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EXPLOSIVE INITIATOR-BOOSTER CONTAINING DIETHYLACETYLENE AND A PERCHLORATE SALT

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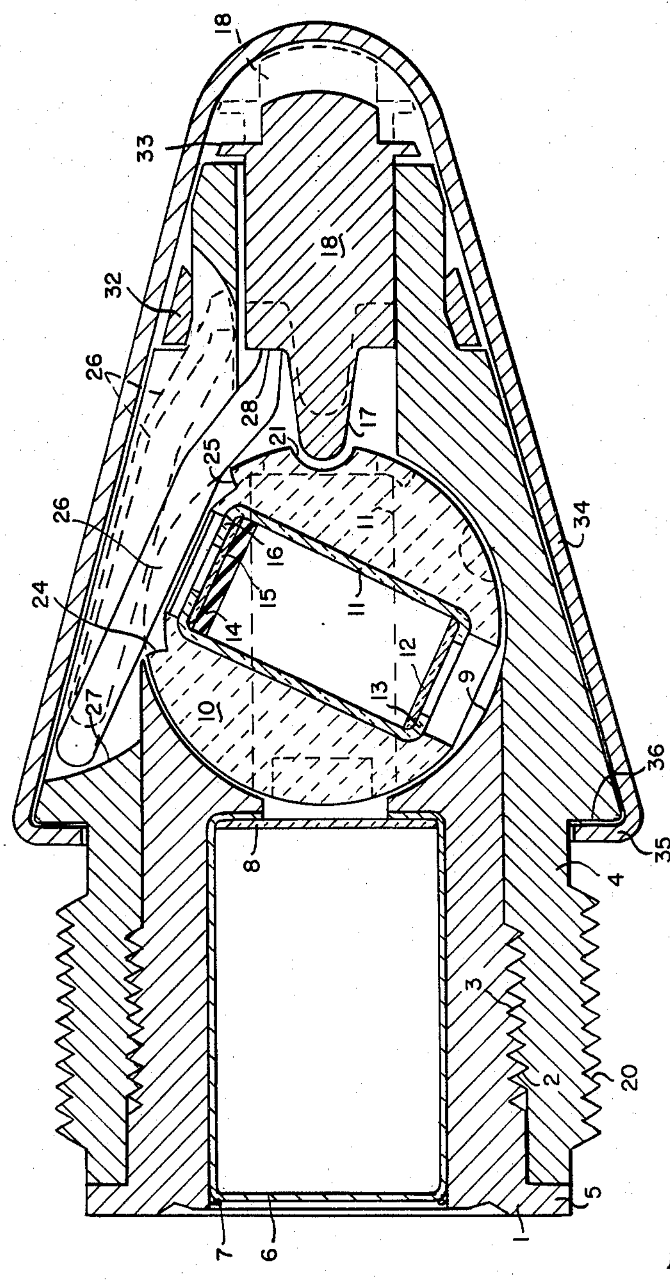

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1

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EXPLOSIVE INITIATOR-BOOSTER CONTAINING DIETHYLACETYLENE AND A PERCHLORATE SALT

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The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to an explosive initiator-booster device serving as a fuze point detonating apparatus when mounted in the forward end of warheads, projectiles and the like, and a new and improved explosive material for the explosive charge within projectiles of a variety of kinds.

Booster devices which are currently used to detonate high explosive charges in projectiles or warheads may contain lead azide of the composition $Pb(N_3)_2$ as the initiator for a booster charge which may contain RDX, 1,3,5-trinitro-1,3,5-triazacyclohexane, which has been desensitized with selected wax compositions. This explosive train provides the energy to detonate the high explosive filler in the projectile or warhead. Problems to be overcome in booster devices are the unintentional initiating of fuze explosions by environmental conditions such as the heat encountered in automatic weapons and in aerodynamic heating, heat generated by inductive couplings with electrical apparatus and the like, and abnormal prelaunch shocks and rough jolts from transportation and handling.

The objects of the present invention are to provide a new and improved point initiating non-delay fuze for detonating the high explosive in a warhead or a projectile filler; a device that materially reduces the unintentional initiating of fuze explosions; the use of mercury or an amalgam of comparable function to react with a mixture of silver perchlorate and 3-hexyne as replacement for the earlier loading increments of a primer mixture, lead azide and an RDX wax explosive; etc.

