No. 745,981. PATENTED DEC. 1, 1903.

C. V. WHEELER & A. G. McKENNA.

DELAYED ACTION FUSE FOR PROJECTILES.

APPLICATION FILED FEB. 24, 1903.

NO MODEL. 2 SHEETS—SHEET 1

Fig. 5.

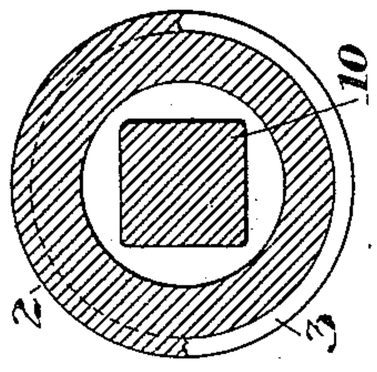



Fig. 6.

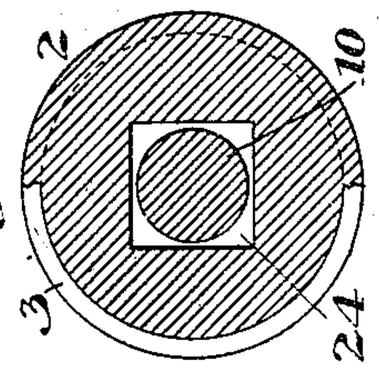



Fig. 7.

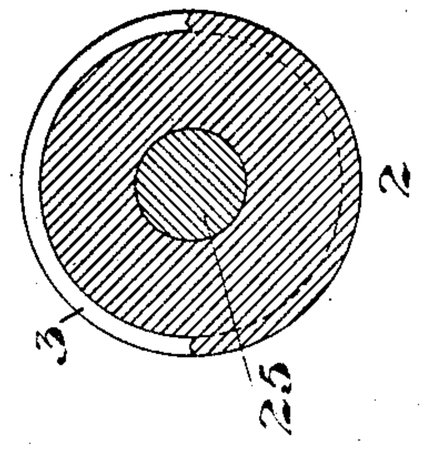



Fig. 4.

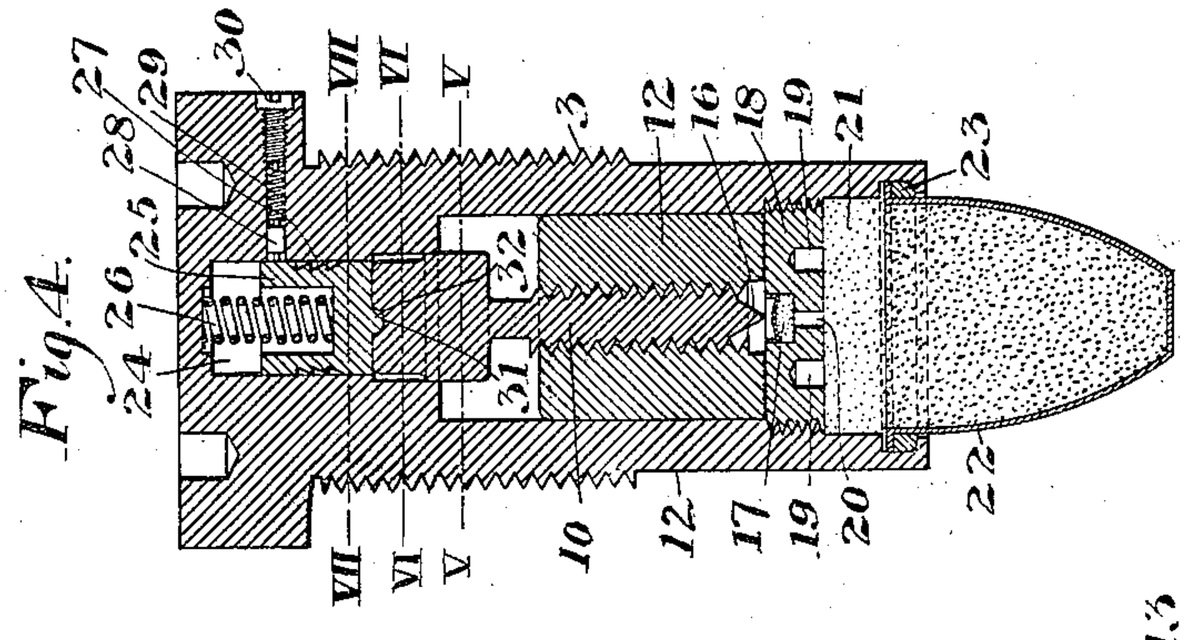



Fig. 2.

