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**Datasheet for the decision
of 20 January 2010**

Case Number: T 1895/06 - 3.4.01

Application Number: 93902890.8

Publication Number: 0724729

IPC: G01T 1/24

Language of the proceedings: EN

Title of invention:

Thin-film, flat panel, pixelated detector array for real-time digital imaging and dosimetry of ionizing radiation

Patentee:

THE REGENTS OF THE UNIVERSITY OF MICHIGAN, et al

Opponent:

Steiner, Richard

Headword:

-

Relevant legal provisions:

EPC Art. 114(2), 104(1), 112(1)(a), 54, 56

Relevant legal provisions (EPC 1973):

EPC Art. 99(1)

Keyword:

"Examination of opposition - admissibility (yes)"
"Late submitted material - evidence admitted (yes)"
"Enlarged Board - referral (no)"
"Inventive step - exclusion of hindsight"
"Novelty (yes)"

Decisions cited:

T 0934/91, T 0843/91, T 0528/93, G 0003/97, G 0004/97

Catchword:

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Case Number: T 1895/06 - 3.4.01

D E C I S I O N
of the Technical Board of Appeal 3.4.01
of 20 January 2010

Appellant: THE REGENTS OF THE UNIVERSITY OF MICHIGAN et al
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 17 November 2006
revoking European Patent No. 0724729 pursuant
to Article 102(1) EPC 1973.

Composition of the Board:

Chairman: B. Schachenmann
Members: F. Neumann
G. Assi

Summary of Facts and Submissions

- I. The current appeal lies from the decision of the opposition division dated 17 November 2006 to revoke the European patent number 0 724 729.
- II. This is the second appeal originating from European patent number 0 724 729.

The patent as granted was revoked a first time by the opposition division in the decision dated 19 October 2001. Subsequent proceedings before the Board of Appeal resulted in decision T 1284/01 dated 14 September 2005. The Board of Appeal, in T 1284/01, did not deal with the contested decision of the opposition division in substance; instead, it was held that a procedural violation had occurred and the case was consequently remitted to the opposition division for further prosecution.

During the second round of proceedings before the opposition division, the proprietor filed a number of new requests containing modified claims; following the negative outcome of the previous opposition proceedings, the request to maintain the patent as granted was no longer presented. The opposition division nevertheless revoked the patent in their decision dated 17 November 2006 and it is this decision which is the subject of the present appeal.

- III. The appellant (proprietor) requested the following:
- the decision be set aside,
 - the opposition be declared inadmissible,

- the patent be maintained as granted, or, alternatively, that the patent be maintained in amended form with claims as set out in one of thirteen auxiliary requests filed with the letter of 08 September 2009, and amended in accordance with the letter of 30 September 2009,
- an apportionment of costs,
- in the event of a further remittal, that the opposition division should have a different composition.

Furthermore, the appellant (proprietor) requested that the following questions be referred to the Enlarged Board of Appeal:

1. *"Is an opposition admissible in a case where an "opponent" receives instructions and evidence from a third party and acts as a straw man and/or a professional representative with the effect of delaying the opposition procedure?"*

2. *"Are the rules given by G3/97 compatible with the principles of the Convention for the Protection of Human Rights and Fundamental Freedoms, which form part of the legal system of the EPO? In other words, in a case where the patentee cannot know the real identity of an opponent, whereas the opponent knows the identity of the patentee, which is public information, is the right to a fair hearing given to the patentee?"*

The respondent (opponent) requested that the appeal be dismissed.

IV. Independent claim 1 of the main request reads as follows:

" An imaging device for use with an incident ionizing radiation beam, comprising:
signal conversion means including an array (50) of pixel sensors (30), each having a predetermined capacitance, for converting the incident ionizing radiation beam (10) into an electron hole-pair signal and storing said signal at the plurality of pixel sensors, said array of pixel sensors having a pixel-pixel pitch P in μm and a length L , in cm, of one column of pixels sensors of the array;
switching means (52) including a plurality of transistors, each having a predetermined resistance, wherein each of said plurality of transistors reads out the signal stored by an associated one of said plurality of pixel sensors; and
electronic circuit means (56, 70, 72) for sampling the signals from the array of pixel sensors at an instantaneous frame rate per second IFPS, which is the effective rate at which the array is being read out, and so as to reinitialize the pixel sensors for a time sufficient to achieve a desired signal-to-noise SN which is the inverse of the degree to which each pixel sensor needs to be sampled and thus recharged;
wherein the capacitance of one of the plurality of pixel sensors when multiplied by the resistance of an associated transistor yield a time constant, τ_{RC} , in μsec , satisfying the following relationship, which thereby permits real-time imaging of said radiation beam,

