(No Model.)

F. M. HALE & J. B. REAVIL.

SHELL FUSE.

No. 588,861. Patented Aug. 24, 1897.

Fig. 3.

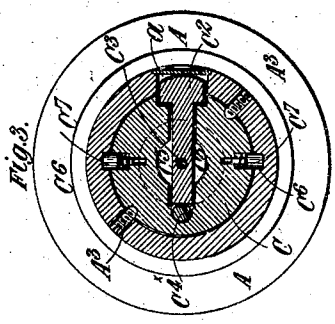


Fig. 4.

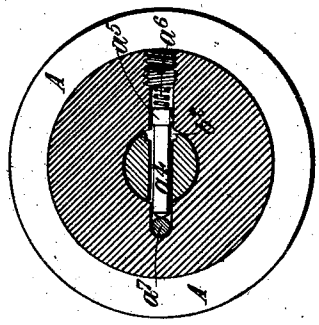


Fig. 2.

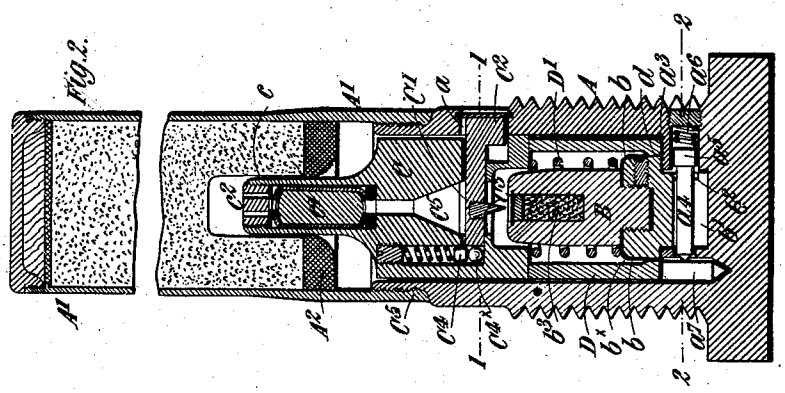


Fig. 5.

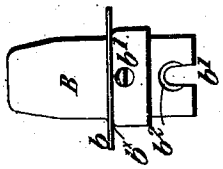
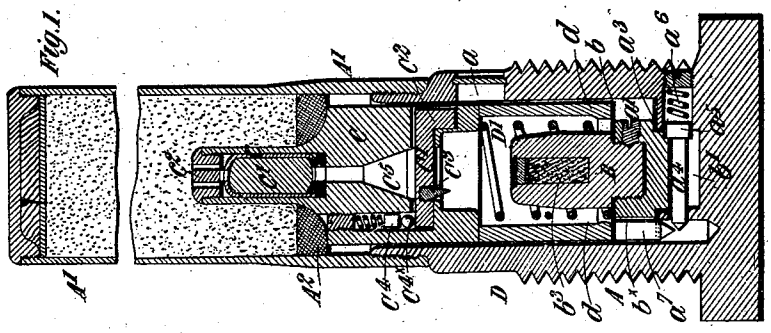


Fig. 1.



Witnesses

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UNITED STATES PATENT OFFICE.

FREDERICK MARTEN HALE AND JOHN BRODIE REAVIL, OF LONDON, ENGLAND.

SHELL-FUSE.

SPECIFICATION forming part of Letters Patent No. 588,861, dated August 24, 1897.

Application filed March 29, 1897. Serial No. 629,819. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK MARTEN HALE, general manager of the New Explosives Company, Limited, residing at 75 Queen Victoria Street, in the city of London, and JOHN BRODIE REAVIL, engineer, residing at 218 Woolwich Road, Charlton, London, in the county of Kent, England, subjects of the Queen of Great Britain, have invented certain new and useful Improvements in Percussion-Fuses for Explosive Projectiles or Shells, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to improvements in percussion-fuses for explosive projectiles or shells, the said fuses being specially suitable for use with high explosives.

