(No Model.) 4 Sheets—Sheet 1.

# H. C. SEDDON.

## SAFETY PERCUSSION FUSE.

No. 521,129. Patented June 5, 1894.

Fig. 1.

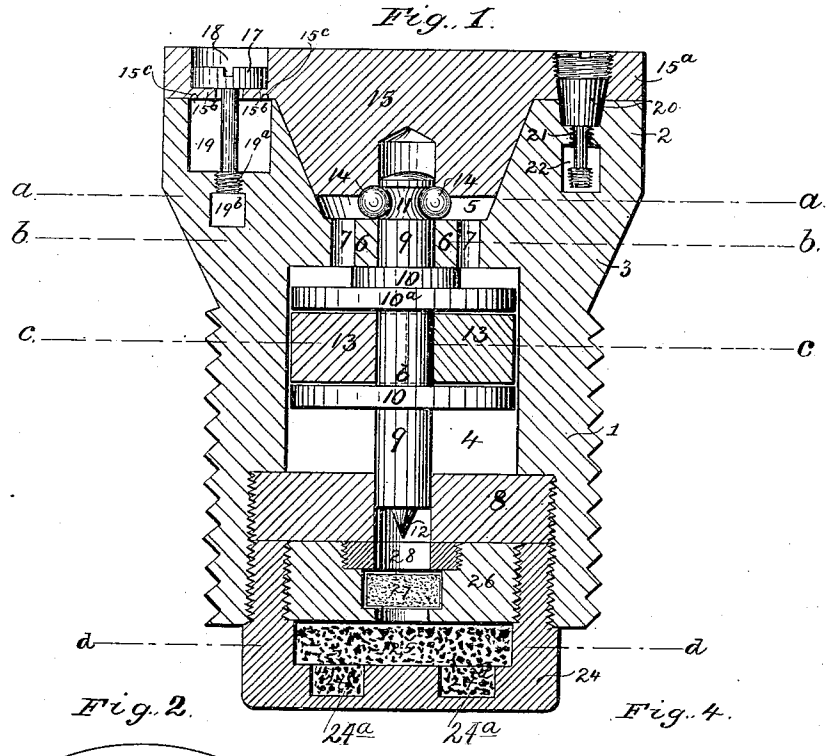



Fig. 2.

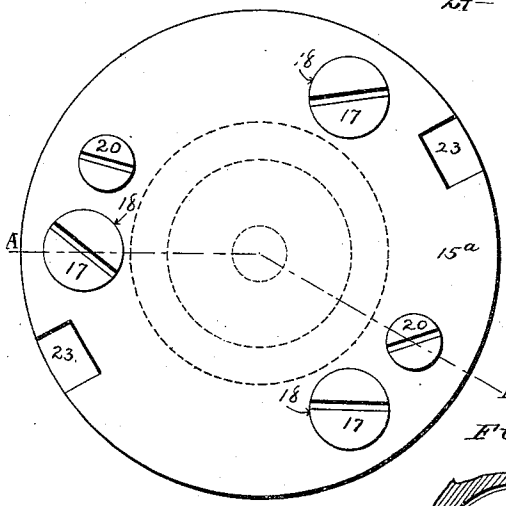
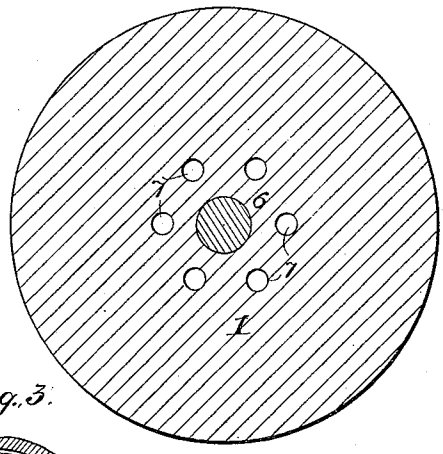



Fig. 3.



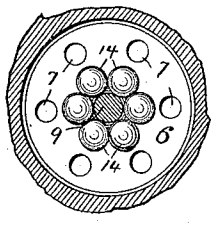




Fig. 4.

Witnesses.

W. R. Edelen.

Geo. Lewis.

Inventor.

Henry Cooper Seadon

by Pollok & Mauro his

Attorneys.

