May 10, 1927. 1,628,227

J. M. BROWNING

FIRING CONTROL FOR AUTOMATIC MACHINE GUNS

Filed July 14, 1924 3 Sheets-Sheet 1

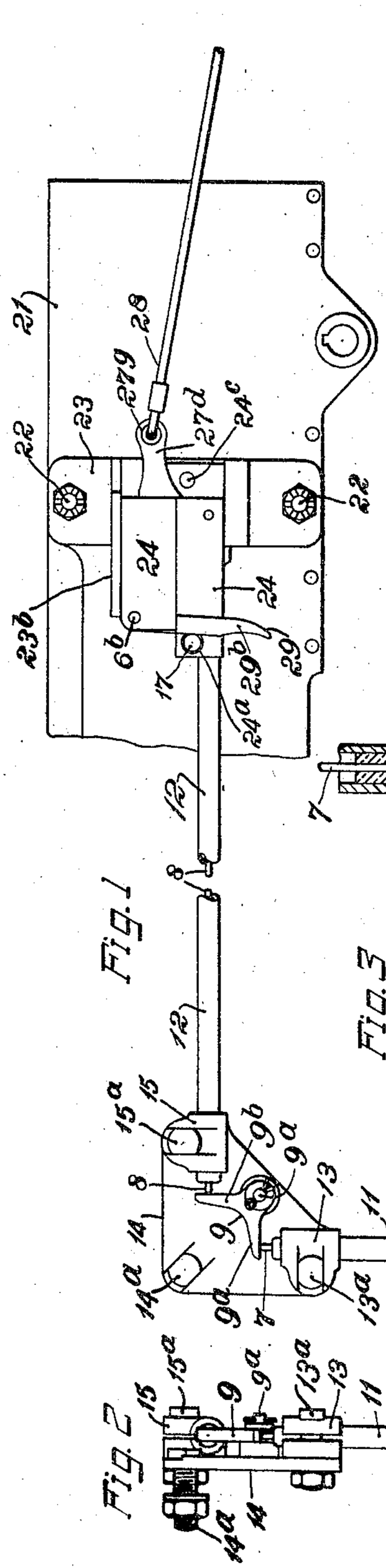