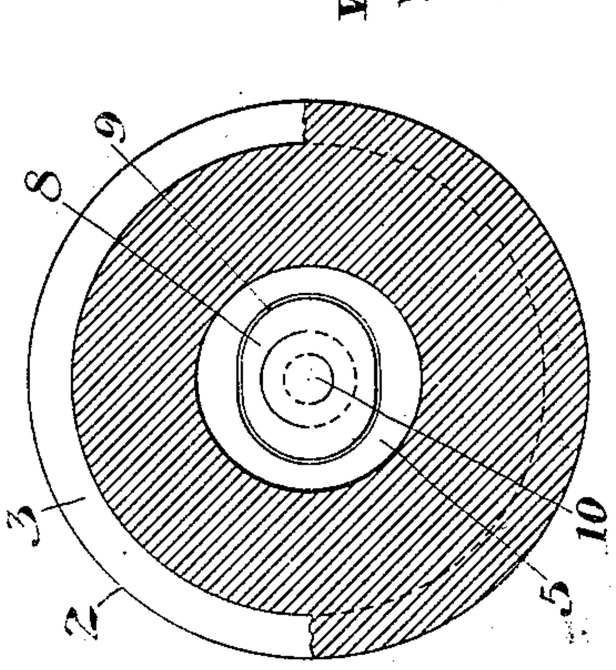



Fig. 3.