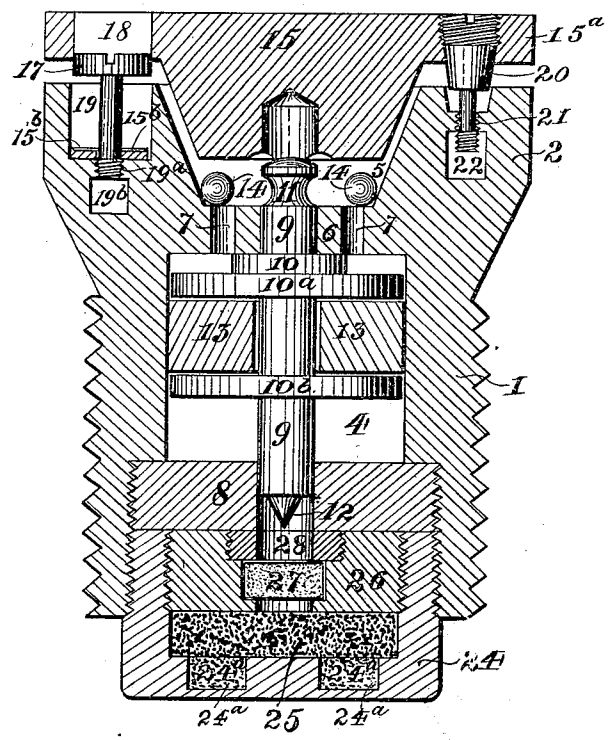
(No Model.) 4 Sheets—Sheet 2.

# H. C. SEDDON.

## SAFETY PERCUSSION FUSE.

No. 521,129. Patented June 5, 1894.

*Fig. 1. a.*




Witnesses.
W. R. Eddy.
Fred Lewis

Inventor.
Henry C. Seddon
by Pollard Macro
his attorneys

(No Model.)

4 Sheets—Sheet 3.

# H. C. SEDDON.

## SAFETY PERCUSSION FUSE.

No. 521,129. Patented June 5, 1894.

Fig. 5.

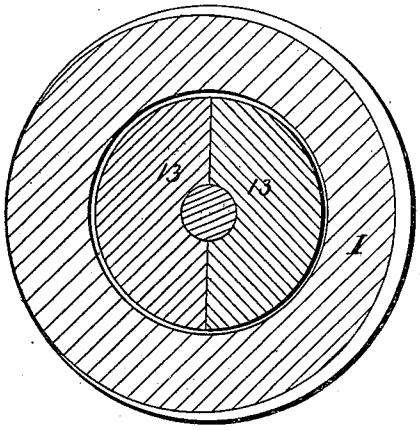



Fig. 6.

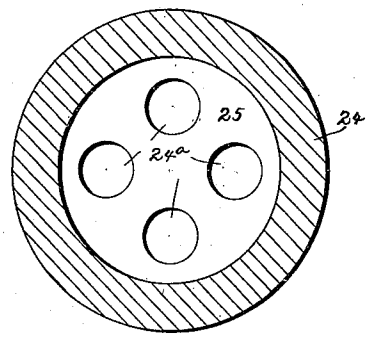
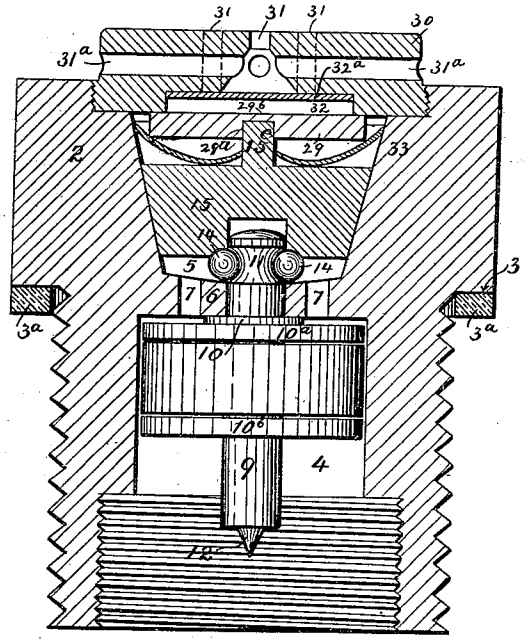



Fig. 7.




Witnesses.

