H. M. GROFF.

MECHANICAL TIME FUSE.

APPLICATION FILED JULY 6, 1918.

1,312,112.

Patented Aug. 5, 1919.

3 SHEETS—SHEET 1.

Fig. 1.

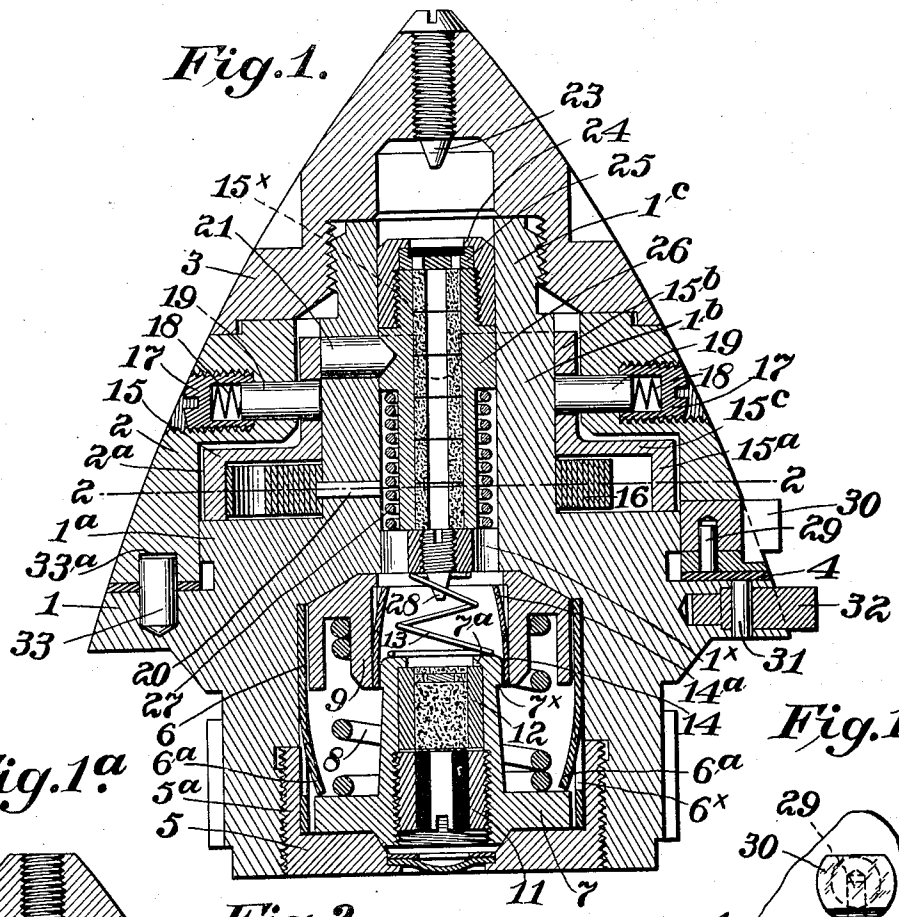


Fig. 1a

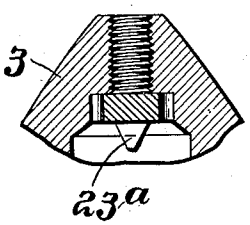


Fig. 1b

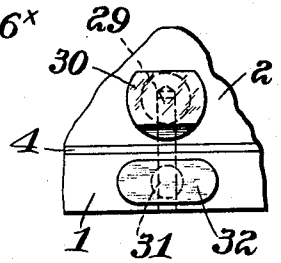
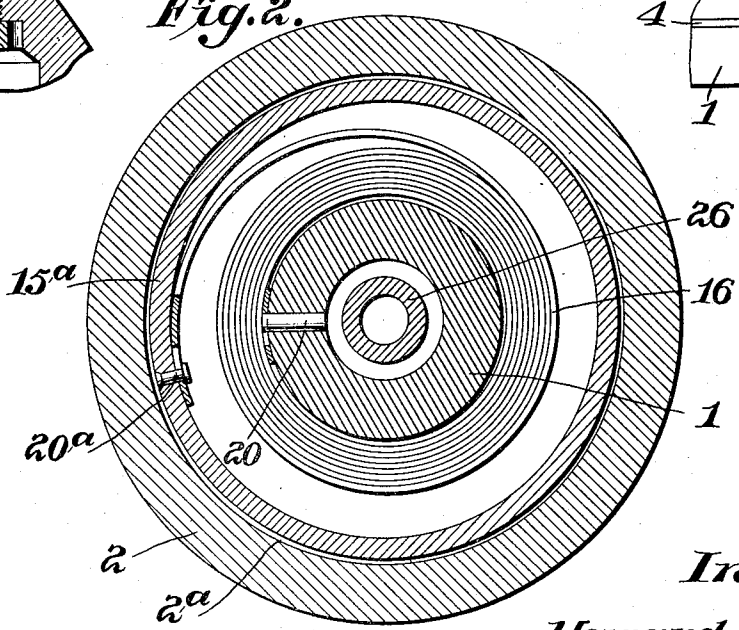


