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Datasheet for the decision of 20 January 2020

Case Number: T 0297/17 - 3.2.03

Application Number: 01944809.1

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Language of the proceedings: EN

Title of invention:
COATING SYSTEM FOR HIGH TEMPERATURE STAINLESS STEEL

Applicant:
Manoir Pitres

Headword:

Relevant legal provisions:
EPC Art. 123(2), 111(1)
RPBA Art. 11

Keyword:
Amendments - allowable (yes)
Appeal decision - remittal to the department of first instance (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
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Office européen des brevets

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Case Number: T 0297/17 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 20 January 2020

Appellant: (Applicant)	Manoir Pitres 37 rue de Liège 75008 Paris (FR)
Representative:	IP Trust 2, rue de Clichy 75009 Paris (FR)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 21 September 2016 refusing European patent application No. 01944809.1 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Ashley
Members:	B. Miller
	D. Prietzel-Funk

Summary of Facts and Submissions

I. The European patent application No. 01944809.1 was refused by the examining division, since it came to the conclusion that claim 1 as filed in electronic form on 7 July 2016 did not fulfil the requirements of Article 123(2) EPC.

II. This decision was appealed by the applicant (appellant). The appellant requested that the contested decision be set aside and, after an interlocutory revision, a patent be granted by the examining division on the basis of the set of claims filed with the statement setting out the grounds of appeal.

III. Independent claim 1 reads as follows:

"A method for providing a protective coating having a non-catalytic surface on low carbon steel and stainless steel comprising depositing onto a steel substrate being a high temperature stainless steel and metallurgically bonding thereto
- a continuous coating of a MCrAlX alloy, where
M = nickel, cobalt or iron or mixture thereof and
X = yttrium, hafnium, zirconium, lanthanum, scandium or combination thereof,
having about 10 to 25 wt% chromium,
about 6 to 15 wt% aluminum
and in which X is present in an amount of
0.25 to 1.5 wt%, the balance M
the coating being deposited in a thickness of about 50 to 500 µm

- additionally comprising depositing a surface layer of aluminum, aluminum alloy containing up to 50 wt%

silicon, or aluminum alloy containing up to 60 wt% silicon, a total of up to 30 wt% of at least one of chromium and titanium, the balance at least about 20 wt% aluminum, and having a thickness of up to about 50% of the coating onto the coating

- additionally comprising depositing a continuous layer onto the stainless steel substrate before depositing the continuous MCrAlX coating to provide an interlayer between the stainless steel substrate and the coating effective to minimize or avoid the formation of continuous nitride or carbide layers at the coating and substrate interface

the interlayer being deposited by magnetron sputtering physical vapour deposition at a temperature in the range of 800 to 900°C
in a thickness of about 20 to 100µm

the interlayer is comprised of about 35 to 45 wt% aluminum, a total of about 5 to 15 wt% of at least one of chromium or titanium, and about 50 to 55 wt% silicon deposited onto the high temperature stainless steel substrate
the continuous MCrAlX alloy coating being deposited on the interlayer

the interlayer, MCrAlX coating with aluminum or aluminum alloy surface layer and substrate base alloy being heat treated
at a soak temperature in the range of about 1030 to 1160C
at a rate of temperature rise at a rate of about 10 to 20 Celsius degrees/minute
for a time effective to form a second interlayer between the base alloy and enrichment pool containing

intermetallics of silicon and one or more of titanium or aluminum and the base alloying elements
and for at least about 10 minutes
in an oxygen free atmosphere for a time effective to diffuse the surface layer into the "*coating" (missing word added by the Board)* to provide a multiphased microstructure and to metallurgically bond the coating and interlayer to the substrate,
and subsequently heat-treating in an oxidizing atmosphere at a temperature above about 1000 C for a time effective to form an alumina surface scale thereon."

Dependent claims 2 to 5 concern preferred embodiments of the method of claim 1.

Claim 6 reads

"A coking and corrosion resistant reactor tube or fitting produced by the method of claim 1."