According to our invention the fuse-body is provided with an internal percussion-pellet having a detonator and with a movable portion or plunger carrying a transversely-arranged bolt. This bolt is furnished with a firing point or needle which normally occupies such a position that it lies out of the path of the detonator in the percussion-pellet. On shock of discharge the said movable portion or plunger moves into a position to bring the end of the said transverse bolt opposite a lateral recess in the wall of the fuse-body. The shell in its flight and spin causes the said transverse bolt to shift radially under the action of centrifugal force and to enter the aforesaid lateral recess, thereby bringing the point or needle in alinement with the detonator in the percussion-pellet. The shock of discharge also releases the percussion-pellet, so that on impact of the shell the said pellet strikes the point or needle, and explosion of the shell ensues.

In order that our said invention may be clearly understood and readily carried into effect, we will describe the same more fully with reference to the accompanying drawings, in which we have illustrated our improved fuse adapted to be applied to the base of a shell charged with some high explosive, such as guncotton.

Figure 1 is a central longitudinal section showing the internal parts of the fuse in an inactive position—that is to say, in the position they occupy before the shell is discharged from a gun. Fig. 2 is a similar sectional view, but shows the parts in the position they occupy during the flight of the shell. Fig. 3 is a transverse section taken substantially on the line 1 1 of Fig. 2, and Fig. 4 is a transverse section taken on the line 2 2 of the same figure. Fig. 5 is an elevation of the percussion-pellet.

In all the figures like letters of reference indicate similar parts.

A is the body of the fuse, B the percussion-pellet, and C the plunger. The said body is provided with external screw-threads to enable the fuse to be connected to the shell in the ordinary manner, and when the fuse is intended for use with a shell containing a charge of guncotton we provide it with a cylindrical tube or casing A′, containing a primer of dry guncotton.

A^2 is a felt disk or washer which is interposed between the guncotton in the said primer and the plunger C of the fuse. The aforesaid plunger C is formed with a neck *c*, which is made hollow to contain a detonator *c′*, and is provided with a removable cap c^2 for enabling the said detonator to be inserted in place. This cap is perforated to enable the flame from the detonator *c′* to reach the primer.

Situated transversely within the plunger is a bolt C′, having a weighted end or head C^2 and carrying a point or needle C^3, which normally occupies an eccentric position relatively to the longitudinal axis of the fuse, as shown in Fig. 1. Formed in the wall of the fuse-body is a lateral recess *a*, which is so arranged that when the plunger moves toward the base of the shell on shock of discharge the head of the transverse bolt comes opposite the lateral recess and enters this recess under the action of centrifugal force, to which the said bolt is subjected by the spin of the shell. This movement of the bolt C′ brings the needle C^3 in alinement with the detonator carried by the percussion-pellet B, as shown in Fig. 2. In order to prevent the said bolt C′ from shifting its position after moving transversely, as above stated, we provide a pin C^4, which is

located in a hole at right angles to the tail of the bolt C′, toward which it is kept constantly pressed by a spring. Between the lower end of the said pin and the bolt C′ we interpose a steel ball $C^{4\times}$, so that the friction between the bolt and the pin C^4 is reduced to a minimum and the movement of the said bolt retarded as little as possible. When therefore the tail of the said bolt is removed from proximity to this pin and ball, the latter promptly moves into the space behind the said tail and firmly locks the bolt in its new position, Fig. 2.

