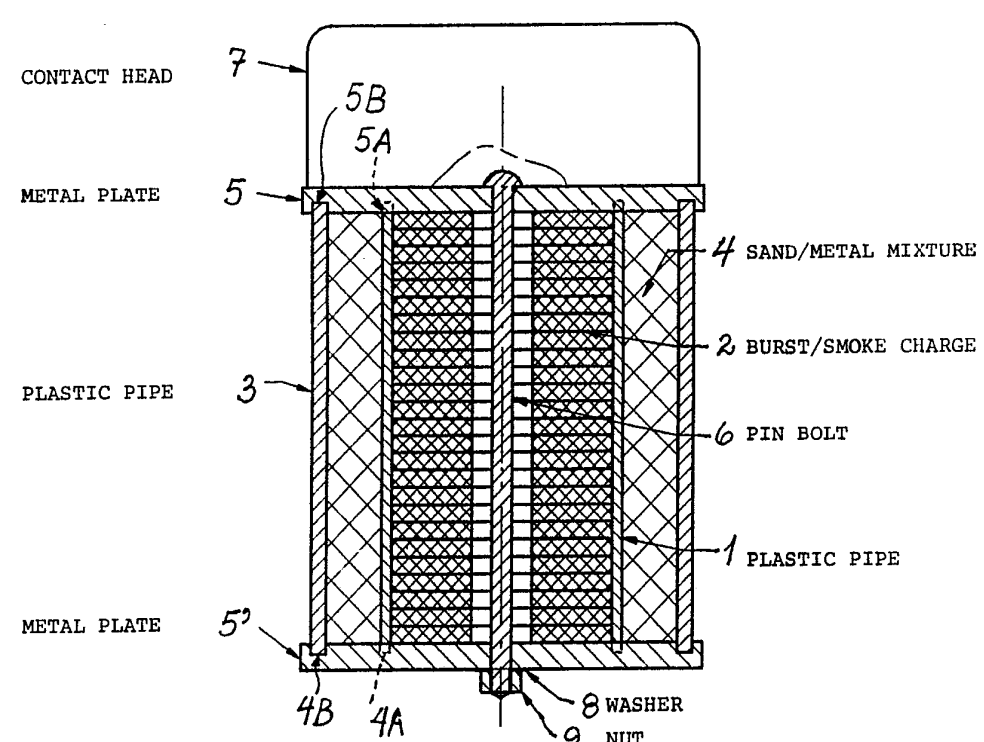


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/NO92/00006 (22) International Filing Date: 16 January 1992 (16.01.92) (30) Priority data: 910228 21 January 1991 (21.01.91) NO (71) Applicant (for all designated States except US): RAUFOSS A/S [NO/NO]; Box 2, N-2831 Raufoss (NO). (72) Inventor; and (75) Inventor/Applicant (for US only) : VARMO, Kjell, Ole [NO/NO]; Granittveien 28, N-2830 Raufoss (NO). (74) Agent: A/S OSLO PATENTKONTOR DR. ING. K.O. BERG; P.O. Box 7007 H, N-0306 Oslo 3 (NO). (81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE, DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB, GB (European patent), GR (European patent), IT (European patent), LU (European patent), MC (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report.</i> <i>In English translation (filed in Norwegian).</i>		
(54) Title: ARRANGEMENT IN A SMOKE SHELL 		
(57) Abstract The present invention relates to an arrangement in a smoke shell rendering protection in both the visible band, and/or the IR band and/or the millimetre band.		

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ARRANGEMENT IN A SMOKE SHELL

Field of the invention

- 5 The present invention relates to an arrangement in a smoke shell which generates smoke in both the visible and/or IR range and/or millimetre range.

Background of the invention

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- Modern weapon systems utilize today the infrared (IR) part of the electromagnetic spectrum in addition to the visible spectrum. Especially the weapon systems which have been developed to defeat armoured fighting vehicles, comprise
15 sighting devices operating in the infrared spectrum, which means that hostile objects can be observed and aimed at as well in daylight as in the dark.

- Further, modern weapon systems utilize the millimetre band
20 of the electromagnetic spectrum, for example in the range of 35-94 GHz, for observation, homing and destroying hostile objects.

