Oct. 15, 1957 S. A. MOSES 2,809,585

PROJECTILE FOR SHAPED CHARGES

Filed Nov. 16, 1949

FIG. 1

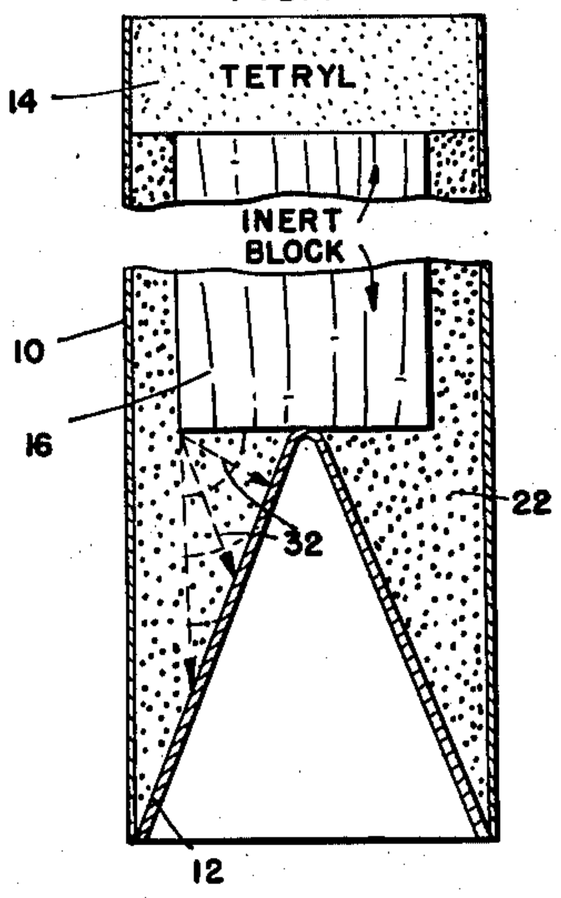


FIG.2

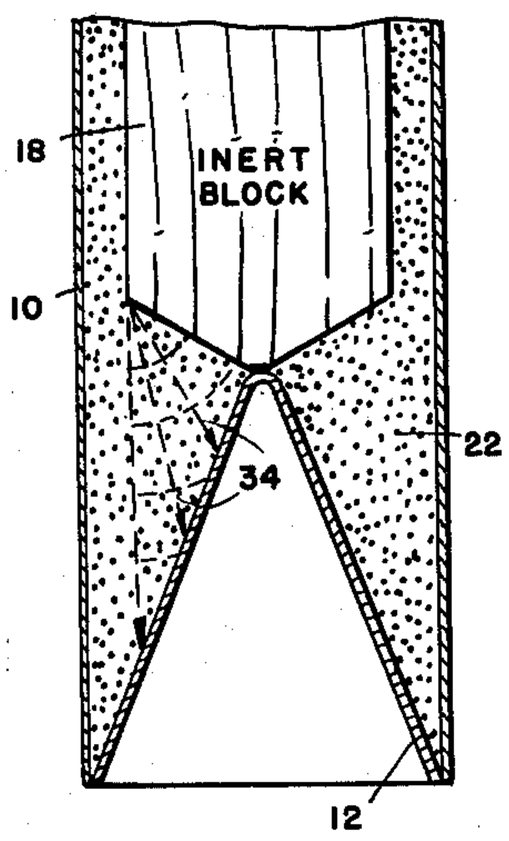


FIG. 3

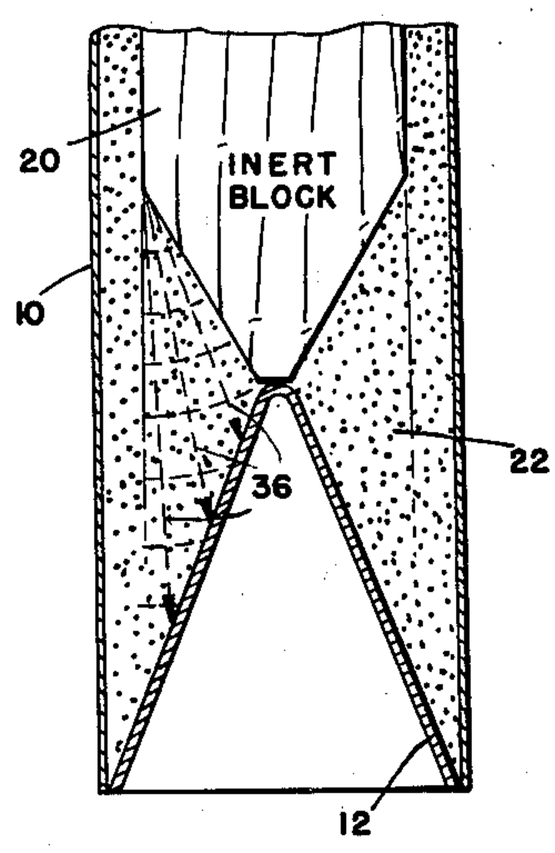


FIG.4

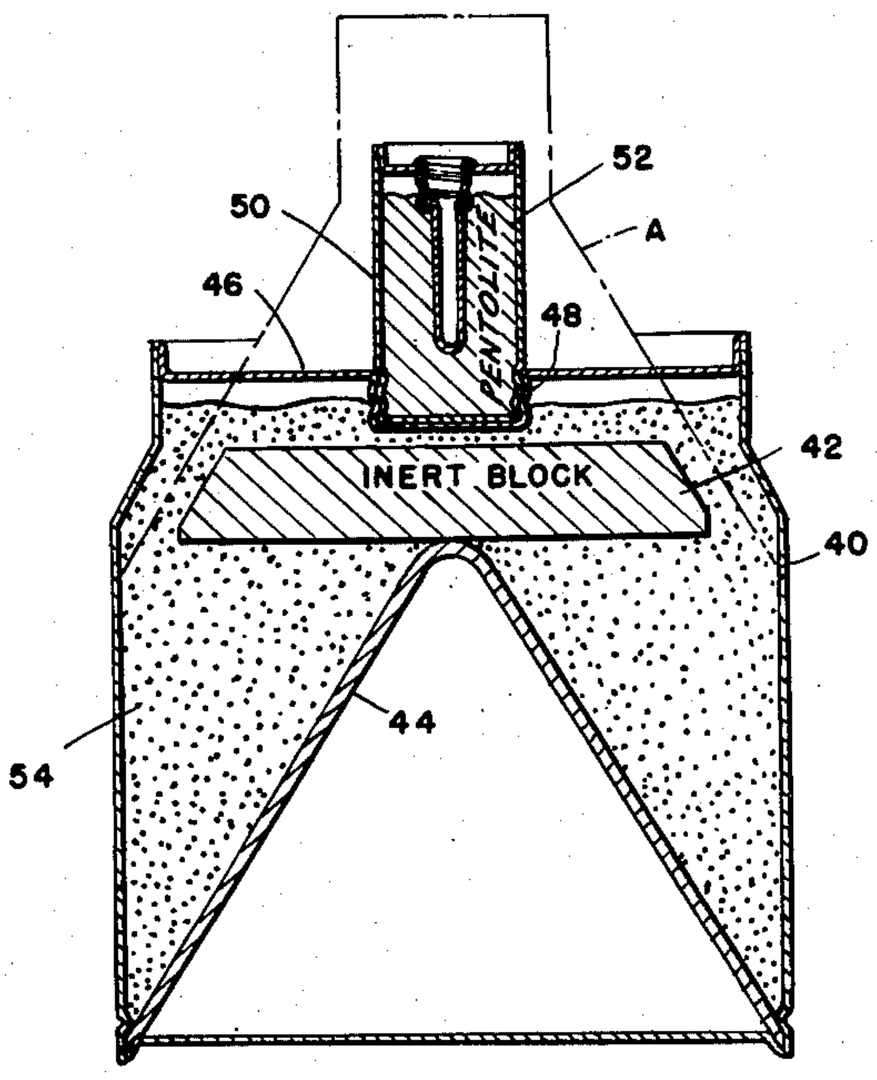
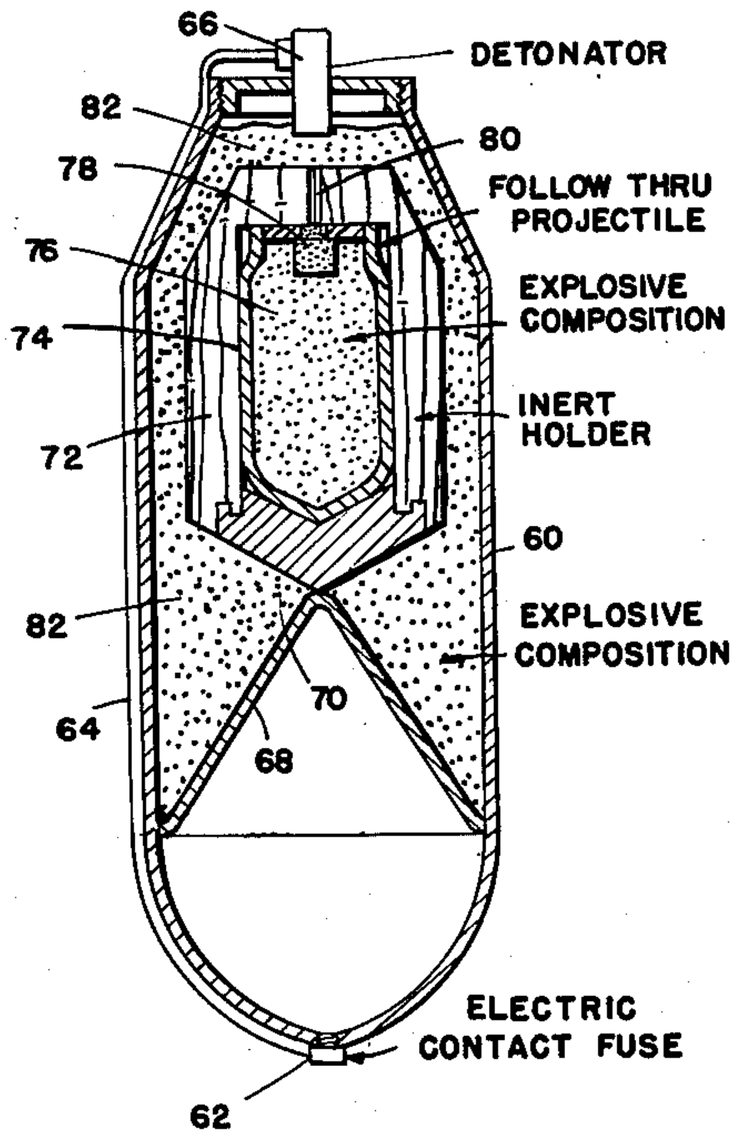


FIG 5



INVENTOR:

SIDNEY A. MOSES

BY M. C. Hayes

ATT'Y

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PROJECTILE FOR SHAPED CHARGES

Sidney A. Moses, Braddock Heights, Md., assignor to the United States of America as represented by the Secretary of the Navy

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12 Claims. (Cl. 102—56)

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This invention relates in general to a projectile for shaped charges and is more particularly described as a follow-through projectile of this class in which a cavity liner of the conical type has an inert core disposed at the apex of the liner.

The present method of obtaining efficiency from a shaped charge is to have the length of the explosive charge behind the cavity liner equal to two or three times the diameter of the cavity liner. Using this method, any follow-through projectile must be placed behind the point of detonation. No successful projectile of this type has yet been presented, because of the difficulty of causing the projectile to travel through the detonation products and enter the hole in the target where the jet has penetrated.

