F. W. S. STOKES.

FUSE FOR PROJECTILES.

APPLICATION FILED JULY 2, 1917.

1,298,418.

Patented Mar. 25, 1919.

2 SHEETS—SHEET 1.

FIG. 1.

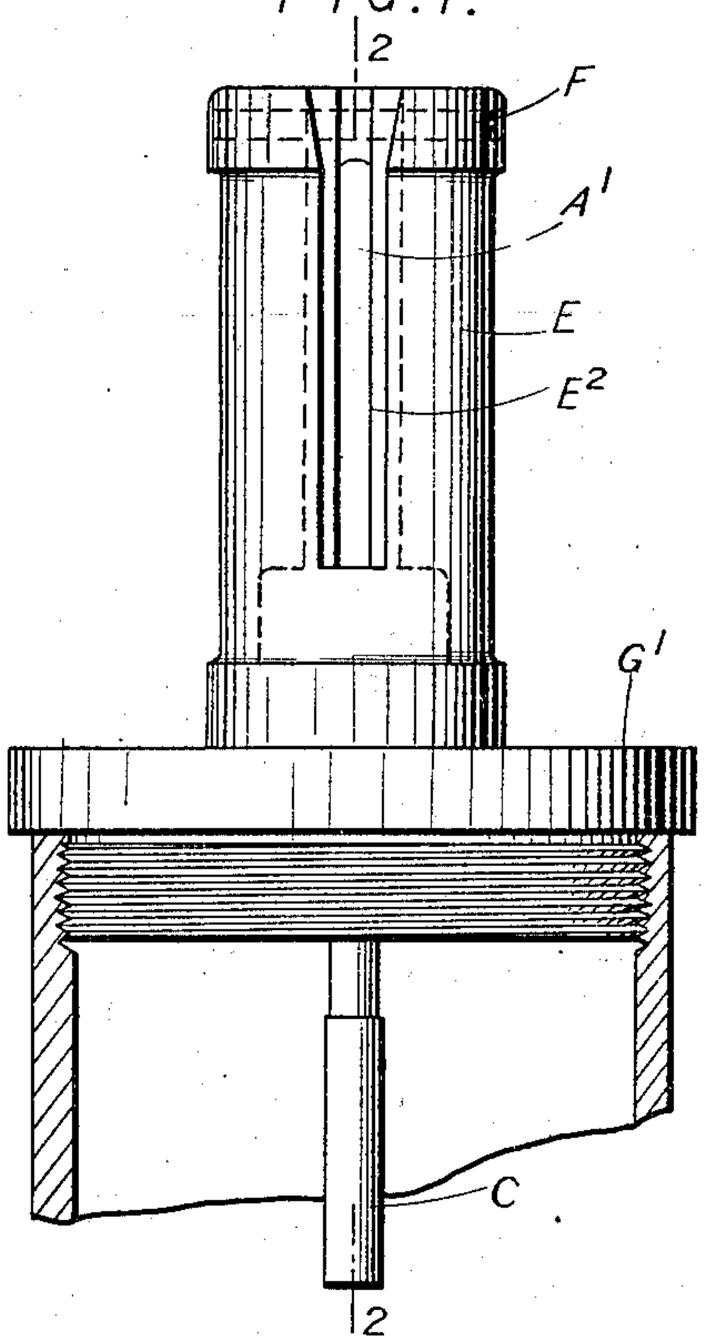
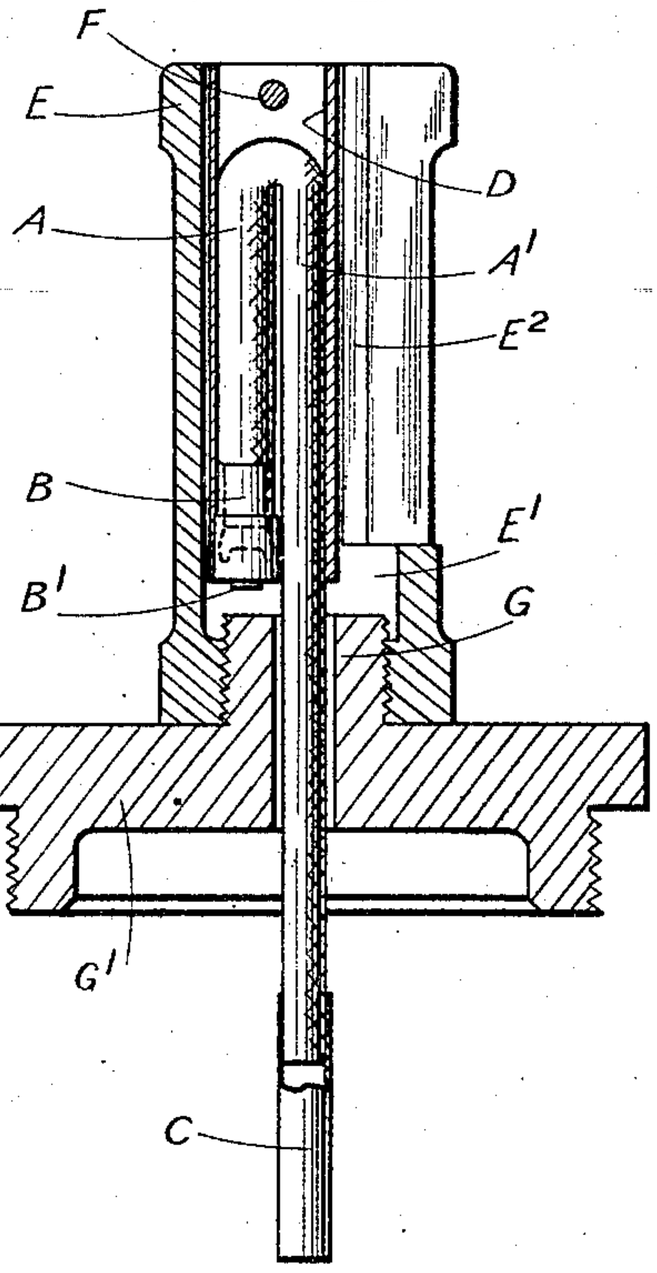


