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D E C I S I O N
of 9 November 2000

Case Number: T 0037/99 - 3.4.2

Application Number: 92909793.9

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IPC: G03G 15/04, H01S 3/18, H04N 1/04

Language of the proceedings: EN

Title of invention:
Image-forming device

Patentee:
SEIKO EPSON CORPORATION

Opponent:
(01) Canon Kabushiki Kashiha
(02) Hewlett-Packard Company

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 84, 114(2), 123

Keyword:
"Late submitted material - admitted (yes)"
"Inventive step - no (main request and first, sixth, seventh and eighth auxiliary requests)"
"Amendments - Articles 123(2) and (3) (second to fifth auxiliary requests)"

Decisions cited:
T 0187/91, T 0633/97, T 1149/97

Catchword:
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Case Number: T 0037/99 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 9 November 2000

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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 13 November 1998
revoking European patent No. 0 544 002 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: S. V. Steinbrener

Members: M. A. Rayner

V. Di Cerbo

Summary of Facts and Submissions

- I. The appellant (= proprietor of the patent) lodged an appeal against the decision of the Opposition Division revoking European patent No. 0 544 002.
- II. Two oppositions against the patent as a whole had been filed by the respondents (= opponents 01 and 02, respectively) and based on the grounds of lack of novelty and/or inventive step (Article 100(a) EPC).
- III. The oppositions *inter alia* referred to the following documents (using the numbering of the opposition proceedings):
- E1: JP-B-58-8627 (and English translation E1* thereof furnished by opponent 01)
- E3: Extended Abstracts of the 51th Autumn Meeting of The Japan Society of Applied Physics, published on 26 September 1990, 29p-R-6 (and English translation E3* thereof furnished by opponent 01)
- E4: K. Iga et al.: "Surface Emitting Laser", Ohm Co., Ltd, 1990, pages 246 to 247 (and English translation E4* thereof furnished by opponent 01)
- E6: JP-A-63-1147 (and English translation E6* thereof furnished by opponent 01), and
- E7: JP-A-1-185513 (and English translation E7* thereof furnished by opponent 01),

which documents were again cited by the parties in the present appeal proceedings.

In addition, the following documents:

- A: Optics, vol. 15, No. 6, December 1986,
pages 504(38) to 505(39) (and partial English
translation thereof furnished by the appellant)

- B: Optics, vol. 19, No. 6, June 1990, pages 350(2) to
355(7) (and partial English translation thereof
furnished by the appellant)

- C: "Search Report on Trends in Optical Technology
VIII / Development Trend and Prospects of Optical
Technology", March 1991, pages 246 to 251 (and
partial English translation thereof furnished by
the appellant)

- D24: US-A-4 956 844

- D25: US-A-4 813 762

- D26: Electronics Letters, 28 February 1991, vol. 27,
No. 6; pages 437 to 438

- E8: JP-B-3-30843, and

- E9: JP-A-62-58214

have been submitted by the parties for the first time
in the appeal proceedings.

- IV. In its revocation of the patent in suit, the Opposition
Division held that the subject matter of amended
independent claims 1 and 11, respectively, was not
inventive with respect to a combination of the
teachings of documents E1 and E3.

- V. With the statement of grounds of appeal, the appellant filed a main request and a first auxiliary request, the independent claims of the former being identical to those considered in the impugned decision.
- VI. Oral proceedings were arranged by the summons dated 21 August 2000 in accordance with the respective auxiliary requests of the parties. In a communication of 28 September 2000, the Board expressed its provisional non-binding opinion that the independent claims of the main request were not anticipated by the prior art. Moreover, in accordance with the case law of the boards of appeal, document E1 should be regarded as closest prior art from which the subject matter of the main request mainly differed by the use of a monolithic two-dimensional surface emitting laser array. The technical effects achieved and the presence of an inventive step were to be assessed at the oral proceedings. An analogous discussion should take place with respect to the subject matter of the first auxiliary request once its admissibility under Article 123(2) EPC had been established.
- VII. With a letter dated 9 October 2000, the appellant filed independent claims for a second auxiliary request based on features derived from the description.
- VIII. As a reaction to said letter, respondent 01 requested rejection of the second auxiliary request as inadmissible because of having been filed too late.
- IX. Oral proceedings took place on 9 November 2000. During the oral proceedings, the appellant replaced all previous auxiliary requests by new auxiliary requests 1 to 8, and respondent 02 submitted new document D26. At

the end of the oral proceedings, the decision of the Board was given.