W. R. Edelen.

Geo. Lewis

Inventor.

Henry Cooper Seddon
by Poole & Mauro his
attorneys.

(No Model.) 4 Sheets—Sheet 4.

# H. C. SEDDON.

## SAFETY PERCUSSION FUSE.

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Fig. 8.

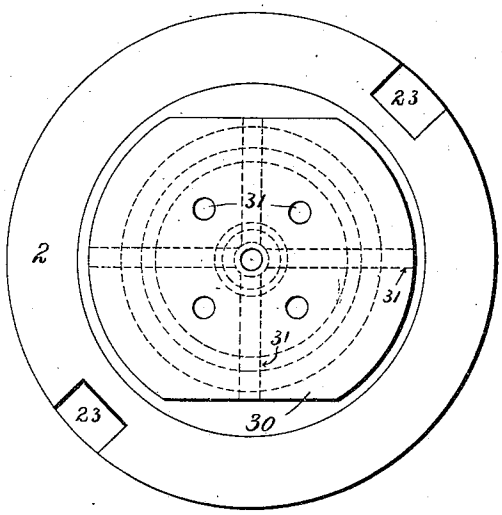



Fig. 9.

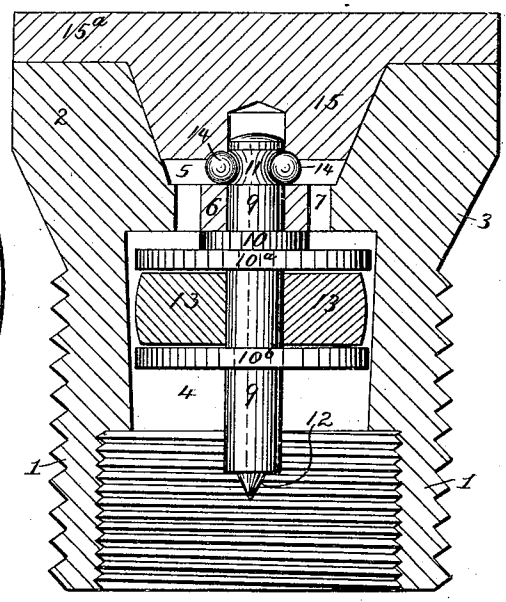
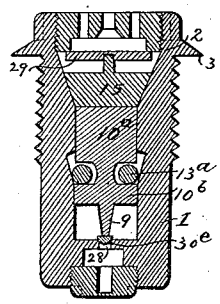



Fig. 10.




Witnesses.

W. R. Edelin.

Inventor.

Henry Cooper Seddon

by Pollok & Mauro

his attorneys.

# UNITED STATES PATENT OFFICE.

HENRY COOPER SEDDON, OF LONDON, ENGLAND.

## SAFETY PERCUSSION-FUSE.

SPECIFICATION forming part of Letters Patent No. 521,129, dated June 5, 1894.

Application filed February 9, 1894. Serial No. 499,673. (No model.) Patented in England December 14, 1892, No. 22,992.

*To all whom it may concern:*

Be it known that I, HENRY COOPER SEDDON, of London, England, have invented a new and useful Improvement in Percussion-Fuses for Projectiles, (for which I have made application for British patent, dated December 14, 1892, No. 22,992,) which improvement is fully set forth in the following specification.

The object of my invention is to produce a safety percussion fuse that will be self-acting and very sensitive, but not liable to detonate until the projectile to which it is applied has been suddenly checked in its flight after quitting the bore of the gun. For this purpose according to my invention, forward movement of the detonating plunger or pellet is prevented by means of a piece or pieces of some suitable hard substance, metal balls by preference, retained in place until released by the freeing and setting back of a gas tight stopper or cover that is normally attached to or closes the base of the fuse but is adapted to be unfastened therefrom by the action upon the fastening device of the gases within the bore of the gun after leaving which the said gas tight stopper or cover is relieved from the gas pressure so that it may be set back or retired to free the piece or pieces of hard substance that would otherwise oppose the forward movement of the detonating plunger in relation to the body of the fuse on sudden checking of the flight of the projectile. Any suitable means (for example, springs) may be employed if desired, to insure the necessary setting back or retirement of the gas tight stopper or cover. With the constructions of fuses hereinafter described no such special means for this purpose are considered necessary though they may be added if desired.