FIG. 2.



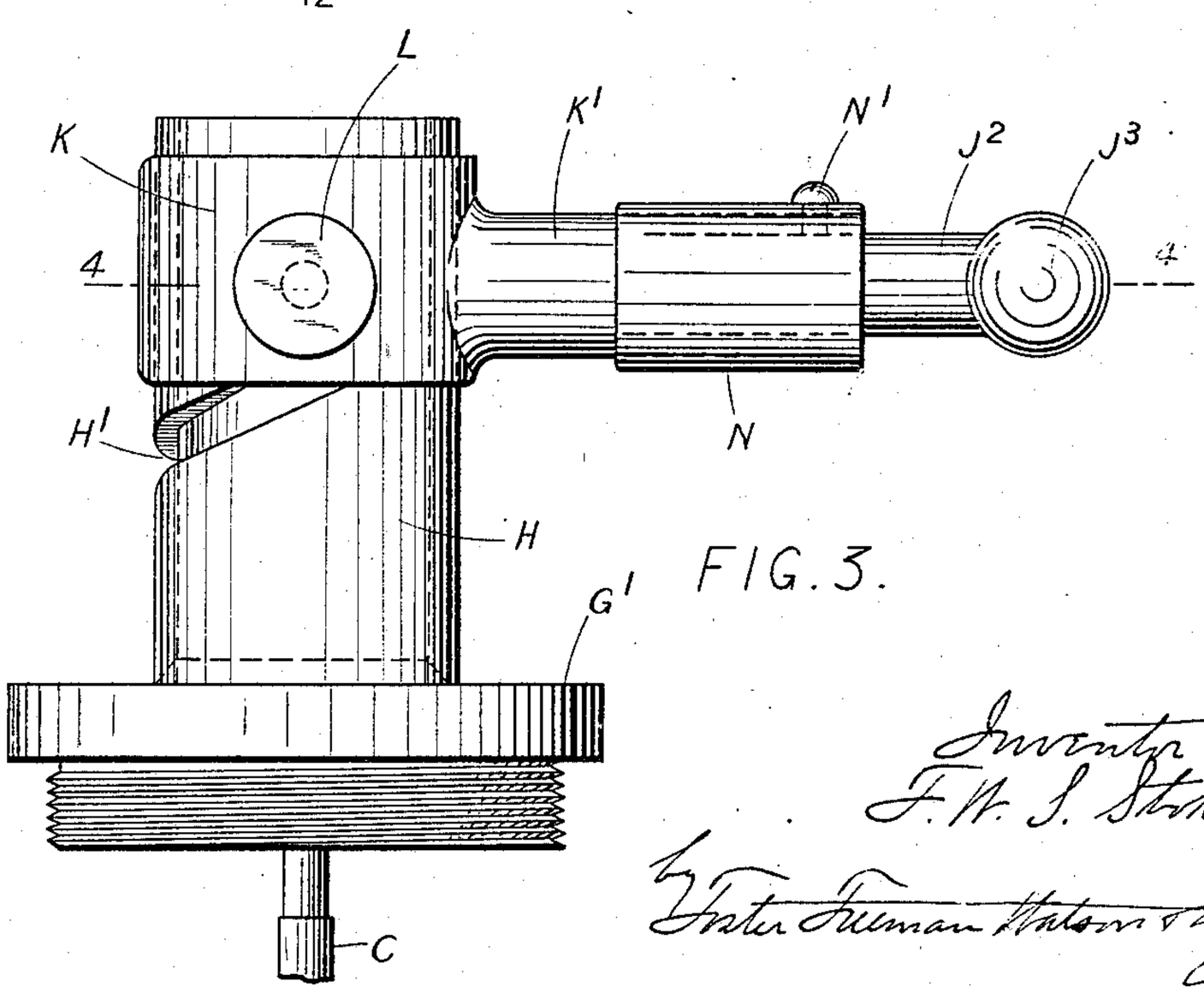


FIG. 3.

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