Fig. 1

Fig. 2

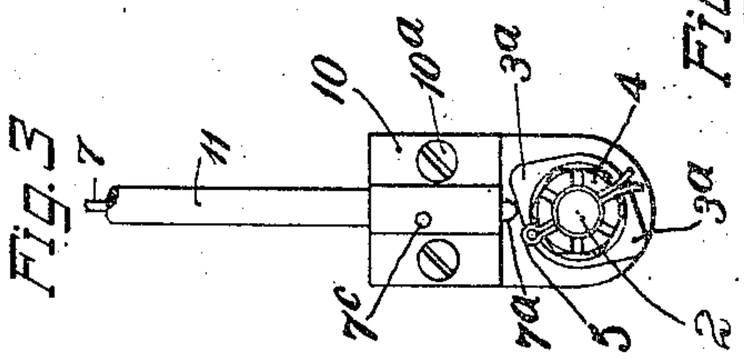

Fig. 3

Fig. 5

Fig. 6

Fig. 4

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Fig. 8

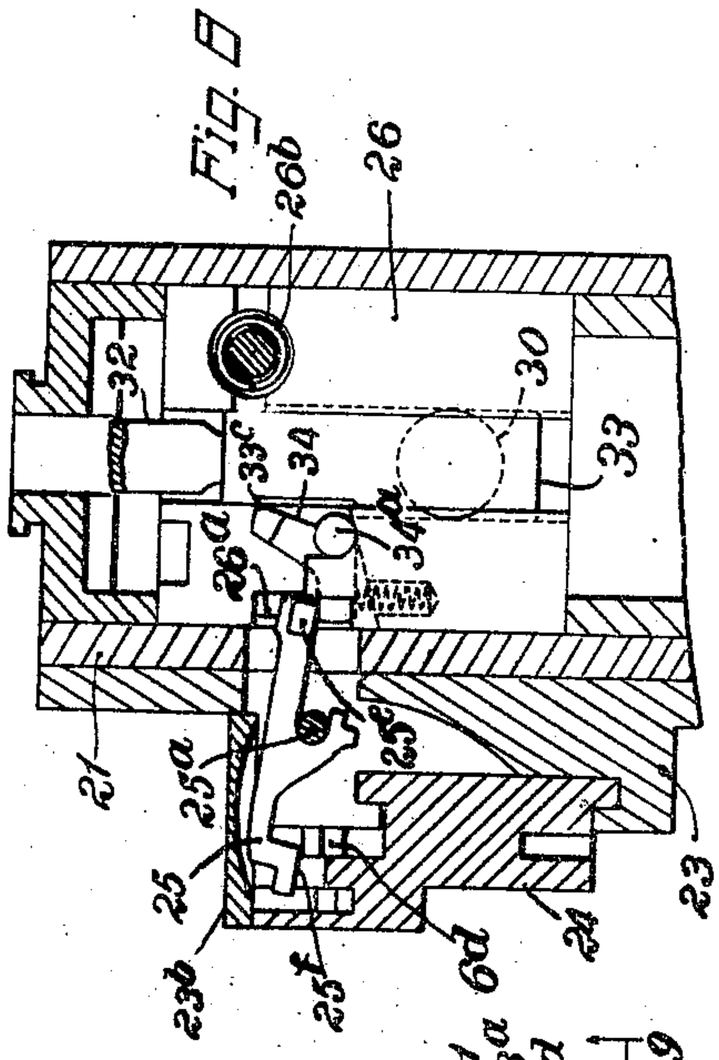


Fig. 10

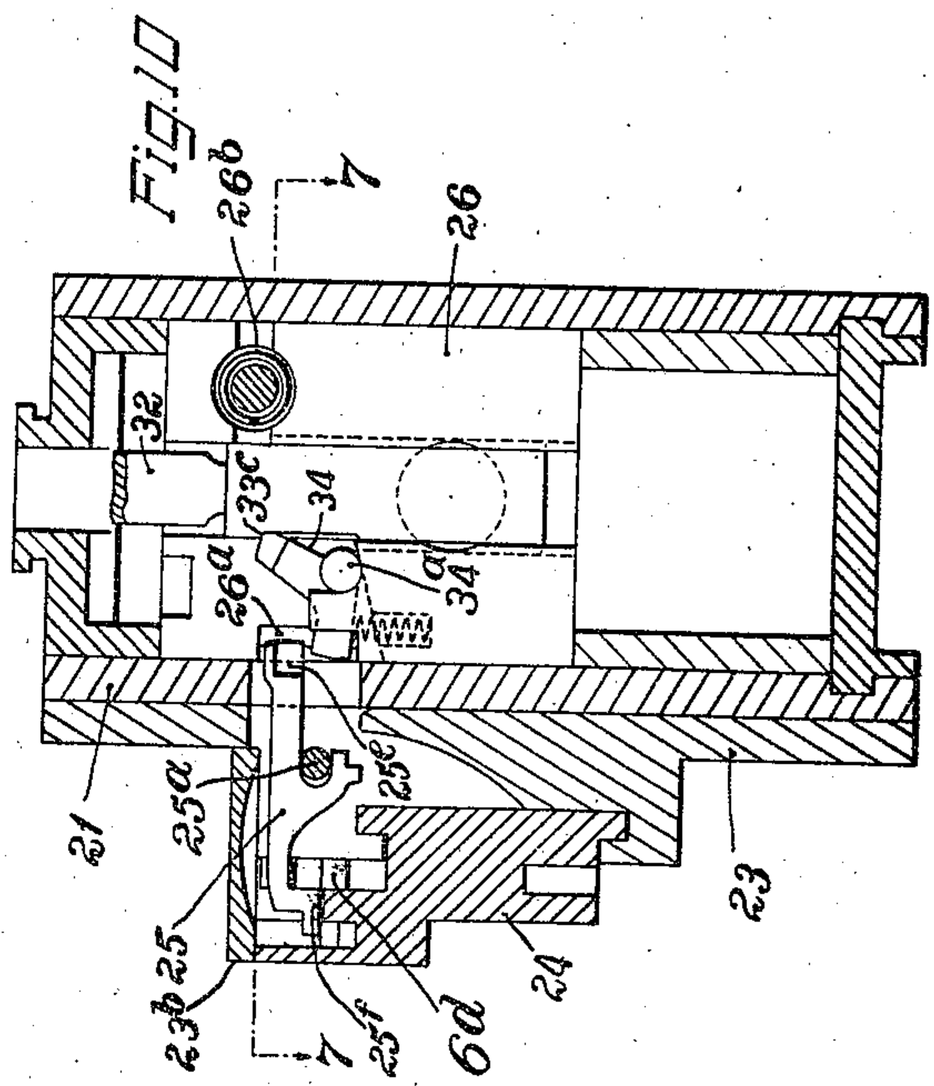


Fig. 7

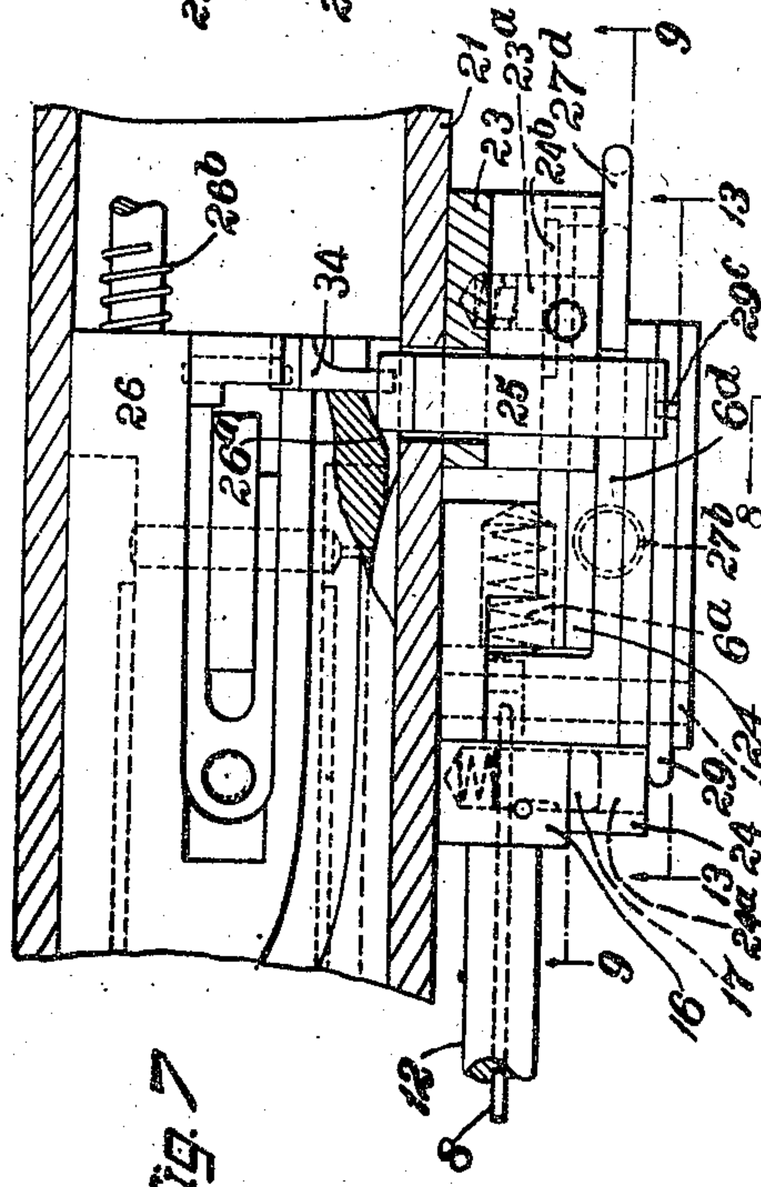
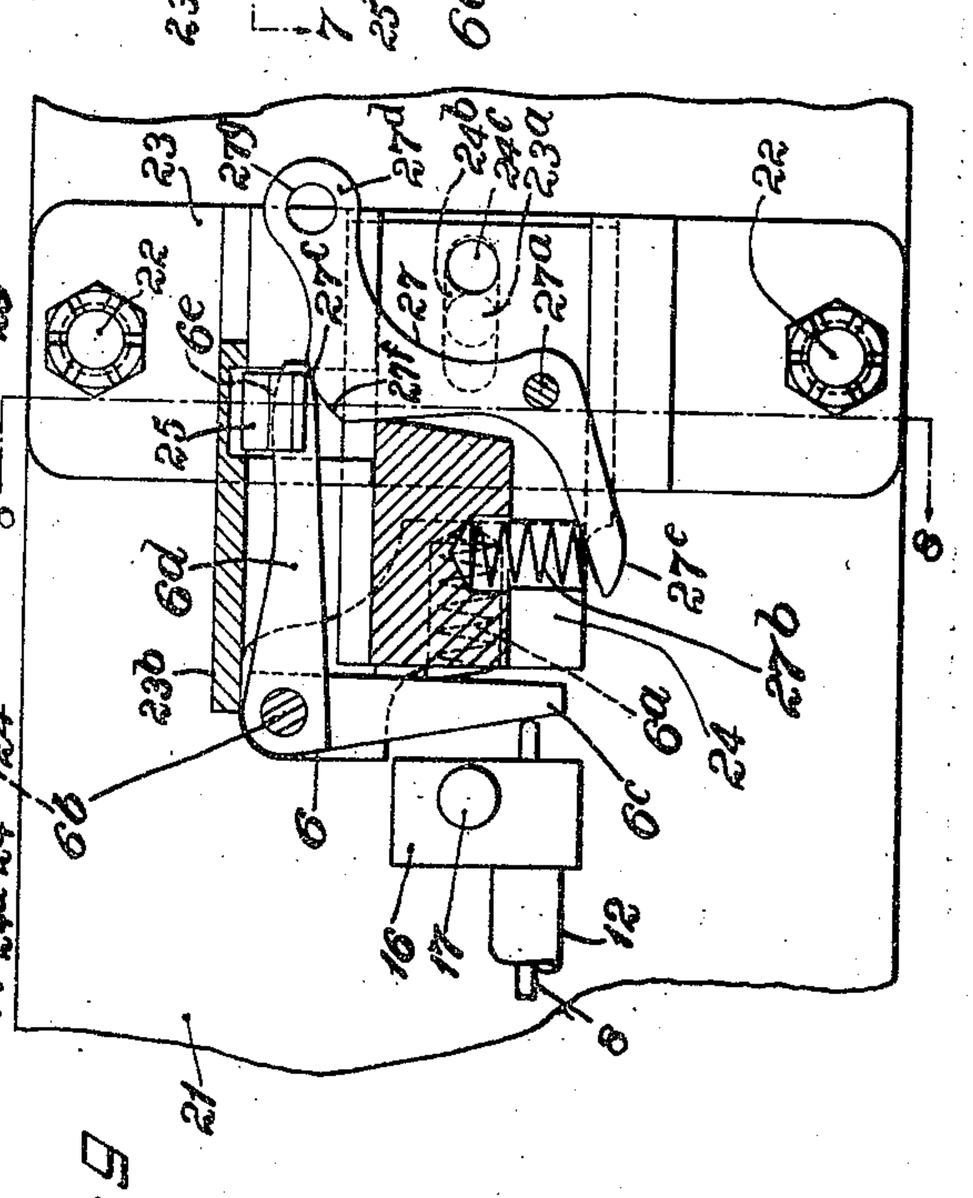