Prior Art

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- What the prior art gives instructions for, for example as discussed in NO patent application 83.3740, is that for dissemination of copper powder there must be used a separate bursting charge, i.e. a further bursting charge in addition
30 to the charge which ignites the smoke elements.

- Besides, the prior art according to NO patent application 83.3740 gives instructions for smoke shells having an axial configuration, which includes a first chamber comprising
35 smoke elements, and a second chamber comprising copper powder, said two chambers being arranged one after the other in the axial direction, and without the smoke elements and copper powder mutually influencing each other for co-

ordinated dissemination of smoke in the visible band and the IR band or the millimetre band.

Also according to NO patent application 88.1063 there is suggested on the one hand smoke generators generating visible smoke, and on the other hand a container including powder and having its own bursting charge or explosive rod. That the two types of smoke should operate separately from each other, is also obvious from this publication, since it is suggested that the two containers including smoke generating, pyrotechnical mixture are separated from the powder mixture by letting a device which initially connects the two different chambers, burst, for example by the breaking of a rod.

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Summary of the invention

An object of the present invention is to provide a smoke system giving rapid protection over a large physical area, not only in the visible band, but also in the infrared and/or millimetre band of the electromagnetic spectrum.

According to the invention this is achieved in an arrangement in a smoke shell of the type as mentioned in the preamble, which is characterized in that the arrangement comprises a first inner container housing pyrotechnical instantaneous smoke elements associated with an ignition charge, as well as a second container arranged substantially radially in relation to the first container and being without an ignition charge, and housing means for smoke in the IR and/or millimetre band, such that the reaction of the pyrotechnical instantaneous smoke elements upon ignition of said smoke shell provides a large enough pressure for bursting also the outer container for thereby disseminating the instantaneous smoke elements over a smoke screening area together with the means for providing smoke screening in the IR band and/or millimetre band.

What is novel and characterizing in the present invention, thus appears in the replacement of the bursting charge for IR and millimetre smoke with the pyrotechnical charge itself which develops instantaneous smoke, and which contributes
5 directly to the dissemination of IR and millimetre smoke, the pyrotechnical instantaneous smoke elements upon ignition of the smoke shell rendering sufficient pressure for disseminating themselves and thereby the enclosing powder of said types of smoke.

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Further advantages and features of the present invention will appear from the following description and the appended patent claims.

15 Brief disclosure of the drawings

Fig. 1 is a side view partly in section of a first embodiment of an arrangement in a smoke shell according to the present invention.

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Fig. 2 is a section through an alternative embodiment of an arrangement in a smoke shell according to the present invention.

25 Description of embodiments

In Fig. 1 which illustrates a side view partly in section of a first embodiment of an arrangement in a smoke shell according to the present invention, reference numeral 1
30 designates an inner pipe, and this inner pipe 1 is filled with substantially disc-shaped smoke elements 2. Outside the inner pipe 1 there is provided an outer pipe 3, and in the intermediate space between the inner pipe 1 and the outer pipe 3 there is provided powder or particles 4 providing
35 screening in the IR band and/or powder or particles providing screening in the millimetre band.

The powder or particles obscuring in the IR band comprise

either separately or in combination metal powder, for example aluminum, possibly flakes of bronze or brass, graphite powder or organic salts, or similar, this powder or these particles preferably being mixed with a flow-improving or anti-agglomerating material, for example sand particles in the size band of approx. 0,3-1,5 mm.

The powder or the particles obscuring in the millimetre wave band comprise preferably materials which scatter or absorb such millimetre waves, for example chaff material, cut to appropriate small dipole lengths, for example 4,1 mm at 35 GHz and 1,5 mm at 94 GHz. Also here this material is preferably mixed with a flow-improving or anti-agglomerating material, for example sand particles in the size band of 0,3-1,5 mm.

A ratio between the IR obscuring and/or millimetre obscuring material and the flow-improving or anti-agglomerating material can appropriately be between 1:2 and 1:16.

