

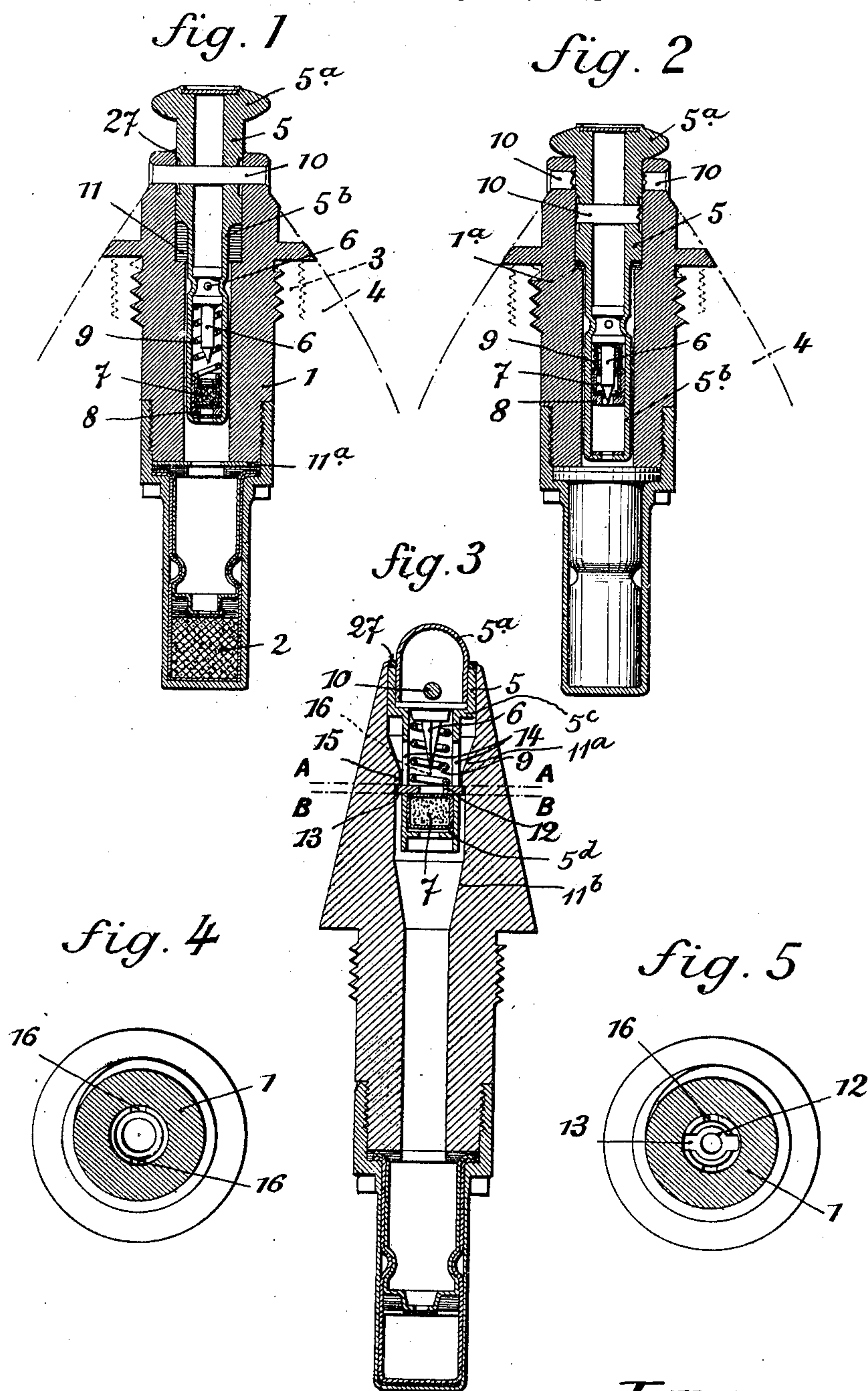
June 19, 1923.

1,459,075

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FUSE FOR ARTILLERY AND AVIATION PROJECTILES

Filed Sept. 2, 1921.