- X. The appellant requested that the decision under appeal be set aside and that the patent be maintained as amended according to the main request filed with the letter of 5 February 1998 or alternatively on the basis of auxiliary requests 1 to 8 submitted at the oral proceedings.
- XI. The respondents requested that the appeal be dismissed.
- XII. The wording of the independent claims according to the appellant's requests reads as follows:

Main request

"1. An image forming apparatus, comprising:

an image bearing member (5) for forming a static latent image thereon;

a charging unit (52) for charging the surface of said image bearing member (5);

a laser beam scanning unit (53) for scanning, with a plurality of laser beams, a surface of said image bearing member (5) which is charged; and

a developing unit (55) for causing a developing agent to adhere on the surface of said image bearing member (5) scanned with the laser beams;

wherein said laser beam scanning unit (53) comprises:

a monolithic semiconductor laser array (21) having a plurality of light emitting portions (21a) for emitting laser beams, said light emitting portions (21a) being formed on a single device substrate (22); and

a deflecting unit (3) for deflecting laser beams

emitted from said light emitting portions (21a) to the surface of said image bearing member (5);

a scanning optical system for two-dimensionally forming spots on a surface of said image bearing member with the laser beams deflected by said deflecting unit (3), said image bearing member being moved in a direction substantially perpendicular to a scanning direction of said laser beams so that the spots are two-dimensionally formed;

characterized in that: each of said light emitting portions (21a) has an optical oscillator with an optical axis substantially perpendicular to the surface of said single device substrate;

the lighting and the amount of light of each of said light emitting portions (21a) are discretely controlled; and

said light emitting portions (21a) are so two-dimensionally disposed on said single device substrate that said two-dimensionally formed spots on the surface of said image bearing member form their own separate scanning lines.

11. A laser beam scanning unit, comprising:

a monolithic semiconductor laser array (21) having a plurality of light emitting portions (21a) for emitting laser beams, said light emitting portions (21a) being formed on a single device substrate; and

a deflecting unit (3) for deflecting the laser beams emitted from said light emitting portions (21a);

a scanning optical system for two-dimensionally forming spots on a surface of a member to be scanned with the laser beams deflected by said deflecting unit (3), said member to be scanned being moved in a direction substantially perpendicular to a scanning direction of said laser beams so that the spots are

two-dimensionally formed;

characterized in that: each of said light emitting portions (21a) has an optical oscillator with an optical axis substantially perpendicular to the surface of said single device substrate;

the lighting and the amount of light of each of said light emitting portions (21a) are discretely controlled; and

said light emitting portions (21a) are so two-dimensionally disposed on said single device substrate that said two-dimensionally formed spots on the surface of said member to be scanned form their own separate scanning lines."

First auxiliary request

The first auxiliary request differs from the main request in that claim 11 of the main request has been deleted.

Second auxiliary request

Claims 1 and 11 of the second auxiliary request in substance differ from those claims of the main request in that the additional feature

"and the distance apart of each adjacent laser beam emitted from the semiconductor laser array being 100 μm or less"

has been inserted at the end of the clause beginning with "a monolithic semiconductor laser array (21)".

Third auxiliary request

The third auxiliary request differs from the second auxiliary request in that claim 11 of the second auxiliary request has been deleted.

Fourth auxiliary request

The fourth auxiliary request corresponds to the third auxiliary request, the additional feature however reading

"and the distance apart of each adjacent laser beam emitted from the semiconductor laser array being 50 μm to 100 μm ".

Fifth auxiliary request

The fifth auxiliary request corresponds to the third auxiliary request, the additional feature however reading

"and the distance apart of each adjacent laser beam emitted from the semiconductor laser array being 50 μm or 100 μm ".

Sixth auxiliary request

The sixth auxiliary request corresponds to the third auxiliary request, the additional feature however reading

"and the distance apart of each adjacent laser beam emitted from the semiconductor laser array being 100 μm ".

Seventh auxiliary request

The seventh auxiliary request differs from the main request in that the additional feature

"and each laser beam emitted from the semiconductor laser array has a cross section of an elliptical shape having its major axis according with the scanning direction of the laser beam"

has been inserted at the end of claims 1 and 11.

Eighth auxiliary request

The eighth auxiliary request corresponds to the seventh auxiliary request, claim 11 of the seventh auxiliary request having, however, been deleted.