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

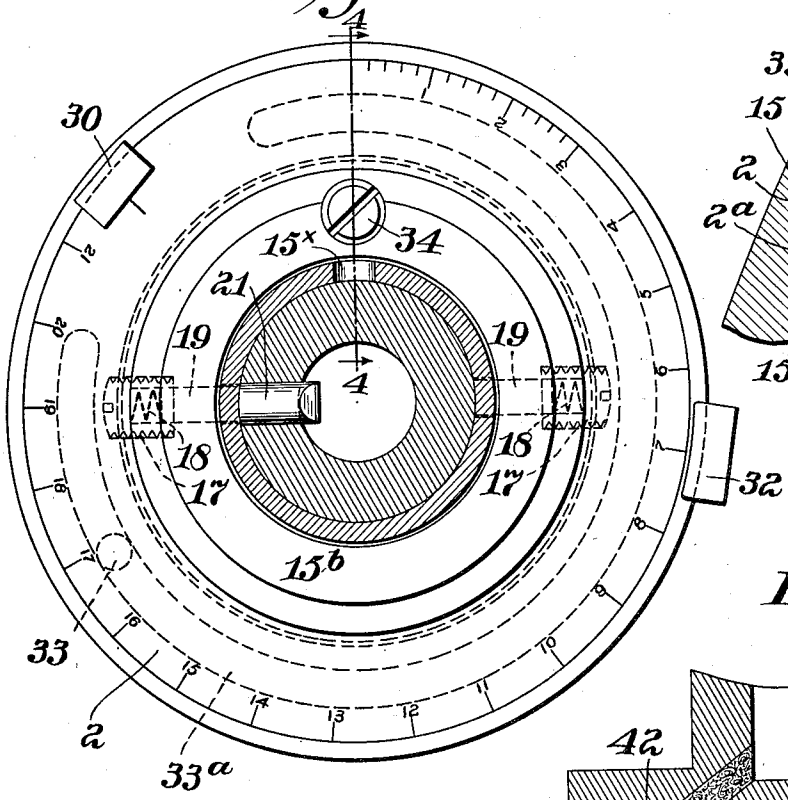


Fig. 4.

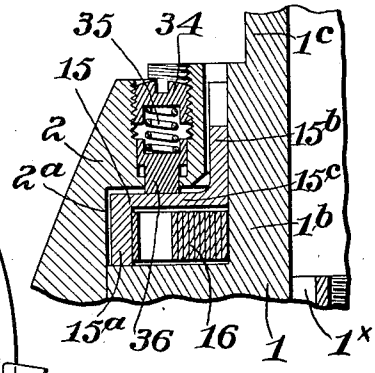


Fig. 6.

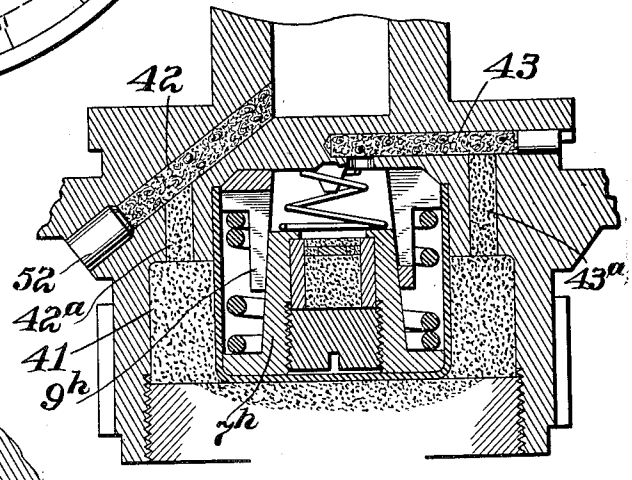


Fig. 5.