$$\tau_{RC} \leq \frac{100 \cdot P}{L \cdot \text{IFPS} \cdot \ln(\text{SN})}$$

where

$$\sim 25 \leq P \leq \sim 10,000,$$

$$\sim 2 \leq L \leq \sim 60,$$

$$\sim 1 \leq IFPS \leq \sim 500, \text{ and}$$

$$\sim 10 \leq SN \leq \sim 10,000. "$$

V. Oral proceedings were held before the Board of Appeal on 09 October 2009. The parties were heard on the issues of the admissibility of the opposition and the apportionment of costs. The main request was then discussed.

At the end of the oral proceedings, the chairman declared the debate closed and announced that the proceedings would be continued in writing. Nevertheless, following the oral proceedings, the appellant (proprietor) filed two further sets of submissions which the Board has disregarded in view of the closure of the debate.

VI. During the appeal proceedings, the following citations were taken into account:

D1: L.E. Antonuk et. al.: "*Signal, noise, and readout considerations in the development of amorphous silicon photodiode arrays for radiotherapy and diagnostic x-ray imaging*", SPIE Vol. 1443 Medical Imaging V: Image Physics (1991), pages 108-119;

D6: WO 91/03745.

VII. The arguments of the parties, insofar as they are relevant for the present decision, can be found below in the reasons for the decision.

Reasons for the Decision

1. Reference is made to the transitional provisions for the amended and new provisions of the EPC, from which it may be derived which Articles of the EPC 1973 are still applicable to the present application and which Articles of the EPC 2000 shall apply.
2. Admissibility of the opposition
 - 2.1 The Board of Appeal, in decision T 1284/01, dated 14 September 2005, decided that the opposition in the present case is admissible (see Order, point 1). This final judgement is *res judicata* and, from the issuance of the decision, can no longer be challenged.
 - 2.2 The term "*res judicata*" defines "... a matter finally settled by a Court of competent jurisdiction, rendering that matter conclusive as to the rights of the parties..." Such a final judgment by a court of competent jurisdiction therefore constitutes an absolute bar to a subsequent legal action involving the same claim, demand or cause of action, and the same parties (T 934/91, OJ 1994, 184, Reasons, point 3).
 - 2.3 Despite the conclusion in decision T 1284/01 that the opposition is admissible, the second decision of the opposition division, dated 17 November 2006, addressed the "new facts" that the appellant (proprietor) had presented after the issuance of decision T 1284/01 and included a statement to indicate that the opposition is admissible.

- 2.4 The appellant (proprietor) submitted that new facts had been subsequently presented and that the finality of the previous decision only applied insofar as the facts are the same.

Following T 843/91 (OJ 1994, 818), the current Board is of the opinion that the remittal proceedings should not afford the parties a further opportunity to attack the finally decided and therefore binding parts of the remitting decision by introducing new facts, since this would offend the general principle of legal certainty, i.e. the general interest of the public in the termination of legal disputes. Were it open to the parties to challenge these findings and for the Opposition Division to overturn them during subsequent proceedings on remittal, this would destroy the binding nature of the decision insofar as finally decided issues are concerned.

- 2.5 The appellant (proprietor) furthermore submitted that the opposition division had, in its decision of 17 November 2006, decided this issue anew, and the appellant (proprietor) had a right to appeal all findings of this latest decision, including the question of admissibility of the opposition.

In the present Board's judgement, the *res judicata* effect of the previous decision T 1284/01 constituted an absolute bar to any reconsideration of the question of admissibility of the opposition. The conduct of the opposition division in this respect was erroneous: the admissibility of the opposition should not have been reconsidered, and, in view of the *res judicata* effect of the decision, could not have been re-decided. In

section 1. of the Reasons for the Decision, the opposition division concluded that "...the opposition is admissible." In view of the above, this statement can only be seen as a mere communication of the clear and immutable legal position brought about by the earlier decision T 1284/01 of the Board of Appeal and cannot constitute an appealable decision.

