May 15, 1945. S. T. FARRELL 2,375,983

EXPLOSIVE PROJECTILE

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Fig. 1.

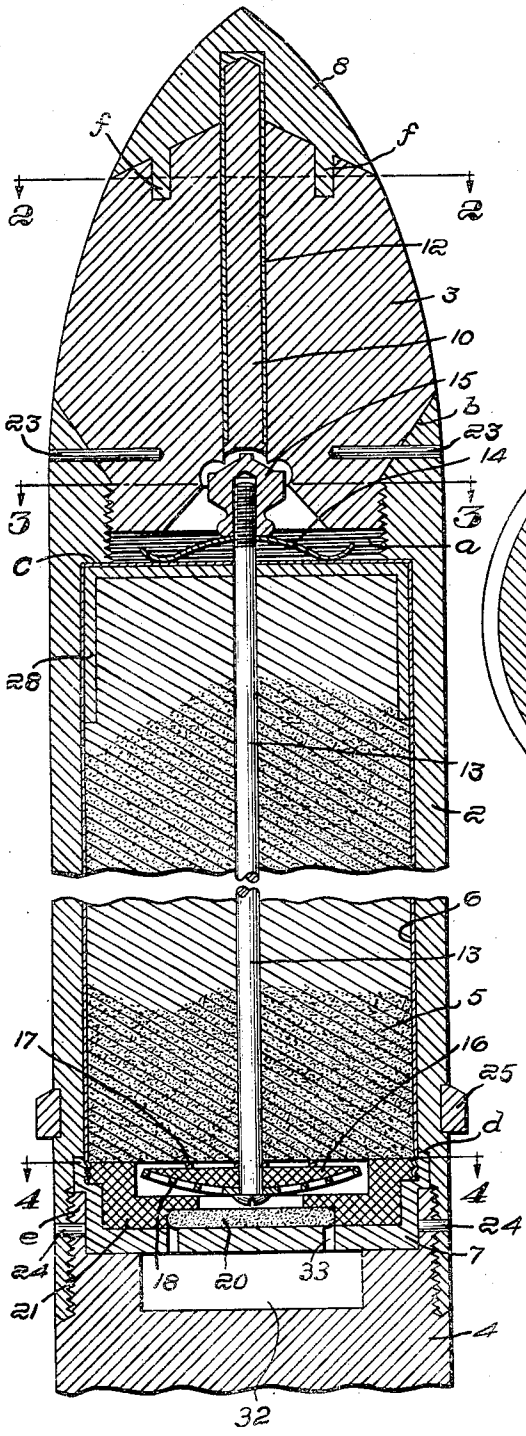


Fig. 2.

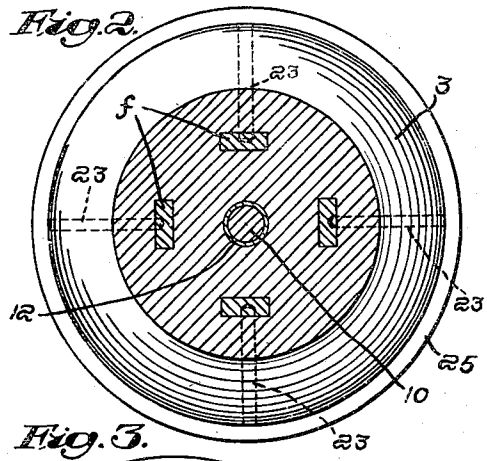


Fig. 3.

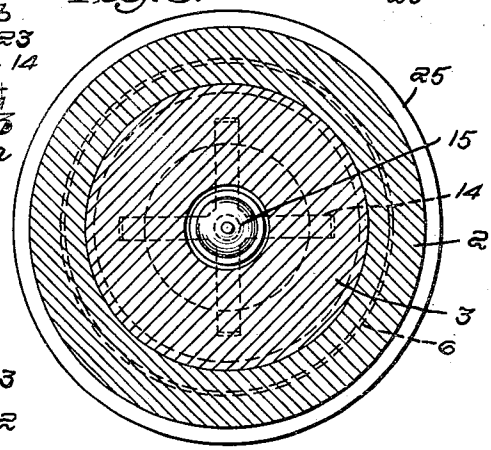
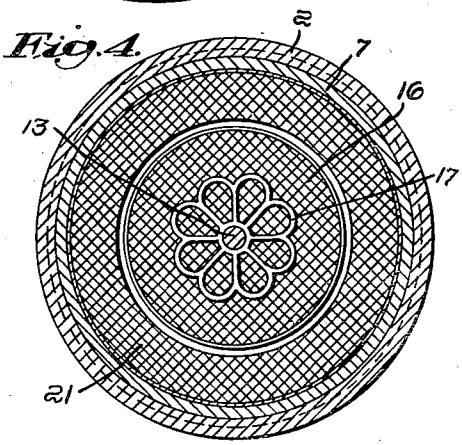


