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The title of the invention has been amended (Guidelines for Examination in the EPO, A-III, 7.3).

54 **Detonator hollow charge.**

57 An arrangement in explosive devices, e.g. shells, mines, bombs or the like, including a fuse (3), a main charge (1) and an auxiliary charge (4) which is disposed between the fuse and the main charge and effective in detonating the main charge. The main charge (1) is encapsulated in a safety casing and separated from the auxiliary charge (4) by different mechanical obstructions. In accordance with the invention, the auxiliary charge (4) comprises a charge having directed explosive action of the type which on being detonated produces a mass jet of high-order energy and high velocity. The auxiliary charge is oriented such that after penetrating an intermediate mechanical obstruction the jet will penetrate into the main charge, therewith detonating the main charge. To this end, the auxiliary charge (4) is spaced from the mechanical obstruction (11) by a distance sufficient to enable the jet to develop to the extent required, before meeting the obstruction.

Description

An arrangement in explosive devices

The present invention relates to an improvement in explosive devices, e.g. shells, mines, bombs or like devices, which include a fuse, a main charge and an auxiliary charge arranged between the fuse and the main charge and effective in detonating the main charge, which is encapsulated and separated from the auxiliary charge with the aid of mechanical obstacles.

The main charge of an explosive device constructed in accordance with the above is usually placed in a strong casing. The casing is utilized, inter alia, for reasons of safety, e.g. as protection during transport and storage. Its purpose is, inter alia, to protect against blows and knocks and other extraneous effects. Moreover, the casing is normally required to be impervious, such as to allow the explosive device to be stored for long periods under hard conditions.

In order to achieve reliable detonation of the main charge in spite of the presence of its safety casing, there have been previously used different types of arming safety means or moveable mechanical parts, e.g. for rotating an opening in the casing into register with an auxiliary detonating charge. Alternatively, a casing which incorporates weakened portions can be used, although this will also present certain drawbacks. Apart from a decrease in safety, means of the kind mentioned above also result in extra costs and design restrictions.

In the detonation of such encased main charges, normally an auxiliary charge, a so-called BOOSTER, is used as a connecting link in the explosive chain between fuse and main charge. Depending on the size of the main charge, this BOOSTER can assume large dimensions, e.g. 1-1.5 kg.

If an additional barrier is located between the BOOSTER and the main charge, e.g. in the form of a sheet metal plate, a plastics plate, water or some other material, or combinations therebetween, the size of the BOOSTER must be increased in order for it to perform its task of detonating the main charge.

The main object of the present invention is to provide an arrangement which will permit simple and reliable detonation of an encased main charge without utilizing arming safety means or other mechanical parts or weakened portions, while using a considerably smaller charge than has been required previously.

The invention is based on the knowledge that the abovementioned object can be achieved with the aid of an auxiliary charge which has a directed explosive action of the type which on detonation achieves a mass jet of high energy and high velocity. Such charges, known as "shaped charges" or "hollow charges", are utilized today mainly for providing greater penetrative power, primarily against armour plating. It has also been proposed to utilize small charges of this kind in different fuse systems, but never for solving the specific problems encountered in conjunction with detonating encased main charges. Civil applications are also to be found.

Much smaller charges can be used when conventional BOOSTER charges are replaced by such shaped or hollow charges. As a result of the large penetrative power of such charges, the encasement and configuration of the main charge can be decided upon essentially without regard to detonation problems, since the jet generated by such a shaped or hollow charge will penetrate far into the main charge in any case. However, it is necessary to position the shaped charge at a given distance from the main charge, so that the jet has time to develop to the extent necessary to penetrate the main charge.

An inventive device of the kind mentioned in the introduction is characterized in that the auxiliary charge comprises a charge which has a directed explosive action and of the type which achieves on detonation a mass jet having high-order energy and high velocity; in that the auxiliary charge is oriented so that the jet will penetrate into the main charge subsequent to penetrating intermediate mechanical obstruction; and in that the auxiliary charge is spaced from said mechanical obstruction such that the jet has time to develop sufficiently prior to meeting the obstruction.

When the auxiliary charge includes a charge with a metal lined cavity which expands conically in the jet direction, it is preferred that the distance between the auxiliary charge and the mechanical obstruction substantially corresponds to the largest diameter of the auxiliary charge cavity. The jet path should be free from every element which can affect the development of the jet, and said path is preferably represented by an enclosed space filled with air but otherwise empty. This will ensure that the jet has time to develop, such as to obtain the required penetrative power.

For locating and directing the auxiliary charge in a desired manner relative the main charge and to ensure that the auxiliary charge is sufficiently spaced from said mechanical obstruction, it is preferred to arrange the auxiliary charge at the outer end of a tubular device, the other end of which is closed off and fastened to a protective casing enclosing the main charge.

It is preferred that the tubular device projects out through an opening in the protective casing of the main charge and that the inward end of said device is provided with a flange connected to the protective casing on the surface surrounding the opening. A sealing element is suitably arranged between the flange and the interior surface of the protective casing.