3. Admissibility of the main request

3.1 The respondent (opponent) questioned the admissibility of reverting to the claims of the patent as granted since during the second round of opposition proceedings, maintenance of the patent was no longer requested on this basis. The respondent (opponent) was of the view that since the contested decision did not address claim 1 as granted, it was not permitted to return to this version. Decision T 528/93 was cited to support this view.

3.2 As pointed out by the appellant (proprietor), claim 1 as granted was already the subject matter of the first decision of the opposition division, dated 19 October 2001, where the subject matter of claim 1 as granted was found to lack an inventive step. It was therefore clear to the appellant (proprietor) during the second round of opposition proceedings that to revert to the version of claim 1 as granted would only have led to the same result as the first decision. This assumption was confirmed by the fact that, in the second decision of the opposition division, dated 17 November 2006, claim 1 of the main request had been restricted with respect to the version as granted, but was nevertheless found to lack novelty.

3.3 The proprietor now wishes to have the negative findings on novelty and inventive step of both decisions of the opposition division reviewed in this current second round of appeal proceedings. For this reason, the proprietor has reverted to the claims as granted as a main request.

3.4 The decision T 1284/01 resulting from the appeal proceedings following the first round of opposition proceedings did not deal with the contested decision of the opposition division in substance. Since the Board of Appeal has not yet issued a decision on the substantive issues leading to the revocation of the patent as granted, the proprietor is entitled to a review of this - his currently main - request. For this reason the appellant's (proprietor's) main request, i.e. maintenance of the patent on the basis of the set of claims as granted, is admitted into the proceedings.

3.5 In case T 528/93, which the respondent (opponent) cited to support his argument, the proprietor had attempted, during appeal proceedings, to introduce a set of claims which had never been decided upon by the opposition division. The Board in that case decided that a request based on such claims was inadmissible since no decision had been issued on such claims and the appellant could consequently not be considered to be adversely affected by the decision in respect of such claims.

The situation in the present case is distinguished from the situation of T 528/93 in that the opposition division has issued a decision upon the subject-matter of the claims of the granted patent, the substance of

this decision having not yet been decided upon by the Board of Appeal. Thus, the line taken in T 528/93 cannot be applied to the present case.

4. Admissibility of prior art document D6 and apportionment of costs

4.1 The appellant (proprietor) has submitted that document D6 was late-filed and should not have been admitted into the proceedings. Moreover, in view of the lengthy proceedings caused - at least in part - by the late filing of D6, an apportionment of costs in favour of the appellant (proprietor) would be justified. Having regard to the late filing, it was alleged that the respondent (opponent) received documents from third parties and consistently filed them shortly before the oral proceedings with the intention and result of delaying the proceedings, this practice undermining the fundamental requirements of Article 99(1) EPC.

4.2 The Board agrees that the "fuelling" of an opposition is a questionable practice but notes that Article 114(2) EPC provides the counter-measure for such practice. Thus an opponent who intentionally holds back relevant documents until a late stage of the proceedings risks having these documents disregarded: such tactics will often backfire on the opponent.

4.3 The Board is of the opinion that late-filed documents which could at least potentially be relevant to the proceedings may be admitted into the proceedings. In view of the pertinence of D6, the Board considers that the opposition division exercised its discretion correctly by admitting D6 into the proceedings.

- 4.4 Under Article 104(1) EPC, each party to the opposition proceedings shall in general bear the costs it has incurred. The Board cannot recognise any basis for ordering a different apportionment of costs in the circumstances of the present case.

The Board acknowledges that a number of prior art documents were produced by the respondent (opponent) well after expiry of the opposition period and shortly before two separate oral proceedings. Of these documents, D6 was admitted into the proceedings which, arguably, may have been prolonged as a result of the relevance of D6.

