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**Datasheet for the decision
of 19 January 2026**

Case Number: T 1193/24 - 3.2.03

Application Number: 20167356.3

Publication Number: 3725436

IPC: B22F3/105, B29C64/153,
B29C64/268, B29C64/393,
B33Y30/00, B33Y50/02

Language of the proceedings: EN

Title of invention:

ELECTRON BEAM MELTING ADDITIVE MANUFACTURING MACHINE WITH
DYNAMIC ENERGY ADJUSTMENT

Applicants:

AP&C Advanced Powders And Coatings Inc.
ARCAM AB

Headword:

Relevant legal provisions:

EPC Art. 83
RPBA 2020 Art. 11

Keyword:

Sufficiency of disclosure - after amendment
Remittal - special reasons for remittal - (yes)

Decisions cited:

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

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Case Number: T 1193/24 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 19 January 2026

Appellant: AP&C Advanced Powders And Coatings Inc.
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Appellant: ARCAM AB
(Applicant 2) Krokslätts Fabriker 27A
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 4 April 2024
refusing European patent application No.
20167356.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman N. Obrovski
Members: B. Miller
B. Goers

Summary of Facts and Submissions

- I. The appeal lies from the decision of the examining division to refuse European patent application No. 20167356.3, published as EP 3725436 A1. References below regarding the application relate to its published version.
- II. In its decision, the examining division concluded that the invention as defined in claim 1 was not disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 83 EPC).
- III. The applicants ("appellants") initially requested that the decision be set aside and that a patent be granted on the basis of the claim requests that had been considered by the examining division in its decision, i.e. the main request as filed with the submission dated 12 January 2023 or, alternatively, one of auxiliary requests 1 to 3 as filed with the submission dated 23 February 2024.
- IV. With the summons to oral proceedings, the Board sent a communication pursuant to Article 15(1) RPBA, indicating its preliminary, non-binding opinion of the case.
- V. With a letter dated 17 November 2025, the appellants withdrew the main request and auxiliary requests 1 and 2. They also resubmitted auxiliary request 3 as the sole remaining request, together with an adapted description.

Subsequently, the summons to attend oral proceedings before the Board was cancelled.

VI. The following evidence is relevant to the appeal proceedings.

D1: WO 2018/217646 A1

VII. Claim 1 of the sole remaining request (called "auxiliary request 3" below) reads as follows.

"A method of operating an additive manufacturing machine comprising:
depositing a layer of additive powder over a build platform movably positioned within a build chamber;
directing an electron beam toward the layer of additive powder at an incident energy level and energy density;
measuring electron emissions from the layer of additive powder; and
adjusting at least one of the incident energy level and energy density of the electron beam based at least in part on the measured electron emissions;
further comprising:
determining absorbed energy based at least in part on the incident energy level, the energy density, and the measured electron emissions;
wherein measuring the electron emissions comprises:
measuring an electric current that passes through the build platform of the additive manufacturing machine;
and
determining transmitted electrons based at least in part on the measured electric current;
wherein the build platform is electrically insulated from the build chamber and measuring the electric current comprises:

measuring a voltage across a resistor electrically connected to the build platform;
wherein adjusting at least one of the incident energy level and the energy density comprises compensating for the measured electron emissions to maintain the absorbed energy at a target energy level;
wherein measuring the electron emissions comprises: measuring secondary electrons and backscattered electrons."

Independent claim 5 is directed to a corresponding additive manufacturing machine. Its specific wording is not relevant to this decision.

VIII. The arguments of the appellants may be summarised as follows.

The invention as defined in claim 1 was sufficiently disclosed to the skilled person. The information provided in paragraphs [0004], [0016], [0031] and [0032] of the application, in particular, enabled the skilled person to carry out the invention. The concept of the invention was based on the finding that the influence of the surface chemistry of the powder is reflected in the secondary electron emissions. This concept was so simple for a skilled person to put into practice that a specific illustrative working example was not required.

The disclosure in D1 was not relevant to the invention as defined in claim 1, since it related to different circumstances.

Reasons for the Decision

1. Auxiliary request 3 - Article 83 EPC
 - 1.1 In the electron beam melting (EBM) method according to the invention as defined by claim 1, the energy input by the electron beam is adjusted in a manner dependent on the measurement of electron emissions from the powder bed (melt pool), see the method steps of:
 - measuring electron emissions from the layer of additive powder
 - adjusting at least one of the incident energy level and energy density of the electron beam based at least in part on the measured electron emissions
 - determining the absorbed energy
 - adjusting the beam energy to compensate for the electron emissions and thus to maintain the absorbed energy at a target value
 - 1.2 The objection relating to the determination of electron emissions by thermal imaging no longer applies.
 - 1.2.1 In its decision to refuse the application, the examining division concluded that the method according to claim 1 was not disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art. This was because it was not possible to determine electron emissions during an EBM method by measuring the temperature of the powder bed and the melt pool using a thermal imaging device as defined in what was then claim 3 of the main request, which corresponded to claim 6 as originally filed and was also disclosed in paragraph [0033] of the application as published (EP 3 725 436 A1, "the

application"). The examining division based its finding on the disclosure of common general knowledge in paragraphs [0011] and [0094] of D1.

