Nov. 23, 1965 M. F. MASSEY 3,218,975

SHAPED CHARGE LINER

Filed June 28, 1950

Fig. 1.

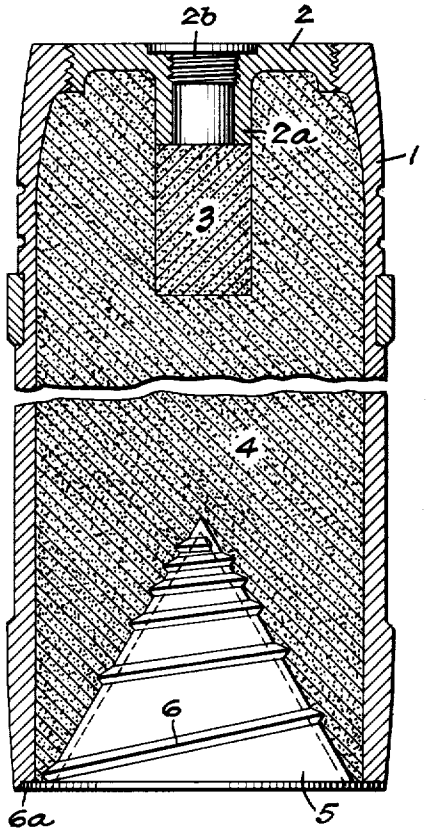


Fig. 3.

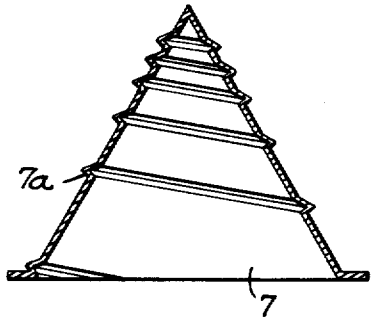
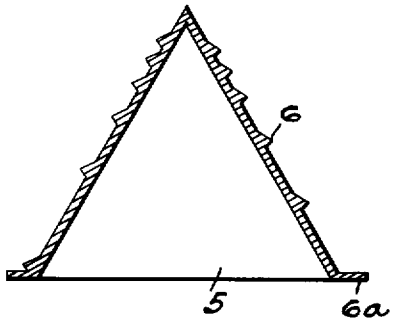


Fig. 2.



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SHAPED CHARGE LINER

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1 Claim. (Cl. 102—56)
(Granted under Title 35, U.S. Code (1952), sec. 266)

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

This invention relates to shaped explosive charges operating upon the Monroe effect. The great armor-penetrating power of the jet of a shaped charge when detonated statically at the optimum stand-off distance, is well known. It is equally well known that the penetrating power of such charges is greatly reduced when the charge is spinning at the instant of detonation, as in the case when it is fired from a rifled gun. For this reason, to obtain the maximum penetration of which shaped charge projectiles are capable, it has heretofore been necessary to project them by means of rockets or mortars despite the inferior range and accuracy inherent in missiles so projected.

It is therefore the principal aim of my invention to provide a liner for shaped charges wherein the forces acting on the liner generated by the explosive charge, act to nullify or compensate for rotation of the liner, whereby the deleterious effects of rotation of the projectile may be overcome and the great penetrating power of the shaped charge may be combined with the superior accuracy and greater range, of spinning projectiles.

Other objects and advantages of the invention will become apparent from a study of the following description, in connection with the accompanying drawing.

In these drawings:

FIG. 1 is an axial cross section through a shaped charge projectile having a liner constructed in accordance with the invention, the liner being shown in elevation,

FIG. 2 is an axial cross section of the liner of FIG. 1, and

FIG. 3 is an axial cross section of a modified form of liner.

