

Internal distribution code:

- (A) [-] Publication in OJ
- (B) [-] To Chairmen and Members
- (C) [-] To Chairmen
- (D) [X] No distribution

**Datasheet for the decision
of 16 May 2017**

Case Number: T 0748/14 - 3.2.03

Application Number: 06003154.9

Publication Number: 1666830

IPC: F41H5/04

Language of the proceedings: EN

Title of invention:

Armour plate with spall layers

Patent Proprietor:

Aceram Materials and Technologies Inc.

Opponent:

Krauss-Maffei Wegmann GmbH & Co. KG

Headword:

Relevant legal provisions:

EPC Art. 100(a), 56

Keyword:

Inventive step - (no)

Decisions cited:

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 0748/14 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 16 May 2017

Appellant: Aceram Materials and Technologies Inc.
(Patent Proprietor) 102 Fraser Street
Kingston ON K7K 2J2 (CA)

Representative: Boff, James Charles
Phillips & Leigh
5 Pemberton Row
London EC4A 3BA (GB)

Respondent: Krauss-Maffei Wegmann GmbH & Co. KG
(Opponent) Krauss-Maffei-Strasse 11
80997 München (DE)

Representative: Feder Walter Ebert
Patentanwälte
Achenbachstrasse 59
40237 Düsseldorf (DE)

Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 5 February 2014
revoking European patent No. 1666830 pursuant to
Article 101(3) (b) EPC.**

Composition of the Board:

Chairman C. Donnelly
Members: V. Bouyssy
W. Van der Eijk

Summary of Facts and Submissions

- I. European patent No 1 666 830 (in the following: "the patent") concerns a ceramic armour plate with anti-spall layers.
- II. The patent as a whole was opposed on the ground of Article 100(c) EPC and on one ground of Article 100(a) EPC (lack of inventive step).
- III. The opposition division decided to revoke the patent for lack of inventive step of claim 1 amended according to the main request before it, in view of patent US 5,326,606 (D3).
- IV. This decision has been appealed by the patent proprietor (in the following, "appellant").
- V. Oral proceedings before the Board were held on 16 May 2017.
- VI. Requests

The appellant requested that the decision under appeal be set aside and the patent be maintained in amended form on the basis of the set of claims filed as main request during the oral proceedings before the opposition division on 12 December 2013; and that the appeal fee be reimbursed.

The opponent (in the following, "respondent") requested that the appeal be dismissed.

VII. Claim 1 of the respondent's main request

Independent claim 1 as amended is directed to the following subject-matter (compared with claim 1 as granted, added passages are indicated in bold, deleted passages in strike-through):

"1. An armour plate, for use in a ceramic armour system, **characterised by comprising in front to back order:**

i) **a front spall layer comprising a polycarbonate sheath;**

ii) a ceramic plate;

~~ii) a front spall layer comprising a polycarbonate sheath;~~

iii) a rear spall layer comprising a polycarbonate sheath; ~~and characterized by comprising~~

iv) a backing comprising at least one layer of poly-paraphenylene terephthalamide fibres, polyethylene, glass fibres; or a metal,

the ceramic plate, rear spall layer, front spall layer, and backing being bonded together **such that the front spall layer is bonded to the front of the ceramic plate and the rear spall layer is bonded to the rear of the ceramic plate.**"

VIII. Cited evidence

In the statement setting out the grounds of appeal, and in the reply to it, the parties relied among others on the following documents which were filed in the opposition proceedings and are cited in the decision under appeal:

D2: US 4,908,083 A

D3: US 5,326,606 A

D10: EP 0 237 095 A1

D32: Witness statement of Mr Sanjeet Chana,
18 October 2013

IX. The arguments of the parties, insofar as relevant for the present decision, can be summarised as follows:

(a) Inventive step

Appellant's case:

Contrary to the decision of the opposition division, D3 cannot be considered as the closest prior art for consideration of inventive step. D10 is a more relevant prior art since it discloses a ceramic armour plate with anti-spall layers at both front and rear surfaces.

As acknowledged by the respondent, a difference with claim 1 from D10 lies in the selection of polycarbonate for the front and rear spall layers.

As outlined in witness statement D32, this feature unexpectedly results in a radical reduction of the extent both of spallation and of cracking of the ceramic plate as a result of prior ballistic impacts, and thus in an enhanced multi-hit capability. In fact, by providing spall layers at the front and rear surfaces of the ceramic plate, additional support against tension is provided and thus flexural waves in the ceramic plate upon impact are converted into longitudinal and surface waves which tend to dissipate more rapidly than flexural waves, leading to lower risk of radial cracking of the ceramic plate.

Thus, starting from D10, the technical problem objectively solved by the distinguishing feature is to improve the multi-hit capability of the armour plate.

