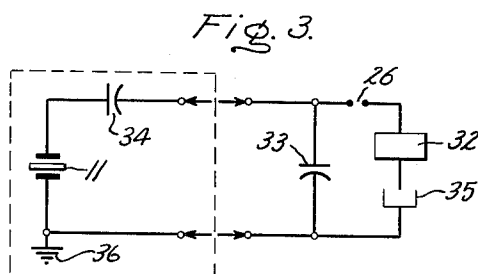
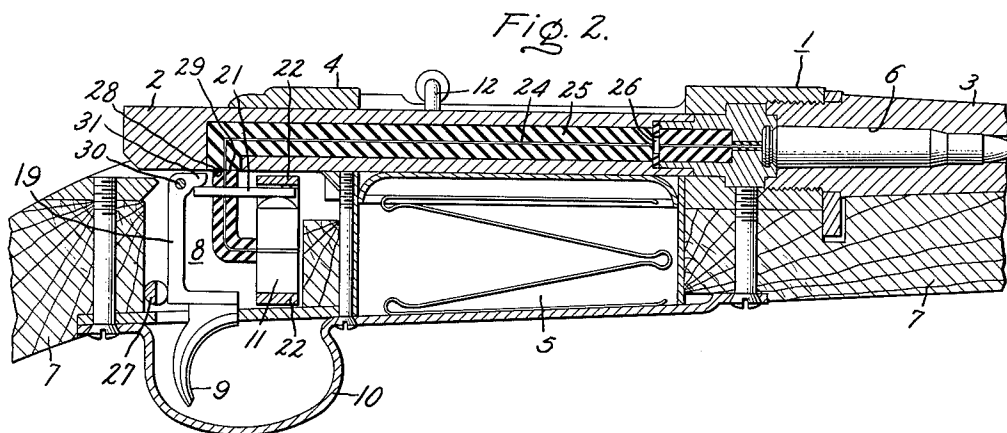
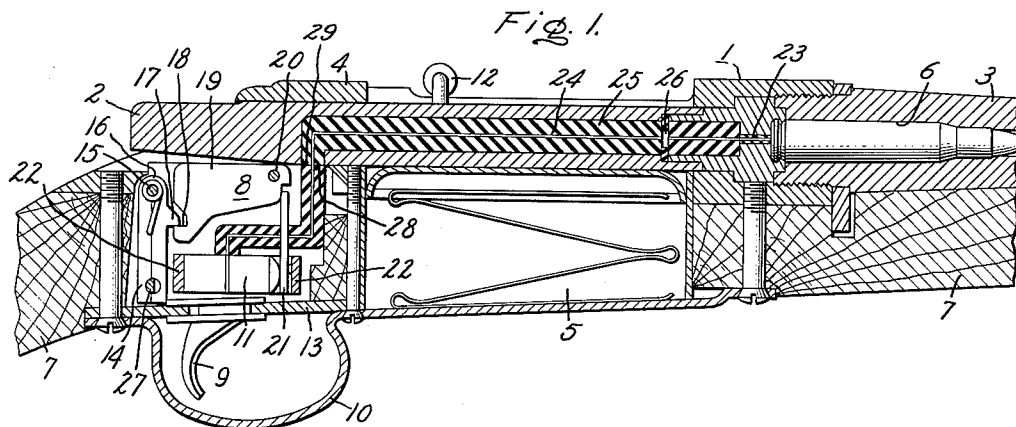


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ELECTRICALLY CONTROLLED FIREARM UTILIZING  
A PIEZO-ELECTRIC CRYSTAL  
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## ELECTRICALLY CONTROLLED FIREARM UTILIZING A PIEZO-ELECTRIC CRYSTAL

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This invention relates to firearms for use with electrically fired ammunition and in particular, to a firearm with a fire control which generates a voltage sufficient to fire ammunition.

The common type of firearm in use today employs a mechanical striker to detonate a primer which in turn ignites the propellant. Some weapons have been designed to fire electrically primed ammunition. Most of these require batteries carried in the gun, while some others have been designed with very complicated electro-magnetic devices to generate the charge necessary to fire ammunition.

