May 20, 1924. 1,494,718

J. B. SEMPLE

PROJECTILE

Filed Aug. 8, 1922.

FIG. I.

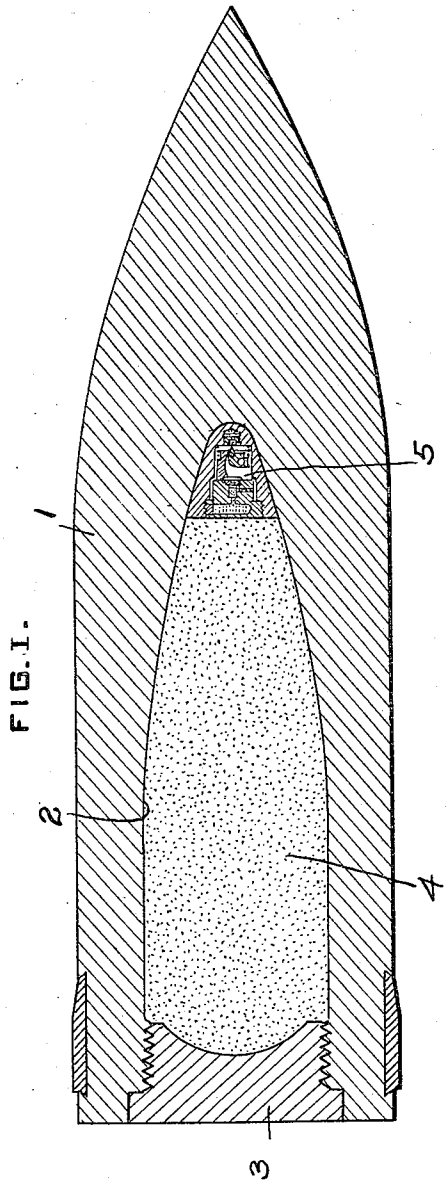
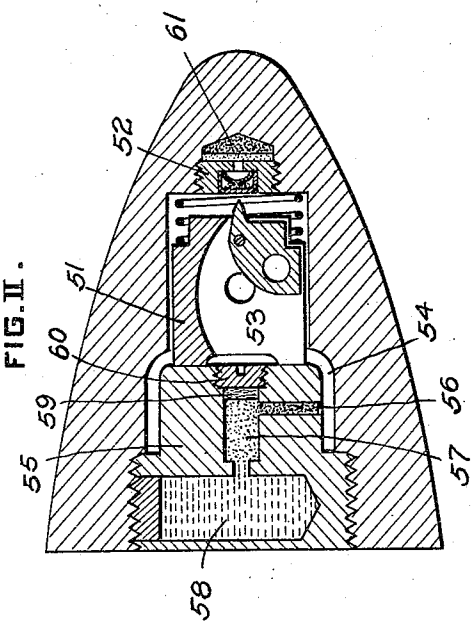


FIG. II.



WITNESSES

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Patented May 20, 1924. 1,494,718

UNITED STATES PATENT OFFICE.

JOHN B. SEMPLE, OF SEWICKLEY, PENNSYLVANIA.

PROJECTILE.

Application filed August 8, 1922. Serial No. 580,473.

To all whom it may concern:

Be it known that I, JOHN B. SEMPLE, residing at Sewickley, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Projectiles, of which improvements the following is a specification,

My invention relates to improvements in projectile structure, and consists in a novel assembly of component parts. While not necessarily limited to this particular application, I have made my invention with the particular conditions attendant upon the use of armor-piercing projectiles in mind, and my immediate object has been to overcome difficulties encountered in attempting to build a delay-action armor-piercing shell.

My invention may, for example, be embodied in the projectile structure illustrated in the accompanying drawings. Fig. I is a view in axial section of the complete projectile structure. Fig. II is a similar view to larger scale of the fuse alone. Here again, in the particular construction of the fuse, the showing is exemplary.

