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IMPACT FUZE FOR PROJECTILES

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Fig. 1-

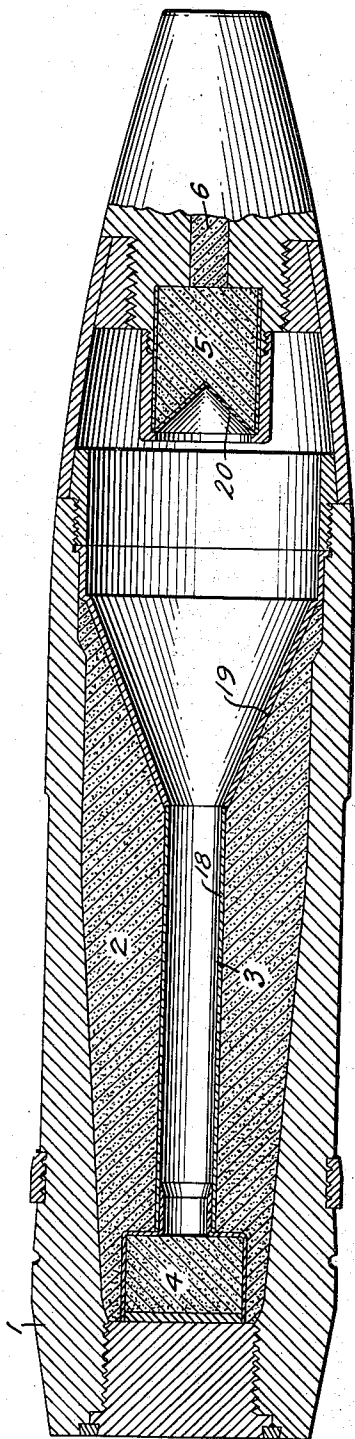
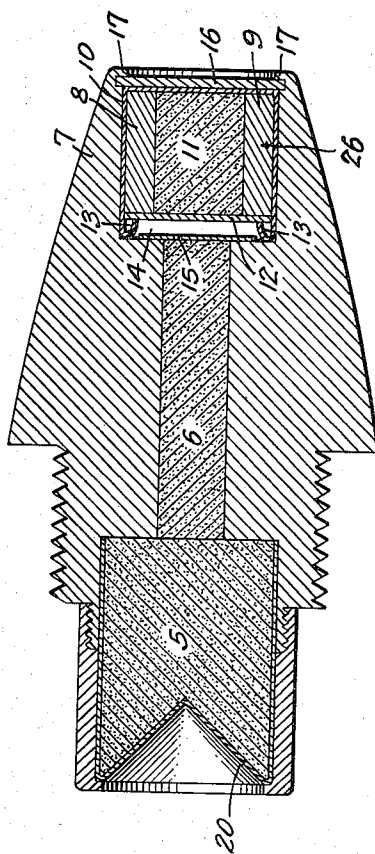


Fig. 2-



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IMPACT FUZE FOR PROJECTILES

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5 Claims. (Cl. 102—73)

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This invention relates to an impact fuze for artillery projectiles and has for its primary object the provision of such a fuze to utilize the heat generated by impact.

Another object is to provide a point detonating or point initiating fuze for hollow or shaped charge artillery projectiles which will offer a minimum obstruction to the forward explosive or jet action of the explosive charge.

In accordance with my invention I provide a point-detonating fuze of the type which utilizes the heat generated upon impact of the projectile against the target, by the action of a plunger in the nose of the projectile. The heat is produced by the action of the plunger in compressing a column of air at its base, said air being substantially in contact with an explosive material, and also to some extent by the effect of friction between the plunger and its confining walls as the plunger is moved back relatively to the projectile. An additional temperature rise due to crumpling of the nose of the projectile and plunger upon impact may be a factor in causing detonation. It has been shown by test that a fuze can be constructed in accordance with the principles outlined above which is effective in detonating a booster charge in the projectile upon impact with the target.