Fig. 4.



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Fig. 6.

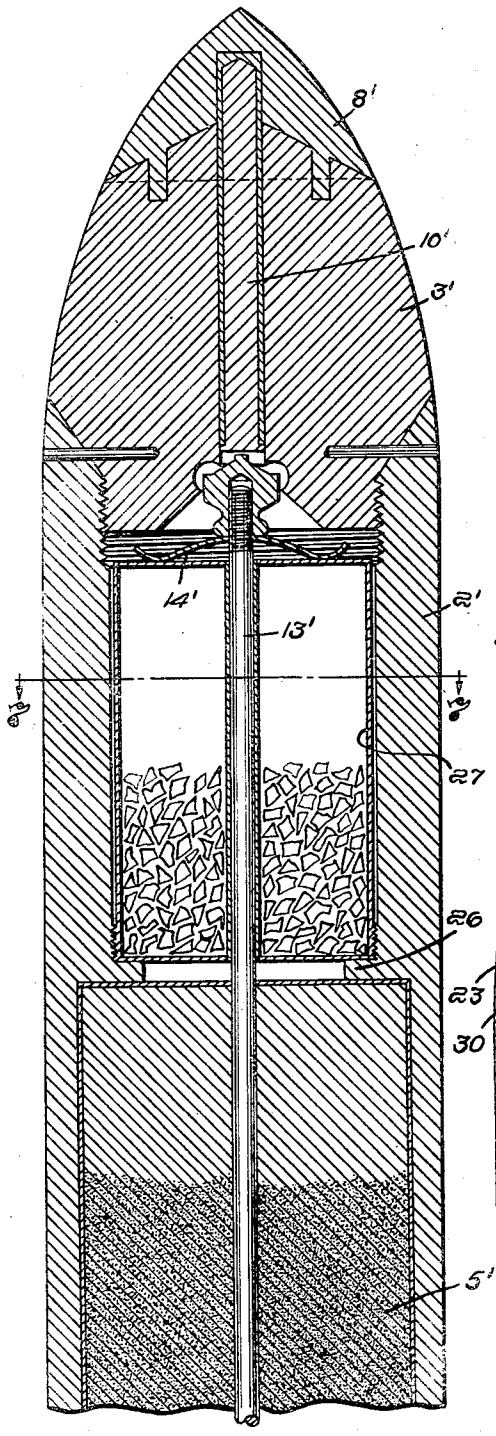


Fig. 5.

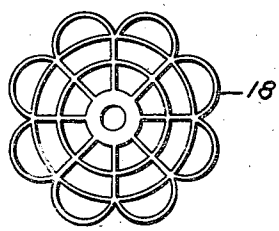


Fig. 8.

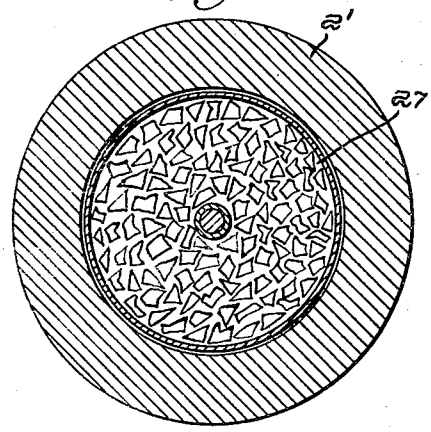


Fig. 8.

