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SHELL WITH PLASTIC EXPLOSIVE AND HOLLOW LINER

Filed Feb. 7, 1951

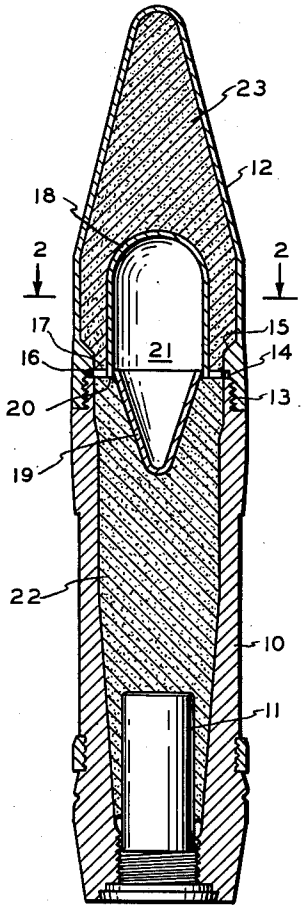


FIG. 1

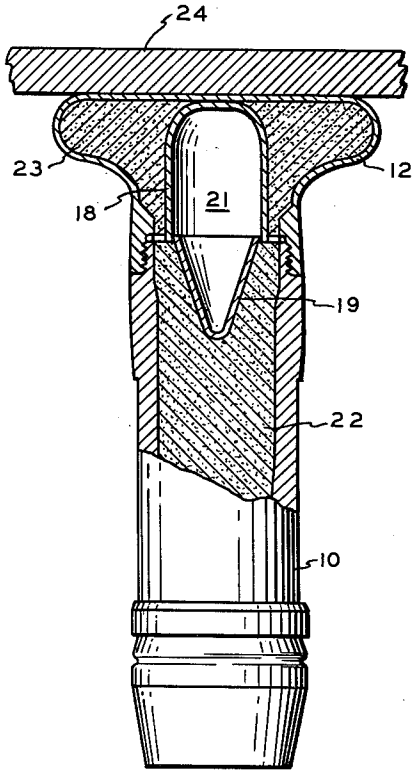


FIG. 4

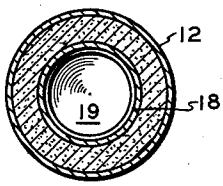


FIG. 2

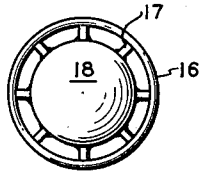


FIG. 3

INVENTOR

JOHN O. EVANS JR.

BY Stowell & Evans.

ATTORNEYS

United States Patent Office

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SHELL WITH PLASTIC EXPLOSIVE AND HOLLOW LINER

John O. Evans, Jr., Washington, D.C.
(3121 Westcliff Road W., Fort Worth, Tex.)

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This invention relates to projectiles, more particularly to shell for use against armor.

The invention utilizes in a single projectile two known principles, namely:

(*a*) The "shaped charge" effect, and
(*b*) The plastic explosive or "squash head" effect.

An object of the invention is to provide a shell having excellent armor penetrating characteristics.

Another object is to provide a "shaped charge" projectile that carries an unusually large explosive charge.

Another object is to provide a shell of this character that is constructed in a simple manner of relatively few and simple components.

The foregoing and other objects and advantages of the invention are realized in an explosive shell comprising an elongated enclosed hollow casing having a nose portion the walls of which are deformable upon impact and a body portion having substantially stronger walls, enclosed hollow liner means supported within said casing and substantially spaced from the walls thereof, said liner means extending from a point within the body portion of said casing to a point within the nose portion of said casing, an initiator in the body portion of said casing, an explosive composition substantially filling the space between said linear means and the walls of said casing, at least a substantial part of the explosive composition in the nose portion of said casing being plastic.

One form of the invention is shown in the accompanying drawing in which:

FIG. 1 is an axial sectional view of a shell embodying the principles of the invention;

FIG. 2 is a transverse sectional view taken along the plane of the line 2—2 of FIG. 1;

FIG. 3 is a plan view of one of the components of the shell of FIGS. 1 and 2; and

FIG. 4 is a view similar to FIG. 1 showing the shell at a stage shortly after impact with a target.

Referring to the drawing, the illustrative shell has a body portion **10** of conventional form having relatively thick, strong side walls and a base fuze and booster device **11** that is also conventional.

An ogival nose portion **12** is screwed at **13** to the body **10**. An annular recess **14** is provided between a shoulder **15** of the nose portion and the forward end of the body and a ring **16** is removably seated in this recess. The ring has inwardly projecting legs **17** welded to the bottom or rearward part of the skirt of a bell-shaped liner **18** that extends forwardly into the nose cavity of the shell.

A conical cup-shaped liner **19** is fitted into the bottom of the liner **18** and tack-welded thereto along the line **20** of peripheral engagement therebetween. This conical liner projects rearwardly into the body cavity of the shell.

The assembly of liner **18** and **19** provides an envelope in which is a cavity **21** that normally contains only air. These liners are preferably made of metal such as steel or copper.