The Board observes that D6 is the proprietor's own patent application, so it may be assumed that the proprietor was familiar with its contents and its potential relevance. Consequently the Board fails to see that any additional time and energy which would justify an apportionment of costs has been incurred. Moreover, as the respondent (opponent) argued, the fact that this document was not mentioned in the prior art portion of the current patent could also be considered to be a factor which contributed to the lengthy proceedings.

5. Alleged substantial procedural violation

- 5.1 The appellant (proprietor) submitted that during the second oral proceedings before the opposition division a complicated reasoning was presented by the opposition division which related to the alleged disclosure of the formula $\ln SN = N_t$ in D6. No indication had previously

been given that the discussion would revolve around this specific detail and so the appellant (proprietor) was taken by surprise and unable to sufficiently prepare a proper defence with regard to this point. The appellant (proprietor) therefore considered that his right to be heard had been infringed.

- 5.2 The Board notes that the parties were informed by the communication of 20 April 2006 that the opposition division considered D6 to be "essential" and were warned that the disclosure of D6 with regard to novelty and inventive step would be discussed in the oral proceedings. The fact that the appellant (proprietor) felt ill-equipped for a complicated discussion on the disclosure of D6 during the oral proceedings can only be seen to be due to a lack of adequate preparation on his part with respect to the contents of D6. Moreover, the appellant's (proprietor's) argument is not convincing in view of the fact that one of the designated inventors mentioned in D6 in fact accompanied the appellant (proprietor) to the oral proceedings in question.

The Board is therefore of the opinion that no substantial procedural violation can be recognised in this respect.

6. Proposed referral to the Enlarged Board of Appeal
- 6.1 In the present case, the appellant (proprietor) has requested that the questions set out in section III above be referred to the Enlarged Board of Appeal.

6.2 Under Article 112(1)(a) EPC the Board of Appeal shall refer a question to the Enlarged Board of Appeal if it considers that a decision is required for ensuring uniform application of the law or if a point of law of fundamental importance arises.

Consistent case law has held that, in general, a question will not be referred if it can be resolved by the Board without any doubt or if it is not relevant for deciding the specific case (see Case Law of the Boards of Appeal of the European Patent Office, 5th edition 2006, VII.D.13.2).

6.3 Since the admissibility of the opposition has been decided with *res judicata* effect in decision T 1284/01, the first of the proposed questions is no longer relevant to the present case.

6.4 With regard to the second question, whether or not the appellant (proprietor) is aware of the true identity of the opponent (i.e. the person behind the straw man), the appellant (proprietor) is guaranteed a fair and public hearing by an independent and impartial tribunal in the form of the Board of Appeal: the true identity of the opponent does not influence this fundamental principle. Equally fair treatment is guaranteed to both parties to the proceedings.

6.5 The Board therefore does not consider that in the present circumstances the above questions need to be referred to the Enlarged Board of Appeal.

7. Novelty - Article 54 EPC

7.1 It is common ground that D6 discloses an imaging device for use with an incident ionizing radiation beam, comprising:

signal conversion means including an array of pixel sensors, each having a predetermined capacitance, for converting the incident ionizing radiation beam into an electron-hole pair signal and storing said signal at the plurality of pixel sensors, said array of pixel sensors having a pixel-pixel pitch P and a length L of one column of pixel sensors of the array;

switching means including a plurality of transistors, each having a predetermined resistance, wherein each of said plurality of transistors reads out the signal stored by an associated one of said plurality of pixel sensors; and

electronic circuit means for sampling the signals from the array of pixel sensors at an instantaneous frame rate per second IFPS.

7.2 Furthermore, the Board notes that although D6 does not discuss the degree to which the pixels are recharged, it is nevertheless inherent that the pixels must be recharged to a degree which provides an acceptable image. Hence it may be inferred that the electronic circuit means is arranged to reinitialise the pixel sensors for a time sufficient to achieve a desired degree of recharge which may be expressed in terms of the parameter "SN" of claim 1.

7.3 The imaging device of claim 1 is further defined in terms of a number of parameters which are each to be selected from a specified range, but are further

restricted by the fact that the choice of a specific value for any one of the parameters from the respective range must be such that the inequality given in claim 1 is also satisfied.

In the assessment of novelty, it must therefore firstly be established whether the values of the array parameters disclosed in D6 lie within the ranges set out in claim 1 and then, if this is the case, whether the specific combination(s) disclosed in D6 satisfy the inequality of claim 1.

