H. B. STRANGE.

FUSE FOR PROJECTILES.

APPLICATION FILED NOV. 11, 1913.

1,107,461.

Patented Aug. 18, 1914.

2 SHEETS—SHEET 1.

FIG. 1.

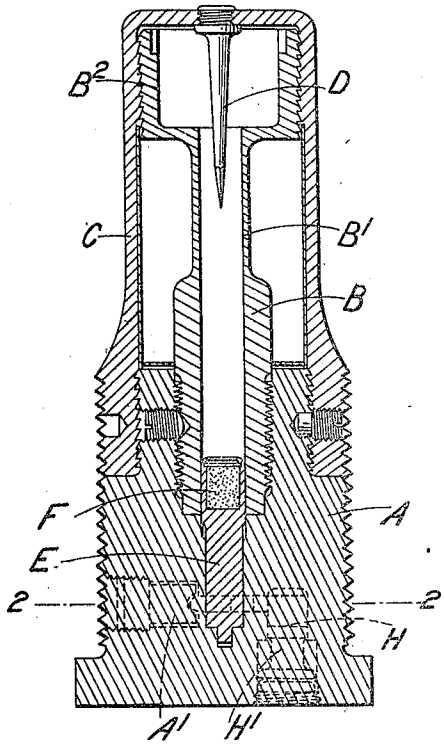
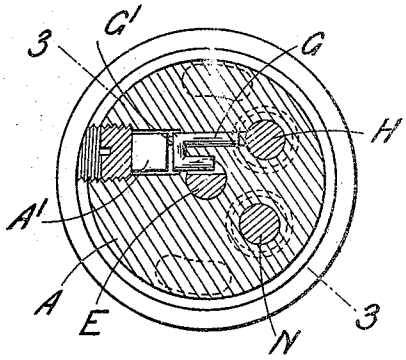


FIG. 2.



WITNESSES.

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2 SHEETS—SHEET 2.

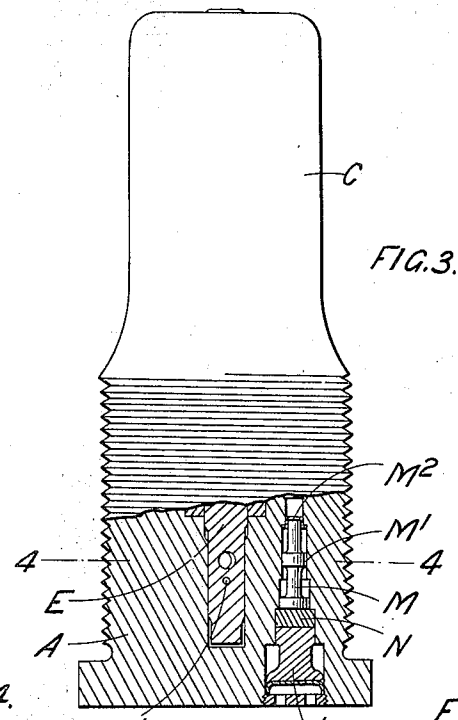


FIG. 3.

FIG. 4.

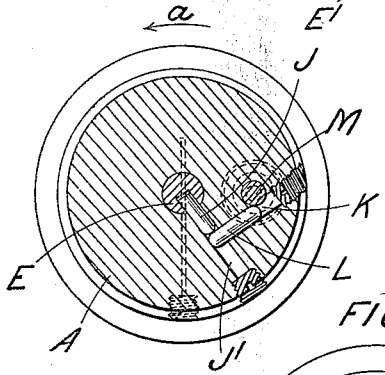


FIG. 5.

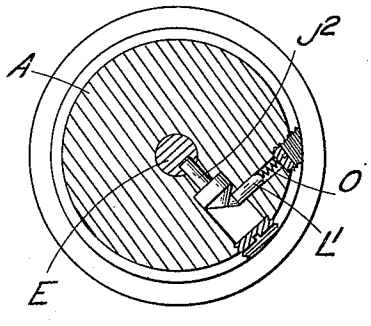
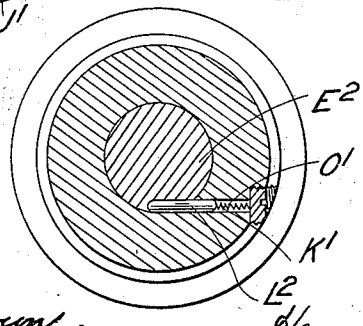


FIG. 6.