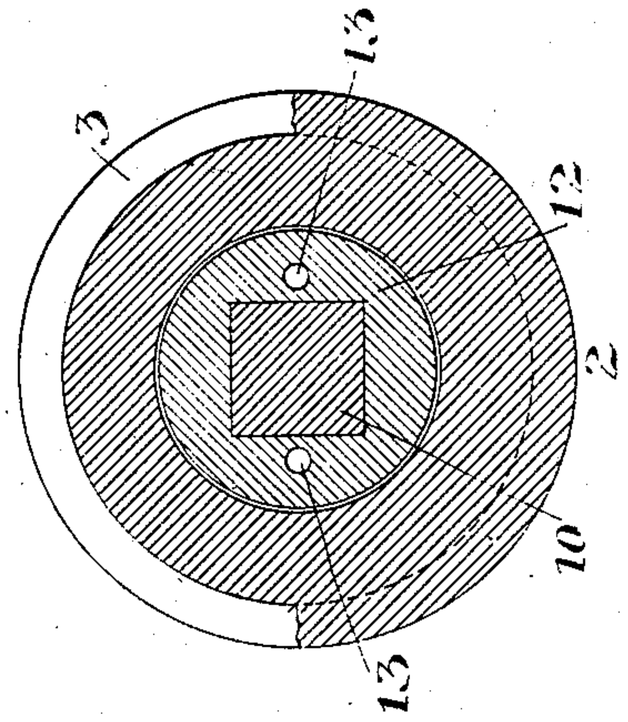
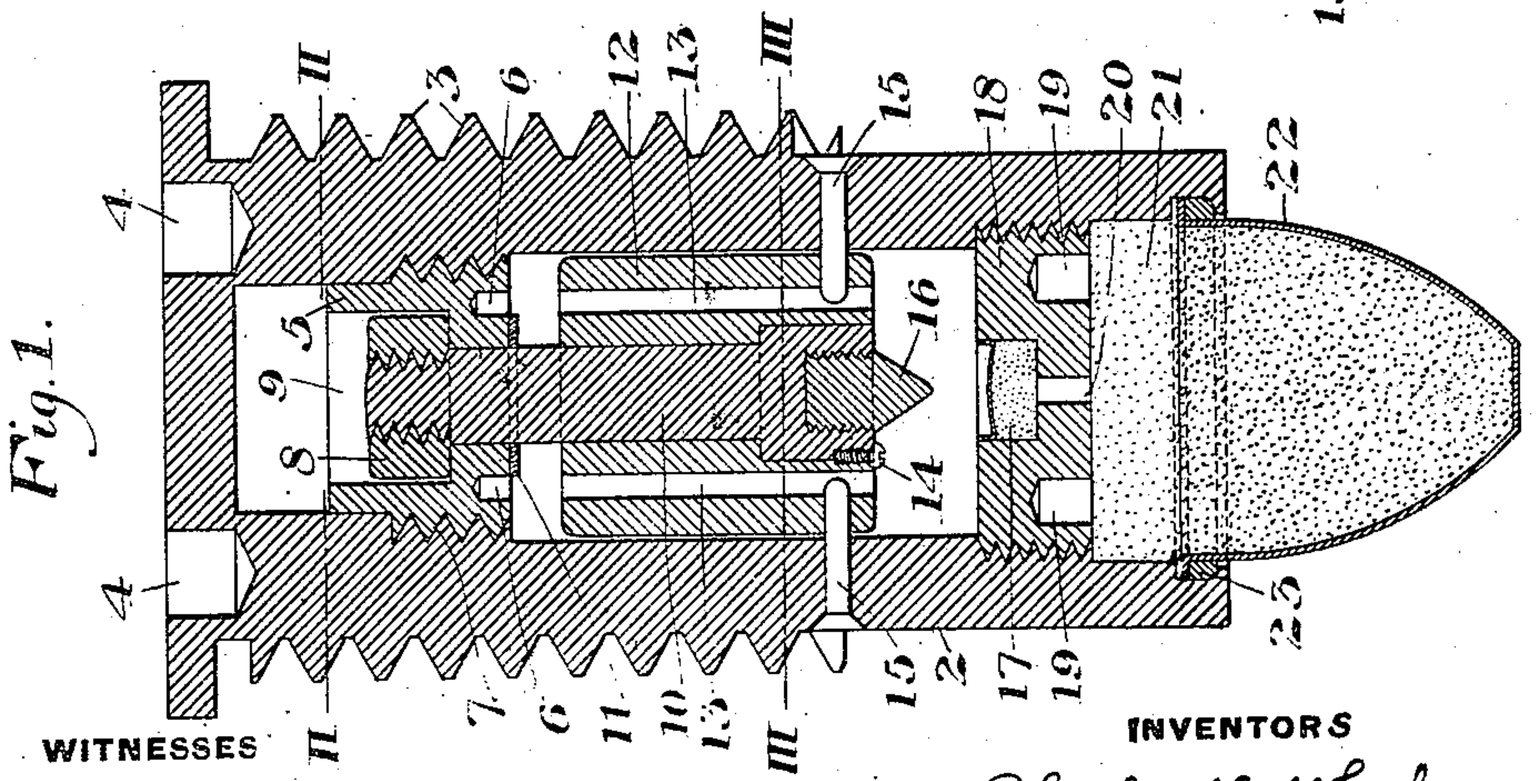



Fig. 1.




WITNESSES

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Fig. 9.