In paragraph [0011], D1 refers to textbooks when stating that the yields of secondary electrons (SE) and backscattered electrons (BSE) "may be sensitive to the topographical characteristics of the specimen surface **but have been found to be almost independent of the specimen temperature for metals** (see, e.g., JEOL Ltd., SEM; Scanning Electron Microscope A To Z: Basic Knowledge for Using the SEM (2009); Reimer, Ludwig, Scanning Electron Microscopy: Physics of Image Formation and Microanalysis (1998)), and thus the influence of the Heat Affected Zone (HAZ) of the in-process specimen on the electron signal is minimal" (emphasis added by the Board).

- 1.2.2 This objection raised by the examining division does not apply to the invention as defined by auxiliary request 3, because claim 1 is now restricted to the determination of electron emissions by measuring transmitted electrons, secondary electrons and backscattered electrons. Therefore, the invention no longer encompasses thermal imaging for the measurement of electron emissions.

The dependent claim which corresponded to claim 5 as originally filed was deleted from the amended application documents of auxiliary request 3, as was the former embodiment described in paragraph [0033] of the A1-application.

- 1.2.3 Regarding the remaining methods of determining electron emissions, it is undisputed that the skilled person knows how to measure transmitted electrons directly by

determining the electric current passing through the build platform of the additive manufacturing machine as defined in claim 1. Furthermore, the skilled person knows that secondary and backscattered electron emissions can be measured using, for example, an Everhart Thornley detector (see paragraphs [0031], [0032] and [0041] of the application).

The previous objection of lack of sufficient disclosure thus no longer applies, and the Board sees no reason hindering the skilled person in carrying out the invention as defined by claim 1 of auxiliary request 3.

1.3 The further objections of lack of sufficient disclosure raised by the examining division are not convincing.

1.3.1 The Board agrees with the examining division's conclusion, in point II.1.2 of the contested decision, that - according to common general knowledge and in line with the information provided in paragraphs [0011] and [0094] of D1 - during an EBM method:

- "emissions" can also encompass thermal and X-ray emissions (in addition to electron emissions)
- the amount of electron emissions depends strongly on the topography

1.3.2 However, this does not mean there is a lack of sufficiency of disclosure, since the invention according to claim 1 (in line with the disclosure in paragraphs [0031], [0032] and [0041] of the application, i.e. by applying an Everhart Thornley detector) does not require determination of electron emissions depending on temperature or the absorbed energy.

The application confirms that the "absorbed energy" depends on the amount of absorbed electrons (see paragraph [0042]), which can be determined by measuring the electrons that are not absorbed, i.e. the electron emissions are to be subtracted from the incident energy level.

For the method as defined in independent claim 1 it is not relevant whether the electron emissions depend on the topology, whether further energy loss results from X-ray emissions and/or whether heat radiation or heat conduction occurs and can be determined.

The skilled person can determine the electron emissions directly and can calculate the absorbed energy as defined in the application in paragraph [0042]. Whether this calculation leads to an accurate value for the absorbed energy is irrelevant to the question of sufficiency of disclosure, as explained in the following paragraph.

- 1.3.3 The examining division argued that the claimed invention ignored the reality of physics of the radiation phenomena around the melt pool, particularly thermal conduction, topography and emissions (heat and X-ray), and falsely assumed that the electron emissions at least mainly depended on the absorbed energy (points II.1.3 and II.1.9 of the contested decision). Under these circumstances, it was also impossible to accurately measure the absorbed energy, and it was impossible to achieve the desired effect, namely to maintain the absorbed energy at a target level using the disclosed method.

However, this line of reasoning does not take into account the fact that the claimed method does not

require accurate measurement of the absorbed energy. The invention defined in the application is based on the assumption that the absorbed energy can be determined simply by calculating the amount of the absorbed electrons, irrespective of whether or to what extent thermal conduction, heat emission or X-ray radiation occurs as a consequence of the high-energy beam of electrons hitting the metal target powder (i.e. without knowing the "true" level of emissions).

Claim 1 only requires the incident energy level to be adjusted to compensate for the measured electron emissions, and thus the absorbed energy to be maintained at a target level.

