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**Datasheet for the decision
of 30 July 2024**

Case Number: T 0925/22 - 3.2.03

Application Number: 15190847.2

Publication Number: 3012350

IPC: C23C24/04, C04B35/00,
F01D11/00, F01D5/28, F16C33/04

Language of the proceedings: EN

Title of invention:
COLD SPRAY MANUFACTURING OF MAXMET COMPOSITES

Patent Proprietor:
RTX Corporation

Opponents:
Siemens Aktiengesellschaft
Safran Aircraft Engines

Headword:

Relevant legal provisions:
EPC Art. 100(b), 111(1)

Keyword:

Grounds for opposition - insufficiency of disclosure (no)
Appeal decision - remittal to the department of first instance
(yes)

Decisions cited:

T 0409/91, T 0435/91, T 0172/99, G 0001/03

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

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Case Number: T 0925/22 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 30 July 2024

Appellant: RTX Corporation
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 2 February 2022
revoking European patent No. 3012350 pursuant to
Article 101(3)(b) EPC.**

Composition of the Board:

Chairman C. Herberhold
Members: B. Miller
 D. Prietzel-Funk

Summary of Facts and Submissions

I. European patent EP 3 012 350 B1 ("the patent") relates to a process for forming a MAXMET composite coating by cold spraying.

II. Two oppositions against the patent were filed on the grounds of Article 100(b) and (c) EPC and Article 100(a) EPC together with Articles 54 and 56 EPC.

The opposition division concluded that the ground for opposition under Article 100(b) EPC prejudiced the maintenance of the patent and revoked it.

The patent proprietor ("the appellant") appealed against the opposition division's decision.

III. The following documents already cited during the opposition proceedings are of particular importance for the present decision:

D8: H. Assadi et al., "Bonding mechanism in cold gas spraying", Acta Materialia 51 (2003), pages 4379-4394

D13: H. Katanoda et al., "Numerical Study of Combination Parameters for Particle Impact Velocity and Temperature in Cold Spray", Journal of Thermal Spray Technology, vol. 16(5-6) 2007, pages 623-627

D23: T. Schmidt et al., "Development of a generalized parameter window for cold spray

deposition", Acta Materialia 54 (2006),
pages 729-742

IV. Wording of claim 1 as granted

"A process of forming a MAXMET composite coating on an article comprising:
providing an article having a substrate (30);
forming at least one MAX phase particle (34);
coating said at least one MAX phase particle (34) with a metallic shell (36);
providing at least one powder containing the MAXMET composite, wherein the MAXMET composite comprises said MAX phase particles coated with said metallic shell;
cold spraying said at least one powder on said substrate (30) such that the powder velocity is at least a critical velocity required for deposition;
forming a layer (32) of said MAXMET composite on the substrate."

V. Oral proceedings were held on 30 July 2024.

VI. At the end of the oral proceedings the following requests were confirmed by the parties.

The appellant requested that the decision under appeal be set aside and that the case be remitted to the department of first instance for further prosecution on the basis of the patent as granted or, alternatively, on the basis of one of auxiliary requests 1 to 8 as submitted with the statement setting out the grounds of appeal or on the basis of auxiliary request 1a filed with a letter dated 27 February 2023.

The respondent (opponent 2) requested that the appeal be dismissed and that the auxiliary requests not be admitted into the proceedings.

Opponent 1 had withdrawn its opposition with a letter dated 21 April 2023.

VII. The appellant's arguments, as far as they are relevant for this decision, can be summarised as follows.

Different commonly known methods were available for coating particles with a metallic shell, as summarised in paragraph [0030] of the patent. The patent also confirmed the skilled person's common general knowledge that there was no single general coating method for obtaining all possible MAX phase particle and coating metal combinations. However, the skilled person was aware of the various available methods for any technically reasonable choice of metal and MAX phase particles, with the patent specifically disclosing no fewer than eight such methods.

It would be readily apparent to the person skilled in the art that the allegedly undefined 50% of the MAXMET composite could be made up of additional components that were typically present in MAXMET composites, such as extra metals, oxide ceramics, carbon, soft fillers, solid lubricants and/or laminate structured ceramics, depending on the specific application.