In impact fuzes now in use, the explosive train usually consists of a very small highly sensitive explosive charge of primer mixture followed by a larger less sensitive charge such as mercury fulminate or lead azide, in turn followed by a still larger and still less sensitive charge such as tetryl (trinitrophenylmethylnitramine) or PETN (pentaerythritol tetranitrate). Such a charge functions by successive detonation, hence the term "detonating fuze."

Since the main charges of a high explosive shell are relatively insensitive to shock, a comparatively large detonating charge is necessary to insure a high-order detonation of the main charge. The use of more sensitive charges such as mercury fulminate, or lead azide, in the quantities required for the purpose would create excessive hazards in handling and firing. Therefore such explosives are used only in small amounts as initiating and intermediate detonating charges. A separate charge of somewhat less sensitivity (usually tetryl) is provided for detonating the high-explosive charge of shells, and because its function is to increase or "boost" the effectiveness of explosive trains, this charge is known as a booster charge.

The fuze of my invention eliminates the necessity for using the highly sensitive primer materials described above, as the heat generated by my projectile point upon impact with the target is sufficient to directly detonate the relatively insensitive booster charge of tetryl or PETN. This also eliminates the need for elaborate safety devices such as are now conventional in the art, as the impact force necessary to produce detonation with my fuze is of such an order of magnitude as can not be obtained in ordinary handling or dropping, since this force must be sufficient to crush the nose of the projectile.

The following description shows my invention applied

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to a shaped charge projectile such as is used for piercing armor. It will be apparent however, that my fuze will also function with any other type of military projectile containing a high explosive charge on impact with a target objective.

In the drawings:

Figure 1 is a longitudinal cross section through an artillery shell embodying my invention;

Figure 2 is an enlarged sectional view of the fuze shown in Figure 1.

The casing 1, of the projectile contains a shaped charge 2, of known design, provided with a hollow central bore 3, leading to a base detonator 4 which is detonated by the action of a small shaped charge 5, of tetryl or PETN in the nose of the projectile. The bore 3 and the characteristic funneled configuration of the shaped charge are provided with a thin liner 18, 19 of metal or any other suitable rigid material in accordance with known practice while shaped charge 5 is similarly lined at 20. The construction so far described is known in the art, the charge 5 usually being initially detonated by action of a conventional train of primer and exploder as explained above. Instead of this, in accordance with my invention, I provide the construction which I show in the drawing, in which the booster 5, preferably of tetryl, is set off by the explosion of a charge 6 of PETN, although any explosive of similar character may be used at this point. The PETN is ignited by the action of the nose igniter generally shown at 26, which I will now describe in detail.

A suitable hollow or bore, usually cylindrical, is formed in the metal of the fuze body 7 to accommodate the plunger 8. This plunger is formed of a relatively thick-walled metal tube 9, set into a thinner-walled cup or liner 10 of sheet metal lining the bore of nose 7. The cylindrical chamber thus formed is filled with tetryl and closed with a relatively rigid disc 12 of sheet metal which is retained in place by turning or crimping over the rear edge of cup 10 as shown at 13. This leaves an air space 14 between disc 12 and the bottom of the bore in fuse body 7. A thin sheet 15 of any suitable material, such as onion-skin paper, is pasted or shellacked over the end of the chamber containing the charge 6, in order to confine the charge and make certain that space 14 is unobstructed.

A fairly heavy metal disc 16, is placed over the closed end or bottom of cup 10, and the rim of the fuse body is turned over as shown at 17, to secure the component parts in assembled relation.

Upon impact of the projectile against target, disc 16 is crushed, which in turn forces down or crushes cylinder 9 to compress the air in chamber 14. The force of this impact by itself is not always sufficient to detonate the tetryl 11, but the heat produced by the friction of the plunger against the walls of the chamber and by the crumpling of the metal, or by the rapid compression of air in chamber 14, or by a combination of these effects detonates charges 6 and 11. The explosion of charge 6 detonates the booster charge 5. The rearwardly-directed jet resulting from detonation of shaped charge 5 initiates the base detonator 4 which in turn detonates the shaped charge 2 of the projectile. The effect of this shaped charge is to produce a highly penetrative jet forwardly along the axis of the projectile.

