



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/SE88/00278</p> <p>(22) International Filing Date: 25 May 1988 (25.05.88)</p> <p>(31) Priority Application Number: 8702352-9</p> <p>(32) Priority Date: 4 June 1987 (04.06.87)</p> <p>(33) Priority Country: SE</p> <p>(71) Applicant (for all designated States except US): EXPLO- WELD AB [SE/SE]; Pl. 2712, S-713 93 Nora (SE).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only) : PERSSON, Ingemar [SE/SE]; Pl. 2585, S-713 00 Nora (SE).</p> <p>(74) Agent: ÖRTENBLAD, Bertil; Noréns Patentbyrå AB, Box 27034, S-102 51 Stockholm (SE).</p>		<p>(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FI, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US.</p> <p>Published <i>With international search report.</i></p>
<p>(54) Title: WATER-RESISTANT ELASTIC EXPLOSIVE MATERIAL</p> <p>(57) Abstract</p> <p>Explosive material consisting of one or several self-detonating explosives, such as PETN, HMX, TNT or RDX, desensitized by wax or water and one or several inert materials. The invention is characterized in that the inert material or a part thereof consists of a rubber of the type silicone rubber or latex rubber, which inert material constitutes matrix or binding agent, and that components comprised after being mixed together constitute a compound, which can be cast, extruded or rolled-out.</p>		

Water-resistant elastic explosive material

This invention relates to a water-resistant elastic explosive material.

It is known that explosive materials containing a self-
5 -detonating explosive, as for example PETN, HMX, RDX
or TNT, can be manufactured with casting plastics as
matrix.

The manufacture of these so-called PBX-explosives, how-
ever, is expensive and complicated, due to the fact, that
10 the self-detonating explosives must be added in sensitized
state, because the curing process of the plastic material
is affected considerably by existing desensitizing
agents, such as wax, oil or water.

Owing to their high sensitivity and the risks associated
15 therewith, the handling of sensitized explosives is
complicated and requires special premises and special
equipment, which limits the rate of production.

The mouldable plastics, as a rule, are per se injurious
to health and, therefore, require effective protective
20 equipment. When the temperature in the cast compound
is not kept under accurate control, local temperature
increases can be so high that the explosive reacts, res-
ulting in an explosion. The PBX-explosives at their
detonation or combustion also yield products which are
25 injurious to health or corrosive.

Explosive material according to the present invention
can be manufactured and used without the aforesaid
disadvantages and risks.

One desire is to be able to work with desensitized
30 explosives. It is, however, not possible to use mould-
able plastics as matrix material when the desensitizing
agent is, for example, oil or wax, because such plastics
solve the desensitizing agent. Water can also be used
as desensitizing agent, but for example water-desensit-

ized pentyl together with a mouldable plastic gives rise to a substantial increase in volume.

The present invention, however, renders it possible to work with desensitized explosives in order to produce
5 a water-resistant and elastic explosive material.

The present invention, therefore, relates to an explosive material consisting of one or several self-detonating explosives desensitized with wax or water, such as PETN, HMX, TNT or RDX, and one or several inert materials, and is characterized, in that the inert material
10 or a part thereof consists of a rubber of the type silicone rubber or latex rubber, which inert material constitutes matrix or binding agent, and that components comprised after their mixing together constitute a
15 compound, which can be cast, extruded or rolled-out.

As matrix and binding agent, thus, either silicone rubber or latex rubber can be used. Both these materials are innocuous to environment, non-toxic and do not give rise to dangerous temperature increases at curing.
20 They are entirely inert in relation to explosives such as PETN, TNT, HMX or RDX. At casting with silicone rubber or latex, for example, wax-desensitized PETN can be used.

At casting with latex also water-desensitized explosives can be used. Latex rubber, however, is restricted
25 to the casting of thin layers, because it must be possible that water evaporates at the curing. Layers of greater thickness, however, can be obtained by stacking or winding several cured thin layers one upon
30 the other. In the case of silicone as well as latex rubber further additions can be made, for example metal powder for adjusting the density or micro-spheres of plastic or glass for controlling the initiating capacity.

Some examples of explosive material according to the invention are described in the following.

Example 1

The following ingredients were weighed out and mixed:

- 5 37,6% wax-desensitized PETN (7% wax)
- 15% iron powder
- 6,4% micro-spheres of glass
- 41% silicone rubber

The mixture was cast in moulds to 25 mm layers. The
10 solidified explosive bodies detonated with the rate
7800 m/s.

Example 2

The following ingredients were weighed out and mixed:

- 87% wax-desensitized PETN
- 15 13% latex

The mixture was cast to layer thickness 3 mm. Strips of
16 mm width were initiated with detonator cap and deton-
ated with the rate 7800 m/s.

Example 3

- 20 A mixture according to Example 1 was cast to 3 mm layers.
A stack of five strips, 16 mm wide, was detonated with
a rate of 3500 m/s.

