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**Datasheet for the decision
of 21 November 2013**

Case Number: T 1664/11 - 3.2.03

Application Number: 99921114.7

Publication Number: 1080337

IPC: F41H 5/04

Language of the proceedings: EN

Title of invention:
Composite armor plate

Patent Proprietor:
Cohen, Michael

Opponents:
Rafael-Armament Development Authority Ltd.
Plasan-Sasa - Limited Partnership of Kibbutz Sasa

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no) - reformulation of the technical problem
not allowed"

Decisions cited:
T 0386/89, T 0452/05

Catchword:
-



Case Number: T 1664/11 - 3.2.03

DECISION
of the Technical Board of Appeal 3.2.03
of 21 November 2013

Appellant: Cohen, Michael
(Patent Proprietor) Kfar Etzion
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Respondent: Plasan-Sasa -
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
11 May 2011 concerning maintenance of European
patent No. 1080337 in amended form.

Composition of the Board:

Chairman: U. Krause
Members: G. Ashley
K. Garnett

Summary of Facts and Submissions

I. European patent EP-B1-1 080 337 relates to composite armour plates and panels. Grant of the patent was opposed by Rafael Armament Development Authority Ltd (Opponent 1) and Plasan-Sasa - Limited Partnership of Kibbutz Sasa (Opponent 2), citing the grounds of lack of novelty and inventive step (Article 100(a) EPC), insufficiency of disclosure (Article 100(b) EPC) and added subject-matter (Article 100(c) EPC).

II. The opposition division held that claim 7 of the main request was contrary to Article 123(2) EPC, and the subject-matter of claim 2 of the first auxiliary request did not have the right to claim priority from application IL 12454398 of 19 May 1998 and lacked an inventive step.

The single independent claim of auxiliary request 1A was held to meet the requirements of the EPC, and hence it was decided that the patent could be maintained on this basis. The decision was posted on 11 May 2011.

III. Notice of appeal was filed by the patent proprietor (hereafter the appellant) on 6 July 2011, with the appeal fee being paid on the same day. A statement containing the grounds of appeal was received on 19 September 2011.

The respondents (the opponents) did not submit a reply to the grounds of appeal.

IV. In accordance with Article 15 of the Rules of Procedure of the Boards of Appeal, the board issued a preliminary

opinion of the case, together with a summons to oral proceedings. In a letter dated 18 October 2013, the appellant withdrew its request for oral proceedings, stating that it would not be attending the oral proceedings should they take place, and requested that a decision be issued based on the submissions on file.

V. Requests

The appellant requests that the above decision be set aside and the patent be maintained on the basis of one of the sets of claims filed as the main or first auxiliary requests with the grounds of appeal, or on the basis of the claims found allowable by the opposition division (second auxiliary request).

There are no requests from the respondents.

VI. Claims

(a) Main Request

(i) Claim 1 reads as follows:

"1. A composite armor plate (10) for absorbing and dissipating kinetic energy from high velocity projectiles;

said plate containing a single internal layer of pellets (14) which are directly bound and retained in plate form by a solidified material (16) such that the pellets are bound in a plurality of adjacent rows; said solidified material (16) and said plate being elastic;

the pellets (14) having a specific gravity of at least 2;

the majority of pellets (14) each having at least one axis having a length in the range of from 6 to 19 mm and being bound by said solidified material (16) in said single internal layer of adjacent rows such that each of a majority of pellets (14) is in direct contact with six adjacent pellets (14) in the same layer to provide mutual lateral confinement therebetween;

said pellets (14) each having a major axis and a substantially regular geometric form with at least one convexly-curved end face oriented to substantially face in the direction of an outer impact-receiving major surface of said plate;

wherein said pellets (14) are arranged with their major axes substantially parallel to each other and oriented substantially perpendicularly relative to the outer impact-receiving major surface of said plate,

and wherein the weight of the plate does not exceed 45 kg/m²;

wherein said pellets are made of a material selected from the group consisting of glass, sintered refractory material, and ceramic material other than aluminium oxide;

characterised in that

each pellet (14) is other than an excluded body hereafter defined:

wherein the excluded body is cylindrical and has at least one convexly-curved end face, the ratio D/R between the diameter D of said cylindrical excluded body and the radius R of curvature of said at least one convexly-curved end face of said cylindrical excluded body is at least 0.64:1; and

in that the solidified material is a thermoplastic polymer."

