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(54) **A DEVICE TO ENABLE TARGETS TO BE COMBATED BY A SHAPED CHARGE FUNCTION**  
VORRICHTUNG MIT HOHLLADUNGFUNKTION ZUM EINSATZ GEGEN ZIELE  
DISPOSITIF D'ATTAQUE DE CIBLES A FONCTION DE CHARGE FORMEE

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## Description

**[0001]** The present invention relates to a device to enable the engagement of targets using a shaped charge function.

**[0002]** The use of a unit of ammunition in the form of a projectile, shell, missile, etc to engage a target by the application of a shaped charge function is already known. The shaped charge is thus matched to the type of target, and there are thereby shaped charges arranged to operate at short standoff distances to the target or surface of the target, compared with a so-called jetting shaped charge function that operates at a very small standoff distance (e.g. 100 millimetres) from the surface of the target to achieve a hole in, or an impact on, the target. The use of EFP (explosively formed projectile/penetrator) shaped charges with which one can begin to attack a target or surface of a target at considerably larger stand-off distances (e.g. 50 metres) is also already known. Consequently, there are major differences in effectiveness against different types of target, and to optimise effect in each case it is vital to use the correct ammunition unit with the correct shaped charge. The use of different ammunition units optimised for different engagement situations is thereby already known. See for reference document DE-11 28 345 B, which discloses a device according to the preamble of claim 1, DE 36 09 865 C1 and US A 5 939 663.

**[0003]** There is a need, however, to be able to reduce the assortment of ammunition units. The objective of the present invention is to resolve this problem, and to propose that modular charge components be used to enable one and the same ammunition unit to be matched to, or be re-configured for, the type of target in question, i.e. so that the ammunition unit can be assigned a shaped charge function at the deployment site (e.g. prior to firing, launch or weapon release) that is optimised for the target to be engaged on the occasion in question. It is thus necessary that re-configuration for the various engagement occasions can achieve optimisation for the target in question, and that it can be performed in a safe and, primarily, technically simple manner. There is even a desire that the new function with modular charges shall not unduly intrude upon the total costs in the system as such. The present invention is envisaged to resolve this problem too.

**[0004]** The above mentioned problems are solved by the features of claim 1.

**[0005]** The main characteristic features of the arrangement initially mentioned are, among other things, that an ammunition unit in the form of a projectile, shell, missile, etc is arranged to operate with at least two modular charge configurations, in the first of which the ammunition unit incorporates a first modular charge or modular array that projects a first shaped charge function-such as a jetting shaped charge-while in the second configuration the first modular charge or modular array is conjoined with a second modular charge or modular array that

projects a second shaped charge function such as an EFP function. Another feature is that the ammunition unit is arranged to enable changeover from the first configuration to the second before firing, launch or release of the ammunition unit.

**[0006]** Thus in embodiments of the invention concept the second modular charge or modular array eliminates the shaped charge function effected by the first modular charge or modular array when the modules or arrays are arranged in conjoined mode. The first modular charge incorporates a liner-forwards facing and in the form of a funnel or cone-that produces the first shaped charge function. The second modular charge is thus designed with a rear section that exhibits a corresponding form to that of the said funnel or cone form. In the second case the second modular charge is conjoined with the first modular charge via the said rear section which, in conjoined mode, is inserted in the funnel or cone form of the first modular charge. In a preferred embodiment the fit between the form of the rear section of the second modular charge and the funnel or cone form of the first modular charge is a salient feature, and exhibits an extremely precise fit in the preferred embodiment.

**[0007]** The liner that produces the second shaped charge function exhibits a lateral face that conjoins with the lateral face of the first modular charge, and the first mentioned lateral face can be considered to form a continuation or constituent part of the latter mentioned lateral face. The said rear section preferably consists of or contains explosive material, and the first modular charge preferably incorporates an essentially cylindrical container enclosing the explosive material of the first modular charge. Parts of the explosive material in the first and second modular charges conjoin with each other in the said conjoined mode. In a preferred embodiment the ammunition unit at delivery incorporates both modular charges or modular arrays in conjoined state. If the first charge configuration shall be used the second modular charge or modular array is thus removed. The ammunition device in one embodiment is arranged with a casing or structural element that is removable when changing over between the first and second configuration modes. After the changeover it shall be possible to refit the said casing or structural element to enable the ammunition unit to be fired, launched or released. Additional variants of the present invention are disclosed in the subsequent Patent Claims and the detailed description.