20

The inner pipe 1 and the outer pipe 3 are manufactured preferably from plastic, and in the embodiment illustrated in Fig. 1, the two pipes 1 and 3 are kept together with round end plates 5 and 5', namely by means of a central bolt 6 including a washer 8 and a nut 9. Preferably the end plates 5 and 5' can be provided with circular tracks 4A, 4B and 5A, 5B, respectively, into which the end portions of the pipes 1 and 2 fit. To one of the end plates, here the end plate 5, there is attached a contact head 7 including an electrical ignition device, launching charge and time delay.

30

This embodiment of a smoke shell is ignited through a pyrotechnical delay and an ignition charge. The inner pipe 1 will then burst, and the effect of the burst will immediately result in the bursting of also the outer pipe 3, such that over a large physical area there are disseminated instantaneous smoke elements generating visual smoke, at the same time as there is taking place a dissemination of the

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powder or the material obscuring in the IR band and/or millimetre band. This is due to the the pressure inside the smoke shell, as the outer pipe 3 bursts, and the burning instantaneous smoke discs and the entrained material for obscuring the IR band and/or millimetre band are thus disseminated with large speed. It is to be understood that the object of the flow-improving or anti-agglomerating material, for example sand particles, is its functioning as a carrier material for the powder or the particles obscuring in the IR band and/or millimetre band.

In Fig. 2 there is illustrated a section through an alternative embodiment of an arrangement in a smoke shell, comprising an inner wall 11 enclosing substantially disc-shaped smoke elements 12, as well as an outer wall 13 embracing the inner wall 11 with a certain play, the intermediate space between the walls 11 and 12 being provided with a material 14 which upon dissemination obscurs in the IR band and/or millimetre band.

Also here there are provided end plates 15 and 15', respectively, holding the walls 11 and 13 together in an appropriate manner. Differently from the embodiment according to Fig. 1, there is here not used a central bolt for keeping the end plates 15 and 15' together, but instead there is provided a core of ignition charge 16. In the same manner as in the embodiment according to Fig. 1, there is in Fig. 2 attached to one of the end plates, here the end plates 15, a contact head 17 comprising an electrical ignition device, launching charge and delay unit 19, all of which is enclosed by a lid 18.

The mode of operation of this embodiment is analogue to the mode of operation of the embodiment according to Fig. 1.

P a t e n t c l a i m s

1. Arrangement in a smoke shell which generates smoke in both the visible and/or IR band and/or millimetre band,
5 c h a r a c t e r i z e d i n that the arrangement comprises a first inner container (1;11) housing pyrotechnical instantaneous smoke elements associated with an ignition charge, as well as a second container (3;13) arranged substantially radially in relation to the first container
10 (1;11) and being without an ignition charge, and housing means for obscuration in the IR or millimetre band, such that the reaction of the pyrotechnical instantaneous smoke elements upon ignition of the smoke shell provides a large enough pressure for bursting also the outer container (3;13)
15 for thereby disseminating the instantaneous smoke elements over a smoke screening area together with the means for providing obscuration in the IR and/or millimetre band.

2. Arrangement as claimed in claim 1,
20 c h a r a c t e r i z e d i n that the inner container is provided as a pipe (1;11) which is filled with a plurality of instantaneous smoke elements (2;12), and that the outer container is provided as a pipe (3;13) enclosing the inner pipe (1;11) with a certain play, and that the
25 space between the two pipes (11;13) is filled with means (4;14) which upon dissemination provide screening in the IR band and/or millimetre band.

3. Arrangement as claimed in any of the claim 1 or 2,
30 c h a r a c t e r i z e d i n that the inner pipe (1;11) is filled with substantially disc-shaped smoke elements (2;12), and that the outer adjacent space is filled with powder or particles (4;14) obscuring in the IR band and/or powder or particles obscuring in the millimetre band.

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4. Arrangement as claimed in claim 3,
c h a r a c t e r i z e d i n that the powder or the particles obscuring in the IR band, comprise either

separately or in combination metal powder, for example from aluminum, possibly flakes of bronze or brass, graphite powder of organic salts, or similar, and that this powder or these particles preferably are mixed with a flow-improving or anti-agglomerating material, for example sand particles in the size band of approx. 0,3-1,5 mm.

