

Nov. 18, 1930.

O. A. ROSS

1,782,148

SYNCHRONIZED MACHINE GUN

Original Filed Oct. 26, 1927 2 Sheets-Sheet 1

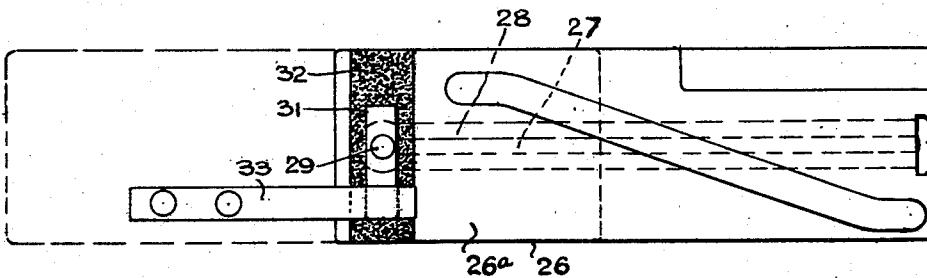
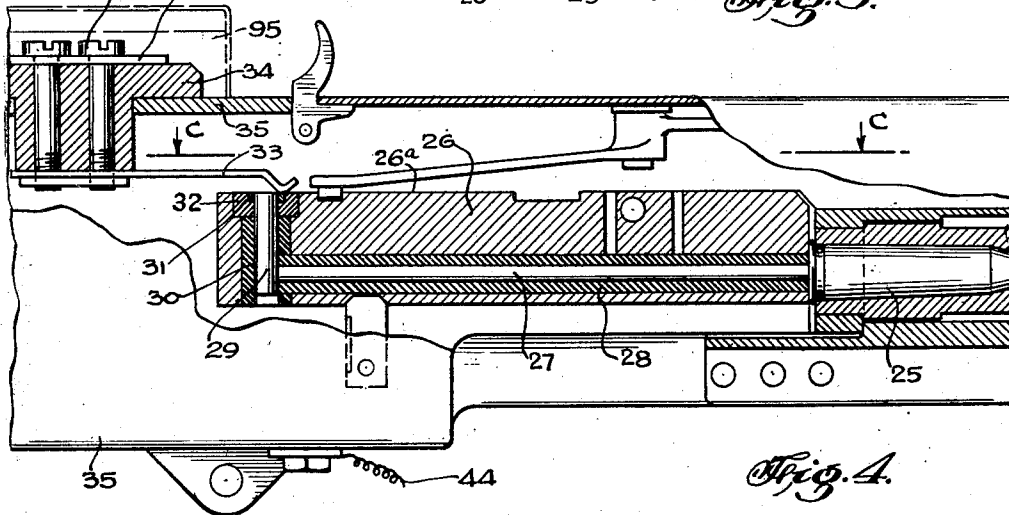
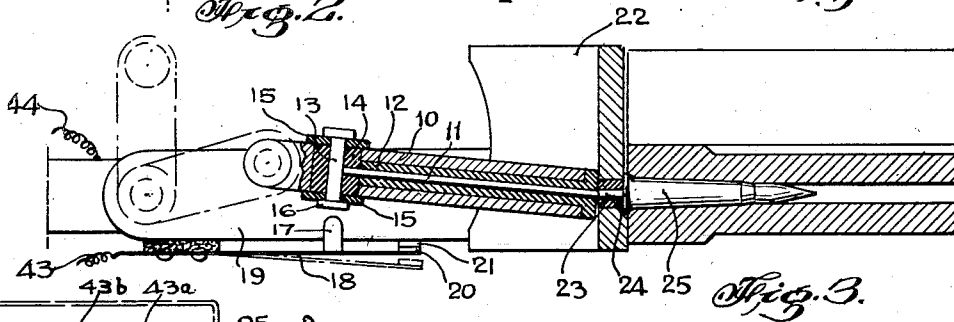
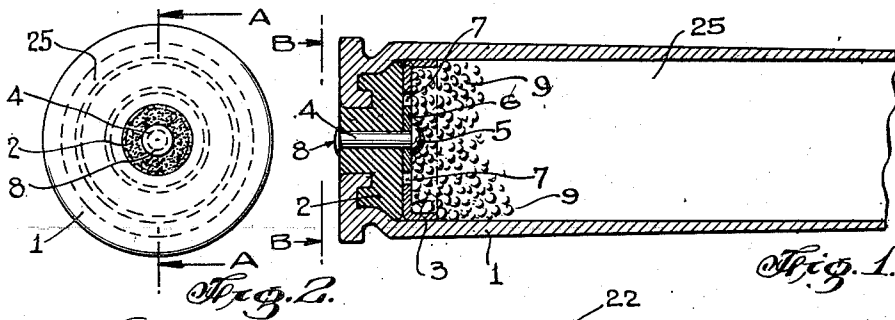