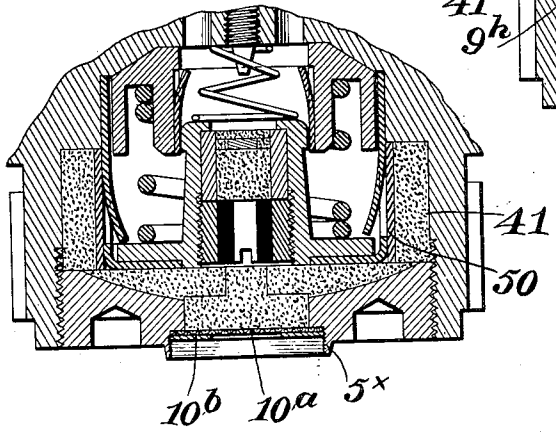
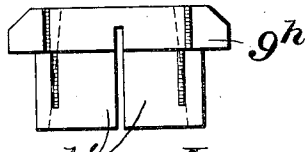


Fig. 6a.



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3 SHEETS—SHEET 3.

Fig. 7.

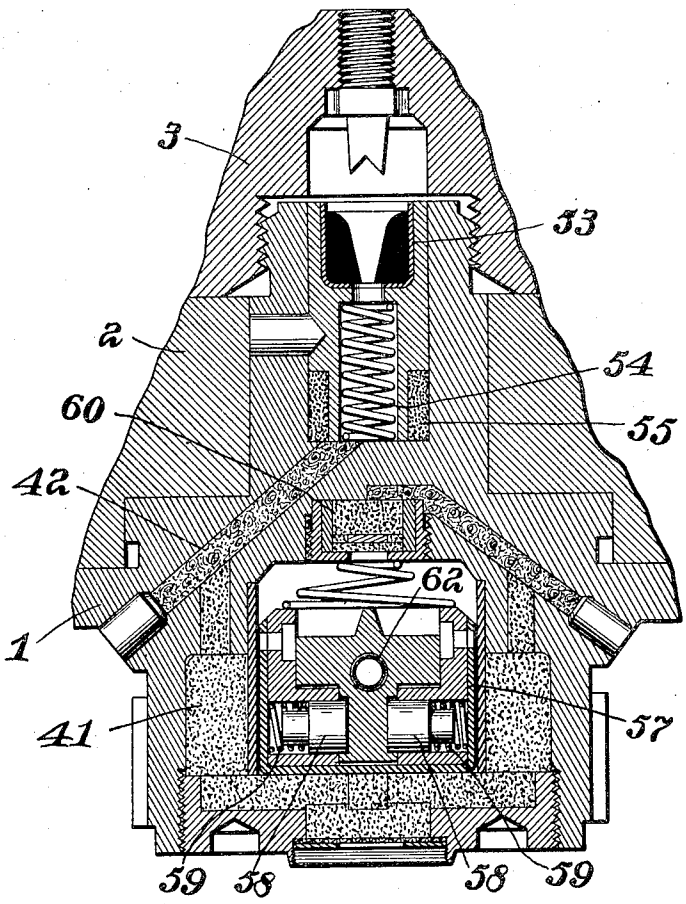


Fig. 7a

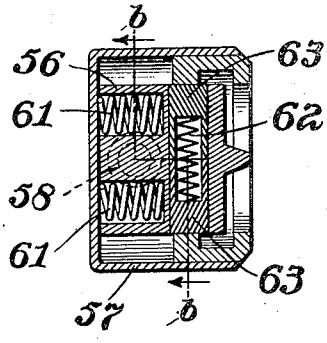
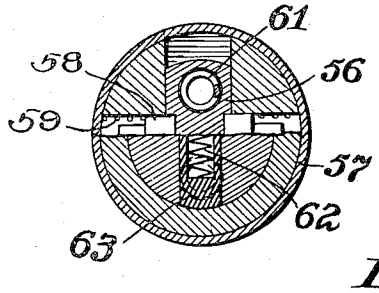


Fig. 7b



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MECHANICAL TIME-FUSE.

1,312,112. Specification of Letters Patent. Patented Aug. 5, 1919.

Application filed July 6, 1918. Serial No. 243,577.