IV. The appellant's arguments may be summarised as follows.

The wording of the method according to claim 1 is directly based on the wording of claims 1 to 4, 6, 8, 12 and 14 to 16 as originally filed. Therefore the technical teaching of claim 1 does not extend beyond the teaching as originally filed. Claims 2 to 4 correspond to claims 17 to 19 as filed. Claim 5 is based on the teaching on page 16, lines 17 to 22 as originally filed. Claim 6 corresponds to claim 41 as originally filed.

The amended claims fully meet the objections raised in the contested decision.

The appellant therefore should benefit from an interlocutory revision.

Reasons for the Decision

1. Article 123(2) EPC

1.1 The subject-matter of claim 1 as submitted with the grounds of appeal is based on the technical teaching provided by claims 1 to 4, 6, 8, 12 and 14 to 16 as originally filed. The features of these claims as originally filed have been rearranged as follows (corresponding to the annotated claim wording submitted by the appellant):

A method for providing a protective coating having a non-catalytic surface on low carbon steel and stainless steel comprising depositing onto a steel substrate (**claim 1**)
being a high temperature stainless steel (**claim 2**)
and metallurgically bonding thereto (**claim 1**)

- a continuous coating of a MCrAlX alloy, where
M = nickel, cobalt or iron or mixture thereof and
X = yttrium, hafnium, zirconium, lanthanum, scandium or combination thereof (**claim 1**),
having about 10 to 25 wt% chromium, about 6 to 15 wt% aluminum (**claim 12**)
and in which X is present in an amount of 0.25 to 1.5 wt% (**claim 4**)
the balance M (**claim 1**)

the coating being deposited in a thickness of about 50 to 500 µm (**claim 4**)

- additionally comprising depositing a surface layer of aluminum, aluminum alloy containing up to 50 wt% silicon, or aluminum alloy containing up to 60 wt% silicon, a total of up to 30 wt% of at least one of chromium and titanium, the balance at least about 20 wt% aluminum, and having a thickness of up to about 50% of the coating onto the coating (**claim 6**)

- additionally comprising depositing a continuous layer onto the stainless steel substrate before depositing the continuous MCrAlX coating to provide an interlayer between the stainless steel substrate and the coating effective to minimize or avoid the formation of continuous nitride or carbide layers at the coating and substrate interface (**claim 8**)

the interlayer being deposited by magnetron sputtering physical vapour deposition at a temperature in the range of 800 to 900°C (**claim 14**)
in a thickness of about 20 to 100µm (**claim 16**)

the interlayer is comprised of about 35 to 45 wt% aluminum, a total of about 5 to 15 wt% of at least one of chromium or titanium, and about 50 to 55 wt% silicon deposited onto the high temperature stainless steel substrate (**claim 12**)
the continuous MCrAlX alloy coating being deposited on the interlayer (**claim 12**)

the interlayer, MCrAlX coating with aluminum or aluminum alloy surface layer and substrate base alloy being heat treated (**claim 16**)

at a soak temperature in the range of about 1030 to 1160C (**claim 16**)
at a rate of temperature rise at a rate of about 10 to 20 Celsius degrees/minute (**claim 15**)
for a time effective to form a second interlayer between the base alloy and enrichment pool containing intermetallics of silicon and one or more of titanium or aluminum and the base alloying elements (**claim 16**)
and for at least about 10 minutes (**claim 4**)
in an oxygen free atmosphere for a time effective to diffuse the surface layer into the ***coating*** *(word added by the Board)* to provide a multiphased microstructure and to metallurgically bond the coating and interlayer to the substrate (**claim 12**),
and subsequently heat-treating in an oxidizing atmosphere at a temperature above about 1000 C for a time effective to form an alumina surface scale thereon (**claim 12**).

The combination of the various features defined in claim 1 as indicated above corresponds to the subject-matter generated by the claim dependencies of the claims as originally filed.