2 SHEETS—SHEET 2.

FIG. 4.

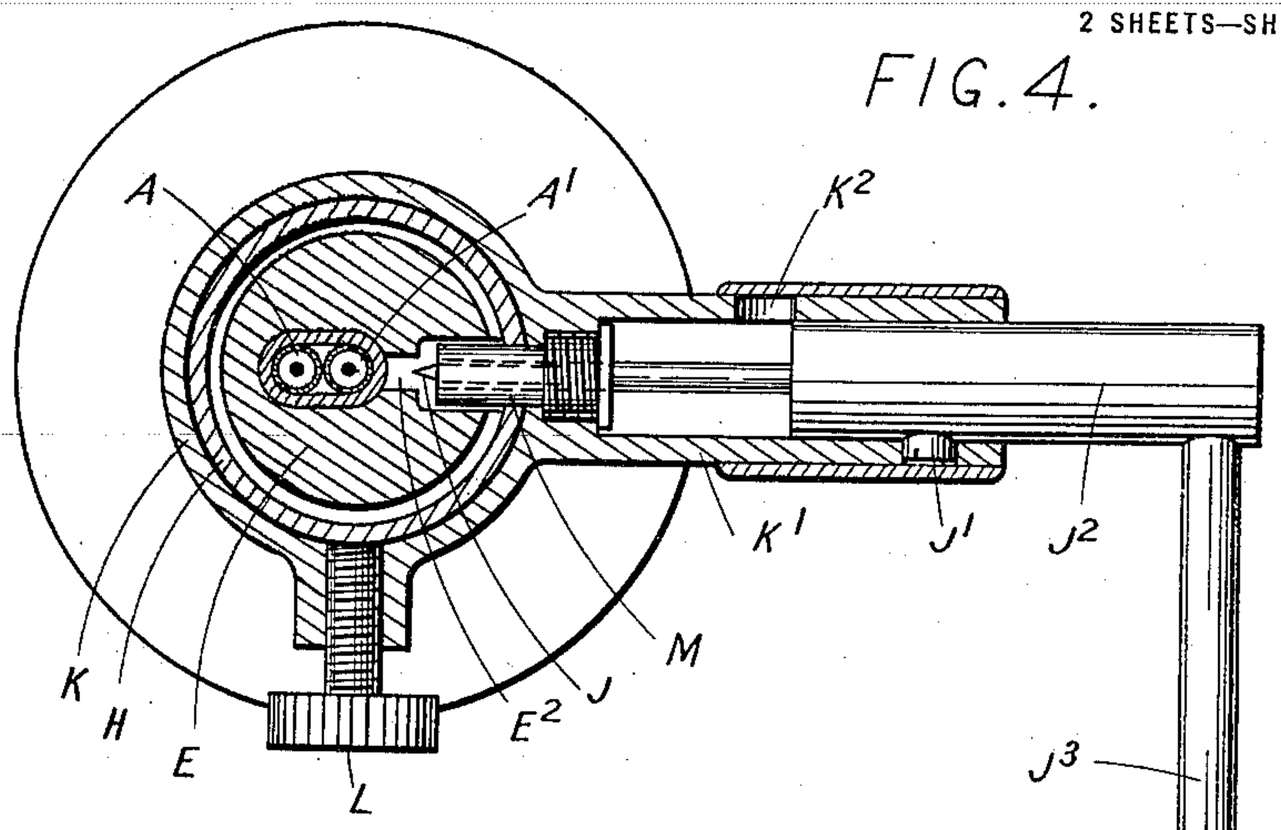


FIG. 5.