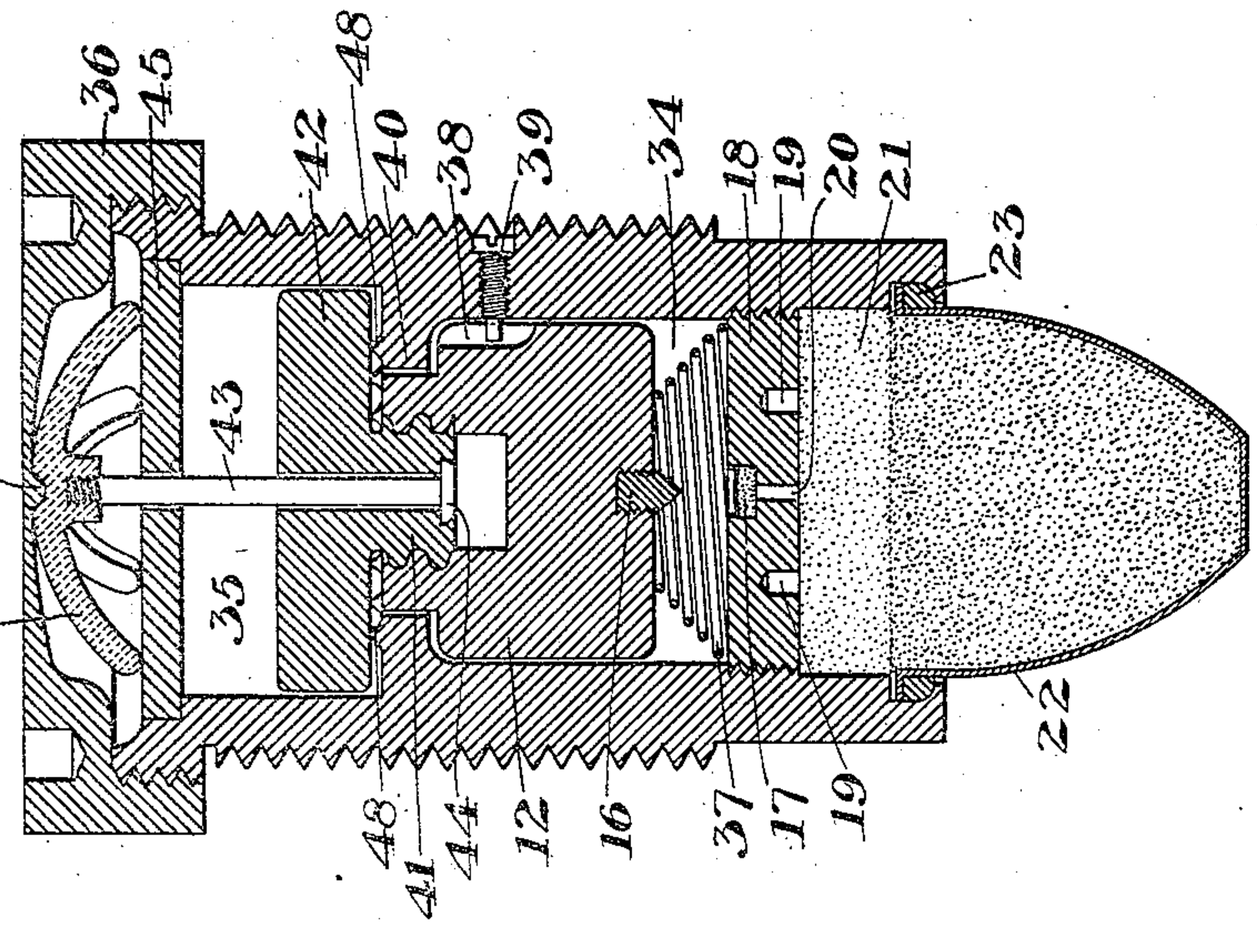
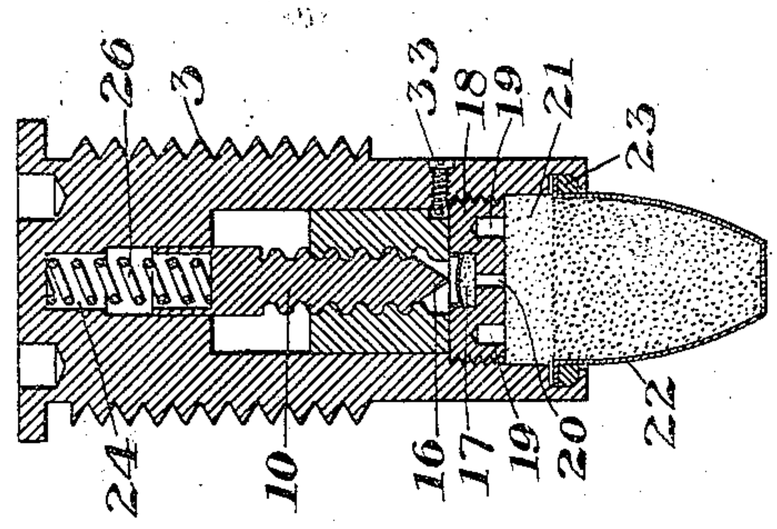



Fig. 8.

