the SMPTE, vol. 80 (1971) September, 699-703,
- OIII.7: M. Lutz et al, "Modulated Light Source for Recording with GaAlAs-Lasers", SPSE Proceedings of the First International Congress "Advances in Non-Impact Printing Technologies for Computer and Office Applications", Venice 22-26 June 1981, 1982 [not "1983" as stated in the appealed decision], 356-375,

- OIII.1: D.G. Herzog, "Performance Comparisons of Electrophotographic, Dry Silver, and Wet Processed Recording Media Exposed with Gas Laser and Laser Diode Light Sources for Image Recording", Proceedings of SPIE, vol. 390 "High Speed Read/Write Techniques for Advanced Printing and Data Handling", Los Angeles 20-21 January 1983, 149-154,
- OIII.5: US-A-4 040 096,
- OIII.6: US-A-3 750 189,
- OI.4: F. Bestenreiner et al, "Visibility and Correction of Periodic Interference Structures in Line-by-Line Recorded Images", Journal of Applied Photographic Engineering, vol. 2 no. 2 (Spring 1976), 86-92,
- OIII.13: A.D. Berg et al, "High-Resolution Graphics Using a HeCd Laser to Write on Kalvar Film", Journal of the SMPTE, vol. 83 (1974) July, 588-599,
- OIII.8: Patterson et al, "Semiconductor Lasers Reach for Maturity: Applications in Fiber Optic Communications", Photonics Spectra, 1982 April, 83-87,
- OI.2: US-A-4 375 067.

The reason given for the decision to revoke was that the subject-matter of the only independent claim, Claim 1, filed in two versions in February 1993, did not involve an inventive step.

More particularly, having considered specifically the first six of the documents listed above, the Opposition Division considered the claimed subject-matter to be obvious from a combination of OI.1(P) - as starting point - with OIII.7. Furthermore, it drew a similar

conclusion with regard to auxiliary request Claim 1, taking into account the additional prior art citation OIII.1.

No other substantive or formal objection was raised. In particular, it was stated in the decision that the requirements of Articles 83, 123(2), 123(3), 84 and 54 EPC were met.

- II. The decision under appeal, which was announced (with brief grounds) in oral proceedings, was issued with full reasons on 26 March 1993.

The appeal was lodged, with a request to reverse the decision and to maintain the patent, on 3 June 1993. The appeal fee was paid on the same day.

On 5 August 1993, the Appellant filed a Statement of Grounds:

- III. In that Statement, the Appellant contended, based on a letter from SPIE - The International Society for Optical Engineering, that OI.1(P) was not published before the priority date of the application on which the patent-in-suit is based, that priority date being established as valid. Furthermore, he contested that the contents of OI.1(P) was made public during the Conference reported in OI.1(P).

But, nevertheless, he included the contents of OI.1(P) in the prior art he considered in his argumentation, including also the following additional prior art document:

P.1: US-A-4 395 766;

another US document referred to (4 814 791) not being prior art.

In that argumentation, the Appellant contested that the claimed invention would be rendered obvious by the cited documents.

IV. Respondents OI and OIII argued that the decision was correct, and requested that the appeal be dismissed.

Both of them agreed that OI.1(P) was not published prior to the priority date, but contended that its contents had been made available to the public at the respective conference. Thus, in effect, they replaced the "written description" of the state of the art in document OI.1(P) as defined above, by the "oral description" of the same state of the art (Art. 54(2) EPC) in the form of a lecture held at that conference, viz. by:

OI.1: K.A. Butters et al, lecture held on "A high resolution (5.7 micron) laser film printer" at the SPIE Conference, 21-22 August 1984, San Diego, California [subsequently referred to as OI.1(C)].

As evidence in support of this submission, OI filed, in addition to a contents page of the Proceedings mentioning the lecture in question under Session 1, an Addendum to the Proceedings showing that the lecture was not among those "papers scheduled to be presented at this conference and published in these proceedings", which had been cancelled, and OIII filed a declaration from the author (K.A. Butters) asserting that his co-author (S.R. Poludniak) "presented the content of the paper at a session of the (Conference) meeting".

Furthermore, OI referred, in addition, to OIII.5, OIII.6 and OI.4.

OIII made a correction to his translation of OIII.11.

V. In response to a Communication pursuant to Article 11(2) Rules of Procedure, expressing, inter alia, the Board's provisional opinion that a lack of inventive step objection could possibly be based on OIII.1 or P.1 as the starting point, with other prior art (e.g. OIII.11 or OIII.12) being taken additionally into account, the Appellant filed, on 23 December 1994, a new Claim 1 in six versions constituting his main and five auxiliary requests .

In all, the Appellant formulated the following requests :

**Main request:**

- that the decision under appeal be set aside and the patent maintained as amended on the basis of main request Claim 1;

**Subsidiary requests:**

- that OI.1(C) be disregarded according to Article 114(2) EPC;
- that the case be remitted to the first instance for further prosecution;
- that the correction made to OIII.11 be rejected;
- that the patent be maintained on the basis of Claim 1 according to any of the auxiliary requests 1 ff.



**Independent request:**

- that the Respondents be ordered to bear all the costs of the Appellant reasonably incurred during this and any later proceedings.

VI. No response either to the appeal or to subsequent submissions was received from OII.

The Board was merely informed that OII would not attend the oral proceedings scheduled for 24 January 1995, and in fact OII was not represented.

VII. In the oral proceedings, the Appellant corrected its auxiliary request 1 filed on 23 December 1994 and added two further auxiliary requests to those filed on that day.