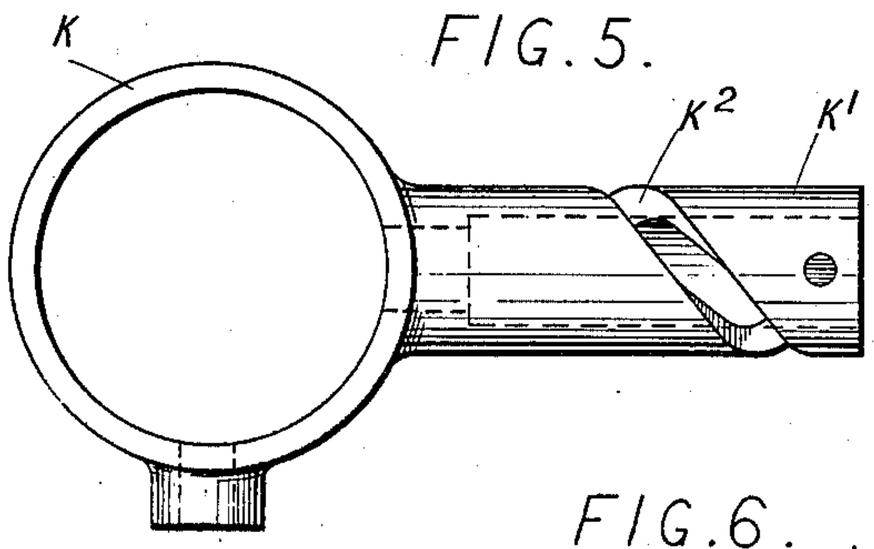
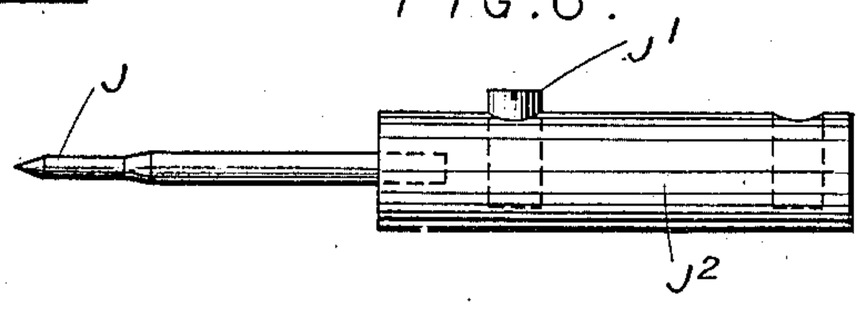


FIG. 6.



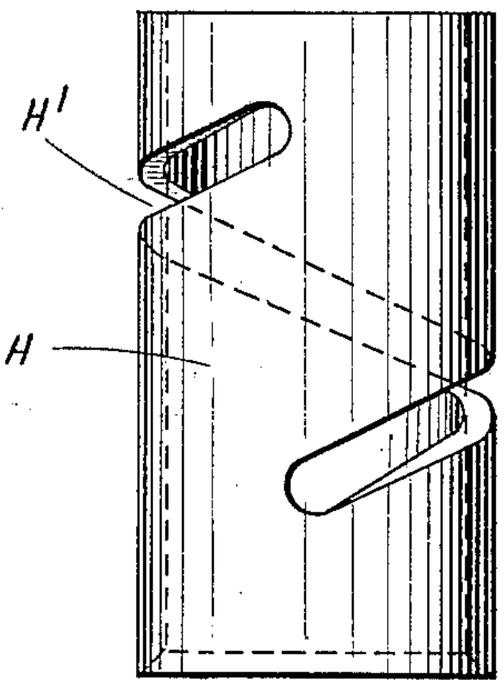


FIG. 7.

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FREDERICK WILFRID SCOTT STOKES, OF LONDON, ENGLAND.

FUSE FOR PROJECTILES.

1,298,418. Specification of Letters Patent. **Patented Mar. 25, 1919.**

Application filed July 2, 1917. Serial No. 178,282.

To all whom it may concern:

Be it known that I, FREDERICK WILFRID SCOTT STOKES, a subject of the King of England, residing at London, 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 time fuses and has for its object to produce a simple and cheap form of fuse which will be certain in operation and more especially adapted for use with projectiles to be fired from trench mortars and like ordnance.

