W. J. SMITH.

EXPLODING DEVICE FOR PROJECTILES.

APPLICATION FILED NOV. 24, 1914.

1,142,375. Patented June 8, 1915.

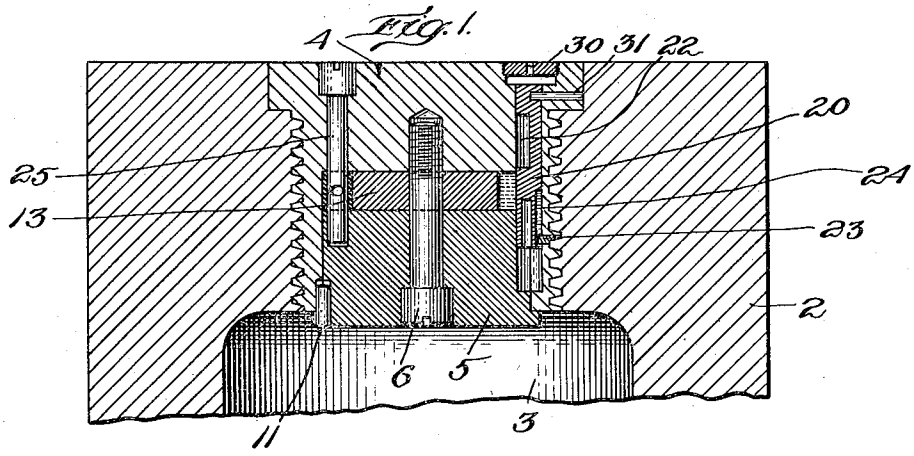


Fig. 1.

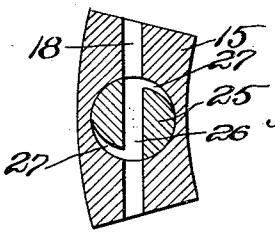


Fig. 6.

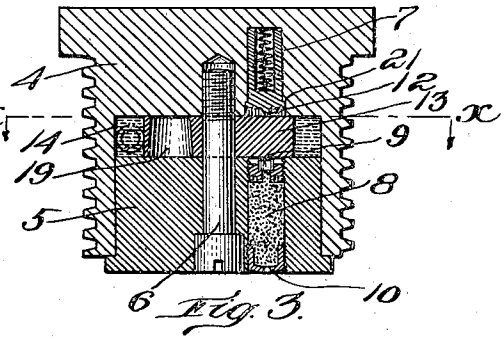


Fig. 3.

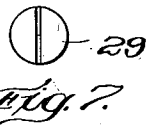


Fig. 7.

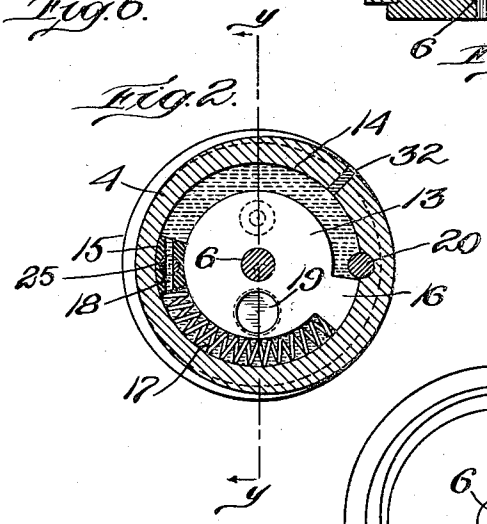


Fig. 2.

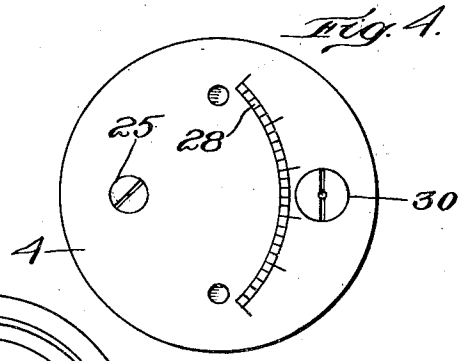


Fig. 4.

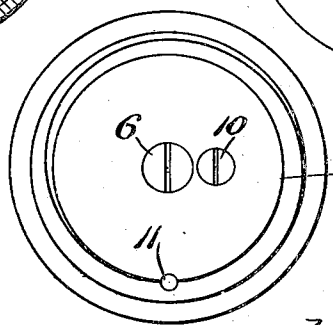


Fig. 5.

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UNITED STATES PATENT OFFICE.

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EXPLODING DEVICE FOR PROJECTILES.

1,142,375. Specification of Letters Patent. Patented June 8, 1915.

Application filed November 24, 1914. Serial No. 873,820.