Fig. 9



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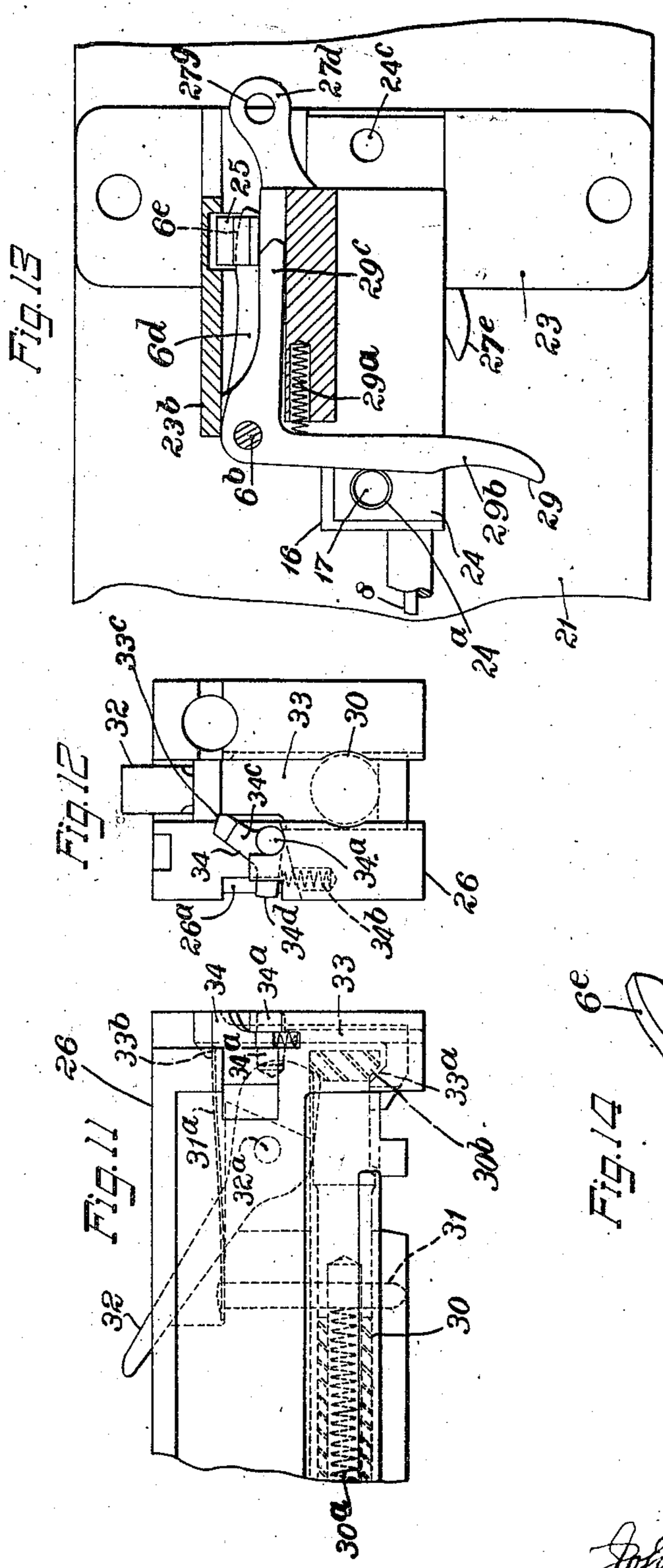