XIII. The appellant's arguments in support of its requests can be summarised as follows:

Document E1 may be accepted as closest prior art. This document is, however, vague in some respect and rather old - 16 years between its date of filing and the priority dates of the patent in suit being a long time in a highly commercial field. Although the prior art deals with high speed printing, it relies on expensive optics so that an objective remains of producing a commercial product at reasonable price and robustness.

It is admitted that claims 1 and 11 of the respective requests relate to the same invention. Hence, if one claim falls, the other claim will also fall. The subject matter of the main request differs from the prior art in that a monolithic two-dimensional laser array of Vertical Cavity Surface Emitting Laser (= VCSEL) diodes is employed. This difference results in the following effects:

(1) A smaller spread angle θ with respect to that of Edge Emitting Laser (= EEL) diodes.

This has important advantageous consequences for a laser printer since a high θ requires a powerful collimating lens, which is expensive, and very precise adjustment so that any movements will effect the image

quality. The collimating lens of the claimed invention is cheaper and easier to position due to its greater focal length.

(2) A reduced spot spacing.

Owing to the larger spread angle and the smaller focal length, there is a large spacing of spots in the prior art so that one either has to accept a bad resolution or to angle the linear array to the scanning direction. However, when doing so in the prior art, a tiny angle results which is difficult to adjust. Hence, a smaller spot spacing leads to realistic angles, cheaper optics and a better and more stable adjustment.

(3) A more compact array.

VCSELs have a more uniform spread angle as compared to EELs. In addition, there is a low threshold current and, accordingly, less heat, and each spot forms its own scanning line.

Document E1 discloses a monolithic linear EEL array (see Figure 4) arranged perpendicular to the scanning direction and having a big spacing between the lines because of the spread angle. Figure 5 of E1, which shows only two lines of discrete lasers, can hardly be considered a full and detailed disclosure. The respondents' interpretation of E1 is based on a great deal of hindsight since this prior art only schematically shows a series of boxes in Figure 5 and cannot anticipate VCSELs, simply because they did not exist in 1975.

Newly submitted documents D24 and D25 correspond to

other documents discussed before the first instance and disclose nothing more than Figure 6 of the patent in suit: a combination of individual lasers to form a high power light source. The only example of a discretely controlled VCSEL is described in document E3. However, a skilled person would not have taken E3 into consideration since there is no use disclosed and no other pointer which might encourage a skilled person in this direction. On the contrary, a large spacing and a low power output guide away from the requirements of the present invention, and the existence of a smaller spread angle which gives a host of advantages for laser printers is even not mentioned in E3.

Starting from E1, there is no one-way street situation since the VCSEL structure is not the only version of a monolithic two-dimensional array, but only one option among at least three, as can be seen from document D24. Therefore, the use of VCSELS in the present context involves an inventive step.

Although no further time is required to study document D26 submitted at the oral proceedings, it should not be admitted to the proceedings since it could have been filed earlier and the patentee is now denied any possibility of being consulted. This document may also relate to a combination of laser beamlets for power purposes, the meaning of "addressable" is unclear and the spread angle problem is not discussed.

Since some of the above arguments actually do not relate to a scanning unit but to a printer, claim 11 has been cancelled in the first, third to sixth and eighth auxiliary request, respectively.

Having regard to the second auxiliary request, it is accepted that the specific phrase "100 μm or less" has not been explicitly disclosed apart from the upper limit 100 μm (see column 11, equation (3) of the patent in suit). However, looking at the disclosure as a whole there is no reason to be limited to 100 μm since the desirability of a small spacing is clearly apparent from the contested patent (see also decision T 187/91 which can be applied here). Moreover, this view is supported by the application as published, which is not limited to the contents of the patent as granted, and has also lead to a number of divisional applications. At various places of the A-publication, a beam spacing of less than 100 μm has been disclosed (see in particular page 22, line 24 and page 29, line 25: "as narrow as 50 μm "; page 37, line 14: "0.05 mm or less"). The full original disclosure must be available for amendments after grant, and an extent of protection by shifting the subject matter of a claim would only be possible if the new feature were not inserted into the preamble, but into the characterising portion of said claim.

Nevertheless, to safeguard the appellant's last chance the third to sixth auxiliary requests have been restricted to spacing values more specifically disclosed. In any case, the reason for defining the spacing in the preamble of said claims was not to make a substantive limitation, but to make explicit what is already implicit from suitability for laser printing, and thus to highlight the full width of the above argument with respect to document E3. The appellant acknowledges that such spacing values belong to the prior art.