5. Arrangement as claimed in claim 3 or 4, characterized in that the powder or the particles obscuring in the millimetre band, comprise materials which are effective for scattering or absorbing such millimetre waves, for example chaff material which is cut to appropriate dipole lengths, for example 4,1 mm at 35 GHz and 1,5 mm at 94 GHz, and that these materials are preferably mixed with a flow-improving or anti-agglomerating material, for example sand particles in the size band of approx. 0,3-1,5 mm.

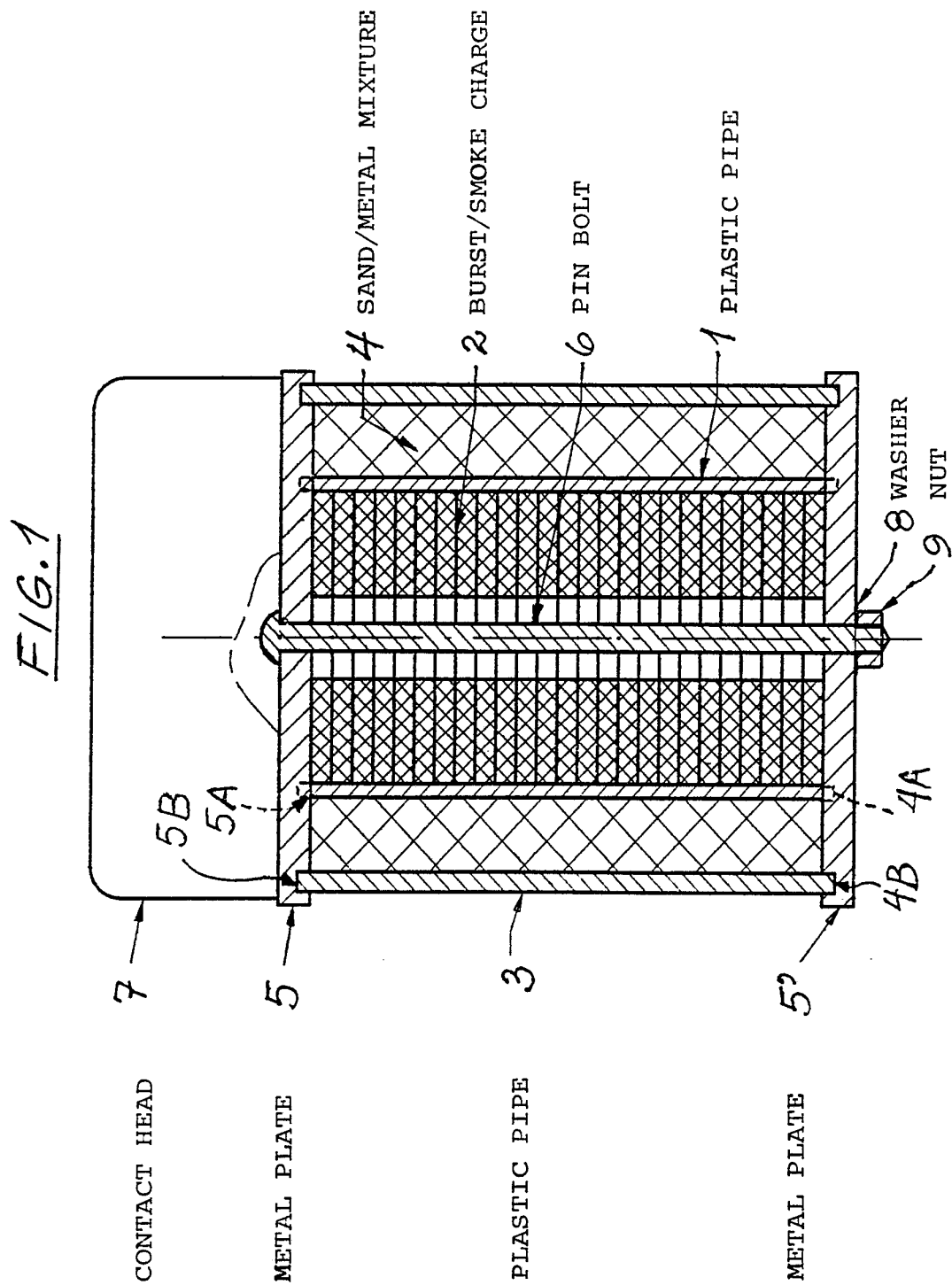
6. Arrangement as claimed in claim 4 or 5, characterized in that the mixture between the IR screening and/or the millimetre screening material and the flow-improving and anti-agglomerating material are between 1:2 and 1:16.