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Patented June 19, 1923.

1,459,075

# UNITED STATES PATENT OFFICE.

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FUSE FOR ARTILLERY AND AVIATION PROJECTILES.

Application filed September 2, 1921. Serial No. 497,837.

*To all whom it may concern:*

Be it known that I, LÉON EMILE RÉMONDY, a citizen of the Republic of France, and residing at Rueil, Seine-et-Oise Department, No. 125 Avenue de Paris, in the Republic of France, engineer, have invented certain new and useful Fuses for Artillery and Aviation Projectiles, of which the following is a specification.

My invention relates to a fuse which is operated by inwardly directed movement and by inertia and contains no arming mechanism nor device requiring previous maneuver before the firing operation. The said fuse comprises a movable carriage adapted to be impelled inwardly of the main body of the said fuse and provided to this effect with a portion extending outwardly of the projectile. The said carriage is connected with the body of the fuse by a retaining member adapted to yield under the effect of the inertia of the projectile in the event of the sudden stop of the movable carriage upon the target.

An important feature of the invention resides in the fact that the movable carriage contains both the striker and the percussion priming. Of these two elements, the one which is situated forwardly of the other is connected with the main body of the carriage, the element situated in the rear being caused to bear upon a portion of the said body by means of a retaining member adapted to yield under the effect of the inertia of the said rearwardly disposed element when the body of the movable carriage shall be submitted to a high negative acceleration, such as can only be produced when the latter possesses a high speed and is caused to encounter an obstacle, the said negative acceleration of the percussion device being much more considerable, especially in soft ground, than that of the projectile whose mass is very much greater.

This device will absolutely prevent the priming and the striker from approaching each other under the effect of inertia upon firing the shot, inasmuch as the main body of the device will transmit a like positive acceleration to both these elements at the same time. This will afford a means of dispensing with the use of mechanisms for automatic or other arming which have hitherto been considered as indispensable but whose operation is of an unreliable nature in spite of all precautions. In case of pro-

jectiles for artillery use, the movable carriage comprises a movable stop piece preventing the element of the percussion device, priming or striker, which is situated in the rear of the other, from moving forward with reference to the body of the fuse in the event of a slowing up or stoppage of the projectile within the cannon, thereby preventing any improper operation of the said fuse. In this manner the invention will provide a fuse which affords a considerable safety and contains but a small number of elements of a simple and inexpensive character.

The following description, together with the accompanying drawings which are given by way of example, sets forth constructional forms of this invention, wherein:

Fig. 1 is a vertical section of a fuse in the parts being shown in their normal positions.

Fig. 2 represents the said fuse in the operative position.

Fig. 3 is a partial vertical section of a modified form of construction for artillery use.

Figs. 4 and 5 are cross-sections respectively on the lines A—A and B—B Fig. 3.

The fuse shown in Figs. 1 and 2 comprises a main fuse body 1 provided at the lower part with the detonating primer 2 and adapted to be screwed into the priming tube or booster 3 which is in turn screwed into the projectile 4. The movable carriage comprises a main body 5 made of a light material such as aluminium or the like and provided with a head 5<sup>a</sup> and a cut out tail portion 5<sup>b</sup>. Within the said body is disposed the percussion primer 7 which is contained in a primer holder 8. The latter is movable in the interior of the tail portion 5<sup>b</sup>, and is normally held apart from the striker 6 by a spring 9 termed the safety spring. The main body of the movable carriage is connected with the body of the fuse by a pin 10 which is intended to be sheared off when the projectile reaches the target. 11 indicates a packing washer formed of a flexible, elastic or plastic substance such as felt, cloth, leather, cork or the like, disposed in a recess of the body of the fuse and adapted to receive the enlarged part 5 of the latter.

In case of accidental shearing of the pin 10 when firing, the said washer 11 obviates all violent impact of the movable carriage against the body of the fuse, which shocks



might cause rupture or vibrations giving rise to ignition of the priming.

