March 2, 1948. J. B. TRAYLOR 2,436,837

FUSE FOR ANTITANK MINES

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Fig. 2.

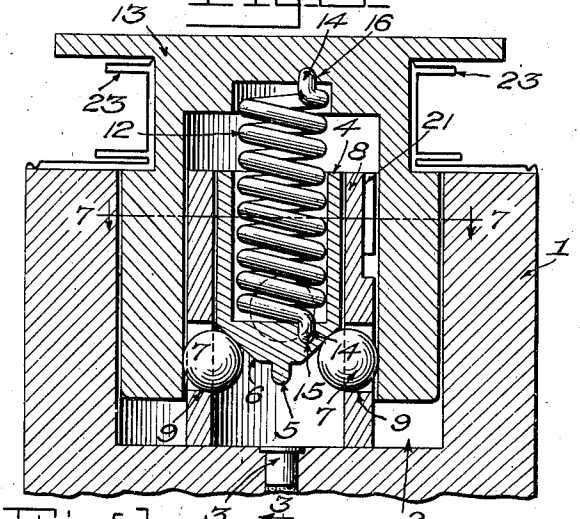


Fig. 7.

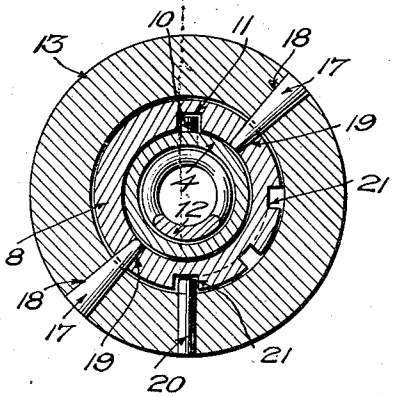


Fig. 1.

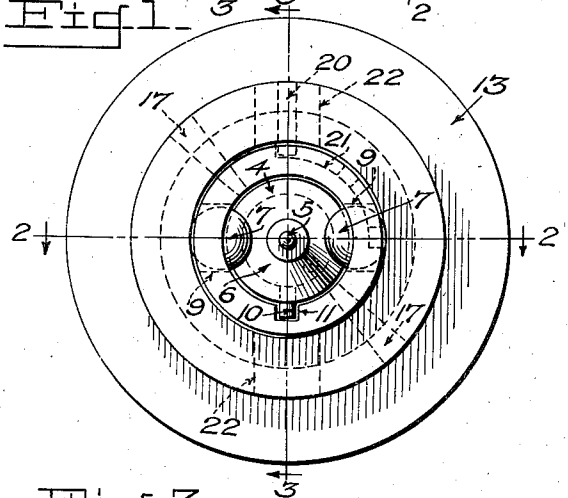


Fig. 8.

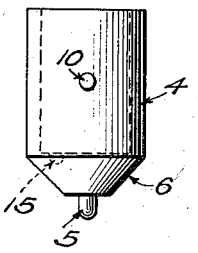


Fig. 9.

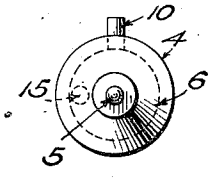
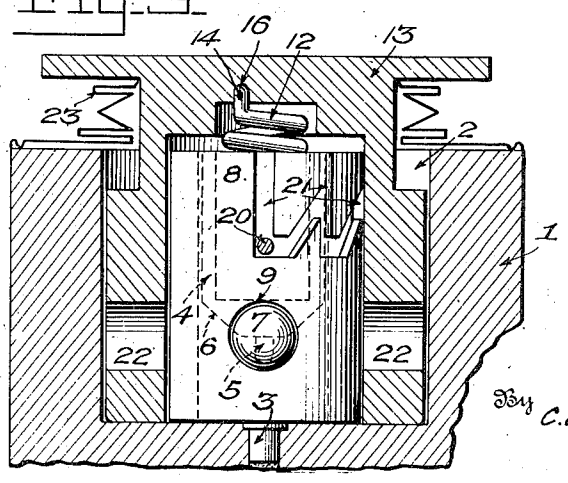


Fig. 3.



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Fig. 4.