7.3.1 D6 discloses only one concrete example of an array, the parameters of which are derivable from pages 11 to 15. Here, it can be seen that the length L of the array is 25.6 cm (page 11, line 30), the pitch P of the sensor elements is 1000 μm (page 12, lines 1-5), the IFPS is 390 frames per second (as can be derived from page 14, lines 12-16) and the desired time constant for this arrangement is given as being less than 10 μsec (page 14, line 21-23). However, the first paragraph of page 14 of D6 indicates that the transistor characteristics and the sensor capacitance effectively set a lower limit for the time constant, this value being 5 μsec in this specific case.

7.3.2 The opposition division considered that D6 also discloses - or at least implies - that the parameter SN is defined as taking on a value of 1000.

The Board does not agree. In the passage of D6 relied upon by the opposition division (the paragraph bridging pages 15 and 16), it is the signal-to-noise ratio which is being discussed, with specific reference to the

quantum noise of the device. This passage explains that the quantum noise is the significant source of noise in an ideal detector and goes on to explain that a signal-to-noise ratio of 1000:1 requires a certain number of converted photons and consequently requires a certain number of gamma-ray bursts to produce this number of photons. In the view of the Board, this signal-to-noise ratio cannot be equated with the "signal-to-noise SN" of claim 1, which is further defined as being "the inverse of the degree to which each pixel sensor needs to be sampled and thus recharged".

Since D6 contains no discussion of the degree of recharge, a direct and unambiguous disclosure of a value of "SN" (in the sense defined in claim 1) greater than 10 and less than 10 000 cannot be said to be present.

- 7.3.3 The respondent (opponent) considered, however, that it was implicit in the teaching of D6 that the value of SN (as defined in claim 1) must be greater than 10. It was argued that the skilled person would simply not consider operating the device with a value of SN less than 10 since this would result in an unusable image. A value of SN lying within the range of 10 to 10 000 was therefore inherently disclosed in D6.

The Board agrees with the respondent (opponent) that a certain minimum level of recharge must be required in order to obtain usable images. However, to establish a lack of novelty of the subject-matter of claim 1, it is not only the individual values as such which have to be disclosed in the prior art, but the combination of the

selected parametric values has to satisfy the inequality set out in claim 1.

Inserting a value of $SN = 10$ into the inequality of claim 1, along with the above-mentioned values of L , P and $IFPS$ which are disclosed together in a single embodiment of $D6$, gives a value of $4.35 \mu\text{sec}$ on the right hand side of the inequality. However, as noted above, $D6$ indicates that for these particular values, the desired time constant has a lower practical limit of $5 \mu\text{sec}$. Hence, even if $D6$ were considered to imply a value of SN greater than 10, the remaining parametric values given in the single concrete example of $D6$ do not satisfy the inequality of claim 1.

7.3.4 In summary, $D6$ discloses all features of claim 1 including the parametric values P , L and $IFPS$, but not a value of SN lying in the range 10 to 10 000. In the absence of a disclosure of a specific value of SN , it cannot be established whether or not the inequality is satisfied. However, even if - as the respondent (opponent) submits - a value of SN greater than 10 is inevitable, the inequality would not be satisfied for the values disclosed in the single concrete embodiment of $D6$.

7.4 As established by the opposition division in the decision of 19 October 2001, $D1$ contains no disclosure of values for $IFPS$, SN and τ_{RC} . No other document has been cited to contest the novelty of claim 1.

7.5 The Board is therefore of the opinion that the subject-matter of claim 1 is novel.

8. Inventive step - Article 56 EPC

8.1 It was not contested that D6 represents the closest prior art. To establish a lack of novelty, it would have sufficed if D6 had disclosed parametric values which fell within the specified ranges and fulfilled the inequality. In a similar manner, the respondent (opponent) considered that claim 1 would lack an inventive step if it could be shown to be obvious to choose a value of SN falling within the range 10 to 10 000 and fulfilling the inequality of claim 1. The Board disagrees. When assessing inventive step in the present case, claim 1 cannot be seen to be distinguished from D6 merely by the fact that the value of SN has not been defined: the distinguishing features must be seen to be the constraints as they are defined in claim 1. Thus, it is the definition of each of the ranges within which the parametric values must be chosen and the definition of the inequality which distinguish claim 1 from the teaching of D6. It is therefore not justified to pick up the question of inventive step where the question of novelty left off and to contemplate whether it would be obvious to select values of SN and τ_{RC} meeting the criteria set out in claim 1. Instead, it has to be established whether, starting from D6, it would have been obvious (i) to define the parametric ranges in their entirety and (ii) to introduce a further constraint in the terms of the inequality.