Fig. 5.

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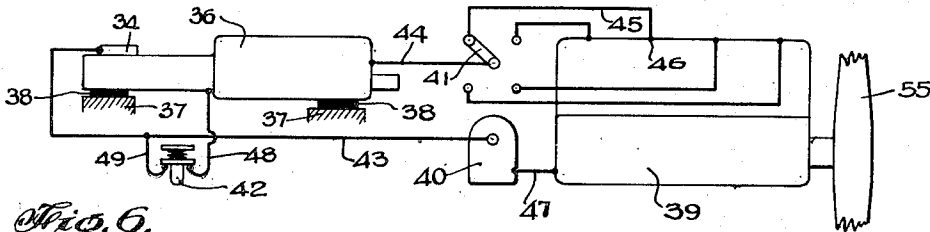


Fig. 6.

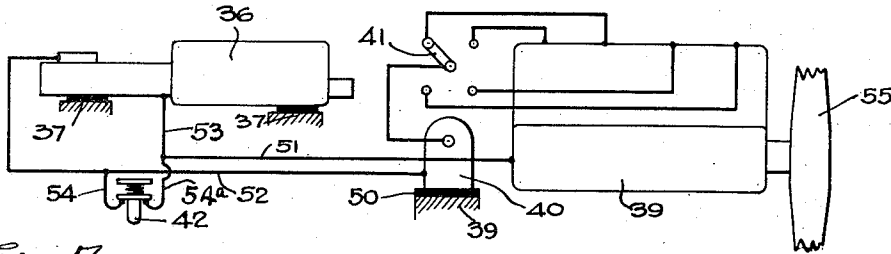


Fig. 7.

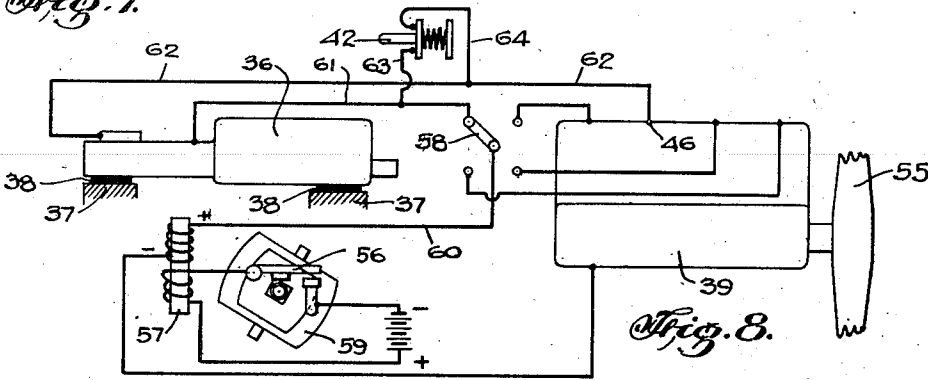


Fig. 8.

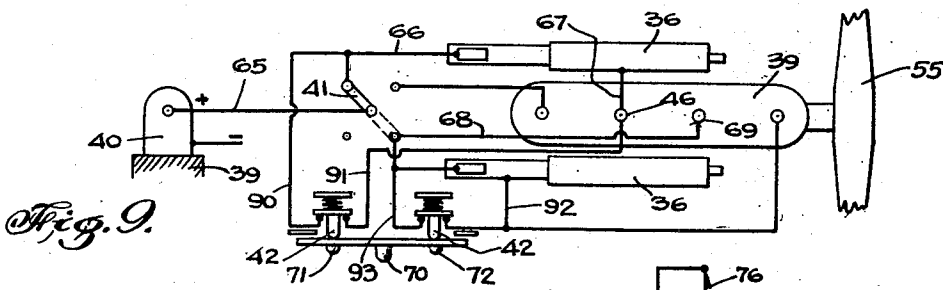


Fig. 9.