Example 4

A mixture of:

- 25 43% water-desensitized HMX
- 13,7% iron powder
- 5,9% micro-spheres of glass

The mixture was cast on gauze to a web of 3 mm thickness
and after casting was covered by an additional gauze.

- 30 The gauze was intended as mechanical reinforcement. Five
strips of 50 mm width were stacked upon each other and

initiated. The detonation rate was measured to be 3400 m/s. When another strip of 50 mm width was wound five turns one upon the other about a cardboard pipe of 100 mm diameter and detonated, the same detonation rate was obtained.

It is, thus, possible to manufacture explosive material with rubber of silicone or latex type in a simple way, which material has different thicknesses and properties. Charges of the type manufactured according to the formula in Example 1 above have proved to readily detonate at a water depth of 450 m, immersed into a water-filled mine. Even charges, which had been lying immersed during the period of one month, could be detonated without problem.

According to a preferred embodiment, the inert material consists, as mentioned, in addition to said rubber of a metal powder and/or hollow micro-spheres of glass or plastic.

According to another preferred embodiment, a mechanical reinforcement of a fabric, wires or fibres of textile material or glass fibres is located cast-in in the explosive material.

The inventor has discovered by experiments, that at explosive material containing latex rapid solidification on the surface can take place when the material is brought into contact with acetone or alcohol. Strings with a diameter of 7 mm, for example, were extruded down into a bath of acetone. Due to the surface solidification, the strings became so manageable that they could be wound on a drying reel. This condition facilitates substantially a mass production of the explosive material.

According to a preferred embodiment, therefore, the explosive material is made so that, when the matrix or binding agent consists of latex, a rapid solidific-

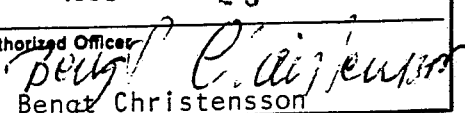
ation of the surface of the explosive material has taken place by the effect of a coagulating liquid such as acetone or alcohol.

Claims

1. Explosive material consisting of one or several self-detonating explosives, such as PETN, HMX, TNT or RDX, desensitized with wax or water and one or
5 several inert materials, characterized in that the inert material or a part thereof consists of a rubber of the type silicone rubber or latex rubber, which inert material constitutes matrix or binding agent, and that components comprised after being mixed
10 together constitute a compound, which can be cast, extruded or rolled-out.
2. Explosive material as defined in claim 1, characterized in that the inert material in addition to said rubber consists of a metal
15 powder and/or hollow micro-spheres of glass or plastic.
3. Explosive material as defined in claim 1 or 2, characterized in that a mechanical reinforcement of a fabric, wires or fibres of textile material or glass fibres is located cast-in in the
20 explosive material.
4. Explosive material as defined in claim 1,2 or 3, in cases when the matrix or binding agent consists of latex, characterized in that a rapid solidification of the surface of the explosive material
25 has taken place by the effect of a coagulating liquid, such as acetone or alcohol.

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE88/00278

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 ⁴				
C 06 B 45/06, 25/32, 25/34				
II. FIELDS SEARCHED				
Minimum Documentation Searched ⁷				
Classification System	Classification Symbols			
IPC 4	C 06 B 45/04-/10, 25/32-/34			
US C1	149: 17-18, 19.1-19.9, 92-93			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸				
SE, NO, DK, FI classes as above				
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹				
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³		
X	DE, B2, 2 027 709 (DYNAMIT NOBEL AG) 16 February 1978 See claim 1 & SE, 388601	1		
X	EP, A1, 0 208 665 (NOBEL KEMI AB) 14 January 1987 See claim 1 & SE, 449527 US, 4718346	2		
A	US, A, 3 151 010 (CHARLES C BICE) 29 September 1964 See column 4, lines 35-64	1		
A	US, A, 2 067 213 (WALTER O SNELLING) 12 January 1937 See claims 1-2	1		
A	US, A, 4 019 932 (SCHROEDER) 26 April 1977 See claims 1-2 .../...	1		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <ul style="list-style-type: none"> • 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 </td> <td style="width: 50%; border: none; vertical-align: top;"> <ul style="list-style-type: none"> "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. "G" document member of the same patent family </td> </tr> </table>			<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> "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. "G" document member of the same patent family
<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> "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. "G" document member of the same patent family 			
IV. CERTIFICATION				
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report			
1988-08-15	1988 -08- 23			
International Searching Authority	Signature of Authorized Officer			
Swedish Patent Office	 Bengt Christensson			

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 3 376 175 (R D SHEELINE) 2 April 1968 See claims 1-2	1
A	US, A, 3 104 995 (WILLIAM B REYNOLDS et al) 24 September 1963 See claim 1	1
A	NO, B, 153 452 (SCHWEIZERISCHE EIDGENOSSENSCHAFT VERTRETEN DURCH DIE EIDG. MUNITIONSFABRIK THUN DER GRUPPE FÜR RÜSTUNGSDIENSTE) 16 December 1985	1