The problem of building a delay-action fuse for an armor-piercing shell is different from and much more difficult than the problem of building an ordinary fuse, because the progressive functioning of the fuse must continue through the desired interval of time and space, after the structure has sustained the tremendous shock of impact upon armor plate. The stress then exerted upon the fuse, tending to drive it forward, may be stated in general approximation to be one hundred thousand times the weight of the movable part of the fuse.

It hitherto has been impracticable, under the limitations of dimension imposed by service, to build a delay-action base fuse which under the tremendous strain indicated, will not immediately be either torn asunder or so stretched or distorted as to fail to function.

My invention is found in mounting the fuse, not in a screw-threaded orifice, opening from the outside through the wall of the shell (either at the base or at the point) into the cavity which contains the burster charge, but in placing the fuse within the burster-charge cavity, at the anterior end thereof, and with such adaptations of form and structure as I shall presently describe.

Referring to the drawings, the shell itself is indicated at 1, Fig. I. Within it is formed the cavity 2 for the burster charge. 3 is the base plug closing the burster charge cavity to the rear. Within the cavity 2 are found the burster charge 4 and the fuse 5. The fuse is, as has already been said, illustrated in detail in Fig. II, and description of it will presently be given.

Fig. I may be taken to show diagrammatically, and without elaboration of detail unnecessary to a comprehension of this invention, an armor-piercing projectile. The body of the shell is formed as an integral block of metal. The cavity for the burster charge is axially arranged within the body of the shell, is circular in cross section, opens rearwardly, is closed forwardly, and tapers forwardly, in general approximation to the external shape of the shell. The thickness of the cavity wall diminshes from the forward end rearwardly; the mass of metal is so disposed as to be strongest in resistance to longitudinal stress. These general features are now standardized.

I take advantage of the shape of the interior cavity, to accomplish more effectively the ends I have in view. I make my fuse with exterior contour to conform closely in size and shape, so that it may fit snugly within and abut firmly upon the wall at the forward end of the cavity, and I preferably shape the fuse rearwardly with a flat face which when the fuse is brought to position, as shown in Fig. I, extends perpendicularly to the axis of the shell.

This position of the fuse, at the forward end of the burster-charge cavity, is the position to which a base fuse, torn from the base plug on impact upon heavy armor, tends to move; the shape is that which any fuse placed in the forward end of the cavity, would on impact tend to assume. The tapered anterior surface of the fuse is, under stress of impact, supported at every point upon the correspondingly tapered cavity wall. Such is the preferred construction; but manifestly the invention would be realized, even though this correspondence in shape, of fuse to cavity wall, were not complete, so long as the areas of contact were sufficient to sustain the thrust.

The fuse having the general shape indicated may be held within the cavity 2 in the position shown in various ways. For instance, it may be secured by screw-threaded engagement with the cavity wall. This is

the usual way of securing a fuse in the body of a shell, and such being the case, I have deemed it unnecessary to make particular showing thereof. I prefer, however, to secure the fuse in place in the manner illustrated in Fig. I; the body 4 of the burster charge, filling the otherwise unoccupied portion of the cavity and held in place rearwardly by the base plug 3, itself furnishes adequate support for the fuse. This burster charge will in the assembly of the structure be compressed upon the fuse body and within the cavity, from the rear, and will be sufficiently dense to hold the fuse in place when the shell is fired from a gun, that is, against set-back. The stress of set-back is relatively not great, particularly in the firing of large shell, and a fairly dense charge will easily hold the fuse in its forward position.

In United States Letters Patent No. 905,042, granted November 24, 1908, to A. Wratzke, and in United States Letters Patent No. 1,105,849, granted me August 4, 1914, a certain advantage, incident to the use of high explosives, of filling the anterior end of such a tapered burster-charge cavity with another body and forming that other body with a flat rear face, upon which the body of high explosive may be impacted, is dwelt upon: a tendency to spontaneous explosion under the strains incident to service is met and overcome. That advantage is present in the structure here shown and described.