The independent Claims 1 according to the eight requests thus on file read as follows:

**Main request claim**

"A photographic quality continuous tone image recording system comprising:

- (a) means including a solid state laser diode for generating an analog signal-controlled, intensity-modulated beam of light,
- (b) a feedback circuit responsive to the instantaneous intensity of said light beam for continuously providing a feedback control signal coupled to said generating means for adjusting said laser diode to stabilise its light output, allowing virtually instantaneous changes in output intensity in response to an input signal while maintaining the output constant regardless of changes in the characteristics of said laser diode,

- (c) means for scanning said light beam across the width of an image plane at which a photosensitive recording medium having a sensitivity and exposure range matched to the intensity-modulated light beam is positioned, said means providing scan lines on said recording medium,
- (d) a lens system for collimating, focusing and controlling the path of said beam of light, said lens system ensuring that a light spot of uniform dimension is correctly located on the recording medium,
- (e) means including said lens system for positioning said scan lines consecutively along the length of said image plane with a line placement having a standard deviation of less than 2 percent,

whereby the combination of the recited elements enables the formation at the image plane of a photographic quality continuous tone image, said elements being capable of creating at least 64 gray levels when imaged onto a transparent medium or at least 32 gray levels when imaged onto an opaque medium."

**Auxiliary request 1 claim**

This claim differs from the main request only in that in the "whereby"-phrase after the words "continuous tone image" the following insertion is made:

"at a rate of at least  $484.5/8.5$  lines/second,".

**Auxiliary request 2 claim**

This claim differs from the auxiliary request 1 only in that in the inserted expression the value " $484.5/8.5$ " is replaced by " $3300/41$ ".

**Auxiliary request 3 claim**

This claim differs from the main request only in that feature (c) reads as follows:

"(c) means for scanning said light beam across the width of an image plane at which a photosensitive recording medium which is a silver halide film or paper or a dry silver film or paper having a sensitivity and exposure range matched to the intensity-modulated light beam is positioned, said means providing scan lines on said recording medium, said light beam forming a light spot on said recording medium,".

**Auxiliary request 4 claim**

This claim combines, in effect, the amendment according to auxiliary request 1 with the amendment according to auxiliary request 3.

**Auxiliary request 5 claim**

This claim combines, in effect, the amendment according to auxiliary request 2 with the amendment according to auxiliary request 3.

**Auxiliary request 6 claim**

This claim differs from the auxiliary request 1 only in that in the inserted expression the value "at least 484.5/8.5" is replaced by the range "484.5/8.5 to 4845/8.5".

**Auxiliary request 7 claim**

This claim combines, in effect, the amendment according to auxiliary request 6 with the amendment according to auxiliary request 3.

- VIII. In the oral proceedings, OI formally objected against the amendments according to auxiliary requests 1, 2, 4, 5, 6 and 7.

OIII referred, in addition to the documents discussed before, to OIII.13.

The Appellant made reference, in addition, to OIII.8 and OI.2.

- IX. The parties' submissions made in the oral proceedings in support of their respective requests may be summarized as follows:

**re: Main request claim**

(i) A preliminary statement by the Appellant asserted that the inventiveness of the claim in the main request lay in the combination of five constructive features (a) to (e) and the specification of two parameters to be adhered to in designing the system, viz. the number of distinguishable grey levels to be achieved in the final image, and a statistical measure of the accuracy of placing successive lines in the image. Together, these features and parameters led to a device capable of producing photographic quality images. The Appellant did not claim that any individual feature was necessarily new to the art at the time - the invention lay in their selective combination, which had led to a breakthrough in the field.

(ii) The commercial success of a corresponding "laser imager" in medical applications was put forward as an indication of inventive step, and the output of such an imager was demonstrated.

(iii) The Appellant put forward a brief comparative analysis of the relevant features disclosed in the prior art documents mentioned by the Opponents and the Rapporteur, with the aim of showing that neither these documents nor any combinations thereof disclosed the features as claimed in combination. Critical to this analysis were certain assumptions and definitions.

It was asserted that at the priority date the skilled person would have understood electrographic or electrophotographic processes, i.e. those involving imaging by means of producing a distribution of electrostatic charge on a medium and the subsequent application of a toner, to be only capable of producing black and white tones in the image. In particular he would have understood references to laser printers as falling into this category. He would further have interpreted the term "half-tone" as referring to the technique, well-known in the printing industry, whereby shades of grey are produced in such a picture by making black dots of varying sizes on a white background.

(iv) There were essentially two attacks on the inventiveness of the claimed material, each preferred by one of the opponents. Respondent OI favoured OI.1(C) (Butters) as the nearest prior art, whereby the teaching of OIII.7 (Lutz) should be applied to arrive at the claimed material (this was the line taken in the decision of the Opposition Division). Respondent OIII favoured OIII.11 (Ricoh/Hamaguchi), together with the general knowledge of what might be expected of routine

development work by the skilled person. The arguments put forward for and against each of these approaches follow.

Henceforth, where, for simplicity reasons, reference is made to "OI.1", what is meant is the disclosure by OI.1(C) as assumed to be reported correctly by OI.1(P).

(v) Respondent OI claimed that OI.1 showed all the features of Claim 1, with the exceptions of (1) the laser diode, since it disclosed a gas laser, and (2) the specific parameter for line placement. In particular, it showed a continuous feedback mechanism (p. 24 second para: "The modulator responds ... while also performing feed-back compensation for variations in the source intensity"), and it disclosed 64 grey levels (p. 23: "Radiometric requirements"). The advantages of using laser diodes (i.e. semiconductor lasers) were well established at the priority date, and the teaching of OIII.7 would have encouraged the skilled person to replace the gas laser of OI.1 by a laser diode. This document further taught stabilisation of the laser output by "instantaneous" feedback in the sense of the patent, i.e. feedback having an effect in a small fraction of a pixel time, and while in OIII.7 this stabilisation was always at a particular level, since it was a pulsed (binary) system, the skilled person would realise that the same arrangements could be used to stabilise the laser output at all desired grey levels.