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UNITED STATES PATENT OFFICE.

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FUSE FOR PROJECTILES.

1,107,461. Specification of Letters Patent. Patented Aug. 18, 1914.

Application filed November 11, 1913. Serial No. 800,356.

To all whom it may concern:

Be it known that I, HARRY BLAND STRANGE, subject of the King of England, residing at Blackheath, Kent, in England, have invented certain new and useful Improvements in Fuses for Projectiles, of which the following is a specification.

This invention relates to fuses for projectiles more particularly fuses of the type provided with safety bolts which are so constructed and arranged as to be withdrawn by centrifugal action.

The object of the present invention is to provide means whereby the release of the pellet or other fuse mechanism is controlled or delayed until the projectile has left the muzzle of the gun.

Various devices have previously been proposed to delay the action of the fuse so as to insure safety while the projectile is still within the gun but such devices have proved or tended to be unreliable and are more complicated than the present arrangement.

According to this invention a movable retaining member such as a bolt is so disposed relatively to the axis of the fuse that it is acted upon by centrifugal force but is prevented from moving under that force before the projectile leaves the muzzle of the gun owing to the action of the rotary acceleration of the projectile. When, however, the projectile leaves the muzzle of the gun and rotary acceleration ceases, centrifugal force will cause the retaining member to move and to bring about the release of the pellet. Such release may be direct or may take place through a well known type of centrifugal bolt interposed between the pellet and the retaining bolt. Thus forces necessarily brought into operation by the motion imparted to the projectile while it is still in the gun are caused to prevent automatically the release of the pellet before the projectile has left the muzzle.

In a convenient construction for carrying out the present invention the end of the usual centrifugal bolt bears on the end of a second retaining bolt disposed in a passage within which it can slide in a direction which forms an angle with the axis of the main centrifugal bolt. The direction of the passage with regard to the axis of the fuse and the disposition of the retaining bolt within the passage are such that the retaining bolt is acted upon by centrifugal force and also by the force due to the rotary acceleration of the projectile. On discharge, the projectile as it passes down the gun receives rotary motion with a certain acceleration, which acceleration owing to the inertia of the retaining bolt counteracts the normal tendency of centrifugal force to cause the retaining bolt to move outward. When the projectile has left the muzzle of the gun this rotary acceleration has ceased and the spin of the projectile remains approximately constant for some distance during the flight of the projectile. Centrifugal force is now free to act on the retaining bolt which consequently slides outward in its passage freeing the main centrifugal bolt which at once moves outward and releases the pellet.

The portions of the two bolts where they are in contact may be shaped in various ways as found desirable but a convenient construction is to form the end of each bolt conical the conicity of the ends of the two bolts being equal or complementary one to the other so that the two cones will make smooth contact with each other over a small surface and at an angle such that there will be no tendency for the bolts to adhere to each other, bind, lock or otherwise engage so as to render them incapable of moving and acting as desired when the projectile is discharged. In place of forming the end of each bolt conical one bolt may have its end rounded while the end of the other bolt is coned.

In the accompanying drawings Figure 1 is a central longitudinal section through one construction of fuse according to this invention. Fig. 2 is a transverse section on the line 2—2 of Fig. 1. Fig. 3 is a longitudinal section on the line 3—3 of Fig. 2. Fig. 4 is a transverse section on the line 4—4 of Fig. 3. Fig. 5 is a view similar to Fig. 4 but illustrating a modified construction of certain parts of the fuse also according to this invention, and Fig. 6 is a transverse section through another form of fuse also according to this invention in which the retaining bolt acts directly upon the pellet instead of upon a centrifugal bolt.

Like letters indicate like parts throughout the drawings.