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# UNITED STATES PATENT OFFICE.

CHARLES V. WHEELER, OF ALLEGHENY, AND ALEXANDER G. McKENNA, OF BRADDOCK, PENNSYLVANIA.

## DELAYED-ACTION FUSE FOR PROJECTILES.

SPECIFICATION forming part of Letters Patent No. 745,981, dated December 1, 1903.

Application filed February 24, 1903. Serial No. 144,606. (No model.)

*To all whom it may concern:*

Be it known that we, CHARLES V. WHEELER, of Allegheny, and ALEXANDER G. McKENNA, of Braddock, Allegheny county, Pennsylvania, have invented a new and useful Delayed-Action Fuse for Projectiles, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal section of our improved fuse. Figs. 2 and 3 are cross-sections on the lines II II and III III of Fig. 1. Fig. 4 is a longitudinal section of a modification. Figs. 5, 6, and 7 are cross-sections on the lines V V, VI VI, and VII VII of Fig. 4. Figs. 8 and 9 are sectional views of other modifications.

Our invention is a delayed-action fuse for projectiles; and it consists in a fuse for projectiles containing thermite, which is composed of metallic oxid and powdered aluminium or other element, such as powdered silicon, capable of reacting with the oxid and producing a high temperature without the production of explosive gases, together with metallic magnesium and percarbonate of potassium or other suitable composition adapted to start combustion of the thermite; and it also consists in certain mechanical devices whereby communication of heat from the combustion of the thermite to the bursting charge of the projectile is delayed in its action; and it has for its object delayed action of the fuse and also the production of intense heat within the body of the shell, whereby it is capable of being employed as an incendiary projectile.

We will now describe our invention, so that others skilled in the art may employ the same.

In the production of fuses for projectiles the chief requirements are, first, safety in handling; second, certainty in action; third, simplicity in construction; fourth, safety from deterioration; fifth, sensitiveness, and, sixth, delayed action when the shell is to be used for perforating plates. In order to secure a fuse having all these requirements, we have produced a fuse which normally is unarmed—that is, it is provided with safety devices which prevent mechanical movement of the parts under any ordinary shock that might be produced in handling the shell, and at the same time these safety devices are of such character that the fuse will invariably arm itself when the projectile is discharged from the gun and be sensitive enough to explode when the shell is checked by the resistance of the skin-plate of a ship or other target.

In the drawings we have shown a variety of mechanical devices which may be employed to arm the fuse; but as other devices may be employed we do not desire in our broad claims to limit ourselves to the use of the construction which we have shown.

In the drawings, 2 represents the body of the fuse, which is preferably a tube of brass or other suitable metal having on its outer face a thread 3, which enables the fuse to be screwed into a threaded cavity in the base of the projectile, suitable wrench-sockets 4 being formed in the base of the fuse.

In the bore or cavity of the fuse, at a point slightly removed from the base of the same, is a metal sleeve 5, having a wrench-cavity 6 and a thread 7, which thread engages with a thread formed on the interior bore of the fuse. The base of this sleeve 5 is recessed to receive an oblong nut 8, which fits within the recess 9 in the sleeve 5 and is capable of longitudinal movement; but owing to its oblong shape and the oblong shape of the recess it is not capable of turning therein. The interior of this oblong nut 8 is provided with a screw-thread adapted to engage with the threaded end of the firing pin or bolt 10. This firing-pin 10 extends through a bolt-hole in the upper portion of the sleeve 5, and on the outer face of the sleeve 5 is a washer or ring 11 of lubricating material. Surrounding the firing-pin 10, within the cavity of the fuse and forward of the sleeve 5, is a pellet 12 of cylindrical form adapted to fit the cavity or bore of the fuse and capable of rotation therein, and at the forward end of the firing-pin 10 the bolt-hole through which the firing-pin 10 passes in the pellet 12 is square in cross-section, as shown in Fig. 3 of the drawings, and the head of the firing-pin 10 is also square, so that the firing-pin shall not be capable of rotation within the pellet 12. This pellet 12 is provided with two wrench holes or cavities