To all whom it may concern:

Be it known that I, HOWARD M. GROFF, a citizen of the United States, residing at Frankford, Pennsylvania, have invented certain new and useful Improvements in Mechanical Time-Fuses, of which the following is a specification.

My present invention relates to improvements in mechanical time fuses and has among its objects to produce a mechanical time fuse which may be economically manufactured, which can be easily set to fire after a predetermined interval of time, and will be reliable in its action, and which is also provided with means enabling it to be exploded by impact.

Other objects will appear from the following description.

The invention includes the novel features of construction and arrangement and combination of parts hereinafter described and defined by the appended claims, an embodiment and some modifications of my invention being illustrated in the accompanying drawings, in which,

Figure 1 is a transverse vertical section through a mechanical fuse according to one form of my invention.

Fig. 1^a is a detail view of a modification.

Fig. 1^b is a detail of mechanical setter.

Fig. 2 is a section on line 2—2 of Fig. 1.

Fig. 3 is a plan view of the time ring (the cap being removed) and with the main spring barrel and portion of body contained therein shown in section on the line of the locking pin 21.

Fig. 4 is a partial vertical section on line 4—4 of Fig. 3.

Fig. 5 is a sectional detail view illustrating a modification.

Fig. 6 is a similar view of a further modification, and Fig. 6^a a detail view.

Fig. 7 is a similar view of a still further modification, and Figs. 7^a and 7^b detail views.

Referring by reference characters to these drawings, in which the like characters designate the same parts throughout the several views and referring first to the form shown on Figs. 1 to 4, inclusive, the numeral 1 designates the body or carrier for the various parts and which body is intended to be applied to or inserted in the projectile in the usual or any approved manner.

This body has a plurality of successively reduced cylindrical portions 1^a and 1^b and encircling these reduced portions is a rotatable time ring 2 which has an inner annular wall 2^a fitting the wall 1^a of the body and guided thereby. Said annular wall is extended upward above the annular wall 1^a to provide an annular chamber for the main spring barrel and main spring hereinafter described. The body 1 has a central chamber to carry the fuse parts, also hereinafter described, and closure thereof is effected by a cap 3 at the upper end screw threaded upon the (preferably further reduced) portion 1^c of the upper portion of the body, and by the bottom closing screw cap or member 5 having an annular flange 5^a threaded on the exterior to engage corresponding screw threads formed on an enlarged portion of the cylindrical opening in the lower end of the body 1. The time spring barrel 15 constituting a part of the time control mechanism has lower and upper annular walls 15^a and 15^b connected by a horizontal wall 15^c beneath which is located the main spring 16, one end of which is secured to the wall 15^a by suitable means such as rivet 20^a and the other end to the body or casing by pin 20.

The main spring thus tends constantly to rotate the main spring barrel which, when rotated, releases the firing mechanism in the manner hereinafter described.

The main spring barrel is, however, normally locked against movement by the barrel locking pins 19, preferably two in number and diametrically opposed. These are slidably mounted in openings in the wall of the time ring and are pressed in by springs 18 within the cap screws 17 which are tapped into the enlarged outer parts of the locking pin openings. By means of these springs the pressure or tension on the pins may be adjusted or varied at will. The pins engage corresponding openings in the wall 15^b of the main spring barrel and thus lock it against movement, but, the compression of the springs being properly adjusted, the rotary movement given the projectile by the rifling of the gun will cause the pins to fly outward under the centrifugal action, releasing the main spring barrel so that it will be free to be rotated by the spring.

The time controlled firing means comprises a cylindrical plunger 26 guided in the axial cylindrical opening or passage in the body and having in its hollow center the booster charge which is fired by the time

primer 25 held in by the cap screw 24 threaded upon the reduced upper end of the plunger. The primer is fired by being forced upward against the stationary firing pin 23, through the action of a helical spring 27 incircling a reduced lower portion of the plunger and confined under compression between an annular shoulder on the plunger and the bottom of the plunger opening, such bottom wall having flame openings 1^{x}. The plunger is normally locked in the retracted position shown in Fig. 1 by a plunger release pin 21 which has a wedge shaped or beveled nose engaging a correspondingly shaped recess in the wall of the plunger. Normally the pin 21 is held in locking position by its outer end bearing against the inner face of the flange 15^{b} of the spring barrel. Said flange, however, is provided with an opening 15^{x}, which, as the barrel is rotated by the spring, comes into alinement with the pin, permitting the latter to be forced back by the action of the plunger spring and the beveled end of the pin and wall of the recess engaged thereby, the plunger being forced outward by its spring to cause the primer 25 to contact with the firing pin 23. The firing pin, as shown, in Fig. 1, is screwed into a threaded opening in the outer end of the cap from the outside, but if desired it may be screwed in from the inside as illustrated in Fig. 1^{a} at 23^{a}.

