Tandem warhead with piezoelectrical percussion fuses

The invention relates to a tandem warhead in accordance with the preamble of claim 1.

Tandem warheads are chiefly used to combat targets, for example tanks, which are provided with so-called ERA-boxes. ERA-boxes are explodable bodies which have the job of exploding when struck by a projectile in order to minimize thereby the ef the projectile.

A tandem warhead, for example an ant grenade launcher, is known from DE-OS 41 30 64 consists of a preliminary charge and a main charge coupled with spatial separation. The preliminary charge is ignited before the main charge and effects primary damage to the target struck, so that the temporally delayed main charge is fully effective. The ignition of the main charge takes place without contact by way of the preliminary charge, namely by way of light which is generated by the preliminary charge upon its detonation. For this purpose, a photodiode is arranged in the circuit of the fuse of the main charge, the photodiode responding shortly after the detonation of the preliminary charge.

To achieve maximum damage to the target struck, the main charge must be ignited after an accurately established instant after the detonation of the preliminary charge. In DE-OS 41 30 646, this is achieved with a delay part which is arranged in the circuit of the fuse of the main charge.

DE-OS 39 42 841 describes a tandem warhead of the type mentioned above, wherein the main charge has a piezoelectrical percussion fuse. Piezoelectrical percussion fuses essentially contain an electrical transformer (percussion sensor) for generating the ignition voltage and a detonator. The ignition voltage

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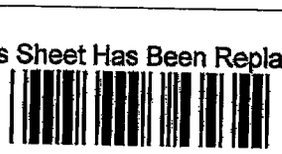

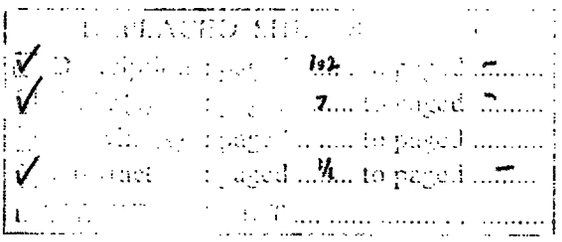

for the detonator arises when, upon striking a target, a shockwave strikes the contact sensor. Piezo-elements are used as sensors. The ignition of the main charge does not takes place accordingly without contact.

The manner of functioning of a piezoelectrical contact fuse is described, for example, in DE-PS 1 145 522 or US-PS 2,894,457.

The object of the invention is to develop a tandem warhead in accordance with the preamble 1 in such a way that the ignition takes place contact, is absolutely reliable and to ignite charges, two fuses which are completely identi used, which are arranged separately as independent structural components behind the charges without electrical connections to one another and the detonation of the main charge takes place after a required delay period.

In accordance with the invention, this object is achieved by the fuse of the preliminary charge also comprising a piezoelectrical percussion fuse, which can be triggered by a shockwave, and the housing construction as well as the arrangement of the fuses and the material composition of the housing being selected such that the propagation time of the shockwave gives rise to a desired delay of the main charge.

Through the use of piezoelectrical percussio fuses both for the preliminary charge and for the main charge, no mechanically moveable parts are used for the ignition. Moreover, two fuses which are completely the same are installed. In this way, the ignition device can be manufactured more securely and also more easily and thus more favourably in terms of cost, since no new official approval method is necessary. Piezoelectrical percussion fuses are distinguished by their high level of reliability. The propagation time of the shockwave

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until ignition of the main charge, and thus the desired, delay is to be established by the housing construction, the arrangement of the fuses and the material composition of the housing.

Advantageously, the preliminary charge together with its fuse is arranged in a spacer which can be moved out of the housing in flight direction, with the spacer consisting of two segments which can be inserted into one another. Seen in the flight direction, the preliminary charge is arranged foremost segment. Both segments can be insert the housing of the warhead.

Both charges, namely preliminary charge and main charge, are, in a preferred embodiment, hollow charges with the tandem warhead preferably being used as an antitank grenade launcher.

Both the fuses are piezoelectrical percussion fuses, as are described, for example, in DE-PS 1 145 522 or US-PS 2,894,457. Piezoelectrical percussion fuses essentially consist of a percussion sensor which conducts an ignition voltage to a detonator upon the striking of the shockwave. As known, the detonator subsequently causes a primary charge to explode, as a result of which the main charg or secondary charge is ignited. A delay charge can be arranged in the detonator.

Advantageously, the spacer has a front cap which is provided with a pulse attenuator. In this way the ignition reacts less sensitively.

Tests have shown that the first shockwave generated by the striking of the tandem warhead on a target generates in the piezoelectrical percussion fuse at the preliminary charge, or in the piezo-element arranged therein, an electrical voltage of far above 500 V. This voltage is far higher than is required by the detonator of the preliminary charge, with the

result that the preliminary charge is always ignited safely and reliably.