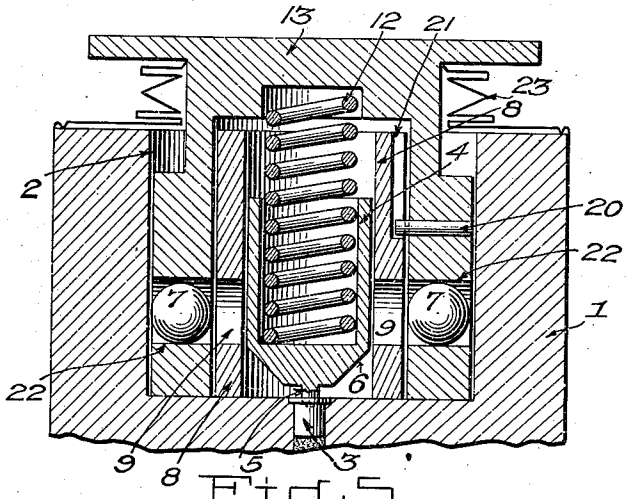


Fig. 5.

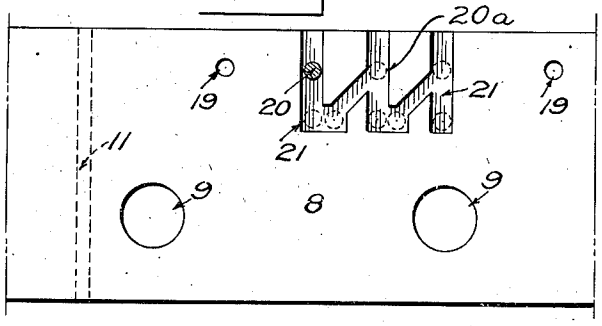
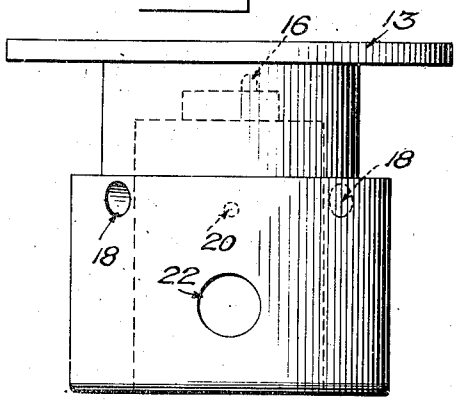


Fig. 6.



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UNITED STATES PATENT OFFICE

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FUSE FOR ANTITANK MINES

John B. Traylor, Denver, Colo.

Application October 14, 1943, Serial No. 506,190

11 Claims. (Cl. 102—70)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to an improved fuse for an explosive, particularly an antitank mine. Whereas the usual fuse mechanism in a mine is so designed that a single contact activates the mine, it is the purpose of this invention to provide a "skip" fuse whereby a mine may be activated either by the first or by such subsequent contact as may be desired.

"Skip" fuses constructed in accordance with this invention and used to activate antitank mines would permit an infinite variety of patterns for the layout of mine fields to be used to impede, harass, or confuse the enemy in accordance with the tactical requirements.

For example, in a rapid enemy advance over a suspected mine field, the enemy scout tanks sent ahead to locate mines and clear a path would pass undamaged over the mines equipped with "skip" fuses set for activation on the second contact, but enemy forces following them would activate the mines on contact.

In an enemy advance of tanks followed by infantry, the tanks would pass over such a mine field into trapped positions unable to retreat without activating the mines and the foot troops following them would, upon contact, activate the mines.

In an enemy advance against retreating friendly tanks, the latter would pass over such a field on a prescribed course so as to contact the mines only once, then pursuing enemy tanks would, upon contact, activate the mines.

In case of a feint by friendly forces, mines set for activation on the third contact would be planted in positions such that the friendly tanks would proceed over them making first contact on their way to attack the enemy, later withdrawing over the mines to make the second contact, whereup the mines are left in such condition that contact by the pursuing enemy forces would activate them.

The foregoing illustrations show clearly the desirability of a "skip" fuse for mines in accordance with this invention.

Accordingly, it is an object of this invention to provide an improved fuse or detonating mechanism for explosives, particularly antitank mines.

The particular object of this invention is to provide for an antitank mine which may be activated only by the first or by such subsequent contact as may be desired.

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A further object of this invention is to provide a fuse requiring an initial contact by a body of large mass, such as a tank and thereafter be in condition for actuation by light weight contact such as by personnel.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

Fig. 1 is a top elevational view of the fuse.

Fig. 2 is a longitudinal sectional view taken along the plane 2—2 of Fig. 1 showing the fuse in assembled relation to the body of the mine.

Fig. 3 is a longitudinal sectional view taken along the plane 3—3 of Fig. 1.

Fig. 4 is a view similar to Fig. 2 showing the fuse in the fired position.