- 1.3.4 While the examining division agreed with the appellants' argument that a more stable method could be achieved by providing a constant absorbed energy level in line with the disclosure of paragraph [0005] of the application (see point II.1.4 of the contested decision), it was not convinced that the application provided sufficient guidance on how to vary the incident energy level and energy density in response to the electron emissions, to achieve this goal.

This is not persuasive.

The Board sees no difficulty for a skilled person using their common general knowledge to apply the application's teaching to improve the manufacturing method by providing a stable method as aimed at in paragraph [0005] of the application.

When performing the EBM manufacturing method while measuring the electron emissions from the build platform, a skilled person can calculate the absorbed

energy in the manner referred to in the application (incident energy level minus the energy from the measured electron emissions). Nor does the Board see any problem for a skilled person to compensate for a determined deviation in the calculated absorbed energy simply by adjusting the electron beam correspondingly, and in this manner to maintain the absorbed energy at a target energy level. The amount required can be calculated easily. This process can be implemented in a conventional control loop.

- 1.3.5 Furthermore, the examining division concluded (points II.1.5 and II.1.6 of the contested decision) that there was no commonly known correlation between the electron emissions and melt pool temperature, nor was it disclosed in the application how such a correlation might be found. In particular, the skilled person was not aware of how to establish a correlation between the surface chemistry and the absorbed energy.

This is not convincing either.

- 1.3.6 The aim of the claimed invention is to provide a control action in the absence of knowledge of the surface topology and chemistry, because these are subject to unpredictable variations that are to be compensated for by the claimed method (see application, paragraphs [0004] and [0005]). This is achieved by determining the electron emissions and calculating the absorbed energy by subtracting the measured electron emissions from the incident energy level (see paragraph [0042]). If the absorbed energy value determined in this way deviates from the target value, the incident energy level and the energy density are adjusted to compensate for the losses by the measured electron emissions, thereby maintaining the absorbed energy at

the target energy level (see claim 1). This can be achieved by using a simple controller, and thus there is no need to know what the correlation is, or what the "true" level of emissions is. Implementing such a controller is within the skilled person's knowledge.

Therefore, when carrying out the invention, it is not necessary to determine the surface chemistry of the metal powder or to establish specific correlations between the surface chemistry and the absorbed energy or between the electron emissions and the melt pool temperature, see also the comments above in point 1.3.2.

- 1.3.7 In point II.1.8 of the contested decision, the examining division correctly observed that the application did not include a concrete (experimental) implementation of the claimed control method and that the appellants had not filed any such experimental evidence during the examination proceedings.

However, in the case at hand, a concrete working example is not required in view of the above conclusions relating to compliance with the requirements of Article 83 EPC.

According to established case law (see Case Law of the Boards of Appeal, 11th edition, 2025, II.C.5.3), a clear distinction must be made between the concepts of "way of carrying out the invention claimed" and "examples" as referred to in Rule 42(1)(e) EPC. While the description as a whole must disclose, in the light of the common general knowledge at the priority date, at least one way of carrying out the invention, examples are not always necessary to satisfy the requirement of sufficiency of disclosure. The presence

of examples is only indispensable if the description is otherwise insufficient to meet this requirement.

In the present case, methods for determining the transmitted, secondary and backscattered electrons are described sufficiently clearly and completely, as ways of carrying out the invention. In fact, the examining division confirmed, in point II.1.9 of the contested decision, that the calculation of the absorbed energy level as the underlying principle of the invention was simple, as it involved equating the incident energy with the sum of the absorbed energy and the energy lost due to the electron emissions.

Hence, in the present case, the skilled person does not require a detailed experimental embodiment of the invention to implement the invention as defined in claim 1 (in line with the disclosure in paragraphs [0031], [0032] and [0042] of the application).

1.4 The above considerations relating to the method according to claim 1 also apply in a similar manner to the corresponding additive manufacturing machine according to claim 5 of auxiliary request 3.

1.5 In summary, the Board concludes that the invention as defined in the claims of auxiliary request 3 is sufficiently disclosed in the application.

2. Remittal to the examining division

Under Article 11 RPBA, the Board may remit the case to the department whose decision was appealed if there are special reasons for doing so.

The examining division has not yet decided upon the patentability requirements of novelty and inventive step. In view of the primary object of the appeal proceedings to review the decision under appeal in a judicial manner (Article 12(2) RPBA), the board considers that these circumstances constitute a special reason for the remittal of the case. Moreover, the appellants also agreed to the remittal.

Therefore, in accordance with Article 111(1) EPC, the Board decided to remit the application to the examining division for further prosecution.

Order

For these reasons it is decided that:

1. The decision is set aside.
2. The case is remitted to the examining division for further prosecution.

The Registrar:

The Chairman:



C. Spira

N. Obrovski

Decision electronically authenticated