May 22, 1928. 1,670,419

W. S. MAYER

BLASTING GUN

Filed March 6, 1924 2 Sheets-Sheet 1

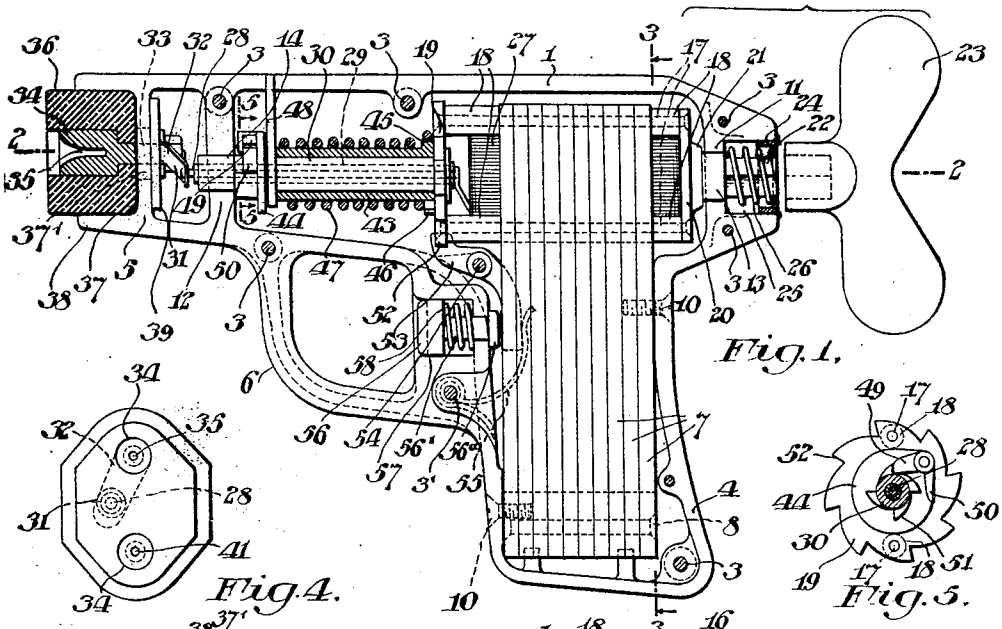


Fig. 1.

Fig. 4.

Fig. 5.

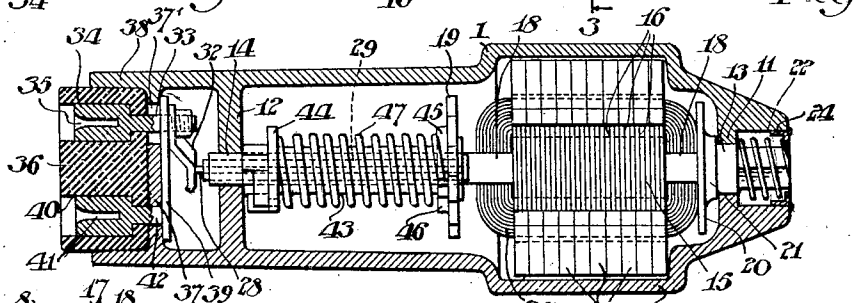


Fig. 2.

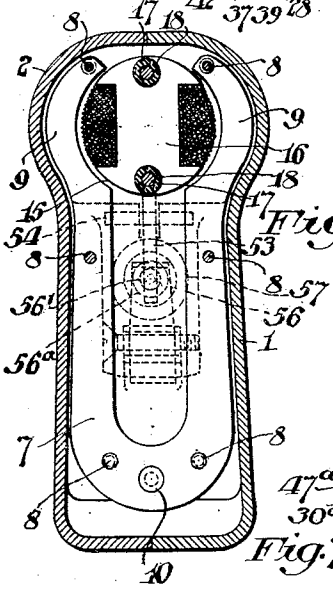


Fig. 3.

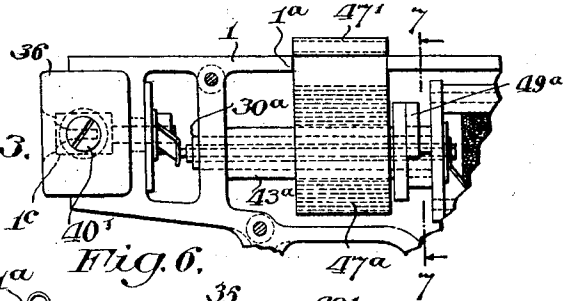


Fig. 6.

