

July 9, 1946.

F. JAN W. DEN OUDEN
GUNFIRE SYNCHRONIZING CONTROL
Filed March 30, 1944

2,403,641

FIG. 1

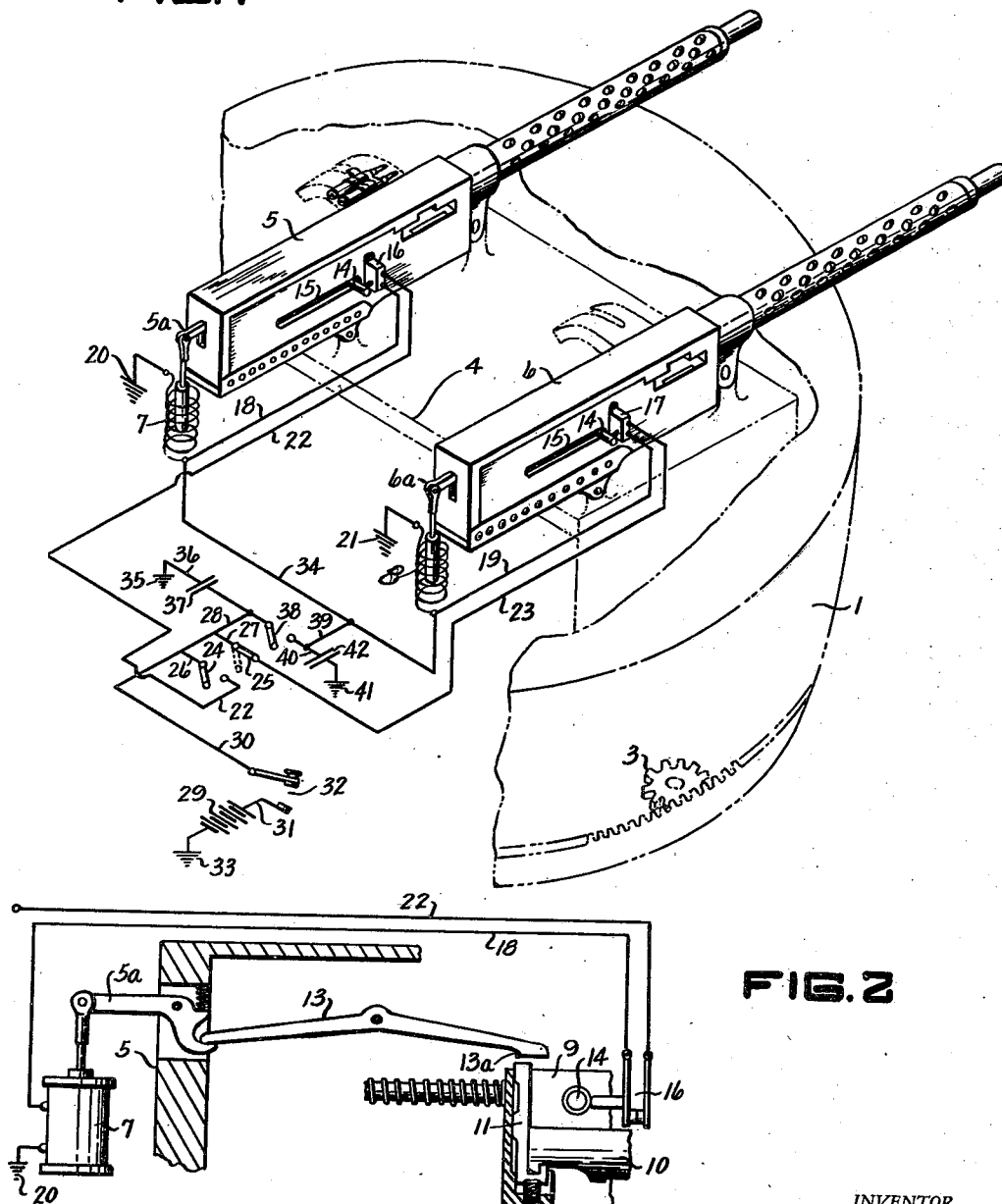


FIG. 2

INVENTOR

F. JAN W. DEN OUDEN

Joseph H. Hagell
and
Claude K. Kroyer
ATTORNEYS

UNITED STATES PATENT OFFICE

2,403,641

GUNFIRE SYNCHRONIZING CONTROL

Frits Jan Willem den Ouden, Melbourne,
Victoria, Australia.

Application March 30, 1944, Serial No. 528,759

3 Claims: (Cl. 89—28)

1

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

This invention relates to improvements in gun fire control apparatus, and more particularly, to means for synchronizing the fire of a plurality of automatically operable guns.

An object of the invention is the provision of means for synchronizing fire of a plurality of automatically operable guns of the machine gun type by controlling the discharge of the guns by the reloading operation of one of the guns.