It is also possible to employ the same construction as shown above, but to omit the tetryl charge 11 in the plunger. This construction also leaves a hollow axial space for the action of the jet. However, I prefer to employ the tetryl 11, in the plunger.

It will thus be seen that my improved fuse construction eliminates the usual sensitive primer and at the same

time provides a structure peculiarly adapted for use with projectiles.

While I have shown my invention applied to artillery shells, it will be understood that my invention is equally applicable to a rocket, mortar shell, or any other projectile which attains sufficient velocity to act upon impact in the manner shown, and I do not intend my invention to be limited except by the appended claims.

By the expression "shaped charge" I mean an explosive charge containing a generally-funnel-shaped cavity whose open end faces in the direction in which penetration is sought, as is well known in the art and commonly employed in armor-piercing shells.

I do not broadly claim the principles of producing an ignition in a projectile fuze by plunger compression of entrapped air due to impact, as this is not my invention, but the application of this feature to the extent shown, in the particular structure which I hereby describe and claim, I believe to be novel and useful.

I claim:

1. A nose fuze for impact detonation of ordnance projectiles comprising a fuze body having a passage way axially thereof defining three axially disposed chambers, a rearwardly directed shaped booster charge in the rear-most of the said chambers, a high-temperature-sensitive detonating charge in the middle one of said chambers, a hollow plunger filled with a relatively insensitive booster explosive capable of being detonated by the detonator charge, said plunger frictionally engaging the walls of the forward portion of the foremost of said chambers to define an air space between the rear of said plunger and the forward portion of said middle chamber, whereby upon impact of the projectile against a target the plunger will be forced rearwardly to compress the air in said air space and to raise the temperature to the ignition point.

2. In a fuze, a fuze body adapted for threaded engagement with the nose of a projectile to close the same, there being an axial bore through said body and a counterbore opening through the forward end thereof, a first explosive charge confined within said axial bore, a thin-walled metallic cup fitting said counterbore with its bottom closing the forward end of said counterbore, the rim of said cup being curled inwardly and forwardly and having its curled rim resting against the shoulder between said bore and counterbore, a closure disc fitting said cup resting against the inwardly and forwardly disposed edge of said cup, to define a sealed air chamber between said first explosive charge and disc, a plunger slidably fitting said cup between the forwardly-disposed

bottom thereof and said disc, and means closing the forward end of said body and confining said cup against movement within said counterbore.

3. A fuze as recited in claim 2, said plunger being tubular, and a second explosive charge filling the space within said tubular plunger and confined between said closure disc and the bottom of said cup.

4. In an impact fuze for projectiles, a fuze body having a central axial bore counterbored at its forward end to define a forwardly-facing annular shoulder, a first explosive charge filling said axial bore, a tubular plunger slidably fitting said counterbore, a second explosive charge filling and confined within said tubular plunger, means interposed between said plunger and shoulder to yieldingly space the same and define a compressible air space therebetween whereby said first explosive charge is initiated by elevation of the temperature of the air within said space due to compression thereof by movement of said plunger in response to impact, and cover means fixed with said fuze body sealing the forward end of said plunger and counterbore.

5. In a fuze for a shaped charge projectile, a fuze body having a central axial bore and first and second counterbores at its forward and rearward ends, respectively, and defining forwardly- and rearwardly-facing annular shoulders respectively, a tubular plunger slidably fitting said first counterbore, a first explosive charge filling said axial bore only, a second explosive charge filling said tubular plunger, discs sealing the forward end of said first charge and the rearward end of said second charge, yieldable means interposed between said plunger and forwardly-facing shoulder and positively spacing said discs to define a sealed air chamber between said discs, said chamber having a transverse dimension greater than its dimension axially of said body, sealing means fixed with said body and closing the forward end of said body and confining said plunger against axial movement in said first counterbore, and a third explosive charge filling said second counterbore.

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