H. B. STRANGE.

FUSE FOR PROJECTILES.

APPLICATION FILED OCT. 4, 1911.

1,048,910.

Patented Dec. 31, 1912.

2 SHEETS—SHEET 1.

FIG. 1.

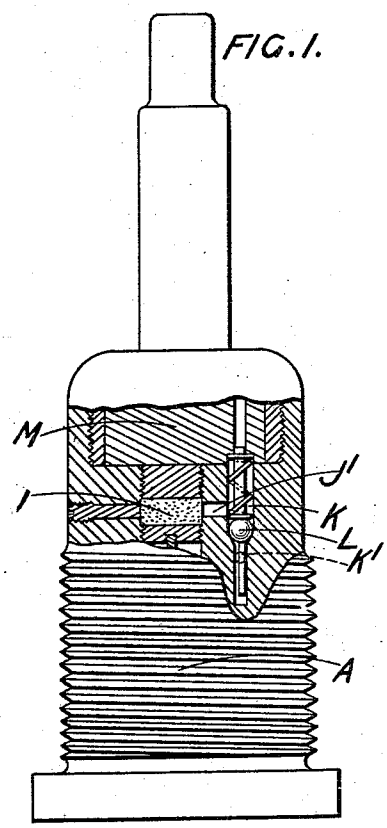


FIG. 2.

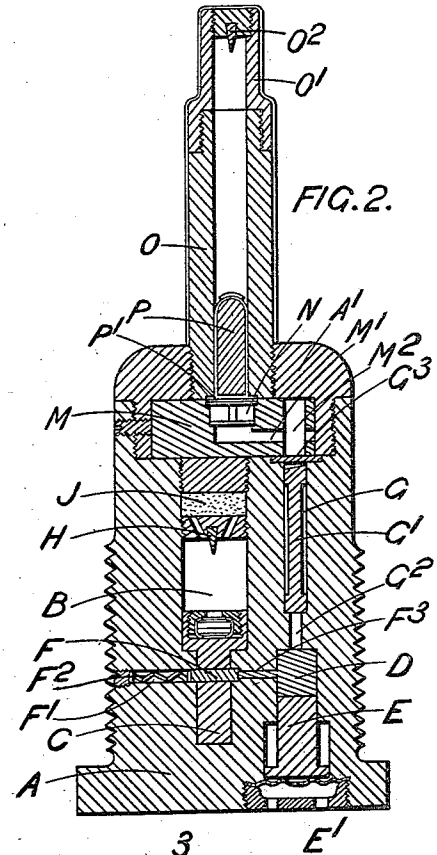


FIG. 3.

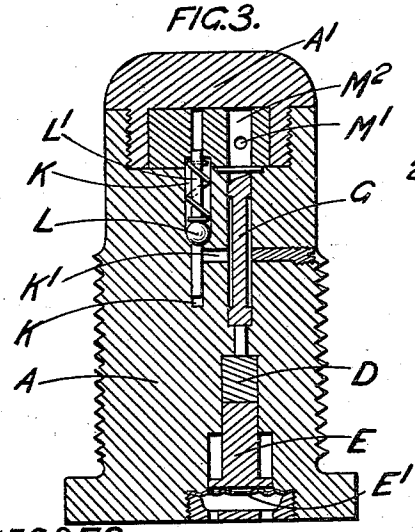


FIG. 4.

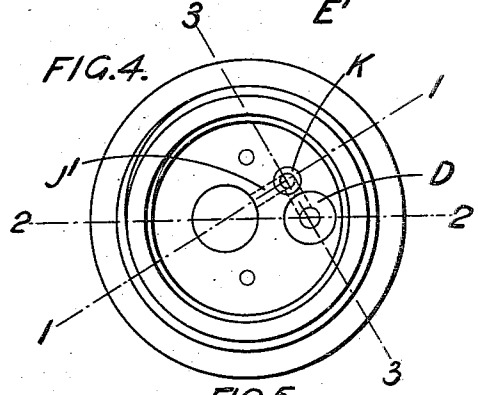
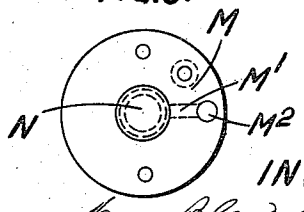


FIG. 5.



WITNESSES.

Elizabeth Griffith

Walter P. Brown

INVENTOR.

Harry Bland Strange

By Church & Church

His Attorneys.