Fig. 5 is a view showing the development of the fuse sleeve and the fuse cam.

Fig. 6 is a side elevational view of the fuse housing.

Fig. 7 is a cross sectional view of the fuse taken along the plane 7—7 of Fig. 2.

Fig. 8 is a side elevational view of the firing pin.

Fig. 9 is a bottom view of Fig. 8.

In Fig. 2 is shown in assembled relation a "skip" fuse mechanism in position in a mine. The mine casing 1 is shown cut away to reveal the recess 2 in which is located the fuse assembly. In the center of the bottom of the recess 2 is located the percussion cap 3 which activates the detonating charge (not shown) of the mine.

A hollow sleeve 8 is secured to casing 1, concentrically positioned with respect to cap 3. A firing pin 4 is mounted within the sleeve 8. Firing pin 4 is in the form of a hollow cylinder open at the upper end. The lower end is formed to a small tip 5 of suitable proportions for activating the percussion cap 3. Back of the tip 5 the firing pin is provided with a cone shaped surface 6, the cone shaped surface 6 resting on two balls 7 which are held in place by holes 9 in sleeve 8. A hollow cylindrical housing 13 is mounted around sleeve 8 and retains the balls 7 within sleeve 8 against the camming action of cone shaped surface 6.

Extending out from the side wall of the firing pin 4 is a pin 10 which fits into a longitudinal groove 11 in the inside of the sleeve 8 and hence keeps the firing pin 4 and the sleeve 8 in longitudinal alignment. Within the hollow cylinder of the firing pin 4 is located a helical spring 12 extending from the inside bottom of the firing

pin 4 to the inside top of the plunger housing 13. The ends of the spring 12 are formed into nubs 14 which fit into holes 15 and 16 respectively in the firing pin 4 and the housing 13. Spring 12 is assembled to produce a torsional bias between firing pin 4 and plunger housing 13.

The housing 13 fits loosely into the recess 2 in the mine casing 1 and serves as a housing for the fuse mechanism and also as the depressor for activating the fuse.

At the time of assembly, the sleeve 8 and the housing 13 are fixed in relationship by the shear pins 17 which fit into holes 18 and 19 in the housing and sleeve respectively, hence preventing downward movement of plunger housing 13 until subjected to a force greater than the shear resistance of pins 17.

In the inner wall of the housing 13 is located a pin 20 which, in assembly, fits into groove 21 in the outer wall of sleeve 8. The layout of the sleeve 8 is shown in Fig. 5. The layout shows three vertical sections of the groove, but there may be any number corresponding to the number of contacts desired to cause activation.

On the outside of the sleeve 8 and in a position 90° from the groove 11 is located the first section of a cam guide groove 21 which is shaped as shown in the developed view of Fig. 5. The construction shown here requires three successive contacts to actuate the mine but it will be understood that the guide groove 21 may be conveniently modified to actuate the mine after any desired number of successive contacts. The second and third vertical sections of the groove are 45° and 90° respectively to the right of the first section. Two holes 9 in sleeve 8 are in diametrical alignment with the first section of the groove 21.

In the housing 13 there are provided two holes 22 located in diametrical alignment with the third section of the groove 21 and at such a height that when pin 20 is in the third section of groove 21 and the housing 13 is depressed to the bottom of the recess 2, the holes 22 are in alignment with holes 9 in the sleeve 8. Holes 9 and 22 are of the same size and the thickness of the wall of the housing 13 plus that of the sleeve 8 is greater than the diameter of ball 7 so that when alignment is obtained, the balls 7 are forced into the space provided by the two pair of holes 9 and 22, allowing the firing pin 4 unimpeded movement to contact with the percussion cap 3 under the bias of spring 12.

A lock nut (not shown) or any other suitable device may be used to retain the fuse assembly in the mine casing, and also prevent the housing 13 from rising beyond the position shown in Fig. 1 after the pins 17 have been sheared.

An accordion formed collar 23 of metal foil fits around the joint between the mine case 1 and the housing 13 sealing the junction against water or dirt.

When assembled, the sleeve 8 is located in fixed relationship to the housing 13 by the two shear pins 17. This prevents misassembly or accidental activation of the fuse while handling. It also prevents accidental activation by personnel after the mine has been planted. The shear strength of the pins is preferably such that the pins will be sheared and the mine thereby rendered sensitive by small tanks or vehicles after which even foot pressure will be sufficient to activate it. A total shear strength for the two pins 17 of about 500 pounds and a compression strength in spring 12 of about 100 pounds would meet these conditions.