13, the purpose of which is to enable the sleeve 5 to be screwed into the body of the fuse. The pellet 12 may also be secured to the firing-pin 10 by means of the screw 14. Passing through suitable cavities in the wall of the fuse and into the pellet 12 are frangible pins 15, the purpose of which is to prevent the pellet from rotating normally within the cavity of the fuse. Seated in the head of the firing-pin 10 is a steel hammer 16, which is adapted to strike against and explode the primer 17 when the fuse is armed. This primer 17 is located a short distance in front of the hammer 16 and is seated in a disk 18, which is screwed into the fuse-cavity a short distance below the mouth of the same, wrench-cavities 19 being formed in the disk to enable the disk to be screwed into its position in the cavity of the fuse. An opening or passage 20 leads from the space 21 in front of the primer through the disk 18 into the bore of the fuse in front of the disk. At the mouth of the body of the fuse is a metallic case 22, secured to the body of the fuse by a packing-ring 23 and adapted to contain a charge of the oxid and element, such as powdered aluminium and oxid of iron. The space 21 in the rear of this case 22 is adapted to be charged with powdered magnesium or other suitable chemical, which may be mixed with percarbonate of potassium or sodium peroxid or other oxidizing material. These chemicals may be inclosed in a paper case, or instead of the magnesium other means may be employed for generating the initial heat.

The operation of this fuse is as follows: Normally the fuse is in an unarmed condition, the hammer 16 on the firing-pin 10, which is keyed to the pellet 12, being retained at a distance from the primer 17 by means, first, of the pins 15, and, secondly, by means of the nut 8, which is screwed on the end of the firing-pin 10 and is seated in the oblong recess in the sleeve 5. The fuse having been fitted in the base of the shell and the shell being fired from a gun, the force of the explosion within the gun drives the shell forward. Owing to the inertia of the pellet 12, which tends to cause the pellet to lag behind within the cavity of the fuse, the pins 15 are sheared or broken, which allows the pellet and firing-pin 10 to be free from restraint against rotation within the bore of the fuse. As a rotary movement has been imparted to the shell by the rifling of the gun, the shell and the fuse therein are rotated at a very rapid rate. Owing to the inertia of the now free pellet 12 and the firing-pin 10 this pellet and firing-pin do not rotate with the fuse at the rate of rotation of the projectile, and this lagging action therefore causes the rear end of the firing-pin 10 to unscrew from the oblong nut 8, whereby the fuse becomes armed, and the firing-pin now is free to move against the primer 17. When the projectile strikes the ship or other target against which it is directed the retardation of the projectile caused by striking a resisting force permits the momentum of the pellet 12 to advance the firing-pin 10, and the hammer of the firing-pin is brought violently in contact with the primer 17, exploding the same and igniting the charge of magnesium and oxidizing material in the cavity 21 and thereby, owing to the combustion of the magnesium, sufficient heat is generated to induce chemical action between the aluminium and the metal oxid in the case 22. This chemical action produces a gradually-increasing and intense non-gaseous heat, which is sufficient in time to fuse the case 22 and to explode a detonator or to explode the bursting charge of the projectile directly. By varying the composition or the thickness of the case 22 the time required to fuse the case and explode the bursting charge of the projectile may be increased or lessened.

The advantage of the use of chemicals which shall produce a non-gaseous heat is to prevent premature explosion, as where gases are produced by the fuse the gases would be apt to start or loosen the case 22 and to explode the shell prematurely.