There is no incentive in the cited art to solve this problem by replacing the spall layers of D10 with polycarbonate spall layers. D10 consistently teaches to use fabric materials impregnated with a synthetic adhesive as spall layers. D2 discloses armoured glass in which a polycarbonate rear spall layer is provided to protect persons standing behind the glass, while the front face of the glass, which receives the impact of a bullet, has no spall layer. The skilled person would not see D2 as providing any solution to the problem, particularly given the different ballistic properties of glass and ceramic. The armoured glass of D2 is designed to fully absorb the kinetic energy of a bullet by glass breakage (column 4, lines 55 to 61 in D2), while in D10 the kinetic energy of the bullet is absorbed by plastic deformation of the sub-layer 3 (page 5, lines 37 to 49 in D10).

Finally, apart from the spall layers not being made from polycarbonate, the armour plate of D10 lacks "a backing" as required in claim 1. In the context of this claim and in the relevant art, this term means a support layer which limits damage to the ceramic plate from impact by stiffening against bending stress, but has no ballistic function in its own right. The sub-layer 3 as disclosed in D10 cannot be seen as a backing layer in the sense of claim 1 because it is an integral part of the ballistic protection, designed to absorb the kinetic energy of the projectile to a considerable extent.

Respondent's case:

The subject-matter of claim 1 lacks an inventive step in light of the teaching of D10.

D10 discloses, in figure 2, a ceramic armour plate 1 comprising, in front to back order, a front spall layer 6, a ceramic plate 2, a rear spall layer 7, a sub-layer 3, a supporting layer 4 and a back layer 5. The layers 3, 4 and 5 form a multilayered "backing" in the broad sense of claim 1. Even though backing sub-layer 3 is designed to absorb the kinetic energy of a projectile by plastic deformation, this is not excluded by the claim wording. The ceramic plate 2, the spall layers 6 and 7 and the backing are bonded together such that the spall layer 6 is bonded to the front of the ceramic plate 2 and the spall layer 7 is bonded to the rear of the ceramic plate 2 (page 6, lines 13 to 16).

The backing sub-layer 3 is formed by a laminate of alternating metal plates 8 and fabric layers 9 of poly-paraphenylene terephthalamide filament yarns (page 6, lines 18 to 21 and line 29), and this takes away the novelty of feature (iv) of claim 1.

Each of the front and rear spall layers 6 and 7 is a thin layer with a total thickness of 0,1 to 2 mm, such as a glue-impregnated woven fabric of poly-paraphenylene terephthalamide (PPDT), polyethylene (PE), glass, polyacrylonitrile (PAN), polyvinyl alcohol (PVA) or the like material (page 5, lines 8 to 12 and page 6, lines 13 and 14). Therefore, the material of the spall layers 6 and 7 each form a sheath since they are relatively thin with respect to the ceramic plate and tightly bonded thereto.

The subject-matter of claim 1 thus differs from the armour plate as disclosed in D10 only in that the front and rear spall layers both consist of polycarbonate.

The appellant alleges that it follows from document D32 that this feature inevitably results in improved multi-hit capability for the armour plate. However, D32 only indicates that, in ballistic tests, an armour plate according to the claimed invention showed less cracking upon impact and thus exhibited enhanced multi-hit capability compared to armour plates having only a front, or rear, spall layer and to armour plates having no spall layer. Thus, starting from D10, the objective problem is simply to provide an alternative material for the front and rear spall layers.

Thin layers of polycarbonate are commonly used as spall layers for ballistic protection, in particular bullet proof glazing. For instance, D2 discloses the use of a thin polycarbonate sheet as rear spall layer of a bullet proof glass pane (column 2, lines 42 to 64) and teaches that this construction surprisingly can resist several bullets without spalling from the rear face (column 4, lines 55 to column 5, line 2). Thus, the skilled person would arrive at the claimed solution in an obvious manner.

(b) Reimbursement of the appeal fee

The appellant argued that the opposition division committed a substantial procedural violation because it did not inform the parties of its preliminary, non-binding opinion on inventive step before the oral proceedings. The appellant requested refund of the appeal fee based on this substantial procedural violation.

Reasons for the Decision

1. Inventive step
 - 1.1 D10 forms the most relevant starting point for the assessment of inventive step since it discloses a ceramic armour plate having front and rear anti-spall layers, whereas D3 does not specifically mention anti-spall layers.
 - 1.2 D10 discloses, in figure 2, an armour plate 1 for use in the ballistic protection of ground vehicles and aircraft and comprising, in front to back order, an anti-spall layer 6, a ceramic impact layer 2, an anti-spall layer 7, a sub-layer 3, a supporting layer 4 and a back layer 5. These layers are bonded together, whereby the anti-spall layer 6 is bonded to the front of the ceramic layer 2 and the anti-spall layer 7 is bonded to the rear of the ceramic layer 2 (page 6, lines 13 to 16). The anti-spall layer 6, the ceramic impact layer 2 and the anti-spall layer 7 respectively form "a front spall layer", "a ceramic plate" and "a rear spall layer" in the sense of claim 1.
 - 1.3 The sub-layer 3, the supporting layer 4 and the back layer 5 together form the back of the armour plate 1 and support the laminate composed of layers 6, 2 and 7. They thus form "a backing" in the broad sense of claim 1. Contrary to the appellant's opinion, the claim wording does not exclude that the "backing" has a multilayer structure. In fact, feature (iv) of claim 1 defines the backing as "comprising at least one layer". Further, the claim wording does not exclude that a backing layer absorbs the kinetic energy of the

projectile by plastic deformation, as does backing sub-layer 3 in D10.