The invention will now be described in more detail with reference to the accompanying drawing, the single Figure of which schematically illustrates a section through a part of a main charge to which there is connected an auxiliary charge having a detonator.

The numeral 1 denotes the main charge itself, which can be moulded or pressed and comprises a commercially available explosive, such as HEXO-

TOL, OKTOL, HEXOTONAL and OKTONAL, plastically bonded explosives, etc.

The main charge 1 is enclosed in a strong protective casing 2, which protects the charge against external forces. Further mechanical obstruction may be present between the casing and the charge.

The numeral 3 denotes a conventional fuse which is disposed for detonating an auxiliary charge 4 having directed explosive action and having the form of a hollow or shaped charge. The hollow or shaped charge 4 includes an explosive 5 which can be detonated by the fuse 3, the explosive being provided with a cavity 6 widening in a direction towards the main charge 1, this cavity being lined with a metal lining 7, suitably a copper lining.

The sleeve-shaped hollow charge is fixed in the outer end of a tubular connector 8, which extends through an opening in the protective casing 2. The inward end 11 of the tubular connector 8 is closed off and provided with a flange 9, which is connected to the protective casing on the surfaces surrounding the opening, e.g. with the aid of screws 10. A sealing element (not shown) is preferably applied between the flange 9 and the interior surface of the casing 2.

As a result of the closed off end 11 of the tubular connector 8, the main charge can be kept encapsulated in a protective casing without weakened portions or moveable parts which are to be moved relative each other. The closed end 11 presents a mechanical obstacle which is penetrated by the mass jet from the shaped or hollow charge when the charge is detonated, the jet then penetrating deeply into the main charge and therewith effects satisfactory detonation of the charge. The shaped or hollow charge is arranged with given spacing from the closed end 11, this spacing being sufficiently great to enable the jet to develop to the required extent, before it reaches the mechanical obstruction represented by the end 11. It has been found that this spacing should be of the same order of magnitude as the calibre of the shaped or hollow charge, i.e. a distance substantially corresponding to the largest diameter of the cavity 6.

By utilizing a closed tubular connector in accordance with the illustrated embodiment, there is achieved the advantage of intact encapsulation of the main charge while, at the same time, ensuring that the shaped or hollow charge will be correctly oriented relative the main charge and fixed at a pre-determined distance from the first true mechanical obstruction. Moreover, the jet path between the shaped or hollow charge and the mechanical obstruction will be free from other elements which can affect the development of the jet.

As a result of rotational symmetric compression of the metal insert 7 of the shaped or hollow charge when the auxiliary charge is detonated, the jet will take the form of a short pulse consisting of metal from the insert 7. As mentioned above, the metal insert will punch through the end enclosure 11 and penetrate deeply into the main charge 1, such as to detonate the charge. This will occur irrespective of whether there is further mechanical obstruction between the end closure and the main charge or not.

The invention thus permits the main charge to be configured and enclosed solely on the basis of the demands placed on such an enclosure without regard to detonation problems, since the latter can be solved in accordance with the present invention and essentially quite independently of the configuration and encapsulation of the main charge.

The above described embodiment of an arrangement according to the invention may, of course, be modified in several respects within the scope of the claims. This applies, for example, to the configuration or design of the auxiliary charge and the manner in which the charge is connected to the protective casing of the main charge.

Claims

1. An arrangement in explosive devices, such as shells, mines, bombs or the like, including a fuse (3), a main charge (1) and an auxiliary charge (4) which is arranged between the fuse and the main charge and effective in detonating the main charge, said main charge being encapsulated and separated by mechanical obstruction from the auxiliary charge, characterized in that the auxiliary charge (4) comprises a charge which has directed explosive action and of the type which on being detonated produces a mass jet of high-order energy and high velocity; in that the auxiliary charge (4) is oriented such that said jet penetrates into the main charge (1) after penetrating intermediate mechanical obstruction (11); and in that the auxiliary charge is spaced from said mechanical obstruction such that the jet is able to develop to the extent required before meeting said obstruction.

2. An arrangement as claimed in Claim 1, wherein the auxiliary charge includes a charge (5) with a metal lined cavity (6) which expands conically in the direction of the jet, characterized in that the spacing between the auxiliary charge (4) and said mechanical obstruction (11) corresponds essentially to the largest diameter of the auxiliary charge cavity (6).

3. An arrangement as claimed in Claim 1 or 2, characterized in that the jet path between the auxiliary charge (4) and said mechanical obstruction (11) is substantially free from any element which can affect the development of the mass jet.

4. An arrangement as claimed in Claim 3, characterized in that said jet path is represented by an enclosed space, filled with air but otherwise empty.

5. An arrangement as claimed in any one of Claims 1-4, characterized in that the auxiliary charge (4) is fixed in the outer end of a tubular element (8), the inner end of which is closed off and attached to a protective casing (2) encapsulating the main charge (1).

6. An arrangement as claimed in Claim 5, characterized in that the tubular element (8) projects out through an opening in the protec-

tive casing (2) enclosing the main charge (1); and in that the inner end (11) of the casing is provided with a flange (9) which is connected to the part of the inner surface of the protective casing (2) surrounding the opening.