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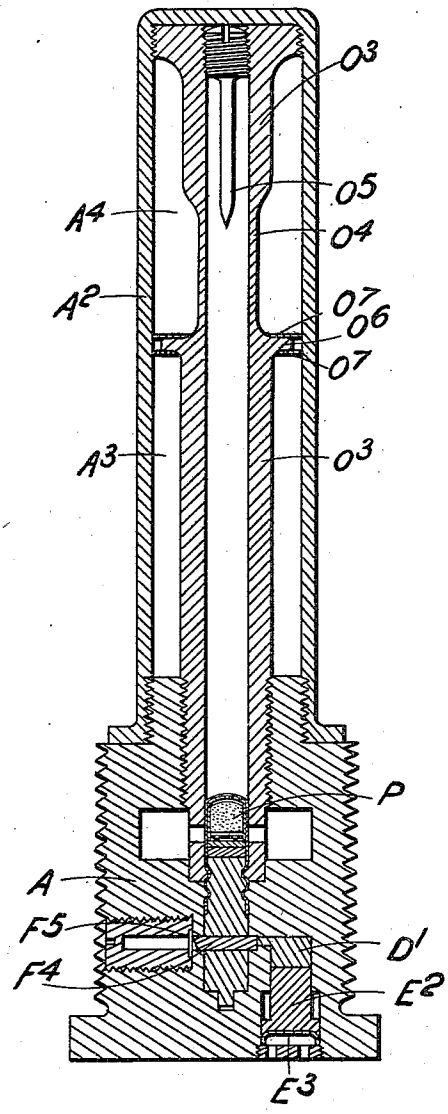
2 SHEETS—SHEET 2.

FIG. 6.



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His Attorneys.

UNITED STATES PATENT OFFICE.

HARRY BLAND STRANGE, OF SHEFFIELD, ENGLAND, ASSIGNOR TO THOMAS FIRTH AND SONS, LIMITED, OF SHEFFIELD, ENGLAND.

FUSE FOR PROJECTILES.

1,048,910. Specification of Letters Patent. Patented Dec. 31, 1912.

Application filed October 4, 1911. Serial No. 652,795.

To all whom it may concern:

Be it known that I, HARRY BLAND STRANGE, a subject of the King of England, and residing at Sheffield, in Yorkshire, 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, and has particular reference to a fuse for use with a projectile filled with an explosive which is required to burst it on the impact of the projectile with its objective.

In many fuses of this type, a movable member which becomes operative to bring about the bursting of the projectile on impact, is retained until the moment of impact by some form of safety device, such for example, as a pin or disk, which has to be sheared off in order to release the movable member, and such fuses generally require a considerable amount of retardation or shock before the projectile can be exploded. Other fuses have safety devices which depend, for example, on the centrifugal force developed in some member such as a safety catch, when the projectile commences to revolve; but these are likely to become easily deranged and to fail to fulfil their functions.

These disadvantages are obviated in a fuse according to this invention, for the fuse is set definitely ready for action, even on a slight impact, by the pressure of the gases generated on the discharge of the gun. This pressure is made to actuate various parts of the fuse by causing the deformation or flow of some non-elastic material, such for example as soft lead. This material is conveniently placed in a chamber where it can be acted upon by a plunger which, in its turn, is moved forward directly or indirectly by the pressure of the gases. Leading from this chamber is a passage in line with a brass or other comparatively strong shearing pin which passes through a movable member, such as a detonator carrier in the body of the fuse. As soon as the lead is deformed, it is caused to flow along this passage and to force the shearing pin out of its hole in the movable member against the action of a spring, or other retaining device, such as a small lead rod; and thus, a lead shearing pin capable of being sheared off and releasing the movable detonator carrier, even on a very slight impact, is substituted, as soon as the projectile is fired, for the comparatively hard and strong safety pin which holds the movable member in place during storage or transit of the projectile. The size and consequently the resistance to shearing, of the lead pin can be regulated by diminishing the size of the passage, a small passage resulting in a small and thin lead shearing pin being formed. Preferably the gases do not act directly upon the plunger but upon a disk of copper or like material, corrugated so that it can move forward for a sufficient distance without being ruptured. The soft lead may also be caused to flow through another passage and to operate a steel punch, causing it to perforate a disk and thus open a passage allowing the gases or flame from a powder charge exploded by the detonator to pass to a second charge placed in another chamber at the bottom of a tube of rifle steel or other material of great tensile strength. This tube which is preferably screwed into the fuse is an important feature in the present invention. Its main portion extending upward from the cap of the fuse is of such material and of such a small bore that the explosion of a cartridge containing say, a comparatively large quantity of fulminate of mercury, is insufficient to burst the tube but the upper portion of the tube is made comparatively weak by employing a weaker material or by making the walls of that portion thinner. This weak portion of the tube will burst only if the fulminate cartridge is within it when the explosion takes place. Should the cartridge be exploded while in another part of the tube the thin portion does not burst.