When assembled the guide pin 20 can be located in the first, second or third section of groove 21 as may be desired in order to bring about activation on the third, second or first contact respectively.

If activation on the third contact is desired, the fuse mechanism is assembled with the pin 20 in position in the third section in the guide groove 21. When contact is made by a tank or vehicle, the weight on top of the mine depresses the housing 13 thereby shearing the pins 17 and forcing the housing down till it rests on the bottom of the recess 2 in the mine casing 1 (Fig. 3). In this position the guide pin 20 is in the bottom of the first section of the groove 21 whereupon the spring 12 which exerts a torsional bias causes rotation of housing 13 with respect to firing pin 4 and sleeve 8 causes rotation of the firing pin and sleeve to the point where pin 20 enters the second section of groove 21. When the load is removed from the housing 13, the compressive force of spring 12 causes the housing to rise and the firing pin 4 and sleeve 8 turn till they come to rest with the guide pin 20 in position 20*a*.

The fuse mechanism is now ready for the second contact which would again force the housing 13 down into contact with the bottom of the recess 2. Much less force is required for this contact since the shear pin 17 has been broken previously. The torque in spring 12 would then cause rotation of housing 13 till the pin 20 entered the third section of the groove 21. In this position the fuse mechanism is ready for the third, and in this example the final contact. The plunger housing 13 has now been rotated 90° with respect to sleeve 8 so that the holes 9 in the sleeve 8 are in vertical alignment with the holes 22 in the housing 13. When the plunger housing is next depressed, holes 22 come into full alignment with holes 9 in the sleeve 8 and the balls 7 are forced into the holes 22 in the housing 13, allowing the firing pin 4, now under the pressure of the fully compressed spring 12, to move downward and strike the percussion cap 3 (Fig. 4).

It will be readily seen that with even three possible settings of the "skip" fuse offer there is an almost endless variation in the tactical use of antitank mines equipped therewith. Furthermore, the shear pin feature makes possible the placing of such mines for ultimate use as either antitank or antipersonnel mines, without danger to personnel handling and placing them.

I claim:

1. A fuse comprising a firing member, a locking member and a plunger member mounted in telescoping relation, said firing member and said plunger member being movably mounted with respect to said locking member, a primer arranged in the path of said firing member, a resilient means operative between said firing member and said plunger member, said locking member having a hole thru a wall thereof, a locking ball mounted in said hole in said locking member, said locking ball projecting in the path of said firing member to hold said firing member out of engagement with said primer, said plunger member having a recess arranged to align horizontally with said hole in said locking member upon movement of said plunger member toward said primer, means for aligning said recess and said hole radially upon movement of said plunger member away from said primer, whereby said recess and said hole may be aligned horizontally

and radially upon reciprocation of the plunger member and a cam surface on said firing member contacting said locking ball and operative to cam said ball into said recess of said plunger member, whereby said firing member is freed to strike said primer under force of said resilient means.

2. A fuse comprising a firing member, a locking member and a plunger member mounted in telescoping relation, said firing member and said plunger member being mounted on said locking member for axial movement with respect thereto, a primer arranged in the path of said firing member, means preventing rotational movement of said firing member with respect to said locking member, resilient means operative between said plunger member and said firing member, said resilient means arranged to bias said plunger member rotationally with respect to said firing member and to oppose relative axial movement of said plunger member with respect to said firing member, means permitting limited unidirectional rotational movement of said plunger member with respect to said locking member under the bias of said resilient means when said plunger member is reciprocated axially, said locking member having a hole thru a wall thereof, a locking ball mounted in said hole in said locking member, said locking ball projecting into the path of said firing member to hold said firing member out of engagement with said primer, said plunger member having a recess located with respect to said locking member so as to align with the said hole in said locking member when said plunger member has been rotationally advanced with respect to said locking member by a predetermined number of axial reciprocations of said plunger member, and a cam surface on said firing member contacting said locking ball and operative to cam said ball into said recess of said plunger member when said recess is aligned therewith, whereby said firing member is freed to strike said primer under force of said resilient means.