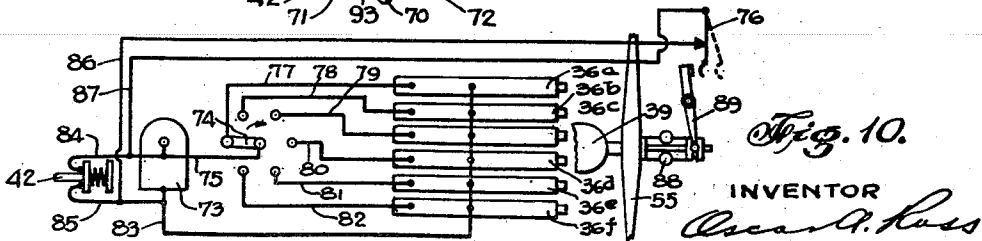


Fig. 10.

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# UNITED STATES PATENT OFFICE

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## SYNCHRONIZED MACHINE GUN

Application filed October 26, 1927, Serial No. 228,859. Renewed October 29, 1928.

This invention refers to machine guns and more particularly to machine guns employed on airplanes for attack or defense purposes.

5 One object is to simplify machine gun mechanisms by firing the cartridge powder charge by an electric spark thereby eliminating the use of a movable firing pin and its incident mechanisms, the cocking mechanism and trigger mechanism.

10 Another object is to furnish more safe ammunition in the form of cartridges, applicant's improved cartridges being formed without the use of percussion caps and the easily explodable fulminate of mercury contained therein.

15 Another object is to eliminate the synchronizing mechanism usually associated with machine guns which are synchronized to fire with the propeller blades of the airplane. This is accomplished by firing the cartridge with a high tension electric spark and preferably employing the same electrical ignition system as is usually associated with 25 the hydro-carbon motor employed for driving the airplane, the firing circuit being placed in series with the motor high tension ignition circuit.

30 Another object is to provide novel means whereby the guns when not in use permit normal operation of the ignition circuit and also permit continual operation of said circuit when the guns are being fired.

35 Another object is to furnish means whereby a plurality of machine guns may be fired not only in synchronism with propeller blades of an airplane, but also sequentially whereby a very rapid or large volume fire may be obtained at the same time giving each 40 gun ample time to complete its cycle of loading before it is again fired.

45 Another object is to furnish means whereby the time of firing of a synchronized machine gun may be advanced as the speed of the propeller is increased, in this manner permitting the bullet to intercept the plane of the blade movement at substantially the same relative distance from the blade edge, irrespective of motor speed.

50 Other objects and advantages will appear

as the description of the invention progresses, and the novel features of the invention will be pointed out in the appended claims.

This invention consists in the novel construction and arrangement of parts hereinafter described, delineated in the accompanying drawings, and particularly pointed out in that portion of the instrument wherein patentable novelty is claimed for certain and peculiar features of the invention, it being understood that, within the scope of what hereinafter thus is claimed, divers changes in the form, proportions, size and minor details of the system may be made without departing from the spirit of, or sacrificing any of the details of the invention.

In describing the invention in detail, reference is had to the accompanying drawings wherein I have illustrated embodiments of my invention, and wherein like characters of reference designate corresponding parts throughout the several views, and in which:

7 Figure 1, is a sectional view of applicant's improved cartridge and is taken on line A—A of Fig. 2, and Fig. 2, is an end view of the same taken on line B—B of Fig. 1, and Fig. 3, is a sectional view of a portion of a Vickers machine gun to which applicant's 8 novel system has been applied and, Fig. 4, is a sectional view of a portion of a Browning machine gun to which applicant's novel system has been applied, and, Fig. 5, is a top view of the "bolt" showing the application of applicant's system and is taken on 81 line C—C, Fig. 4, and Fig. 6, is a diagrammatic view of one adaptation of applicant's system, and Fig. 7, is also a diagrammatic view of another adaptation, and Fig. 8, is 90 also a diagrammatic view of still another adaptation, and, Fig. 9, is also a diagrammatic view of another adaptation, and Fig. 10, is also a diagrammatic view of still another adaptation. 94

Referring to Figs. 1 and 2, into shell 1 of cartridge 25, is molded or inserted insulating member 2, restrained into position by annular angle ring 3. Centrally disposed in insulating member 2, is the electrode 4, the 10

head 5 of which allocates washer 6 whereby an annular spark gap 7 is formed between said washer and annular angle ring 3, whereby an electric spark jumping said gap will ignite powder grains 9—9.