It is an advantage inherent in the structure here shown and described that the burster charge 4 is, on impact of the projectile upon heavy armor, pressed close upon the body of the fuse. In the case of a base fuse, the strain of impact tends to separate the body of the burster charge from the fuse.

The position which the fuse occupies is such that on impact of the shell the fuse stays in place; there can be no driving forward of the fuse body, and no consequent hammer blow of fuse body upon another part, and no premature ignition of the shell charge by pinching of its substance between the fuse and the inner wall of the shell.

The form of fuse shown in Fig. II is, as I have said, shown by way of example; the invention is not limited by the type of fuse employed. In this instance the fuse plunger 51, such as shown and described in United States Letters Patent No. 860,354, granted me as assignee of the inventor, Samuel D. Cushing, on July 16, 1907, arms centrifugally, and on impact fires the percussion cap 52. The flash from the cap (augmented, as presently will be explained) gains access rearwardly through the slot 53 in which the firing pin swings, and through a passageway 54 formed in the base block 55 of the fuse, to the delay train 56, consisting conveniently of a body of black powder lightly compressed in a bore drilled in the base block. This delay train transmits ignition with the desired slowness of action to the detonator 57, contained in this instance in an axial bore in base block 55 with which the bore charged with the delay train communicates. A booster charge 58 is conveniently carried in the base block 55 and in such position relative to detonator 57 as to be detonated by it. This booster charge is further arranged in the very lowermost part of block 55, with only a thin web of metal separating it, when the parts are assembled as in Fig. 1, from the burster charge 4. By such means the flash of the percussion cap, which occurs on impact, is with preestablished delay effective to bring about detonation of the booster charge and thereupon, of the burster charge of the shell, closely adjacent to which, as has been said, the booster lies.

The bore which carries the detonator is conveniently drilled through the upper or anterior face of base block 55, and, after loading, the detonator is secured in place by a felt washer 59 and then a plug 60 screwed into the mouth of the bore.

The primer 52 is reenforced, and its flash intensified by means of a small magazine charge 61 of black powder compressed sufficiently to give a long continued flash.

I claim as my invention:

1. An armor-piercing projectile whose body is formed as an integral block of metal tapered forwardly to a point and having within it a burster-charge cavity which extends from the rear forwardly part way toward the point, a delay-action fuse arranged within and at the anterior end of the said burster charge cavity, a burster charge arranged with the cavity rearward of said fuse, and a base plug closing the cavity to rearward.

2. An armor-piercing projectile whose body is formed as an integral block of metal tapered forwardly to a point and having within it a burster-charge cavity which extends from the rear forwardly part way toward the point and tapers forwardly, a delay-action fuse arranged within and at the anterior end of said cavity and making shape-sustaining abutment forwardly upon the cavity wall, a burster charge arranged within the cavity to rearward of said fuse, and a base plug closing the cavity to rearward.

3. In a projectile structure the combination of a shell provided interiorly with a forwardly tapered cavity, a fuse having a forwardly tapered body complementary to the cavity in shape and arranged within and at the forward end thereof and bearing forwardly with shape sustaining abutment upon the cavity wall, and a burster charge ar-

ranged within the cavity to rearward of said fuse.

4. In a projectile structure the combination of a shell provided interiorly with a cavity closed forwardly and opening rearwardly, a fuse arranged within such cavity and abutting upon the cavity wall at the forward end of the cavity, and a burster charge secured in the cavity to rearward of said fuse and alone supporting said fuse in its aforesaid position of abutment upon the wall of the cavity.

5. In a projectile structure the combination of a shell having within a burster-charge cavity closed at its forward end a fuse arranged within and at the forward end of said cavity and abutting forwardly upon the cavity wall, and a burster charge arranged in the cavity to rearward of said fuse and securing the fuse in its said position of abutment in the cavity wall, the abutment so effected of the fuse forwardly upon the cavity wall being such as to exclude the intrusion between these parts of the substance of the burster charge.

In testimony whereof I have hereunto set my hand.

JOHN B. SEMPLE.

Witnesses:
J. CHESTER JUBIN,
JOHN S. TODD.