3. A fuse comprising a firing member, a locking member, and a plunger member mounted in telescoping relation, said firing member and said plunger member being mounted on said locking member for axial movement with respect thereto, a primer arranged in the path of said firing member, means preventing rotational movement of said firing member with respect to said locking member, resilient means operative between said plunger member and said firing member, said resilient means arranged to bias said plunger member rotationally with respect to said firing member and to oppose relative axial movement of said plunger member with respect to said firing member, a pin on said plunger member cooperating with a cam slot on said locking member to permit limited rotational movement of said plunger member with respect to said locking member under the bias of said resilient means when said plunger member is reciprocated axially, said locking member having a hole thru a wall thereof, a locking ball mounted in said hole in said locking member, said locking ball projecting into the path of said firing member to hold said firing member out of engagement with said primer, said plunger member having a recess located with respect to said locking member so as to align with the said hole in said locking member when said plunger member has been rotationally advanced with respect to said locking member by a predetermined number of axial reciprocations of said plunger member, and a cam surface on said firing member contacting said locking ball and operative to cam said ball into said recess of said plunger member when said recess is aligned therewith, whereby said firing member is freed to strike said primer under force of said resilient means.

4. A fuse comprising a firing member, a locking member, and a plunger member mounted in telescoping relation, said firing member and said plunger member being mounted on said locking member for axial movement with respect thereto, a primer arranged in the path of said firing member, means preventing rotational movement of said firing member with respect to said locking member, resilient means operative between said plunger member and said firing member, said resilient means arranged to bias said plunger member rotationally with respect to said firing member and to oppose relative axial movement of said plunger member with respect to said firing member, means permitting limited unidirectional rotational movement of said plunger member with respect to said locking member under the bias of said resilient means when said plunger member is reciprocated axially, said locking member having a hole thru a wall thereof, a locking ball mounted in said hole in said locking member, said locking ball propecting into the path of said firing member to hold said firing member out of engagement with said primer, said plunger member having a recess located with respect to said locking member so as to align with the said hole in said locking member when said plunger member has been rotationally advanced with respect to said locking member by a predetermined number of axial reciprocations of said plunger, a cam surface on said firing member contacting said locking ball and operative to cam said ball into said recess of said plunger member when said recess is aligned therewith, whereby said firing member is freed to strike said primer under force of said resilient means, and a shear pin preventing movement of said plunger member under applied forces less than the shear strength of said pin.

5. A fuse comprising a casing defining a cylindrical recess, a percussion primer mounted in the base of said recess, a hollow locking cylinder concentrically secured in said recess, a plunger mounted around said locking cylinder and arranged to slide thereon, a firing pin slidably mounted within said locking cylinder and arranged to move into contact with said primer, resilient means operative between said plunger and said firing pin, said locking cylinder having a hole thru a wall thereof, a locking ball mounted in said hole in said locking cylinder, said locking ball projecting in the path of said firing pin to hold said firing pin out of engagement with said primer, said plunger having a recess arranged to align horizontally with said hole in said locking cylinder upon movement of said plunger toward said primer, means for aligning said recess and said hole radially upon movement of said plunger member away from said primer, whereby said recess and said hole may be aligned horizontally and radially upon reciprocation of the punger member, and a cam surface on said firing pin contacting said locking ball and operative to cam said ball into said recess of said plunger, when said recess is aligned therewith, whereby said firing pin is freed to

strike said primer under force of said resilient means.

6. A fuse comprising a casing defining a cylindrical recess, a percussion primer mounted in the base of said recess, a hollow locking cylinder concentrically secured in said recess, a plunger mounted around said locking cylinder and arranged to slide thereon, a firing pin slidably mounted within said locking cylinder and arranged to move into contact with said primer, means preventing rotational movement of said firing pin with respect to said locking cylinder, resilient means operative between said plunger and said firing pin, said resilient means arranged to bias said plunger rotationally with respect to said firing pin and to oppose relative axial movement of said plunger with respect to said firing pin, means permitting limited unidirectional rotational movement of said plunger with respect to said locking cylinder under the bias of said resilient means when said plunger is reciprocated axially, said locking cylinder having a hole thru wall thereof, a locking ball mounted in said hole in said locking cylinder, said locking ball projecting into the path of said firing pin to hold said firing pin out of engagement with said primer, said plunger having a recess located with respect to said locking cylinder so as to align with the said hole in said locking cylinder when said plunger has been rotationally advanced with respect to said locking cylinder by a predetermined number of axial reciprocations of said plunger, and a cam surface on said firing pin contacting said locking ball and operative to cam said ball into said recess of said punger when said recess is aligned therewith, whereby said firing pin is freed to strike said primer under force of said resilient means.