A little later, the same first shockwave reaches the piezoelectrical percussion fuse of the main charge. If the tandem warhead has struck its target almost at a right angle, then the shockwave is intense enough for the voltage generated in the piezo-element of the fuse belonging to the main charge to be sufficient to ignite the associated detonator. However, if the tandem warhead strikes a targe acute angle, then the intensity of the shockwa issuing from the impact is often not sufficier generate in the piezo-element of the fuse of the main charge a voltage adequate for the detonator.

In accordance with the invention, this is also not at all a requirement, since shortly after the impact the preliminary charge detonates and this detonation triggers a specific second shockwave which is transmitted in the direction of the fuse of the main charge. This second shockwave is so intense that the voltage generated in the piezo-element of the fuse of the main charge reaches an adequately large value even with extremely small angles of impact of the projectile on a target, with the result that the main charge is always safely ignited.

When firing against ERA-boxes, the latter were penetrated by the preliminary charge so that the jet from the main charge could flow almost undisturbed through the hole in the box generated by the preliminary charge.

In the following, the invention is described in more detail with reference to one figure.

The figure shows a tandem warhead with a main charge 2 arranged in a housing 5, the main charge being constructed as a hollow charge and having a copper inlay 7. For the ignition, a piezoelectrical

percussion fuse 4 is arranged at the rear end of the housing 5, which comes to a point there in the shape of a wedge. A primary charge 8 and an inert body 9 as detonation wave guide are arranged between this fuse 4 and the main charge 2.

Seen in flight direction, the housing 5 tapers in front of the main charge 2 and forms there an annular opening which is constructed as a spacer guide 10. A spacer 6 is guided in this spacer guide spacer consisting of two segments 6a, 6b, the 6a of which is displaceably mounted in the spa 10. The spacer 6 is dimensioned in such a way hollow charge spike can be formed in the free area 11 over the inlay 7. The segment 6a of the spacer 6 can be fixed by way of a thread 12 in the extended state. The segment 6b, in which is arranged a preliminary charge 1 with associated fuse 3 is guided in the segment 6a. The primary charge for the preliminary charge 1 is indicated by the reference number 13. No detonation wave guide is provided. The segment 6b can be inserted into the segment 6a of the spacer 6 and is provided with a thread 14 for fixing to its end facing the segment 6a. A hemispherical cap 15 is attached to the segment 6a of the spacer 6 at its head. So that the ignition does not react too sensitively, for example when striking trees etc., the cap 15 is advantageously provided with a pulse attenuator, not shown. An inlay 16 is attached to the preliminary charge, as is usual with hollow charges.

Both fuses 3, 4 are piezoelectrical percussion fuses. Since the propagating time of a shockwave greatly depends on the distance, the material composition and the construction of the housing 5, these values which influence the delay period must be selected in such a way that the delay period lies within the desired limit. Should a longer delay period

be necessary, a delay charge or a delay element can be installed in the detonator of the main charge.

The housing 5 of the tandem warhead is manufactured from a light metal, such as, for example, a magnesium alloy or an aluminium alloy. The travel time of the shockwave and the delayed ignition of the main charge 2 connected therewith is determined, as already stated, mainly by the composition of the material and the distance between the two fuse from one another. This distance should advant lie between 300 to 400 mm. As a result there produced a travel time for the shockwave from fuse 4 of 100 to 150 µ sec. In order for the shockwave to be able to penetrate the fuse and set it off, the fuse must be firmly attached to the housing. The housing has, moreover, no soft points which would damp the shockwave, but is made stiff so that the shockwave can propagate without being damped.

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Claims

1. Tandem warhead with a housing (5), in which there are arranged a preliminary charge (1) and a main charge (2) arranged with spatial separation behind it with in each case a fuse (3, 4), wherein the preliminary charge (1) is ignited before the main charge (2) and the fuse (4) of the main charge (2) comprises a piezoelectrical percussion fuse which can be triggered by a shockwave, characterized in fuse (3) of the preliminary charge (1) also cc piezoelectrical percussion fuse which can be t by a shockwave, and the housing construction a the arrangement of the fuses (3, 4) and the material composition of the housing (5) are selected such that the propagation of the shockwave imparts a desired delay of the main charge (2).

2. Tandem warhead according to claim 1, characterized in that the preliminary charge (1) together with its fuse (3) is arranged in a spacer (6) which can be moved out of the housing (5) in the flight direction.

3. Tandem warhead according to claim 1 or 2, characterized in that the spacer (6) consists of two segments (6a, 6b) which can be inserted one into the other.

4. Tandem warhead according to one of claim 1 to 3, characterized in that the preliminary charge (1) and the main charge (2) are hollow charges.

5. Tandem warhead according to one of claims 1 to 4, characterized in that the warhead is an antitank grenade launcher.

6. Tandem warhead according to one of claims 2 to 5, characterized in that the spacer (6) has a front cap 15 which is provided with a pulse attenuator.

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