



U.S. Army Research, Development and Engineering Command



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

**The Future of Hand Grenade Fuzing
20120515**

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- Hand grenades are used to supplement small arms against an enemy in close combat, and for non-lethal operations to temporarily stun enemy personnel.
- The M67 Fragmentation Hand Grenade consists of a 4.0 to 5.5 second delay fuze. These grenades are used to produce casualties by the high-velocity projection of fragments.



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- **Observations during training recruits on the M67 Tactical Grenade and M69 Practice Grenade:**
 - **Right handed and left handed throwers held the grenade completely different.**
 - **Milking or dropping the grenade is the biggest safety concern for the instructors.**
 - **Grenades thrown without removal of the safety clip requires E.O.D. to clear range and halt training.**
 - **If a recruit freezes after removing the safety pin, the instructor has to remove the grenade from his hand and throw it down range without the safety pin.**





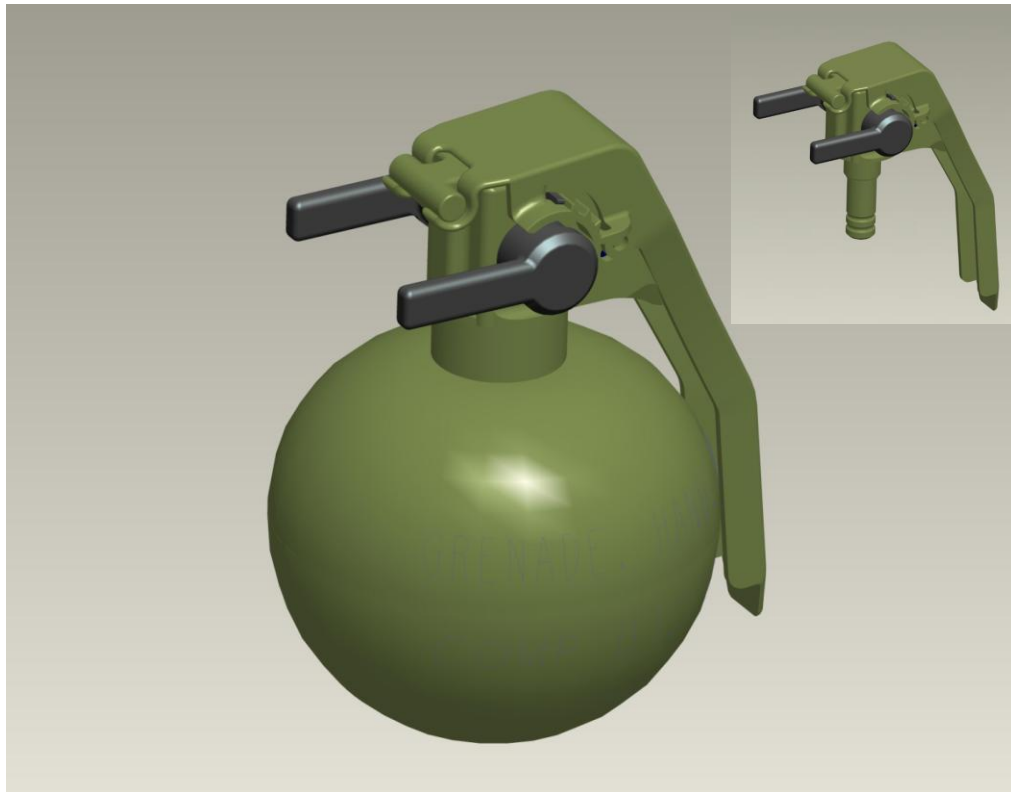
Rotating Thumb Safety Grenade Fuze



Innovative Rotating Thumb Safety Concept for Hand Grenade Fuzes

ARDEC Science & Technology Effort

The concept provides ergonomic user interface features



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DEPARTMENT OF DEFENSE DESIGN CRITERIA STANDARD HAND-EMPLACED ORDNANCE DESIGN, SAFETY CRITERIA FOR

- a. Safety redundancy. The safety system of HEO shall contain ***at least two independent safety features***, each of which shall prevent unintentional arming. Enabling of each safety feature shall require a different action. Those actions must be performed in a ***specific sequence*** for arming to be permitted.