**[0008]** The above proposals enable the new change-over function to be achieved without any significant financial burden to the system in its entirety. The present invention exploits the insight that the explosive charge represents a relatively small value with regard to the total system, in which the functions for guidance, propulsion, actuation, etc represent the major costs. The redundancy thereby achieved by the use of two different types of modular charges or modular arrays in which one modular charge or modular array is discarded in certain engagement situations is thus not a burden to the system as

such. Changeover can be arranged in an already known way, such as by means of screw joint(s), by means of which the casing or structural element can be removed and then refitted to achieve reliable closure. The modular charges as such can also consist of conventional constructions and designs.

**[0009]** A currently proposed design for a device as claimed in the present invention is described below with reference to the appended Figures 1 and 2 in which

Figure 1 shows a longitudinal section of a modular charge configuration comprising first and second modular charges in conjoined mode, and Figure 2 shows a longitudinal section of the modular charges illustrated in Figure 1, but with the second modular charge removed from the first modular charge.

**[0010]** Number 1 in Figure 1 symbolises parts of an ammunition unit in accordance with the above. The ammunition unit comprises, among other things, an explosive charge arrangement denoted 2. The explosive charge arrangement incorporates an initiation function symbolised by 3. As claimed in the present invention the explosive charge arrangement comprises two modular charges, of which the first modular charge is designated 3 and the second modular charge is designated 4. Modular charge 3 comprises explosive 3a and a trumpet formed, shaped charge effecting inner cone illustrated in Figure 1 by sections 3b and 3c. This inner cone 3b, 3c extends from the frontal part 3d of the modular charge 3 inwards towards the central part of the modular charge. Sections 3b, 3c show the curvature of the inner cone, and that it forms a funnel shaped space. Sections 3b and 3c can exhibit other curvatures or extensions and, for example, may be essentially cone shaped. The second modular charge 4 comprises a rear section 4a consisting of explosive. The second modular charge also comprises a frontally concave frontal liner 4b that effects shaped charge function. The rear section 4a thus exhibits a form that conjoins with walls of the space formed between 3b, 3c. As claimed in the present invention the fit between the outer surface 4a' of the rear section and the inner surfaces 3c' and 3b' is very precise.

**[0011]** Sections 3b, 3c are also arranged so that the first modular charge can effect a jetting shaped charge function when in a mode separated from the second modular charge. In the conjoined mode for modular charges 3 and 4 illustrated in Figure 1 the explosive charge arrangement operates with a shaped charge function effected by liner 4b. The latter function in the embodiment example constitutes an EFP shaped charge function. The explosive charge arrangement 2 can thus function for a large standoff A to a target 5 that is to be engaged using the shaped charge function in question, and the resultant explosively formed projectile 6 will attack the target in a concentrated zone 5a. The standoff distance A may be, for example, 50 metres.

**[0012]** In Figure 2 the second modular charge 4 has been separated from modular charge 3. The space in the funnel shaped part bounded by sections 3b, 3c is designated 3e. Figure 2 shows the shape of the rear section 4a of modular charge 4 and its matching shape in relation to space 3e. The shape of surfaces 3c' and 4a' is also illustrated. In this embodiment modular charge 4 is not used and is discarded. Modular charge 3 thus operates independently from modular charge 4, and can effect its shaped charge function which is of said jetting type. Consequently, the ammunition unit or explosive charge arrangement 2 can in this case be used to engage a target that is at standoff distance A' when ammunition unit 1 is triggered, standoff A' being relatively small-e.g. 100 millimetres-in relation to standoff A. The shaped charge jet projected by modular charge 3 is designated 6'. In Figure 2 a screw joint on the casing of the device is symbolised by 7. The screw joint can comprise an internal and external thread of already known type. The casing or structural element 1a can thereby be temporarily separated from the casing or structural element 1b. The ammunition unit is supplied with the explosive charge arrangement in conjoined mode as illustrated in Figure 1. For a possible changeover to the mode illustrated in Figure 2 the casing or structural element 1a is thus unscrewed to enable modular charge 4 to be removed, after which the casing or structural element 1a is screwed back onto casing or structural element 1b.