According to this invention two strips or lengths of material such as Bickford fuse composed of a highly combustible substance inclosed in an outer covering of material less readily combustible are disposed side by side and in contact throughout the whole or a portion of their length. Preferably a continuous strip is employed and doubled or folded back on itself so that the two parts lie parallel and in contact for the desired distance. The strips are suitably mounted in a fuse body and some convenient means are provided for so perforating or otherwise breaking the outer cover of each strip at adjacent points that when one strip has been ignited combustion can spread from the interior of one strip to the interior of the other at the place where the perforations have been effected. A graduated guide or the like serves to indicate the point at which the perforating or similar operation must take place in order that combustion will travel from the end of one strip through the perforations and to the end of the other strip in a given time. For the purpose of effecting initial ignition a cap or the like is mounted on one end of one strip while at one end of the other strip is mounted a detonator. The strips are preferably wholly or partially inclosed in a sheath or the like and so mounted in the fuse body that on the shock of discharge of the projectile the strips will be so set back that the cap will strike a needle or anvil or other suitable surface and be fired thereby igniting the end of the strip to which the cap is attached. The perforating device may be formed in various ways but conveniently it comprises a needle carried on a screw-threaded holder provided with a suitable handle by means of which the needle can be forced inward and pass successively through the two strips of fuse material. The means employed for positioning the perforating device along the length of the strips may vary but conveniently may comprise a rotatable sleeve which can be mounted on the fuse body around the parallel portions of the strips of fuse material. The sleeve is provided with a spiral slot along which are suitable markings and through this slot passes the perforating needle, the carrier for which may be in the form of a collar surrounding the positioning sleeve. By rotating the sleeve the point of the needle will move along the spiral slot and be caused to occupy the necessary position along the length of fuse strips so that perforation of the latter can be effected at a point in their length in accordance with the time which it is desired shall elapse while combustion travels from the cap to the detonator. Though as indicated two separate strips of fuse material may be employed it is preferable to use a single length and double this on itself in the manner indicated, as with that arrangement, in the event of the flame failing to travel through the perforations, or if the perforation has been forgotten, combustion will continue through the length of the fuse strip until the detonator is ignited. In this case the time which will elapse between the moment when one end of the strip is ignited by the cap and the firing of the detonator will be determined by the total length of the strip. By means of the perforations the combustion taking place in the strip is as it were short-circuited and the time that will elapse between the firing of the cap and of the detonator is determined by the distance of the perforations from the cap along the length of the double strip.

The accompanying drawings illustrate by way of example one construction of fuse in accordance with the present invention. In these drawings,

Figure 1 is an elevation of the improved fuse mounted on the end of a projectile.

Fig. 2 is a longitudinal sectional elevation on the line 2—2 of Fig. 1.

Fig. 3 is an elevation of the perforating device when mounted in position for use on

the fuse, the latter being viewed as in Fig. 2, that is to say, from a direction at right angles to the view shown in Fig. 1.

Fig. 4 is a transverse section on the line 4—4 of Fig. 3.

Fig. 5 is a plan of the collar which carries the perforating device.

Fig. 6 is a longitudinal elevation of the perforating needle and carrier therefor.

Fig. 7 is an elevation of the positioning sleeve.

Like letters indicate like parts throughout the drawings.

A suitable length of Bickford fuse is taken and doubled on itself so as to form two strips A A′ of unequal length. On the end of the shorter portion A of the strip is mounted in a case or holder B of some suitable type a percussion cap B′ which is adapted to be fired when brought sharply in contact with a needle or anvil. On the end of the longer part A′ of the strip is mounted a detonator C of suitable type. The doubled portions A A′ of the strip are inserted in a metal sheath D which is either in the form of a closed sleeve or oval or other suitable cross-section as shown in Figs. 2 and 4 or may have an opening running throughout the whole or the greater portion of its length. This opening permits of the passage of the perforating needle. Where, as in the construction illustrated, the sheath D is formed as a closed sleeve the metal employed in the formation of the sheath is of such a nature that the perforating needle will easily pass therethrough for example lead or lead composition may be used. The sheath D is of such length as to embrace the cap holder B and thus support the cap B′ in such a manner that the set back action necessary to bring about the firing of the cap will occur. The folded strip A A′ is fixed within the sheath D in some convenient manner as for instance by an adhesive or by so compressing the sheath about the fuse strips that the latter will be firmly held in the sheath and not be liable to become readily displaced.