As to the line placement accuracy, this was generally known to be a critical feature, as might be seen from document OI.4. OI.1 itself was clearly very concerned with accurate placing of lines, although it used other parameters (p. 23: "Geometric requirements"). As to the specific value of geometric accuracy being specified in OI.1 as a tolerable error of  $>0.1$  pixel, it should be

borne in mind that the pixel size specified in OI.1, 4  $\mu\text{m}$ , is much smaller than the typical size in the patent, 85  $\mu\text{m}$  (col. 7, ll. 49 to 50).

The Appellant counter-argued that in OI.1 neither of the two cases of feedback shown, in Figures 1 and 3, corresponded to the "feedback circuit responsive to the instantaneous intensity of said light beam ..." specified in the claim. The system of Figure 1 showed a feedback detector which sampled the intensity of the laser before modulation, and it was well-known in the art that this kind of feedback on gas lasers was simply to compensate for long-term influences on output, for example temperature drift and aging. The sentence cited by Respondent OI from OI.1, and relating to the system illustrated in Figure 3, had to be read in correspondence with the sentence bridging page 24 and page 25 and the last four lines of page 25. These made it clear that the feedback in this case was merely from the sensing of a reference value once per line, via photodiode 11, and hence was also only to compensate for long-term drift factors.

OIII.7 was only concerned with binary signals and furthermore the feedback was only operative in the "on mode" of the diode (p. 360 first para.). Because of the binary nature of the system in this document, the skilled person would not have combined it with OI.1.

In addition, Figure 5 showed that the feedback of this document was slow, since the stabilisation period could be seen to be several minutes. However, the Respondents pointed out that this last point could not be correct, since the patent-in-suit itself referred to OIII.7 as disclosing suitable feedback circuits (col. 5, ll. 43 to 49).

The Appellant further argued that OI.4 was exclusively concerned with periodic errors in line placement. The conclusion of that document indicated that more work would be necessary to form conclusions about aperiodic variation. The parameter in the contested claim was statistical in nature, indicating that the patent was concerned with random errors in line placement. The Respondents counter-argued that periodical errors would still fall under the claim.

(vi) Respondent OIII preferred to start from the teaching of OIII.11. It was asserted that this document showed all the constructive features claimed. In addition, the purpose of the system was the same as that of the patent, i.e. to reproduce accurately an original having "half tones". This was said to be an ambiguous term, but essentially to be understood, as the skilled person would have understood OIII.11, as indicating the presence of shades of grey. During the course of the oral proceedings, OIII sought to introduce two dictionary definitions alleged to support this view.

The remaining features of the claim merely defined a "wish list" of goals. It would be clear to the skilled person that there must be some minimum number of producible grey levels if the viewer was to perceive the image as having continuous light-to-dark shading. It would be easy to establish what that number was, and reference was made to OIII.13, last page, showing that 6-bit values (i.e. 64 shades of grey) were in fact needed. Incidentally, it was noted that the declaration of J.D. Xanthos, submitted by the Appellant in the opposition proceedings on 4 February 1993, indicated that an apparatus constructed according to the OIII.11 specification could easily achieve 64 grey levels.



As to the line placement question, it was quite clear that "banding" was a known phenomenon in the art and that it was to be avoided in a "photographic quality" image. What the skilled person would do was clearly laid out in the patent itself, column 9, lines 13 to 29, i.e. he would conduct experiments to see what degree of error was in fact noticeable to the viewer, and design the apparatus accordingly.

In this context, the Respondent referred further to OIII.12 and OIII.13, which documents showed the general awareness of the importance of accurate line placement. In particular OIII.12 referred to a vertical placement linearity of <1%. However, the Appellant argued that linearity was not the same measure as standard deviation of placement error.

Respondent OIII objected to the claim being formulated in terms of performance goals and raised doubt as to whether there was any teaching in the patent which told the skilled person how to reach these goals. Solid engineering effort on the part of a team would be required to achieve the specified parameters. Reference was made to the Headnote of T 68/85, which referred to functional features not being allowable in a claim, if they put an undue burden on to the skilled person to find means of realising them.

The Appellant argued firstly that OIII.11 should not be considered as an appropriate starting point for the invention. The invention was concerned with a photographic quality continuous tone image device. There were at least three documents in the proceedings which were also concerned with such devices. One should not, therefore, start from a laser printer as disclosed in OIII.11. Further, it continuously referred to half-tones, which had to be understood as previously

presented. The Appellant objected to the dictionary definitions produced by the Respondent, both because they were being introduced so late and also because they were German dictionaries and defining "Halbton", rather than "half tone". It was quite possible that there is a discrepancy between the meanings of these two terms in the two languages.

OIII.11 referred to pre-charged material. It was therefore clear that it referred to half tones in the sense previously presented. OIII.11 was further not concerned with the problems that the patent overcame. The only teaching of OIII.11 was to perform a  $\gamma$ -correction. In the context, the skilled person would have understood this to mean that the intensities of the laser light corresponding to the particular shades of grey were adjusted in order to produce the correct size dots. Pointing out that the light intensity falling on the medium had a Gaussian distribution, it was argued that the effect of increased intensity on a black-and-white recording medium would indeed be to enlarge the pixel size.