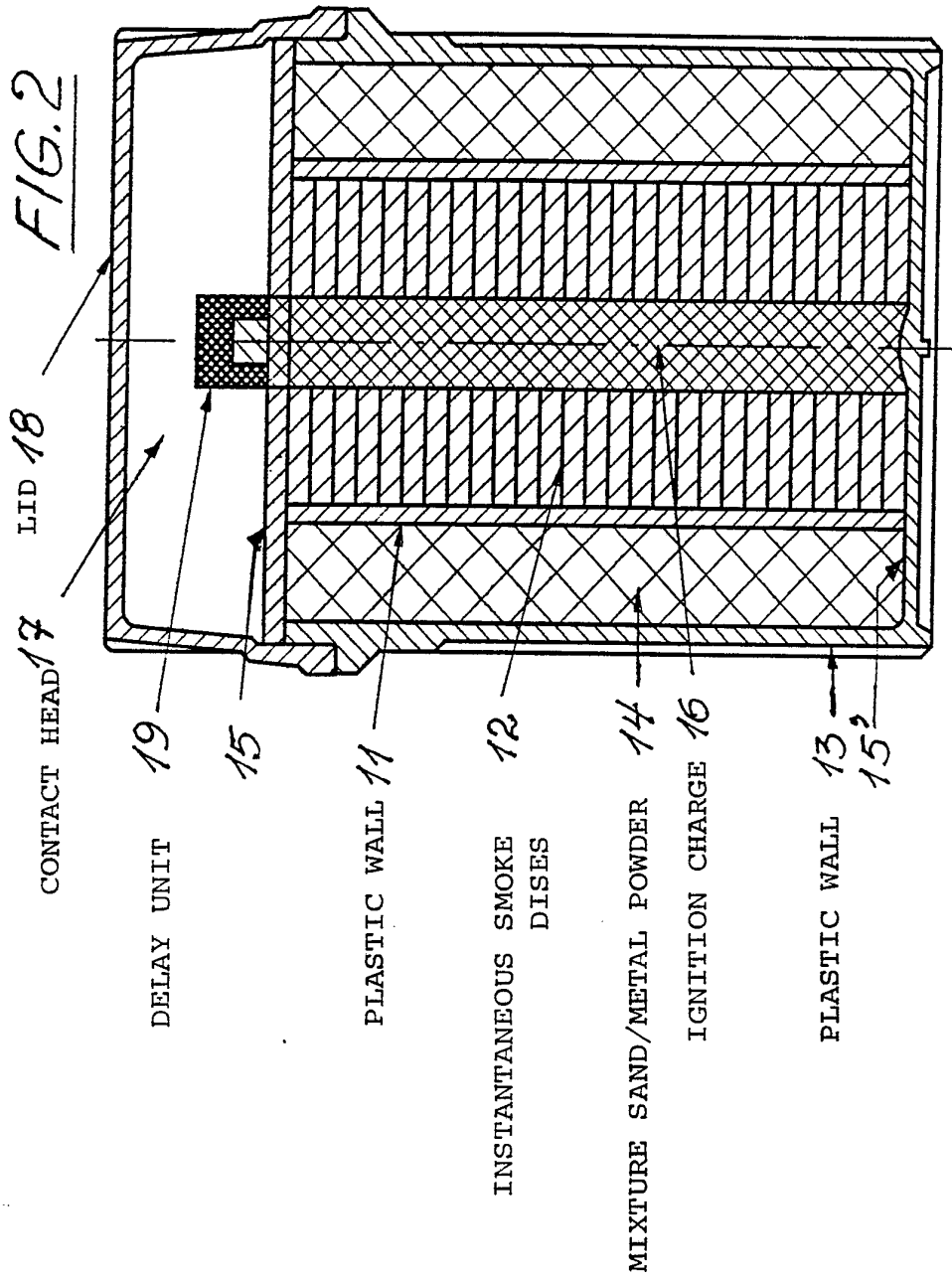
7. Arrangement as claimed in any of the claims 2-5, characterized in that the inner pipe (1) and the outer pipe (3) are made of plastic, and that the pipes (1, 2) are kept together between round end plates (5, 5') by means of a central bolt (6).

