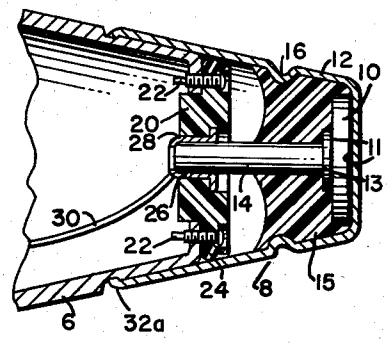
Feb. 3, 1959 R. B. RIZER ET AL 2,871,787

NOSE INITIATOR MOUNTING

Filed Jan. 11, 1956

Fig. 2.



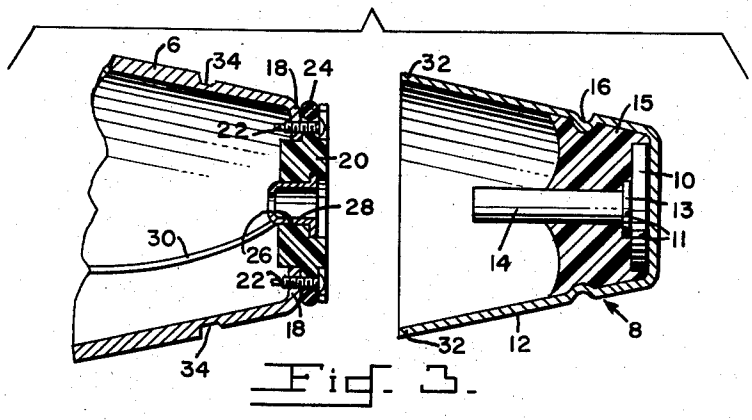


Fig. 3.

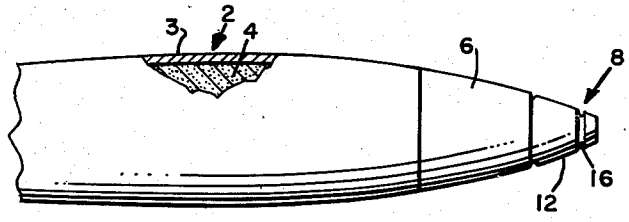


Fig. 1.

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NOSE INITIATOR MOUNTING

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1 Claim. (Cl. 102—70.2)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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

This invention relates to ordnance projectiles and particularly to an energizing means and energizer assembly for shaped charge projectiles.

In designing projectiles designed for shaped charge action it is essential to provide for proper "stand off" function; that is, to provide for initiating the shaped charge at a distance with respect to the target such that the semimolten metallic "spear" will have a chance to form properly before it engages the target. "Stand off" must not be so great that the "spear" will lose its high initial energy before striking the target. The "stand off" distance is rather critical and is normally accomplished by providing the projectile with an elongated ogive, the shaped charge initiating element being mounted in the nose of the ogive. It follows that, once contact with the target is made, initiation must be very rapid in order to maintain "stand off" substantially equal to the distance from the nose of the ogive to the rim of the shaped charge liner.

It is important that the initiator be reliable, that the operability approach 100% for head-on target approaches as well as for larger angles of obliquity at which the projectile may engage the target. Finally, safety of handling and loading is a most important consideration in the design of this as well as other types of ammunition.

Heretofore an electromechanical transducer was mounted in the nose of a shaped charge projectile by positioning it between an inner and an outer ogive. There are several disadvantages to that method of assembly. In the first place, the addition of an extra ogive is expensive in that it requires additional steps in the manufacturing process as well as requiring an additional amount of metal. The extra ogive makes the round heavier, thus reducing its velocity, whereas the extra metal provides little or no additional lethal effect. Another disadvantage lies in the fact that the energizer and the powder charge are brought together in one package at the time of initial assembly, thus creating a dangerous condition as far as testing and handling are concerned. Finally, it has been found that the old method of construction functioned poorly when the projectile impacted with the target at high angles of obliquity.

One object of the invention is a "plug-in" initiator assembly adapted to be affixed to the projectile at a time subsequent to the time the projectile is loaded.

Another object of the invention is to provide a more sensitive initiator at high angles of obliquity.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from the following description and drawing wherein:

Figure 1 is a side view, partly cut away, of a "plug-in" initiator assembly, in accordance with the invention, affixed to a shaped-charge projectile.

Figure 2 is an enlarged longitudinal sectional view of the nose portion of Fig. 1.

Figure 3 is an unassembled view of the invention as shown in Fig. 2.