The Appellant further challenged the assertion that the "instantaneous" in the text of OIII.11 referred to instantaneous feedback. No specific speed was specified in OIII.11 for the circuit shown, and no component values were given. The skilled person would be driven back to other prior art documents to evaluate the circuit (mention was made of OIII.8 and OI.2, Fig. 5). He would come to the conclusion there was a slow feedback.

The general teaching of OIII.13, cited by OIII, led away from the patent, there being a very complicated feedback mechanism. It was further argued that the mere production of 64 different analogue signals by a

digital-to-analogue converter in OIII.13 did not necessarily mean that 64 different shades were produced in the image. This depended on other factors, including the medium.

The passage of the patent (col. 9 l.13 ff.) cited by OIII discussed periodic errors. It did not make reference to the standard deviation which was used in the claim.

The fact that the claims contained functional features was justified since the body of the specification told the skilled person how to realise them.

The Respondents disputed the Appellant's interpretation of "half tone" in the context of OIII.11, but pointed out further that if one were to accept the Appellant's view, this would only mean that the claimed invention was distinguished from OIII.11 by the medium used, a factor which was not claimed in the independent claim of the main request. They challenged even whether a half-tone image production system in the Appellant's sense (i.e. dot-size) was excluded by the patent.

It was further argued that OIII.1 would teach the skilled person that he could use photographic media, if necessary, to reach 64 different shades of grey. There was mention of a dynamic range of 1 to 20, which clearly implied a wide range of grey scales (this last being disputed by the Appellant). Further, page 149 "Electrophotographic Films" contradicted the Appellant's assertion that at the priority date electrophotographic techniques excluded grey-scale images.

**re: Auxiliary request claims**

(vii) With respect to the auxiliary requests , the Appellant argued firstly that speed of production of images was an important problem, which had been referred to in the original description, and that the number of lines per second was a determinant of that speed. The actual values chosen in the auxiliary requests were all derivable from the description. As regards auxiliary requests 3 to 5 (and 7), these specified a class of media particularly suited to fulfil the requirement of feature (d) of the claims, that it have a sensitivity and exposure range matched to the intensity-modulated light beam.

The Respondents argued that the specification of a range of speeds (auxiliary requests 1, 2 and 4 to 7), whether open-ended or closed, was in violation of Article 123(2) EPC. Further, the technical meaning of this measure of speed was dubious; there were many alternative ways of specifying speed. For instance, the description, column 8, lines 4 to 7, gave a very wide range of possible "transporting speeds", without giving any indication of the factors to be weighed in choosing a speed. Equally the line width was specified very broadly in the description, making a nonsense of line speed as a measure of rate of image production. Finally, the line speed as a feature of the claim could not be seen as contributing anything to the declared problem that was to be overcome, that is producing a high-quality image. Indeed higher speeds would at some point obviously lead to a deterioration in the quality. Hence the line speed should not be considered when weighing up the inventive step of the claim.

(viii) OIII.1 mentions the films specified in auxiliary requests 3 to 5 (and 7). The skilled person would learn from that document that there was a free choice of a wide variety of media to suit the circumstances. The particular choice could not be considered inventive.

### Reasons for the Decision

1. The appeal (cf. II) is admissible.

#### *Main request*

2. The first and main issue to be decided within the framework of the Appellant's requests (cf. V) is whether the subject-matter of Claim 1 according to the main request (cf. VII) involves an inventive step.
3. It appears, in the circumstances, appropriate for the Board to state its understanding of the claim:
  - 3.1 As a preliminary remark, the Board wishes to state how the wording of the "whereby"-phrase is **not** to be understood: The expression "the combination ... enables ..." is clearly not intended to, nor could it, mean an **inevitable** result of the combination of means (a) through (e). It would certainly be possible to construct a combination falling under the definition in the claim but which would not necessarily ensure the achievement of the number of grey levels mentioned in the "whereby"-phrase.

Instead, therefore, the "whereby"-phrase must be, and is, understood as meaning that one or more of the features of said combination is specifically designed so as to ensure that the result indicated in the "whereby"-phrase is achieved.

3.2 The subject-matter claimed is understood as consisting of the following groups of features:

(A) General goal: (cf. introductory phrase) the recording of "photographic quality continuous tone images" by (cf. whereby-phrase) their "formation at the image plane" at which (see (c)) "a photosensitive recording medium having a sensitivity and exposure range matched to the intensity-modulated light beam is positioned". In the present context (claim features and description), the word "continuous" must however be understood as covering a quasi-continuous tone in the sense that the images recorded have so many grey levels that their "steps" would not be observable. The term "photographic quality" is understood as meaning that the observer would not notice any difference from a picture obtained by a photographic method. This definition excludes, of course, normal black and white "printers" not providing any grey levels, but it would not seem to clearly and unambiguously exclude those image recorders which give the impression of a large number of grey levels by creating larger or smaller black dots, as is well known. It is furthermore noted that neither feature (c) nor any other feature specifies the kind of recording medium, for instance in respect of its development, any further. The claim appears thus not to be restricted to "photographic" media.

(B) System components in general: (a) "means for generating an analog signal-controlled, intensity-modulated beam of light", (c) "means for scanning said

light beam across the width of an image plane ... (see (A) above), said means providing scan lines on said recording medium", (d) "a lens system for collimating, focusing and controlling the path of said beam of light, said lens system ensuring that a light spot of uniform dimension is correctly located on the recording medium", and (e) "means including said lens system for positioning said scan lines consecutively along the length of said image plane".

(C) Specific components: (a) "(the generating means) including a solid state laser diode", and (b) "a feedback circuit responsive to the instantaneous intensity of said light beam for continuously providing a feedback control signal coupled to said generating means for adjusting said laser diode to stabilise its light output, allowing virtually instantaneous changes in output intensity in response to an input signal while maintaining the output constant regardless of changes in the characteristics of said laser diode,".