In multiple machine gun mounts, such as those used in turrets of airplanes and the like, it has been found that there is a considerable variation in the accuracy of fire from these guns, depending upon whether the guns are fired in synchronism or not, this being especially true where the guns are mounted in turrets in tandem mounts. The rate of fire of these machine guns is adjustable, but since these guns, after the triggers are actuated, fire and reload independently of each other, it is practically impossible to adjust both guns to fire exactly the same number of rounds per minute, and consequently, if the triggers are depressed for a prolonged burst of fire, the guns are soon firing out of synchronism with each other. Apparently, the recoil or shock of the faster firing gun causes the mount and turret to be vibrated and this shock is communicated to the other or slower firing gun, reducing the accuracy of this latter gun, and consequently, the corresponding subsequent explosion of the slower firing gun then similarly affects the accuracy or bullet dispersion following the subsequent explosion of the cartridge in the faster firing gun.

In addition to the above, these machine guns are usually mounted in the turrets at either side of a vertical plane passing between the guns through the center of the turret, and any slight play or resiliency existing in the turret rotating mechanism will cause the alternate firing of the two guns, when they are out of synchronism, to produce a slight oscillatory motion of the turret with a corresponding increase in the bullet dispersion area and a marked decrease in the accuracy of fire. It has been found that the area of bullet dispersion between two machine guns in a turret mount, when firing in synchronism, may be as little as one-sixth of the bullet dispersion area when the guns are firing out of synchronism.

A further object of the invention is the provi-

2

sion of means for controlling the firing operation of a plurality of machine guns in a common or multiple gun mount so that the discharge of the faster firing guns is controlled by the operation of the slowest firing gun.

A still further object is the provision of a gun fire control system for remotely controlled tandem mounted machine guns having relatively different rates of fire in which means are provided for retarding the discharge of the faster firing gun by the gun loading operation of the slower firing gun.

A further object is the provision, in a multiple machine gun firing remotely controlled apparatus having a plurality of machine guns firing and reloading in different time periods, of means which includes a common gun firing control circuit for said guns and circuit interrupting means operable to interrupt the firing circuit of all of the guns when the slower firing gun is not in gun firing position.

Another object of the invention is to control the firing operation of one gun of remotely controlled tandem mounted machine guns by the position of the breech bolt of the other gun.

Other objects and advantages of the invention will become apparent in the following description taken in connection with the accompanying drawing in which like reference characters refer to like parts on the several figures.

Fig. 1 is a somewhat diagrammatic perspective view disclosing a tandem gun mount of the turret type having my improved gun fire synchronizing control incorporated therein and schematically illustrating a wiring diagram for the remote fire control of the guns.

Fig. 2 is a fragmentary diagrammatic view illustrating the trigger release mechanism of a machine gun, and electro-magnetic means for actuating the trigger to fire the gun.

Referring particularly to Fig. 1 of the drawing, the numeral 1 indicates a gun turret such as used in air planes and the like, having a rack or ring gear. A pinion 3 is disposed in meshing relation with the rack 2 for rotatably adjusting the turret under the control of a suitable power driven adjusting mechanism (not shown). The turret carries a tandem or multi-gun mount 4 on which are positioned the right-hand and left-hand machine guns 5 and 6. Each of the guns 5 and 6 is provided with a trigger, as indicated in the drawing at 5a and 6a, respectively, and these triggers are actuated by trigger actuating solenoids 7 and 8.

Each of the guns 5 and 6 is of the conventional

machine gun type, as disclosed in Patents 2,050,539 and 2,108,060, reference being made to these patents for the internal firing and loading mechanism of the guns.

Referring now to Fig. 2, the guns each have a breech bolt 9 carrying a firing pin 10 which, when cocked, is engaged by a vertical sear member 11 normally held in raised latching position by the spring 12 to prevent the firing pin from exploding the cartridge in the barrel. Actuation of the trigger 5a (or 6a) rocks the sear actuating member or trigger bar 13 to depress the sear 11, releasing the firing pin 10 in the usual manner. When the trigger is held depressed or in firing position, the cam portion 13a depresses the sear 13 as the breech bolt moves forward, releasing the firing pin to fire the fresh cartridge inserted in the barrel incident to the auto-loading action of the gun. The energizing of the solenoid 7 (or 8) moves and holds the trigger 5 (or 6) in firing position.