By introducing the projectile inside an inert core at the apex of the cavity liner, the follow-through projectile does not travel through the detonation products and moves only a short distance to enter the jet hole.

An important object of this invention is to increase the efficiency of shaped charges (also called hollow or cavity charges) by introducing a follow-through projectile or corrosive agent in the jet hole formed by the charge.

A further object of the invention is to increase the area of damage in a target by introducing an explosive projection or corrosive agent through a jet hole made by the projectile charge, into the interior of the target.

A still further object of the invention is to incorporate the follow-through projectile in the inert core, close to the apex of the cavity liner so that it is not required to travel through the detonation products to enter a formed jet hole.

Other objects of the invention will appear in the specification and will be apparent from the accompanying drawings, in which:

Fig. 1 is a sectional view representing a shaped charge having an inwardly projecting conical cavity liner with an inert block of material having a blunt end in contact with the liner apex;

Fig. 2 is a sectional view representing a portion of a shaped charge with an inert block having a blunt point in engagement with the liner apex;

Fig. 3 is a sectional view representing a portion of a shaped charge with an inert block having a sharp point in engagement with the liner apex;

Fig. 4 is a section view of a shaped charge with an inert plug of broad and flat form to shape the detonation wave; and

Fig. 5 is a section view of a projectile having an inert core with a pointed tip to engage the liner apex and containing a follow-through projectile.

In a projectile of this type, the detonation of the explosive causes the detonation wave to pass around the inert core and to impact with the liner which sends out a narrow jet piercing the target. In the meantime, the propellant powder behind the follow-through projectile has burned, propelling the projectile through the jet hole where it will explode inside the target.

Referring now more particularly to the drawings, shaped charge containers **10** (or portions thereof) are represented in Figs. 1, 2 and 3, each having a conical liner **12** with the cone thereof inserted at one end, and having a tetryl charge **14** at the other end, as shown in Fig. 1. Inert blocks **16**, **18** and **20**, less in diameter than the containers are inserted against the liner cones, leaving space around the blocks and against the liner for an explosive **22**, such as pentolite.

To change the shape of the detonation wave, the inert blocks may have different contact portions for engaging the liner cones; block **16** has a plain or flat end **26**; block **18** has a bluntly pointed tip **28**, and block **20** has a sharply pointed tip **30** in contact with the liner cone tip. These different shapes may modify the shapes of the detonation waves which engage the liner substantially as shown: lines of force **32** in Fig. 1, being more nearly normal to the liner than lines of force **34**, in Fig. 2, and the latter being at a less incline than lines of force **36** as shown in Fig. 3. By varying the diameter and shape of the blocks, the angles the lines of force make with the liner surface, can be varied at will. Experiments show that where the lines of force meet the liner at a greater angle, up to a right angle, the penetration charge is increased.

In order to reduce the explosive weight of one type of charge by the use of shaped inert cores, an outer shell **40** may be modified in shape from an outline A to include a flat inert block **42** which fits loosely in the shell and is in contact with the apex of an inwardly extending core **44**. At the base end, the container is slightly reduced in diameter and provided with an end cap **46** having a central threaded hole **48** to receive a correspondingly threaded end of a detonator block **50**. In the block **50**, is a detonator well surrounded by an explosive **52**, such as pentolite, and in the container **40** surrounding the block **42** and the cone **44**, is an explosive **54**. In this form, the explosive weight has been reduced from 30 pounds to approximately 20 pounds with only a slight change of the metal shell.