- b. Fail-safe design. To the greatest extent feasible, the HEO shall incorporate design features ***that render the HEO incapable*** of attaining or maintaining an armed state and of functioning upon the failure, improper assembly, omission, or ***out-of-sequence operation of components***.





- c. Human factors engineering. HEO design shall emphasize human factors engineering to ***eliminate or control the hazards*** associated with manual operations.

- d. Design simplicity. HEO design shall be ***as simple as possible*** to minimize operator error.

- e. Manually operated safety features. Manually operable safety features critical to system safety shall be designed to minimize inadvertent or unintended operation. Unless otherwise specified in the requirements document, ***operation of these features shall be reversible.***

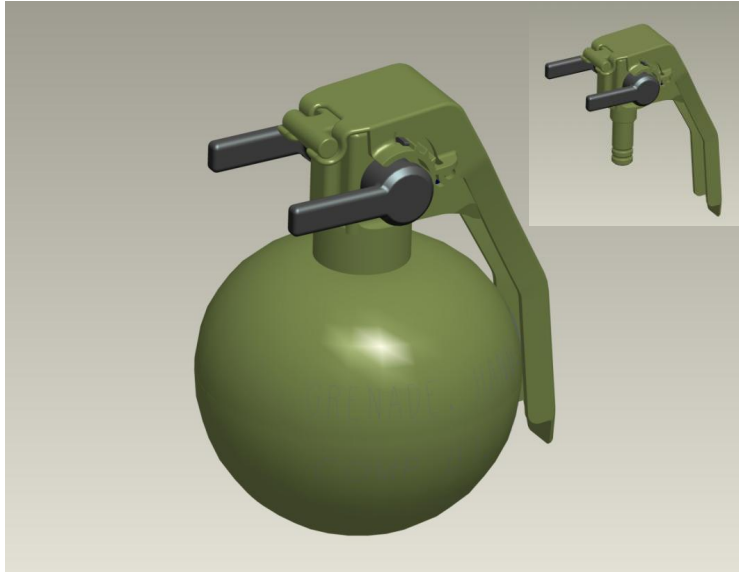




- f. Non-armed and armed condition indicator. HEO shall provide a ***positive, unambiguous indication*** of the non-armed and armed conditions. Indicator failure shall not result in a false non-armed condition indication.

- g. Explosive train interruption. When an element of the explosive train contains explosive material other than allowed (e.g., primary explosive), at least one interrupter (shutter, slider, rotor) shall functionally separate it from the lead and booster explosives until the intended arming delay is achieved. ***The interrupter(s) shall be directly locked mechanically in the non-armed position by at least two independent safety features.*** The safety features shall not be removed prior to intended initiation of the arming sequence.

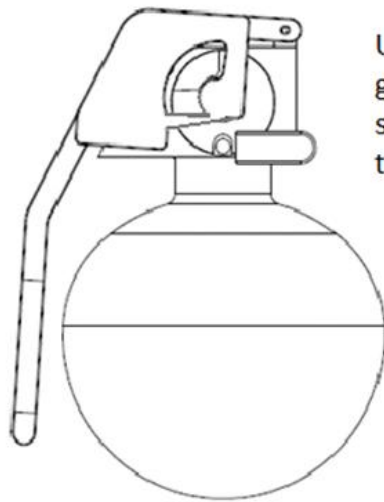




- Fuze and grenade concept now truly ambidextrous. Gripping, arming and deployment is identical for right and left handed Warfighters.
 - Out-of-Line explosive train until user arms grenade prior to deployment.
 - Grenade concept can be easily “re-safed” by Warfighter .
-
- Grenade fuze concept will have visual indication of armed (red) and safe state (green).
 - Concept will provide “two operations in specific order” arming sequence.
 - Ensures positive grip/control by user before arming process is complete.
 - US Army has filed for a patent and owns all rights to concept.