The fuse body is in the form of a cylindrical casing E hollowed out to form a chamber of oval or circular cross-section which extends throughout the whole, as in the example shown, or the greater part of the length of the body. In this chamber lies the sheath D with the fuse strips A A′ contained therein the sheath being so disposed that when released it can slide or set back in the fuse body.

Until the projectile is to be fired the sheath is retained in the safety position by a pin F which passes through openings in the wall of the fuse body E and in the upper part of the sheath D. When as in the preferred construction a soft metal sheath is employed the safety pin F need not be withdrawn as the set back causes the holes to enlarge or the metal of the sheath D to tear and allow the sheath to move so that the cap B′ may be struck. To arm the fuse when a hard metal sheath is employed this safety pin is formed so that it can be withdrawn when the sheath and the fuse strip are free to set back on discharge of the projectile. The sheath D preferably fits closely in the chamber in the fuse body so that when the pin is withdrawn it is frictionally held in its safety position until discharge occurs. A shearing wire or pin may if desired be provided to insure this.

The cap B′ on the end of the limb A of the fuse strip is suitably vented and lies with its head in a recessed or enlarged portion E′ at one end of the chamber in the fuse body in which is disposed a firing pin or anvil. Conveniently, however, the end of the fuse body E is screw-threaded to engage a projecting portion G formed on the nose of the projectile G′ this projection being so shaped that when the fuse body is screwed into place on the projectile some portion of this projection G will occupy such a position in relation to the cap B′ that it will act as an anvil. Thus on discharge the cap B′ will be set back on to the projection G and be fired thereby.

The fuse body E is slotted as at E^2 throughout the whole or the greater portion of its length this slot corresponding to the opening along the length of the sheath D if such is provided or being so arranged and of such dimensions that the perforating needle can pass therethrough in the direction necessary to perforate the two parallel strips A A′ of fuse material. The relative positions of the fuse strips A A′ and the slot E^2 are shown in Fig. 4.

The positioning part of the setting device is conveniently formed as a sleeve H which fits over the fuse body E so that it can be easily rotated thereon and in this sleeve is formed a spiral slot H′ of suitable length and of such dimensions as will allow the perforating needle to pass freely therethrough. The perforating needle J is carried by a collar K which surrounds the positioning sleeve H on which it can be fixed by a set-screw L. This collar K has formed on it a tubular lug K′ in which is formed a spiral slot K^2 and in this slot lies the head of a screw or stud J′ which is inserted in the carrier J^2 for the perforating needle J. The needle J which is of suitable length and construction is mounted in the end of a short rod J^2 conveniently of larger diameter than the needle and this rod lies and slides within the tubular lug K′. On the end of the rod J^2 opposite to that which carries the needle J is mounted a handle of suitable type such as the lever arm J^3. The perforating needle J is guided by a sleeve M which is screwed

into the inner end of the tubular lug K′ and projects a short distance radially inward from the collar K passing through the slot H′ in the sleeve H. While the needle J is thus guided the carrier rod J² slides and rotates in the tubular lug K′. When the carrier J² is rotated by means of the lever arm J³ the movement of the stud J′ in the spiral slot K² in the tubular lug K′ causes the carrier J² and the needle J to move axially with the result that the needle J will pierce the two strips A A′ of fusible material which are positioned opposite to it one behind the other the needle passing first through the strip A′ and then into the strip A.

The spiral slot K² in the tubular lug K′ is conveniently closed in by a sleeve N which surrounds that portion of the tube K′ in which the slot K² is formed. This sleeve is fixed by a set screw N′.

In the nose of the projectile G′ may be carried a tube or gain not shown in the drawings adapted to receive the end of the longer part A′ of the fuse strip with the detonator C thereon. The inner end of this tube which is closed may carry a pad of suitable material against which the end of the detonator will come when the sheath D and fuse strip A A′ set back on discharge.

Graduations are provided on the sleeve H which show the setting positions for the perforating needle J and these may be suitably marked as for example along a spiral line or along the edge of the slot H′ so that the graduations can be read off at a mark or pointer carried by or formed on the collar K which supports the needle J.