In Fig. 4 we show a modification of the mechanical devices which may be employed for arming the fuse and for retaining the feature of safety in handling. In this modification the bore of the body of the fuse at its base is preferably reduced in area, forming a cavity 24. The forward end of this cavity 24 is square in cross-section, as shown in Fig. 5 of the drawings, while the lower portion of the cavity is cylindrical in cross-section, as is shown in Fig. 7. Seated in the rear portion of the cavity 24 is a block 25, having a recess in the base thereof, which provides a seat for a spiral spring 26, which spring bears against the block 25 and also against the base of the cavity 24. On the outer circumference of the block 25 is formed a ratchet 27, adapted to engage with a spring-dog 28, which is operated by the spring 29, this spring being so seated between the dog and the screw 30 that when the block 25 is pushed back against the spring 26 in the recess 24 the spring-dog 28 shall engage with the ratchet 27 and retain the block in this position. Seated in the forward part of the cavity 24 is the base of the firing-pin 10, which at its rear end is cylindrical in cross-section, as shown in Fig. 6, and is provided with a transverse groove or notch 31, which engages with a lug 32 in the forward end of the block 25. The forward portion of the base of the firing-pin 10 is square in cross-section, as shown in Fig. 5, so as to fit snugly within the squared portion of the recess 24. The firing-pin 10 is secured to the pellet 12 by means of a screw-thread formed on the outer face of the firing-pin and within the cavity of the pellet. The pellet 12 seats against the disk 18 and the meeting faces of the disk and the pellet are roughened to prevent accidental rotation of the pellet. The hammer of the firing-pin is situate back of the face of the pellet 12, and thereby the

hammer is protected from coming prematurely in contact with the primer 17. The operation of this modification is as follows: When the projectile is fired from a gun, the pellet 12 falls back within the cavity of the fuse, owing to its inertia, as has already been described, and the firing-pin 10 being carried with the pellet moves back in the recess 24, carrying with it the block 25, and as the ratchet 27 passes the dog 28 the dog enters the ratchet and prevents the spring 26 from driving the block 25 and the firing-pin 10 forward when this inertia has been overcome. The purpose of the spring 26 in the normal condition of the projectile is to keep the pellet 12 on the end of the firing-pin 10 pushed forward against the disk 18. Owing to the rotation of the projectile and the inertia of the pellet 12 against this rotation, as already described, the pellet 12 runs down on the screw-thread of the firing-pin 10, this firing-pin being caused to partake of the rotation of the shell, owing to the square shoulder at the base of the same fitting in the squared portion of the slot 24, and the firing-pin now projects in front of the forward end of the pellet. When the projectile comes in contact with the target against which it is fired, the rapidity of its flight is checked and the momentum of the pellet 12 carries the firing-pin 10 against the primer 17 and ignites the magnesium in the cavity 21 in the manner already described.

In the modification shown in Fig. 8 the pellet 12 is screwed to the forward end of the firing-pin 10, the hammer of the firing-pin 10 being in rear of the forward face of the pellet, and the pellet is held against the disk 18 by a pin 33. The rear end of the firing-pin is seated in the cavity 24 at the base of the fuse, and a spiral spring is so seated in this cavity and against the base of the fuse that the firing-pin shall hold the pellet 12 against the face of the disk 18. The function of the pin 33 is to prevent the pellet 12 from running down on the screw-thread of the firing-pin during the handling of the shell. When the projectile is fired from a gun, the pellet 12 runs down on the thread of the firing-pin 10 until the hammer of the firing-pin projects beyond the face of the pellet. When the projectile strikes the target, the momentum carries the pellet and the firing-pin forward in the manner already described against the primer 17 and ignites the magnesium in the cavity 21.

In Fig. 9 we show another modification, in which the cavity of the fuse is divided into a front and rear portion 34 and 35, and the base of the cavity of the fuse is closed by a threaded copper cap 36, which screws on a thread formed on the outer circumference of the fuse. The pellet 12 is situate in the forward portion 34 of the bore of the fuse and is provided with a steel hammer 16. Between the disk 18 and the pellet 12 is a spiral spring 37, which is normally under compression. At the rear portion of the pellet 12 is a longitudinal slot 38, into which extends a screw 39, which passes through the wall of the fuse and is adapted normally to prevent the rotation of the pellet. In the rear of the recess 38 the inner circumference of the fuse-cavity is contracted, forming a collar 40, which acts to prevent the pellet from falling back beyond a fixed distance in the bore of the fuse. Within the base of the pellet 12 is formed a cavity, a portion of which is cylindrical in cross-section and is threaded to engage with a screw-thread on the neck 41 of the disk 42. Extending through the cavity in the center of the disk 42 is a pin 43, the end of which is provided with a head 44, so seated in the base of the cavity of the heavy-metal disk 42 that pressure on the base of the shell will force the pin 43 forward and release the disk from the head 44. At the base of the cavity 35 is a steel disk 45, and the pin 43 extends through an opening in this disk and is screwed to a soft-metal compressible yoke or mushroom 46. The arms of the yoke 46 bear against the disk 45 and hold it in its seat in the body of the fuse. This yoke is held in position by a lug 47 in the cap 36, which fits in the cavity in the base of the yoke. Normally this fuse is kept in an unarmed condition by the pin 43 and also by the thread 41 on the neck of the disk 42, being prevented from forward movement by the collar 40 of the body of the fuse, and it is kept from rotating within the cavity 35 by teeth or projections 48, which bear against the face of the metal disk 42.

