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Multiple component penetrator projectile.

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Description

The present invention relates to a multiple component penetrator projectile comprising a body component and a tail component joined to one end of the body component, the latter consisting of frangible tungsten material. A penetrator projectile of this type is shown in EP-A-51375, published 12.05.82, this document being an intermediate document coming thereby within the provisions of Articles 54(3) and 89 EPC.

According to the above identified prior art document the body component (mid-section) consists or a frangible tungsten alloy whereas the tail component consists of a high strength tungsten alloy or equivalent metal commonly used for armor-piercing projectiles.

As used herein the term "frangible material" means a material which, under high velocity impact against a target, will break into small fragments while penetrating the target. While frangible materials can penetrate light armor and break up into small fragments, generally they are difficult to machine using conventional machining techniques.

The multiple component penetrator projectile of the afore identified prior art document has a cavity in its tail section for a tracer and in some instances such cavities also can hold a self-destruct mechanism to avoid hazards to friendly personnel, equipment or installations from projectiles not hitting the target. In the prior art multiple component penetrator projectile, the tail component consisting of high strength tungsten alloy or equivalent armor-piercing metal is used in order to permit the defeat of spaced multiple plate targets as represented. For example, by aircraft or helicopters equipped with armored cockpits or other protected components.

In FR-E-75765 there is known a multiple component penetrator projectile comprising a body component and a tail component joined to one end of the body component. the latter consisting of a high hardness metal for instance sinter tungsten carbide and the tail component consisting of a high density metal for instance sinter tungsten or uranium 238.

Furthermore, in FR-A-1 231 010 there is disclosed a multiple component penetrator projectile of which the tail component consists of tungsten alloy with a high content of tungsten or a material with at least the density of the body but less expensive and more machinable.

It is the object of the present invention to provide a multiple component penetrator projectile such that it provides flexibility in manufacture and overcomes some of the problems associated with the prior art and constitute an advancement in the art.

The above object of the present invention is achieved by the invention as claimed in claim 1.

Preferred embodiments of further improvements

of the claimed invention are defined in the subclaims.

Some ways of carrying out the invention are described below in detail with reference to drawings which illustrate several preferred embodiments, in which:

Figures 1, 2 and 3 show longitudinal cross-sectional views of projectiles according to the present invention.

Frangible materials are known. In addition, frangible alloys of tungsten are known, such as 98W-2Ni, 97W-2.1 Ni-0.9Fe, and 90W-10Mo and tungsten doped with about 400 ppm of nickel. All of these materials will penetrate a target such as a 2" (5 cm) thick steel armor plate, when fired at a high velocity such as from an anti-tank gun, then break into small fragments while penetrating or exiting from the plate. Such materials, while exhibiting the desired frangibility, have a tendency to form cracks when cavities are machined into the tail of the penetrator for tracer or self-destruction mechanisms. The cracks can cause premature fragmentation.

"Heavy alloys" are that class of two phase multi-component tungsten alloys containing nickel and at least one other metal and in which one phase is essentially tungsten and the other phase is a solid-solution of nickel, tungsten and the other metal or metals. It has been found that the heavy alloys are suitable for forming the tail component of a penetrator where a cavity is to be machined into the tail component. These heavy alloys have a density of at least about 16.7 grams/cc, therefore these alloys containing at least about 88% tungsten and the balance being nickel and other metals such as copper, molybdenum, iron, titanium and the like. A particularly preferred alloy is 97.3W-1.35Ni-1.35Fe.

The projectiles of the present invention have multiple components of different materials. With particular reference to Fig. 1, a cross section of penetrator 10 is shown comprising a body component 12, and a tail component 14 containing a tracer cavity 16. Nose component 18 is of the same material as the body component 12 and can be either fabricated in one section comprising both the body component 12 and nose portion component 18 or if desired the pieces can be fabricated separately and the nose component 18 can be joined to one end of body component 12. The method of joining the components can be brazing, inertial welding and the like. The tail component 14 is similarly joined to the opposite end of body component 12. Frangible materials as indicated in claim 1 are used for the body portion 12 and nose component 18. Each of these materials will penetrate the targets up to about 2" (5 cm) thick steel and will break into small pieces upon exiting the target.

The tail portion is the heavy alloy as previously described having a density of at least 16.7 grams/cc.

With particular reference to Fig. 2 a cross section of a penetrator 20 having three segments is shown.

Body component 22 is a frangible material. The nose component 24 is a tungsten base alloy such as 98W-2Ni, 97W-2.1Ni-0.9Fe or 90W-10Mo. Tail component 26 is essentially identical to the tail portion of Fig. 1, that is, it is a machinable heavy alloy. The penetrator 20 also contains a tracer cavity 28.