The seventh and eighth auxiliary requests rely on the previous second auxiliary request filed in reasonable time before the oral proceedings and thus should be admissible. As regards Article 123(2) EPC, the elliptical cross-section of the laser beam is directly derived from the description indicating that on the imaging member the minor axis is in the scanning direction to have a more square-like pixel shape. However, it has to be taken into account that the laser beam is processed by normal optical components which - due to spherical aberration as generally known from textbooks - cause a rotation of the ellipse. Therefore, in view of common general knowledge, the claimed subject matter is sufficiently clear. This is also true for the meaning of "scanning direction" and where the shape of the cross-section is defined. Before the beam gets to the optics, it has the claimed shape and ends up rotated at the scanning plane.

The prior art is silent on a specific shaping of the laser beam which is particularly simple if VCSELS are used. Figure 6 of document E8 relates to EELs and does not show the claimed beam shape. Document E9 is unclear with respect to the beam shape emitted by the laser. Document E7 shows the desired effect and thus confirms the fact that the claimed shape is conventional. However, the question is how to achieve this shape.

XIV. The respondents advanced the following counterarguments:

Respondent 01:

Apparently, all parties agree that document E1, which shows the basic configuration for simultaneous scanning, comes closest to the subject matter of the

patent in suit. Document E1, which relates to an up-to-date technical concept, discloses an alternative two-dimensional arrangement in Figure 5, where the laser emitting points of adjacent rows are staggered to achieve a closer spacing. Page 6, last paragraph of the English translation, which deals with the preference of monolithic laser arrays, applies to the entire teaching of E1, i.e. to the structure of Figure 5 as well. For a skilled reader, this directly implies the use of SEL type lasers which were known at the priority dates of the patent in suit. If a skilled person were to check the availability of such laser type he would come across document E3 or newly filed document D26 describing the SEL structure claimed, the use of which inherently leads to all effects and advantages referred to by the appellant. In particular, an individual addressability is clearly disclosed in these documents.

The appellant's arguments with respect to E3 are not persuasive since an output power of 0.3 W or more is sufficient, and no lower limit has been disclosed for the laser spacing, 600 μm being merely a particular example. Although E3 does not refer to a printer, it should be born in mind that claim 11 is also not restricted to a printer. Therefore, the subject matter of the main request lacks novelty or at least inventive step since no hindsight is necessary to arrive at the claimed invention by a straightforward application of E3.

With respect to the subject matter of the second to fifth auxiliary requests, the objection under Article 123(2) EPC is maintained in view of the fact that the only spacing value disclosed in the patent specification is 100 μm in the context of highlighting

the influence of the collimator focal length. However, this is not an upper limit value, and it is also inadmissible to claim a range without lower limit or to refer to passages and figures no longer included in the contested patent as a basis of disclosure. Furthermore, the fact that the new feature has been inserted in the first part of claim 1 does not make any difference with respect to admissibility since an invention is defined by the whole set of features contained in a claim.

In any case, the spacing values claimed in the second to sixth auxiliary requests are conventional (see e.g. E4) and amount to a mere clarification which cannot support patentability. If, on the contrary, such values were considered relevant, it would be necessary to arrange for an additional search which at this very late stage of the proceedings should also not be admissible.

The same argument holds for the subject matter of the seventh and eighth auxiliary requests comprising a new unsearched feature which never formed part of any claim, but was derived from the description, and thus should also be inadmissible at this late stage. Moreover, this amendment offends against Article 123(2) EPC since the new feature is taken out of its context and based on an unclear relationship: a "scanning plane" is defined by two directions, i.e. a scanning direction and a subscanning direction. Moreover, "emitted" being an inherent property of any laser beam, this term does not impose any limitations on the laser beam status. It is also unclear at which location the claimed orientation exists, i.e. when emitted or just before impinging on the scanning plane?

The effect to be achieved in accordance with the appellant's explanations is not apparent from the claims which do not include any optics causing the alleged rotation of the elliptical cross-section. A provisional search carried out by respondent 01 has, nevertheless, lead to documents E8 and E9 disclosing the new feature *per se*.

Respondent 02:

The focus of argument has changed in the present discussion since most of the appellant's allegations are now directed to the importance of vertical cavity lasers, whereas document E1 allegedly relates to the EEL type. While document E1 does not explicitly define the type of lasers employed, it is the view of respondent 02 that VC laser arrays are widespread for two-dimensional scanning purposes as can be seen not only from document E3, but also from document D26 disclosing a VCSEL matrix architecture for optical scanners. Hence, when starting from document E1 only basic knowledge would be involved to arrive at the subject matter of the main request in a genuine one-way street situation. In consequence, there should be lack of novelty or at least of inventive step.