**[0013]** It is envisaged in accordance with the above that modular charge 3 in principle can comprise a number of first modules, explosive compositions and other configurations, and that in such cases reference is made to a first modular array. In a corresponding way the second modular charge 4 can consist of more than one module, whereby such an arrangement can be envisaged as a second modular array. As claimed in the present invention the first modular charge can interact with a second modular array, and the second modular charge can interact with a first modular array. Figure 2 also shows that the rear section 4a exhibits a rear plane 4a'' that is circular and extends at right angles to the plane of the figure illustrated. In the conjoined mode illustrated in Figure 1 this end plane 4a'' butts against an inner surface 3a' in the explosive 3a of the first modular charge. Thus in conjoined mode there is mechanical contact between parts 4a and 3a. Liner 4b on the second modular charge 4 exhibits a lateral face 4b'. This lateral face extends adjacent to an outer surface 3f of the casing or structural element of the first modular charge. Lateral face 4b' can be considered to constitute a continuation of outer surface 3f. The first modular charge in principle comprises a casing that encases the explosive 3a, with the said initiating device 3' arranged at the rear of the said casing. Rear section 4a consists of a self-supporting explosive charge.

## Claims

1. A device to satisfy the engagement of targets (5, 5') with a shaped charge function in which an ammunition unit (1) is arranged to operate with at least two modular charge configurations in the first of which the ammunition unit (1) comprises only a first modular charge (3) or modular array that effects a first shaped charge function and that in the second configuration the first modular charge (3) or modular array is conjoined with a second modular charge (4) or modular array that effects a second shaped charge function and that the ammunition unit (1) is arranged to enable changeover from the first configuration to the second configuration or vice versa prior to firing, launch or release of the said ammunition unit (1), the second modular charge (4) or the second modular array eliminates the first shaped charge function effected by the first modular charge (3) or first modular array when the modular charges (3, 4) or modular arrays are arranged in conjoined mode, the first modular charge (3) incorporates the liner (3b, 3c) effecting the first shaped charge, which liner (3b, 3c) is directed forwards and forms a funnel or cone shape, and the second modular charge (4) incorporates a rear section (4a) that exhibits a shape matching that of the said funnel or cone shape, that in the second configuration mode the second modular charge (4) is conjoined with the first modular charge (3) via the said rear section (4a) which, in conjoined mode, is inserted into the funnel or cone shaped space (3e) of the first modular charge (3), **characterized in that** the shape of the rear section (4a) of the second modular charge is conjoined with the funnel or cone shape (3e) of the first modular charge (3) by a direct mechanical contact, the end plane (4a") of the rear section (4a), which consists of explosive of the second shaped charge (4) has direct contact with the inner plane (3a') of the explosive (3a) of the first shaped charge (3), the first modular charge (3) or modular array is arranged to engage a target (5') at a first standoff distance A' for effecting the first shaped charge function being a jetting shaped charge function, that the second modular charge (4) or modular array is arranged to engage a target (5) at a second standoff distance A, which second standoff distance A is larger than the first standoff distance A', for effecting the second shaped charge function being an explosively formed projectile/penetrator shaped charge function and that the ammunition unit (1) when delivered incorporates both modular charges (3 and 4) or modular arrays in conjoined state, and that when selecting the first modular charge (3) configuration the second modular charge (4) or modular array is removed.
2. A device as claimed in Claim 1 **characterized in that** the liner (4b) in the second modular charge (4) that effects the second shaped charge function exhibits a lateral face (4b') that conjoins with an outer surface (3f) of the first modular charge (3), and can be considered to form a continuation of, or be a constituent part of, the latter mentioned outer surface (3f).
3. A device as claimed in any of the previous Claims 1 or 2 **characterized in that** the said rear section (4a) is embodied with explosive relating to or incorporated in the second modular charge (4).
4. A device as claimed in any of the previous Claims 1, 2 or 3 **characterized in that** the first modular charge (3) exhibits an essentially cylindrical container encasing the explosive of the first modular charge (3).
5. A device as claimed in Claim 4 **characterized in that** the first modular charge (3) exhibits an igniting or initiating device (3') arranged at the rear of the cylindrical container.
6. A device as claimed in any of the previous Claims **characterized in that** the ammunition unit (1) is arranged with a casing or structural element (1a) that is removable when changing over between the first and second configurations, and is re-installable or closable after the changeover.
7. A device as claimed in any of the previous Claims **characterized in that** the disjoinable casing or structural element is joined to another casing or structural element (1b) via a joint (7) that is disjoinable and reconnectable under field conditions to enable manual removal and refitting of the casing or structural element (1a).
8. A device as claimed in any of the previous Claims **characterized in that** each explosive charge (3a, 4a) incorporates a number of initiation points which, depending on quantity and position, when initiated simultaneously enable the shaped charge to effect a jet, or a knife-blade or cruciform shaped projectile, or alternatively primarily fragmentation effect.