8.2 Starting from D6, the skilled person will be aware that numerous array and operating parameters influence the image obtained by the device and that the values of these parameters cannot be set without first

establishing whether the desired imaging requirements can still be achieved. However, beyond this general principle, D6 does not provide any specific guidance as to how to select appropriate parametric values. Thus, in the real-time imaging applications of D6, the skilled person wishing to design an array would be faced with the problem of selecting a number of different parameters which are determinative for the sensor design, setting appropriate values for these parameters and ensuring that the selected values do not conflict in any way with each other and that in combination, they enable the desired imaging requirements to be satisfied.

- 8.3 The solution provided by claim 1 of the contested patent is to define a relationship between the parameters τ_{rc} , L, P, IFPS and SN which allows incompatible combinations of parametric values to be identified and thus enables the designer to select combinations of array values which will actually permit various demands to be met and/or balanced.

Claim 1 defines five conditions which have to be satisfied by the array parameters: each of the values P, L, IFPS and SN must fall within a respective range and the sensor capacitance multiplied by the resistance of the corresponding transistor sets a lower limit for the specific combination of P, L, IFPS and SN set out in the inequality of claim 1. In particular, this relationship defines a balance between the potentially conflicting timing demands associated with the desired degree of recharge SN (which has a direct effect on the contrast of the image) and the read-out rate IFPS. The five conditions of claim 1 allow the array designer to

determine whether tweaking one of the parameters will affect the performance of the device and/or by how much the other parameters will have to be modified in order to reach an acceptable balance.

- 8.4 In order to assess the inventive step of this solution, firstly the question of whether the **ranges** defined in claim 1 may be regarded as obvious will be considered.

The respondent (opponent) submitted that the ranges defined in claim 1 represent simple design options for the skilled person. The parameters L, P, IFPS and SN can take on a wide range of possible values depending on the intended use of the device. The fact that the ranges given in claim 1 are so wide reflects the variety of intended uses of the device.

The Board notes that D6 provides a straightforward illustration of this principle: the size of the array depends on the area of the body to be imaged. In particular, head and neck portals require an array length of at least 25cm whilst pelvic, abdominal and thoracic portals require an array length of at least 50cm (page 5, lines 3-7). This demonstrates that the parameter L can take on different values depending on the size of the area to be imaged. So the range of values for L given in claim 1 can be considered to simply reflect the design choices that the skilled person would make in accordance with the intended use of the device.

Similar considerations apply to the other parameters. As argued by the respondent (opponent), the ranges set out in claim 1 simply represent the anticipated

boundary conditions for specific applications. In fact, the ranges do not actually serve to restrict the parameters in any real sense at all since the skilled person would not select values outside these ranges anyway, the given ranges representing the full extent of values which would be implemented in any of the anticipated uses of the device and in any of the associated operating conditions.

This finding was not contested by the appellant (proprietor).

- 8.5 Secondly, the question of whether it would have been obvious to define a further constraint in the terms of the **inequality** has to be considered.
- 8.5.1 As mentioned above, D6 refers to numerous array and operating parameters which influence the image obtained by the device. The number, complexity and interrelation of factors which must be considered when designing an imaging array is further underlined by the teaching of D1. This document identifies a number of additional factors which affect the array design and the imaging performance (see, e.g., page 111, paragraphs 2-4) but provides no guidance as to how the specific array parameters should be selected in order to accommodate the specific performance demands.
- 8.5.2 The respondent (opponent) has submitted that one major issue relevant to real-time imaging which was addressed in detail in D1 was the question of sampling time. In D1 it was disclosed that the desired contrast and dynamic range required by the imaging application dictated the degree to which the bias must be re-

established across the sensor during each readout cycle and that the value of the time required for sufficient initialisation of the sensors directly determined the maximum rate at which an array can ultimately be read out (page 115, lines 8-21). Hence it was known from D1 that the degree to which bias must be re-established and the speed of read-out will always have to be balanced in order to meet potentially conflicting imaging demands.