With respect to the numerical spacing values claimed in accordance with the second to fifth auxiliary requests, no such disclosure is derivable from the patent specification. The original application documents are to be disregarded in this context because the patent specification has been restricted in the eyes of the public so that spacing values below 100 μm are no longer relevant to the invention as granted. If the amended claims were to be allowed, Rule 86(4) EPC should apply since the respective new features have

never been searched and are not linked by a unitary concept with the original claims. In any case, the claimed spacing would not be inventive because a spacing of not much more than 100 μm can be derived from document D26 and a design as compact as possible is clearly desirable.

Finally, as regards the seventh and eighth auxiliary requests, respondent 02 concurs with respondent 01 in that these requests should not be admissible because they contain unsearched subject matter filed at a very late stage of the proceedings. Moreover, the teaching imparted is technically incorrect in that a laser beam has no relationship to the scanning direction. In fact, all of the appellant's arguments relate to the image formed on the scanning plane. Thus, the new feature is unclear and has only been disclosed in combination with an appropriate ratio of the ellipse axes. There are also serious doubts as to the rotation referred to by the appellant since no such influence of lenses has been reported in the patent.

Reasons for the Decision

1. Admissibility of appeal

The appeal complies with the provisions mentioned in Rule 65 EPC and is therefore admissible.

2. *Late filings*

2.1 In exercise of its discretion deriving from Article 114(2) EPC, the Board admitted both the appellant's auxiliary requests filed about one month

before or during the oral proceedings and the new evidence filed by respondent 02 at the oral proceedings into the present proceedings since no new complex issues were raised by the fresh subject matter and all parties were able to react, and indeed reacted, to it within the existing time frame (see decision T 633/97, not published in OJ EPO).

- 2.2 In particular, the relevant passages of newly filed document D26 are concise, straightforward to understand and were cited mainly to support the respondents' evaluation of document E3 and as a reaction to the emphasis put by the appellant on the VCSEL structure at the oral proceedings.

The newly inserted features of the second to eighth auxiliary requests are in substance based on the preceding first and second auxiliary requests which had been submitted sufficiently in advance of the oral proceedings, as is apparent from the respondents having had time to comment on and file evidence with respect to these requests.

3. *Main request and first auxiliary request*

3.1 Admissibility and clarity of amendments

In the opinion of the Board, the subject matter of the independent claims according to both the main and first auxiliary request can be considered to comply with Articles 123 and 84 EPC. No objections have, in fact, been raised by the respondents in these respects.

3.2 Novelty

3.2.1 Contrary to the respondents' objections, the Board is of the view that the subject matter of claims 1 and 11 of the main request and of claim 1 of the first auxiliary request (which is identical to claim 1 of the main request) is not anticipated by document E1 as can be seen from the following assessment of inventive step. None of the remaining prior art documents can be considered to remove novelty from this subject matter, nor was this even alleged by the respondents.

3.3 Inventive step

3.3.1 There was general agreement amongst the parties with the view of the Board that document E1 comes closest to the subject matter of claim 1.

This prior art document discloses an image forming apparatus including

- an image bearing member (see Figure 4: photosensitive recording material 11);
- a charging unit (implicit from page 10, first paragraph of E1*);
- a laser beam scanning unit (see Figure 4: semiconductor lasers 21¹, 21²...; polygonal mirror 6), and
- a developing unit (see Figure 4: unit 12).

The laser beam scanning unit known from E1 comprises

- a semiconductor laser array (see Figure 4: array 20) having a plurality of light emitting portions

for emitting laser beams (see Figure 4: semiconductor lasers 21¹, 21²...; output beams 22¹, 22²...);

- a deflecting unit (see Figure 4: polygonal mirror 6) for deflecting the laser beams emitted from said light emitting portions;
- a scanning optical system for two-dimensionally forming spots on a surface of a member to be scanned (see Figure 4: photosensitive recording material 11) with the laser beams deflected by said deflecting unit, said member to be scanned being moved in a direction substantially perpendicular to a scanning direction of said laser beams (see Figure 4: drive mechanism 10) so that the spots are two-dimensionally formed (see Figure 4: "fan shaped" reflected beams 8¹, 8²...).