With particular reference to Fig. 3 there is provided a penetrator 30 having four separate segments. Body component 32 is made of the aforementioned annealed tungsten or tungsten containing 400 ppm of nickel. The tail component 34 and one section 36 of the nose component 38 are made of the machinable heavy alloy. A second section 40 extends from the first section 36 to serve as a windscreen and is a lighter weight material such as aluminium or a ceramic material. The nose component 38 thus is comprised of a first section 36 which is machined to enable attachment of the second section 40 which serves as a windscreen. The cavity 42 is shown in the tail component 34.

While there has been shown and described what are at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

Claims

1. A multiple component penetrator projectile (10, 20, 30) comprising a nose component (18, 24, 38), a body component (12, 22, 32) and a tail component (14, 26, 34) joined to one end of said body component, said body component consisting of a frangible tungsten material selected from tungsten alloys selected from the group consisting of 96% W-2% Ni; 97% W-2.1% Ni-0.9% Fe; and 90% W-10% Mo, and tungsten doped with about 400 parts per million of nickel, said tail component (14, 26, 34) consisting of a machineable two-phase, multi-component tungsten alloy containing nickel and at least one other metal and in which one phase is essentially tungsten and the other phase is a solid solution of nickel, tungsten and the other metal or metals, the density of said two-phase, multi-component tungsten alloy being at least 16.7 grams/cm³.
2. A penetrator projectile according to claim 1, wherein said nose component (18, 24, 38) generally has a conical shape extending from the opposing end of the body component (12, 22, 32), said nose component having the same composition as the body component or consisting of a material different than said body component.

3. A penetrator projectile according to claim 2, wherein said nose component (18, 24, 38) is comprised of a first section (36) and a second section (40), the first section being a machinable tungsten portion joined to the end of the body component opposite to the tail component and the second portion being a low density portion joined to and extending from the first section and having a different composition than said first section.
4. A penetrator projectile according to claim 3, wherein said second section (40) is selected from aluminium and ceramics.

Patentansprüche

1. Mehrkomponenten-Wuchtgeschöß (10, 20, 30) mit einem Vorderteil (18, 24, 38), einem Rumpfteile (12, 22, 32) und einem Heckteil (14, 26, 34), welches mit einem Ende des Rumpfteiles verbunden ist, wobei das Rumpfteile aus einem zerbrechbaren Wolframmaterial besteht, ausgewählt aus Wolframlegierungen, ausgewählt aus der Gruppe bestehend aus 98 % W-2 % Ni; 97 % W-2,1 Ni-0,9 % Fe; und 90 % W-10 % Mo, und Wolfram mit einer Dotierung von ungefähr 400 ppm Nickel, und wobei dieses Heckteil (14, 26, 34) aus einer bearbeitbaren zweiphasigen, Mehrkomponenten-Wolframlegierung besteht, umfassend Nickel und wenigstens ein weiteres Metall, und in welchem eine Phase im wesentlichen Wolfram ist, und die andere Phase eine feste Lösung aus Nickel, Wolfram und dem anderen Metall oder anderen Metallen, und wobei die Dichte dieser zweiphasigen, Mehrkomponenten-Wolframlegierung wenigstens 16,7 g/ccm beträgt.
2. Wuchtgeschöß nach Anspruch 1, wobei das Vorderteil (18, 24, 38), welches im wesentlichen eine sich von dem gegenüberliegenden Ende des Rumpfteiles (12, 22, 32) aus erstreckende konische Form aufweist, wobei das Vorderteil die gleiche Zusammensetzung wie das Rumpfteile aufweist oder aus einem Material besteht, welches sich von dem Material des Rumpfteiles unterscheidet.
3. Wuchtgeschöß nach Anspruch 2, wobei das Vorderteil (18, 24, 38) aus einem ersten Bereich (36) und einem zweiten Bereich (40) besteht, wobei der erste Bereich ein maschinell bearbeitbarer Wolframteil ist, welcher mit dem Ende des Rumpfteiles, welches dem Heckteil gegenüberliegt, verbunden ist, und wobei der zweite Bereich ein Bereich geringerer Dichte ist, welcher mit dem ersten Bereich verbunden ist und sich von die-

sem aus erstreckt und eine von dem ersten Bereich unterschiedliche Zusammensetzung aufweist.