Referring to Fig. 3, showing a Vickers machine gun in the final stages of loading, the usual firing pin has been removed from the bolt 10 and in place thereof has been substituted by an electrode 11 and insulating sleeve 12. The left hand end of said electrode contacts with contact member 13, also insulatively supported by bolt 10 by means of insulated bushing 14 and washers 15—15, the head 16 of said contact member being adapted to impinge on contact 17 secured to contact spring 18, the free end of said spring also supporting contact 20 arranged to impinge on contact 21 secured to gun frame 19, said latter contacts acting to short circuit the gun circuit during a predetermined period of operation of the gun mechanism insulatively supported by the gun frame 19. The breech-block 22 is also modified to include electrode 23 insulated therefrom by insulating bushing 24, said electrode being adapted to furnish an electrical path from electrode 11 to head 8 of electrode 4 of cartridge 25.

Referring to Fig. 4, showing a Browning machine gun which is assumed to be loaded and ready to fire, the bolt 26 has been modified by supplanting the usual firing pin and parts incidental thereto, by an electrode 27 insulatively supported by insulating sleeve 28. The right hand end of said electrode is adapted to contact with head 8 of electrode 4 of cartridge 25, whereas the left hand end impinges on contact post 29 insulated by bushing 30, and the upper end of which is secured to contact plate 31 insulated from bolt 26 by insulating member 32 and is adapted to contact with contact spring 33 supported by insulating block 34 secured to gun frame 35. Contact spring 39 contacts with plate 31 only when the bolt 26 is "home" namely in position to fire cartridge 25. As said block is moved to the left by action of the discharge of the gun in known manner, the spring 39 will contact on the surface 26<sup>a</sup> thereof, thereby short circuiting the firing circuit through electrodes 29, 27, 4 and shell 25.

Referring to Fig. 6, showing a system wherein a machine gun 36 mounted on the airplane body 37 but insulated therefrom by insulation 38—38. The motor 39 also suitably mounted on the airplane 37 comprises in part high tension magneto 40 having distributor 41. The high tension current which normally passes from the magneto has been interrupted to include the circuit of machine gun 36. This circuit is normally shunted by push button or switch 42.

The operation of this system is as follows:—assuming pushbutton 42 is depressed,

and the magneto distributor in the position shown, the current from magneto 40 passes through wire 43 to terminal 43<sup>a</sup> (Fig. 4) thence through screws 43<sup>b</sup> to contact spring 33, thence to contact strip 31 and thence through post 29, electrodes 27, 4 and washer 6, (Fig. 1) to spark gap 7 where it jumps to ring 3 thereby causing a spark which ignites the powder grain 9—9 in this manner firing the cartridge 25. From ring 3 the current returns through the shell 1 and the frame of the gun to wire 44 and thence to distributor 41, to wire 45, spark plug 46, motor 39 returning via ground 47 to magneto 40. Whereas the circuit has been described as passing through motor spark plug 46, it may pass through any other plug dependent upon the position of distributor 41 when button 42 is depressed. Push button 42 normally shunts out the gun circuit through wires 48 and 49. The gun 36 is assumed to be firing from airplane 37 at a location other than between the propeller blades. In other words it is not synchronized with said propeller blades. Furthermore the magneto 40 is assumed to be normally grounded to the motor 39.

Referring to Fig. 7, showing a system similar to that disclosed in Fig. 6, the magneto 40 is insulated from motor 39 by insulating member 50. The high tension current passes from magneto 40 to the distributor and motor plugs in normal manner. However, after passing to the motor body the current may pass through the airplane frame to the gun frame, or by wires, as 51 and 53, whereafter it passes through the gun circuit in reverse direction from that heretofore described in connection with Fig. 6, and thence through wire 52 to the frame of magneto 40. The gun circuit is shunted out by wires 54, 52<sup>a</sup> normally shortcircuited by circuit closer 42.