## Patentansprüche

1. Vorrichtung zum Erfüllen der Bekämpfung von Zielen (5, 5') mit einer Hohlladungsfunktion, in welcher eine Munitionseinheit (1) zum Betrieb mit mindestens zwei modularen Ladungskonfigurationen eingerichtet ist, in deren erster die Munitionseinheit (1) nur eine erste modulare Ladung (3) oder modulare Anordnung, die eine erste Hohlladungsfunktion bewirkt, umfasst, und dass in der zweiten Konfiguration die erste modulare Ladung (3) oder modulare An-

ordnung mit einer zweiten modularen Ladung (4) oder modularen Anordnung verbunden ist, die eine zweite Hohlladungsfunktion bewirkt, und dass die Munitionseinheit (1) eingerichtet ist, eine Umstellung von der ersten Konfiguration zu der zweiten Konfiguration oder umgekehrt vor dem Abfeuern, Abschießen oder Auslösen der Munitionseinheit (1) zu ermöglichen, wobei die zweite modulare Ladung (4) oder die zweite modulare Anordnung die erste Hohlladungsfunktion, die durch die erste modulare Ladung (3) oder erste modulare Anordnung bewirkt wird, beseitigt, wenn die modularen Ladungen (3, 4) oder modularen Anordnungen in einer verbundenen Weise angeordnet sind, die erste modulare Ladung (3) die Einlage (3b, 3c), welche die erste Hohlladung bewirkt, einschließt, wobei die Einlage (3b, 3c) nach vorne gerichtet ist und eine Trichter- oder Kegelform bildet, und die zweite modulare Ladung (4) einen hinteren Abschnitt (4a) einschließt, der eine Form aufweist, die mit jener der Trichter- oder Kegelform übereinstimmt, dass in der zweiten Konfigurationsweise die zweite modulare Ladung (4) mit der ersten modularen Ladung (3) mittels des hinteren Abschnitts (4a) verbunden ist, der, in der verbundenen Weise, in den trichter- oder kegelförmigen Raum (3e) der ersten modularen Ladung (3) eingeführt ist, **dadurch gekennzeichnet, dass** die Form des hinteren Abschnitts (4a) der zweiten modularen Ladung mit der Trichter- oder Kegelform (3e) der ersten modularen Ladung (3) durch einen direkten mechanischen Kontakt verbunden ist, die Endfläche (4a") des hinteren Abschnitts (4a), der aus Explosivstoff der zweiten Hohlladung (4) besteht, direkten Kontakt mit der inneren Fläche (3a') des Explosivstoffs (3a) der ersten modularen Ladung (3) hat, die erste modulare Ladung (3) oder modulare Anordnung zum Bekämpfen eines Ziels (5') bei einer ersten Entfernung A' zum Bewirken der ersten Hohlladungsfunktion, die eine strahlgeformte Ladungsfunktion ist, eingerichtet ist, dass die zweite modulare Ladung (4) oder modulare Anordnung zur Bekämpfung eines Ziels (5a) bei einer zweiten Entfernung A, wobei die zweite Entfernung A größer als die erste Entfernung A' ist, eingerichtet ist, um die zweite Hohlladungsfunktion zu bewirken, die eine explosivgeformte projektil- / penetratorförmige Ladungsfunktion ist, und dass die Munitionseinheit (1), wenn sie geliefert wird, beide modularen Ladungen (3 und 4) oder modulare Anordnungen im verbundenen Zustand einschließt und dass, wenn die erste Konfiguration der modularen Ladung (3) gewählt wird, die zweite modulare Ladung (4) oder modulare Anordnung entfernt wird.

2. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Einlage (4b) in der zweiten modularen Ladung (4), welche die zweite Hohlladungsfunktion bewirkt, eine laterale Fläche (4b') aufweist, die sich mit einer äußeren Oberfläche (3f) der ersten

modularen Ladung (3) verbindet und als eine Fortsetzung von, oder als ein Bestandteil von, der letzteren erwähnten äußeren Oberfläche (3f) betrachtet werden kann.

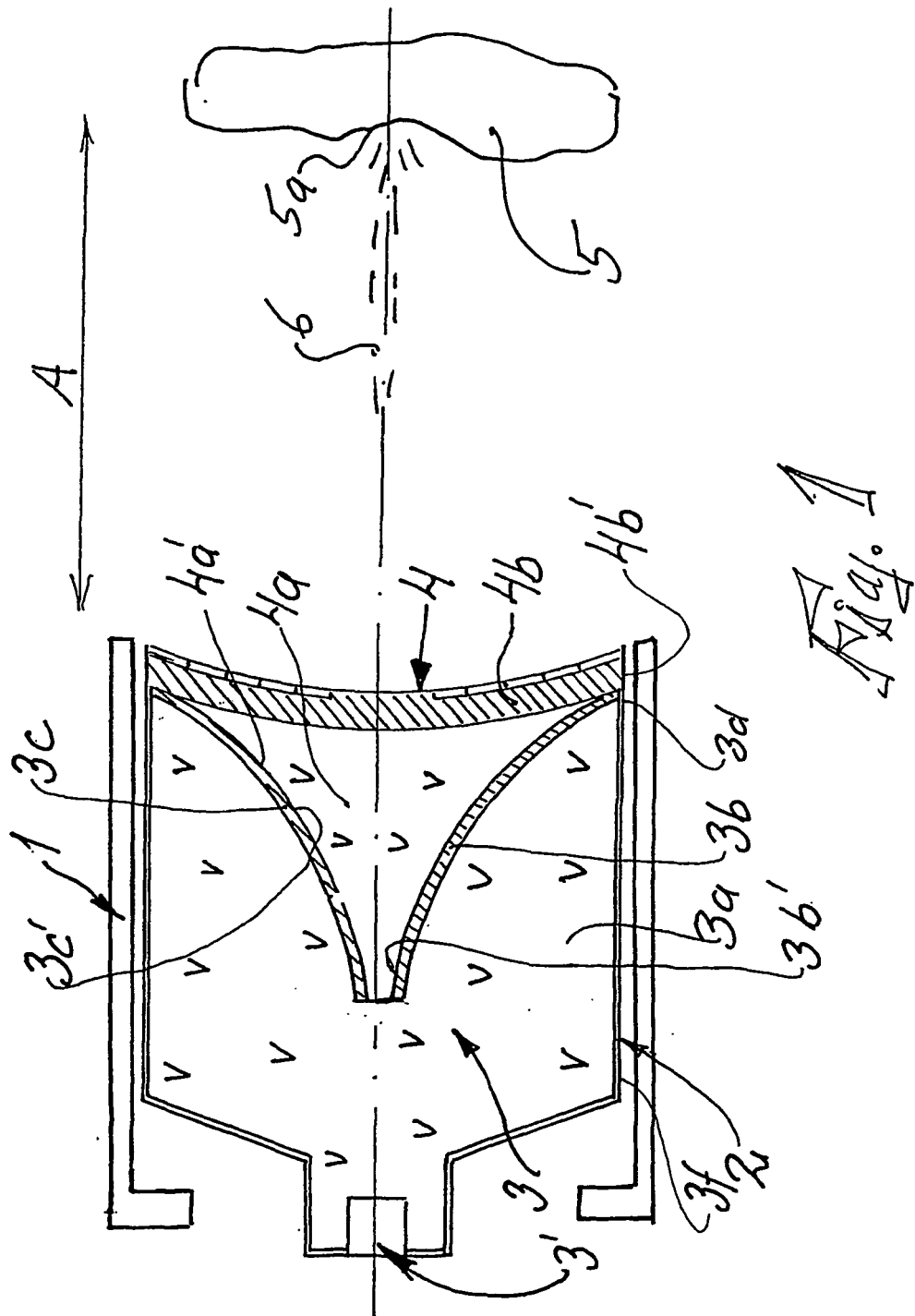
3. Vorrichtung gemäß einem der vorherigen Ansprüche 1 oder 2, **dadurch gekennzeichnet, dass** der hintere Abschnitt (4a) mit Explosivstoff ausgeführt ist, der sich auf die zweite modulare Ladung (4) bezieht oder darin eingeschlossen ist.
4. Vorrichtung gemäß einem der vorherigen Ansprüche 1, 2 oder 3, **dadurch gekennzeichnet, dass** die erste modulare Ladung (3) einen im Wesentlichen zylindrischen Behälter aufweist, der den Explosivstoff der ersten modularen Ladung (3) umhüllt.
5. Vorrichtung gemäß Anspruch, **dadurch gekennzeichnet, dass** die erste modulare Ladung (3) eine Zünd- oder Initiierungsvorrichtung (3') aufweist, die an dem hinteren Teil des zylindrischen Behälters angeordnet ist.
6. Vorrichtung gemäß einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** die Munitionseinheit (1) mit einem Gehäuse oder Strukturelement (1a) eingerichtet ist, das entfernbar ist, wenn zwischen der ersten und zweiten Konfiguration umgestellt wird, und nach der Umstellung erneut installierbar oder schließbar ist.
7. Vorrichtung gemäß einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** das trennbare Gehäuse oder Strukturelement mittels einer Verbindung (7), die unter Feldbedingungen trennbar und wieder verbindbar ist, um manuelle Entfernung und Wideranbringung des Gehäuses oder Strukturelements (1a) zu ermöglichen, mit einem anderen Gehäuse oder Strukturelement (1b) verbunden ist.
8. Vorrichtung gemäß einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** jede Explosivladung (3a, 4a) eine Anzahl von Initiierungspunkten einschließt, die, abhängig von Menge und Position, wenn sie gleichzeitig initiiert werden, ermöglichen, dass die Hohlladung ein als Strahl oder als Messerklinge oder als Kreuzform geformtes Projektil bewirkt, oder alternativ hauptsächlich einen Fragmentierungseffekt.

