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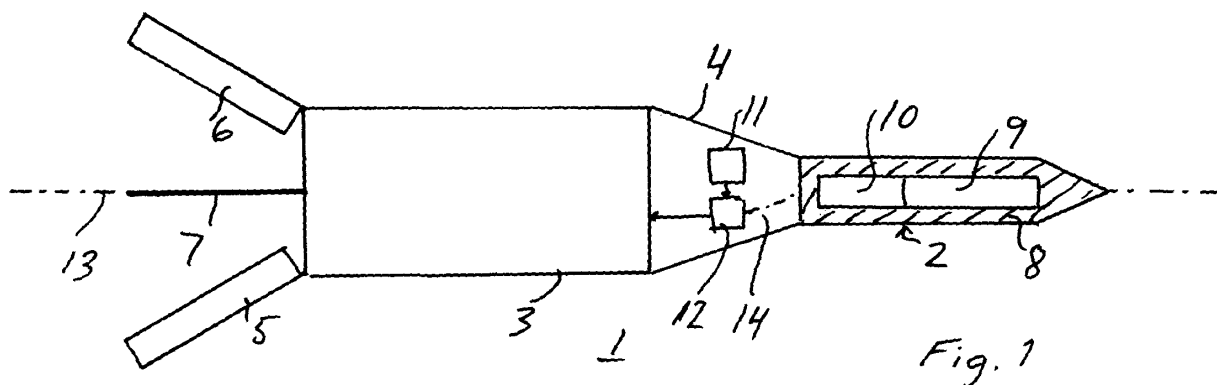
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(54) **Ammunition unit with kinetic precursor**

(57) The present invention relates to an ammunition unit (1) suitable for combat in urban terrain. The ammunition unit (1) is provided with a warhead comprising a kinetic pre-cursor (2), a main charge (3), an impact sensor and an ignition system (10). According to the invention a pre-charge (9) is accommodated in the kinetic pre-

cursor (2). The ignition of the pre-charge (9) is controlled by the ignition system by introducing a time delay between a sensed impact and the ignition of the pre-charge (9) and the ignition of the main charge (3) is controlled by the ignition system by introducing a further time delay before ignition of the main charge (3).



Description

[0001] The present invention relates to an ammunition unit, such as a shell, missile, charge carrying projectile or the like, having a warhead comprising a kinetic precursor, a main charge, an impact sensor and an ignition system.

[0002] An ammunition unit according to the above is i. a. previously known from published international application WO 90/12271. According to said publication and in particular figure 2, the ammunition unit is provided with a reinforced tip consisting of a separate body, preferably of heavy alloy, and with increased material thickness in the longitudinal direction. Such a tip is primary intended to be able to force aside reactive armour before the warhead of the shell in the form of a shaped hollow charge located in the intermediate portion of the shell is initiated. The ammunition unit is mainly intended for penetration of armoured targets provided with reactive armour.

[0003] When combating in urban terrain there is a desire to fight troops behind walls and to open up large openings in walls. In order to obtain such effects a warhead built up of more than one charge is likely to be required. A first charge, a pre-charge, makes a hole in the wall while a second charge, a main charge, detonates either inside the wall or behind the wall in dependence on desired effect. Warheads provided with two or more charges are per se generally known, see for example US 6,443,068 B1, US 4,803,928, US 4,063,512 and DE 196 38 295 B3.

[0004] In the application field discussed above it is important to keep the warhead weight down but nevertheless be able to obtain the desired effect out of the ammunition unit. It is also of great value to be able to make larger openings. Another important thing is to secure that the ammunition unit is safe for the operator.

[0005] The objects of the invention is to provide for a low weight ammunition unit that is safe in its construction and that at the same time offers desired effect when fighting troops behind walls and opening up large openings.

[0006] The objects of the invention is obtained by an ammunition unit according to the invention that is characterized in that a pre-charge is accommodated in the kinetic precursor, that the ignition of the pre-charge is controlled by the ignition system by introducing a time delay between a sensed impact and the ignition of the pre-charge and that the ignition of the main charge is controlled by the ignition system by introducing a further time delay before ignition of the main charge.

[0007] By introducing a pre-charge into the pre-cursor and igniting the pre-charge when the pre-cursor has penetrated into a target such as a wall, a hole or opening in the wall is created that a following main charge in an advantageous way can utilise to create a large opening by having the main charge detonating inside the wall in the hole or opening created by the precursor. Detonating or initiating the pre-charge of the precursor inside the wall is advantageous when making holes or openings

due to the fact that the precursor is covered by target material or damping material all around except from straight backwards towards the remaining ammunition unit. This results in a high efficiency of the energy created upon detonation. At the same time the detonation inside or behind the wall supplies the ammunition unit operator with a good protection. As an alternative it is also possible to have the main charge detonated behind the wall. There is still a good protection for the operator at the same time as the detonation of the main charge is effectively used behind the wall.