8. Arrangement as claimed in claim 7, characterized in that a contact head (7) including an electrical ignition device, launching charge and delay are attached to one of the end plates (5).

9. Arrangement as claimed in any of the claims 1-6, characterized in that in the first inner pipe (11), preferably of plastic, there is provided a core

of ignition charge (16) and around and outside this core (16) there is provided instantaneous smoke discs (12), and that outside the inner pipe (11) there is provided a mixture of IR screening and/or millimetre screening material, preferably including associated flow-improving or anti-agglomerating material, all of which are located in an outer pipe-shaped container (13) with an integral bottom plate (15') and releasable top plate (15) over which top plate (15) there is provided a lid (18).





INTERNATIONAL SEARCH REPORT

International Application No PCT/NO 92/00006

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: F 42 B 12/48																	
II. FIELDS SEARCHED Minimum Documentation Searched⁷ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; border: 1px solid black; text-align: left;">Classification System</th> <th style="width: 75%; border: 1px solid black; text-align: left;">Classification Symbols</th> </tr> <tr> <td style="border: 1px solid black; height: 40px; vertical-align: top;">IPC5</td> <td style="border: 1px solid black; vertical-align: top;">F 42 B</td> </tr> </table> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸ SE,DK,FI,NO classes as above			Classification System	Classification Symbols	IPC5	F 42 B											
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IPC5	F 42 B																
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; border: 1px solid black;">Category *</th> <th style="width: 60%; border: 1px solid black;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%; border: 1px solid black;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="border: 1px solid black; text-align: center;">A</td> <td style="border: 1px solid black;">EP, A1, 0293273 (ETAT-FRANCAIS) 30 November 1988, see the whole document --</td> <td style="border: 1px solid black; text-align: center;">1</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">A</td> <td style="border: 1px solid black;">DE, C2, 3035799 (AKSJESELSKAPET RAUFOSS AMMUNISJONSFABRIKKER) 23 December 1987, see the whole document --</td> <td style="border: 1px solid black; text-align: center;">1</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">A</td> <td style="border: 1px solid black;">DE, A1, 3048595 (DYNAMIT NOBEL AG) 22 July 1982, see the whole document --</td> <td style="border: 1px solid black; text-align: center;">1</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">A</td> <td style="border: 1px solid black;">NO, B, 142929 (A/S RAUFOSS AMMUNISJONSFABRIKKER) 4 August 1980, see the whole document -- -----</td> <td style="border: 1px solid black; text-align: center;">1</td> </tr> </tbody> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	EP, A1, 0293273 (ETAT-FRANCAIS) 30 November 1988, see the whole document --	1	A	DE, C2, 3035799 (AKSJESELSKAPET RAUFOSS AMMUNISJONSFABRIKKER) 23 December 1987, see the whole document --	1	A	DE, A1, 3048595 (DYNAMIT NOBEL AG) 22 July 1982, see the whole document --	1	A	NO, B, 142929 (A/S RAUFOSS AMMUNISJONSFABRIKKER) 4 August 1980, see the whole document -- -----	1
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* Special categories of cited documents:¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family																	
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 31st March 1992 </td> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report 1992-04-08 </td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;"> International Searching Authority SWEDISH PATENT OFFICE </td> <td style="border: 1px solid black; padding: 5px;"> Signature of Authorized Officer Johan Löfstedt </td> </tr> </table>			Date of the Actual Completion of the International Search 31st March 1992	Date of Mailing of this International Search Report 1992-04-08	International Searching Authority SWEDISH PATENT OFFICE	Signature of Authorized Officer Johan Löfstedt											
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/NO 92/00006

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 28/02/92
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A1- 0293273	88-11-30	FR-A- 2612287	88-09-16
DE-C2- 3035799	87-12-23	BE-A- 885423	81-01-16
		FR-A-B- 2466743	81-04-10
DE-A1- 3048595	82-07-22	NONE	
NO-B- 142929	80-08-04	NONE	