There is a distinct need for an electrically controlled firearm which is simple to make and which will contain its own generating system. The use of batteries has not been accepted by the sportsman. A shooter cannot afford to rely on batteries which may go dead during a hunt leaving the gun useless. A simple, reliable electric fire control containing a foolproof and failproof source of voltage would be accepted by most shooters and would make electric guns and ammunition popular. Such a gun could be more reliable than the current guns using mechanical strikers due to the greatly reduced number of parts.

One object of this invention is to provide a firearm having a fire control mechanism which generates a potential for firing electrically primed ammunition.

A further object of this invention is to provide a fire control mechanism with a piezo electric element.

Another object of this invention is to provide a fire control with a generating element which is actuated by a reciprocating bolt.

Still another object of this invention is to provide a fire control mechanism with an element which generates a potential either when compressed or when decompressed.

Other objects and advantages of this invention will become apparent as the following description proceeds, and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In the drawings:

FIGURE 1 is a cross sectional view of a portion of a firearm incorporating one embodiment of the electric fire control mechanism;

FIGURE 2 is a cross sectional view of a portion of a firearm incorporating a second embodiment of the electric fire control mechanism; and

FIGURE 3 is a schematic wiring diagram of an electric fire control specifically for use in automatic weapons.

Reference is now made to the drawings wherein it can be seen in FIGURES 1 and 2, that the self-generating electric fire control of this invention may be utilized with any firearm 1 having a reciprocating bolt 2. Firearm 1 includes a barrel 3, receiver 4, magazine 5, chamber 6, stock 7 and fire control 8.

Fire control 8 includes the usual trigger 9 and trigger guard 10, but the remainder is quite different than normal fire control mechanism. The most important difference in fire control mechanism 8 is the inclusion of a charge generating or piezoelectric crystal element 11 and the associated mechanism, to be described hereinafter, to

actuate it. Crystal 11 is a self-generating element which can be actuated to generate a charge of electricity either by compressing the crystal or releasing the crystal from compression.

As can be seen in FIGURE 1, the firearm shown is of the reciprocating bolt type. This firearm can be a bolt action, pump action, lever action autoloader or full automatic. In any of these firearms the bolt is reciprocating in the receiver from the closed or so-called battery position, shown in FIGURE 1 to an open position. In the open position bolt 2 is retracted to allow a cartridge 34 to be loaded into chamber 6. For simplicity sake firearm 1 is shown as a bolt action rifle having a bolt handle 12 to function bolt 2.

Further referring to FIGURE 1, it can be seen that trigger 9 is slidably mounted on the bottom plate 13 of fire control mechanism 8. A trigger link 14 contacts trigger 9 at one end and is pivotally mounted on pin 15 at its opposite end. A spring 16 is arranged to bias link 14 toward trigger 9.

Link 14 carries a pawl or detent 17 positioned to engage a notch 18 formed in lever 19. Lever 19 is pivotally mounted on pin 20 and is biased upwardly and toward link 14 by spring arm 21. Crystal 11 is mounted between two ends of bracket 22 and spring 21 has one end positioned between crystal 11 and bracket 22.

The voltage generated by crystal 11 is carried to the electrode 23 by a high tension lead 24 surrounded by suitable insulation 25. The other terminal of crystal 11 is in direct contact with bracket 22 so that the metal portion of the firearm is at ground potential. A spark gap or diode 26 is provided in lead 24 so that a sufficiently high voltage required for firing is generated before the voltage is carried to the electric primer of cartridge 34 in chamber 6.

To prevent accidental discharge of the firearm, a cross-bolt type safety 27 is mounted in link 14. The portion of safety 27 passing through link 14 has a cross-sectional shape of a half circle so that in the position of FIGURE 1 link 14 is free to pivot but will be prevented from moving when safety 27 is given a quarter of a turn. To prevent firing without bolt 2 fully closed in the battery position, lead 24 is broken and provided with sliding contact surfaces 28 and 29 on the receiver and on the bolt.