With reference first to Figs. 1, 2, 3 and 4,

the fuse body A is provided with a frangible tube B having a weakened portion B^1 and formed with an enlarged part or expansion chamber B^2. This frangible tube is supported by a casing C attached to the upper part of the tube and to the fuse body A and provided with a detonating needle D which extends downward so that its pointed extremity is within the weakened portion B^1 of the tube. In a cavity in the fuse body is a carrier or pellet E provided with a detonator or percussion cap F which when the pellet travels forward through the tube B is brought into contact with the detonating needle D and exploded. The pellet E is normally kept in its place at the lower end of the tube by a hook-shaped pin G which on the discharge of the gun is forced out of engagement with the pellet into a cavity A^1 (Figs. 1 and 2) in the fuse body by soft lead or other suitable material H caused to extrude from the chamber wherein it lies by the pressure of the discharge gases acting upon a plunger H^1. These details are given for the purpose of illustrating the general construction of the fuse and do not in themselves form a part of the present invention. The pellet E is also retained normally by a centrifugal bolt J (Fig. 4) contained in a radial passage J^1 formed in the fuse body A and tending to fly out along that passage and release the pellet owing to the centrifugal force set up by the spin of the projectile. Breaking into the radial passage J^1 is another passage K containing another bolt L. The normal position of this bolt L is shown in Fig. 4 where it will be seen that its end lies across the passage J^1 containing the centrifugal bolt J and prevents that member from withdrawing from engagement with the pellet E.

The retaining bolt L will be acted upon to some extent by the centrifugal force set up by the spin of the projectile which is intended to take place in the direction indicated by the arrow *a* in Fig. 4, but owing to the direction of the containing passage K in relation to the axis of the fuse the centrifugal force acting on the retaining bolt L will be overcome by another force due to the inertia of the retaining bolt and the rotary acceleration of the projectile as it passes through the bore of the gun before it leaves the muzzle. This force tends to keep the retaining bolt in the position shown in Fig. 4 where it locks the centrifugal bolt J. As soon as the projectile leaves the muzzle the rotary acceleration ceases and the retaining bolt L can then move outward along its passage K under the influence of centrifugal force leaving the passage J^1 clear so that the centrifugal bolt J may also move outward and disengage the pellet E. Supposing the retaining bolt L were left quite free to move in its passage K there would be a possibility that in the handling of the fuse it would move outward and set free the centrifugal bolt J. To obviate this disadvantage a second retaining member is provided in the form of a pin M (Figs. 3 and 4) having a shoulder M^1 which in the normal position before the gun is fired enters the passage K and prevents the outward movement of the retaining bolt L as shown in Fig. 4. This pin M is arranged to be acted upon by soft lead N which is forced forward by the pressure of the discharge gases acting upon a plunger N^1 after the same manner that the lead H forces the pin G to move as previously described. Both the pin G and the locking pin L are preferably provided with pins or cups G^1 (Fig. 2) or M^2 (Fig. 3) to keep them normally in the positions shown, these pins or cups being sheared when the pins G and M are moved by the extruded lead. In addition to the other locking and retaining devices the pellet E may be provided with the usual shearing pin E^1 which however may be very weak and only sufficiently strong to retain the pellet at the base of the tube B until impact occurs between the projectile and its objective when the pin is at once sheared and the pellet moves forward.

In the construction shown in Figs. 1, 2, 3 and 4, the centrifugal bolt J and the retaining bolt L are shown provided with rounded ends but in some cases it is preferred to shape the two adjacent ends of the bolts which are in contact, as cones. An example of this construction is shown in Fig. 5 where the outer end of the centrifugal bolt J^2 is coned, a similar form being given to the adjacent end of the retaining bolt L^1. In this construction also a light spring O is shown acting to keep the retaining bolt L^1 normally in locking engagement with the centrifugal bolt J^2. In this instance the spring O partly fulfils the function of the second retaining member M of the other construction and it will be understood that the strength of the spring O is such that it can be overcome when the centrifugal force is allowed to act on the retaining bolt L^1. The angle of inclination between the axes of the two bolts may vary in accordance with requirements and to meet the conditions which obtain when the projectile is discharged these conditions being dependent on the rate of acceleration of the rotation imparted to the projectile and the extent of the centrifugal force which has to be counteracted. Further the dimensions and form of the second retaining bolt may vary as found desirable in order to provide for the center of gravity of this bolt being so positioned as to insure this bolt being acted upon in the desired manner by the acceleration and centrifugal forces.