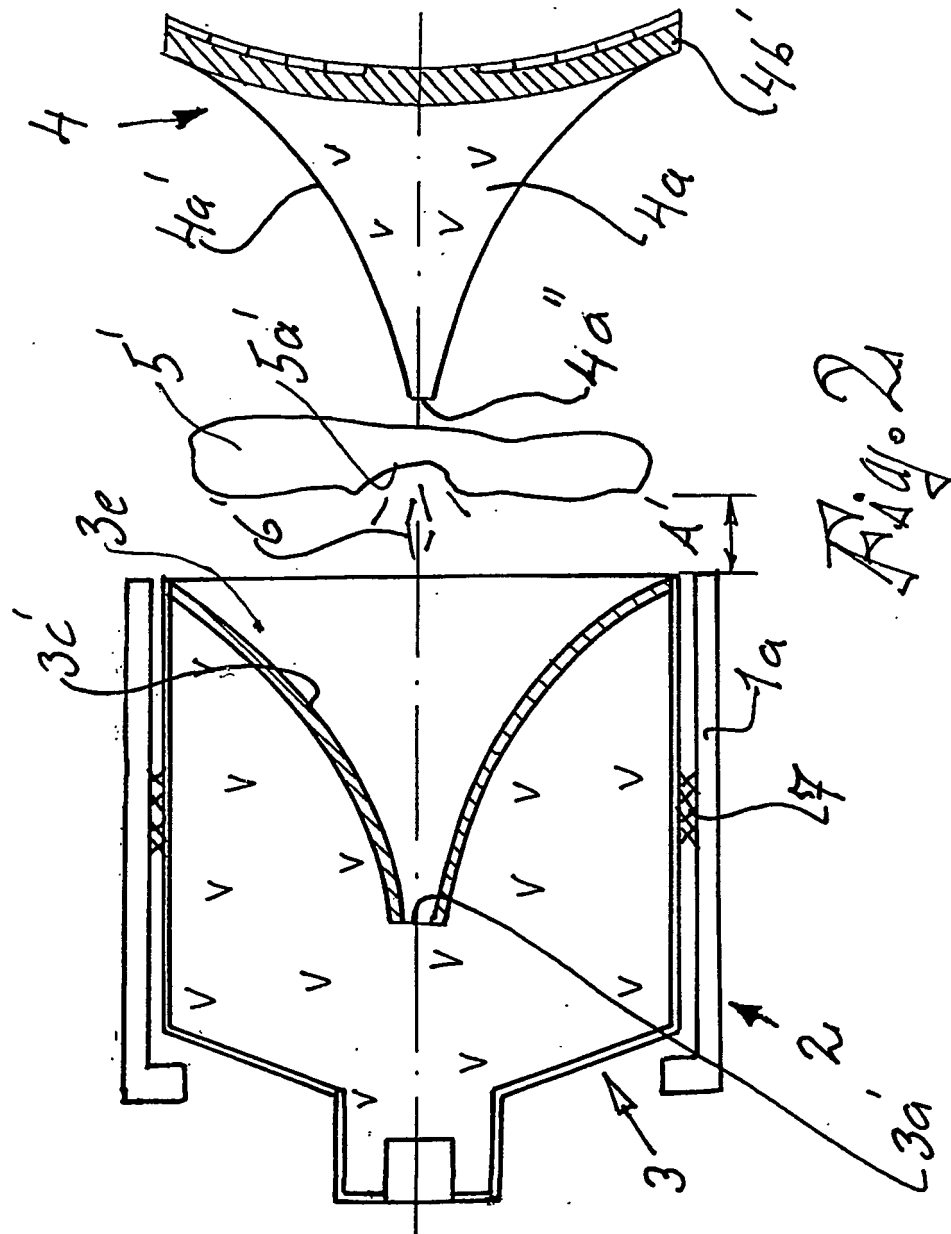
## Revendications

1. Dispositif permettant d'assurer l'engagement de cibles (5, 5') avec une fonction de charge creuse dans laquelle une unité de munition (1) est agencée pour fonctionner avec au moins deux configurations de charge modulaire, parmi lesquelles une première