(D) Specific parameters: (e) "(positioning said scan lines) with a line placement having a standard deviation of less than 2 percent" and (cf. whereby-phrase) said combination elements being "capable of creating at least 64 gray levels when imaged onto a transparent medium or at least 32 gray levels when imaged onto an opaque medium".

[Designators (a) through (e) and (A) through (D) ~~have~~ ~~above,~~ and ~~will below,~~ be used wherever appropriate not only when referring to whole features but also when referring to partial features.]

4. For the issue to be decided, in accordance with general practice, it would be relevant what the piece of prior art coming closest to the claimed invention is, thus constituting the most appropriate starting point.

4.1 In the present case, however, as the parties' submissions (cf. VIII) would show, the answer is not readily apparent.

It should be clear that the nearest prior art must result in pictures approaching (or even having) the quality required in feature group (A). Feature group (B) being, in effect, common to all prior art systems cited, this group needs no individual consideration. Any piece of prior art disclosing, apart from concerning image recording in the sense of (A), some of the "means" features recited in (C) and/or some of the "design defined by result" features recited in (D) would be prone to coming "near" to the claimed invention and thus to being suitable as a starting point.

4.2 Clearly, OIII.11 is such a piece of prior art and, in the Board's view, even more suitable than OI.1 would be.

For this reason, the Board will start with OIII.11.

4.3 OIII.11 is understood as disclosing a system of the type defined in feature group (A) above.

The word "printer" used in OIII.11 is not inconsistent with this interpretation. This word seems to be used not only for impact printers but, at least sometimes, also for "non-impact printers" such as laser printers including those recording continuous tone or quasi-continuous tone images.



The term "half tone" can be interpreted in the light of its context, as the Appellant proposed to do. The Board has therefore chosen not to consult the references offered by OIII (a "Wörterbuch" and a "Handbuch"); this the more so as these are in the German language whereas OIII.11 is a translation from Japanese into English and the terminology might not have the same meaning in all languages. Figures 3 and 5 of OIII.11 show the relationship between the "exposure amount" or the "information signal" and the "image density", and it is very clear from the text, e.g. page 2 1.2 ff., that the term "image density" corresponds in substance to the term "gray level" as used in the patent-in-suit, whatever the "photosensitive material" (6 in Fig. 1 of OIII.11) actually used, i.e. by whatever physical effect the information signal is transformed, within that material, into said grey levels. In this context, "half tone" can clearly be understood as not meaning something like half-black but the whole range of grey levels or image densities as graphed in Figure 3 (uncorrected) or Figure 5 (corrected image density vs. signal relationship).

The stated effect striven for (cf. p. 2) by the proposed signal correction is "higher accuracy", or "quality", of the reproduction of an image. Whether "photographic quality" would actually be achieved with the system shown in Figure 1, including the circuitry shown in Figure 6, is apparently a matter of how great the accuracy of the system elements used is. It is agreed that nothing can be derived from OIII.11 about an actually "photographic" quality.

4.4 As already said (4.1), feature group (B) is present in the OIII.11 system as a matter of course, and as illustrated (Fig. 1) and described.

4.5 Feature group (C) is present to the following extent.

The light generator (1) is a laser device and includes a solid state laser diode (2) and the system includes a feedback circuit (Fig. 6). This circuit is responsive (by means of photodiode 11) to the instantaneous intensity of said light beam; that this is so even though it is not stated where the photodiode is mentioned (p. 5 second para.), is confirmed by the reference to an "instantaneously" conducted control of the laser diode (p. 9 first para.). The circuit continuously provides a feedback control signal; even without an express statement to this effect, this is clearly implicit in the function described (p. 5 ff.). This control signal is coupled to the generating means for adjusting the laser diode, or rather the intensity of its light output.

4.6 By the particular comparison made in differential amplifier OP3 with a  $\gamma$ -correction signal obtained from circuit 10, the function of the feedback circuit of OIII.11 is that of linearising (see Fig. 5) the originally non-linear image density vs. signal function (Fig. 3). The function of the feedback circuit of the patent-in-suit is, however, according to feature group (C), that of "stabilising" the laser diode light output "maintaining (this) output constant regardless of changes in the characteristics of said laser diode", without however affecting the "instantaneous changes in output intensity in response to (the) input signal". In accordance therewith, the feedback circuit shown in

Figure 3 feeds the signal detected by the photodiode (114) back (via 136) to the laser diode input, without it being compared with a correction signal and, instead, with superposition (in 128) on the input signal.

Thus, the specific function of the feedback circuit according to feature (C) (b) is different from the specific function of that of OIII.11.

5. With this starting point in mind, it can now be determined what problem would be solved by those features claimed which are not known from OIII.11.

5.1 As follows from the above, those features are:

- (C) the particular function of the feedback circuit to stabilise the laser diode light output;
- (D) the particular technical design of system components so that the line placement deviation is below a certain value, and so that the grey levels created have at least a certain number.

5.2 It is evident already from these features that the problem to be solved is that of ensuring that the images are really "continuous tone" (or quasi-continuous as stated before) and of really "photographic quality" in the afore-mentioned sense (cf. (A)). This problem can therefore be defined as improving the picture quality or ensuring that it is of a certain degree.

Incidentally, this problem lies clearly within the statement, in the patent-in-suit, of a goal (col. 2 l. 30, l. 39, ll. 58 to 59) and similar statements in the description of an embodiment.