4. Wuchtgeschöß nach Anspruch 3, wobei der zweite Bereich (40) aus Aluminium oder Keramik besteht. 5

Revendications 10

1. Projectile perforant à parties multiples (10, 20, 30) comportant une partie avant (18, 24, 38), une partie centrale (12, 22, 32) et une partie arrière (14, 26, 34) fixée à une extrémité de la dite partie centrale, la dite partie centrale étant réalisée dans un matériau au tungstène fragile choisi entre des alliages de tungstène choisis dans le groupe comprenant 98% W - 2% Ni; 97% W - 2,1% Ni - 0,9% Fe; et 90% W - 10% Mo, et du tungstène dope avec 400 parts environ par million de nickel, la dite partie arrière (14, 26, 34) comprenant un alliage à base de tungstène usinable à parties multiples à deux phases, contenant du nickel et au moins un autre métal et sans lequel une phase est essentiellement du tungstène et l'autre phase est une solution solide de nickel, tungstène et autre(s) métal ou métaux, la densité du dit alliage à base de tungstène à parties multiples à deux phases étant au moins égal à 16.7 g/cm³. 15 20 25 30
2. Projectile perforant selon la revendication 1 dans lequel la dite partie avant (18, 24, 38) présente généralement une forme conique faisant saillie de l'extrémité opposée de la dite partie centrale (12, 22, 32), la dite partie avant ayant la même composition que la partie centrale ou étant dans un matériau différent de celui de la dite partie centrale. 35 40
3. Projectile perforant selon la revendication 2 dans lequel la dite partie avant (18, 24, 38) comprend une première partie (36) et une seconde partie (40), la première partie étant une partie en tungstène usinable fixée à l'extrémité de la partie centrale du côté opposé à la partie arrière, et la seconde partie étant une partie de faible densité fixée à et faisant saillie de la première partie et présentant une composition différente de celle de la dite première partie. 45 50
4. Projectile perforant selon la revendication 3 dans lequel la dite seconde partie (40) est réalisée soit en aluminium soit en céramique. 55

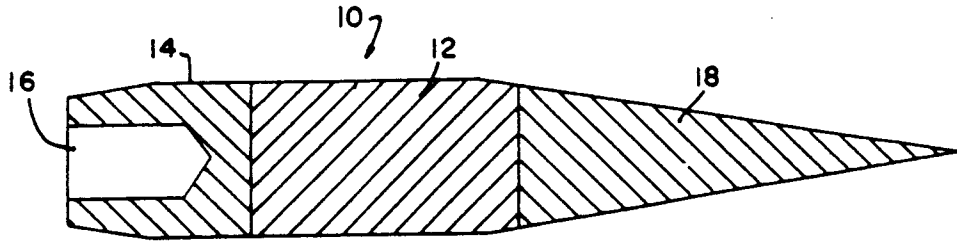


FIG. 1

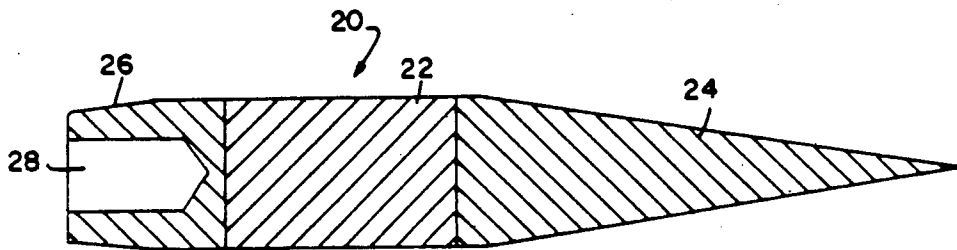


FIG. 2

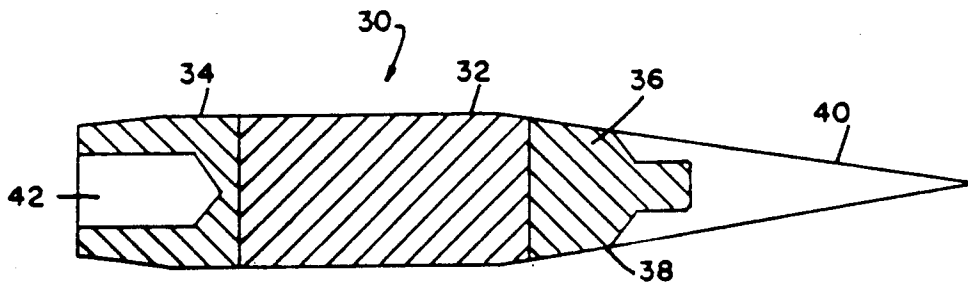


FIG. 3