Aug. 9, 1932. T. B. DOE 1,870,405

FUSE FOR ANTIAIRCRAFT PROJECTILES

Filed Aug. 14, 1931

Fig. 1.

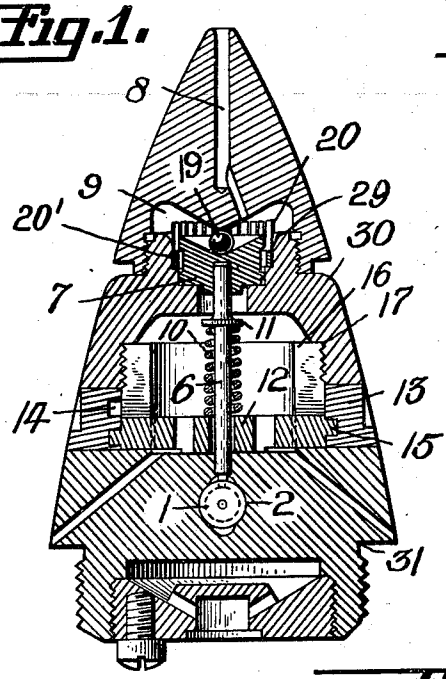


Fig. 2.

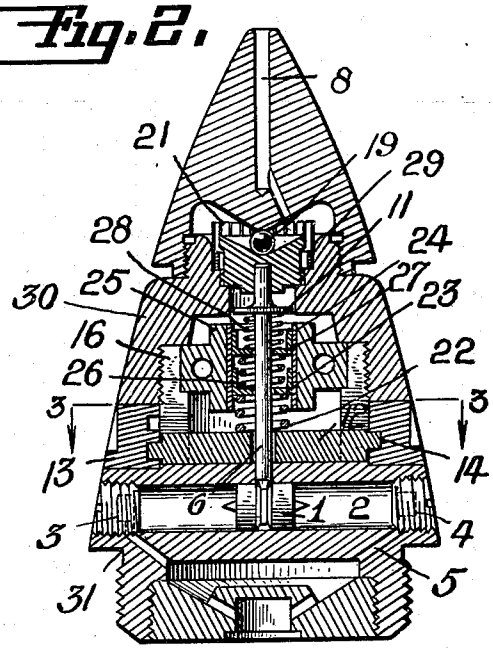


Fig. 4.

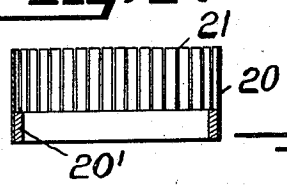


Fig. 5.

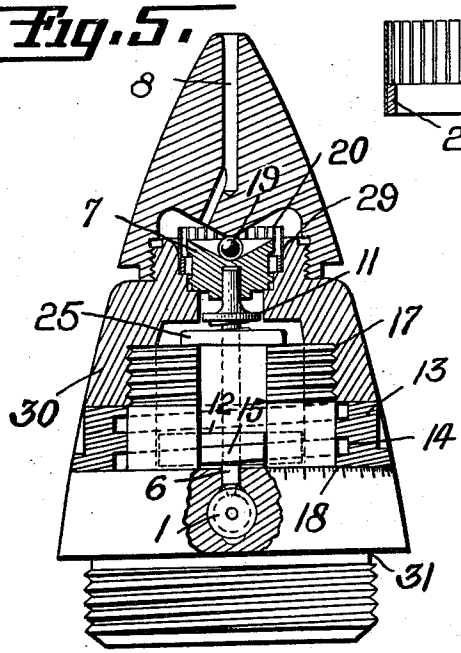
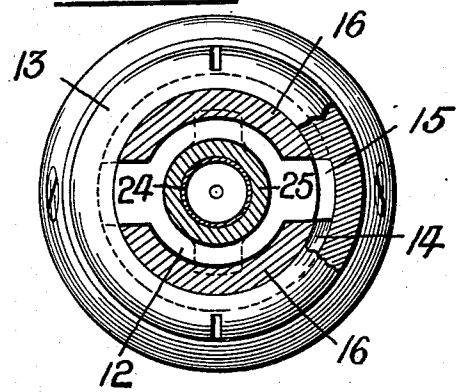


Fig. 3.