From the foregoing it will be evident that the interval of time which elapses between the firing of the projectile and the release of the plunger is determined by the amount of movement of the spring barrel or in other words the distance the latter has to travel to bring the opening 15^{x} into line with the plunger release pin. This is determined by the position or adjustment of the timing ring which is rotated, together with the spring barrel connected thereto by the locking pins, to bring the opening 15^{x} nearer to or farther from the release pin 21. It will be understood that the main spring is wound up at the time the parts are assembled.

Suitable graduating marks are provided on the time ring indicating seconds and suitable fractions thereof, fifths for example, cooperating with a setting mark.

Too free rotation of the time ring may be prevented by any suitable means, as for example a washer of suitable friction material operating in conjunction with the pressure exerted by the closing cap and interposed between the time ring and body as indicated at 4.

To prevent the timing ring being turned by hand sufficiently to bring the opening 15^{x} into line with the release pin 21 and thus firing the charge I provide a safety pin 33 interposed between the time ring and shell body and rigidly affixed to one of said parts, say the body, and engaging and traveling in an arc shaped groove or channel 33^{a} in the other part, the contact of the pin with the end of the groove preventing the movement of the time ring sufficiently far to fire the charge.

It will be understood that the pressure of the end of the plunger release pin 21 against the spring barrel 15 secures a certain amount of friction tending to retard the rotation of said barrel but this friction may vary due to inequalities in the spring 27, and this is compensated for and supplemented by a plunger (or plungers) 36 sliding in a suitable vertical opening in the timing ring, as shown in detail in Fig. 4, the pressure of which may be determined by pressure spring 35 and screw cap 34.

It is desirable that means be provided for mechanically setting the fuses to secure rapid duplication of the same setting.

To this end I provide the time ring with a projection or contact member 30 which may be conveniently held in a recess in the ring by a locking pin 29, and the body 1, while another projection or contact member 32 is similarly held by pin 31. These projections are designed to coöperate with a mechanical fuse setting device of standard construction on the gun carriage which, as it forms *per se* no part of the present invention, is not shown herein. It suffices to say that the time fuse would be inserted in the mechanical setter with projection 32 engaging a fixed part of the setter and projection 30 engaging a rotatable ring in the fuse setter.

The movement of rotating ring and projection 30 would be controlled by an adjustable stop.

To insure the firing of the shell in the event that the time element fails to act I provide percussive means for firing the shell upon striking any object, one form of which means is shown in Fig. 1.

This comprises a percussion plunger 7 which has a head portion guided in the cylindrical chamber formed by the annular flange of the bottom closing screw cap or member 5. The plunger 7 has a reduced portion with a central cylindrical passage and an inwardly extending or overhanging lip 7^{a} at its upper end against which the percussive primer 12 is held by the tubular screw member 11. The impact of the shell causes the percussive plunger 7 to be driven forward by its inertia, which results in the primer being fired by the percussive firing pin 28 screwed into a threaded opening in the body.

To prevent the percussive plunger 7 from accidentally moving forward I insert in the cylindrical opening in the body above the base of the percussive plunger a sleeve 6

having a plurality of spring tongues 6^a which normally incline inwardly and abut against the head or flange of the percussive plunger, thus locking it against forward movement. A plunger release ring 9 is provided which is slidably fitted within the sleeve 6 and is normally pressed away from the plunger 7 by an interposed helical spring 8 which also serves as additional means for holding the plunger in its rearward position.

When the shell is fired from the gun the inertia of the ring 9, which is made of suitable weight for this purpose, forces it back against the tension of spring 8 which results in the spring tongues 6^a being forced outwardly into alinement with slots or recesses 6^x in the sleeve 6.

The ring 9 has affixed to its inner wall a sleeve 14 provided with inwardly deflected spring tongues 14^a which, as the ring moves rearwardly, engage beneath the annular shoulder 7^x of the cylindrical extension of the plunger and lock the ring in its rearward position.