The operation of the said fuse is as follows:

5 When the shot is fired, the elements of the fuse retain their relative position. The pin 10 resists the action due to the inertia of the movable carriage, which action is exerted throughout the whole duration of the positive acceleration of the projectile. The relative position of the elements also remains unchanged during the remainder of the trajectory of the projectile and to the end of the same. When reaching the ground, the head 15 5<sup>a</sup> of the movable carriage strikes the ground before any other part of the fuse or of the projectile. By the effect of the shock, the body 5 of the movable carriage will be submitted, by reason of its very small inertia 20 to a very sudden slowing action or even an instantaneous stop, whilst the projectile and fuse body 1 will shear off the said pin and will continue their movement until the forward end of the fuse body contacts with the head 5<sup>a</sup>, Fig. 2, thus obliging the movable carriage to again participate in the movement of the projectile, until the latter comes to a stop after more or less entering the ground.

30 The movable carriage will thus be submitted for a very short space of time, and particularly after the said pin has been sheared off, to a sudden slowing, whereby the primer 7 under the effect of its own inertia and that of the primer holder 8, will be forwardly projected, compressing the spring 9 and will strike against the striker 6. This contact will cause the percussion primer to detonate, thereby producing the detonation 40 of the primer 2 which will bring about the explosion of the detonator and consequently of the projectile.

It should be observed that any accidental shearing of the pin 10 at the time of firing 45 will occasion no accident, especially since the piece 11 will prevent all violent shocks of the movable carriage against the body of the fuse. The shock of the movable carriage may also be deadened in the event of an accidental breakage of the pin at the start of the firing, by absorbing its vis viva by means of work consisting in the deformation of one or more of its parts. It will suffice for instance to stop the movable carriage upon 50 one or more conical surfaces whereupon it will undergo a deformation without breakage. Fig. 3 shows two conical surfaces of this kind. One of these, 11<sup>a</sup> serves to receive and to produce the deformation of the upper 60 part of the body of the device at 5<sup>c</sup>; the other 11<sup>b</sup> serves to receive and to produce the deformation of the lower part of the said body at 5<sup>a</sup>.

The tapered surfaces 11<sup>a</sup> and 11<sup>b</sup> act respectively on the portions 5<sup>c</sup> and 5<sup>a</sup> of mov-

able carriage 5 in such a manner as to progressively retard the rearward movement of carriage 5. The "set back" of the movable carriage is thus dampened to such an extent that there is no danger of spring 9 being collapsed and primer 7 being thrown into contact with pin 6.

It is also possible, in a well known manner, to absolutely prevent this breakage of the pin while at the same time allowing it a very low degree of strength by placing under the head 5<sup>a</sup> or at any other internal or external point a roughened ring or similar locking device which will prevent the movable carriage from being driven in at the starting of the shot, and which will disappear for instance under the action of centrifuge force. A safety spring 9 which is intended to be pushed together under the effect of the inertia of the primer holder upon the sudden slowing of the main body 5, will always have a sufficient force to prevent any improper movement of the primer towards the striker in case the projectile should be accidentally dropped from a height of several metres, and therefore the handling of the projectile during transportation or during the operation of loading the cannon will offer no danger.

For fuses intended for artillery use, it is advisable to take suitable precaution against all operation of the fuse in case of a sudden stop of the projectile in the cannon. To this effect the primer holder or the primer may be provided with a stop piece preventing all relative movement of these elements towards the front as long as the movable carriage is not driven into the shell. Figs. 3, 4 and 5 show a device of this kind wherein the stop piece is constituted by a washer 12 provided with tenons 13 and disposed loosely upon the primer. The said tenons pass loosely through the slots 14 in the body 5 and bear upon a shoulder 15 of the fuse body. This device will afford a hindrance to the operation when reaching the target, which takes place as above set forth. In order to permit the movable carriage to be mounted in position from the exterior, the cut out portions 16 are formed in the fuse body in such manner as to allow the passage of the tenons 13. These having been introduced into the body of the fuse the body 5 is rotated through a right angle and is held in this position by a pin 10, as shown in the drawings.