When a projectile provided with the improved fuse is to be fired the collar K is set along the length of the sleeve H at the graduation indicating the time that it is desired shall elapse between the igniting of the one end of the strip A of fuse material by the cap B and the firing of the detonator C, the combustion traveling from the cap along the strip A through the short-circuiting perforation down the strip A′ to the detonator C. In thus setting the collar K on the sleeve H the former naturally rotates about the sleeve H as the guide sleeve M, through which the needle J passes, travels along the spiral slot H′. When the needle-carrying collar K is in the required position it is fixed by means of the set screw L. The sleeve H is now placed over the fuse body E with one end of the sleeve butting up against the end of the projectile G′. The end of the needle J now lies in the slot E² in the fuse body E opposite the point in the length of the doubled strip of fuse material A A′ where the perforation is to be effected. By means of the handle J³ the carrier J² is rotated and by the action of the stud J′ in the spiral slot K² in the tubular lug K′ of the collar K the needle J is forced through the one strip A′ into the other strip A of the fuse material. The needle J is now withdrawn by turning the handle J³ in the opposite direction and after the collar K and sleeve H have been removed from the fuse body E the projectile is ready to be fired.

The setting device for the perforating needle may be formed otherwise than as above more particularly indicated. For example in place of a rotatable sleeve H with spiral slot H′ a fixed sleeve may be used with a longitudinal opening through which the needle can pass the side of this opening being graduated in some suitable manner. In this case the collar or other needle carrier is merely moved straight along the sleeve to the required position. If desired a separate sleeve H such as described as constituting the positioning device may be dispensed with and the necessary markings or graduations may be disposed on the fuse body E which is then suitably formed to receive the needle-carrying collar K and permit of its adjustment thereon. By employing a rotatable sleeve H, however, with spiral slot H′ it is possible to graduate or mark the positions more clearly and obtain greater accuracy.

The short circuiting or puncturing of the fuse may be brought about by cutting away in some suitable manner adjoining portions of the walls of the parallel strips A A′ thus exposing the fuse material within so that the flame may flash across at the determined place where the cutting of the walls has been effected. The device by means of which this cutting is performed may pass between the walls of the strips A A′ where they are in contact so as to remove or tear a portion of each wall simultaneously. On the other hand when a needle or the like is used to effect perforation of the walls of the fuse strip A A′ this needle is preferably arranged so as to perforate the walls in succession by passing first right through one strip and then entering the other as described.

In place of the cap B′ being so mounted in its holder B as to project sufficiently to insure its being fired when set back against the part G of the projectile G′ or of the fuse body or whatever may be presented to it according to the construction employed, the cap may be arranged so that its end is flush with the holder or recessed therein. On the holder may then be mounted by means of suitable clips a nipple, projecting stud or the like which lies against the face of the cap. For example the cap holder may be cylindrical with a flanged periphery the arrangement resembling that commonly adopted in the construction of cartridges for fixed ammunition. Attached to the head of the holder is a clip comprising for example, a disk of suitable dimensions, for instance

having a diameter approximately the same as that of the cap, the disk being provided with three or more radial arms the ends of which are turned up to embrace the flange of the holder. In the center of the disk is mounted the nipple. With this arrangement when the fuse strips are set back on discharge the projection which lies against the face of the cap is brought sharply into contact with the cap when the cap holder sets back on to the part of the fuse body or projectile nose which is formed to act as a hammer or anvil.

Though as above mentioned the present invention is more particularly intended for use with projectiles to be fired from trench mortars and like ordnance it will be understood that the improved time fuse may be used with other forms of projectile. The details of construction may be modified to meet requirements and the type of projectile to which the fuse is applied.

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

1. In a fuse for a projectile the combination of a fuse body having a longitudinal chamber therein, an anvil at the rear end of said chamber, a strip of fuse material composed of a highly combustible substance inclosed in an outer covering of material less readily combustible, said strip being doubled on itself so that the two parts are parallel and in contact, a percussion cap at one end of the fuse strip in proximity to the anvil and a detonator at the other end of the fuse strip substantially as and for the purpose set forth.

2. In a fuse for a projectile the combination of a fuse body having a longitudinal chamber therein, an anvil at the rear end of said chamber, two strips of fuse material composed of a highly combustible substance inclosed in an outer covering of material less readily combustible, said strips being parallel and in contact for a portion of their length, a percussion cap at the end of one of said strips in proximity to the anvil, a detonator at the end of the other strip and means for perforating or otherwise breaking the outer covers of the strips at adjacent points so that when one strip has been ignited by the percussion cap combustion can spread from the interior of that strip to the interior of the other at the place where the perforations have been effected substantially as set forth.