Referring to Fig. 8, showing a system wherein a machine gun 36 is assumed to be arranged to fire in synchronism with the propeller 55, and also arranged to have the time of firing advanced as the speed of said propeller is increased, the magneto 40 has been supplanted with the well known battery form of ignition comprising the low tension circuit breaker, or timer 56, induction coil 57, and distributor 58, said distributor and circuit breaker being driven from a common shaft actuated by motor 39 in well known manner, a governor 59 being arranged to advance the circuit interruption of circuit breaker 56. A gun 36 is synchronized with propeller 55 and said propeller has been mounted on the motor 39 in a manner whereby the distributor 58 fires gun 36 and spark plug 46 just after a blade of propeller 55 has passed its line of fire at substantially zero speed. The firing circuit is as follows:—From induction coil 57, wire 60,

distributor 58, and, assuming push button 42 is depressed, wire 61. frame of gun 36, thence through gun circuit in reverse direction from that described in connection with Fig. 6, thence to wire 62 to spark plug 46, returning via motor ground to induction coil 57. As motor 39 is increased in speed governor 59 advances the firing periods of the motor ignition system, simultaneously advancing the time of firing of gun 36. The advancing of time of firing of synchronized machine guns is more fully described in my copending application Serial No. 182,346, filed April 9, 1927. Push button 42 shunts out gun 36 through wires 63 and 64 when said gun is not to be fired.

Referring to Fig. 9, showing a system wherein two machine guns as 36—36 insulatively mounted and which are adapted to be fired in synchronism with blades of propeller 55. This system is similar to that disclosed in Fig. 7, in that both guns 36—36 are fired in synchronism with propeller 55. However the battery ignition system has been supplanted by the ignition magneto 40, and whereas guns 36—36 fire in synchronism with propeller 55, the firing periods are not assumed to be advanced simultaneously with increase of motor speed. Guns 36—36 are however fired sequentially as more fully described in my Patent #1,454,137, issued May 8, 1923, however in this system the gun-fire is controlled by, and forms part of the ignition system associated with airplane motors. Whereas in Figs. 6, 7 and 8 a side view of motor 39 has been shown, in Fig. 9 a top view is shown. The gun 36 above motor 39, or normally at the left thereof, is fired through the ignition circuit to ignition plug 46 as follows:—from magneto 40, wire 65, distributor 41, and assuming left hand push button 42 is depressed, wire 66, gun 36, wire 67, plug 46, returning to magneto 40 via ground on motor 39. The gun 36 below motor 39, or normally to the right thereof, is fired as follows:—from magneto 40, wire 65, distributor 41, (in dotted position) and assuming right hand push button 42 is depressed, wire 68, spark plug 69, returning to magneto 40, via ground on motor 39. Propeller 55 is secured to motor 39 in a manner whereby, and with said motor operating at approximately 1000 R. P. M., the upper gun 36 will be fired to cause its bullets to intersect the plane of movement of one blade of propeller 55 just as said blade has passed the line of fire of said gun, and the lower gun 36 will be fired to cause its bullets to intersect said plane of movement just as the other blade has passed the line of fire of said last named gun. To prevent firing of said guns during speeds less than 1000 R. P. M. this system may be supplied with a centrifuge shunting switch as will be more fully hereinafter described in connection with Fig. 10.

The push buttons 42—42 are controlled by a master button 70, which if depressed actuates both the buttons 42—42, or if desired button 71 may be depressed to operate the left hand button 42 independently or button 72 may be depressed to operate the right hand button 42 independently.

Wires 90 and 91 act to shunt out the circuit of the upper gun and wires 92 and 93 act to shunt out the circuit of the lower gun 36.