Apparently, each of said prior art light emitting portions has an optical oscillator (implicit from the laser structure), and the lighting and the amount of light of each of said light emitting portions is discretely controlled (see Figure 4: drive circuits 23¹, 23²...). In addition, the light emitting portions are so disposed on the semiconductor laser array that said two-dimensionally formed spots on the surface of said image bearing member form their own separate scanning lines (see Figure 4: scanning lines formed by "fan shaped" reflected beams 8¹, 8²... on the photosensitive recording material 11).

Finally, the semiconductor laser array known from E1 may be a monolithic array formed on a single device substrate (see page 6, last paragraph of E1*).

The subject matter of claim 1 therefore differs from the image forming apparatus disclosed in E1 mainly in that

- (i) said light emitting portions are two-dimensionally disposed on said single device substrate, whereas the array of Figure 4 of E1 appears to be a linear one (see also page 8, third paragraph of E1*: "line printer"); and
- (ii) the optical laser axis is substantially perpendicular to the surface of the single device substrate, i.e. the claimed array is of VCSEL type, whereas the linear array of Figure 4 of E1, though not specified, seems to be of EEL type.

Although a two-dimensional array may also be provided in E1 (see Figure 5), it is not unambiguously disclosed in the prior art that this array is of the monolithic surface-emitting type (see also page 6, last paragraph to page 7 first paragraph of E1* in this context, referring to "a bundle of a plurality of partially monolithic laser arrays"), and that the two-dimensional light emitting portions are arranged so as to form separate scanning lines. Indeed, Figure 5 (see also its associated text at page 11, third paragraph of E1*) gives the impression of a two-dimensional assembly of two discrete EEL line arrays.

- 3.3.2 In view of the fact that document E1 already aims at achieving a high scanning speed by simultaneously performing information recording of multiple lines per scan (see e.g. page 6, third paragraph of E1* and column 2, lines 41 to 45 of the patent in suit), the problem solved by the above differences (i) and (ii)

with respect to the closest prior art may be seen in providing a modern, even more compact version of an image forming apparatus for scanning laser beams at a high speed and with a high resolution.

- 3.3.3 Monolithically integrated two-dimensional semiconductor laser arrays of VCSEL type, in which each element can be independently driven, are known from document E3 (see Figure 1). As the parties agreed and as can also be seen from the publication date of document E3, such devices have become available only after the application date of document E1.

In the Board's view, it would have been immediately apparent to a skilled person that the VCSEL structure of document E3 lends itself to a monolithically integrated version of an older concept which relied on the more cumbersome and time-consuming formation of two-dimensional arrays by assembling a plurality of monolithically integrated linear EEL subunits. Therefore, even if no possible application of the proposed array is mentioned in E3, the new structure would as such be attractive to a skilled person in the present context. Moreover, following modern miniaturisation trends, a skilled person would naturally expect an advantage from such application having regard to design compactness.

- 3.3.4 The appellant's main counterarguments against obviousness are based on the assertions

- that document E3 is not a proof for the general availability of VCSEL arrays at the priority dates of the patent in suit, but in fact the only example available for such technology;

- that further monolithic two-dimensional SEL arrays not employing vertical cavity laser structures were known (see document D24) so that there was no one-way street situation; and

- that a skilled person would be barred from considering the teaching of E3, isolated as it is, for the present application since the new design does not meet the spacing and power requirements involved.

3.3.5 However, as can already be seen from document D24 (see column 2, lines 9 to 19), the VCSEL structure was widely known at the priority date of the patent in suit, and in view of its obvious technical potential as regards design compactness it appears doubtful whether a skilled person would have considered the relatively high spacing and relatively low output power values reported in E3 to constitute definite barriers even preventing a trial application of this structure in a laser beam scanning unit.

In the Board's opinion, these doubts are confirmed by document D26 handed over by respondent 02 at the oral proceedings. The prior art (see in particular the abstract and page 437, left-hand column, first paragraph) clearly indicates that VCSELS are the most appropriate devices for the fabrication of large two-dimensional arrays of compact optical sources because of their relatively low threshold currents and their high packing density. In particular, such arrays are useful for two-dimensional optical scanners, and each of the lasers may be individually addressed with the aid of a matrix addressing architecture (see the abstract) so that there can be no doubt about the fact

that the light emitting portions are discretely controllable.

- 3.3.6 The Board therefore comes to the conclusion that considering a monolithically integrated two-dimensional VCSEL array for an image forming apparatus disclosed in E1 would have been obvious for a skilled person wishing to improve the design compactness. In accordance with the multiple line scanning concept of E1, it would also have been natural to arrange the individual lasers on the single device substrate so that each laser forms its own separate scanning line. Furthermore, it appears that all the advantageous effects referred to by the appellant are achieved as an automatic consequence of effecting this obvious choice.