A patent was to be interpreted by a skilled person. Hence it was immediately apparent that the MAXMET particle of claim 1 had to contain a sufficient amount of metal to be suitable for the subsequent cold spraying process.

A skilled person familiar with the cold spraying process was also aware of its critical parameters and could adjust them as part of routine experimentation.

Moreover, the patent disclosed specific details regarding the cold spraying process, such as suitable spray guns (see paragraph [0037] of the patent), and explained the various parameters influencing the critical velocity, such as the carrier gas feed rate, the nature of the carrier gas, the powder feed rate or the distance of the spray gun from the surface; see paragraphs [0034] and [0038] of the patent. Paragraph [0039] of the patent further explained that the critical velocity could be estimated by using an approach as set out by D23. Further information on the relationship between the decisive and important parameters could also be found in D8 and D13. For example, the final sentence of D8 read: "Overall the analysis supplies a tool to predict critical velocities and to optimize spray parameters for different materials."

D23 not only reflected the skilled person's common general knowledge regarding the cold spraying process but also was specifically mentioned in paragraph [0039] of the patent. The skilled person would not expect it to be possible for the cold spraying process to be performed under conditions for which it was known not to be effective. Therefore, D23 did not provide evidence that the invention could not be reworked by a skilled person. On the contrary, the patent taught the skilled person to refer to exactly that document and to its teaching about the critical velocity being based on the metal's specific gravity, specific heat, melting point and ultimate stress, as well as the spray

temperature and size distribution of the feedstock powder.

VIII. The respondent's counter-arguments can be summarised as follows.

The skilled person was faced with an undue burden in reworking the invention over the whole scope since they had to select and optimise multiple parameters to obtain a MAXMET particle coating on a substrate.

The opposition division correctly concluded that the patent did not disclose the following within the broad scope of claim 1:

- a suitable general method for providing a shell of any type of metal on any type of MAX phase-containing particle and
- suitable cold spraying conditions for depositing any MAXMET composite on a substrate

According to paragraph [0015] of the patent the MAXMET particles could comprise 25-50 vol% MAX phase and 25-50 vol% metallic phase. The unknown fraction of the particle extended to 50%. The patent did not give any information on the composition and structure of this unknown fraction. The person skilled in the art was forced to make excessive efforts, and even to be inventive, to overcome the shortcomings of the description and to find a material which was neither metallic nor a MAX phase and was suitable for the claimed process.

Claim 1 did not even define a minimum metal content of the MAXMET particles. The MAXMET particles therefore could contain such a small amount of metal that they

would be unsuitable for the subsequent cold spraying process.

The broad wording of claim 1 and the general disclosure of the patent placed an undue burden on the skilled person to coat the MAX phase-containing particles with a metal and to deposit them by cold spraying.

The patent did not teach the skilled person which coating method to use for coating the MAX phase-containing particles with a metallic shell.

Furthermore, the patent did not disclose how to determine the critical velocity and all the other relevant parameters for cold spraying, such as the carrier gas temperature. The parameters presented by the patent were specified by broad ranges or relative terms and hence did not provide sufficient guidance for the skilled person.

Moreover, further critical parameters were not mentioned in the patent at all, for example the required ductility of the metal of the MAXMET particles, the required impact temperature of the particles or the type of substrate to be coated.

D23 made it clear that the critical velocity of cold spraying could not easily be estimated since it depended on many parameters. D23 confirmed that various further parameters were critical and required careful adjustment to achieve a coating, such as selecting suitable metals having, for example, the required ductility, selecting appropriate temperatures and selecting particles with not too small a particle size. D23 also created serious doubts that the invention could be reworked over the whole scope of claim 1. For

example, D23 demonstrated that the cold spraying process could not be performed for particular combinations of metals such as cobalt and copper, or when the particle contained heat-sensitive components such as biopolymers. The invention thus could not be reduced to practice over the whole scope of the claim.