To all whom it may concern:

Be it known that I, WILLIAM J. SMITH, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented new and useful Improvements in Exploding Devices for Projectiles, of which the following is a specification.

This invention relates to devices for exploding shells and similar projectiles, and more particularly to exploding devices of the general character represented in my prior U. S. Letters Patent No. 570,065, dated October 27, 1896, in which is shown and described an exploding device comprising an igniter or detonator, a spring-actuated hammer for firing the same, a spring-actuated locking member which normally presents an obstruction to the firing movement of the hammer, and a detent which normally holds the locking member immovable but is operated to release the latter either by the firing of the projectile or by its impact, whereupon the locking member moves and releases the hammer.

The present invention is intended to improve upon prior constructions of the type above referred to, my principal objects being to provide an arrangement by means of which the timing of the explosion of the projectile may be regulated with extreme accuracy, to produce a more compact construction and arrangement of the several parts in order that the exploding device may be made of smaller size and thereby adapted for use with smaller shells, and to simplify the construction and render the parts less expensive to manufacture and assemble.

In the accompanying drawing illustrating my improvements, Figure 1 is a central longitudinal section through the rear end of a shell containing my exploding device as preferably constructed and arranged for operation as a time fuse; Fig. 2 is a transverse section through the detached exploding device, the plane of section being indicated by the line x—x in Fig. 3; Fig. 3 is a longitudinal section on the line y—y in Fig. 2; Fig. 4 shows in plan view the upper or outer end of the device shown in Figs. 2 and 3; Fig. 5 is a plan view of the opposite end of the same device; and Figs. 6 and 7 are detail views showing certain parts hereinafter described.

Fig. 1 of the drawing shows the rear portion of a shell 2 having the usual internal cavity 3 for the reception of the explosive charge and also having in its rear end wall a cylindrical passage for the reception of the exploding device, which has a cylindrical body portion 4 carrying the operating parts and provided with external threads whereby it may be detachably screwed into the correspondingly-threaded rear end of the shell 2. This body portion 4 is provided with a cylindrical cavity extending upward from its lower or inner end and containing a tightly-fitting plug 5, which is removably held in place by a bolt 6 passing centrally through the same and into the body portion 4. A spring-actuated hammer 7 is located within said body portion above the plug 5, and the latter is provided with a longitudinal perforation containing a priming charge 8 of loose powder or the like, with a percussion cap 9 at the upper end of the charge and a perforated retaining plug 10 at its lower end, the body portion 4 and plug 5 being circumferentially positioned with respect to each other by a key 11 in such manner that the cap 9 is located directly beneath the firing point 12 of the hammer 7.

Except for the employment of the plug 5 and the location of the exploding charge therein, the construction as thus far described is similar to that disclosed in my prior Patent 570,065, above referred to, but in the present case the hammer is retained in its elevated position against the pressure of its actuating spring by means of a locking member which is a departure from my former construction in that it has a rotary unlocking movement. In the particular construction illustrated this rotary locking member consists substantially of a flat disk 13 located between the flat upper end of the plug 5 and the opposed flat surface of the body portion 4, said disk being centrally mounted on the bolt 6 and having a somewhat less diameter than the chamber in which it is located, so that an annular space 14 is provided between the periphery of the disk and the peripheral wall of the chamber. Within this annular space is located a fixed abutment 15, and the disk 13 is provided with a lateral projection 16 between which and the abutment 15 is located

a compression spring 17 lying in the annular space 14 and tending to rotate the disk 13 until such movement is arrested by the engagement of its projection 16 with the abutment 15. Preferably the disk 13 and its projection 16 are shaped to make a close sliding fit with the fixed abutting walls with which they are in contact, in order that the annular space 14 may be filled with oil or similar liquid for retarding the rotation of the disk under the influence of its actuating spring 17, the oil being forced through a perforation 18 in the abutment 15 by the projection 16 acting as a piston, as hereinafter described, but this is not essential if the exploding device is to operate instantaneously upon impact of the shell.

The disk 13 is provided with a perforation 19 of such size as to permit the hammer 7 to pass through it, which perforation is so located in the disk that it is brought directly under the hammer when the disk is rotated to a sufficient extent by the spring 17. Under normal conditions, however, said disk is locked in the position shown in Fig. 2 by a detent 20, in which position said disk is interposed between the hammer 7 and the cap 9 and therefore presents an obstruction to the firing movement of the hammer, and preferably the locked position of the disk is such that it has to make substantially a half-rotation in order to bring the perforation 19 beneath the hammer and permit the latter to operate. In order that the operating movement of the hammer may not be retarded by frictional contact between the hammer and the disk 13, said hammer is slightly flared outwardly at its lower end, as at 21, and the perforation 19 is flared downwardly, as shown.