Hence, the subject matter of claim 1 of the main and first auxiliary requests lacks the inventive step required by Article 56 EPC, and said claim is not allowable for this reason.

- 3.3.7 The same finding holds for independent claim 11 of the main request which is limited to the laser beam scanning unit of claim 1.

4. *Second to fifth auxiliary requests*

4.1 Admissibility and clarity of amendments

- 4.1.1 In the second to fifth auxiliary requests, the spacing of adjacent beams emitted from the semiconductor laser array has been specified in the pre-characterising portion of the respective claims to be

- 100 μm or less (second auxiliary request: claims 1

and 11; third auxiliary request: claim 1);

- 50 μm to 100 μm (fourth auxiliary request: claim 1); and
- 50 μm or 100 μm (fifth auxiliary request: claim 1).

4.1.2 Having regard to issues under Articles 123 and 84 EPC, in the Board's view, it does not make any difference whether a new feature is introduced in the pre-characterising portion or in the characterising portion of a claim as the claimed invention is defined by the whole set of features irrespective of their location in the claim.

4.1.3 The passages of the patent specification referred to by the appellant with respect to original disclosure of the beam spacing are

- column 5, lines 40 to 46 explaining that "in the conventional semiconductor laser arrays, it is difficult to set the distance between each light emitting portion to 100 μm or below due to mutual interference thereof", a spacing of 100 μm leading to a spot distance of 6.6 mm on the image plane under certain assumptions on further parameter values (see equation (1)); and
- column 11, lines 11 to 17, in particular equation (3), where apparently an identical laser beam spacing of 100 μm has been used to arrive at a spot spacing of 0.57 mm for the claimed invention.

4.1.4 However, the first passage relates to the prior art and more or less advises against spacings of 100 μm or less

so that - at least on the basis of this passage - a skilled reader would consider 100 μm to constitute a lower limit already difficult to achieve in the prior art. The second passage relating to the claimed invention does not specify any spacing range but merely uses the lower limit value of 100 μm for calculating a reduced spot distance as compared to the spot distance of the prior art based on the same lower limit value.

Hence, in the Board's view the patent specification does not disclose that the beam spacing is 100 μm **or less** for the claimed invention, and for the prior art such beam spacing would only be regarded by a skilled reader as a desideratum. Thus, the additional feature claimed (see claims 1 and 11 of the second auxiliary request and claim 1 of the third auxiliary request) cannot be derived from the patent in suit.

4.1.5 Decision T 187/91 (OJ EPO 1994, 572) referred to by the appellant in this context is not applicable to the present situation since it relates to a specific example (one light source) within a generic disclosure (more or less than three light sources) forming part of the description as filed. In accordance with that decision, such specific example belongs to the content of the application as filed if the skilled reader would seriously contemplate said example as a possible practical embodiment of the described invention, having regard to its context in the remainder of the application as filed, and subject to any understanding of the skilled reader to the contrary (see T 187/91, point 4 of the reasons).

As can be seen from the above arguments, the Board holds the view that there is neither a generic

disclosure of beam spacings of less than and up to 100 μm in the specification of the contested patent nor would a skilled reader seriously contemplate spacings below 100 μm as a possible practical embodiment of the claimed invention having regard to its context in the remainder of the patent specification. Finally, the subject matter claimed in accordance with the second and third auxiliary requests does not relate to a specific example of the alleged generic disclosure but to the alleged generic disclosure itself.

4.1.6 An analogous argument holds for the range of 50 μm to 100 μm (see claim 1 of the fourth auxiliary request), and for the single value of 50 μm (see claim 1 of the fifth auxiliary request), since no values lower than 100 μm are contained in the patent specification.

4.1.7 The appellant referred to such values included in the original application documents, which values had been removed from the application before grant of the contested patent as a consequence of limiting the application to the subject matter of original claims 1 to 11 and withdrawing original claims 12 to 40 (see the applicant's letter dated 1 June 1995). However, according to decision T 1149/97 (OJ EPO 2000, 259; see Headnote III), if the application documents have been adapted to amended claims before grant, thereby deleting part of the subject matter originally disclosed in order to avoid inconsistencies in the patent specification, subject matter deleted for this reason can neither be reinserted into the patent specification nor into the claims as granted without infringing Article 123(3) EPC.