The booster device that is illustrated in the single figure of the accompanying drawing comprises a hollow cylindrical inner core **1** made of steel or the like. The core **1** bears external threads **2** that thread axially into internal threads **3** of a booster holder assembly outer sleeve **4**. A flange **5** of the inner core **1** abuts axially the left hand end of the outer sleeve **4**. The outer sleeve **4** may be made of steel and is provided with external threads **20** for threading the device into the front end of the warhead or projectile with which it is to be used.

The inner core **1** is apertured centrally to contain a thin inert metal or plastic fuze booster can **6** that is secured in its compartment by beads **7** of cold solder or the like. The fuze booster can **6** contains a suitable fuze booster, such illustratively as a mixture of silver perchlorate $AgClO_4$ and 3-hexyne or diethylacetylene $C_2H_5C{\equiv}CC_2H_5$ in the weight proportion of 16.1 grams of silver perchlorate to 7.2 grams of 3-hexyne. The front end **8** of the fuze booster can **6** is frangible and illustratively may be made of glass, a thin, prescored plastic, such as a phenol-formaldehyde resin or the like.

The front end socket **9** of the inner core **1** is shaped as a concave part of a sphere or a cylinder, as preferred, to house a freely rotatable member **10**. The rotatable member **10** contains a detonator containing cup **11**. The cup **11** contains a detonator that is explosively reactive when mixed with the fuze booster contents of the can **6**. An illustrative detonator is mercury, a suitable amalgam that releases mercury on impact or the like. An amalgam is a solution of a metal in mercury.

2

The rotatable member **10** illustratively may be made of a refractory material, as indicated by the dashed section lines. The rotatable member **10** contains a cylindrical detonator cup **11** that is of a material that is inert to mercury, such as glass, or the like. The member **10** is shown in full lines in its unarmed position and in dotted outline in its armed position. In its unarmed position the rotatable member **10** has a firing pin plunger retention hole **21** in its peripheral surface that receives and retains the tip of the frusto-conical plunger end **17** of the firing pin **18**. The firing pin **18** slides axially of the assembly in a cylindrical hole in the forward end of the outer sleeve.

The cup **11** has a bottom **12** that is of a mercury inert frangible material, such as a thin disc of glass, a scored disc of phenol-formaldehyde resins or the like, that is sealed in plastic with cement against the inwardly flared bottom flange **13** of the cup **11** in leakproof relation therewith to avoid the loss of the contents of the cup **11**.

The cup **11** contains a cushion **14** of resilient rubber or plastic that compensates for the expansion and contraction of the contents of the cup from the temperature change to which the device is subjected. Above the rubber cushion **14** is a top disc **15** of frangible material that is inert toward mercury. The peripheral edge of the cup top disc **15** is cemented against leakage to the upper flange **16** of the cup **11**.

The upper flange **16** of the cup **11** in its armed position is dimensioned to progressively closely fit and preferably as nearly as possible to seal its engagement with the frusto-conical plunger end **17** of the firing pin **18** when the firing pin plunger end is rammed into the orifice defined by the cup **11** upper flange **16** on impact of the device against its target.

The rotatable member **10** has a pair of shoulders **24** and **25** that are engaged by a retaining leaf spring **26** to positively secure the rotatable member **10** against rotation in its unarmed position. The spring **26** is positioned with its ends abutting against the outer sleeve shoulder **27** and the firing pin shoulder **28**. The rotatable member **10** is held in its unarmed position by the engagement of its shoulders **24** and **25** bearing against the edge of the spring **26**. The rotatable member shoulders **24** and **25** are shown to be spaced away from the inturned flange **16** that is turned in along the edge of the upper end of the cup **11** to secure the cup **11** in place within the rotatable member **10** during the assembly of the device. A ring **32** arrests the motion of the right hand end of the spring **26** during the assembly of the device.

The firing pin **18** flange **33** abuts the right hand end of the outer sleeve **4** and, together with the spring **26** exerts a dual safety provision for the device.

The fuze cover **34** is of thin metal such as aluminum, steel or the like and terminates to the left in an inturned flange **35** that overlies the outwardly extending outer sleeve flange **36** that is intermediate between the ends of the device.