Reasons for the Decision

1. Article 100(b) EPC
 - 1.1 None of the arguments presented in the contested decision or by the respondent casts doubt on the sufficiency of disclosure of the invention in the patent.
 - 1.2 A successful objection of lack of sufficiency of disclosure presupposes that there are serious doubts, substantiated by verifiable facts. In order to establish insufficiency, the burden of proof is upon an opponent to establish on the balance of probabilities that a skilled reader of the patent, using their common general knowledge, would be unable to carry out the invention (Case Law of the Boards of Appeal, 10th edition, 2022, Chapter II.C.9.).

The mere fact that a claim is broad is not a reason to assume that the patent does not fulfil the requirement of sufficient disclosure. Rather, it is to be assessed whether or not the patent discloses a technical concept fit for generalisation which makes it credible that the skilled person can rework the invention over the whole scope without undue burden using their common general

knowledge (Case Law of the Boards of Appeal, 10th edition, 2022, Chapter II.5.4.).

- 1.3 Contrary to this established case law, the opposition division concluded, despite a lack of serious doubts substantiated by verifiable facts, that the patent did not disclose the method of claim 1 completely enough for it to be reworked by the skilled person (see point II.3 of the grounds of the decision).

The opposition division reasoned this finding by arguing that the patent did not disclose the following within the broad scope of claim 1:

- a suitable general method for providing a shell of any type of metal on any type of MAX phase-containing particle and
- suitable cold spraying conditions for depositing any MAXMET composite on a substrate

- 1.4 Concerning the method step of providing a metal shell

- 1.4.1 As proof of the technical difficulties involved in providing a shell of any kind of metal on any type of MAX phase-containing particles, the opposition division referred to paragraph [0030] of the patent.

Paragraph [0030] of the patent discloses that various commonly known coating methods for applying a metal coating on MAX particles can be used. Therefore, this teaching in the patent gives the skilled person the required guidance on how to provide metal-coated MAX phase-containing particles.

Paragraph [0030] further explains that for specific active metals such as aluminium, certain procedures may be unique in order to create good bonding of the metal

to the MAX phase. However, the patent also discloses which methods are ideal for forming a shell of an active metal with a very negative electrode potential such as Al and Mg; see second-to-last sentence of paragraph [0030].

1.4.2 Although there is no general method valid for all combinations of MAX phase particle and coating metal, as acknowledged by the patent, no reason has been identified by the opposition division, nor can any be found by the Board, as to why the skilled person would be unable, as part of routine experimentation, to coat MAX particles with a metal by using one of the known coating methods listed in paragraph [0030].

1.5 Concerning the method step of cold spraying

1.5.1 As confirmed by claim 9 and paragraph [0039] of the patent, effective deposition during a cold spraying process can be achieved if the particle velocity is above the "critical velocity". This minimum velocity depends on many parameters, for example the metal's specific gravity, specific heat, melting point, ultimate stress, spray temperature, the size distribution of the feedstock powder and the substrate type.

Anyone experienced in the cold spraying process is aware of these factors and of the requirement to work above the critical velocity. This is also evidenced by D23, which is also cited in paragraph [0039] of the patent, and the further documents D8 (see "Introduction") and D13 (see "Introduction").

Although the specific equation (1) for calculating the critical velocity presented on page 730 of D23 is

limited to materials with properties similar to those of the reference material, i.e. copper, D23 nevertheless clearly demonstrates that the skilled person is aware of the various parameters which influence the critical velocity.

It becomes clear from the patent that the metal of the MAXMET composite particles, and in particular its ductility, is responsible for the adherence of the MAX phase-containing particles to the substrate; see paragraphs [0013] and [0029] of the patent. The skilled person can therefore start with the corresponding parameters of a cold spraying process of the corresponding metal and adapt the velocity as part of routine experimentation as needed when spraying the MAXMET particles. Whether or not the skilled person is able additionally to determine the exact critical velocity for any type of MAXMET particle by using or setting up an equation such as disclosed in D23 is not important for reworking the invention.

- 1.5.2 Moreover, paragraphs [0032] to [0038] of the patent disclose typical conditions for the cold spraying process, such as typical carrier gases, the feed rate, the spraying distance and the type of spray gun.
- 1.5.3 In the absence of verifiable facts, no reason can be discerned why the skilled person would be unable to rework the process of claim 1 over the whole scope of protection on the basis of the disclosure in the patent by using routine experimentation and common general knowledge concerning the cold spray process.