Fig. 13

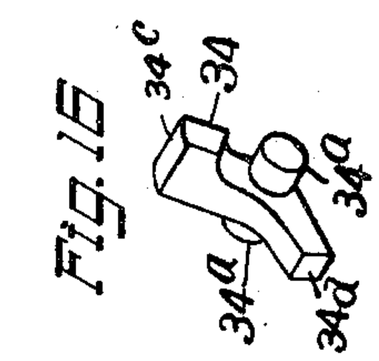

Fig. 15

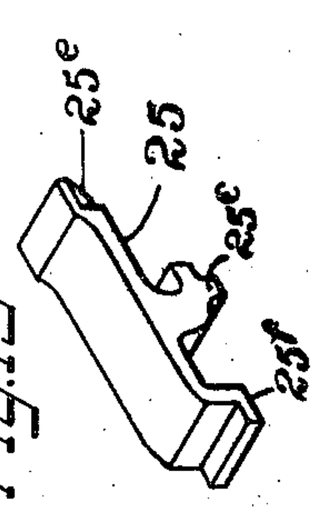

Fig. 12

Fig. 11

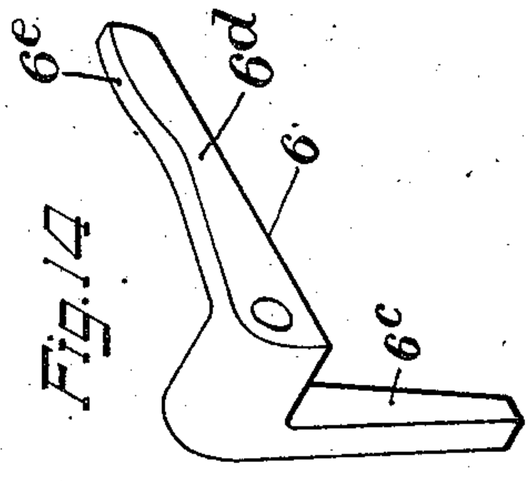

Fig. 14

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Patented May 10, 1927. 1,628,227

UNITED STATES PATENT OFFICE.

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FIRING CONTROL FOR AUTOMATIC MACHINE GUNS.

Application filed July 14, 1924. Serial No. 725,868.

The invention relates to a firing control for automatic machine guns and more particularly to such a control for guns adapted to be mounted on aircraft to fire through the plane swept by the blades of the airplane propeller.

It is an object of the invention to provide such a control which is simple in construction and light in weight, yet reliable in operation and most durable, which can be readily adjusted and adapted to fit it for use with different types of airplanes, and for changes in the relative location of the gun and the power unit of the airplane, and which adapts the gun to be, at will, fired in synchronism with the rotation of the propeller or at its normal rate when firing automatically.

Other and further objects will appear as the description proceeds.

These objects are attained by the provision of the novel improved means now to be described in connection with the accompanying drawings, and more specifically pointed out in the claims appended hereto.

In the drawings:

Fig. 1 represents in side elevation a portion of the left-hand side of the breech casing of an automatic machine gun showing the invention applied thereto; parts of the impulse transmitting system having been broken away.

Fig. 2 represents in a front view a portion of the impulse transmitting system.

Fig. 3 represents a rear view of a portion of said impulse transmitting system showing its co-operative relation with the impulse generating means.

Fig. 4 represents a sectional view through the portion of the transmission system shown in Fig. 3, and on its natural scale, the impulse transmitting rod being shown in its inoperative position.

Figs. 5 and 6 represent a part of the frame of the trigger mechanism unit adapted to be fixedly secured to the breech casing of a gun, detached, and with parts carried thereby, respectively, in a front view and in a left-hand side view.

Fig. 7 represents a plan view of a portion of the gun with the invention applied thereto, the breech casing, the fixed part of the frame of the trigger mechanism unit, and also a portion of the breech block within the breech casing being shown in a section taken on the line 7—7 of Fig. 10; the parts are shown in their inoperative position for synchronized firing.

Fig. 8 represents a vertical transverse section on the line 8—8 of Fig. 9, as seen from the rear, through the breech casing of the gun and through the trigger mechanism unit, showing the breech block in elevation and in its forward firing position, and the parts of the firing mechanism in the position they occupy the instant the sear is released; the lower portion of the gun and a portion of the cocking lever are broken away.