(ii) Claim 2

Independent claim 2 reads as for claim 1, but with the following amendments:

- the majority of the pellets (14) are defined as each having at least one axis having a length in the range of from 20 to 75 mm; and
- the weight of the plate does not exceed 185 kg/m^2 .

(iii) Further Claims

Dependent claims 3 to 7 concern preferred embodiments of the composite armour plate of claims 1 and 2.

Independent claims 8, 10 and 14 relate to a multi-layered armour panel comprising a composite armour

plate, as defined in claims 1 to 7. Dependent claims 9 and 11 to 13 are directed to preferred embodiments of the multi-layered armour panels of claims 8 and 10 respectively.

(b) First Auxiliary Request

Claim 1 is as for the main request.

Independent claim 2 differs from claim 1 in that:

- it concerns a composite armour plate (10) for absorbing and dissipating kinetic energy from high velocity armour piercing projectiles;
- the majority of the pellets (14) are defined as each having a major axis having a length in the range of from 20 to 30 mm;
- the pellets are made of a material selected from the group consisting of boron carbide, titanium diboride, silicon carbide, magnesium oxide and mixtures thereof.

Dependent claim 5 of the main request has been deleted and the remaining claims renumbered.

(c) Second Auxiliary Request

The claims of the second auxiliary request correspond to those upheld by the opposition division. In particular, independent claim 2 of the main and first auxiliary requests has been deleted.

VII. Relevant Documents

The following documents, amongst others, were referred to in the contested decision:

- D1: WO-A-98/15796, published 16 April 1998.
- D2: EP-A-0 843 149, published 20 May 1998.
- D4: Roy C. Laible, "Ballistic Materials and Penetration Mechanics", Vol. 5, pages 135 to 143, Elsevier Scientific Publishing Company, 1980.
- D8: Janes International Defence Review, page 63, 9/1996.
- D12: F. Ko et al., "Characterization of Multifunctional Composite Armor", pages 947 to 956, Proceedings of the American Society for Composites, Eleventh International Conference, 1996.
- D16: IL 115397, published 16 August 1998.

VIII. Submissions of the Appellant

A summary of these submissions is as follows:

(a) Main Request

The opposition division considered that the subject-matter of claim 2 lacked an inventive step in view of either the combination of D1 and D2, or the combination of D1 and D16.

Starting from the prior art disclosed in D1, the appellant argued that the opposition division had applied the problem-solution approach incorrectly.

The claimed armour plate differs from that of D1 in that pellets having certain dimensions have been excluded, and in that the solidified material is a thermoplastic polymer.

The objective problem is not, as was argued by the opposition division, to provide armour plate with improved resistance to a subsequent projectile, following damage inflicted by a first projectile. In light of the novel features, the problem to be solved is to provide a composite armour plate which mitigates or eliminates wastage associated with damage of the armour plate. The solution to this problem, ie use of a thermoplastic polymer in combination with the pellets as defined in claim 2, is not rendered obvious by the cited prior art, and in particular by the combination of D1 with either D2 or D16.

(b) First Auxiliary Request

Claim 2 of the first auxiliary request is entitled to claim the priority of IL 12454398, dated 19 May 1998. As a consequence, documents D2 and D16 are no longer prior art for the assessment of inventive step. As with claim 2 of the main request, there is no suggestion of using a thermoplastic polymer as the solidified material for solving the problem of wastage of damaged armour.

(c) Second Auxiliary Request

This request concerns maintenance of the patent on the basis of the claims approved by the opposition division, and is protected by the doctrine of *reformatio in peius*.