1.6 Further arguments raised by the respondent

1.6.1 The respondent acknowledges that the patent specification gives several isolated examples of MAX particles and metals and that it is possible to implement certain well-defined embodiments, particularly when the claimed MAXMET composite particles comprise only a MAX phase and a metal phase; see reply to appeal, points 2.1.3 and 2.1.4, first sentence.

1.6.2 However, the respondent challenges sufficiency of disclosure since, in its view, an undue burden is placed on the skilled person and they are unable to rework the invention over the whole scope due to the broad definition in claim 1. The argument is based on the missing definition of specific MAX phases and metals in claim 1 and the undefined composition of the MAXMET particles, which follows from the open claim language ("containing" and "comprising") and the disclosure in paragraph [0015] of the patent or claim 11 as granted.

The respondent's argument is not convincing.

1.6.3 As indicated above in point 1.2, the mere fact that a claim is broad is not a reason to assume that the patent does not fulfil the requirement of sufficient disclosure. Rather, it is to be assessed whether or not the patent discloses a technical concept fit for generalisation which makes it credible that the skilled person can rework the invention over the whole scope without undue burden using their common general knowledge (Case Law of the Boards of Appeal, 10th edition, 2022, Chapter II.5.4.).

1.6.4 In the absence of verifiable facts or experimental evidence to the contrary, the Board cannot see any reason, nor has any been identified by the respondent, as to why the skilled person would be unable to provide MAXMET particles according to claim 1, comprising MAX phase particles as well as further conventional components. In particular, no specific reason has been identified why particles comprising a certain quantity of further components would generate an undue burden for the skilled person due to unforeseeable problems either during the application of the metallic shell to the MAX phase-containing particles using one of the eight methods disclosed in paragraph [0030] of the patent or during the subsequent cold spraying.

1.6.5 The same reasoning applies with regard to the disclosure in paragraph [0015] of the patent, even if paragraph [0015] is interpreted as referring to an embodiment of claim 1 ("metal particles" vs "metal shell"), as argued by the respondent. Paragraph [0015], which is similar to claim 1 as granted, allows the MAXMET composite particles to comprise up to 50 vol% of undefined material. A similar disclosure is provided by claim 11 as granted, which specifies that the MAXMET composite comprises a volume fraction mixture of from 25% to 50% MAX phase particles and from 25% to 50% Al.

The respondent has not identified any reason why the skilled person is unable to obtain MAXMET composite particles comprising only 25 vol% MAX phase particles and 25 vol% metal or Al and up to 50 vol% further materials.

1.6.6 In this context the respondent also argues that claim 1 does not define a minimum metal content of the MAXMET particles, meaning that the MAXMET particles could

contain such a low amount of metal that they would be unsuitable for the subsequent cold spraying process.

However, the wording of a claim is directed to a skilled person and has to be read in the context of the technical teaching provided by the patent. A person skilled in the field of cold spraying is aware of the required properties of the feedstock. Hence, they would not expect to be able to deposit MAXMET particles with a negligible metal content, in particular in view of the emphasis placed on the metallic shell and the ductility of the metal throughout the specification (see paragraphs [0013] and [0029]). Even if the skilled person were to realise that certain MAXMET particles cannot be used for cold spraying due to their low metal content, the solution to this problem is immediately apparent to them and does not result in an undue burden in putting the invention into practice.

- 1.6.7 The respondent similarly argues that the broad wording of claim 1 and the general disclosure of the patent place an undue burden on the skilled person in coating the MAX phase-containing particles with a metal and depositing them by cold spraying.

This argument is again not convincing for the reasons set out above in point 1.6.3.

- 1.6.8 Moreover, a person skilled in the field of cold spraying is aware of the required properties of the feedstock and of methods to obtain them. Choosing an appropriate coating method from the eight methods described in paragraph [0030] of the patent is part of the skilled person's customary practice. Furthermore, as set out above in point 1.4, paragraph [0030] of the patent even provides guidance on which methods are

ideal for forming a shell of an active metal with a very negative electrode potential such as Al and Mg; see second-to-last sentence of paragraph [0030].