The body cavity of the shell is filled with a brisant high explosive composition **22** up to the liner **19** and spider ring legs **17**. The nose cavity is filled with a plastic high explosive composition **23** forwardly of the spider ring and the liner **18**. The masses of explosive composition in the nose and body cavities may be in physical contact with each other through the openings between the legs **17**

of the spider ring. The charge **22** may be TNT and the charge **23** may be TNT plasticized with lubricating oil, wax or the like.

The nose portion **12** of the shell preferably is formed of a soft, ductile metal such as aluminum or magnesium or alloys thereof. The body portion **10** may be a conventional steel forging.

Referring to FIG. 4, the projectile of FIGS. 1 to 3 is shown in contact with a target **24** that may be an armor plate. In point of time, the shell has struck the target and the fuze and booster have just been fired but the explosive wave or shock wave has not yet progressed forwardly through the explosive material **22** to the apex of the cone liner **19**. The nose portion **12** has been flattened at the forward end against the target and the liner **18** has been driven forwardly through the plastic explosive material **23** into contact with the nose portion **12**. Some deformation of the front of the liner **18** has occurred. The plastic explosive is deformed and expanded laterally to provide a mushroom shaped head. A clear passage is provided by the cup **18** forwardly of the base of the conical liner **19** to the nose portion **12**.

Now, let it be assumed that the shock wave progresses forwardly to the base of the conical liner **19**. The liner collapses inwardly extruding an armor piercing jet that is projected forwardly through the space provided by the cup **18** to penetrate the forward end of the cup, the nose portion **12** and the target **24**.

The shock wave continues forwardly through the annular mushroom shaped mass of plastic explosive material **23**, through the nose portion **12** and into the target **24**. The effect of this shock wave is to set up disruptive stresses in the target resulting in spalling of the metal at the reverse side of the armor plate.

The fuze in the fuze and booster device **11** preferably is one of the inertia type that functions by action of set forward forces. It is adjusted to function shortly after impact of the projectile against the target at a time that will allow the explosive wave to reach the cone apex just after the liner **18** has been driven forward into contact with the deformed nose piece **12**.

From the foregoing description, other forms of the invention will readily occur to those skilled in the ordnance art. The forwardly projecting liner **18** may be replaced by other means that will provide a substantially unobstructed path through which the armor piercing jet produced by the conical liner **19** may travel to the target through the mass of plastic explosive. The liner **19** may have other appropriate forms. The explosive containing cavities of the shell may be entirely filled with plastic explosive instead of being partly filled with a non-plastic type.

Although the invention has been described with reference to a spin stabilized projectile, it is evident that it may be applied to fin stabilized or other non-rotating projectiles.

I claim:

1. An explosive shell comprising an elongated enclosed hollow casing having a nose portion the walls of which are deformable upon impact and a body portion having substantially stronger walls, enclosed hollow liner means supported within said casing and substantially spaced from the walls thereof, said liner means extending from a point within the body portion of said casing to a point within the nose portion of said casing, explosive composition substantially filling the space between said liner means and the walls of said casing, at least a substantial part of the explosive composition in the nose portion of said casing being plastic, and means for initiating detonation of said explosive composition solely at the base thereof.

2. An explosive shell comprising a shell body having a cavity therein, a first liner at the front end of said body

cavity and spaced from the walls of said body, said first liner having a forwardly facing depression therein, a nose portion secured to said shell body and extending forwardly thereof, said nose portion having a cavity therein, a second liner in said nose portion cavity and spaced from the walls of said nose portion, said second liner having a rearwardly facing depression therein, the depression of said second liner communicating with the depression of said first liner, a plastic explosive composition in the space between said second liner and said nose portion, an explosive composition in the space between said first liner and said shell body, and base fuze means in said shell body positioned to initiate detonation solely at the base of the explosive composition in said shell body.

3. An explosive shell comprising a substantially cylindrical shell body having a substantially cylindrical coaxial cavity therein, said cavity being closed at the base end and open at the forward end, a hollow ogival nose piece attached to the forward end of said shell body, said nose piece having a rearwardly opening cavity communicating with the forwardly opening cavity of said shell body, the walls of said nose piece being constructed of a ductile metal readily deformable on impact, a substantially cylindrical first liner supported in the cavity of said nose piece and spaced from the walls of said nose piece, said first liner being open at the rearward end and closed at the forward end, a second conical liner supported in the open end of said first liner with its apex pointing rearwardly

and substantially spaced from the walls of said shell body, a plastic explosive composition in the space between said nose piece and said first liner, an explosive composition in the space between the walls of said shell body and said second liner, and a base fuze in said shell body cavity positioned to initiate detonation solely at the base of the explosive composition in said shell body.

4. An explosive shell comprising an elongated enclosed hollow casing having a nose portion the walls of which are deformable upon impact of the shell against a target, enclosed hollow liner means supported within said casing and spaced from the walls of said casing, the rearward portion of said liner means having the form of a cone pointing rearwardly, explosive composition substantially filling the space between said liner means and the walls of said casing, at least a substantial part of the explosive composition in the nose portion of said casing being plastic, and base fuze means for initiating detonation of said explosive composition.

References Cited in the file of this patent

UNITED STATES PATENTS

1,150,667	Dunwoody	Aug. 17, 1915

FOREIGN PATENTS

572,661	Great Britain	Oct. 18, 1945
614,320	Great Britain	Dec. 14, 1948