Reasons for the Decision

1. The appeal is admissible.

Main Request

2. Priority

The opposition division held (point 4.2.2 on page 8 of the contested decision) that claim 2 is not entitled to claim the priority date of 19 May 1998, the reason being that the claimed range for the length of the pellet axis "from 20 to 75 mm" is not disclosed in the priority document, which only cites a range of 20 to 40 mm. This has not been contested by the appellant.

The consequence is that D2 and D16 are prior art documents according to Article 54(2) EPC for assessing inventive step of the subject-matter of claim 2.

3. Inventive Step (Article 56 EPC)

- 3.1 Starting Point

Document D1 discloses a composite armour panel comprising a single layer of ceramic pellets embedded in either epoxy resin or an aluminium alloy (see Figure 7 and the last paragraph on page 13).

The pellets are defined in claim 1 of D1 as follows:

"...substantially cylindrical in shape, with at least one convexly curved end face, wherein the ratio D/R between the diameter D of said cylindrical body and the radius R of curvature of said at least one convexly curved end face is at least 0.64:1."

Both the opposition division and the appellant see D1, and in particular the embodiment shown in Figure 7, as being the closest prior art, and the board sees no reason to depart from this view.

3.2 Difference

As set out in point 4.3.1 (page 9 of the decision), the subject-matter of claim 2 of the main request differs in that pellets having the shape given in claim 1 of D1 (see above) have been disclaimed. It is noted that the allowability of the disclaimer is not in issue.

A second difference is that the solidified material is defined as being a thermoplastic polymer.

3.3 Objective Problem to be Solved

3.3.1 Starting from D1, the opposition division defined the problem to be solved as providing an armour plate with improved resistance to a subsequent projectile (see first paragraph on page 13 of the decision).

3.3.2 The appellant disagrees with this definition, arguing that it does not relate to the two distinguishing features, in particular:

- pellets of the excluded shape are superior to pellets having other shapes; their exclusion in claim 2 does not provide a plate with improved ballistic properties;
- likewise, use of a thermoplastic polymer as a means for binding the pellets does not improve resistance to a second projectile.

3.3.3 The appellant defines the problem to be solved as "to provide a composite armour plate which mitigates or eliminates wastage associated with damage of the armour plate".

This problem basically concerns the recycling of armour plate. If an armour plate is hit, only a relatively small number of pellets are affected. The use of a thermoplastic resin enables undamaged pellets to be recovered easily from the material and to be used again.

3.3.4 The board agrees with the appellant that the problem formulated by the opposition division is, given the differences over D1, not appropriate.

However, the problems underlying the invention, as set out in the patent specification only relate to improvements in the ballistic properties of lightweight armour. The problem suggested by the appellant is different, namely the recycling of the armour plate. It is established case law of the boards of appeal that in certain circumstances the technical problem set out in a patent can be reformulated (see Case Law of the Boards of Appeal, 7th Edition, I.D. 4.4). However, any new problem or effect can only be taken into account if

it is derivable from the application (see for example T 386/89, point 4.3 and T 452/05, point 3.2).

The problems addressed by the present invention are set out in the patent specification as follows:

- reduction of weight (paragraph [0005]);
- cost of complex armour arrangements and synthetic fibres (paragraph [0008]);
- protection against multiple impacts (paragraphs [0015] and [0018]);
- protection against a range of different projectiles (paragraphs [0016], [0017]).

The appellant argues that recycling is made possible because the solidified material for the binder is a thermoplastic. Regarding the choice of material for a binder, the patent specification states (paragraph [0046]) that it is selected in accordance with the weight, performance and cost considerations applicable to the intended use of the armour. The properties of the solidified material (the binder) are described in more detail in paragraphs [0026] and [0028], where it is said that it can be any suitable material which retains elasticity on hardening, in order to allow curvature of the plate, to allow an elastic reaction to incoming projectiles and to increase the probability that a projectile simultaneously impacts several pellets.