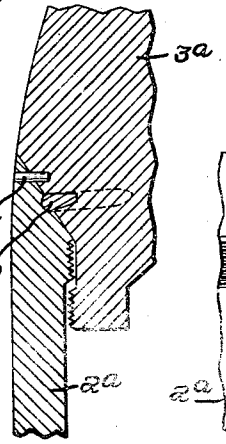
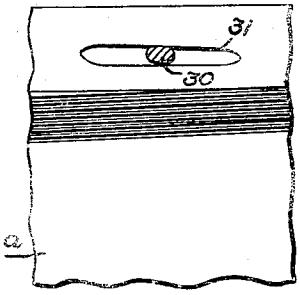


Fig. 9.



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UNITED STATES PATENT OFFICE

2,375,983

EXPLOSIVE PROJECTILE

Sydney T. Farrell, Belmont, Mass.

Application December 21, 1940, Serial No. 371,164

3 Claims. (Cl. 102—56)

This invention relates to explosive projectiles of the type used in warfare.

The invention aims to devise a projectile of this type which will be adapted for manufacture by mass production methods, will be applicable to a wide range of sizes or calibers, in which the loading of the projectile with the explosive charge can be deferred until the time for shipment, and then can be performed very quickly, and in which the removal of the explosive charge, if desired, after the projectile has been completed, can be readily accomplished.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a longitudinal, sectional view of those parts of a projectile with which this invention is especially concerned;

Figs. 2, 3 and 4 are transverse, sectional views taken, respectively, on the lines 2—2, 3—3 and 4—4 of Fig. 1;

Fig. 5 is a plan view of one of the elements of the construction shown in Fig. 1;

Fig. 6 is a view similar to Fig. 1 showing a modification;

Fig. 7 is a transverse, sectional view approximately on the line 7—7, Fig. 6; and

Figs. 8 and 9 are sectional and side views, respectively, showing another modification.

Referring first to Figs. 1 to 5, inclusive, the construction there shown comprises a sleeve 2 made of any suitable metal such, for example, as brass, or any of those customarily used for shell casings. At the forward end of this shell a nose piece 3 is securely fastened thereto, preferably by means of a screw-threaded shank on the nose piece threaded into an internally threaded portion *a* of the shell. Preferably, also, these parts have meeting tapered surfaces, the tapered joint being indicated at *b* and forming a tight union between these parts. At its rearward end the sleeve is secured by a screw-threaded joint or union to the part 4 of the main body or base of the projectile. That is, the assembly just described is adapted to contain the explosive charge which is fired only at some desired point during the flight of the projectile or at the end of that flight and the charge of explosive used for the purpose of projecting this assembly is contained in a shell of the usual, or any suitable, construction. The base 4 just referred to consists of the part which fits into and projects from the casing of said shell.

The explosive charge 5 preferably is enclosed in a container 6 of any convenient form but adapted to fit snugly into the chamber provided for it in the sleeve 2. This container abuts at its upper end against an internal shoulder *c*, Fig. 1, formed in the sleeve near the forward end thereof, while at its rearward end it is screw-threaded into an anvil 7 of brass or other suitable metal. The piece 7 is clamped in the sleeve between an internal shoulder *d* on the sleeve and the upper end of the screw-threaded extension *e* of the part 4.

The projectile is adapted to be fired by percussion. For this purpose the nose piece 3 is provided with a tip 8 made of soft metal or any equivalent material, such for example, as some of the synthetic resins, so that the tip is adapted to be deformed upon striking the target or any solid object, and the firing mechanism is actuated by such deformation. As shown, the tip is provided with several lugs *f* driven into holes in the main body 3 of the nose piece so that the two parts of this piece are securely fastened together. The part 3 may conveniently be made of steel, either cast or not, as desired. Positioned axially in this member 3 is a plunger 10, preferably mounted slidably in a bushing 12 and lubricated by graphite, or any other suitable material, to enable the plunger to move freely. This plunger is adapted to operate a firing pin 13 which extends axially through the charge 5, and which normally is held in a stationary position by means of a leaf spider shaped spring 14 bearing on the outer end of the container 6. A contact piece 15 is screwed on to the adjacent end of the firing pin 13 and practically bridges the space between the spring 14 and the inner end of the plunger 10, only a slight clearance being left between the parts 10 and 15. Cooperating with the spring 14 to hold the pin 13 centered is a molded disk-like section 16 of dry gun cotton held between upper and lower spider springs 17 and 18, Figs. 1, 4 and 5, both these springs being loosely fitted on the firing pin 13 and the lower spring resting on the rounded head of said pin. Immediately below this head is the priming charge 20 of black powder, fulminate of mercury, or any other suitable priming material adapted to be exploded by the impact of the firing pin as it is pushed downwardly toward the anvil 7. The explosion so produced ignites the gun cotton 16 and also an additional body of dry gun cotton 21 surrounding the priming charge and composed of molded disks of this explosive fitted