As will be seen the details of construction

may be varied as found desirable and to meet different conditions, the invention being applicable also to fuses provided with different forms of centrifugal bolt and operating on different systems. Where two centrifugal bolts are provided each may be controlled by a separate retaining bolt or these bolts may both be held by a common member which forms part of the retaining bolt or is itself held by a single retaining bolt. Again a single centrifugal bolt may be locked or held inoperative by more than one retaining bolt.

Where it is not convenient to arrange the retaining bolt so that it will act on one end of the centrifugal bolt the retaining bolt may be arranged to engage or bear upon the centrifugal bolt at some point in its length. In this case a conical or other recess may be formed in the side of the centrifugal bolt in which will normally lie the conical or other shaped end of the retaining bolt which is only withdrawn when the projectile is fired and has left the muzzle of the gun in the manner described. Or again the centrifugal bolt may be shouldered and the retaining bolt bear against this shoulder in some suitable manner.

Although it is preferred to employ a centrifugal bolt and a retaining bolt acted upon both by centrifugal force and by the rotary acceleration of the projectile, in some cases only one bolt may be employed. That is to say, the retaining bolt may engage directly with the pellet and be kept in engagement by the force due to its inertia and to the rotary acceleration of the projectile. When that acceleration ceases centrifugal force acting upon the bolt causes it to move outward and release the pellet. Such a construction is illustrated diagrammatically in Fig. 6 where a pellet E^2 of somewhat larger diameter than the pellets shown in the other figures is engaged directly by a retaining bolt L^2 capable of moving in a passage K^1. The action of the bolt L^2 is similar to that described with reference to the bolts L and L^1 in the constructions previously described but the intermediate centrifugal bolt is dispensed with. A light spring O^1 serves to keep the bolt L^2 normally in locking engagement with the pellet E^2.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a fuse for a projectile the combination with a fuse body, of a member adapted to travel forward therein on impact of the projectile with its objective and a sliding retaining bolt contained in a conduit or passage in the body and normally engaging with the movable member, said conduit or passage being so disposed relatively to the axis of the fuse that the retaining bolt is acted upon by centrifugal force but is prevented from moving under that force before the projectile leaves the muzzle of the gun owing to the action of the rotary acceleration of the projectile.

2. In a fuse for a projectile the combination of a member adapted to travel forward within the fuse on impact of the projectile with its objective and a sliding retaining bolt so disposed relatively to the axis of the fuse and to the member, that under the action of centrifugal force the bolt tends to move and release the member but is prevented from doing so before the projectile leaves the muzzle of the gun, owing to the action of the rotary acceleration of the projectile.

3. In a fuse for a projectile the combination of a member adapted to travel forward within the fuse on impact of the projectile with its objective, a bolt normally engaging with the member to retain it in its inoperative position but capable of moving under the action of centrifugal force to release the member and a retaining bolt so disposed relatively to the centrifugal bolt and to the axis of the fuse, that the rotary acceleration of the projectile, as it passes through the bore of the gun, tends to keep the retaining bolt in such a position that the centrifugal bolt cannot move.

4. In a fuse for a projectile the combination with a fuse body, of a pellet movable therein, a centrifugal bolt adapted to engage with the pellet and contained in a radial conduit or passage in the fuse body and a retaining bolt also contained in a passage in the fuse body, such passage being so disposed in relation to the axis of the fuse, that the rotary acceleration of the projectile, before it leaves the muzzle of the gun, keeps the retaining bolt in such a position as to prevent the centrifugal bolt disengaging the pellet.

5. In a fuse for a projectile the combination of a fuse body, a pellet movable therein, a centrifugal bolt adapted to engage with the pellet, a retaining bolt acted upon by centrifugal force but prevented from moving under that force before the projectile leaves the muzzle of the gun owing to the rotary acceleration of the projectile, a second retaining member or locking bolt and means operated by the pressure of the gases of discharge for moving the locking bolt.