The detent 20 preferably consists of a rod-like member adapted to slide longitudinally in the body portion 4 and so located that when in its operative or locking position it lies partly within the outer wall of the body portion and partly within the annular space 14, where it serves as a stop for the projection 16 on the disk 13 and thus prevents movement of the latter. Above the space 14, however, the detent 20 is provided with a lateral notch 22 through which the projection 16 can pass, so that when said notch is brought opposite the projection 16 by an inward movement of the detent the disk 13 is released and permitted to rotate. Turning movements of the detent 20 are prevented by suitable means such as a pin 23 passing through the outer wall of the body portion 4 and entering a longitudinal groove 24 formed in the detent. As thus constructed, if the detent 20 is moved downward to a sufficient extent to release the disk 13 the latter will be rotated by the spring 17 until the perforation 19 is brought under the hammer 7, whereupon the latter will fire the priming charge 8 by striking the cap 9 and the shell will be exploded. If the annular space 14 is empty the rotation of the disk 13 will not be retarded and the explosion will take place instantly, but if said space 14 is filled with oil or other liquid the explosion will be delayed until the oil between the projection 16 and the abutment 15 has been forced through the perforation 18 in the latter, and in order that the timing of the explosion may be accurately regulated provision is made for varying the capacity of said perforation. In the construction illustrated this is accomplished by means of a valve member consisting of a rod 25 extending downward from the top or outer face of the body portion 4 and passing through the abutment 15 in position to intersect the perforation 18, the rod 25 where it crosses said perforation 18 being provided with a passage-way preferably shaped as shown in Fig. 6 and comprising a transverse perforation 26 and grooves 27 extending circumferentially in opposite directions from the opposite ends of said perforation 26 and each gradually tapering to a point. This arrangement enables the capacity of the passage through the abutment 15 to be adjusted with great exactness by merely turning the rod 25 until any desired point in the length of each groove 27 is brought in line with the perforations 18.

Provision is made for turning the rod 25 by locating its outer end at the top surface of the body portion 4 and providing it with a slot adapted to receive a suitable tool for rotating it. The extent of rotation and the final position of the valve may be indicated by a graduated scale 28 marked on the top of the body portion 4 and adapted to coöperate with a pointer attached to the rotating tool employed, a suitable tool for this purpose being shown in Fig. 6 of my prior patent above referred to. The scale 28 is usually marked to indicate seconds and fractions of a second, measuring the delay which will occur between the movement of the detent 20 and the explosion of the shell.

The detent 20 may be operated to release the disk 13 either by the impact of the shell or by the gas pressure developed in the gun when the shell is fired therefrom. In the former case the passage in which the detent moves is completely closed at the top of the body portion 4 by means of a screw plug 29, Fig. 7, and in this case the detent is moved by its own momentum when the shell strikes its mark. When the detent is to be operated by gas pressure within the gun the plug 29 is replaced by a perforated plug 30, Figs. 1 and 4, the perforation in which permits the gas pressure to become effective on the upper end of the detent. In either case the plug above the detent prevents the latter from being operated accidentally during

the handling of the shell, and as an alternative or supplemental means to the same end a small pin 31 may be located in a perforation formed in the body portion 4 and continued into the detent, as shown in Fig. 1, this pin being made of such strength that it will resist any accidental pressure likely to be exerted on the detent but will be sheared off by the tendency of the latter to move when the gun is fired or when the shell strikes, as the case may be. When this pin is not employed the detent is caused to make a close sliding fit with the passage in which it moves, so that it will be held in its normal position by friction. The lower end of the detent is shown in Fig. 1 as made hollow, so as to provide sufficient space to take care of the air compression which is developed by the downward movement of the detent in case the space below the detent is not vented.

When the detent is operated by the firing of the gun the explosion of the shell will of course be delayed by filling the annular space 14 with oil or the like as above described, and it may also be delayed when the detent is operated by the impact of the shell, if desired, in order to give the latter a chance to penetrate its mark before exploding. The space 14 is filled with oil through a passage leading into the same from the exterior of the body portion 4 and normally closed by a plug 32, Fig. 2.

The provision of a rotary locking member for the hammer is an important feature of my invention, since such a locking member can be given a considerable range of movement within a comparatively small space and therefore a considerable body of oil can be utilized for retarding the rotary movement of said member. The result is that my exploding device can be so compactly constructed that it may be used with shells of considerably smaller size than has been possible heretofore without sacrificing accuracy in the timing of the explosion or diminishing the maximum time interval during which the explosion can be delayed. Various other forms of rotary locking member may be employed in substitution for the member specifically disclosed herein, if desired, and said member may be associated with various forms of hammer, priming charge, detent and regulating valve without departing from my invention, although the specific construction and arrangement herein described is preferred for the reason that the parts are of simple and inexpensive construction, being finished mainly by turning and boring operations, and are readily assembled and taken apart. It is also a useful feature of the device that the priming charge is located wholly within the removable plug 5, so that the latter can be loaded while removed from the body portion and then inserted into the latter after the rotary locking member has been secured by the detent in its normal position.