into the annular space between the anvil and the lower end of the charge 5. Consequently, the burning of the priming charge is promptly transmitted through the explosive bodies 16 and 21 to the main charge 5.

Rearward movement of the firing pin is produced by the striking of the projectile against any solid body which, as above indicated, deforms the metal of the tip 8, forces the plunger 10 backwardly against the contact piece 15, and the latter, in turn, transmits such backward movement directly to the firing pin.

In this connection it should be noted that it is not necessary for the projectile to strike squarely on its end in order to operate the firing mechanism but, on the contrary, it would still operate even if the nose piece struck at a very considerable angle. The conical point at the forward end of the plunger 10 and the angularly disposed surfaces of the bushing engaging said end are useful in producing this result.

It will be observed that all of the parts of this projectile can be made independently and later assembled. A convenient order of assembly is to connect the parts 3 and 8 of the nose piece together. Later this portion of the assembly may be screw-threaded into the shell 2. Either at this time or later, as desired, the parts 2 and 3 may be locked securely against any unthreading action, due to the rotation of the projectile while in flight, by means of one or more pins 23 driven through the meeting tapered portions of the parts 2 and 3. If desired, these parts may be left in this condition and shipped to the point of final assembly where the explosive charge 5 is to be introduced. Also, the assembly of the parts 2 and 4 may be deferred until this time, the exact procedure to be followed depending upon the requirements of individual situations.

In introducing the charge it is contemplated that it will come to the assembling point with the disks of gun cotton all inserted in the container 6. At this time the firing pin 13, with the molded gun cotton disk 16 on it and held between the springs 17 and 18, may be inserted through the central aligned holes in said disks, and the spring 14 then may be slipped on to the upper end of the pin, after which the contact piece 15 will be threaded in place. Prior to introducing this charge into the shell 2 the plunger 10 and its bushing 12 should be placed in position. After the charge has been inserted the gun cotton disk 21 and the priming charge 20 may be placed in the anvil and the latter then is screw-threaded on to the lower end of the shell 6 of the container. Thereafter the shell 2 may be screw-threaded on to the base 4 and locked there by one or more pins 24.

In making this assembly the usual precautions to protect the charge from the action of moisture, such as coating with paraffin, or wrapping in waterproof materials, will, of course, be followed. The shell 2 also should be fitted at any suitable point with the ring 25, Fig. 1, to take the rifling of the gun from which the projectile will be fired.

It should be noted that if, for any reason, after the entire assembling operation has been completed, it becomes desirable to unload or, in other words, to withdraw the charge 5 from the shell, the pins 24—24 which may conveniently be made of brass or soft steel, or any other easily worked metal, can be drilled out very quickly. The same also is true of the pins 23, if it should be desired to remove them. Or, the pins can be provided with screw threads and they may be threaded into tapped holes and then cut off, if a more secure anchorage of them is desired.

This construction lends itself readily to various modifications to suit the requirements of different types of explosive projectiles. For example, if it is desired to use this invention in a shrapnel cartridge or shell, the shrapnel slugs can be enclosed in a container separate from that in which the powder or gun cotton is enclosed, and both may be inserted in the chamber in the sleeve 2. Or, this sleeve can be divided more or less completely, as by the partition 26, Fig. 6, of the shell 2', into upper and lower chambers, the latter containing the explosive charge 5' and the former the shrapnel package or enclosure 27.