7. A fuse comprising a casing defining a cylindrical recess, a percussion primer mounted in the base of said recess, a hollow locking cylinder concentrically secured in said recess, a plunger mounted around said locking cylinder and arranged to slide thereon, a firing pin slidably mounted within said locking cylinder and arranged to move into contact with said primer, means preventing rotational movement of said firing pin with respect to said locking cylinder, resilient means operative between said plunger and said firing pin, said resilient means arranged to bias said plunger rotationally with respect to said firing pin and to oppose relative axial movement of said plunger with respect to said firing pin, a pin on plunger cooperating with a cam slot on said locking cylinder to permit limited rotational movement of said plunger with respect to said locking cylinder under the bias of said resilient means when said plunger is reciprocated axially, said locking cylinder having a hole thru a wall thereof, a locking ball mounted in said hole in said locking cylinder, said locking ball projecting into the path of said firing pin to hold said firing pin out of engagement with said primer, said plunger having a recess located with respect to said locking cylinder so as to align with the said hole in said locking cylinder when said plunger has been rotationally advanced with respect to said locking cylinder by a predetermined number of axial reciprocations of said plunger, and a cam surface on said firing pin contacting said locking ball and operative to cam said ball into said recess of said plunger when said recess is aligned therewith, whereby said firing pin is freed to strike said primer under force of said resilient means.

8. A fuse comprising a casing defining a cylindrical recess, a percussion primer mounted in the base of said recess, a hollow locking cylinder concentrically secured in said recess, a plunger mounted around said locking cylinder and arranged to slide thereon, a firing pin slidably mounted within said locking cylinder and arranged to move into contact with said primer, means preventing rotational movement of said firing pin with respect to said locking cylinder, resilient means operative between said plunger and said firing pin, said resilient means arranged to bias said plunger rotationally with respect to said firing pin and to oppose relative axial movement of said plunger with respect to said firing pin, means permitting limited unidirectional rotational movement of said plunger with respect to said locking cylinder under the bias of said resilient means when said plunger is reciprocated axially, said locking cylinder having a hole thru a wall thereof, a locking ball mounted in said hole in said locking cylinder, said locking ball projecting into the path of said firing pin to hold said firing pin out of engagement with said primer, said plunger having a recess located with respect to said locking cylinder so as to align with the said hole in said locking cylinder when said plunger has been rotationally advanced with respect to said locking cylinder by a predetermined number of axial reciprocations of said plunger, a cam surface on said firing pin contacting said locking ball and operative to cam said ball into said recess of said plunger when said recess is aligned therewith, whereby said firing pin is freed to strike said primer under force of said resilient means, and a shear pin securing said plunger to said casing to prevent movement of said plunger member under applied forces less than the shear strength of said pin.

9. A fuse comprising a firing member, a locking member, and a plunger member mounted in telescoping relation, said firing member and said plunger being movably mounted with respect to said locking member, a primer arranged in the path of said firing member, resilient means located between said firing member and said plunger member for separating said two members and constructed and arranged for rotating said locking member and plunger member relative to each other, locking means operative between said firing member and said locking member for holding said firing member out of engagement with said primer, and guide means rotatably connecting said plunger and said locking member, operative by longitudinal movement of said plunger, for releasing said locking means from engagement with said firing member whereby said firing member is freed to strike said primer under force of said resilient means.

10. A fuse comprising a firing member, a locking member, and a plunger member mounted in telescoping relation, said firing member and said plunger being movably mounted with respect to said locking member, a primer arranged in the path of said firing member, resilient means located between said firing member and said plunger for separating said two members and constructed and arranged for rotating said locking member and plunger member relative to each other, locking means operative between said firing member and said locking member for holding said firing member out of engagement with said primer, cam means rotatably connecting said plunger and said locking member for per-

mitting a controlled relative rotation of said locking member and said plunger, operative by longitudinal movement of said plunger, means operative upon a predetermined rotation and longitudinal movement of said plunger relative to said locking member for releasing said locking means from engagement with said firing member whereby said firing member is freed to strike said primer under force of said resilient means, and a shear pin preventing movement of said plunger member under applied forces less than the shear strength of said pin.

11. A fuse comprising a casing having a cylindrical recess, a percussion primer mounted in the bottom of said recess, a sleeve concentrically disposed in said recess, a plunger surrounding said sleeve and arranged to slide thereon, a striker member slidably mounted within said sleeve and having a firing pin for contacting said primer, spring means between the plunger and striker biasing them longitudinally and angularly, detent means carried by the sleeve and normally obstructing the striker, cam means for rotating said sleeve stepwise upon reciprocation of said plunger, and escape means in the plunger for said detent means at a predetermined degree of rotation of said sleeve.

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