Fig. 9 represents a portion of the breech casing of the gun and of the firing control as seen from the left and in a vertical longitudinal section on the line 9—9 of Fig. 7; the parts are shown in their inoperative position for synchronized firing.

Fig. 10 represents a vertical transverse section through the gun on the same plane as Fig. 8, the parts of the firing mechanism being shown in their inoperative position for synchronized firing.

Fig. 11 represents in a left-hand side view the rear portion of the breech block and parts carried thereby, the rear portion of the firing pin being shown in dotted lines in a central vertical longitudinal section and held in a rearward cocked position by the cocking lever.

Fig. 12 represents the breech block and parts carried thereby in a rear view.

Fig. 13 represents a view similar to Fig. 9, the section being taken on the line 13—13 of Fig. 7.

Fig. 14 represents a perspective view of the trigger lever actuated by the impulse transmitting means, detached.

Fig. 15 is a similar view of the connector, detached.

Fig. 16 is a similar view of the sear catch, detached.

In the drawings, the invention is shown applied to an automatic machine gun of the class shown in my prior Patent No. 1,293,021

for automatic machine gun, dated February 4, 1919, but it will be understood that certain features thereof are equally applicable to other classes of automatic machine guns.

For convenience of description, the means forming the preferred embodiment of the invention may be divided into three units, namely, (1) the impulse generating and transmitting unit, (2) the trigger mechanism unit, and (3) the breech block unit.

The impulse generating and transmitting unit comprises means whereby the trigger lever 6 of the trigger mechanism unit is oscillated in synchronism with the rotation of the propeller of the aircraft upon which the machine gun is mounted. The impulses are preferably mechanically transmitted from a cam shaft 2 suitably mounted on the motor 1 of the aircraft and carrying a cam sleeve 3 having two opposed cam projections 3^a. The cam sleeve 3 is preferably adjustably secured to the end of the shaft 2 thereby permitting the proper angular positioning of the cam projections 3^a with relation to the propeller blades. To keep the cam sleeve 3 securely in its adjusted position, it is provided with fine teeth 3^b adapted to interlock with corresponding teeth on a collar 2^a on the shaft 2, see Fig. 1. A castellated nut 4 screwed onto the corresponding end of the shaft keeps the said teeth in engagement with each other and the nut is locked by suitable means, such as the cotter pin 5. By this construction, a fine adjustment of the cam sleeve 3 relative to the shaft 2 can be readily made.

In the embodiment of the invention selected for illustration, the trigger lever 6 is rocked on its transverse pivot pin 6^b in one direction by a strong helical spring 6^a, see Fig. 9, but to move it in the opposite direction against the tension of said spring, impulses generated by the cam projections 3^a on the cam shaft 2 are transmitted to said lever by a pair of push rods 7, 8 of small diameter and an intermediate rocker 9, see Figs. 1 and 9. The rods 7, 8 and the intermediate rocker 9, while relatively light and consequently having little inertia, are yet capable of transmitting a considerable thrust, and are, because of their lightness, readily returned, after actuation by one cam projection 3^a, into position for actuation by the next cam projection 3^a by the spring 6^a. The end of the rod 7 adjacent the cam sleeve 3 has an enlarged portion 7^a having a rounded end which normally projects beyond the face of a bracket 10 secured to the motor 1 by any suitable means such as the screws 10^a, see Fig. 3, into the path of the cam projections 3^a (see Figs. 1 and 3). The opposite end of the rod 7 engages one arm 9^a of the two right-angularly arranged arms of the rocker 9, while the adjacent end of the rod 8 rests against the other arm 9^b of the rocker. The other end of the rod 8 normally rests against the trigger lever 6, see Fig. 9. By this construction, for each rotation of the cam shaft 2 the trigger lever 6 will be oscillated twice.

To prevent the relatively light rods 7 and 8 from bending or buckling, they are guided for the greater portions of their lengths by the spacing tubes 11 and 12, respectively. The tube 11 has one end secured as by screw threads, see Fig. 4, in the bracket 10 while its other end is adjustably secured, as by clamping means comprising a split clamping element 13, and a bolt 13^a, to a suitable bracket 14, which may be detachably secured to some part (not shown) at the motor of the aircraft, as by the bolt 14^a. The form of this bracket and the manner of its connection to the aircraft motor will vary with the type of motor used. The adjacent end of the tube 12 is likewise adjustably secured to the bracket 14 by a split clamping element 15, and a bolt 15^a, and the rocker 9 operatively connecting the rods 7 and 8 is also pivotally mounted on said bracket on the pivot stud 9^a. The surfaces of the arms of the rocker 9 engaged by the rods 7 and 8, if extended, would intersect in the axis of the pivot stud 9^a. The end of the tube 12 adjacent the trigger mechanism unit of the gun is secured in a block 16 fitting between the breech casing and the forward portion of the frame part 24 of the trigger mechanism unit, see Fig. 7, and said block is releasably secured to said part 24 of the trigger mechanism unit by a spring actuated stud 17 on the block 16, which projects into a corresponding hole 24^a in said portion of the frame of the trigger mechanism unit, see Figs. 1, 7 and 13. By inserting the bullet end of a cartridge or other suitable tool in said hole, the stud 17 may be pressed back to permit the gun with the trigger mechanism unit thereon to be disconnected from the impulse transmitting system by relative longitudinal movement of said parts.