The operation is as follows: When the projectile is fired from a gun, the pressure on the base of the shell forces the copper plate of the cap 36 inwardly, and as the yoke is flattened the pin 43 is driven forward, releasing the pin from the disk 42, which permits the disk to set back in the fuse, while the steel disk 45 protects the body of the fuse from injury. The inertia of the pellet 12, aided by the spring 37, causes it to move backward in the fuse-cavity 34. The disk is now free to unscrew from the pellet 12, which receives the rotation of the projectile as it is held in connection with the body of the fuse by the screw 39. As soon as the disk 42 has become unscrewed from the pellet 12 the fuse is armed, and when the projectile strikes the target the momentum carries the pellet forward and the hammer 16 against the primer 17, igniting the magnesium in the cavity 21.

Where it is so desired, the body of the projectile may be formed of fusible metal and the cavity of the shell may be filled with aluminium and metal oxid. Such a projectile may be employed for setting fire to wooden buildings and ships.

The advantages of our invention will be appreciated by those skilled in the art. Owing to the locking of the mechanical devices which we have described, the hammer is prevented from coming in contact with the primer of the fuse until after the fuse has been armed by the inertia of the weight against the for-

ward motion of the projectile and until after the fuse has been further armed by the inertia of the devices against the rotation of the projectile. The fuse is therefore perfectly unarmed and not liable to accidental ignition.

The fuse is absolutely certain in action, for the reason that although the fuse is proof against accidental arming in handling yet the double movement of flight and rotation as the projectile leaves the gun and passes through the air will invariably arm the same.

The fuse is exceedingly simple in construction and without parts liable to get out of order.

The fuse will not deteriorate, owing to the fact that aluminium, oxid of iron, and magnesium are each so fixed in its condition that chemical action cannot take place until heat has been produced by the ignition of the magnesium. The fuse cannot be exploded by external heat.

The fuse can be made of any degree of sensitiveness desired without danger of arming the same by accident.

Owing to the time required to produce a heat intense enough to destroy the case 22 and to explode the bursting charge of the shell, the action may be delayed sufficiently to allow the shell to lodge in the armor-plate or target before explosion takes place, and owing to the non-gaseous combustion of the fuse the premature explosion of the shell is prevented.

In the following claims we intend by the term "thermite" to include a mixture of metallic oxid or metallic sulfid with a powdered element, such as aluminium or silicon, adapted to react with the oxid or sulfid and to produce heat within the body of the projectile non-explosively without the evolution of gas. In stead of percarbonate of potassium percarbonate of sodium or other material which will give up oxygen at a low temperature may be employed for starting the reaction in the thermite.

What we claim is—

1. A delayed-action fuse for projectiles consisting of a chamber containing thermite and means for starting the reaction between the components of the thermite.

2. A delayed-action fuse for projectiles said fuse containing thermite, metallic magnesium and percarbonate of potassium and having means for igniting the magnesium and percarbonate of potassium.

3. A delayed-action fuse for projectiles having a fusible chamber containing thermite, and means for starting the reaction between the components of the thermite.

4. A delayed-action fuse for projectiles containing thermite, a compound for starting the reaction between the components of the thermite, a primer for igniting said compound, and means for igniting the primer.

5. A delayed-action fuse for projectiles, containing thermite and a compound for starting the reaction between the components of the thermite, a weighted firing-pin, and devices for weakly securing the firing-pin to the body of the fuse.

In testimony whereof we have hereunto set our hands.

C. V. WHEELER.
A. G. McKENNA.

Witnesses:
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H. M. CORWIN.