- 5.3 Quality being the motivation already in the prior art (OIII.11) started from, and quality improvement lying generally in the skilled person's interests, no inventive step can be detected in the recognition of the problem to improve the quality of the recorded images even beyond that of the system of OIII.11:

This applies even to the "photographic" quality striven for. It would, as a matter of course, appear desirable for the skilled person implementing the system of OIII.11 to enhance its quality to the extent of obtaining a result comparable with a "photographic" picture.

6. Turning now to the solutions offered for this problem by the claimed features (cf. 5.1):

- 6.1 First, there is the stabilising function of the feedback circuit.

In the Board's view, it is plainly obvious that, if, as in the present case, the problem is a high, or higher, quality, it will be the first task of the skilled person seeking to achieve the highest possible quality of the system of OIII.11 to make all its components as "accurate" as possible, and that, if quality is still not high enough, it will be his second task to improve the quality of its components by special measures not known from OIII.11 but proposed in other pieces of prior art.

As one of the parameters he will consider making more "accurate", the light output of the laser diode will come to mind. It is well-known in the art that this output is not constant from the outset but may be subject to short-term and long-term variations. That this is so, is told, for instance, also by OIII.7 which

is a document concerned with image recording, although not necessarily of "photographic quality continuous tone" in the sense of feature group (A).

Furthermore, OIII.7 proposes an implementation of such stabilisation means in the form of a feedback circuit. More specifically, it teaches that the light output of a laser diode serving as the light source in an image recording system should be made constant, or stabilised, by an instantaneously acting feedback circuit fast enough to be able to stabilize even a single image dot (p. 359 bottom lines). This is, although not expressly stated in the claim, a requirement also, according to the Appellant's submissions, in the patent-in-suit.

- 6.2 The second feature group (D) requires, because the underlying cause for poor quality is different, separate considerations, as follows.
- 6.3 The "banding" problem caused by inaccurate line placement, which was impressively demonstrated in the oral proceedings, cannot be considered to be an entirely new discovery. It is true that it is not known from the prior art considered so far (OIII.11, OIII.7); but OI.4 would point to this problem.

OI.4 is, in the context of feature group (A), primarily concerned with "the visibility and correction of periodic interference structures" (cf. headline); however, it mentions also "random fluctuations", e.g. from row to row, giving rise to an interference structure called "banding" (p. 86 right-hand column). To the skilled person, it will thus be clear that, to avoid the "banding" effect, random as well as periodic line placement deviations should either be avoided (by "precision" measures) or corrected (by "compensating" means). As a particular value for periodic

line displacements, which can under certain circumstances (visibility, luminosity) still be perceived, 1% is mentioned (p. 90).

It will thus have to be regarded as being clearly obvious to the skilled person that a line placement having a standard deviation of less than 2 percent would be a reasonable condition for avoiding perceptible "banding".

- 6.4 Quite independently from this condition, another obvious prerequisite for the quality of a recorded image is the number of grey levels created, as also demonstrated in the oral proceedings.

For this feature, again OI.4 would appear relevant, but OIII.13 even more so.

OI.4 considers a contrast of luminance of "continuous-tone" image recording from around 0.001 up to about 0.5. Apparently, this means a minimum number of grey levels of the order claimed.

OIII.13 discloses, in the context of "high-resolution graphics using a laser" (although gas laser), a digital range of up to 6 bits for the range of tone levels, 4 bits yielding an insufficient result. This corresponds, in effect, to the grey level range claimed.

7. From these considerations (6.1 to 6.4 in conjunction with 5 and 4) it follows that, starting from the combination of features disclosed in OIII.11, the subject-matter of Claim 1 is obvious, having regard to

- the particulars of feature group (C) which are new against this starting point being rendered obvious by OIII.7,

- the maximum tolerable range of line placement deviations claimed in feature group (D) being rendered obvious by OI.4, and
- the minimum necessary range of grey levels claimed in feature group (D) being rendered obvious by OIII.13;

having regard further to the fact that any of these three features contributes **independently from any of the other two** to a solution of the underlying quality problem.

8. As a first conclusion, according to the Board's finding, the subject-matter of main request Claim 1 does not involve an inventive step.

The Appellant's request that the patent be maintained on this basis cannot therefore be allowed.

*First subsidiary request*

9. In respect of the Appellant's request that OI.1(C) be disregarded, the Board notes the following:

- 9.1 In its Notice of Opposition, OI cited OI.1(P). In the opposition procedure, the question whether this citation was prior art was neither disputed nor discussed. In the Grounds of Appeal, the Appellant established that it was in fact not prior art. In response, OI (and OIII) replaced citation OI.1(P) by "citation" OI.1(C).

As a further fact to be considered, it is noted that, at least at the time of filing the Notice of Opposition, OI could rely on the assumption that, in such situations as the present, according to the Guidelines for Examination D-V, 3.3, "the subsequently published written

description may be deemed to give a true account of that oral description". At that time, the further wording ("unless ...") of that paragraph of the Guidelines was not relevant.

Having regard to these facts, the Board doubts that the "facts and evidence" concerning OI.1(C), which were submitted in response to the Appellant's Grounds of Appeal, were "not submitted in due time".

- 9.2 But, however this may be, in the context of the Appellant's main request (see 4.2 to 7), it was not in effect necessary to refer to any particular feature of Claim 1 having been made available to the public in the sense of Article 54(2) EPC by OI.1.

Thus, in the present situation, a binding decision on the question of Article 54(2) EPC in respect of OI.1(C) is not required and, therefore, the Appellant's First subsidiary request is without object.

*Second subsidiary request*

10. In view of the outcome of the Appellant's main request (point 8), the Board sees no reason for remittal of the case, in view of "the new facts and alleged evidence" concerning OI.1(C), to the first instance department.

In application of the discretion, given to the Board by Article 111(1) EPC, this request is therefore rejected.