The foregoing construction provides a highly flexible system of transmission from the cam shaft 2 to the trigger mechanism unit mounted on the gun, such flexibility adapting it for use with guns mounted in various positions with relation to the cam shaft 2 driven by the aircraft motor. Moreover, such flexibility is attained by the present construction without the inconvenience inherent in all Bowden wire or cable transmission systems of making adjustments from time to time to allow for the stretching of the wire or cable.

The means whereby the transmission system may be readily detached from the trigger mechanism unit on the gun, permits of the ready dismounting of a gun from the aircraft and the substitution of another

without necessarily disturbing the adjustments of the transmission system.

While I have hereinbefore described a transmission system involving two push rods arranged at right angles to each other, it will be understood that the rods will be arranged at the angle necessitated by the particular installation and in some cases only a single rod extending from the cam shaft to the trigger mechanism unit will be required. In such cases, the cam projections and cam shaft are so arranged with relation to the gun, that the cam projections will be in a position adjacent the axis of the gun, so that the rod can be arranged substantially parallel to said axis as is the rod 8 in the embodiment of the invention shown.

To minimize friction between the inner surfaces of the spacing tubes 11 and 12 and the rods 7 and 8, respectively, the bore of each of said tubes is of considerably larger diameter than the rods 7 and 8, and said bore is provided, at intervals sufficiently close to prevent bending or buckling of the rods, with supporting and guiding bushings 18 for the rods. These bushings, one of which is shown in Fig. 4, are held in place by frictional engagement with the wall of the tubes or by any suitable means.

When the gun is not being fired in synchronism with the propeller of the airplane, it is desirable that the transmission means be withdrawn from the action of the rotating cam projections 3^a on the shaft 2. To this end, the tube 11 is provided with a bushing 19, see Fig. 4, which is fixed in the tube by suitable means, such as the pin 19^a passing through a hole in the tube and having a part thereof seated in an annular groove 19^b in said bushing. A reduced end 19^c of this bushing is surrounded by and has fixed to it the end of a helical spring 20, the other end of which surrounds and is fixed to a correspondingly reduced part 7^b at the inner end of the enlarged portion 7^a, the rounded end of which co-operates with the cam projections 3^a. This spring 20 constantly tends to withdraw said end of the rod 7 into its inoperative position shown in Fig. 4, but is opposed, when the gun is being fired in synchronism with the rotation of the propeller of the aircraft, by the strong spring 6^a of the trigger lever, which renders the weaker spring 20 inoperative for this purpose. However, when the firing control of the invention is rendered inoperative for synchronized firing by the means to be hereinafter described, the spring 6^a is rendered inoperative and the spring 20, being unopposed by the stronger spring, moves the rod 7 to the position shown in Fig. 4, where its end is withdrawn from the path of the cam projections 3^a on the cam sleeve 3. The movement of the rod 7 is limited by the transverse pin 7^c in the bracket 10 passing through a groove in the enlarged portion 7^a of said rod, see Fig. 4.

The trigger mechanism unit is detachably secured to the left-hand side plate 21 of the breech casing of the gun, as by the bolts 22, see Figs. 1 and 9. This unit is shown as comprising two frame parts 23 and 24, the part 23 being rigidly fixed to the breech casing 21 by the bolts 22 and the part 24 being connected to the part 23 by a longitudinally extending T-slot and groove connection which permits relative longitudinal movement of said parts. Such relative longitudinal movement is limited, however, by the engagement of a spring-pressed stud 23^a on one of said parts, as 23, see Fig. 5, with a corresponding groove 24^b in the part 24, shown in dotted lines in Figs. 7 and 9. The mechanical transmission system is connected to the movable part 24 of the trigger mechanism unit by the means hereinbefore described.

This limited movement between the parts 23 and 24 allows for the vibration or kick of the gun during the firing. Since the trigger lever 6 is mounted on a transverse pivot pin 6^b in the movable part 24, by this construction the distance between it and the motor of the aircraft cannot vary regardless of the longitudinal vibration of the gun, which is necessary for the proper timing of the shots. This limited movement between the parts 23 and 24 also permits the substitution of one gun for another without necessitating any adjustments in the transmission system.