During the flight of the projectile the coupled elements are prevented from creeping forward under the gradual retardation of the speed of flight by the spring 13 interposed between the front end of the plunger and the wall of the body around the firing pin.

In Fig. 5 I have shown a modification of the percussion element arranged to provide an additional powder charge to insure the firing of the shell. In this the body is cored out to a larger diameter and a sleeve 50 encircles and acts as a guide for the percussive plunger, the annular space 41 being filled with powder. In this form the closing cap is milled out to provide further powder space, and the powder is held in place by muslin disk 10^a and screw washer 10^b, which are secured in place by spinning over the flange 5^x of closing screw.

In Fig. 6 I have illustrated an arrangement whereby the firing of the shell by the time plunger is made independent of the percussive element.

A passage 42 is bored through the body to the space occupied by the booster charge (not shown in this figure) and this space may be filled with gun cotton, the outer end of the passage being closed by a plug 52. Said space communicates with the powder space 41 by a powder filled branch passage 42^a.

Another passage 43 bored into the body from the opposite side and communicating with the space above the percussive primer is filled with gun cotton which, when fired, ignites the powder charge by the powder in branch passage 43^a.

In this form I have shown a modification of the percussive plunger.

In this form the percussive plunger 7^h is made tapered, and the release ring 9^h is provided with a correspondingly tapered portion, slotted vertically to provide spring tongues h'. These expand or spread outwardly as the ring is driven down and by their frictional engagement hold the release ring in such depressed or rearward position.

Fig. 7 illustrates another arrangement whereby the ignition of the powder charge 41 by the firing plunger and the percussion firing pin independently takes place. The firing plunger is recessed to provide for retention of the stab primer 53 and the firing plunger spring 54. A booster charge 55 can be introduced to insure the ignition of the gun cotton charge 42.

In this form the arrangement of the percussion element is reversed, the firing pin being incorporated in the moving element and the percussion primer mounted directly in the body.

The percussion firing pin 56 is retained in the percussion firing pin housing 57 by the safety pins 58 held in position by the safety pin springs 59. The percussion firing pin is thus held below the upper surface of the percussion firing pin housing so that accidental discharge of the percussion primer 60 cannot occur until the percussion firing pin is armed. The acceleration of the projectile at the moment of discharge causes the percussion firing pin 56 to seat itself on the shoulder of the percussion firing pin housing 57, releasing the pressure of the percussion firing pin arming springs 61 from the safety pins 59. The centrifugal force developed by the rotation of shell caused by the rifling of the gun releases the safety pins 59 and allows the percussion firing pin arming springs 61 to project the percussion firing pin forward until the locking pin spring 62 forces the locking pins 63 into the annular groove in the percussion firing pin housing locking the percussion firing pin in an armed position.

The percussion plunger sleeve provides a housing for the various parts and retains the safety pin springs in position.

Having thus described my invention what I claim is:

1. A mechanical time fuse comprising a suitable body, a spring pressed time firing plunger therein, a plunger release pin carried by the body having a beveled end engaging a corresponding recess in the plunger, a spring barrel having an annular flange normally holding said release pin in locking position and having an opening adapted to register with said pin, a spring tending to rotate said barrel, an adjustable time ring encircling said barrel, radially movable pins normally connecting said spring barrel and time ring, springs bearing on said pins, and means for varying the tension on said springs.

2. A mechanical time fuse comprising a suitable body, a spring pressed time firing plunger therein, a plunger release pin carried by the body having a beveled end engaging a corresponding recess in the plunger, a spring barrel having an annular flange normally holding said release pin in locking position and having an opening adapted to register with said pin, a spring tending to rotate said barrel, an adjustable time ring encircling said barrel, radially movable pins normally connecting said spring barrel and time ring, springs bearing on said pins, means for varying the tension on said springs, and means for limiting the extent of adjustment of said time ring.

3. A mechanical time fuse comprising a suitable body, a spring pressed time firing plunger therein, a plunger release pin carried by the body having a beveled end engaging a corresponding recess in the plunger, a spring barrel having an annular flange normally holding said release pin in locking position and having an opening adapted to register with said pin, a spring tending to rotate said barrel, an adjustable time ring encircling said barrel, said time ring and said body having means for limiting their relative adjustment comprising a fixed pin in one of said parts engaging an arc shaped groove in the other part.