In the form of construction shown in Fig. 3, the body of the movable carriage is made in two parts 5, 5<sup>a</sup>, which may be formed during the pressing process. The striker 6 is maintained between these two parts which are connected by the pin 10 which is subject to the shearing effect. In order to reduce the sensitiveness of the percussion fuse, it will be advantageous to dispose thereon a d-



of paper, metal or any suitable substance to protect the primer from the action of the point of the striker, thus affording a partial or an entire substitute for the protecting safety spring 9.

Inasmuch as the fuse according to the invention is not provided with arming devices, it is always in the armed condition in a certain measure, that is, it does not require to be submitted to a violent inertia action at the start in order to be prepared to operate, and it may thus be used in all cases for the arming of a projectile for avions or all other projectiles adapted to be thrown without high velocity. The body 5 of the movable carriage may be forwardly extended by a piece which is formed of light material such as wood, aluminium or the like. This extension piece may be connected or not with the body 5 carrying the striker or may be removably secured to the latter by any suitable means. In like manner, the forward end of the body of the movable carriage may be made flush with the body of the fuse 1, or it may also be rearwardly disposed in the interior should this be required for certain applications.

The above-described devices relate to fuses for instantaneous operation, but in all cases the fuse may be provided with a delaying device of the relay type in order to obtain a retarded action. The percussion detonating fuses of known types may be readily transformed to fuses constructed according to the invention. In most cases, the modification will consist simply in removing the existing mechanism and substituting the new percussion device. The internal parts of the various fuses herein represented may be protected from dampness by a plastic joint 27, Figs. 1 and 3, disposed at the upper part of the body of the fuse around the body 5. It should be also observed that contrary to the major part of the fuses of the type having the primer fixed and the striker free, the present fuse will not occasion any firing accidents in cases where the said pin or any substituted or additional member should fail to operate. In fact, as above indicated, the accidental forward or rearward displacement of the movable carriage within the body of the fuse under the firing action will be unable to effect the detonation of the primer.

It is obvious that in all the constructional forms of the invention herein represented, the relative positions of the priming and the striker may be inverted, and in this case the striker will move forwardly in order to strike the priming disposed in the body 5, at the instant of the sudden slowing of the movable carriage. The detonating priming 2, may be secured to the percussion priming 7, or may be formed together with the same. The latter may be disposed within the de-

vice 8, Figures 1 and 2, or may be closely disposed within the body of the movable carriage as shown in Figure 3. The body of the fuse 1 may be made integral with the booster 3, or, if desired, integral with the body 4 of the projectile.

#### Claims—

1. In a fuse for projectiles, a movable carriage comprising a hollow member adapted to be forced into the said fuse by the resistance of the obstacle encountered, a primer and a striker disposed in sequence in the said hollow member and whereof the forwardly situated element is secured to the said hollow member, and means for maintaining the second element at a certain distance in the rear of the preceding, the said means being adapted to yield solely under the action of the inertia of the said rearwardly situated element when the said hollow member encounters the obstacle.

2. In a fuse for projectiles, the combination of a fuse body, a hollow member slidable within the said fuse body and provided with a head extending outwardly of the said fuse body, fixing means for securing the said hollow member to the said fuse body and adapted to break under the action of the inertia of the fuse body and the projectile when the said head encounters an obstacle, a primer and a striker disposed in sequence in the said hollow member and whereof the forwardly situated element is secured to the said hollow member, and means for maintaining the second element at a certain distance in the rear of the preceding, the said means being adapted to yield solely under the action of the inertia of the said rearwardly situated element when the said hollow member encounters the obstacle.

3. In a fuse for projectiles, the combination of a fuse body, a hollow member slidable within the said fuse body and provided with a head extending outwardly of the said fuse body, fixing means for securing the said hollow member to the said fuse body and adapted to break under the action of the inertia of the fuse body and the projectile when the said head encounters an obstacle, means for obtaining a strong damping of the movement of the said hollow member towards the rear of the said fuse body, a primer and a striker disposed within the said hollow member, and a spring interposed between these two elements.