A preferred embodiment of the invention is shown in the figures wherein the numeral 2 indicates generally a shaped-charge projectile with shell body 3 and charge 4. The charge 4 must be initiated immediately upon contact of the projectile nose with the target if maximum effectiveness is to be obtained. Projectile 2 has a thin-walled ogive 6 which is modified and adapted to receive and have affixed thereto a plug-in assembly 8. Assembly 8 includes an initiator in the form of a piezoelectric crystal 10. Assembly 8 comprises a light weight metallic cap 12 which is generally ogival or conical in shape. A conductive plate 13 is attached to one side of crystal 10 by electrical bonding cement 11; the terminal 14 depends from the plate 13. The opposite side of crystal 10 is attached with an electrical bonding cement 11 to the inner surface of the flat tip of cap 12, the longitudinal axis of terminal 14 falling upon the longitudinal axis of assembly 8. Crystal 10 is coupled to cap 12 by potting with a non-conductive compound 15 which does not require high temperatures for setting, such as epoxy-resin. Good results have been obtained using a potting compound that shrinks upon setting, hence placing the crystal under tension. Also the compound eliminates all voids or gaps between the crystal and itself so that the crystal has a mass immediately behind it. It has been found that potted crysals are more sensitive than mechanically mounted ones. Crimp 16, formed in cap 12, helps to maintain compound 15 in place.

As seen in Fig. 3, the ogive 6 has lips 18 flared inwardly, plastic closure member 20 being affixed by means of screws 22. A hard rubber O ring 24 is positioned therebetween to form a hermetic seal for the protection of sensitive components. Closure member 20 is provided with perforation 26 into which metallic bushing 28 is fitted, the bushing being adapted to make electrical contact with terminal 14, the ogive 6 acting as the other terminal. Wire lead 30, Fig. 3, is in current conducting relationship with bushing 28.

Assembly 8 is a complete package and may be handled, boxed, shipped, or stored separate from the projectile of which it will later become a part. To affix the assembly to the ogive it is necessary only to slide terminal 14 into bushing 28 and to crimp lip 32 of cap 12 into groove 34 of ogive 6, as indicated by reference numeral 32*a* (Fig. 2). In so doing the inner wall of cap 12 is pressed tightly against O ring 24 to hermetically seal the elements within the assembly.

It will be understood that, with assembly 8 thus assembled to ogive 6, mechanical impact of the tip of cap 12 against a target will result in the generation of a voltage that will appear between lead 30 and the metal shell body 3 of projectile 2. This voltage may be applied to a suitable electric detonator (not shown) at the base of charge 4. Appropriate safety-and-arming means (not shown), which may conveniently consist of a setback-actuated switch, will normally be provided to desensitize the detonator until the projectile has been launched and is at a safe distance from using personnel.

It will be apparent that the embodiment shown is only exemplary and that various modifications can be made in construction and arrangement within the scope of the invention as defined in the appended claim.

We claim:

A shaped-charge ordnance projectile having a plug-in energizer assembly affixed to the nose of said projectile;

said projectile having a thin-walled ogive with a groove in the outer surface of its wall and inwardly flaring lips at its nose end, a flat plastic closure member affixed to said lips by means of screws, a hard rubber O ring positioned between said plastic closure member and said lips, said plastic closure member having a perforation falling substantially along the axis of said projectile, a bushing fitted in said perforation and adapted to receive the uncovered portion of said terminal so as to make electrical contact therewith, and a wire lead attached to said bushing in current conducting relationship therewith; said energizer assembly comprising a generally ogival metal cap open at its large end and having a flat closure at its small end, a piezoelectric crystal having one of its sides attached to the inner surface of said flat closure by electrical bonding cement, a conductive plate attached to the other side of said crystal by electrical bonding cement, a terminal depending from said conductive plate on the side away from said crystal, said terminal having its longitudinal axis substantially falling on the axis of said assembly, said conductive plate and said terminal being electrically insulated from said cap, and an epoxy-resin compound which shrinks upon setting potted in the small end of said cap so as to cover said conductive plate and crystal and a portion of said

terminal, said compound thereby rigidly coupling said crystal to said cap and placing said crystal under tension, said cap having a crimp in a portion of its side wall to secure said compound in said cap; the extremities of the open end of said cap being crimped in said groove in the outer surface of the wall of the ogive of said projectile so as to press said O ring tightly against the inner wall of said cap, thereby rigidly affixing said assembly to said projectile and hermetically sealing the elements therein, the uncovered portion of said terminal passing through said bushing so as to make electrical connection therewith; the mechanical impact of said cap against a target causing a voltage to be generated in said crystal which is transferred to said wire lead through said terminal and said bushing.

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