4.1.8 In consequence, the independent claims of the second to

fifth auxiliary requests are neither allowable under Article 123(2) EPC in view of the passages of the patent specification referred to, nor under Article 123(3) EPC in view of the passages of the original application documents deleted before grant.

5. *Sixth auxiliary request*

5.1 Admissibility and clarity of amendments

As can be seen from the preceding assessment of the second to fifth auxiliary requests (see point 4.1 above), the spacing value claimed in the sixth auxiliary request, i.e. 100 μm , is in accordance with original disclosure.

5.2 Novelty

Since in claim 1 of the sixth auxiliary request the novel subject matter of claim 1 of the main request (see point 3.2 above) has been further restricted, the novelty of the restricted subject matter with respect to the available prior art is not in doubt.

5.3 Inventive step

However, a laser spacing of about 100 μm is typical for optical scanner applications as can, e.g., be derived from documents A (see the translated passage: pitch normally around 100 μm , in some cases 30 to 50 μm), B (see the translated passage: gap between laser beams 25 to 100 μm) or D26 (see page 437, right-hand column, last paragraph leading to a spacing of about 140 μm) or E4 (see page 3 of E4*, last paragraph: device interval = 50 μm). This fact has not been contested by the

appellant at the oral proceedings.

In consequence, when starting from an image forming apparatus as described in document E1 with a view to make the prior art apparatus more compact, a skilled person would not only select a two-dimensional VCSEL array as e.g. known from documents E3 or D26 without exercising inventive skill, but also obviously adjust the laser spacing to suitable conventional values. That such spacings can be achieved with the VCSEL structure is apparent from document D26.

Hence, claim 1 of the sixth auxiliary request is also not allowable (Article 56 EPC).

6. *Seventh and eighth auxiliary requests*

6.1 Admissibility and clarity of amendments

6.1.1 In the appellant's opinion, the new feature relating to the orientation of the laser beam cross-section and figuring in claims 1 and 11 of the seventh auxiliary request and in claim 1 of the eighth auxiliary request is derivable from column 10, lines 7 to 15 of the patent specification.

6.1.2 However, said passage specifies a "laser beam with a cross-section whose major axis accords with the scanning plane". Since a "scanning plane" must be considered to be generated by two directions, i.e., for instance, a scanning direction and a subscanning direction perpendicular to the scanning direction, said passage is unclear and its replacement by "scanning direction" in the claims at least doubtful under Article 123(2) EPC.

6.1.3 Furthermore, even if the appellant's interpretation of "scanning plane" to mean "scanning direction" were accepted, the new feature as a whole remains vague because it does not specify the location in the optical path where the laser beam emitted from the semiconductor array has the claimed orientation of its cross-section. This vagueness results from the fact that on one hand a laser beam must be considered to be "a laser beam emitted from the laser" at any point of its path from the laser through the optics to the image spot. On the other hand in accordance with the appellant's explanations (see the appellant's letter of 9 October 2000) and conventional practice (see e.g. column 9, line 58 to column 10, line 6 of the patent in suit or document E7*, Figure 4 and associated text), the minor axis of the elliptical image spot should be aligned with the scanning direction, i.e. the claimed orientation of the elliptical shape of the beam cross-section is to change along said optical path. Such change would, however, be subject to a particular influence of the optics on the beam cross-section which is neither defined in the claims nor in the patent specification.

6.2 Inventive step

6.2.1 In any case, irrespective of the forementioned problems under Articles 123(2) and 84 EPC, as it is worded the additional feature of the independent claims according to the seventh and eighth auxiliary requests cannot make any contribution to inventive step since laser beams emitted from semiconductor lasers and having a cross-section of the claimed shape and orientation at certain points of the optical path are conventional in the art (see documents E8, Figure 6 (shape and

orientation of cross-section on rotating mirror) and E9, Figure 1 (shape and orientation of cross-section on lenses 5 and 8, respectively)). The Board is therefore convinced that the specific selection of this feature for a compact image forming apparatus of the type disclosed in E1 and making use of a two-dimensional VCSEL array known from E3 or D26 would fall within the competence of an average practitioner.

6.2.2 Therefore, taking account of the above assessment of inventive step with respect to claims 1 and 11 of the first and second auxiliary requests, respectively (see point 3.3), the subject matter of the independent claims of the seventh and eighth auxiliary request in any case lacks the inventive step required by Article 56 EPC, and accordingly, the claims are not allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

P. Martorana

S. Steinbrener