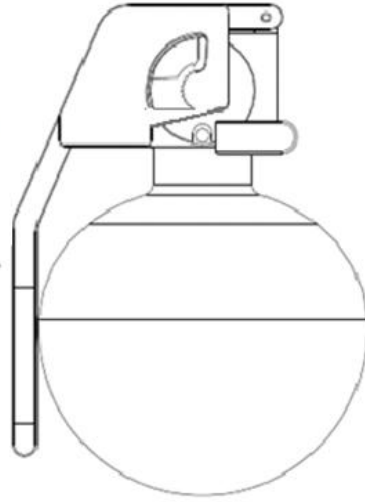


Arming Operation

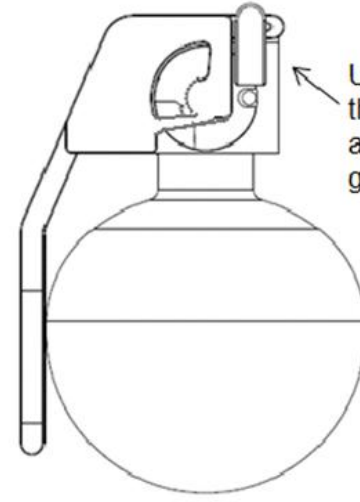


Safe-Locked State

User grips grenade and squeezes lever to body

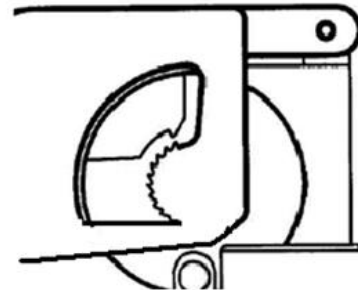
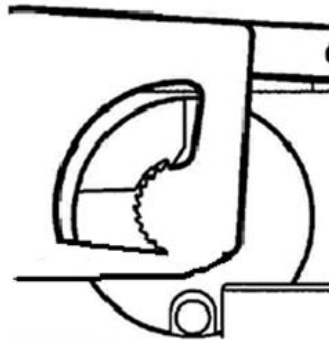