6. In a fuse for a projectile the combination of a fuse body, a pellet movable therein, a centrifugal bolt adapted to engage with the pellet, a retaining bolt acted upon by centrifugal force but prevented from moving under that force before the projectile leaves the muzzle of the gun, owing to the rotary acceleration of the projectile, a second retaining member or locking bolt, a hook-shaped pin engaging with the pellet and means operated by the pressure of the gases of discharge for moving the locking bolt to release the retaining bolt and for

moving the hooked pin out of engagement with the pellet.

7. In a fuse for a projectile the combination of a fuse body, a pellet movable therein, a radial passage in the fuse body, a centrifugal bolt movable in said radial passage and adapted to engage with the pellet, a second passage in the fuse body breaking into the radial passage, a retaining bolt movable in the said second passage and caused by the action of the rotary acceleration of the projectile to prevent the centrifugal bolt releasing the pellet before the projectile leaves the muzzle of the gun, a second retaining member or locking bolt acting to lock the retaining bolt and contained in another passage in the fuse body, a hook-shaped pin engaging with the pellet and means operated by the pressure of the gases of discharge for moving the locking bolt to release the retaining bolt and for moving the hooked pin out of engagement with the pellet.

8. In a fuse for a projectile the combination of a fuse body, a frangible tube carried thereby, a pellet adapted to travel forward within the tube on impact of the projectile with its objective, a bolt normally engaging with the pellet to retain it in its inoperative position but capable of moving under the action of centrifugal force to release the pellet and a retaining bolt so disposed relatively to the centrifugal bolt and to the axis of the fuse, that the rotary acceleration of the projectile, as it passes through the bore of the gun, tends to keep the retaining bolt in such a position that the centrifugal bolt cannot move.

9. In a fuse for a projectile the combination of a fuse body, a frangible tube carried thereby, a pellet adapted to travel forward within the tube on impact of the projectile with its objective, a radial passage in the fuse body, a centrifugal bolt movable in said radial passage and adapted to engage with the pellet, a second passage in the fuse body breaking into the radial passage, a retaining bolt movable in the said second passage and caused by the action of the rotary acceleration of the projectile to prevent the centrifugal bolt releasing the pellet before the projectile leaves the muzzle of the gun, a second retaining member or locking bolt acting to lock the retaining bolt and contained in another passage in the fuse body, a hook-shaped pin engaging with the pellet and deformable material acted upon by the pressure of the discharge gases to move the locking bolt and the hook-shaped retaining pin.

10. In a fuse for a projectile the combination of a fuse body, a frangible tube carried thereby provided with a weakened portion, an expansion chamber communicating with the forward end of the tube, a casing supporting the tube, a detonating needle in the tube, a pellet adapted to travel forward within the tube on impact of the projectile with its objective, a detonator or percussion cap carried by the pellet, a radial passage in the fuse body, a centrifugal bolt movable in said radial passage and adapted to engage with the pellet, a second passage in the fuse body breaking into the radial passage, a retaining bolt movable in the said second passage and caused by the action of the rotary acceleration of the projectile to prevent the centrifugal bolt releasing the pellet before the projectile leaves the muzzle of the gun, a second retaining member or locking bolt acting to lock the retaining bolt and contained in another passage in the fuse body, a hook-shaped pin engaging with the pellet and deformable material acted upon by the pressure of the discharge gases to move the locking bolt and the hook-shaped retaining pin.

11. In a fuse for projectiles, the combination of a member adapted to travel forward within the fuse on impact of the projectile with its objective, a bolt normally engaging with said member to retain it in its inoperative position but capable of moving under the action of centrifugal force to release said member and a retaining member so disposed relatively to the centrifugal bolt and to the axis of the fuse that the rotary acceleration of the projectile as it passes through the bore of the gun tends to keep the retaining member in such position that the centrifugal bolt cannot move.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HARRY BLAND STRANGE.

Witnesses:
EUSTACE H. BARKER,
ARTHUR T. WAGHOM.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."