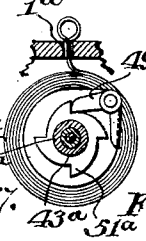


Fig. 7.

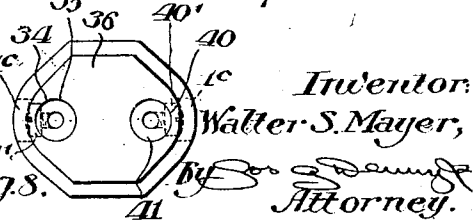


Fig. 8.

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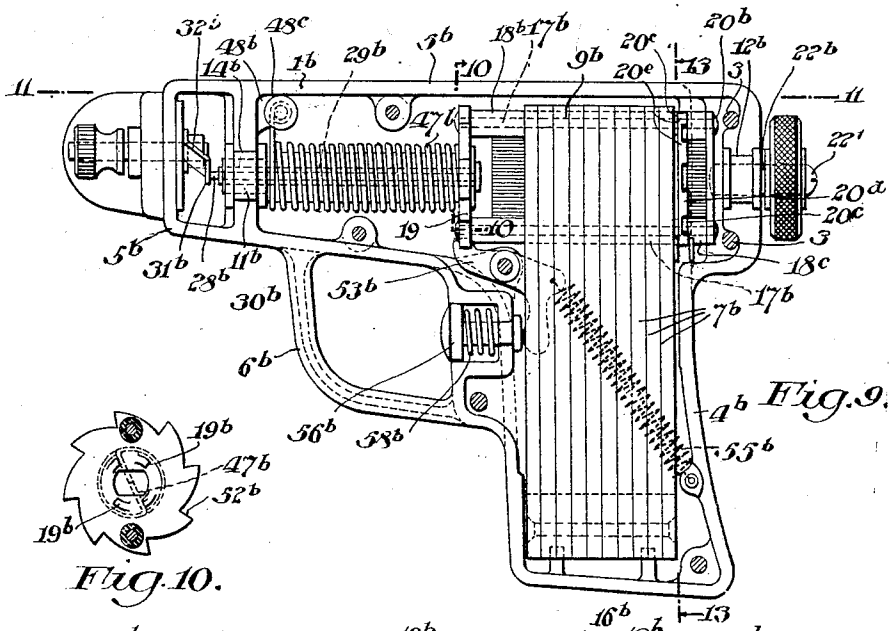


Fig. 9.

Fig. 10.

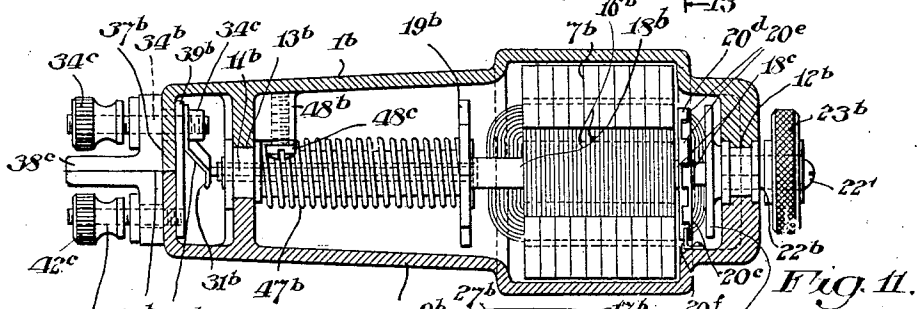


Fig. 11.

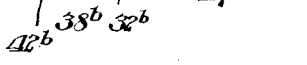


Fig. 12.

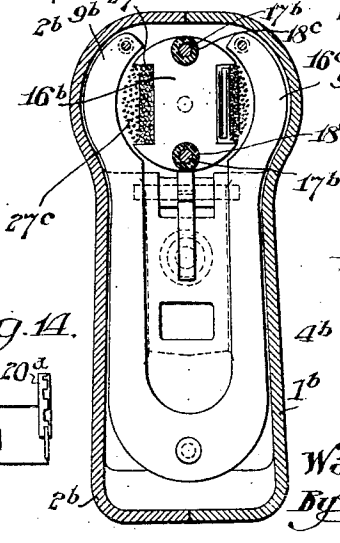


Fig. 13.