Safe-Unlocked State



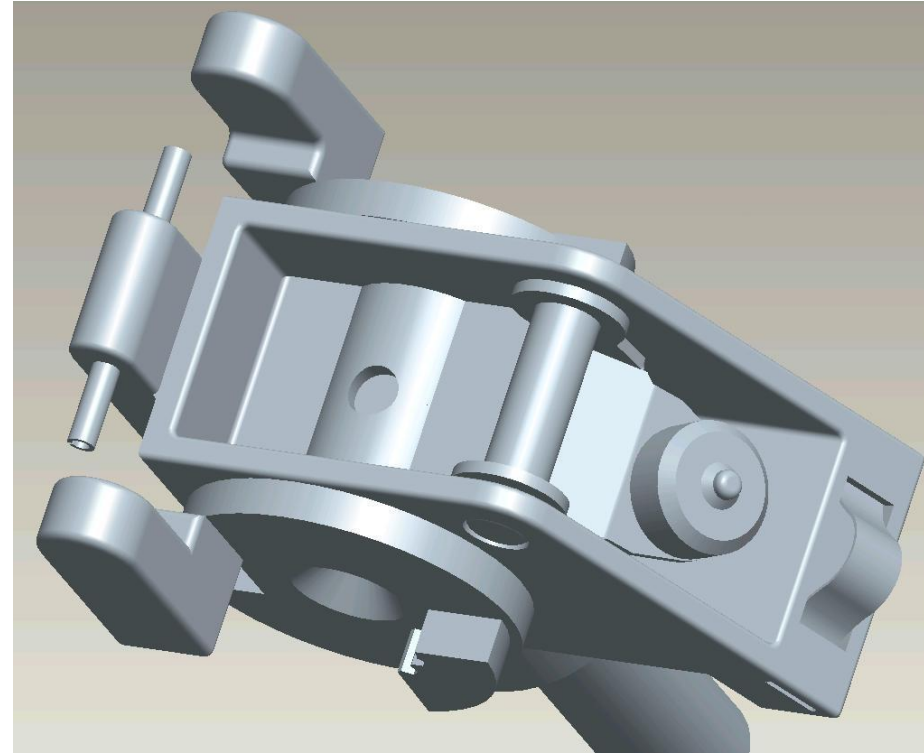
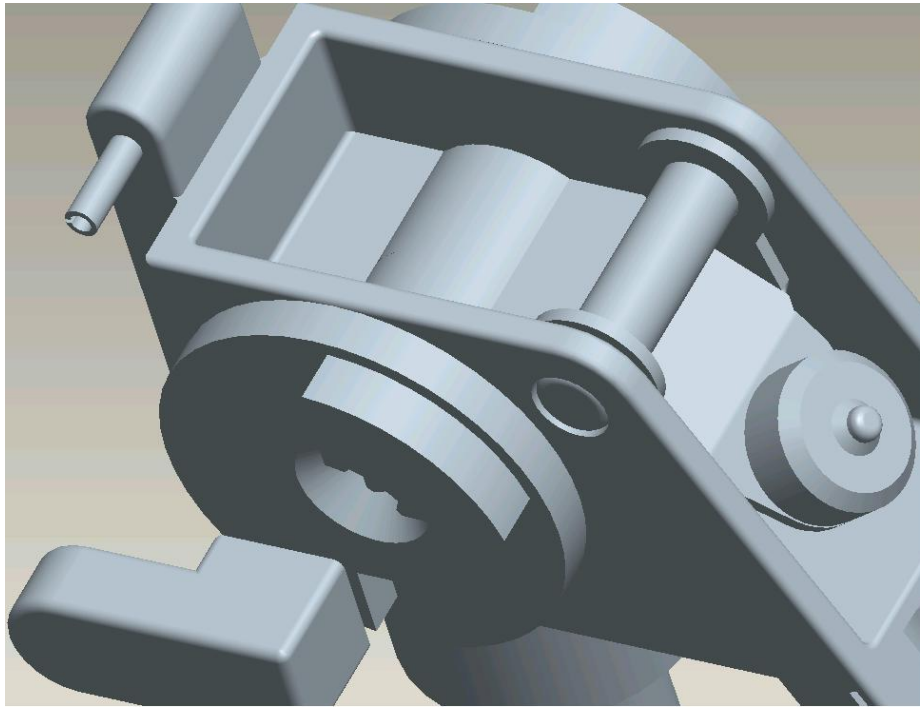
Armed State

User rotates thumb safety and arms grenade



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Rotating Thumb Safety brings initiation device in line with striker



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✓ 2013 Projected Activity

- Design Efforts

- Concept Optimization (dimension validation)
- CAD work and drawing development
- Evaluation of Fuze Interface components
- Optimized component design to be suitable for cast and stamped metal

- Timing Initiation Device

- Analysis of alternative concepts
- Evaluation of delay/initiation mechanism
- Concept Evaluation and selection

✓ 2014 Projected Activity

- Concept Optimization (integration) Integration of delay mechanism into rotating thumb concept

- Concept integration into fuze (system integration)
- Sample manufacturing
- Conduct rough handling testing
- Conduct timing / performance testing
- Design optimization, finalize drawing development and final report





- Concept is an incremental step towards MIL-STD-1911A compliance by providing:
 - an ambidextrous safety.
 - a safety that requires two distinct actions to be performed in a specified sequence to arm.
 - a simple means to re-safe the device after the fuze is armed.
 - visual color coded indication of armed and safe position of the thumb switch.
 - assurance that user has control of the lever before arming.
 - an out-of-line explosive train until user initiates arming sequence just prior to deploying the device.
 - A tamper-proof safety.
 - fewer steps required to deploy device.





- **Questions?**

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