4. A mechanical time fuse comprising a suitable body, a spring pressed time firing plunger therein, a plunger release pin carried by the body having a beveled end engaging a corresponding recess in the plunger, a spring barrel having an annular flange normally holding said release pin in locking position and having an opening adapted to register with said pin, a spring tending to rotate said barrel, an adjustable time ring encircling said barrel, and adjustable friction means for retarding the rotation of the spring barrel.

5. A mechanical time fuse comprising a suitable body, a spring pressed time firing plunger therein, a plunger release pin carried by the body having a beveled end engaging a corresponding recess in the plunger, a spring barrel having an annular flange normally holding said release pin in locking position and having an opening adapted to register with said pin, a spring tending to rotate said barrel, an adjustable time ring encircling said barrel, and adjustable friction means for retarding the movement of the spring barrel comprising a spring pressed pin bearing on said barrel and means for varying the pressure of said pin.

6. A mechanical time fuse comprising a body having a tubular bore, a spring pressed plunger therein, a booster charge and primer carried thereby, a plunger release pin carried by the body and normally engaging said plunger, a spring barrel having a ring or flange normally holding said release pin against movement and having a recess to aline with said pin, an adjustable time ring encircling said barrel, centrifugally operated means normally locking said barrel to said time ring, and a cap secured to said body and holding said barrel and time ring in position, and a firing pin carried by said cap.

7. A mechanical time fuse comprising a body having a tubular bore, a spring pressed plunger therein, a booster charge and primer carried thereby, a plunger release pin carried by the body and normally engaging said plunger, a spring barrel having a ring or flange normally holding said release pin against movement and having a recess to aline with said pin, an adjustable time ring encircling said barrel, and friction means interposed between said time ring and body.

8. A mechanical time fuse comprising a suitable body, a time firing plunger slidably mounted therein, a release pin carried by said body and normally engaging said plunger, a rotatable ring overlying the end of the release pin to hold it in engaging position, said ring having an opening to aline with said release pin when the ring is moved to a determined position, means for rotating said ring, and centrifugally operated locking means normally holding said ring against rotation, said body and said ring having peripheral recesses, time setting projections seated in said recesses, and pins locking said projections in said recesses.

9. A mechanical time fuse comprising a suitable body, a time firing plunger slidably mounted therein, a release pin carried by said body and normally engaging said plunger, a rotatable ring overlying the end of the release pin to hold it in engaging position, said ring having an opening to aline with said release pin when the ring is moved to a determined position, means for rotating said ring, and centrifugally operated locking means normally holding said ring against rotation, and percussive firing means also carried by said body.

10. In combination, a suitable body or casing having a stationary firing pin, a percussive plunger slidably mounted in the casing, carrying a primer to coact with said pin, spring locking tongues normally engaging said plunger, a slidable ring movable by its inertia to disengage said tongues from the plunger, a spring interposed between said ring and plunger tending normally to separate them, and means for locking the ring in its tongue holding position.

11. In combination, a suitable body or casing having a fixed firing pin, and a central chamber, a percussion plunger having a main portion slidably fitting in said chamber, and having a reduced portion carrying a primer to cooperate with said pin, a sta-

tionary sleeve fitted in said chamber having spring tongues normally engaging the plunger, an inertia ring interposed between said sleeve and the reduced portion of the plunger and movable to disengage the tongues from the plunger, and means for locking said ring in tongue releasing position.

12. In combination, a suitable body or casing having a fixed firing pin, and a central chamber, a percussion plunger having a main portion slidably fitting in said chamber, and having a reduced portion carrying a primer to cooperate with said pin, a stationary sleeve fitted in said chamber having spring tongues normally engaging the plunger, an inertia ring interposed between said sleeve and the reduced portion of the plunger and movable to disengage the tongues from the plunger, said reduced portion of the plunger having a shoulder, and said inertia ring a tongue or pawl to engage said shoulder when the inertia ring is moved.

13. In combination, a body or casing having a cylindrical opening or chamber at each end with an intervening ported wall, a spring pressed time plunger carried in the forward chamber carrying a primer and booster charge, mechanical time controlled means for releasing said plunger, a cap closing said chamber and holding said time controlled means in position, a percussive plunger in the rear chamber carrying a primer, a firing pin carried by said ported wall to coact with said last named primer, inertia released means for holding said plunger against movement, and a ported cap closing the rear chamber and confining said percussive plunger and means in position.

In testimony whereof, I affix my signature.

HOWARD M. GROFF.