Referring to Fig. 10, showing a system wherein a plurality of machine guns, as 36<sup>a</sup> to 36<sup>f</sup> inclusive are fired sequentially in synchronism with an airplane propeller, as 55. By reference to computations disclosed in my copending application Serial No. 182,346 filed April 9, 1927, it will be noted that to obtain a maximum of volume fire in a substantially short interval of time approximately six machine guns should be fired preferably in sequential order. Whereas in Figs. 6 to 9 inclusive the systems disclosed therein have included the ignition circuit of the airplane motor, in this system a separate and distinct high tension circuit is employed for firing the guns, comprising a magneto 73 and distributor 74, the latter preferably forming part of said magneto. With motor 39 operating at 1000 or more R. P. M. the guns 36<sup>a</sup> to 36<sup>f</sup> inclusive are arranged to fire sequentially, gun 36<sup>a</sup> firing to cause its bullet to intersect the plane of movement of propeller 55 just as one blade has passed its line of fire, and gun 36<sup>b</sup> firing to cause its bullet to intersect the plane of movement of said propeller just as the next blade has passed its line of fire, this sequence continuing until gun 36<sup>a</sup> is again fired. The firing circuit is as follows:—from magneto 73, and assuming push button 42 is depressed and contact lever 76 is in dotted position, wire 75, distributor 74, to any one of wires 77 to 82 inclusive, as shown, to wire 77, gun 36<sup>a</sup>, wire 83 returning to magneto 73. Normally magneto 73 is short circuited by wires 84 and 85 and push button 42. Magneto 73 is also normally short circuited by wires 86 and 87 and contact lever 76 adapted to be opened by lever 88 actuated by centrifuge 89 driven by motor 39. At motor speeds below 1000 R. P. M. contact lever 76 short circuits magneto 73 through wires 86 and 87 whereby the guns 36<sup>a</sup> to 36<sup>f</sup> inclusive cannot be fired. When the speed of motor 39 exceeds 1000 R. P. M. the centrifuge acts to rotate lever 89 and move contact lever 76 to the dotted position, whereafter depression of button 42 will permit guns 36<sup>a</sup> to 36<sup>f</sup> inclusive to be fired.

The gun circuit through the Vickers gun shown in Fig. 3, is as follows: wire 43, contact spring 18, contact 17, contact 16, member 13, electrode 11, electrode 23, electrode 4 of cartridge 25, spark gap 7, shell 1 to gun frame 19 and thence to wire 44.

To prevent disturbance of wireless appa-

ratus usually associated with airplanes all wires are metal clad or armoured and all terminals are suitably housed by metal lined covers, as for example cover 95.

5 Whereas in Fig. 10, a magneto has been shown as the electrical generating unit, it is obvious that an induction coil in connection with a battery, or a high ratio conversion transformer operating from an alternating  
10 current source may be employed. Also that distributor contacts may be non-uniformly spaced for the purpose of firing at a more advantageous location of one or more of the guns, as 36<sup>a</sup> to 36<sup>t</sup>.

15 What I claim is:—

1. A system for firing machine guns comprising in combination; a machine gun, a cartridge therefor arranged to be fired by an electric spark generated therein, an electric  
20 circuit carried by the gun in a manner whereby and as electric current is passed there-through it will produce a spark in the cartridge, an internal combustion motor, a high tension ignition circuit carried thereby,  
25 means for including the gun circuit in the ignition circuit to fire the gun, means normally annulling the including means, and manually operated means for cancelling the annulling means whereby the gun  
30 circuit will be included in the ignition circuit.

2. A system for firing machine guns comprising in combination; a machine gun, a cartridge therefor adapted to be fired by  
35 passage of electric current therethrough, an electric circuit carried by the gun arranged in electrical relation to the cartridge, an internal combustion motor, a high tension ignition circuit, therefor, means for including  
40 the gun circuit in series with the ignition circuit to fire the cartridge, means normally shunting out the gun circuit from the ignition circuit, and manually operated means for annulling the shunting means whereby the  
45 gun circuit will be included in series with the ignition circuit.