In carrying out my invention, I provide a laterally extending projection 14 on each of the breech bolts 9 of the machine guns 5 and 6. These projections extend through guide slots 15 in the receivers of the guns 5 and 6. When the guns are in firing position these projections are disposed in the forward ends of the slots 15, as indicated in Fig. 1 of the drawing. The normally open microswitch 16 is secured to the side of the receiver of the gun 5 in advance of the laterally extending projection 14 so as to be actuated by this projection when the breech bolt 9 of the gun is in its forward or firing position. The machine gun 6 also has secured to the receiver a normally open microswitch 17 arranged to be closed by the laterally extending projection 14 on that gun when the breech bolt is in firing position. Electrical conductors 18 and 19 are connected respectively to one terminal of each of the microswitches 16 and 17 while the other ends of the conductors are connected with the trigger actuating solenoids 7 and 8, the other terminal of each solenoid being grounded to the frame or gun mount, as indicated at 20 and 21. The other terminals of the two microswitches 16 and 17 are connected by the conductors 22 and 23 to one end terminal of each of the gun fire synchronizing control switches 24 and 25. The other end terminals of the switches 24 and 25 are respectively connected by the conductors 26 and 27 to a common feed wire or conductor 28, leading from a battery or other electrical power source 29. The remote gun control circuit, including the conductors 30 and 31 and the fire control button 32 is interposed in the conductor 28 between the gun firing synchronizing control switches 24 and 25 and the battery 29; the other side of the battery is connected or grounded to the frame or gun mount in the usual manner, as indicated at 33.

A conductor 34 is connected at its ends to the conductors 18 and 19 at some point intermediate the microswitches 16 and 17 and the solenoid coils 7 and 8, which are connected respectively to the conductors 18 and 19. The common feed wire or conductor 28 is connected to the ground or gun mount at 35 by a conductor 36, having a condenser 37 interposed between the ground and the conductor to prevent sparking at the microswitch circuit closing terminals. The conductor wire 28 is also connected to one end terminal of a circuit controlling switch device 38, while the other terminal of the switch device is connected by a conductor 39 to the conductor 34 between the

wires 18 and 19 leading to the microswitches 16 and 17. A conductor wire 40 is connected to the other terminal of the switch device 38 at one end and grounded at the other end as indicated at 41, and has a condenser 42 interposed in its length between its end connections.

In the operation of the device it is first necessary to determine which of the guns is the slower firing gun. In the event of a multi-gun mount carrying three or more guns, the slowest firing gun must be determined, since this is the governing gun for the firing operation of the other guns, and once this has been determined, one of the synchronizing control switches 24 or 25 in circuit with the microswitch on the receiver on the slower firing gun will be closed, energizing the circuit including the solenoid trigger depressing mechanism and the microswitch for the slower firing gun.

Assuming that the machine gun 5 has been found to fire 700 rounds per minute while the gun 6 only fires at the rate of 650 rounds per minute, the gun 6 is therefore the slower firing gun. The switch 25 is then closed, as shown in full lines in Fig. 1. When the guns are at rest and loaded, both breech bolts will be in their forward positions with the firing pins 10 cocked or retained in their firing position by the sears 11, and the breech bolt extensions 14 will be resting against the plungers which actuate the microswitch circuit closing contacts of the microswitches 16 and 17, maintaining these switches closed and in current-passing positions.

Upon the actuation of the main fire control button 32, current will flow from the battery 29 through the conductor wires 31 and 30, main feed wire 28, conductor wire 27, across the now-closed synchronizing control switch 25 and conductor 23 to the microswitch 17. Since both the breech bolts will be in their forward positions before the guns are initially discharged, the microswitch 17 will be closed, allowing current to flow through the conductor wire 19 to the solenoid 8, across the wire 34, energizing the other solenoid device 7, causing both the triggers 6a and 5a of the guns 6 and 5 to be depressed, and the guns will be simultaneously fired. The above mentioned firing circuit is completed between the other terminals of the solenoids 7 and 8 through the ground connections 20 and 21, constituting the metallic framework of the turret or gun mount, the current returning to the other side of the battery 29 through the ground 33 between the battery and the frame.

Since the gun 6 is assumed to fire and reload slower than the gun 5, the breech bolt of the gun 6 will not return to firing position as soon as the breech bolt of the gun 5, and since the microswitch 17 will not be closed until the breech bolt of the gun 6 has moved to its forward firing position, the circuit at both solenoids will be open, preventing either of the solenoids 7 or 8 from depressing the triggers 5a or 6a of the guns until the breech bolt of the slower gun 6 moves to its former firing position. As the breech bolt of the gun 6 moves forward to the firing position, the microswitch 17 is again closed, energizing the controlling circuit just described, causing the solenoids 7 and 8 to be simultaneously energized, depressing the triggers and firing both guns in synchronism.

In the event that the other gun 5 was found to be the slower functioning of the two guns 5 and 6, the switches 25 and 38 would be left open and the switch 24 connecting the conductor 22 lead-

ing to the microswitch 16 on the gun 5 would be closed. Under these conditions, the firing of the gun 6 would be delayed or retarded after each explosion until the breech bolt of the gun 5 has moved forward to its subsequent firing position, closing the circuit through the conductors 18, 22 and 34 to the two trigger actuating solenoids 7 and 8, causing both guns to be fired simultaneously.