In order to prevent the creeping forward of the detonating plunger during the flight of the projectile, the said plunger is constructed with parts adapted to serve as friction pieces against the inside wall of the plunger-chamber during the rotary motion of the projectile, but to move forward with the detonating plunger when the projectile has been suddenly checked in its flight.

In order that the detonating plunger may easily advance when the flight of the projectile is suddenly checked the detonating plunger is in some cases provided with axial extensions or ends mounted in holes that serve as fore and aft bearings in such wise that the circumference of the main body of the detonating plunger is kept out of actual contact with the wall of its containing chamber. The fore bearing and in some cases both bearings may be dispensed with.

It will be understood that in a fuse constructed with a gas tight stopper or cover adapted to be released according to my invention, the pressure in the gun tends to increase and preserve the safety of the fuse against premature explosion.

In the accompanying drawings, Figure 1 shows partly in central longitudinal section and partly in elevation, to an enlarged scale, a percussion fuse constructed according to this invention, the section being taken on the line A—A of Fig. 2. Fig. $1^a$ is a similar view showing the position of the parts during the flight of the projectile. Fig. 2 is an elevation of the base end thereof. Figs. 3, 4, 5 and 6 are cross sections on the lines *a—a*, *b—b*, *c—c*, and *d—d*, respectively of Fig. 1. Figs. 7 and 8 are views similar to Figs. 1 and 2 of a modified construction. Fig. 9 is a central longitudinal section of another modification, and Fig. 10 is a central longitudinal section of still another modification.

The body of the fuse, which may advantageously be made of manganese bronze, consists of an externally screw-threaded portion 1 adapted to be screwed into the base of a projectile, and an enlarged base portion 2 having a conical shoulder 3 adapted to bear against a corresponding shoulder in the base of the projectile and thereby assist in taking the pressure of the gas upon the base of the fuse.

Internally the body of the fuse is formed with two chambers, namely, a cylindrical plunger chamber 4, and a conical ball chamber 5, these two chambers being separated by a wall or diaphragm 6 through which a series of air holes 7 is formed.

8 is a centrally perforated metal disk or plate screwed into the forward end of the body of the fuse and forming the forward end wall of the plunger chamber.

The detonating plunger, which may advantageously be made of Muntz metal, comprises a pin 9 formed with three collars 10, $10^a$ and $10^b$,

the former one 10, being made of small size so as to form a distance piece to prevent the plunger setting back and closing the air holes 7 in the diaphragm 6, and the two latter being arranged at a suitable distance apart so as to form an annular space for the reception of a friction device, and being of such a diameter as to just run clear of the inner side of the plunger chamber. The ends of the pin 9 are carried and guided by the diaphragm 6 and disk or plate 8, and are made of cylindrical form in order that the plunger may have greater freedom of movement, than otherwise, in an endwise direction, when subjected to a transverse blow caused by a graze contact. The rear or tail end of the said pin is formed with an annular groove 11 of circular shape in cross-section and its forward end is provided with a firing needle 12 that may be of steel. The friction device between the collars $10^a$ and $10^b$ consists, in the example shown, of a loose metal ring 13 made in two halves that can fly apart under the action of centrifugal force during the flight of the projectile to which the fuse is attached, and bear with more or less force, according to their weight, against the inner side of the plunger chamber, and thereby prevent any forward movement of the plunger during flight, but on the projectile receiving the slightest check they will slide forward and add their momentum to that of the detonating plunger and thereby insure the effective action of the latter.

14, 14 are balls arranged within the chamber 5 and adapted to fit into the groove 11 in the tail end of the pin 9 so as to prevent the detonating plunger moving forward until after the projectile has been fired. The fore end of the ball chamber may advantageously be made slightly concave, as shown, so that the balls will tend to assemble around and fit into the groove in the tail end of the pin 9 when vertical or approximately so. The balls, which may advantageously be made of manganese bronze or nickeled steel, are normally held in place in the groove 11 by a conical stopper or cover 15 (hereinafter called a stopper) that fits gas tight within the rearward extension of the conical ball chamber and is recessed at its fore end to receive the tail end of the pin 9, but without touching it and also to surround the series of balls 14 sufficiently to retain them in the groove 11, as shown. The said stopper is normally attached by its rim $15^a$ to the base 2 by fastening screws 17 of which there are three in the example shown. The head of each of these screws is located within a hole 18 in the said rim so as to be protected against accidental blows; the thickness of the portion $15^b$ of metal forming the bottom of the said hole against which the head of the screw rests, and the length and depth of the screw thread $19^a$ are so related that the said portion of metal will be sheared and the screw thread stripped by the gas pressure, acting on the head when the gun is fired. To receive the sheared portions of metal $15^b$ and the screw heads, there are formed in the base cylindrical recesses 19, each coaxial with but of slightly larger diameter than the corresponding hole 18 and there are cavities $19^b$ to receive the ends of the stripped screws when driven forward by the gas pressure upon the screw head. To assist the shearing action above referred to annular grooves or nicks may be formed at $15^c$.