3. A system for firing machine guns comprising in combination; a machine gun, a cartridge therefor, an insulated electrode carried by the cartridge, a spark gap formed  
50 between the electrode and the cartridge body arranged in a manner to ignite the powder charge contained therein, an electric circuit carried by the gun arranged in electrical contact with the cartridge electrode, an internal  
55 combustion motor, a high tension ignition circuit therefor, means for including the gun circuit, the electrode and the spark gap in series with the ignition circuit, means normally shunting out the gun circuit, the electrode and the spark gap, and manually operated means for annulling the shunting means whereby the gun circuit, the electrode and the spark gap will be included in series with  
60 the ignition circuit.  
65

4. In combination with a machine gun having a movable breech block, of ammunition therefor arranged to be electrically fired, an electric circuit carried by the gun arranged to fire the ammunition, a source of energy  
70 for energizing the circuit, normally disconnected therefrom, means for connecting the source to the circuit for firing the ammunition, means rendered effective by movement of the breech block during ejection and loading  
75 cycles for short-circuiting the firing circuit whereby the energy will be shunted around the ammunition and prevent firing thereof, and means rendered effective after the breech block has completed the cycles  
80 for cancelling the short-circuit whereby the energy will be supplied to the circuit for firing the ammunition when the energy is connected to the circuit by the connecting means.

5. In combination with a machine gun having a movable breech block, of ammunition therefor arranged to be electrically fired, an electric circuit carried by the gun arranged to fire the ammunition, a source of energy for  
85 energizing the circuit, means rendered effective by movement of the breech block during the ejection and loading cycles for short-circuiting the firing circuit whereby the energy will be shunted around the ammunition and prevent firing thereof, and means rendered  
90 effective after the breech block has completed the cycles for cancelling the short-circuit whereby the energy will be supplied to the circuit for firing the ammunition.

6. In combination with a machine gun having a movable breech block, of ammunition therefor arranged to be electrically fired, an electric circuit carried by the gun arranged to fire the ammunition, a source of energy for  
100 energizing the circuit, a circuit controller arranged to short-circuit the firing circuit whereby the energy will be shunted around the ammunition and prevent firing thereof, means associated with the breech block for effecting the short-circuit by the circuit controller during the ejection and loading cycles  
105 of the gun whereby the energy is shunted around the ammunition and a cancellation thereof is effected after the cycles are completed and the block is home whereby the  
110 energy thereafter will be supplied to the ammunition for the firing thereof.

7. In combination, an internal combustion motor arranged to drive an airplane propeller, an electrical ignition circuit therefor, a  
120 centrifuge driven by the motor arranged to vary the time of firing of the ignition circuit as the speed of the motor is varied, a machine gun arranged to be fired between the blades of the propeller, electrically fired ammunition therefor arranged to be fired by inclusion in the ignition circuit whereby the time of firing of the gun will be varied by the variation in speed of the motor, and means  
125 actuated at will for including the ammunition  
130

tion in the circuit normally effecting exclusion thereof whereby the ammunition will not be fired.

8. In combination, an internal combustion motor, a normally closed ignition circuit therefor, a machine gun, electrically fired ammunition therefor arranged to be fired by inclusion in the circuit, and means actuated at will for including the ammunition in the circuit normally effecting exclusion thereof whereby the ammunition will not be fired.

9. In combination, an internal combustion motor, a normally flowing ignition circuit therefor, a machine gun, electrically fired ammunition therefor arranged to be fired by inclusion in the circuit, and means carried by the gun normally effecting inclusion of the ammunition in the circuit arranged to effect exclusion thereof during the ejection and loading cycles of the gun.

10. In combination, an internal combustion motor, a normally flowing ignition circuit therefor, a machine gun, electrically fired ammunition therefor arranged to be fired by inclusion in the circuit, means carried by the gun normally effecting inclusion of the ammunition in the circuit arranged to effect exclusion thereof during the ejection and loading cycles of the gun, and means actuated at will for including the ammunition in the circuit normally effecting exclusion thereof whereby the firing thereof will not be effected.

11. In combination with an internal combustion motor having an ignition system for ignition of the explosive charges therein and a machine gun arranged to fire electrically fired ammunition, of means for firing the ammunition in synchronism with the ignition of the explosive charges in the motor.

12. In combination with an internal combustion motor having an ignition system for ignition of the explosive charge therein and a machine gun arranged to fire electrically fired ammunition therefrom, of means for firing the ammunition in synchronism with the ignition of the explosive charges in the motor, means for normally annulling the firing of the ammunition whereby ignition of the charges will not fire the ammunition, and means operated at will for cancelling the annulling means whereby the ammunition will be fired when and as the charges are ignited.

In testimony whereof I hereby affix my signature.

OSCAR A. ROSS.