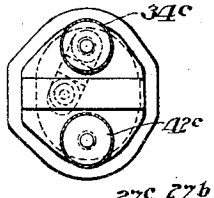
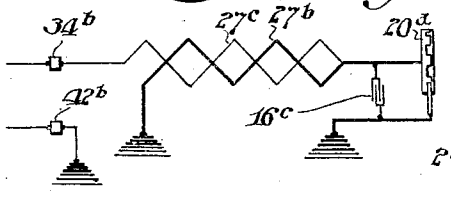


Fig. 14.



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UNITED STATES PATENT OFFICE.

WALTER S. MAYER, OF PHILADELPHIA, PENNSYLVANIA.

BLASTING GUN.

Application filed March 6, 1924. Serial No. 697,419.

My invention is designed to provide conveniently portable and operable means for furnishing an electric current or spark to effect the detonation of a blast or the like. The leading objects of my invention are the provision of a device for such uses which will be certain in operation, rugged in construction, simple and inexpensive to manufacture, and which can be carried in the pocket or on a strap without danger of inadvertent operation.

In its preferred form my invention is comprised in a hollow casing or housing of pistol-like shape forming a stock and a barrel, the housing containing a source of electric current controlled by trigger mechanism and being provided with terminals for the attachment of conductors connected with the squibs or primers of the charge. The terminals are preferably located at the muzzle of the barrel, where they are shielded from injury by a flange or guard, and the trigger may be housed in a countersunk recess and protected by a guard to prevent accidental actuation thereof.

The current is preferably derived from a generator within the housing and comprising a field magnet seated in the stock and a rotor revoluble in the barrel. Either low tension or high tension current may be secured by the provision in the rotor of a suitable armature which is rotatable by a motor, such as a spring motor, capable of storing energy until released by the manipulation of the trigger. The armature is preferably driven by the motor through an overrunning clutch such that retardation or back lash of the spring motor does not check the rotation of the armature. Potential energy may be stored in the motor by winding up the spring by means of a key, which is preferably automatically detached from the winding shaft.

In devices made in accordance with my invention, the parts primarily liable to injury or deterioration are securely housed and protected from blows and moisture, and the device may be operated to effect detonation with one hand, leaving the other free to hold the squib conductors or for other uses.

The characteristic features and advantages of my invention will more fully appear from the following description and the accompanying drawings in illustration of preferred embodiments thereof.

In the drawings, Fig. 1 is a longitudinal vertical sectional view of an embodiment of my invention; Fig. 2 is a horizontal sectional view on the line 2—2 of Fig. 1; Fig. 3 is a transverse sectional view through the stock on the line 3—3 of Fig. 1; Fig. 4 is an end view of the barrel; Fig. 5 is a transverse sectional view on the line 5—5 of Fig. 1; Fig. 6 is a fragmentary view of the barrel showing modified motive mechanism and conductor connections; Fig. 7 is a transverse sectional view on the line 7—7 of Fig. 6; Fig. 8 is a muzzle end view of the modified conductor connections; Fig. 9 is a longitudinal vertical sectional view of a modified embodiment of my invention; Fig. 10 is a transverse sectional view on line 10—10 of Fig. 9; Fig. 11 is a horizontal sectional view on the line 11—11 of Fig. 9; Fig. 12 is an end view of the barrel shown in Fig. 11; Fig. 13 is a transverse sectional view on the line 13—13 of Fig. 9; and Fig. 14 is a diagrammatic layout of the circuit involved in the operation of the device shown in Figs. 9–13.

As illustrated in Figs. 1–5 inclusive, the complementary die castings 1 and 2 are secured together by bolts or rivets 3 to form a hollow pistol-like housing having a stock 4, a barrel 5, and a trigger guard 6.

A permanent field magnet 7, composed of a plurality of laminated U-shaped stampings secured together by rivets 8 and provided with curved pole pieces 9, is fixed in the hollow stock 4 by screws 10, the curved pole pieces being disposed symmetrically on opposite sides of the axis of the barrel.

The barrel 5 contains transverse webs 11 and 12 providing bearings for the journals 13 and 14 of a rotor revoluble in the barrel. The rotor comprises an armature 15 having a core made up of laminations 16 pressed together upon the pins 17 by the collars 18 interposed between the core and the plates 19 and 20. The plate 20 has a shoulder 21 bearing against the web 11 and terminating in a shaft 22 of angular cross section for the engagement of a socketed key 23. A thimble or collar 24, splined relatively to the shaft 22 and rotatable therewith in the recess 25, is normally pressed outward, to disengage the key 23 from the shaft, by a coiled spring 26 anchored to the shaft 22 and engaging the flanged end of the thimble.