In FIG. 1, the numeral **1** identifies a projectile casing having its rearward end closed by a plug or adapter **2** threaded into the casing and provided with a forwardly-extending central sleeve portion **2***a*, forming a receptacle for a standard impact fuze **2***b*. This fuze is secured in position within its receptacle by engagement with threads of the adapter. A booster charge **3** is positioned within a rearwardly-opening cavity in the main charge **4** and is held in position by the portion **2***a*. The foregoing is a well-known construction.

The charge **4** substantially fills the casing **1** except for a conical cavity at its forward end, lined with a hollow liner **5** of metal of uniform thickness and having a helical thread or ridge **6** secured to its outside surface and extending from apex to base. In this form of the invention, the angle which the tangent to the thread makes with the axis of the cone or, more accurately, with a line through the point of tangency parallel with the aforesaid axis, increases from base to apex of the liner. The liner may have a flange **6***a* at its base by which it may be secured to the casing **1** by any suitable means, not shown, such as a light hollow ogival nose cap, not shown. The thread or ridge **6** may be welded or otherwise secured to the surface of the liner.

In FIG. 3 there is shown a liner **7** in which the thread **7***a* is formed in the material of the liner itself. In this modification, the tangents to the thread make a fixed angle with the axis of the cone. In all cases the helical thread or ridge will extend in the same direction as the rifling of the gun with which the assembled projectile is intended for use. Thus, the projectile of FIG. 1 is intended for use with a gun having righthand rifling.

In operation, when the nose of the spinning projectile strikes the target, the charge is detonated by fuze **2***b* to form the usual penetrating jet. The forwardly-moving jet impinges upon the thread or ridge **6** or **7***a*, and produces a tangential reaction component acting along the thread in a direction opposite the direction of spin. The sum of the components thus generated will, by proper construction of the size, pitch and offset of the thread, be sufficient to overcome the angular momentum of the spinning liner and thus effect a penetration equal to, or not materially less than, a like charge detonated statically. The range of utility of shaped charges capable of use with artillery ammunition is thereby greatly increased.

Considering the cone or liner as a plurality of sections cut by equally-spaced planes normal to the axis of symmetry of the liner, it is clear that the desideratum would be to fully compensate each section by and from its own portion of the thread. Such an ideal condition would reduce shearing stresses in the liner to a minimum and give the maximum total compensating impulse to the entire cone. Since the angular momentum of each of the aforesaid sections will increase from section to section with their distance from the apex the form of liner shown in FIG. 1 is to be preferred, wherein the tangent angle increases substantially uniformly from apex to base, whereby the component rotation-opposing impulse effective upon each section will increase with increase of angular momentum of the respective sections. In practice the rate of increase of the helix angle may decrease or increase from apex to base. A thread having constant pitch measured along the axis of the cone, is also contemplated.

While I have disclosed the preferred form of the invention as now known to me, various modifications, such as changes in the size and cross-sectional shape of the thread, will readily occur to those skilled in the art after studying the foregoing disclosure. For this reason, the disclosure should be taken in an illustrative rather than a limiting sense; and it is my intention and desire to reserve all modifications and changes falling within the scope of the subjoined claim. While I have shown only liners of conical shape, it will be clear that the form may correspond to any one of various surfaces of revolution such as a hemisphere, a trumpet, or paraboloid. The term "generally conical" as used in the claim is to be interpreted to include the above-mentioned forms.

Having now fully disclosed the invention, I claim:

In a spin stabilized shaped charge projectile the combination comprising, a hollow casing open at one end, a rotating band secured thereabout, a high explosive charge filling said casing, there being a hollow generally conical cavity formed in said charge at said open end, a hollow generally conical liner contiguous with said cavity and confining said charge within said casing, means to offset the adverse effects of rotation upon jet formation, said means comprising one or more helical threads formed on and integral with the side walls of said liner from apex to base thereof and extending into said explosive, the angular relation between the tangent to said thread at

any point and the axis of said liner increasing progressively from apex to base thereof, said thread extending in the same direction as the rifling of the gun barrel from which said projectile is fired.

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