The operation of the firearm shown in FIGURE 1, will now be set forth. The firearm is shown in the ready to fire position with a slight load placed upon crystal 11 by arm 21. When trigger 9 is pulled to fire the gun, lever 19 is released unloading or decompressing crystal 11 by relieving pressure exerted by arm 21. When sufficient voltage has been generated due to unloading crystal 11, the charge will jump spark gap 26 and fire the electrically primed cartridge in chamber 6. The return path as previously stated is through the metal portions of the firearm. This system obviates the need for a time storage element as the charge is used as soon as it is generated.

Once the gun is fired the action is opened by means of bolt handle 12. This retracts bolt 2 and extracts the empty cartridge case from chamber 6 and also ejects the empty case from the gun. Lever 19 is now biased upwardly to contact bolt 2. The rearward movement of bolt 2 depresses lever 19 reloading or compressing crystal 11 and reengages detent 17 with notch 18 locking lever 19 in the down or shown position. The charge generated at this time is bled off to ground because with bolt 2 open contacts 28 and 29 are disengaged and contact 28 engages the body of bolt 2 which is at ground potential.

With bolt 2 open a new cartridge can be fed into the receiver from magazine 5. If this fire control is used in a single shot gun the new cartridge would be loaded by hand. It should be remembered that no matter what

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type action the gun has the functioning of the fire control would be the same and the only difference would be in the manner in which the bolt is retracted.

When used in a pump action gun the fore end of the stock would be made to reciprocate beneath the barrel. This fore end would have one or more action bars connected to it and the bolt so as to cause the bolt to reciprocate along with the fore end. Another type of firearm using this fire control could be of the lever action type. This type of gun has a lever mounted behind or connected to the trigger guard and is arranged to be moved downwardly from the stock and back again. Suitable linkage is employed to cause bolt reciprocation with lever movement.

The fire control mechanism may also be used with any type of autoloader or full automatic firearm. In these guns the bolt is reciprocated by means of a gas system or a blowback system. In either case the bolt is reciprocated to actuate the crystal. In a full automatic weapon which continues to fire as long as the trigger is held, a time storage element is required to hold the generated charge until the bolt is completely back in the battery position. The circuitry needed for this type of firearm is discussed hereinafter.

The fire control shown in FIGURE 2, works on the same principle as the one in FIGURE 1, but requires less parts. In this system trigger 9 has link 19 made integral and the resulting trigger assembly is pivotally mounted on pin 30, so that extension 31 engages spring arm 21. The other end of arm 21 is mounted between bracket 22 and crystal 11. Trigger 27 and contacts 28 and 29 function the same as previously described and this system can be used in any of the types of weapons previously mentioned except automatic.

When trigger 9 is pulled, extension 31 depresses arm 21 loading or compressing crystal 11. When sufficient voltage is generated the charge will jump spark gap 26 and fire the ammunition. The charge generated by unloading or decompressing crystal 11 upon release of trigger 9 is grounded to the firearm. No time storage element is required in this system. In this unit the crystal is not loaded by bolt movement and a charge is generated only when the trigger is pulled.

To utilize this self-generating fire control mechanism in a fully automatic weapon requires the addition of a time storage element to the electric circuitry. In such a system which is shown in FIGURE 3, crystal 11 is loaded by recoil energy of the reciprocating bolt. As in the other systems, spark gap 26 is utilized to withhold the charge until sufficient voltage has been generated.

Time storage element 32 is used to retain the charge until the bolt closes, at which time the charge is fed to the primer of the cartridge which has been fed to the chamber. Additional safety means in the form of a voltage limiting or regulating capacitor 33 has been added to this circuit to prevent too high a charge from being fed to the circuitry of the system. While the above elements constitute the complete circuit required in a piezo electric fire control system for a completely automatic firearm, FIGURE 3 includes additional voltage smoothing capacitor 34 and shows output terminals 35. Also the connection of crystal 11 to ground 36 is shown.

What is claimed is:

1. An electric fire control mechanism for firearms of the reciprocating bolt type comprising a piezo-electric element, means to actuate said element to generate a charge and means to feed said charge to a cartridge loaded in the firearm to fire said cartridge.

2. An electric fire control mechanism for firearms of the reciprocating bolt type comprising a self-generating element, means to compress said element to generate a charge of electrical power and means to feed said charge to an electrically primed cartridge loaded in the firearm to cause said cartridge to fire.