In the tube, adjacent to the weak portion, is a needle plug or detonating needle which acts to explode the cartridge of fulminate of mercury or other sensitive explosive when it travels forward in the tube and comes into contact with the needle. The cartridge of fulminate of mercury is intended to be normally kept in place securely by a flange so that until the second charge of powder at the bottom of the tube is ignited there is no possibility of the cartridge traveling to the other end and coming into contact with the needle plug. When on the impact of the projectile the second charge of powder in the chamber below the cartridge is exploded by the flame from the first charge, the car-

tridge is forced up the tube into contact with the needle plug and exploded bursting the weak portion of the tube and exploding the bursting charge of the projectile.

In a simple construction of fuse also according to this invention the cartridge of fulminate or other high explosive may be the only member which is released and moves forward on the impact of the projectile. Such a modified cartridge is adapted to be retained normally by a shearing pin of comparatively hard metal and for this is substituted, in the manner previously described, a soft shearing pin of lead or the like such substitution being brought about through the action of the discharge gases in the gun.

In the accompanying drawings, Figure 1 is an elevation of one construction of fuse according to this invention partly in section on the line 1—1 of Fig. 4. Fig. 2 is a vertical section on the line 2—2 of Fig. 4. Fig. 3 is a section on the line 3—3 of Fig. 4. Fig. 4 is a plan with portions removed. Fig. 5 is a plan of a separate portion of the fuse, and Fig. 6 is a vertical section through another construction of fuse also according to this invention.

Like letters indicate like parts throughout the drawings.

With reference first to the form shown in Figs. 1 to 5, A is the body of the fuse having a chamber B wherein is a detonator carrier C. In another chamber in the body of the fuse some deformable non-elastic material such as soft lead is placed as at D and adjacent to it is a plunger E the head of which can be acted upon by a diaphragm E′, this diaphragm being exposed on its outside to the pressure of the gases generated on the discharge of the gun.

The detonator carrier C is perforated and is normally retained in the position indicated in Fig. 2 by means of a pin F of brass or other hard material which is inserted through the transverse passage F′ and kept in its place by a light spring F^2. As will be seen from Fig. 2 a passage F^3 connects the chamber containing the lead D with the end of the passage F′ and thus on the deformation of the lead D due to the pressure of the discharge gases it is caused to flow along the passage F^3 and to force the shearing pin F out of its hole in the detonator carrier C against the action of the spring F^2. Thus a lead shearing pin capable of being sheared off and releasing the movable detonator carrier even on a very light impact is substituted, as soon as the projectile is fired, for the comparatively hard and strong safety pin which holds the carrier in place during storage or transit of the projectile.

In the fuse body above the chamber containing the soft lead is a vertical conduit G having within it a shearing punch G′. The bottom of the chamber G is joined by a passage G^2 with the chamber containing the lead D and thus the pressure of the discharge gases causes the lead to flow through the passage G^2 and to force the punch G′ upward. This movement of the punch perforates a safety disk G^3 which normally closes the top of the conduit G.

In the upper part of the chamber B is fixed a detonating needle H and behind the needle is a powder charge J contained in a chamber made to receive it. This chamber containing the powder charge J communicates through a cross passage J′ with a conduit K parallel to the axis of the fuse and itself in communication through a cross passage K′ with the conduit G containing the shearing punch G′. Normally communication between the cross passage J′ and K′ is cut off by a ball valve L having a spring controlled stem L′.

At the upper part of the body A of the fuse and kept in place by a cap A′ is a disk M containing in a central cavity a compressed powder pellet N the cavity containing the pellet communicating through a cross passage M′ with a vertical conduit M^2, in the disk M and forming a continuation of the conduit G′.