When it is desired to fire the guns independently of the synchronizing mechanism for any reason, such as to initially determine which is the faster firing gun, or in the event that the slower firing gun had jammed, the switch 38 is closed. The closing of this switch establishes a circuit from the battery 29 through the gun fire control button 32 across switch 38 and conductor 39 to the conductor 34 connected to both of the solenoids 7 and 8. Both triggers 5a and 6a will be simultaneously depressed and remain depressed as long as the main fire control switch 32 is held closed by the gunner. Should either gun be jammed the other gun will continue to fire.

It has been found that where two or more machine guns are mounted on a multi-gun mount in a power driven turret employing my improved synchronizing system, by utilization of the slower firing gun to delay the discharge of the other or faster firing gun or guns until the breech bolts of all the guns are in firing position, and then simultaneously firing all the guns, I am able to effectively maintain the discharge of all the guns in synchronism, and that the area of bullet dispersion is about one-sixth the bullet dispersion area when the guns are allowed to fire independently or out of synchronism. The off-center recoil or shock of the guns on the turret drive mechanism is also eliminated, making it possible to reduce the power necessary to smoothly rotate the turret during the firing operation of the guns, as well as to reduce the amount of force necessary to hold the gun sighted on the target. The great reduction of the bullet dispersion area by my improved device is equivalent to firing on a target 400 yards away as compared to firing on a similar target 1000 yards distant with the conventional gun turrets now in use without my improved synchronized fire control.

While the construction and arrangement of the invention herein described and illustrated is that of a generally preferred form, obviously, modifications and changes may be made within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. In a gun fire control system for synchronizing the gun firing operations of a plurality of machine guns, a plurality of machine guns, a movable part carried by each gun movable to a gun firing position before the gun can be fired and movable to a recoil position incident to the firing of the gun, an electro-magnetic firing control mechanism connected to each gun for initiating the firing operation of that gun, an electrical energizing firing control circuit including the electro-magnetic firing mechanisms of all of the guns and operable when energized to simultaneously energize said electro-magnetic firing mechanisms to fire all of said guns simultaneously, a normally open circuit closing switch carried by each gun, at least one of said switches being connected in said firing control circuit to normally interrupt the circuit, switch actuating means carried by the movable part of each gun

disposed in actuating engagement with said normally open circuit closing switch of that gun when the movable part of that gun is in firing position to close said normally open circuit closing switch, and movable to switch disengaging position by said movable part when said movable part is in recoil position to allow said normally open circuit closing switch for that gun to move to its normally open position to interrupt said firing control circuit to prevent the firing of said guns.

2. In a gun fire synchronizing control system, at least two machine guns, one of which fires at a slower rate than the other gun, a movable recoil operated breech block for each gun movable forwardly to gun firing position and rearward to recoil position incident to the firing operation of the gun, a trigger means on each gun for firing said gun, magnetic actuating means on each gun engageable with said trigger means when said magnetic actuating means is energized to actuate the trigger means to fire said gun, an electrical firing control circuit connecting the said magnetic actuating means of all of the guns to simultaneously actuate all of said magnetic actuating means to simultaneously actuate said trigger means and fire all of said guns when said firing control circuit is energized, a normally open circuit closing switch connected in said electrical firing control circuit to normally interrupt the same, and actuating means carried by and movable with the breech block of the slower firing gun and engageable with said normally open circuit closing switch to close said switch when the slower firing gun breech block is in firing position and disengageable from said switch when said slower firing gun breech block is in recoil position to allow said switch to move to its normally open position to interrupt the said electrical firing control circuit.

3. In a device of the class described, at least two machine guns, one of which fires at a slower rate than the other gun, a movable breech block on each gun movable forwardly to firing position and movable rearwardly to recoil position incident to firing of that gun, trigger means on each gun for firing that gun, electro-magnetic trigger actuating means on each gun engageable with the trigger means on that gun when energized to actuate the trigger means to fire that gun, an electrical firing control circuit connecting said electro-magnetic trigger actuating means to cause a simultaneous energizing of said electro-magnetic trigger actuating means and simultaneous actuation of the trigger means to fire said guns simultaneously, normally open circuit closing switch means relatively fixed on the slower firing gun with respect to the breech block movement thereof and electrically connected in said electrical firing control circuit to normally interrupt the same, a switch closing actuator fixed on said slower firing gun breech block in switch closing engagement with said normally open circuit closing switch means when the breech block of that gun is in firing position, and retractable with the breech block of the slower firing gun as it moves to recoil position, to disengage the said normally open circuit closing switch means to allow said switch means to open and interrupt said firing control circuit when said slower firing gun breech block and switch actuator are in recoil position.

FRITS JAN WILLEM DEN OUDEN.