1.2 In order to arrive at the wording of claim 1 the following amendments were made when combining the wording of claims 1 to 4, 6, 8, 12, 14 to 16 as filed, in addition to a grammatical adaptation:

Claim as filed	amendments including explanations in brackets
1	A method for providing a protective coating having a non-catalytic surface on low carbon steel and stainless steel comprising depositing onto a steel substrate and metallurgically bonding thereto a continuous coating of a MCrAlX alloy, where M = nickel, cobalt or iron or mixture thereof and X = yttrium, hafnium, zirconium, lanthanum, scandium or combination thereof, having about ~~0 to 40 wt% chromium, about 3 to 40 wt% aluminum~~ **(replaced by a narrower range according to claim 12**) ~~and up to 5 wt% X~~ (**replaced by a narrower range according to claim 4**) the balance M
2	~~A method as claimed in claim 1 in which~~ the substrate is a high temperature stainless steel and ~~the McrAlX alloy comprises about 10 to 25 wt% chromium, about 5 to 20 wt% aluminum and up to about 3 wt% X, the balance M~~ (**replaced by narrower ranges according to claims 4 and 12**)
3	~~A method as claimed in claim 2, metallurgically bonding the coating to the substrate by heat-treating the coating and substrate to a soak temperature for a time effective to provide a multiphased microstructure change and to metallurgically bond the coating to the substrate~~ (**replaced by a more limiting wording according to claim 16**).
4	~~A method as claimed in claim 3 in which~~ X is present in an amount of 0. 25 to 1.5 wt% ~~and~~ in which the coating is deposited in a thickness of about 50 to 500µm and ~~the coating and substrate are heated to a soak temperature in the range of about 1000 to 1200 C and~~

	~~maintained at said soak temperature~~ (**replaced by a more limiting wording according to claim 16**) for at least about 10 minutes.
6	~~A method as claimed in claim 4~~ additionally comprising depositing a surface layer of aluminum, aluminum alloy containing up to 50 wt% silicon, or aluminum alloy containing up to 60 wt% silicon, a total of up to 30 wt % of at least one of chromium and titanium, the balance at least about 20 wt% aluminum, and having a thickness of up to about 50% of the coating onto the coating ~~and heat-treating the coating with aluminum or aluminum alloy thereon and the substrate at the soak temperature in an oxygen-free atmosphere to diffuse the surface layer into the coating and to metallurgically bond the coating overlay to the substrate~~ (**replaced by a more limiting wording according to claim 16**), ~~optionally followed by heat-treating in an oxidizing atmosphere to form an alumina surface scale thereon~~ (**corresponds to the teaching of claim 12 and is therefore rendered superfluous**).
8	~~A method as claimed in claim 6~~ additionally comprising depositing a continuous layer onto the stainless steel substrate before depositing the continuous MCrAlX coating to provide an interlayer between the stainless steel substrate and the coating effective to minimize or avoid the formation of continuous nitride or carbide layers at the coating and substrate interface.

12	~~A method as claimed in claim 8~~ in which the interlayer is comprised of about 35 to 45 wt% aluminum, a total of about 5 to 15 wt% of at least one of chromium or titanium, and about 50 to 55 wt% silicon deposited onto a high temperature stainless steel substrate, ~~depositing a continuous MCrAIX alloy coating, where M = nickel, cobalt or iron or mixture thereof and X = yttrium, hafnium, zirconium, lanthanum, scandium or combination thereof,~~ having about 10 to 25 wt% chromium, about 6 to 15 wt% aluminum ~~and up to about 3 wt% X,~~ (**changed according to the more limited range indicated in claim 4**) ~~the balance M,~~ onto the interlayer, ~~optionally depositing an aluminum layer onto the MCrAlXalloy coating~~, (**replaced by the wording of claim 6**) ~~heat-treating the substrate, interlayer, coating and aluminum or aluminum alloy surface layer at a soak temperature~~ (**replaced by the wording of claim 16**) in an oxygenfree atmosphere for a time effective to diffuse the surface layer into the coating, to provide a multiphased microstructure and to metallurgically bond the coating and interlayer to the substrate, and subsequently optionally heat-treating in an oxidizing atmosphere at a temperature above about 1000 C for a time effective to form an alumina surface scale thereon.
14	~~A method as claimed in claim 12~~ in which the interlayer is deposited by magnetron sputtering physical vapour deposition at a temperature in the range of 800 to 900 C and the interlayer, ~~the MCrAlX coating with the aluminum or aluminum alloy surface layer, and the substrate are heated to a soak temperature~~ (**replaced by the wording of claim 16**) ~~at a rate of temperature rise of at least 5 Celsius degrees/minute~~ (**replaced by the more limiting wording of claim 15**)

