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D E C I S I O N
of 10 November 1994

Case Number: T 0507/92 - 3.3.2

Application Number: 88311459.7

Publication Number: 0320182

IPC: C06B 47/14

Language of the proceedings: EN

Title of invention:
Emulsion explosive containing density reducing agent

Applicant:
DYNO NOBEL INC.

Opponent:
-

Headword:
Emulsion explosive/DYNO NOBEL

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"
"Obvious solution of a technical problem"

Decisions cited:

Catchword:

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0507/92 - 3.3.2

D E C I S I O N
of the Technical Board of Appeal 3.3.2
of 10 November 1994

Appellant: DYNO NOBEL INC.
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Decision under appeal: Decision of the Examining Division of the European Patent Office dated 10 January 1992 refusing European patent application No. 88 311 459.7 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: P. A. M. Lançon
Members: G. J. Wassenaar
J. A. Stephens-Ofner

Summary of Facts and Submissions

I. European patent application No. 88 311 459.7 (publication No. 0 320 182) was refused by a decision of the Examining Division. The decision was taken on the basis of Claims 1 to 11 as originally filed.

II. The Examining Division held that the subject-matter of claims 1 to 11 did not meet the requirements of Article 56 EPC, having regard to the following documents:

(1) US-A-4 708 753
(2) GB-A-2 187 182
(3) EP-A-0 161 821

In its decision the Examining Division took the view that it was doubtful whether the composition of Claim 1 was new over (1) but that, in any case, the subject-matter of the claimed compositions lacked inventive step in view of the prior art cited above. Their decision was based on the proposition that all the components of the claimed composition were disclosed in (1), and that both inorganic and organic microspheres were mentioned as density reducing agent. Accordingly the claimed choice of organic microspheres as density reducing agent was considered to be obvious.

III. The Appellant lodged an appeal against this decision. In the Statement of Grounds of Appeal, he argued that a prejudice existed against the use of organic microspheres in emulsion explosives. This argument was discussed in more detail in an affidavit of Mr. McKenzie, one of the co-inventors in respect of this application, filed with the Statement of Grounds. As an auxiliary request a new Claim 1 was filed, which

differed from Claim 1 as originally filed in a more restrictive definition of the emulsifier.

IV. In a communication of the Board, issued with the summons for oral proceedings, it was indicated that the subject-matter of Claim 1 on file (main and auxiliary request) seemed to lack novelty over (1), (2), EP-0 155 800 (4) and EP-A-0 213 786 (5) each taken individually.

V. By a telefax of 10 October 1994 the Appellant filed a new set of claims, which superseded the previous one. The new independent Claims 1 and 12, contained the additional feature that the organic microspheres are "essentially non-polar".

VI. In the oral proceedings, which were held on 10 November 1994, a still further set of claims was filed. Claim 1 of this set reads as follows:

"1. A water-in-oil emulsion explosive comprising a water-immiscible organic fuel as a continuous phase; an emulsified aqueous inorganic oxidizer salt solution as a discontinuous phase; an emulsifier and a solid density reducing agent; characterized by the combination of polypropenyl- or polybutenyl-succinic anhydride or phenol, each of which has been derivatized with an alcohol, amine or alkanolamine, as the emulsifier and essentially non-polar organic microspheres comprising a copolymer of vinylidene chloride and acrylonitrile as the density reducing agent."

With respect to this amended Claim 1, the Board referred to GB-A-2 132 999 (6), which document was cited in the search report, to show that microspheres comprising copolymers of vinylidene chloride and acrylonitrile have been used in the art of emulsion explosives as a density reducing agent. With respect to (6), the Appellant

argued that the present emulsifier was different and that it was not obvious that the present combination of polymeric emulsifier and polymeric microspheres would have the advantages discussed in the application.

VII. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the set of claims as filed during the oral proceedings. At the end of the proceedings the Board announced its decision to dismiss the appeal.

Reasons for the Decision

1. The appeal is admissible.

2. *Allowability of amendments*

The amendments limit Claim 1 to a combination of Claims 1, 3 and 4 as originally filed and independent Claim 10 to a combination of Claims 11 and 3 as originally filed; the non-polar character of the organic microspheres finds support in the description (column 1, lines 22 to 28). The set of claims under consideration, therefore, fulfils the requirements of Art. 123(2) EPC.

3. *Novelty*

None of the available prior art documents discloses water-in-oil emulsion explosive compositions containing, in combination, all the components of the present independent claims. Their subject-matter is therefore new in the meaning of Art. 54(1)and(2)EPC.