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UNITED STATES PATENT OFFICE

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FUSE FOR ANTIAIRCRAFT PROJECTILES

Application filed August 14, 1931. Serial No. 557,048.

This invention relates to fuses for projectiles, particularly to the type of projectile which is detonated at a predetermined point in its flight. These projectiles are largely employed in anti-aircraft gun fire. More particularly my invention constitutes an improvement in the type of fuse disclosed in my prior Patent No. 1,863,838 issued June 21, 1932 for fuse for anti-aircraft projectiles. In this type of fuse the projectile is detonated when the air pressure on the nose thereof falls below a predetermined amount, the air pressure at each instant being a function of the speed of the projectile and, therefore, a function of the distance of the same from the firing point. The air pressure on the nose is, therefore, balanced against a settable yielding means within the projectile, such as a spring. According to the present invention a plurality of springs of graduated strength are employed in order to increase the accuracy of the setting.

A further object of the invention is to improve upon the safety locking device which prevents the possibility of premature explosion.

Referring to the drawing showing several possible embodiments of my invention:

Fig. 1 is a vertical section through the firing mechanism of the shell constructed according to my invention.

Fig. 2 is a similar section showing the preferred form of spring setting means.

Fig. 3 is a transverse section taken on line 3—3 of Fig. 2.

Fig. 4 is a detail sectional view of the cage or safety member for preventing premature escape of the locking ball.

Fig. 5 is a vertical sectional view taken at right angles to Fig. 2 but with a number of parts shown in elevation.

According to my invention the firing pin or hammer 1 is placed in a transverse channel 2 extending across the nose of the fuse cap, the hammer being normally locked in its mid position in said channel 2. The channel is shown extending entirely through the main body of the fuse, the outer ends being threaded to receive detonator caps 3 and 4 which may be screwed into place after the fuse and shell are otherwise completely assembled. Said caps communicate with the usual powder train channels 5 leading downwardly into the main body of the shell (not shown). Centrifugal force, due to rotation of the shell, is relied upon to actuate the hammer as soon as it is released from the locking detent 6. The detent is shown as having mounted on its upper end a cup-shaped member 7 exposed to the air pressure created by the rapid passage of the shell through the air. For this purpose there is shown a small bore 8 leading from the nose of the projectile to a chamber or generally U-shaped bore 9 so that the air in this chamber is compressed when the shell is in flight and exerts a downward pressure on the cup 7 and hence on the detent 6.

The withdrawing force of the detent is furnished in Fig. 1 by a compression spring 10 bearing at its upper end against a collar 11 of the detent and at its lower end against an adjustable member 12. Said member may be set for the desired range by rotating a ring 13 around the same. Said ring has an internal spiral groove or thread 14 into which projects broad teeth 15 on member 12. Member 12 is prevented from rotating by having the ends and teeth thereon pass between the two parts of the split hub 16 which is firmly screwed into place on internal threads 17 in the body 30 of the fuse cap, thus holding base part 31 to body 30 with ring 13 between. The ring 13 may be set with reference to a finely graduated scale 18 on the bottom of the fuse cap.

For preventing premature withdrawal of the detent and possible premature explosion, I have shown a locking ball 19 placed within the cup 7 so that the top of the ball just clears

the top or roof of the chamber 9. Therefore, as long as the ball lies in the cup 7 the detent cannot be withdrawn. It should be noted that the lowest part of the cup is in the center. This shape tends to prevent the escape of the ball, not only when the shell is at rest on its base, but also as long as the shell is receiving its terrific acceleration in the muzzle of the gun. After such acceleration ceases, however, the centrifugal force quickly throws the ball out of the cup. To prevent accidental displacement of the ball from the cup I have shown a ring-like cage 20 surrounding the cup. This cage has a plurality of flexible fingers 21 extending upwardly above the rim of the cup so that the ball cannot escape. The fingers, however, are made flexible enough so as not to interfere with the escape of the ball after the shell is rotating during flight. Member 20, therefore, is preferably made of some soft metal, such as copper, so that when the ball strikes a finger with appreciable force the finger is bent over and the ball escapes, the ball being then held in its outermost position by centrifugal force. Member 20 is clamped within the shell by spring ring 20′ forced within the same to hold it within a counter-sunk top 29 of the main body 30 of the fuse cap.