4. In a fuse for projectiles, the combination of a fuse body, a hollow member slidable within the said fuse body and provided with a head extending outwardly of the fuse body, fixing means for securing the said hollow member to the said fuse body and adapted to break under the action of the inertia of the fuse body and the projectile when the said head encounters an obstacle, means for obtaining a strong



braking action upon the said hollow member in its movement towards the rear of the fuse body, a striker and a primer disposed within the said hollow member, and a spring interposed between these two elements.

5. In a fuse for projectiles, the combination of a fuse body, a hollow member slidably within the said fuse body and provided with a head extending outwardly of the said fuse body, fixing means for securing the said hollow member to the said fuse body and adapted to break under the action of the inertia of the fuse body and the projectile when the said head encounters an obstacle, the said hollow member having lateral slots formed therein, a washer slidably within the said hollow member and provided with studs extending through the said slots, the said fuse body being provided with internally disposed shoulders cooperating with the said studs, a striker disposed within the said hollow member adjacent the said head, a primer disposed within the rear portion of the said hollow member, and situated rearwardly of the said washer, and a spring interposed between the said washer and the striker.

6. In a fuse for projectiles, the combination of a fuse body, a hollow member slidably within the said fuse body and provided with a head extending outwardly of the said fuse body, fixing means for securing the said hollow member to the said fuse body and adapted to break under the action of the inertia of the fuse body and the projectile when the said head encounters an obstacle, means for obtaining a strong braking action upon the said hollow member in its movement towards the rear of the fuse body, the said means consisting in conical narrowed portions formed in the said fuse body co-operating portions of the said hollow member and adapted to undergo deformation by being forced into the said narrowed portions, a primer and a striker disposed within the said hollow member, and means provided within the said hollow member for affording a certain resistance to the movement of these two elements towards each other.

7. In a fuse for projectiles, a fuse body, a movable carriage comprising a hollow member mounted in said body, a primer, a striker, said primer and striker being disposed in sequence in said hollow member and the forwardly situated one of said elements being fixedly secured to said hollow member, and resilient means for maintaining the rearwardly situated one of said elements at a predetermined distance in the rear of the forwardly situated element, said means being adapted to yield solely under the action of the inertia of said rearwardly situated element when said hollow member encounters an obstacle.

8. A fuse comprising, in combination, a fuse body, a hollow member slidably mounted in said body, means rendered inoperative when said hollow member encounters an obstacle for normally maintaining said hollow member in a predetermined position relative to said body, a primer, a striker, said primer and striker being positioned in said hollow member and one of said elements being fixedly secured to said hollow member, and a spring interposed between said primer and striker.

9. A fuse comprising a fuse body, a member slidably mounted in said fuse body and normally maintained in a predetermined position relative to said body, a primer and a striker positioned in said member, the forwardly positioned one of said two last-named elements being fixedly secured to said member and the rearwardly positioned one of said elements being slidably mounted in said member, and means interposed between said primer and striker for preventing said striker from firing said primer when a projectile in which said fuse is fitted is subjected to a drop test.

10. A fuse comprising a fuse body, a member slidably mounted in said fuse body and normally maintained in a predetermined position relative to said body, a primer and a striker positioned in said member, the forwardly positioned one of said two last-named elements being fixedly secured to said member and the rearwardly positioned one of said elements being slidably mounted in said member, and yielding means interposed between said primer and striker for preventing said striker from firing said primer when a projectile in which said fuse is fitted is subjected to a drop test.

11. In a percussion fuse, the combination of a fuse body, a member movably mounted in said body, means normally retaining said member in a predetermined position relative to said body, a firing pin and a percussion cap mounted in said member, the forwardly positioned one of said two last-named elements being rigidly secured to said member and the rearwardly positioned one of said elements being slidably mounted in said member, means normally maintaining said slidably mounted element at a distance from said rigidly mounted element, said last-named means being rendered ineffective by the inertia of said slidably mounted element when said member encounters an obstacle capable of rendering said first-named means inoperative.

In testimony, that I claim the foregoing as my invention I have signed my name in presence of a subscribing witness.

LÉON EMILE RÉMONDY.

Witness:

MAURICE ROUX.