An induction coil 27 is wound and

grounded on the core 16 and is connected with a conducting rod 28 housed in a non-conducting sleeve 29 by which the rod is insulated from the plate 19 and the tubular shaft 30 fixed thereto and terminating in the journal 14. The end of the rod 28 projects from the sleeve 29 and shaft 30 into engagement with a recessed seat 31 of a spring contact 32 connected by a conducting bolt 33 with a socket terminal 34. The terminal 34 is housed in a recess 35 of an insulating plug 36 seated in a recess formed by the barrel web 37 and flange 38, and the contact 32 is insulated from the pistol casing by a non-conducting plate 39 bearing against web 37 which contains an aperture 37′ sufficiently large to permit passage of the bolt 33 without contact with the web. The plug 36 contains a further recess 40 in which is seated a socket terminal 41 electrically connected with the web 37 by a screw or bolt 42 passing through the web into engagement with the plate 39.

A sleeve 43, journalled on the shaft 30, is provided with end flanges 44 and 45, the latter bearing against the plate 19 and containing a slot 46 for the engagement of the end of a spiral spring 47 coiled about the sleeve and having its end 48 anchored in the pistol housing. The flange 44 has fulcrumed thereon a pawl or dog 49 provided with a tail 50 and adapted for coaction with ratchet teeth 51 on the shaft 30.

The plate 19 is provided with ratchet teeth 52, and a sear 53, fulcrumed on the pivot 54, has its upper end normally pressed into the path of the ratchet teeth by a leaf spring 55 journalled on the rivet 3′ and bearing against the wall of the stock. A trigger or push button 56, seated in a countersunk recess 57 and normally pressed outwardly by a coiled spring 58, has a neck 56′ projecting through an opening in the pistol housing and terminating in a head 56ª which engages the sear and rocks it out of the path of the ratchet teeth 52 when the trigger is pressed inwardly.

In the operation of my device, the key 23 is pressed upon the shaft 22 and turned anti-clockwise to rotate the plate 20, armature 16, 27, ratchet plate 19, and shaft 30. A tooth 51 on the shaft 30 rocks the tail 50 to throw the pawl 49 into the path of a succeeding tooth 31. The engagement of the pawl 49 with the tooth 51 effects the rotation of the shaft 43, thereby winding up the spring 47 and storing up potential energy. The premature clockwise rotation of the rotor by the spring is prevented by the engagement of the spring-pressed sear 53 with a tooth 52 on the plate 19. When the winding has been completed, the key 23 is automatically disengaged from the shaft 22 by the spring-pressed thimble 24.

When it is desired to detonate a charge, the ends of conducting wires connected with the squib or primer are pushed into the apertures of the terminals 34 and 41, where they may be manually held by the operator since but one hand is required for the operation of the gun itself. The conductors having been seated, the trigger 56 is pressed inward to rock the sear 53 and disengage it from the plate 19. Inadvertent operation of the trigger is prevented by housing it in the counter-bored recess 57 and by the trigger guard 6, which latter may also serve for the attachment of a carrying strap to the gun.

The disengagement of the sear 53 from the plate 19, permits the spring 47 to unwind and rapidly rotate the sleeve 43, which, through the pawl 49 and teeth 51, rotates the shaft 30 and armature winding 27. The rotation of the armature causes the winding to rapidly cut the lines of magnetic force of the field magnets and establishes an electric current which flows from the winding through the rod 28, contact 32, bolt 33, terminal 34, to the conductor (not shown) seated therein by which a sparking-producing current is transmitted to the squib or primer. The circuit is completed by a conductor (not shown) leading from the squib to the terminal 41, connected through the pistol housing with the armature core 16, on which the armature winding is grounded.

When the back lash of the unwound spring 47 tends to retard or reverse the rotation of the sleeve 43, the teeth 51 on the more rapidly rotating shaft 30 disengage from and run under the pawl 49 until the momentum of the armature rotor is exhausted. It will thus be seen that the pawl 49 and teeth 51 form a species of overrunning clutch whereby rotation may be communicated between the shafts 43 and 30, but the shaft 30 may rotate more rapidly than the shaft 43 without retardation thereby.

In the modification illustrated in Figs. 6, 7 and 8, the motive force is provided by a helical spring 47ª having its inner end connected with a sleeve 43ª and its outer end anchored to the pistol housing by projecting through a slot 1ª therein and turned over to form a pseudo "sight" 47′ along the top of the barrel. The overrunning clutch formed by the dog 49ª and teeth 51ª to connect the shaft 43ª with the shaft 30ª is arranged reversely to the showing in Figs. 1 to 5 so that the spring 47ª may be wound by the clockwise rotation of the key and the armature is rotated anti-clockwise by the expansion of the spring.