8.5.3 It was submitted by the respondent (opponent) that the standard charge equation contained variables which reflected these two parameters so this provided a good starting point for finding a relationship therebetween.

Since the recharge behaviour of the capacitive sensors must obey the standard charge equation, the charge $Q(t)$ on any one sensor at time t was represented by

$$Q(t) = Q_0 (1 - \exp(-t/\tau_{RC})) \dots\dots (1)$$

whereby Q_0 was the amount of charge present on a fully charged sensor and τ_{RC} was the RC time constant of the sensor.

Having regard to the operation of the array, the time t required to reach a specific level of charge $Q(t)$ on the capacitive sensors would have to be less than or equal to the time available for the recharging process, this time corresponding to the time t_{cond} for which the FETs were left conducting. In other words,

$$t \leq t_{cond} .$$

It was further submitted that the time t could also be expressed in terms of the (not necessarily integral)

number N_{τ} of RC time constants which elapse until the sensor was charged to $Q(t)$, i.e.

$$t = \tau_{RC} \cdot N_{\tau}$$

Combining these last two expressions:

$$\tau_{RC} \cdot N_{\tau} \leq t_{cond} \quad \dots\dots\dots (2)$$

From equation (1), the opponent derived the expression $N_{\tau} = \ln SN$, the degree of recharge "SN" being defined as $Q_0 / (Q_0 - Q(t))$.

The opponent then derived the inequality of claim 1 by substituting $\ln SN$ for N_{τ} in equation (2) and by expressing t_{cond} in terms of IFPS, L and P.

Since the inequality could be derived in an obvious fashion, the opponent submitted that this aspect could not be considered to involve an inventive step, and concluded that claim 1 as a whole therefore lacked an inventive step.

8.5.4 The Board is not convinced that the skilled person would inevitably arrive at the inequality of claim 1 without the use of hindsight.

8.5.4.1 Firstly, the Board does not consider that the inequality may be derived in a straightforward manner from the teachings of D6 and D1.

D1 discusses the recharge behaviour of the sensors and makes clear that in the environment of the array, the rate of recharge does not follow an ideal exponential curve, but instead is moderated by the switching behaviour of the FETs (page 115, fifth paragraph). So

according to D1, the recharge cycle is not governed by the RC time constant τ_{RC} , but instead by a modified time constant.

Following the discussion on page 9, lines 6 to 45 of the contested patent, it may be seen that the appellant (proprietor) has recognised - despite the teaching of D1 - that a simple model which predicts a recharge behaviour with a time constant given by τ_{RC} will be reasonably accurate when a low-resistance metal is used for the gate select lines and that the standard charge equation can in fact be applied to describe the charging behaviour of the array. The appellant (proprietor) has verified this behaviour by performing a systematic study of the re-initialisation time constants of various arrays.

The applicability of the standard charge equation (equation (1) above) only becomes evident once it has been recognised that the switching behaviour of the FETs can effectively be ignored. However, the prior art contains no suggestion that this could be the case. D1 makes clear that it is the moderated time constants which govern the recharge behaviour (page 115, fifth paragraph) and D6 makes clear that the recharge is not governed solely by the RC time constant, other factors also influencing the speed at which the sampling can occur (page 19, paragraph 1). As a result, it cannot be deduced from the prior art that the standard charge equation can be used to describe the behaviour of the array and consequently there exists no basis in the prior art for deriving the expression $N_r = \ln SN$ which the opponent has relied upon in his analysis.

With respect to the issue of the moderated time constant mentioned in D1, the respondent (opponent) indicated that the first three lines of the fifth paragraph of page 115 of D1 disclosed the basic principle that the re-initialisation of the sensors was dictated by the RC time constant of the pixels. Although D1 also indicated that the switching characteristics of the FETs had to be taken into consideration, this did not detract from the basic principle that the charge behaviour followed an exponential curve and was governed by the RC time constant. Moreover, the respondent (opponent) was of the opinion that D1 taught that the moderated time constant could be approximated to the RC time constant if the resistance of the FET lines were to be made so small that the influence of the switching characteristics could be ignored.