- 1.4 The backing sub-layer 3 is formed by a laminate of alternating metal plates 8 and fabric layers 9 of poly-paraphenylene terephthalamide filament yarns (page 6, lines 18 to 21 and line 29). This anticipates feature (iv) of claim 1.
- 1.5 Claim 1 requires that the front and rear spall layers both comprise "a polycarbonate sheath". However, it is stated in D10 that the spall layers 6 and 7 shown in figures 1 and 2 consist of a woven fabric of glass or aramid yarns that are impregnated with a synthetic material, in particular a synthetic glue based on epoxy resin (page 6, lines 13 and 14). In the general part of D10, it is stated that both the front and rear spall layers have a total thickness of 0,1 to 2 mm and preferably consist of an epoxy-impregnated woven fabric of filament yarns having a modulus of elasticity of 10 GPa to 250 GPa, such as poly-paraphenylene terephthalamide (PPDT), polyethylene (PE), glass, polyacrylonitrile (PAN), polyvinyl alcohol (PVA) or the like material (page 5, lines 8 to 12). The spall layers 6 and 7 being relatively thin with respect to the ceramic plate and being tightly bonded thereto, they both form a sheath for the ceramic plate.
- 1.6 The subject-matter of claim 1 thus differs from the armour plate as disclosed in D10 only in that the thin front and rear spall layers are made from polycarbonate.
- 1.7 There is no apparent technical effect achieved by this distinguishing feature. The patent itself is silent about any effect associated with it.

- 1.8 The appellant alleges that the distinguishing feature unexpectedly results in less radial cracking of the ceramic plate upon impact and thus in improved multi-hit capability for the armour plate. To support this allegation, the appellant relies on witness statement D32 which documents that, in experiments in which projectiles were fired at multiple velocities at a range of different ceramic armour plates, plates according to the invention having front and rear spall layers of polycarbonate (PAT 1) showed less cracking following impact and thus enhanced multi-hit capability, compared to plates having only a front spall layer of polycarbonate (PAT 2), plates having only a rear spall layer of polycarbonate (PAT 3) and plates having no spall layers (PAT 4).
- 1.9 However, D32 does not provide a direct comparison of the cracking upon impact of the claimed armour plate and of those disclosed in the closest prior art D10, in particular those having front and rear spall layers which consist of woven fabrics of stiff yarns of PPDT, PE, glass, PAN or PVA.
- 1.10 Therefore, the appellant has not provided any evidence showing that the use of polycarbonate front and rear spall layers inevitably results in improved multi-hit capability over D10. In fact, as explained by the appellant itself, the multi-hit capability of the armour plate appears to be improved by the mere fact that the ceramic plate is confined or sandwiched between the front and rear spall layers. Since the ceramic armour plate of D10 shows this sandwich construction, it appears likely that it already has high multi-hit capacity.

- 1.11 In the absence of any evidence on file for a technical effect of the distinguishing feature, the Board concludes that, starting from D10, the objective technical problem to be solved can only be seen in the provision of an alternative composition for the thin front and rear spall layers.
- 1.12 The use of a thin polycarbonate sheet as spall layer is already known in the field of ballistic protection of vehicles and aircraft. For instance, D2 discloses that a thin polycarbonate sheet up to about 1 mm thick can act as an effective anti-spall layer when adhered to a rear glass face of an impact-resistant laminate, for use as bullet-proof windscreen in aircraft or as bullet-proof window in cars (column 2, lines 42 to 64; column 4, lines 55 to column 5, line 2). The skilled person seeking an alternative composition for the front and rear spall layers of D10 would therefore not need to exercise any inventive activity to apply thin polycarbonate sheets to sheathe the ceramic plate. Thus, the skilled person would arrive in an obvious manner at the claimed subject-matter. The fact that D2 is concerned with armoured glass would not hinder the skilled person from considering its teaching and applying it to the ceramic armour plate of D10. He would have no practical difficulty in bonding thin polycarbonate spall layers to the front and rear surface of the ceramic plate as disclosed in D10.
- 1.13 It follows that the subject-matter of claim 1 lacks an inventive step in the sense of Article 56 EPC when starting from D10.
2. The Board therefore confirms the decision of the opposition division that the opposition ground of lack

of inventive step (Article 100(a) EPC) prejudices the maintenance of the patent as amended.

3. Since the appeal is to be dismissed, the appellant's request for reimbursement of the appeal fee must in any event be refused (Rule 103(1)(a) EPC).

Order

For these reasons it is decided that:

1. The appeal is dismissed.
2. The request for reimbursement of the appeal fee is refused.

The Registrar:

The Chairman:



C. Spira

C. Donnelly

Decision electronically authenticated