20, 20 are check screws that may be employed to prevent the stopper becoming disconnected from the fuse when it moves back to free the balls 14. Each check screw is made with a head that is partly formed with a screw thread and is partly conical; also with a plain stem having its free end enlarged and formed with a screw thread which is screwed through a screw threaded hole 21 into a cavity 22 sufficiently far to afterward allow of the desired rearward movement of the stopper which will be arrested by the enlarged inner parts of the screws coming into contact with the rear end walls of the cavities 22.

It will be understood that the heads of the screws are screwed into the screw holes formed in the rim $15^a$ of the stopper to receive them as shown, the conical parts extending also into cavities formed in the base. By extending the heads of the check screws into the base, as shown, twisting of the stopper and rim is also obviated. On opposite sides of the rim are slots 23 arranged in line with corresponding slots formed in the base of the fuse so as to permit of a suitable key or spanner being inserted into the latter slots for the purpose of screwing the fuse into the base of a projectile.

24 is a screw plug or closure screwed into the forward end of the body of the fuse. It is formed with a powder or detonating chamber 25 closed by a centrally perforated disk or plate 26 in which is a chamber or recess 27 to receive the detonating cap which is held in place by a ring 28 screwed into the said disk or plate.

In order to render the forward end or closure of the detonating chamber water-tight, while at the same time enabling passages to be readily formed therethrough on the occurrence of the explosion within the said chamber, I form the said plug or closure, with one or more holes $24^a$ extending from the inner surface thereof partly but not entirely through the thickness of the closure, leaving a sufficient thickness of material to form an efficient water-tight closure without offering undue resistance on the occurrence of the explosion.

If the detonating chamber is kept separate from the body of the fuse, the rear end of the latter can be closed by a water tight disk, plug, or other suitable device. It is often desirable to thus separate the parts when the fuse is not likely to be required for immediate use.

The action of the fuse hereinbefore de-

scribed is as follows: On discharging the gun containing a projectile fitted with such a fuse the fastening screws 17 are driven inward, shearing the thin portions of metal 15b, stripping the screw threads 19a and freeing the stopper 15 which however is held tightly in place by the gas pressure until the projectile has left the gun. During the flight of the projectile a partial vacuum is formed at its base. This causes the air within the fuse to expand and assist in pushing the stopper back, while the balls 14, holding the tail end of the detonating plunger, at once fly outward and assist in pushing the stopper rearward. The detonating plunger is then free to move forward, but is checked during flight by the two halves of the centrifugal ring 13 clinging to the inner surface of the plunger chamber. On graze or impact of the projectile, the centrifugal ring moves forward with the body of the plunger and causes the firing needle 12 to strike the detonating cap, thus firing the fine-grained powder in the detonating chamber, which, in exploding bursts through the thin metal at the outer ends of the recesses 24a and fires the projectile.

In the modified construction of fuse shown in Figs. 7 and 8, which are similar views to Figs. 1 and 2 respectively, the conical gas tight stopper 15 is provided at its outer side with a central pin 15c, and is normally held in place, so as to retain the centrifugal balls 14 in the groove 11, by a disk shaped pressure plate 29. This pressure plate, which may be of brass, is made with a central recess 29a on its inner face to receive the pin 15a on the stopper, and is held in place by a base plug 30. This plug, which may be made of manganese bronze, is screwed into the base 2 of the fuse, and is formed with longitudinal holes 31, and it may be also with lateral holes 31a running into the enlarged inner portion of the central hole 31 communicating with a circular recess 32, in order to allow the gas pressure produced in the gun, from which the projectile is fired, to act upon the pressure plate 29. The said holes may be covered, at one or both ends, with suitable waterproof material to render the base plug both air and water tight. Or the inner ends of the said holes may be closed, for the purpose mentioned, by a disk 32a of metal, forced into the circular recess 32 on the inner side of the base plug 30.