Provision is made in this modification for mechanical attachment of the squib conductors with the terminals 34 and 41. This may be conveniently effected by forming slots 1ᶜ in the barrel and tapping the muzzle block

36 and terminals 34 and 40 for the insertion of binding screws 34′ and 40′, whereby the squib conductors may be securely clamped in the sockets of the terminals.

In the modification illustrated in Figs. 9 to 14 inclusive, the complementary die castings 1^b and 2^b are secured together to form a pistol-like hollow housing comprising a stock 4^b, barrel 5^b and trigger guard 6^b. The field magnet 7^b is seated in the stock with its pole pieces 9^b on opposite sides of the axis of the barrel. A rotor is journalled in the barrel bearings 11^b, 12^b and comprises an armature and motive mechanism therefor, which may be manually rotated, to wind the spring of the motor, by a knurled knob or key 23^b secured to the shaft 22^b by a screw 22′.

The shaft 22^b has formed thereon a plate 20^b which supports one end of the bolts or rivets 17^b whose opposite ends are set in the plate 19^b. Armature core laminations 16^b are mounted on the rivets 17^b, which also support a circuit breaker member comprising an insulating disk 20^c and a conducting disk 20^d having spaced peripheral members 20^e, telescoped on the periphery of the disk 20^c. The disk 20^d is suitably insulated, as by non-conducting bushings 18^c, from the plate 20^b, rivets 17^b, and core 16^b, and the latter is spaced from the plate 19^b by bushings 18^b. A primary winding 27^b is shuttle wound and grounded on the core 16^b and on the condenser 16^c carried by the core. The primary winding 27^b is also connected with the disk 20^d and a spring contact finger 20^f mounted in the housing in the path of the contacts 20^e alternately makes and breaks the circuit of the primary winding.

A secondary coil 27^c is wound in inductive relation to the primary winding 27^b. One end of the secondary winding is electrically connected with and grounded by the primary and the other end of the secondary winding is connected with a conducting rod 28^b extending axially through a shaft 30^b and insulated therefrom by a non-conducting sleeve 29^b.

The end of the rod 28^b projecting beyond the sleeve 28^b is seated in the recess 31^b of a spring contact 32^b which is insulated from the pistol housing by a non-conducting plate 39^b bearing against a muzzle closure 37^b. A terminal guard 38^b having a median flange 38^c is fixed to the plate 37^b by the terminal bolts 34^b and 42^b, provided with the wire engaging nuts 34^c and 42^c. The contact 32^b is engaged to the bolt 34^b by a nut 34^c, and the bolt 42^b is grounded on the pistol housing.

The shaft 30^b has one of its ends firmly fixed to the plate 19^b and its other end forms the rotor journal 14^b. A spiral spring 47^b, having one end fixed to a lug 48^b by a screw 48^c, is coiled about the shaft 30^b and its free end forms a flat loop and transverse chord member which is pressed with considerable force against the plate 19^b. The plate 19^b has pressed axially from the surface thereof the inclined lugs or teeth 19^b which engage the spring 47^b when the key 23^b is turned anti-clockwise to wind the spring. The inclined faces of these teeth may, however, compress the spring axially and rotate independently thereof when the rotor is revolving clockwise faster than the spring and thus the retardation of the rotor by the backlash of the unwound spring is avoided.

The rotation of the rotor by the spring is normally prevented by the engagement of a tooth 52^b on the plate 19^b by the fulcrumed sear 53^b. The sear is normally held in the path of the teeth 52^b by the coiled spring 55^b, and may be rocked to release the rotor by the push button trigger 56^b, which is normally pressed outwardly by a coiled spring 58^b.

It will be understood that potential energy is stored in the spring motor by the anti-clockwise rotation of the key 23^b. When it is desired to effect detonation, the primer conductors are connected with the terminals 34^b and 42^b and the trigger pressed to disengage the sear from the plate 19^b. The rotation of the rotor by the spring 47^b induces electric currents in the primary winding. The rapid interruptions of the primary currents by the circuit breaker mechanism described induces currents of higher voltage in the secondary winding. The condenser minimizes sparking or surging currents due to the interruption of the primary winding circuit and intensifies the current produced in the secondary.