One of the advantages of a projectile made in the manner above described is that if the firing mechanism should fail to work for any reason, the impact of the nose piece against armor plate, or the ground, would drive it backwardly and the wedging action of the rearward portion of this member against its tapered seat in the sleeve 2 would cause it to expand or split the sleeve, shearing off the pins 23. The impact of the rearward end of the nose piece with the explosive charge 5, Fig. 1, would, in all probability, set off this charge even if the firing mechanism had failed. In order to increase the assurance of such an action the container 6 for the gun cotton, TNT, or other explosive used, can be equipped with an inverted cup-shaped plunger 28 against which the rearward end of the nose piece 3 would strike and thus distribute the pressure exerted by this member over a large area of the charge of explosive.

The action above described would occur even if the shell struck the armor plate or the ground at a relatively acute angle. At the same time the action of those surfaces at the inner end of the nose piece and immediately in front of the head or contact piece 15 upon this member would almost certainly result in setting off the primer.

Another form of connection which can be used between the nose piece and the sleeve is shown in Figs. 8 and 9. Here the parts are so proportioned that the threaded shank of the nose piece passes completely through the threaded portion of the sleeve so that these threaded areas are disengaged when the nose piece is firmly seated in the upper end of the sleeve. This part of the nose piece is equipped with several lugs, one of which is shown at 30, and the tapered seat in the sleeve is provided with an equivalent number of slightly inclined grooves, one of which is shown in Fig. 9 at 31, each adapted to receive one of said lugs. The inclination of these grooves should be reversed with reference to that of the screw threads so that after the threads of the nose piece have passed through and disengaged those of the sleeve, the lugs 30 may then be entered in their respective cam slots 31 and the nose piece can be given a short reverse turning movement which will cause the engagement of these lugs with the cam slots to force the nose piece down firmly into its seat. It may later be locked there by one or more pins 23. If, however, the projectile should be fired without these pins being in place, any rotative movement created while the projectile is in flight tending to turn it in either direction relatively to the sleeve, will be prevented either by the lugs 30 or by the engagement of the screw threads on the nose piece with those on the sleeve.

If the nature of the primer used is such that its action is aided by a limited body of air in con-

tact with it, then a chamber may be provided in the upper part of the member **4**, as shown at **32**, and this chamber may be connected with the primer by a series of vents or ducts **33**.

It will also be understood that although gun cotton and TNT have been referred to as the explosives used in the projectile, the device is not limited to any particular type of explosive, and any material of this nature satisfactory to meet the requirements of individual situations may be employed.

While I have herein shown and described typical embodiments of my invention, it will be understood that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. An explosive projectile comprising a sleeve, a tapered nose piece having a screw-threaded connection with the forward end of said sleeve, said sleeve and said nose piece having meeting complemental tapered surfaces; a base secured to the rearward end of said sleeve and cooperating therewith to provide a chamber for receiving the explosive charge; and a mechanism for firing said charge comprising a primer positioned in the projectile adjacent to the rearward end of said chamber, a firing pin for exploding said primer, said pin extending through said chamber and being provided at its forward end with a contact piece, said nose piece having a cavity in the rearward end thereof to receive said contact piece, the nose piece including a body of hard metal and a tip rigid with said body but of softer material than the body, and a plunger slidably mounted axially in said nose piece with its forward end in said tip and its rearward end positioned to strike said contact piece when the plunger is forced backwardly by the deformation of the tip caused by the projectile striking a hard object.

2. In a projectile according to preceding claim 1, a construction in which said contact piece is provided with rearwardly inclined surfaces and the walls of said cavity in which it is positioned have projections shaped to engage said inclined surfaces and force said firing pin backwardly upon any deformation of the nose piece sufficient to move it backward into engagement with said contact piece.

3. An explosive projectile comprising a sleeve, a tapered nose piece having a screw-threaded connection with the forward end of said sleeve, said sleeve and said nose piece having meeting complemental tapered surfaces; the cooperating threaded portions of said nose piece and said sleeve being so related that continued rotative movement of the nose piece to thread it inwardly will ultimately carry it out of engagement with the threaded section of the sleeve before said meeting surfaces come in solid contact with each other, and additional cooperating parts on said sleeve and said nose piece operable, after such disengagement of said threaded sections, to lock the nose piece and the sleeve together by a relative rotation of these members in a direction reverse to that of the rotation required for said inward threading of the nose piece.

SYDNEY T. FARRELL.