configuration dans laquelle l'unité de munition (1) ne comprend qu'une première charge modulaire (3) ou réseau modulaire qui met en oeuvre une première fonction de charge creuse et une deuxième configuration dans laquelle la première charge modulaire (3) ou réseau modulaire est associé à une deuxième charge modulaire (4) ou réseau modulaire qui met en oeuvre une deuxième fonction de charge creuse et l'unité de munition (1) est agencée pour permettre le passage de la première configuration à la deuxième configuration, ou vice versa, avant le tir, le lancement ou la libération de ladite unité de munition (1), la deuxième charge modulaire (4) ou le deuxième réseau modulaire élimine la première fonction de charge creuse mise en oeuvre par la première charge modulaire (3) ou par le premier réseau modulaire lorsque les charges modulaires (3, 4) ou réseaux modulaires sont disposés en mode conjoint, la première charge modulaire (3) intègre l'inhibiteur (3b, 3c) mettant en oeuvre la première charge creuse, lequel inhibiteur (3b, 3c) est dirigé vers l'avant et a une forme d'entonnoir ou de cône, et la deuxième charge modulaire (4) comprend une section arrière (4a) qui présente une forme complémentaire à celle de ladite forme d'entonnoir ou de cône, dans le deuxième mode de configuration la deuxième charge modulaire (4) est associée à la première charge modulaire (3) par l'intermédiaire de ladite section arrière (4a) qui, en mode conjoint, est insérée dans l'espace en forme d'entonnoir ou de cône (3e) de la première charge modulaire (3), **caractérisé en ce que** la forme de la section arrière (4a) de la deuxième charge modulaire est associée à la forme d'entonnoir ou de cône (3e) de la première charge modulaire (3) par un contact mécanique direct, le plan d'extrémité (4a") de la section arrière (4a) qui se compose d'un explosif de la deuxième charge creuse (4) a un contact direct avec le plan interne (3a') de l'explosif (3a) de la première charge creuse (3), la première charge modulaire (3) ou réseau modulaire est agencé pour engager une cible (5') à une première distance de sécurité A' pour mettre en oeuvre la première fonction de charge creuse qui est une fonction de charge creuse à jet, que la deuxième charge modulaire (4) ou réseau modulaire est agencé pour engager une cible (5) à une deuxième distance de sécurité A, laquelle deuxième distance de sécurité A est plus grande que la première distance de sécurité A', pour mettre en oeuvre la deuxième fonction de charge creuse qui est une fonction de charge creuse en forme de projectile/pénétrateur formé par explosion et l'unité de munition (1) lorsqu'elle est délivrée intègre les deux charges modulaires (3 et 4) ou réseaux modulaires dans l'état conjoint, et en sélectionnant la première configuration de charge modulaire (3) la deuxième charge modulaire (4) ou réseau modulaire est retiré.

2. Dispositif selon la revendication 1 **caractérisé en ce que** l'inhibiteur (4b) dans la deuxième charge modulaire (4) qui met en oeuvre la deuxième fonction de charge creuse présente une face latérale (4b') qui s'associe à une surface extérieure (3f) de la première charge modulaire (3), et qui peut être considéré comme formant un prolongement, ou être une partie constitutive, de la surface extérieure précitée (3f).
3. Dispositif selon l'une des revendications précédentes 1 ou 2 **caractérisé en ce que** ladite section arrière (4a) est intégrée avec un explosif lié à ou incorporé dans la deuxième charge modulaire (4).
4. Dispositif selon l'une des revendications précédentes 1, 2 ou 3 **caractérisé en ce que** la première charge modulaire (3) présente une gaine essentiellement cylindrique enveloppant l'explosif de la première charge modulaire (3).
5. Dispositif selon la revendication 4 **caractérisé en ce que** la première charge modulaire (3) présente un dispositif d'allumage ou de déclenchement (3') disposé à l'arrière de la gaine cylindrique.
6. Dispositif selon l'une des revendications précédentes **caractérisé en ce que** l'unité de munition (1) est agencée avec un boîtier ou un élément structural (1a) qui peut être retiré lorsqu'on le change entre les première et deuxième configurations et qui peut être réinstallé ou refermé après le changement.
7. Dispositif selon l'une des revendications précédentes **caractérisé en ce que** le boîtier ou l'élément structural pouvant être retiré est joint à un autre boîtier ou élément structural (1b) par l'intermédiaire d'un joint (7) qui peut être retiré et reconnecté dans des conditions sur le terrain pour permettre un retrait manuel et un réajustement du boîtier ou de l'élément structural (1a).
8. Dispositif selon l'une des revendications précédentes **caractérisé en ce que** chaque charge explosive (3a, 4a) intègre un nombre de points d'amorçage qui, selon la quantité et la position, lorsqu'ils sont amorcés simultanément permettent à la charge creuse de mettre en oeuvre un jet ou un projectile en forme de croix ou de lame de couteau, ou en variante, un effet principalement à fragmentation.





**REFERENCES CITED IN THE DESCRIPTION**

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