33 is a cup shaped gas check. It is formed of thin metal, such as sheet copper, with a central hole to fit over the pin 15a on the stopper, and is arranged to be driven home against the stopper by the pressure plate. This gas check affords an additional precaution against the stopper 15 moving back prematurely, but its use is not considered essential. When it is used, the pressure plate, instead of being merely recessed at 29a so as to leave a thin portion of metal at 29b to be sheared through by the pin 15c when the pressure plate is forced inward by the gas pressure, may be perforated so that when it is forced inward it passes freely over the pin, in which case I should further raise the central portion of the gas check sufficiently to allow the central portion of the pressure plate to take a bearing on it. I prefer however, for the sake of greater safety, to only recess the said pressure plate as shown. The base 2 of this modified construction of fuse is shown as formed with a square shoulder at 3 to receive a lead or other soft metal gas ring 3a, but it may be formed with a conical shoulder as in the first example, if preferred. The action of this modified construction of fuse is as follows:— On discharging the gun, the gas pressure passing through the holes 31 and 31a in the base plug 30, drives the pressure plate 29 down on to the head of the conical stopper 15, shearing out the portion 29b, and at the same time forcing the gas check 33, if used, tight down onto the head of the stopper and outward against the sides of the conical chamber, so leaving room for the stopper to set back. After the projectile has left the gun, the setting back of the stopper, the bringing into action of the friction device 13, and the subsequent moving forward of the plunger and firing of the projectile, take place in the manner hereinbefore explained with reference to the construction of fuse shown in Figs. 1 to 6 inclusive.

The plunger chamber 4 instead of being made cylindrical, as in the examples hereinbefore described, may be made slightly conical as shown in central longitudinal section in Fig. 9 so as to assist in preventing premature movement of the plunger during flight and the outer periphery of the divided friction ring 13 may, in that case be made convex in cross section as shown. The same object may be attained by dishing or recessing that part only of the wall of the plunger chamber against which the centrifugal blocks are liable to press before the forward movement of the plunger, as indicated in Fig. 10.

In Fig. 10 which illustrates a construction resembling that shown in Fig. 7, the axial bearings of the plunger are dispensed with and its forward movement during flight is prevented by the outward pressure of balls 13a (instead of ring 13 as heretofore described) which impinge against the wall of the plunger chamber. To afford additional resistance the wall may be curved, inclined or indented as indicated. In this figure the plunger is locked in position by the conical stopper, preventing any backing movement, whil any forward movement is prevented by the flattened end of the pin 9, which engages a plug 30c for closing the passage to the detonating cap. After the projectile has left the gun the rearward movement of the plunger releases the plug 30 allowing it to drop away from the opening 28.

Fuses constructed as hereinbefore described possess many important practical advantages. They will withstand the roughest usage with

safety. Premature explosion in a gun, even should the projectile be checked in its passage through the bore, is rendered impossible, as also is premature explosion during the flight of the projectile. They will act on the slight graze of the projectile against an object outside of the gun. They are applicable to various classes of projectiles, including quick firing ammunition, and also to various types of guns, whether using quick or slow burning explosives. They admit of projectiles in which they are fixed being carried about ready fused with perfect safety, and are less liable than ordinary fuses, as heretofore constructed, to deteriorate by storage, owing to their being completely air and water tight, thus being practically imperishable. Their detonating cap and powder chambers being formed in a detachable plug, need not be charged until required for use. Furthermore they are simple in construction and therefore comparatively cheap to make.

It is to be remarked that in the construction of fuses according to my invention, some of my improvements may be adopted without the others.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a percussion fuse, the combination with the detonating plunger, a securing device for normally preventing movement thereof, and a connection between the securing device and the body of the fuse, said connection being destroyed upon the firing of the gun, the securing device being held in place while the projectile remains in the gun by the pressure of the gas therein, substantially as described.