In the preferred form of the invention shown in Figs. 2 to 5, a plurality of springs of graduated strength are employed instead of the one spring 10. As shown there is placed at the bottom a short stiff spring 22. This spring rests at its bottom against the adjustable member 12 hereinbefore described and at its top against a washer 23, slidably mounted in a sleeve 24 within an annular member 25 held in place within the split nut 16. Above said washer is placed a second spring 26 of lesser stiffness which bears at its top against a second washer 27, also slidably mounted within the sleeve 24. Above the latter washer is shown still a third and weaker spring 28, shown as bearing at its top against the collar 11 on the detent 6. The purpose of these graduated springs will be readily appreciated when it is remembered that the velocity of the shell in flight from point to point does not decrease uniformly in a straight line function but falls off much more rapidly during the high velocity first portion of its flight than during the slower velocity latter portion of its flight. Therefore, in order to obtain a sensitive means responsive to small pressure changes during the latter portion of the flight, it is desirable to provide a separate stronger and less sensitive means which shall be effective during the first portion of the flight. With the graduated spring arrangement described it will readily be seen that during the first portion of the flight only the heavy spring 22 will be operative, the others being compressed so that the collar 28 on the detent bears against the top of the up-turned portion on washer 27 and the bottom of washer 27 bearing against the up-turned portion on washer 26. As the flight proceeds, however, first the spring 26 and then the spring 27 will become effective so that for long ranges the sensitive spring is brought into operation, while for short ranges the stiffer spring is utilized which is able to fire the projectile against heavy air pressure if so set.

In accordance with the provisions of the patent statutes, I have herein described the principle and operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

Having described my invention, what I claim and desire to secure Letters Patent is:

1. In a fuse for projectiles, the combination with the firing pin and locking detent, of means for withdrawing said detent at a predetermined point in the flight of the shell and a safety lock for preventing premature release in the gun barrel comprising a cup on said detent, a ball in said cup which prevents lifting of the detent while in said cup, and a flexible cage for preventing untimely escape of the ball from said cup.

2. In a fuse for projectiles, the combination with the firing pin and locking detent, of means for withdrawing said detent at a predetermined point in the flight of the shell and a safety lock for preventing premature release in the gun barrel comprising a cup on said detent, a ball in said cup which prevents lifting of the detent while in said cup, and flexible fingers for preventing untimely escape of the ball from the cup while not interfering with the ball's escape under the action of the centrifugal force due to the shell's rotation in flight.

3. In a fuse for projectiles, the combination with the hammer, of a detent for normally holding said hammer retracted, means subject to the air pressure due to the flight of the projectile for holding said detent in place, and spring means opposing said other means for withdrawing the detent comprising a plurality of springs of graduated relative stiffness for the purpose specified.

4. In a fuse for projectiles, the combination with the hammer, of a detent for normally holding said hammer retracted, means subject to the air pressure due to the flight of the projectile for holding said detent in place, and spring means opposing said other

means for withdrawing the detent comprising a plurality of springs of graduated relative stiffness which come into operation successively as the air pressure diminishes.

5. In a fuse for projectiles, the combination with the hammer, of a detent for normally holding said hammer retracted, means subject to the air pressure due to the flight of the projectile for holding said detent in place, spring means opposing said other means for withdrawing the detent comprising a plurality of springs of graduated relative stiffness, and means for setting said springs for range whereby for the longer ranges the less stiff and more sensitive springs are effective and for shorter ranges the stiffer and less sensitive.

In testimony whereof I have affixed my signature.

THOMAS B. DOE.