An inert block or plug may also be used as a holder for a follow-through projectile as shown in Fig. 5. In this form, an outer shell **60** has an electric contact fuse **62** at its nose connected by a conductor tube **64** with a detonator **66** at the other end. In the nose is a liner cone **68**, and engaging the tip of the cone is a bluntly pointed end **70** in the form of a cap for a recessed inert holder **72**. In the recess of the holder is a follow-through projectile **74** having an explosive composition **76** which may be fired through a delay pellet **78** and a hole **80** in the end of the holder. An explosive composition **82** fills the space in the shell **60** surrounding the holder and around the cone **68**.

In all of these forms, the shaped charge may be varied by an inert plug or block, so that a follow-through charge or projectile may enter and further penetrate the jet hole formed by the charge. The detonation wave may be directed to meet the shaped charge liner more nearly normal to the conical surface of the liner, thereby increasing the penetrating power of the charge.

While various structures are described in some detail, they should be regarded as illustrations, or examples, and not as limitations of the invention, as many changes may be made in the construction, combination and arrangement of the parts without departing from the spirit and scope of the invention.

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

I claim:

1. A follow-through projectile for shaped charges having an inwardly extending conical cavity liner at the nose

and a detonator at the other end, an inert core block abutting the apex of the liner, and an explosive surrounding the core block and the liner and extending longitudinally therefrom.

2. A projectile for shaped charges, comprising an outer shell, an inwardly extending conical cavity liner at the forward end of the shell and a detonator at the rear end of the shell, an inert block abutting the apex of the liner, an explosive surrounding the block and the liner in the shell, and means on the block for varying the path of the detonation lines of force which engage the liner.

3. A follow-through projectile for shaped charges, comprising an outer shell and an inwardly extending conical liner at the forward end, means for detonating the shell at the rear end, an inert core block in the shell between the detonating means and the liner having one end engaging the apex of the conical liner shaped to direct the explosive lines of force at the end of the block toward the conical surface of the liner, and an explosive in the shell surrounding the block and the conical surface of the liner.

4. A projectile for shaped charges comprising an outer shell with an inwardly extending conical liner at one end, and a detonator at the other end, an inert block in the shell abutting the apex of the liner, and an explosive in the shell surrounding the block and the liner.

5. A follow-through projectile for shaped charges, comprising an inwardly extending conical cavity liner at one end and a detonator at the other end, an inert block in the shell abutting the apex of the liner and having a recess therein, a follow-through projectile in the block recess, and an explosive in the shell surrounding the block and the liner.

6. In a follow-through projectile for shaped charges, an inwardly extending liner at one end having an inner apex and a detonator at the other end of the projectile, a recessed inert block abutting the liner apex and substantially in line with the axis thereof, and a follow-through projectile in the recess of the block.

7. In a follow-through projectile for shaped charges, an outer shell having an inwardly extending liner with an inward projection at one end and a detonator at the other end, a recessed inert block in the shell in line with and

abutting the projection with the abutting surface shaped to direct explosive lines of force toward the surface of the liner, a follow-through projectile in the recess of the block, and an explosive in the shell surrounding the block and the liner.

8. A projectile for shaped charges comprising an outer shell with an inwardly extending liner at one end and a central pointed inward end on the liner, a detonator at the other end of the shell, and inert block in the shell in line with and contacting the inward end of the liner, the abutting portion of the block being shaped to direct the explosive lines of force at the end of the block relative to the adjacent surface of the liner, and an explosive in the shell surrounding the block and the liner.

9. In a follow-through projectile for shaped charges, an outer shell, an inwardly extending liner at one end having a central inward projection, a detonator at the other end of the shell, a recessed inert block in line with and having one end in contact with the projection, a follow-through projectile in the recess of the block, and an explosive in the shell surrounding the block and the liner.

10. A projectile for shaped charges in accordance with claim 4 in which the block has a flat end in contact with the apex of the liner.

11. A projectile for shaped charges in accordance with claim 4 in which the block has a bluntly pointed end in contact with the apex of the liner.

12. A projectile for shaped charges in accordance with claim 4 in which the block has a sharply pointed end in contact with the apex of the liner.

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