On the cap A′ is mounted a tube O of rifle steel or other material of great tensile strength provided at its upper extremity with a cap O′ forming a continuation of the tube but made of weaker material such for example as brass. This upper portion O′ of the tube is provided with a detonating needle O^2 adapted to explode a cartridge P of fulminate of mercury or other sensitive explosive when such cartridge travels along the tube and comes into contact with the needle. The cartridge P is normally kept in place by a flange P′ forming part of its casing and sufficiently strong to retain the cartridge securely at the lower end of the tube O until it is forced along that tube by the ignition of the compressed powder pellet N.

The operation of the form of fuse illustrated in Figs. 1 to 5 is as follows:—When the projectile is fired from the gun the pressure of the gases generated by the discharge deforms the lead D and substitutes a lead shearing pin for the comparatively strong shearing pin F. Thus the detonator carrier C remains held only by a weak pin which can be broken by a very slight impact shock. The deformation of the lead also causes the punch G′ to perforate the disk G^3 thus opening communication between the conduit G and the conduit M′. In this position the parts remain while the shell is undergoing acceleration in velocity in the barrel of the gun the cross passages J′ and K′ being still separated by the spring controlled valve L.

When the projectile issues from the muzzle and is retarded by the pressure of the atmosphere on its head the valve L moves forward against its spring and the passages J′ and K′ are thrown into communication. Thus there is now a connection between the first powder charge J and the second powder charge N through the cross passage J′, vertical conduit K, cross passage K′, conduits G and M^2 and cross passage M′. On impact occurring between the projectile and its objective the weak lead shearing pin gives way and the detonator carrier C moves forward exploding its detonator by contact with the needle H. This causes the ignition of the first powder charge J and the resulting flame passing through the cross passages and conduits ignites the powder pellet N. The ignition of this second powder charge forces the fulminate cartridge P along the tube O into the weak portion O′ where it comes into contact with the detonating needle O^2 and is exploded bursting the portion O′ and exploding the bursting charge of the projectile which can be packed around the tube O O′.

In the modified form of fuse according to this invention shown in Fig. 6 the fulminate cartridge P is normally retained at the lower extremity of the strong tube O^3 by a strong shearing pin F^4 for which is substituted a weak pin of lead by the action of the discharge gases upon a plunger E^2 the movement of which deforms a mass of lead D′. It will be noticed that in this form the gases are allowed to act upon a cup shaped disk E^3 instead of upon the corrugated diaphragm E′ of Figs. 2 and 3; also that the safety pin F^4 instead of being displaced against the action of a spring F^2 has to perforate a small safety disk F^5. Another point of difference between the two constructions is that the weak portion of the tube in the fuse shown in Fig. 6 instead of being in the form of a cap made of weaker material is an integral portion O^4 of the tube made with walls of considerably less thickness than the remainder of the tube. The thin or weak portion O^4 is in the modified construction not formed at the extreme end of the tube O^3 but toward that end and the detonating needle O^5 is made of sufficient length to extend down from the top of the tube O^3 to a point adjacent to the weak portion O^4. It is found to be advantageous to have some space in the tube beyond the weak portion as in the event of an accidental explosion of the cartridge P when it is in another part of the tube there is less risk of the weak portion being burst than would be the case if the weak portion were at the extreme end. For this purpose the screwed plug carrying the detonating needle O^3 may in some cases be perforated and a space left on the other side of it to form what may be termed an expansion chamber for the gases. It will be understood that the presence of this chamber or space beyond the weak portion of the tube only has a practical effect in the event of accidental explosion of the cartridge when it is not in the weak portion O^4 of the tube. When it is in that weak portion the action is extremely rapid and the bursting of the weak part of the tube occurs immediately. In the drawing forming Fig. 6 it will be seen that the tube O^3 is provided with a shoulder or flange O^6 adjacent to which are disks O^7 of shalloon or other suitable material. These separate the space between the tube O^3 and the casing A^2 into two parts or chambers A^3 and A^4. These chambers are intended to be filled with some high explosive which would be ignited by the bursting of the tube at the place O^4 and by its explosion would ignite the main bursting charge of the projectile. The function of the shoulder O^6 and disks O^7 is to prevent the setting back of the charge when the projectile is fired. It will be seen that in this construction the detonator carrier C, the shearing punch G′, the powder charges J and N and the valve L of the construction illustrated in Figs. 1 to 5 are dispensed with, the number of parts of the fuse being thus considerably reduced.