The Board does not agree with this interpretation. D1 does indicate that if the voltage change could be applied to the FET gates with no time delay, the recharge behaviour would follow an exponential curve governed by the RC time constant. However, D1 also emphasises that, in the reality of the array environment, this ideal situation does not occur and that a time delay due to the FET switching characteristics will be inevitable. The Board cannot see that this passage contains any suggestion that the resistance of the FET lines could be reduced to a level whereby the total time constant can be approximated to the RC time constant. Instead, the Board considers that this passage teaches that it is the value of the *moderated* time constant which must be used when describing the charging behaviour. To assert that the

charge behaviour in D1 is characterised by the RC time constant instead of the moderated time constant therefore must be considered as involving hindsight.

Thus, the Board considers that it is the insight that the standard charge equation can indeed be applied to the array of D6 which forms a prerequisite for the formulation of the inequality of claim 1. Since this insight is not obvious in the light of the prior art, the further question of whether the inequality may be derived in a straightforward manner from the standard charge equation may be left open.

8.5.4.2 Secondly, the Board does not consider that it is obvious to isolate and select the parameters τ_{RC} , SN, IFPS, L and P from the multitude of parameters mentioned in both D1 and D6 and to formulate a relationship containing just these parameters.

To arrive at the relationship of claim 1, the appellant (proprietor) has concentrated on the requirement of contrast sensitivity, which, as is known from D1, depends on the degree of re-initialisation of the sensors. By factoring the degree of re-initialisation into the array design, the appellant (proprietor) has recognised that it is possible to obtain a contrast sensitivity consistent with a particular imaging application. The relationship defined in claim 1 enables an array to be designed in which a certain read-out speed is maintained whilst ensuring that a certain level of contrast sensitivity (as dictated by the degree of recharge) is achieved.

The respondent (opponent) has attempted to demonstrate that the inequality of claim 1 can be easily derived from basic principles. However, a prerequisite for this analysis is that it must be known in advance which parameters are to be involved in the final expression. In view of the sheer multitude of potentially relevant factors mentioned in D1 and D6, the Board considers that the skilled person would not intuitively know which parameters he should concentrate on.

From D1 the skilled person learns that the desired contrast and the desired dynamic range imply certain constraints to the degree to which the bias must be re-established across the sensors (page 115, second paragraph). The necessary time required for sufficient re-initialisation has further implications for the maximum number of frames per second (page 115, third paragraph). Thus, contrast and dynamic range demands have to be balanced against read-out time demands. In addition to this however, D1 teaches that, for example, the sensor area and the thickness of the intrinsic layer are also important factors for controlling the read-out time (page 112, the last two sentences of the second paragraph; page 113, second paragraph). Hence, using the teaching of D1, the skilled person, looking to define a relationship governing the selection of the parametric values which will fulfil the desired imaging demands and read-out times, would be led to contemplate not only whether factors such as the degree of recharge and read-out time should be incorporated in such a relationship, but also whether, e.g., sensor area and the thickness of the intrinsic layer should be included.

The respondent (opponent) has not shown convincingly that the skilled person would reject the multitude of other parameters and focus specifically on those parameters set out in claim 1 in spite of clear indications in the prior art that additional parameters could also play an important role in achieving the desired imaging demands. No arguments were brought forward to counter the appellant's (proprietor's) observations that, for example, page 111 of D1 lists 23 factors which all play a role in the sensor design and would normally have to be considered for inclusion in any design relationship. The Board is of the view that it is only with hindsight that the relationship of claim 1 can be derived, since it must first be known which parameters are to be included in the expression.

8.5.5 Consequently, the respondent (opponent) has failed to convince the Board that the inequality of claim 1, and as a result, the entire subject-matter of claim 1, lacks an inventive step.

9. In view of this outcome, it is not regarded necessary to consider the appellant's (proprietor's) further request to order a change in composition of the opposition division.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is maintained as granted.

The Registrar:

The Chairman:

R. Schumacher

B. Schachenmann