4. *Inventive step*

4.1 The closest prior art with respect to Claim 1 under consideration is (4). This document discloses a water-in-oil emulsion explosive exhibiting a long storage stability and comprising a water immiscible organic fuel as a continuous phase, an emulsified aqueous inorganic oxidizer salt solution as a discontinuous phase, an emulsifier and a solid density reducing agent. As suitable density reducing agents, hollow microspheres of glass and resinous materials (page 15, lines 20-22) are mentioned. As an example, a composition is disclosed containing as emulsifier a polyisobutenyl succinic anhydride/ethanolamine condensate and as density reducing agent glass microballoons (Example 4).

4.2 According to the description of the application under appeal, emulsion explosives tend to destabilize **if they are subjected to repeated handling or shearing action,** which takes place when the explosive is pumped into a container and is then transported to the blasting site there to be pumped from the container into the borehole. Instability under shear has, obviously, been a significant drawback in repumpable emulsion explosives containing solid density control agents. With respect to repumpable emulsions, it is also essential that the viscosity should remain low at low ambient temperatures as well (page 2 of the description as originally filed). None of these problems have been addressed in (4).

Starting from (4), the technical problem underlying the invention can be seen as the achievement of improved stability under shear and reduced viscosity at low temperatures.

According to Claim 1 this problem is solved by the use of organic microspheres in the form of a copolymer of vinylidene chloride and acrylonitrile as the density reducing agent. The original comparative examples, as listed in the Table, show that for comparable compositions under comparable conditions, the degree of crystallisation and the viscosity are reduced if glass microspheres are replaced with the claimed organic microspheres.

Thus the Board is satisfied that the said problem is solved by the composition of present Claim 1.

4.3 It remains therefore to be decided if, for solving the above stated problem, it was obvious to replace glass microspheres or organic microspheres of resinous materials, such as phenol-formaldehyde and urea-formaldehyde, which are also disclosed in (4), with the claimed vinylidene based microspheres.

4.3.1 The problem of reduced emulsion stability of emulsion explosives caused by the presence of glass microspheres (microballoons) was known in the art, and the problem is discussed in (6), page 2, lines 24-29.

Document (6) is a UK Patent Application published shortly before the publication of (4) and relating to the same field of emulsion explosives. According to (6) the said problem can be overcome by using microballoons of polymeric material. In the Examples microballoons formed from a copolymer of vinylidene chloride and acrylonitrile (Expancel) were used (page 3, lines 28-30). The emulsifier used in the Examples of (6) was sorbitan monooleate but the teaching of (6) is not limited to said specific emulsifier. A whole list of emulsifiers is given, including polymeric emulsifiers (page 2, lines 5-10). There is no indication that the

effect of increased stability by the use of the exemplified polymeric microballoons is linked to specific emulsifiers. Thus although the emulsifier used in the composition of present Claim 1 is not mentioned in (6), this document does give the skilled man a clear lead that the problem of reduced stability by the use of glass microspheres in emulsion explosives according to (4) could be solved by using the polyvinylidene based microballoons of (6), which are identical to those required by present Claim 1.

4.3.2 Document (6) does not provide information concerning the viscosity of the emulsions. In the Board's view, the viscosity is not only related to the nature of the solid particles but also to the amount of those particles. This view is confirmed by the table of comparative examples which shows that viscosity is always reduced if the amount of microspheres is reduced, independently of the nature of the microspheres and emulsifier. This functionality is different from the stability relationship, for which the table shows that for some emulsifiers (sorbitan monooleate) the degree of crystallisation is increased even if the amount of microballoons is reduced. In that case the effect can be clearly attributed to the nature of the microspheres, whereas with respect to the viscosity, the effect appears to be simply related to the amount of particles. Since the claimed polymeric microspheres are much lighter than glass microspheres, so that much less of the former are needed to obtain the same density, it would have been obvious to the skilled man that in solving the stability problem by replacing glass microballoons with a **reduced amount** of the claimed polymeric microballoons, the viscosity problem would be solved as well.

4.3.3 There is no indication of any detrimental effect associated with the use of said polyvinylidene based microballoons which would deter the skilled man from using them in compositions according to (4).

In the light of (6), the Appellant's allegation that the skilled man had to overturn a well-established technical prejudice against the use of organic microspheres in emulsion explosives fails. If such prejudice had existed before the publication of (6), the merit of turning over the prejudice belongs to the inventor of (6).

4.4 For these reasons the invention as claimed by Claim 1 under consideration lacks an inventive step within the meaning of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

P. Martorana P. A. M. Lançon