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3. An electric fire control mechanism for firearms having reciprocating bolts comprising a self-generating element, means to normally compress said element, means to release said compression to generate a charge of electrical power and means to conduct said charge to an electrically primed cartridge loaded in the firearm to fire said cartridge.

4. An electric fire control mechanism for firearms having reciprocating bolts comprising a piezo-electric crystal to generate a charge of electric power, means to actuate said crystal to generate said charge and means to conduct said charge to an electrically primed cartridge to cause said cartridge to fire.

5. An electric fire control mechanism for firearms having reciprocating bolts comprising a piezo-electric crystal to generate a charge of electric power, means to compress said crystal to generate said charge and means to conduct said charge to an electrically primed cartridge causing said cartridge to fire.

6. An electric fire control mechanism for firearms having reciprocating bolts comprising a piezo-electric crystal to generate a charge of electric power, means normally holding said crystal in compression, means to release said compression to generate said charge and means to conduct said charge to an electrically primed cartridge causing said cartridge to fire.

7. An electrically controlled firearm comprising a barrel, bolt, receiver, stock and fire control mechanism, said mechanism having a charge generating element mounted within said receiver, a bolt positioned in said receiver for reciprocation to and from battery position, an arm mounted in said receiver in contact with said element movable between a first position in which said crystal is compressed and a second position in which said crystal is decompressed, means to move said arm from said first to said second position to cause said element to generate a charge of electric power and a trigger mounted on said receiver to release said charge to an electrically primed cartridge loaded in the firearm causing said cartridge to fire.

8. An electrically controlled firearm comprising a barrel, bolt, receiver, stock and fire control mechanism, said mechanism having a charge generating element mounted within said receiver, said element being a piezo-electric crystal which generates a charge of electric power upon being compressed and upon being decompressed, a bolt positioned in said receiver for reciprocation to and from battery position, an arm mounted in said receiver in contact with said crystal, a lever pivotally mounted in said receiver in contact with said arm, a trigger connected to said lever to pivot said arm to compress said crystal to generate said charge and a conductor connected to said crystal to carry said charge to an electrically primed cartridge loaded in the firearm causing said cartridge to fire.

9. An electrically controlled firearm comprising a barrel, bolt, receiver, stock and fire control mechanism, said mechanism having a charge generating element mounted in said receiver, said element being a piezo-electric crystal which generates a charge of electric power upon being compressed and upon being decompressed, a bolt positioned in said receiver for reciprocation to and from battery position, an arm mounted in said receiver in contact with said crystal, a lever pivotally mounted in said receiver in contact with said arm to be moved by said bolt, reciprocation of said bolt away from said battery position moves said arm to compress said crystal generating a charge of electric power, a conductor connected to said crystal, power storage means in said conductor to store said charge until said bolt returns to said battery position whereby said charge will fire a cartridge loaded in the firearm.

10. An electrically controlled firearm comprising a barrel, bolt, receiver, stock and fire control mechanism, said mechanism having a charge generating element

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mounted in said receiver, said element being a piezo-electric crystal which generates a charge of electric power upon being compressed and upon being compressed, a bolt positioned in said receiver for reciprocation to and from battery position, an arm pivotally mounted in said receiver in contact with said crystal, a lever pivotally mounted in said receiver in contact with said arm, reciprocation of said bolt away from said battery position moves said arm to compress said crystal generating a charge of electric power, means to lock said arm in said compressing position, a trigger mounted in said receiver, means connected to said trigger to release said arm generating a charge of electric power and a conductor connected to said crystal to carry said charge to an electrically primed cartridge loaded in the firearm causing said cartridge to fire.

11. An electric fire control mechanism for firearms of the reciprocating bolt type comprising a piezo-electric crystal to generate a charge of electric power, means to compress said crystal to generate said charge, means connected to said crystal to temporarily store said charge and means to conduct said charge to an electrically primed cartridge causing said cartridge to fire.

12. An electric fire control mechanism for firearms of

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the reciprocating bolt type, comprising a piezo electric crystal to generate a charge of electrical power, means normally compressing said crystal, means to decompress said crystal to generate said charge, means connected to said crystal to temporarily store said charge and means to conduct said charge to an electrically primed cartridge causing said cartridge to fire.

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