2. In a percussion fuse the combination with the denonating plunger, of a plate or lid holding said plunger against forward movement, rupturable fastening devices securing said plate or lid to the body of the fuse, said plate or lid being adapted to receive the pressure of the gases of explosion in the gun, whereby the plunger is locked in place after the fastening devices have been ruptured by the explosion and until the projectile has left the gun, substantially as described.

3. In a percussion fuse the combination with the detonating plunger, of a base lid secured by rupturable fastening devices to the body of the fuse, and a centrifugal ball or balls engaging and holding the plunger against forward movement, said ball or balls being held in engagement with the plunger by the base lid, substantially as described.

4. In a percussion fuse, the combination with the detonating plunger, of the base lid, the centrifugal ball or balls cooperating therewith to hold the plunger against forward movement, the fastening screws engaging against a rupturable portion of the lid, and the check screws or devices for preventing the lid from being entirely detached from the fuse, substantially as described.

5. In a percussion fuse, the combination with the detonating plunger having at the rear end a recessed pin, of balls fitting in said recess and holding the plunger stationary, a lid or stopper having a recess at the center gripping and locking the balls in place, rupturable fastening devices securing the lid or cover to the body of the fuse but adapted by the force of the explosion to release the same, and means for preventing the lid or cover from being wholly detached from the fuse, substantially as described.

6. In a percussion fuse the combination with the body of the fuse, having an interior air-tight chamber, a detonating plunger, and a stopper or cover for the air-tight chamber holding said plunger normally immovable, said stopper being movable outwardly by the air pressure within the chamber during the flight of the projectile, thereby releasing the detonating plunger, substantially as described.

7. In a percussion fuse the combination with the body of the fuse, having an air-tight chamber, a detonating plunger, one or more movable bodies engaging with and preventing the movement of said plunger, and a cover or stopper for the air-tight chamber normally retaining said movable body or bodies in engagement with the plunger said cover or stopper being at the base of the projectile, so that the vacuum on its outside due to the movement of the projectile permits the air-pressure in said chamber to force or assist in forcing the cover or stopper away from the body of the fuse, substantially as described.

8. In a percussion fuse the combination with the body of the fuse, having an air-tight chamber, a detonating plunger, a pin or projection thereon provided with a recess therein, centrifugal balls or equivalent bodies engaging in said groove or recess and preventing the movement of the plunger, a stopper or cover for the air-tight chamber holding the balls in engagement with the said pin, said cover being moved outwardly and thereby releasing the balls, by the pressure of the air in the chamber during the flight of the projectile, thus allowing the centrifugal action of the latter to throw the balls away from engagement with the groove or recess in the pin, substantially as described.

9. In a percussion fuse the combination with the detonating plunger of a fastening device actuated by the pressure of the gases to prevent the movement thereof while the projectile is in the gun, but which releases or no longer opposes the forward movement of the plunger after the projectile has left the gun, substantially as described.

10. In a percussion fuse the combination with the chambered body, of a detonating plunger therein, and a friction device having a large contact surface adapted to be engaged

with the wall of the chamber by the centrifugal action of the projectile, for preventing movement of the plunger during the flight of the latter, substantially as described.

11. In a percussion fuse the combination with a chambered block, of a detonating plunger therein, means for holding said plunger out of contact with the walls of the chamber, and a friction device carried by said plunger and actuated by the centrifugal action of the projectile to prevent forward movement of the plunger during the flight of the latter, substantially as described.

12. In a percussion fuse the combination with the detonating plunger, a securing device for preventing movement thereof until the projectile has left the gun and a friction device operating by centrifugal force for preventing movement thereof, until the flight of the projectile is arrested or checked, substantially as described.

13. In a percussion fuse, the combination with the detonating plunger, of two sets of centrifugal acting devices, the first being impelled by centrifugal action away from the plunger thereby releasing or no longer opposing the forward movement of the latter, the second being held by centrifugal action in contact with the walls of the fuse for preventing forward movement of the plunger until the flight of the projectile is checked, substantially as described.

14. In a percussion fuse for a projectile the combination with the detonating plunger, one or both ends of which may rest in suitable bearings in such a way that the circumference of the main body of the plunger is partly or wholly kept out of actual contact with the wall of its containing chamber, and a centrifugal acting friction device for holding the plunger against forward movement until the flight of the projectile is checked, substantially as described.

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

HENRY COOPER SEDDON.

Witnesses:
F. B. POLLARD,
E. C. MERSEN.