[0008] According to one favourable embodiment of the ammunition unit the pre-charge of the pre-cursor is provided with a forwardly effecting shaped charge. Such an ammunition unit is favourable when fighting an armoured vehicle protected by a basic armour and some kind of outer additional protection. In such a case the outer additional protection could be eliminated by means of the pre-cursor so that the basic armour is laid bare for the main charge.

[0009] According to another favourable embodiment of the invention a pre- precursor is provided in front of the precursor. According to this embodiment it is possible to obtain an even better effect with regard to thick targets. The pre- precursor detonates or penetrates into the target prior to the precursor.

[0010] Advantageously according to yet another favourable embodiment the precursor is designed with a weight between 1 and 5 kilograms. In that connection the weight of the pre-charge could be dimension to be more than 1/30 of the precursor weight and less than 1/10 of the precursor weight.

[0011] A suitable proposed dimensioning of the ammunition unit is that the kinetic precursor radius perpendicular to a rotational axis in the flight direction of the ammunition unit is preferably less than half the radius of the main charge.

[0012] According to a further advantageous embodiment of the ammunition unit the kinetic precursor is provided with an envelope of steel.

[0013] According to still a further advantageous embodiment of the ammunition unit a detonating fuse accommodated within the precursor operates as the impact sensor and the ignition system.

[0014] The invention will now be described in more detail with reference to the accompanying drawings in which:

Figure 1 is a schematic side view partly sectioned of an ammunition unit according to the invention comprising a first precursor embodiment.

Figure 2 is a schematic sectioned side view of a second precursor embodiment comprised in an ammunition unit according to the invention.

Figure 3 is a schematic sectioned side view of a third precursor embodiment including a pre- precursor

and comprised in an ammunition unit according to the invention.

[0015] The ammunition unit 1 shown in figure 1 comprises a precursor 2 and a main charge 3. The ammunition unit 1 that could be in the shape of a shell is covered by an envelope 4 surrounding the main charge and in connection with the precursor 2. In the rear end of the ammunition unit three fins 5, 6, 7 are indicated. The precursor 2 has a rigid envelope 8 preferably of a steel having a high strength. Within the envelope 8 there are accommodated an explosive 9 and a detonating fuse 10. The detonating fuse 10 operates as an impact sensor and a delay device. The main charge is preferably a charge having a considerable explosive effect radially from a rotational axis 13 of the ammunition unit 1. The main charge 3 can also have a considerably effect in the forward direction and in particular if it is equipped with a shaped hollow charge. According to the embodiment of figure 1 the main charge 3 is provided with a separate impact sensor 11 and a delay device 12 located between the precursor 2 and the main charge 3. Of course it is possible to locate the impact sensor 11 and delay device 12 otherwise. The impact sensor 11 has been shown as a box and this is meant to imply that any kind of known impact sensor solutions can be used that are suitable in this connection. Before initiation of the ammunition unit it is preferably housed in a not shown barrel.

[0016] When an operator activates the ammunition unit it is ejected from the not shown barrel and sent towards a target such as a wall. When reaching the target the ammunition unit 1 has acquired a not insignificant speed. The shape and weight of the precursor 2 in combination with its speed results in that the precursor 2 penetrates into the wall. The detonating fuse 10 announces that the precursor has hit the target and after a delay controlled by the detonating fuse 10, the explosive 9 is activated by the detonating fuse 10. The impact sensor 11 of the main charge 3 activates the main charge 3 after a time delay determined by the delay device 12. The time delay of the delay device 12 is chosen such that the main charge is not activated until the explosive of the precursor 2 has been detonated. As indicated by a dash-dotted line 14 connecting the detonating fuse 10 with the delay device 12, the impact sensor information of the detonating fuse could be used as an alternative to the separate impact sensor 11.

[0017] In figure 2 a second proposed embodiment of the precursor 2 is shown. An explosive 9 and a detonating fuse are arranged within the envelope 8 of the precursor in a similar way as for the first embodiment shown in figure 1. In addition to the mentioned components there is also provided a liner 15 to obtain the effect of a shaped hollow charge in the forward direction of the ammunition unit. When taking advantage of the shaped hollow charge effect possible outer additional protection is easily eliminated.

[0018] Figure 3 shows a third embodiment of the pre-

cursor 2. In this case there is a pre-precharge 15 provided in front of the precursor 2. The pre- precharge can be designed as a shaped hollow charge or an explosive body detonating or penetrating into the target prior to the pre-charge. The introduction of a pre- precharge enhances the effect of the ammunition unit with regard to thick targets.