3. In a fuse for a projectile the combination of a fuse body having a longitudinal chamber therein, an anvil at the rear end of said chamber, two strips of fuse material composed of a highly combustible substance inclosed in an outer covering of material less readily combustible said strips being parallel and in contact for a portion of their length, a percussion cap at the end of one of said strips in proximity to the anvil, a detonator at the end of the other strip, a perforator or piercer for breaking the outer covers of the strips at adjacent points and a graduated guide for said perforation serving to indicate the point at which the perforating must take place in order that the combustion will travel from the end of one strip through the perforations to the end of the other strip in a given time substantially as set forth.

4. In a fuse for a projectile the combination of a fuse body having a longitudinal chamber therein and a slot giving entrance to said chamber, of an anvil at the rear end of said chamber, a strip of fuse material composed of a highly combustible substance inclosed in an outer covering of material less readily combustible said strip being doubled on itself so that the two portions are parallel and in contact for a portion of their length, a percussion fuse on one end of the fuse strip in proximity to the anvil, a detonator at the other end of the fuse strip, means for perforating or otherwise breaking the outer coverings of the strip at adjacent points and means for positioning the perforating device along the length of the strips in accordance with the time it is desired shall elapse while the combustion travels from the cap to the detonator.

5. In a fuse for a projectile the combination of a fuse body having a longitudinal chamber therein and a slot giving entrance to said chamber, an anvil at the rear end of said chamber, a strip of fuse material composed of a highly combustible substance inclosed in an outer covering of material less readily combustible said strip being doubled on itself so that the two portions are parallel and in contact for a portion of their length, a percussion cap on one end of the fuse strip which is in proximity to the anvil, a detonator at the other end of the fuse strip, a sleeve fitting over the fuse body and having a spiral slot, a perforator mounted on the sleeve so that it can be moved along the spiral slot and be thereby positioned relatively to the slot in the fuse body so that it may pass therethrough to pierce the two layers of fuse strip at a predetermined point in their length as and for the purpose set forth.

6. In a fuse for a projectile the combination of a fuse body having a longitudinal chamber therein and a slot giving entrance to said chamber, an anvil at the rear end of said chamber, a sheath within said chamber normally stationary thereto but capable of moving relatively to the chamber on the shock of discharge, a strip of fuse material composed of a highly combustible substance inclosed in an outer covering of material less readily combustible, said strip being doubled on itself so that the two portions are parallel and in contact with each other the doubled

portion being held within the sheath, a percussion cap on one end of the fuse strip in proximity to the anvil, a detonator at the other end of the fuse strip, a sleeve fitting over the fuse body and having a spiral slot, a perforator mounted on the sleeve so that it can be moved along the spiral slot and be thereby positioned relatively to the slot in the fuse body so that it may pass therethrough to pierce the two layers of fuse strip at a predetermined point in their length as and for the purpose set forth.

7. In a fuse for a projectile the combination of a fuse body having a longitudinal chamber therein and a slot giving entrance to said chamber, an anvil at the rear end of said chamber, a sheath within said chamber normally stationary thereto but capable of moving relatively to the chamber on the shock of discharge, a strip of fuse material composed of a highly combustible substance inclosed in an outer covering of material less readily combustible said strip being doubled on itself so that the two portions are parallel and in contact with each other the doubled portion being held within the sheath, a percussion cap on one end of the fuse strip in proximity to the anvil, a detonator at the other end of the fuse strip, a sleeve fitting over the fuse body and having a spiral slot, an outer sleeve or collar capable of being moved and set relatively to the inner sleeve, a tubular lug or extension on said outer sleeve having a spiral slot therein, a perforator or piercer mounted within the tubular lug and engaging with the spiral slot therein, a hollow pin or sleeve projecting from the tubular sleeve into the spiral slot in the inner sleeve and forming a guide for the perforator and means for rotating the perforator so that it travels forward through the guide, and enters the slot in the fuse body and perforates the outer coverings of the parallel portions of the fuse strip substantially as and for the purpose set forth.

8. In a fuse for a projectile the combination of two strips of fuse material composed of a highly combustible substance inclosed in an outer covering of material less readily combustible said strips being parallel and in contact for a portion of their length, means for igniting one end of one strip, and adjustable means for perforating or otherwise breaking the coverings of the strips at adjacent points so that combustion can spread from the interior of one strip to the interior of the other at the places where perforations have been effected for the purpose set forth.

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

FREDERICK WILFRID SCOTT STOKES.

Witnesses:
E. O. Cask, Jr.,
R. Baggott.