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7. An arrangement as claimed in Claim 6, characterized in that a sealing element is mounted between said flange and the inner surface of the protective casing.

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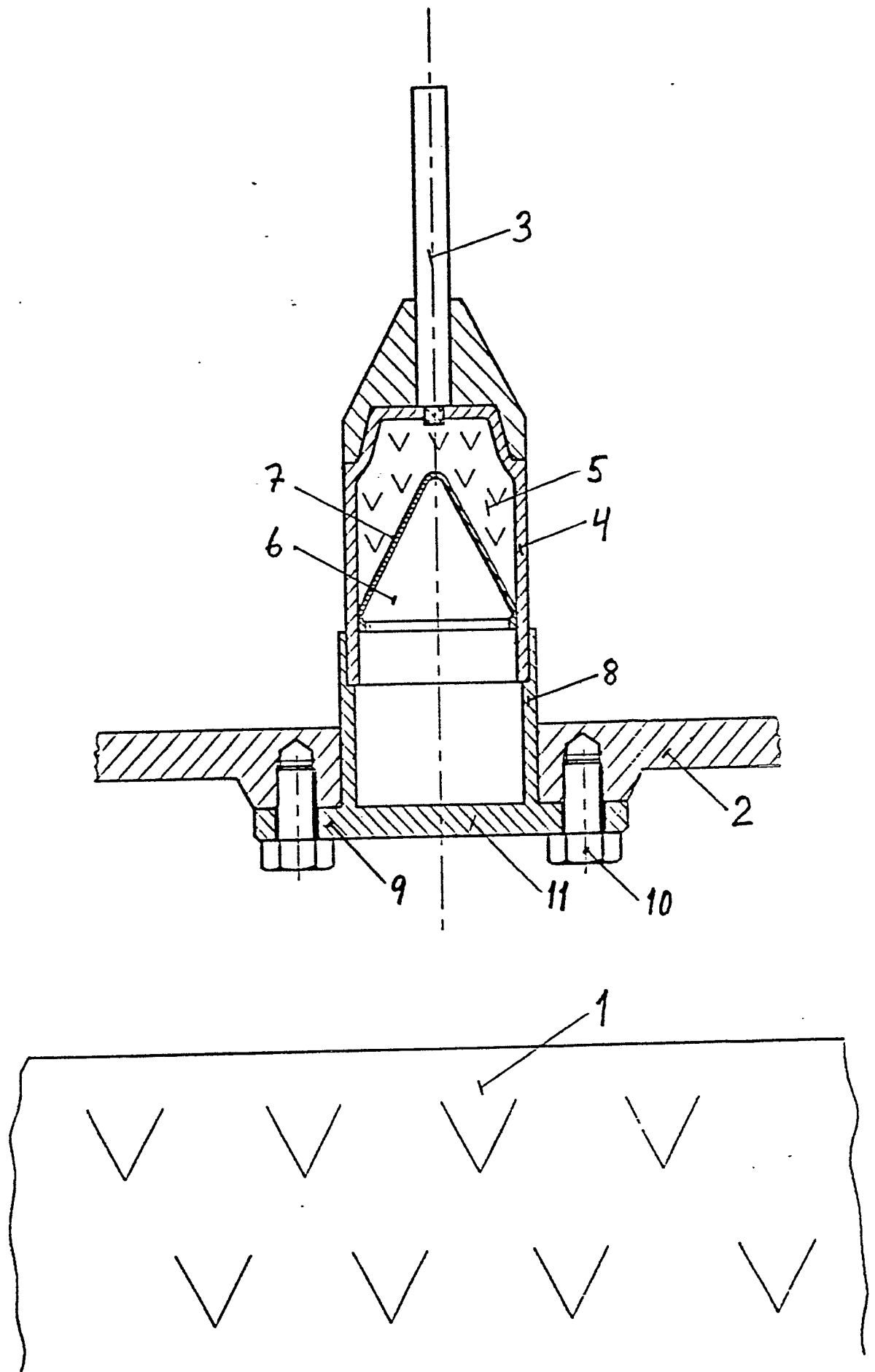
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DOCUMENTS CONSIDERED TO BE RELEVANT			EP 89850197.8
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ⁴)
X	AT - B - 251 462 (THE DOW CHEMICAL COMPANY) * Seite 1, Zeilen 8-13; Seite 3, Zeile 13 - Seite 4, Zeile 34; Fig. 1,2 *	1,2,3, 4	F 42 B 3/10
A	---	5	
A	DE - A1 - 3 340 534 (LUCHAIRE S.A.) * Gesamt *	1-4	
A	---		
A	DE - C2 - 3 116 930 (MESSERSCHMITT-BÖLKOW-BLOHM GMBH) * Gesamt *		

The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl. ⁴) F 42 B 1/00 F 42 B 3/00 F 42 B 23/00 F 42 C 19/00
Place of search VIENNA		Date of completion of the search 18-09-1989	Examiner KALANDRA
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			