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

1. In a fuse for projectiles, the combination with a movable member operated by the impact of the projectile with its objective, a safety device for normally holding said member in inoperative position, a deformable material adapted upon deformation to remove said safety device and be substituted therefor, and means for deforming said material by the pressure of the gases of discharge.

2. In a fuse for projectiles, the combination with a plunger adapted to be acted on by the pressure of the discharge gases, of a plug of deformable material acted on by said plunger whereby said material will be extruded and movable fuse controlling parts moved and retained in their new positions by the extended material.

3. In a fuse for projectiles, the combination of a fuse body having a chamber or cavity containing a soft metal such as lead, movable fuse controlling mechanism, a conduit between such mechanism and the cavity containing the soft metal and a plunger adapted to be acted on by the pressure of the discharge gases and to transmit such pressure to the soft metal thereby causing it to be extruded through the conduit, whereby the mechanism will be moved and retained in its new position.

4. In a fuse for projectiles, the combination with a fuse body having a chamber or cavity, having a soft metal such as lead

therein, a movable member in the fuse, means for holding said member normally in inoperative position, and means acting on said soft metal operated by the pressure of the discharge gases, whereby said metal will be extruded and said holding means removed and the soft metal substituted therefor.

5. In a fuse for a projectile the combination of a member adapted to travel forward within the fuse on the impact of the projectile with its objective, a safety device for retaining such member in its inoperative position until the gun is fired and means operated by the pressure of the gases generated on the discharge of the gun for substituting for such safety device a soft metal retaining member which is easily sheared when the impact occurs.

6. In a fuse for a projectile the combination of a member adapted to travel forward within the fuse on the impact of the projectile with its objective, a pin of hard material normally retaining the member at the rear end of its path of travel, a conduit in alinement with the pin and a deformable substance in the conduit so disposed that the pressure of the gases generated on the discharge of the gun causes the deformable substance to pass along the conduit and displace the pin.

7. In a fuse for a projectile the combination of a member adapted to travel forward within the fuse on the impact of the projectile with its objective, a safety device for retaining such member in its inoperative position until the gun is fired, a chamber in the fuse body adjacent to the safety device, a deformable substance in such chamber, a plunger bearing against the deformable substance and disposed in a cavity in the fuse, a disk or diaphragm adjacent to the plunger and exposed to the pressure of the gases generated on the discharge of the gun so that such pressure is transmitted from the disk through the plunger to the deformable substance for the purpose described.

8. In a fuse for a projectile the combination of a detonator adapted to travel forward in a chamber or cavity in the body of the fuse, a detonating needle at the forward end of the chamber, a powder charge adjacent to the detonating needle, a tube of great tensile strength mounted on the forward end of the fuse body and having its front portion comparatively weak, a cartridge adapted to travel in said tube, means situated in the weaker portion of said tube for exploding the cartridge, a powder charge for propelling said cartridge along the tube, a conduit between the powder charge adjacent to the detonating needle and the powder charge for propelling the cartridge, a safety disk in said conduit, a shearing punch adjacent to the disk, a safety device for retaining the detonator in its normal position until the gun is fired, a chamber in the fuse body adjacent to the safety device, a deformable substance in such chamber, conduits leading from the chamber to the shearing punch and to the safety device, and means, operated by the pressure of the gases generated by the discharge of the gun, for deforming the substance in the chamber and causing it to operate the shearing punch and the safety device.

9. In a fuse for a projectile the combination of a detonator adapted to travel forward in a chamber or cavity in the body of the fuse, a detonating needle at the forward end of the chamber, a powder charge adjacent to the detonating needle, a tube of great tensile strength mounted on the forward end of the fuse body and having its front portion comparatively weak, a cartridge adapted to travel in said tube, means situated in the weaker portion of said tube for exploding the cartridge, a powder charge for propelling said cartridge along the tube, a plurality of conduits between the powder charge adjacent to the detonating needle and the powder charge for propelling the cartridge, a spring-controlled valve in one of said conduits, a safety disk in another of said conduits, a shearing punch adjacent to the disk, a safety device for retaining the detonator in its normal position until the gun is fired, a chamber in the fuse body adjacent to the safety device, a deformable substance in such chamber, conduits leading from the chamber to the shearing punch and to the safety device, and means, operated by the pressure of the gases generated by the discharge of the gun, for deforming the substance in the chamber and causing it to operate the shearing punch and the safety device.

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

HARRY BLAND STRANGE.

Witnesses:

PAUL KEETON,

PERCY G. BEARD.