15	~~A method as claimed in claim 14 in which the interlayer, the MCrAlX coating with the aluminum or aluminum alloy surface layer and the substrate are heated to the soak temperature~~ (**replaced by wording of claim 16**) at a rate of about 10 to 20 Celsius degrees/ minute.
16	~~A method as claimed in claim 15~~ in which ~~the~~ interlayer is deposited in a thickness of about 20 to 100, um and the interlayer, MCrAlX coating with aluminum or aluminum alloy surface layer and substrate base alloy are heat treated at a soak temperature in the range of about 103 0 to 1160 C for a time effective to form a **second** interlayer between the base alloy and enrichment pool containing intermetallics of silicon and one or more of titanium or aluminum and the base alloying elements.

The table above, which is based on the corresponding table submitted by the appellant with the statement setting out the grounds of appeal, demonstrates that the adaptation in the wording of the claims does not change the technical teaching but is a necessary modification in order to merge the original claims together into one single claim.

In this context the Board observes that the amount for X is not defined consistently in the claims as originally filed. For example claim 12 as filed defines that X is present in an amount up to 3 wt% despite the fact that claim 12 depends on claim 4 which defines already that X is present in an amount of 0. 25 to 1.5 wt%.
By adapting the amounts according to the amounts indicated in the higher ranking claim the technical teaching is not changed but the ambiguity generated by

the inconsistent wording of the claims as filed is clarified.

In claim 1 the word "coating" is missing in line 39 of the clean version and line 45 of the annotated version respectively, which obviously has been omitted unintentionally during the redrafting of claim 1 (see page 2, last paragraph of the statement setting out the grounds of appeal). This is confirmed by the disclosure in paragraph [0012] of the A-publication (WO 01/94664 A1).

1.3 Furthermore, none of the objections listed in the contested decision applies anymore to claim 1 of the set of claims filed with the statement setting out the grounds of appeal.

1.3.1 The features
- "(A) centrifugally cast or wrought tubes or fitting intended for use in high-temperature environments" discussed in point 1.2 and
- "a heat treatment in the temperature range of 1030 to 1160°C" discussed in point 1.6
of the contested decision are not present in claim 1 as submitted with the statement setting out the grounds of appeal. Therefore the objections relating to them as raised in said points do not apply anymore.

1.3.2 The reasoning in points 1.3.8, 1.4.5, 1.5.3, 1.7.1 and 1.7.2 of the contested decision is based on the finding by the examining division that the amount for X as defined in claim 4 as filed has not been incorporated into the wording of claim 1.

The appellant reacted to the reasoning by submitting a new set of claims whereby new claim 1 requires that X

is present in the amount as defined in claim 4 as originally filed.

Hence, the reasoning in points 1.3.8, 1.4.5, 1.5.3, 1.7.1 and 1.7.2 of the contested decision does not apply anymore, since the features
- a continuous coating "having about 10 to 25 wt% chromium, about 6 to 15 wt% aluminum and in which X is present in an amount of 0.25 to 1.5 wt%"
- "up to about 50 % of the thickness of the coating" is
- providing an interlayer comprising certain amounts of aluminium, chromium or titanium and silicone
- "heat-treating in an oxidising atmosphere ..."

reflect the teaching of claims as originally filed.

As a consequence thereof, the respective objections referring to a missing teaching for these features in the description as originally filed in the remaining sections of points 1.3, 1.4, 1.5 and 1.7 of the contested decision are rendered meaningless.

1.4 The Board concludes that the appellant has made amendments to claim 1 which fully meet the objections on which the refusal of the application is based and which were notified by the examining division in the contested decision.

The remaining claims are also based on the teaching of the application as originally filed. Claims 2 to 4 correspond to claims 17 to 19 as filed. Claim 5 is based on the teaching on page 16, lines 17 to 22 as originally filed. Claim 6 corresponds to claim 41 as originally filed.

2. Remittal to the examining division

Under Article 11 RPBA 2020 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 concerning novelty and inventive step. Under these circumstances the Board considers it an undue burden to decide on these issues without a decision of the examining division. Thus a special reason exists for remittal of the case.

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

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance for further prosecution.

The Registrar: The Chairman:

C. Spira G. Ashley

Decision electronically authenticated