Immediately in rear of the plunger C is an annular ferrule or guard D, which surrounds the front portion of the percussion-pellet B and rests against an annular flexible washer or collapsible diaphragm *b*, advantageously composed of copper. This washer or diaphragm is firmly connected to the pellet B at its inner circumference, but its outer circumference is free and unsupported and covers an annular cavity or recess *a′* in the fuse-body. (See Fig. 1.) The said washer or diaphragm is of sufficient strength to prevent the plunger C and ferrule D from shifting longitudinally under ordinary circumstances, but on shock of discharge it collapses and bends around the shoulder $b^{\times}$ on the pellet B, as shown at Fig. 2, and thereby allows the said ferrule and plunger to shift into the position indicated in this figure. It will be observed that the edge *d* of the ferrule is somewhat increased in thickness, so that when this thickened edge passes the bent washer or diaphragm the edge of the latter will aid in preventing the ferrule from rebounding and driving the plunger into its forward position again before the bolt C′ has time to enter its recess *a*. To further reduce the tendency of the ferrule to rebound, we provide at the bottom of the cavity *a′* a lead washer a^3, against which the end *d* of the ferrule will strike. The base of the aforesaid pellet B has a transverse slot *b′* therein, and the fuse-body is provided with a transverse pin a^4, which fits the said slot *b′*. This pin has a head a^5, and the end b^2 of the slot that lies contiguous thereto is recessed to receive this head a^5. A spiral spring a^6 acts upon the pin a^4 and normally tends to keep it in the position represented in Fig. 1—that is to say, with its head in engagement with the recessed end b^2 of the slot. So long as the pin is in this position the percussion-pellet remains firmly locked to the base of the fuse-body. When, however, the aforesaid plunger C and ferrule D shift on shock of discharge, as above stated, a pin a^7 is displaced in a direction at right angles to the axis of the said pin a^4. The contiguous ends of these pins a^7 a^4 are conically formed, and therefore as the pin a^7 performs its movement it drives the pin a^4 out of its path and in so doing causes the head a^5 of the pin a^4 to be disengaged from the recessed end b^2 of the pellet. (See Fig. 2.) The pellet is thus disconnected from the fuse-body and is only kept from striking against the needle C^3 by a spring D′, interposed between the pellet B and the plunger C. On impact the momentum of the pellet overcomes the resistance of this spring, and the detonator b^3 therefore strikes the aforesaid needle and explodes. The flame thereby produced passes by the passage C^5 to the detonator *c′*, which in its turn explodes and ignites the guncotton in the primer A′, and explosion of the entire charge in the shell ensues. The aforesaid spring acts to prevent the percussion-pellet from prematurely striking the firing-needle after the release of the said pellet.

A^3 A^3, Fig. 3, are transverse pins which pass through the fuse-body and enter longitudinal slots formed in the plunger. Rotary movement of the plunger is thereby prevented, and the extent of its longitudinal movement is limited by the length of such slots, so that a correct coincidence of the head of the transverse bolt with the recess *a* is insured when the plunger shifts longitudinally on shock of discharge.

It will be evident that by constructing a fuse in accordance with our invention not only must the plunger shift a sufficient distance to bring the transverse bolt opposite the recess *a* and release the percussion-pellet, but the said transverse bolt must also shift laterally to bring its firing-needle in the path of the detonator in the pellet, and, furthermore, the resistance of the spring D′ must be overcome before the said detonator can strike the said firing-needle. Consequently the liability of the fuse to be unintentionally rendered active is very remote, as the aforesaid movements can only be performed by discharging the shell from a gun.

Although we have illustrated a fuse adapted to be applied to the base of an explosive projectile or shell, it will be apparent that we can by making obvious alterations apply it to the nose of a shell.

When the shell does not contain a guncotton charge, we may dispense with the primer A′ and the detonator *c′* and depend on the flash produced by the detonator b^3 alone for exploding the shell.

For the purpose of overcoming the difficulty that would arise in the event of the transverse bolt C′ not promptly entering the recess to lock the plunger in its shifted position immediately the said plunger moves on shock of discharge we may provide in the wall of the fuse-body holes or recesses C^6 and in the plunger spring-controlled pins C^7, as shown at Fig. 3, so that as soon as these parts come opposite each other the pins will instantly snap into the holes and lock the plunger, or instead of these pins we may locate a light spring at the tail end of the transverse bolt, which spring would serve to force the bolt into the recess *a* irrespective of centrifugal force. Without these pins or the said spring the spiral spring D′ when compressed by the moving plunger on shock of discharge might have time enough to react and return the plunger to its original position before the

shell had received sufficient spin to enable the centrifugal force to drive the transverse bolt into the recess *a*.