[0019] The ammunition unit according to the invention is not limited to the embodiments described above, but can be modified within the framework of the following claims and concept of the invention.

Claims

1. An ammunition unit, such as a shell, missile, charge carrying projectile or the like, having a warhead comprising a kinetic pre-cursor, a main charge, an impact sensor and an ignition system, **characterized in that** a pre-charge is accommodated in the kinetic pre-cursor, that the ignition of the pre-charge is controlled by the ignition system by introducing a time delay between a sensed impact and the ignition of the pre-charge and that the ignition of the main charge is controlled by the ignition system by introducing a further time delay before ignition of the main charge.
2. An ammunition unit as claimed in claim 1, **characterized in that** the kinetic precursor radius perpendicular to a rotational axis in the flight direction of the ammunition unit preferably is less than half the radius of the main charge.
3. An ammunition unit as claimed in any of the preceding claims, **characterized in that** the kinetic precursor is provided with an envelope of steel.
4. An ammunition unit as claimed in any of the preceding claims, **characterized in that** a detonating fuse accommodated within the precursor operates as the impact sensor and the ignition system.
5. An ammunition unit as claimed in any of the preceding claims, **characterized in that** the precharge of the pre-cursor is provided with a forwardly effecting shaped charge.
6. An ammunition unit as claimed in any of the preceding claims, **characterized in that** a pre- precursor is provided in front of the precursor.
7. An ammunition unit as claimed in any of the preceding claims, **characterized in that** the precursor is designed with a weight between 1 and 5 kilograms.
8. An ammunition unit as claimed in claim 7, **characterized in that** the weight of the pre-charge is di-

mension to be more than 1/30 of the precursor weight
and less than 1/10 of the precursor weight.

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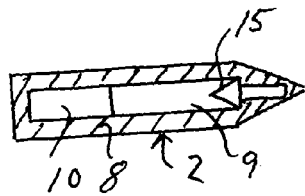
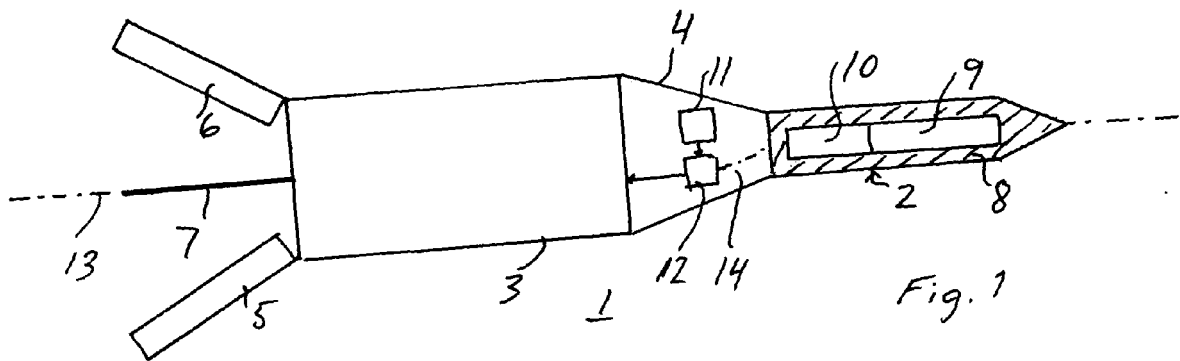


Fig. 2

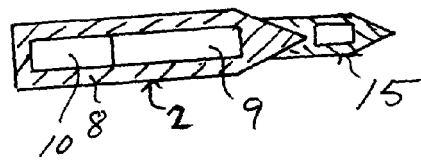


Fig. 3



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X	US 4 488 487 A (CROIZER ET AL) 18 December 1984 (1984-12-18)	1-4,6-8	F42B12/16
Y	* column 2, line 47 - column 3, line 8 * * column 3, line 6 - column 3, line 50 * * column 4, lines 3-48 * * column 5, line 20 - column 6, line 26 *	5	
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Y	DE 35 34 101 C1 (DEUTSCH-FRANZOESISCHES FORSCHUNGSINSTITUT SAINT-LOUIS, SAINT-LOUIS) 11 May 2000 (2000-05-11)	5	
A	* column 7, lines 20-33; figures 15,16 *	1-4,6-8	
D,A	WO 90/12272 A (AB BOFORS) 18 October 1990 (1990-10-18) * the whole document *	1-8	
			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 November 2005	Examiner Ziegler, H-J
CATEGORY OF CITED DOCUMENTS		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	
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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