The theory of operation of the point detonating fuze that is shown in the accompanying drawing mounted in the front end of a warhead or a projectile starts with inertial forces acting on the members of the fuze assembly. The leaf spring **26** acts as a strut and together with the firing pin flange **33** prevents the firing pin plunger **17** from damaging the rotary member **10** during acceleration within the gun bore.

During the launching operation with the fuze in the gun bore the rotary member **10** remains as shown in the drawing with the axis of the cup **11** out of incidence with the central axis of the fuze during acceleration. The rifling in the gun bore from which the projectile is launched imparts rotary motion to the fuze. Increasing centrifugal force causes the spring **26** to move out to its dotted line position and free the rotary member **10** and the firing pin **18**.

The emission of the fuze from the gun bore removes the initial acceleration and the firing pin moves axially forwardly of the assembly and permits the unbalanced rotatable member **10** to assume its balanced position with the central axis of the detonator cup **11** coincident with the central axis of the fuze assembly. The fuze is then armed and awaits impact.

On impact the velocity of the firing pin **18** is arrested, driving its conical plunger end **17** through the orifice in the front end of the cup **11** and, acting as a piston, the firing pin plunger end **17** crushes the detonator cup frangible top disc **15** and advances the rubber plunger **14** axially of the cup **11**.

The resulting pressure applied to the mercury or amalgam in the cup **11** ruptures both the rear frangible disc **12** in the detonator cup **11** and the top frangible disc **8** in the booster can **6**. The contents of the booster can **6** detonates on contact with the mercury from the cup **11** and the force of the resultant explosion is directed through the bottom of the can **6** directly into the high explosive filler in the warhead or in the projectile.

The melting point of an element or a compound is the temperature at which its liquid and solid phases exist together at one atmosphere of pressure. Mercury melts at −39° C. or −38° F. Gallium melts at 30° C. Indium melts at 156° C. Tin melts at 232° C. Bismuth melts at 271° C. Cadmium melts at 321° C. Lead melts at 327° C. All of these melting points are depressed or lowered when mecury is alloyed with the element as an amalgam of the element. The same is true for other elements such as zinc, tellurium, antimony, aluminum, gold, copper etc.

The silver perchlorate disclosed herein may if preferred be replaced for an equivalent function by perchlorates of aluminum, copper and gold. The triple bond between carbon atoms in 3-hexyne or $C_2H_5C{\equiv}CC_2H_5$ imparts a high performance initiating system to the silver perchlorate 3-hexyne complex in the booster can **6** since the triple bond energy per mole is 123 kilocalories, as compared with single bond at 58.6 kilocalories. Bombs containing comparable charges in glass or plastic frangible containers that mix the reagents on impact fall within this disclosure. Amalgams are solid or liquid depending on the proportion of mercury present. Prestressed aluminum dissolves promptly in mercury. Homologues of

acetylene $HC{\equiv}CH$ here of interest include 2-pentyne or ethylmethylacetylene $H_3CC{\equiv}CCH_2CH_3$.

Amalgams that function interchangeably with mercury illustratively are those of gallium, indium, tin, bismuth, cadmium, lead, zinc, tellurium, antimony, aluminum, gold, and copper.

The chemical complex of inorganic perchlorates with disubstituted alkynes and low melting point metals impart an improved performance to the device that is disclosed herein. In this initiator the mercury replaces three loading increments in earlier devices, namely the primer mixture, lead azide and the RDX wax explosive. The explosive components that are disclosed herein provide uniformly reproducible results.

It is to be understood that the device and the charge that are described herein are submitted for the purposes of describing this invention and that similarly functioning modifications may be made therein without departing from the spirit and scope of the invention.

I claim:

1. The booster can contents as a charge proportionally by weight consisting of 7.2 grams of diethylacetylene; mixed with the equivalent of 16.1 grams of silver perchlorate of a perchlorate of a metal selected from the group consisting of silver, aluminum, gold and copper and the mixed material cooperating to produce the unitary result of causing the detonation of an explosive charge.

2. The fuze booster material consisting of silver perchlorate; mixed with diethylacetylene in the weight proportion of 16.1 grams of silver perchlorate to 7.2 grams of diethylacetylene and the mixed material cooperating to produce the unitary result of causing the detonation of an explosive charge.

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