What we claim is—

1. In a percussion-fuse, the combination with the fuse-body and a percussion-pellet, of a transverse bolt having a firing-needle which normally occupies an eccentric position with relation to said percussion-pellet, and of a movable portion or plunger carrying the said bolt and adapted to shift on shock of discharge to bring the bolt opposite a lateral recess in the fuse-body so that the bolt will automatically enter the recess during the flight of the shell and thereby bring its firing-needle concentric with the said percussion-pellet.

2. In a percussion-fuse, the combination with the fuse-body provided with a lateral recess, the percussion-pellet, and a plunger adapted to be shifted longitudinally on shock of discharge, of a transversely-arranged bolt carried in said plunger and provided with a firing-needle, the said bolt being adapted to shift automatically and engage in said recess on coming opposite the same, to thereby bring its firing-needle in alinement with the said percussion-pellet, substantially as described.

3. In a percussion-fuse, the combination with the fuse-body having a lateral recess, the percussion-pellet, the plunger, and a laterally-shifting bolt adapted to be engaged in the recess of the fuse-body and carrying a firing-needle, of means for locking said bolt in its shifted position, comprising a spring-pin and a ball interposed between said pin and bolt, substantially as described.

4. In a percussion-fuse, the combination with the fuse-body, the plunger and the transverse bolt, of spring-pins adapted to enter recesses in the fuse-body when the said plunger shifts on shock of discharge for the purpose specified.

5. In a percussion-fuse, the combination with the fuse-body, the plunger and its transverse bolt, of a percussion-pellet having a transverse groove for the reception of a transverse bevel-pointed pin provided with a head that normally engages with a recessed portion in said groove to lock the pellet to the fuse-body, and of a longitudinal bevel-pointed pin whose pointed end normally lies contiguous to the pointed end of the said transverse pin, so that when said longitudinal pin is shifted by the movement of the plunger on shock of discharge it will cause the head of the transverse pin to be disengaged from the pellet and thereby unlock the latter, substantially as described.

6. In a percussion-fuse, the combination with the fuse-body, the plunger, the ferrule, and the percussion-pellet, of a flexible washer or diaphragm which normally resists the movement of the plunger and ferrule but collapses on shock of discharge substantially as described.

7. In a percussion-fuse, the combination with the fuse-body, the plunger, and the percussion-pellet and its flexible diaphragm, of a ferrule interposed between the said diaphragm and the plunger, and of a non-resilient washer at the base of the fuse-body substantially as described and for the purpose specified.

8. In a percussion-fuse, the combination with the fuse-body, the ferrule, the percussion-pellet and the plunger, of a spiral spring interposed between the said plunger and pellet and inclosed by the ferrule, substantially as described and for the purpose specified.

9. In a percussion-fuse, the combination with the fuse-body, the plunger, its bolt, and the percussion-pellet, of a detonator carried by the said plunger, to which the flash from the detonator in the said percussion-pellet gains access by a central passage in the plunger and thereby fires the primer substantially as described.

10. In a percussion-fuse, the combination of the fuse-body, a longitudinally-sliding plunger, a transversely-shifting bolt carrying a firing-needle, a percussion-pellet normally locked to the fuse-body, means for releasing the said pellet as the plunger shifts on shock of discharge, and means for preventing the said pellet from bringing its detonator into contact with the firing-needle until the shell strikes an object, all substantially as described.

In testimony whereof we have hereunto set our hands this 10th day of March, 1897.

FREDERICK MARTEN HALE.
JOHN BRODIE REAVIL.

Witnesses:
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FRED C. HARRIS.