*Third subsidiary request*

11. The particular passage in OIII.11 (p. 3 third para. last sentence) the correction of which was requested by OIII, relates to the shape in which the photosensitive material used would be fed into the apparatus.



In respect of this request, the following is noted:

- 11.1 The said passage played no role in the examination of the main request Claim 1 (points 4.2 to 7).

That claim does not specify the shape in which the photosensitive medium is fed into the claimed apparatus. What OIII.11 discloses in this respect is therefore irrelevant in the present case.

- 11.2 No decision is therefore needed on the allowability or not of the said request for correction.

This means, in effect, that the Appellant's request for rejection of this correction is without object.

*Fourth subsidiary request*

12. This request consists, in effect, of six auxiliary requests which are hereafter dealt with in turn.

*Auxiliary request 1*

13. The issue to be decided is whether Claim 1 according to the Appellant's auxiliary request 1 would allow a conclusion which is different from that drawn with respect to the main request (point 8).

- 13.1 The feature added to the subject-matter of main request Claim 1 by the auxiliary request 1 cannot be regarded as contributing to the quality problem found to be the problem solved by the subject-matter of that claim (point 5.2).

Instead, it is related to the speed at which the images are recorded, and no other problem was submitted by the Appellant or would be apparent from the patent.

Recording speed in general is dealt with in terms of transporting speed (cm/sec) in the description where it refers to scanning (col. 7) and positioning (col. 8), and it would appear acceptable that, for a given number of lines per picture, the line to line speed will be a measure for the image recording speed and thus of some interest.

- 13.2 A specific image formation speed of 484.5/8.5 lines/sec is disclosed - implicitly - by Example 6 of the patent-in-suit. All of the other six examples have higher values.

It was argued that this restriction of the scope of the claim was not an admissible "disclaimer" but an inadmissible extension of the subject-matter of the patent going beyond the content of the application as filed.

However, no final decision is necessary on this point, because the auxiliary request 1 Claim 1 is not allowable anyway, for the following reasons.

- 13.3 A picture recording speed of more than the claimed minimum value may be considered as a mere matter of intention: any skilled person implementing an apparatus of the kind in question would, in the interest of the user, choose a value not unnecessarily low.

- 13.4 Moreover, values falling in the claimed range would seem to be implicit in OI.4 (450 m/s with an arbitrarily assumed 1 m/line would mean 450 lines/sec, for shorter lines even more), or even explicit in OIII.13 (2000 lines in 4 sec, page 590).

14. For these reasons, auxiliary request 1 Claim 1 is not allowable either.

*Auxiliary request 2*

15. Claim 1 according to this request 2 lifts, in effect, the lower boundary of the claimed recording speed range to the value disclosed in Example 1, thus excluding Example 6.

15.1 Even though the Appellant has offered to delete this latter example in case the said request is allowed, the Board has strong doubts whether such a restriction to a sub-range the lower boundary of which appears to be an arbitrary selection out of all the examples disclosed, would be an admissible "disclaimer".

15.2 Still, as in the case of the foregoing request, no final decision appears to be required in respect of this question, because the range claimed in auxiliary request 2 is by no means less unobvious than the one claimed in auxiliary request 1 (see point 13.4).

*Auxiliary requests 3 to 7*

16. For obvious practical reasons only, the Board wishes to deal with these requests not in the order given by their numbers but in the following order.

*Auxiliary request 6*

17. By introducing, in this request, an upper limit for the range of recording speeds, the Appellant seeks to escape the objection that, as OI put it, the expression "at least" in auxiliary requests 1 and 2 is not admissible.

17.1 In effect, however, by this restriction to a closed range nothing would appear to be gained over auxiliary request 1, because the range now claimed still appears to be arbitrary in the sense that the Appellant did not

establish that any particular effect, pointing to a "selection invention", is achieved in this range, which would not be achieved outside it.

- 17.2 But, however this may be, no inventive step can be recognised in the particular choice of range limits as claimed.

From the point of view of a skilled person using a system as claimed, it would appear desirable to use as high as possible a recording speed, but a skilled person having to implement such a speed would see that technological problems might arise from too high a speed.

In any case, no reason is seen why the range claimed should be specific in the sense of an unobvious choice, particularly as known values have been found to lie within it (see point 13.4).

18. Auxiliary request 6 Claim 1 is therefore not allowable for effectively the same reasons as those given in respect of auxiliary requests 1 and 2.

*Auxiliary request 3*

19. The amendment made to Claim 1 of this request is clearly admissible.
20. The feature added by this request excludes other photosensitive media than films or papers of the silver halide or dry silver kind.

- 20.1 OIII.11 does not specify the recording medium (6 in Fig. 1) in any other way than by the term "photosensitive material" on which a "latent image is formed" which is "visualized by a developing apparatus" (p. 3).

In the Board's view, this general disclosure neither encourages the skilled person to use a particular kind of material nor discourages him from using any well-known kind of material appearing suitable for his purpose.

- 20.2 OIII.7 appears not relevant either for the recording medium now claimed.

- 20.3 In OI.4, however, apart from a substantial number of very different recording media, for example "electrochemical processes" are mentioned (p. 86). It would seem that this term includes photochemical processes, i.e. films or papers which are photosensitive due to their chemical components (as silver would be).

- 20.4 A particular kind of "film" as recording medium is also proposed in OIII.13 (pp. 590, 598) with a reference to the allowable temperature in the projector being "as with silver halide transparencies".

- 20.5 The really relevant document for the feature added to the subject-matter of Claim 1 by auxiliary request 3 is, however, OIII.1.

There, all sorts of recording media are mentioned, and compared with each other, including silver halide and dry silver films. For tactical (transportable) recording, dry silver film is recommended over silver halide film (p. 149).