Having described my invention, I claim:

1. A device of the character described comprising an electric generator having a rotor, a spring wound about the axis of said rotor for rotating said rotor, means for winding said spring, means for maintaining said spring in wound condition, means for releasing said spring, and means permitting the rotation of said rotor after said spring is unwound.

2. A device of the character described comprising a field magnet, an armature rotatable adjacent to the poles of said magnet, means concentric with the axis of said armature for storing potential energy, and trigger mechanism for releasing said means to operate said armature, pawl and ratchet mechanism for permitting the rotation of said armature after said potential energy is dissipated.

3. A device of the character described comprising a housing containing a generator having a rotor comprising an armature, a spring motor in said housing in axial alignment with said rotor for rotating said armature, means adjacent one end of said housing

for winding the spring of said motor means concentric with the axis of said armature to permit the rotor to rotate after dissipation of the potential energy in said spring, and terminals adjacent to the other end of said housing and connected with said generator.

4. A blast detonating device comprising a housing forming a stock and a barrel, said housing containing a source of electric current, and wire gripping terminals adjacent to the muzzle of said barrel and connected with said source of current and means including pawl and ratchet mechanism adapted to release said source of electric current.

5. A blast detonating device comprising a housing forming a stock and barrel, of a source of electric current within said housing, a spring motor in said barrel including a spiral spring for operating said source, and a trigger for controlling the discharge of current from said source.

6. A blast detonating device comprising a housing forming a barrel and a stock and containing a source of electric current, pawl and ratchet mechanism for releasing said source of electric current, wire engaging terminals at the muzzle of said barrel, and a guard for said terminals.

7. A blast detonating device comprising a housing forming a barrel and a stock, a field magnet seated in said stock and a rotor journalled in said barrel, said rotor comprising an armature means for rotating said armature and means permitting the rotation of said armature after said rotating means is stopped.

8. A blast detonating device comprising a housing containing an electric generator and a spring motor for operating said generator, a key for winding the spring of said motor pawl and ratchet mechanism for releasing said spring motor, and means for automatically disengaging said key.

9. A blast detonating device comprising a housing containing a rotor having a shaft, a key for engaging said shaft to operate said rotor and means for automatically disengaging said key from said shaft, means for operating said rotor consisting of a helical spring wound about said shaft.

10. A device of the character described comprising a housing forming a stock and a barrel, a field magnet seated in said stock, an armature revoluble in inductive relation to said magnet, a spring motor in said barrel, ratchet mechanism connecting said motor and armature, and latching mechanism controlling said motor.

11. In a device of the character described, an electric generator rotor comprising a winding and a shaft, a helical spring coiled about said shaft for operating said rotor means permitting said rotor to rotate after said spring is uncoiled, and a conductor housed in said shaft and connected with said winding.

12. In a device of the character described, a housing forming a stock and a barrel, a field magnet in said stock, a rotor journalled in said barrel and comprising a winding shaft, an armature core, a coil wound on said core, a shaft connected with said core, a second shaft sleeved on said shaft first named, a spring coiled on said second named shaft, and pawl and ratchet mechanism whereby said spring rotates said armature.

13. A blast detonating device comprising, a housing forming a stock and a barrel, a generator stator seated in said stock, a generator rotor revoluble in said barrel, a helical spring in said barrel for operating said rotor, spring winding means at one end of said barrel, and terminals at the other end of said barrel and connected with said generator.

14. A blast detonating device comprising, a casing forming a pistol-like housing containing an electric generator having its stator housed in the stock of said housing, and its rotor revoluble in the barrel of said housing and means in said barrel for storing energy to rotate said rotor.

15. In a device of the character described, a housing forming a barrel and a stock, a field magnet disposed in said stock and having pole pieces projecting into said barrel, an armature revoluble in said barrel in proximity to said pole pieces and a motor housed in said barrel for operating said armature.

16. A detonating device comprising an electric generator consisting of a field magnet, a primary winding, and a secondary winding in inductive relation to the primary winding; and spring motor mechanism for operating said generator and means permitting the operation of said generator after said spring motor mechanism is inoperative.

17. A blast detonating device comprising an electric generator having a rotor, a spring motor for operating said rotor, and mechanism connecting said motor and rotor and comprising means for automatically disengaging said motor and rotor when the speed of said rotor exceeds the speed of said spring.

18. A blast detonating device comprising an electric generator having a rotor, a spring motor for operating said rotor, a fulcrumed sear engaging said rotor to prevent rotation thereof, a plunger for rocking said sear.

In testimony whereof I have hereunto set my hand this 29 day of Feb., 1924.

WALTER S. MAYER.