1.6.9 A person skilled in the field of cold spraying is also aware of the various parameters which can be used to optimise the cold spraying process. The patent provides general guidance concerning these parameters by presenting various critical parameters (see paragraphs [0032] to [0038]). Although the parameters are specified by broad ranges (see e.g. paragraph [0033]: "carrier gas temperature can be between 200 degrees Celsius and 800 degrees Celsius") and relative terms (see e.g. paragraph [0032]: "high pressure"), a skilled person working in the field of spray coating is familiar with these parameters and can adjust them by routine experimentation.

1.6.10 The respondent also argues that further parameters critical for the cold spraying process are not even mentioned in the patent, such as the required ductility of the metal of the MAXMET particles, the required impact temperature of the particles or the substrate to be coated.

However, the respondent has again failed to provide verifiable facts to demonstrate that the teaching of the patent is not only broad but also insufficient for a person skilled in cold spraying deposition; see point 1.6.3 above.

1.6.11 The respondent further argues that D23 demonstrates verifiable facts showing that the invention cannot be reworked over the whole scope of claim 1. The respondent points out that D23 demonstrates, for

example, that the cold spraying process cannot be performed:

- with all possible combinations of metals such as cobalt and copper
- at too low or too high a temperature
- using particles with too small a particle size
- using particles containing heat-sensitive components such as biopolymers

This argument is not convincing either.

- 1.6.12 As also argued by the respondent, D23 - which is explicitly referred to in paragraph [0039] of the patent in the context of adjusting and configuring the cold spray parameters for effective deposition of the MAXMET coating by finding the suitable critical velocity - teaches the skilled person about the critical parameters of the cold spraying process, explaining its limits and the requirements for providing a coating made of different metals. Taking into account the knowledge reported by referenced document D23, the skilled person would not expect it to be possible for the cold spraying process to be performed beyond the suitable conditions reported in D23, for example at temperatures which are known to be too low to achieve effective deposition or too high to fall within the commonly accepted definition of a cold spraying process. Therefore, D23 does not provide verifiable facts that the invention cannot be reworked by a skilled person but rather provides further knowledge which the skilled person can rely on to put the invention of the patent into practice.

As set out by the respondent, claim 1 of the patent does not exclude the possibility of using various metals such as copper and cobalt in combination, or of

biopolymers being present in the MAXMET particles. Although it might be clear for the skilled person in view of D23 that specific metals or materials cannot be used alone or in combination due to their varying ductility or thermal stability, the knowledge as reported by D23 would prevent the skilled person from trying to work out the invention in this manner. The same applies to specific process conditions (e.g. deposition temperature or particle velocity too low) under which the skilled person would not expect to successfully perform a cold spraying deposition process in view of their technical knowledge.

Therefore, the case in hand differs from the case law cited by the respondent (Case Law of the Boards of Appeal, 10th edition, 2022, Chapter II.5.4, in particular T 409/91, T 172/99, T 435/91) since no doubts have been created that the method can be reworked over the whole scope of protection using routine experimentation and conventional materials and by applying general knowledge related to the conditions and requirements of the cold spraying process.

The Board is convinced that in the case in hand the principles as set out in G 1/03 (OJ 2004, 413, point 2.5.2 of the reasons) apply, according to which an invention is sufficiently disclosed if there are a large number of conceivable alternatives and the specification contains sufficient information on the relevant criteria for finding appropriate alternatives over the claimed range with reasonable effort.

- 1.7 In view of the above, the ground for opposition under Article 100(b) EPC does not prejudice the maintenance of the patent as granted.

2. Remittal to the opposition division

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

The opposition division has not yet decided upon the issues arising from the ground for opposition pursuant to Article 100(a) EPC, namely novelty and inventive step. Moreover, the appellant requested that the case be remitted to the opposition division for further prosecution and the respondent did not object to the remittal.

Thus, special reasons exist for remitting the case.

In view of the above, the Board decided to remit the case to the opposition division for further prosecution in accordance with Article 111(1) EPC.

Order

For these reasons it is decided that:

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

The Registrar:

The Chairman:



C. Spira

C. Herberhold

Decision electronically authenticated