20.6 This document makes it clearly obvious for the skilled person seeking to implement an apparatus of the kind defined in the main request claim, found above to be obvious (points 7 and 8) and not therefore to involve an inventive step, to use silver halide or dry silver film as a recording medium. Paper of the same kind would then be an evident, equivalent, alternative.

20.7 In the present case, the Board finds it particularly necessary to stress that this conclusion appears correct only by virtue of the fact that all the features, which appear new against the prior art starting point, are not only individually known from citations which are closely related to the said starting point in so far as they all concern, at least in principle, the same kind of apparatus (photographic or near-photographic quality continuous or quasi-continuous tone image recording by means of an intensity-modulated laser beam scanning a photosensitive medium in consecutive lines), but that, moreover, they contribute **independently** to the solution of the underlying problem.

Normally, the necessity of citing more than two pieces of prior art in an obviousness objection would be an indication, albeit not proof, that the claimed combination does involve an inventive step. This holds, however, only as long as the individual contributions of the features added to the prior art starting point are not independent of each other.

In the present case, the subject-matter of auxiliary request 3 Claim 1 was found to be obvious, starting from the apparatus of OIII.11, because the functional feedback feature known from OIII.7, the line placement feature known from OI.4, the grey level number feature known from OIII.13, and the photosensitive film or paper feature known from OIII.1 all contribute independently

to a solution of the accuracy, or quality, problem. Any one of these four features, known individually from OIII.7, OI.4, OIII.13 and OIII.1, would, when added to the apparatus of OIII.11, make this apparatus more accurate and thus improve the quality of the recorded images. The Board was unable to identify, on the basis of the Appellant's submissions, any additional improvement, over and above these individual improvements, ie an improvement which could not be expected from the application of the said features.

The Respondents do not seem to have disputed that an apparatus as claimed would result in the recording of images on the films or papers as specified with an even higher "photographic quality" than images could be recorded without the application of the claimed features, and the Board does not dispute that either. It may also be that the implementation of such an apparatus has contributed to the Appellant's commercial success. However, in the light of the aforementioned one plus four pieces of prior art, the Board felt unable to attribute this result and success to an unobvious step, to be applied in addition to those rendered obvious by said pieces of prior art, in the course of a systematic R&D attempt to eliminate all possible sources for inaccuracy.

21. Auxiliary request 3 Claim 1 is therefore not allowable.

*Auxiliary request 4*

22. This request combines, in effect, the amendments of auxiliary requests 1 and 3.

22.1 In respect of the individual features added by these two requests, reference is made to points 13.1 to 13.4 and 20.1 to 20.7.

- 22.2 Again, it is to be stated that the recording speed feature added by auxiliary request 1 and the photosensitive film or paper feature added by auxiliary request 3 are quite independent of each other, as regards both the speed and quality problems they seek to solve and their functions or effects, respectively.

It follows, therefore, from the statements made above (in particular points 13.4 and 20.7) that the subject-matter of Claim 1 of this request must be considered, starting from the apparatus of OIII.11, as being obvious, having regard to the individual features added to this apparatus being rendered obvious by OIII.7, OI.4, OIII.13 and OIII.1 and to the fact that all these features contribute independently either to the same or even, as far as speed is concerned, to a different problem.

23. Auxiliary request 4 is therefore unallowable on the basis of an application of both the reason set out in respect of auxiliary request 1 and that set out in respect of auxiliary request 3.

*Auxiliary request 5*

24. The same applies, *mutatis mutandis*, to this request, which in effect combines the amendments of auxiliary requests 2 and 3.

Its subject-matter must be considered, starting from the apparatus of OIII.11, as being obvious, having regard to the same four additional prior art documents (OIII.7, OI.4, OIII.13, OIII.1) and with particular reference to point 22.2.



*Auxiliary request 7*

25. The same applies to this request, which combines the amendments of auxiliary requests 3 and 6.

Again, its subject-matter must be considered, starting from the same apparatus (OIII.11), as being obvious, having regard to the same four additional pieces of prior art (OIII.7, OI.4, OIII.13, OIII.1) and with particular reference to point 22.2.

*Fourth subsidiary request*

26. For these reasons (points 14, 15.2, 18, 21, 23, 24, 25), the Appellant's fourth subsidiary request (point 12) cannot be allowed.

*Independent request*

27. The Appellant's request on costs relies on decision T 622/89 of 17 September 1992.

- 27.1 However, the present case is different.

As pointed out above (point 9.1), the Board doubts that the "facts and evidence" concerning OI.1(C) were not "submitted in due time".

- 27.2 Moreover, other than the replacement of a short abstract by the full text of a document in the earlier case, the "replacement" of OI.1(P), as a prior art citation, by OI.1(C) has not, in the present case, created a new situation which would necessitate the remittal of the case to the first instance department (see point 10) to consider the whole matter afresh.

28. This request is therefore to be rejected.

*Conclusions*


- 29. The Appellant's requests, so far as they are not without object (see points 9.2, 11.2), being thus not allowable, the appeal as a whole must fail.
  
- 30. Respondent OI's request that the amendments made to Claim 1 of some of the auxiliary requests be refused as inadmissible (points VIII, IX 7), needs no separate decision (see points 13.2, 15.2, 17.2, 22.1, 24, 25).
  
- 31. Rather, in the circumstances (point 29), the Respondents' (OI, OIII) requests for confirmation of the decision under appeal (point IV) will have to be allowed.

**Order**

**For these reasons it is decided that:**


The appeal is dismissed.

The Registrar:



M. Krehl

The Chairman:



P. K. J. van den Berg