I claim:

1. An exploding device for projectiles, comprising a spring-actuated hammer, a detonator adapted to be exploded thereby, a disk-like locking member mounted to rotate on a central axis and normally obstructing the movement of the hammer, a spring constantly tending to rotate said locking member, and a detent normally preventing movement of the locking member, said detent being longitudinally movable in the body portion independently of the hammer.

2. An exploding device for projectiles, comprising a spring-actuated hammer, a detonator adapted to be exploded thereby, a spring-actuated rotary locking member for holding the hammer in inoperative position and having a projection movable in a liquid-filled annular space, adjustable means for regulating the escape of the liquid from said space, and a detent normally preventing movement of said locking member.

3. An exploding device for projectiles, comprising a body portion having a cavity extending inward from its under side, a plug secured therein, a spring-actuated hammer located within the body portion above said plug, a detonator carried by the plug in position to be exploded by the hammer, a rotary locking member located between the inner end of the plug and the adjacent body portion and normally interposed between the hammer and the detonator, a spring constantly tending to rotate the locking member, and a detent longitudinally movable within the body portion independently of the hammer and normally preventing movement of said locking member.

4. An exploding device for projectiles, comprising a body portion having a cavity extending inward from its under side, a plug secured in said cavity by a central longitudinal bolt, a locking member located between the inner end of the plug and the adjacent body portion and rotatably mounted on said bolt, a spring constantly tending to rotate the locking member, a spring-actuated hammer located within the body portion above said plug at one side of the bolt, a detonator carried by the plug in position to be exploded by the hammer, and a detent normally preventing movement of said locking member.

5. An exploding device for projectiles, comprising a body portion, a spring-actuated hammer carried thereby, a locking member located within the body portion beneath the hammer and mounted to rotate on a longitudinal axis, said body portion being provided at one point with a perforation adapted to receive said hammer, a compression spring constantly tending to rotate said

locking member, a detent normally preventing movement of the latter, and a detonator located below the locking member in line with the hammer.

6. An exploding device for projectiles, comprising a spring-actuated hammer and a detonator located in position to be exploded thereby, said hammer being slightly enlarged laterally at its forward end, a spring-actuated rotary locking member normally interposed between said hammer and detonator and provided at one point with a perforation adapted to receive the hammer and flared in the direction of movement of the latter, and a detent normally preventing movement of the locking member.

7. An exploding device for projectiles, comprising a body portion containing a chamber, a rotary locking member located in said chamber, with a liquid-filled annular space between its periphery and the outer wall of the chamber, a fixed abutment extending across said space and provided with a perforation, a projection carried by the locking member and constituting a piston movable in said annular space, a spring arranged to move said projection toward the abutment, a detent normally preventing movement of the locking member, means for varying the capacity of the perforation in the abutment, a detonator, and means controlled by the locking member for exploding the detonator.

8. An exploding device for projectiles, comprising a body portion containing a chamber, a disk-like locking member located therein and rotatable on a longitudinal axis, said member being provided with a laterally-extending piston movable in a liquid-filled annular space, a fixed abutment extending across said space and provided with a perforation, a compression spring located between said abutment and piston, an adjustable valve member for regulating the capacity of said perforation, a spring-actuated hammer and a detonator located in line with each other and normally separated by the rotary locking member, the latter being provided at one point with a perforation adapted to receive the hammer, and a detent normally preventing movement of said locking member.

9. An exploding device for projectiles, comprising a body portion having a chamber therein, a spring-actuated rotary locking member located in said chamber and provided with a lateral projection, a detent movable longitudinally within the body portion and normally located in the path of movement of the projection on the locking member, the detent being provided above said locking member with a recess adapted to permit movement of said projection when brought opposite the latter, and a spring-actuated hammer and a detonator located in line with each other and normally separated by said locking member.

10. An exploding device for projectiles, comprising a body portion having a chamber therein, a rotary locking member located in said chamber and provided with a lateral projection movable in a liquid-filled annular space, an abutment extending across said space, a compression spring tending to rotate the locking member, a detent movable longitudinally within the body portion and normally located in the path of movement of the projection on the locking member, the detent being provided above said locking member with a recess adapted to permit movement of said projection when brought opposite the latter, a spring-actuated hammer and a detonator located in line with each other and normally separated by said locking member, and adjustable means for regulating the escape of liquid from said annular space.

Signed by me at Boston, Massachusetts, this 21st day of November, 1914.

WILLIAM J. SMITH.

Witnesses:

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MARY A. NYHAN.