There is thus no indication in the patent specification of recycling the pellets and that this is achieved by using a thermoplastic as the solidified material. Consequently, the problem as defined by the appellant is inappropriate.

3.3.5 The problem to be solved starting from D1 is seen simply as providing an alternative material for bonding the ceramic pellets.

3.4 Solution

Document D2 discloses composite armour plate containing pellets having a shape as defined in claim 2. Thermoplastics are suggested as suitable materials for binding the pellets (see D2, page 3, lines 4 to 5).

The appellant argues that D2 discloses the use of a thermoplastic binder only in armour having alumina pellets. D1, on the other hand is neither limited to such pellets nor mentions thermoplastics. The skilled person would understand from D2 that thermoplastics are only suitable for use with alumina pellets, and hence would not apply this teaching to D1. The board does not agree with such a narrow interpretation of the teaching of D2. Thermoplastics are generally known for binding hard particles in composite materials and D16 provides another example of their use for this purpose in the field of armour panels (see D16, page 13, third complete paragraph).

Starting from D1 it is obvious, following the teaching of D2, to bond pellets of the type defined in claim 2 using thermoplastics. Consequently, the subject-matter of this claim lacks an inventive step.

4. First Auxiliary Request

4.1 Claim 2 of the first auxiliary request reads as for claim 2 of the main request, but with additional features relating to the pellets, namely

- that each pellet has a major axis having a length in the range of 20 to 30 mm;
- that the pellets are made of a material selected from the group consisting of boron carbide, titanium diboride, silicon carbide, magnesium oxide and mixtures thereof.

4.2 These features are disclosed in dependent claims 3 and 5 of the application as originally filed (WP-A-99/60327) and in claims 4 and 6 of the priority document (IL 124543). The amendments thus meet the requirements of Article 123(2) EPC, and claim 2 is entitled to the priority of 19 May 1998. This means that documents D2 and D16 are not relevant for the assessment of inventive step.

4.3 Document D1 remains an appropriate starting point for assessing the inventive step of claim 2. The embodiments shown in Figures 9 and 10 of D1 have a major axis of 21.00 and 24.10 mm respectively, hence pellets whose major axes lie within the claimed range are known from this document. Although there is a reference in D1 to ceramic pellets in general, the preferred pellets are based on aluminium oxide (see page 5, second paragraph). The binder used in D1 is epoxy resin (page 13, third paragraph).

- 4.4 The subject-matter of claim 2 thus differs from that of D1 in terms of the choice of hard material for pellets and the use of a thermoplastic as the binding material.
- 4.5 The appellant defines the objective problem as for claim 2 of the main request and, as set out above, the board considers that this problem cannot be derived from the patent. Hence the objective problem to be solved starting from D1 is to select alternative materials for the pellets and the binder.
- 4.6 Use of the hard materials defined in claim 2 (see above) is well known in the art of making composite armour panels - specific examples are given in D4 (Table 1 on page 136), D8 (page 63, left-hand column) and in D12 (page 947, first paragraph of the introduction). It is thus obvious for the skilled person merely using his general knowledge to use pellets made from the materials defined in claim 2.
- 4.7 None of the available prior art documents published before the priority date of the disputed patent discloses the use of a thermoplastic as a matrix material for embedding the pellets. However, use of thermoplastics as a matrix material for ceramic particles is known in the field of composite materials. The appellant has not given any reason why it would not be an obvious choice for the skilled person, other than stating that D1 makes no teaching or suggestion to use a thermoplastic polymer as the solidified material. Consequently, the board concludes that selection of a thermoplastic as the solidified material is within the scope of the general knowledge of the skilled person,

and hence the subject-matter of claim 2 does not involve an inventive step.

5. Second Auxiliary Request

The claims of the second auxiliary request correspond to those upheld by the opposition division. As stated by the appellant, under the doctrine of reformatio in peius neither the Respondents nor the Board may contest these claims.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

C. Spira

U. Krause