As is clearly shown in Figs. 9 and 14, the trigger lever 6 has its two arms 6^c and 6^d arranged substantially at right angles to each other and offset along the pivot, the arm 6^c extending in a substantially vertical direction and being engaged near its lower end and on its forward face by the rear end of the push rod 8 of the transmission system, and on its rear face by the forward end of the helical spring 6^a seated in a recess in the frame part 24, see Figs. 7 and 9; the other arm 6^d extends rearwardly substantially horizontally and is adapted to engage the outer arm of the connector 25, pivoted on a longitudinally extending pin 25^a in a transverse slot in the frame part 23 of the trigger mechanism unit, to lift said arm and thereby depress the inner arm of the connector, which projects through a slot in the side wall of the breech casing, to operate the firing mechanism carried by the breech block unit. The trigger lever arm 6^d has a long curved bearing surface 6^e for operative engagement with the connector 25 regardless of the longitudinal vibration of the gun and consequent relative movement of the parts 23 and 24 of the trigger mechanism unit.

The connector 25, shown detached in Fig. 15, is normally kept on its pivot pin and

swung to its inoperative position by a spring 25^b seated in a recess in the part 23 and having one end thereof bearing against a projection 25^c on the member 25 below its pivot while its opposite end rests against an abutment 25^d projecting forward from the rear wall of the transverse slot in the frame part 23 and provided with a groove to receive the end of said spring 25 and thereby keep it in place, see Figs. 5 and 6.

When the trigger lever 6 is swung on its pivot pin 6^b by the rearward movement of the rod 8 its rearwardly extending arm engages the downwardly offset portion 25^f at the outer end of the connector and moves the same to the position shown in Fig. 8, where it is represented as having just released the firing mechanism on the breech block 26 to fire a shot. The connector 25 has endwise as well as pivotal movement for reasons which will now be described.

After firing, the breech block 23 recoils in the usual manner compressing the reaction spring 26^b. In such recoil, a cam surface 26^a at the left-hand side of the breech block 26 engages the inner end of the connector 25 and moves it endwise outwardly slightly beyond the position shown in Figs. 7 and 10, with the downwardly offset portion 25^f outside the path of the rearward arm of the trigger lever 6, thereby breaking the operative connection between the trigger lever and the connector 25.

The synchronized firing may be started or stopped, at will, from the operator's position in the aircraft by means of a stop lever 27 which is pivotally supported on a transverse pivot pin 27^a in a vertical slot in the movable frame part 24, see Fig. 9. This lever 27 is normally moved to and held in its operative position where a shoulder 27^c on its upward and rearward extending arm 27^d engages under the end of the rearward trigger lever arm 6^d and locks the same in the raised position as shown in Fig. 9. The means for so moving said stop lever to and holding it in its operative position comprises a strong helical spring 27^b seated in a vertical recess in the bottom of the frame part 24 and bearing with its lower end against the short forwardly extending arm 27^e of said stop lever. When the trigger lever 6 is in the position shown in Fig. 9, its rear arm 6^d is raised above the downwardly offset portion 25^f of the connector 25 and, by its engagement with the vertical shoulder formed by said offset, keeps said connector in its outer position.

The rearward arm 27^d of the stop lever 27 is provided with an eye 27^g to which is secured an operating cable 28, see Fig. 1, or other suitable means leading to the operator's position. A pull on this cable swings the lever 27 about its pivot and withdraws the stop shoulder 27^c thereon from beneath the trigger lever 6, thereby permitting the latter to be swung by its spring 6^a into position for oscillation by the impulse generating and transmitting means hereinbefore described, and thus starting the synchronized firing. If the stop lever 27 is held in its inoperative position, the synchronized firing will continue as long as ammunition is supplied to the gun.

When it is desired to stop the synchronized firing the stop lever 27 is released to the action of its spring 27^b, which, if the rear arm 6^d of the trigger lever 6 is in the raised position, swings the cam surface 27^f immediately forward of the locking shoulder 27^c and merging thereinto, against the under side of the end of the lever arm 6^d and raises the same slightly higher until the locking shoulder 27^c struck substantially on a curve from the pivot axis of the lever 27 moves under said end and thereby locks the lever 6 in its inoperative position shown in Figs. 9 and 10. If the rear arm 6^d of the trigger lever is in its lowered position when the stop lever is released, the substantially vertical portion of the upward and rearward arm 27^d is first swung forward into engagement with the end of said arm 6^d, but as soon as the same is raised by the next impulse of the impulse transmitting means, the shoulder 27^c is brought under the rear end of said arm 6^d to lock the trigger lever 6 in inoperative position in the manner already described.

On the recoil of the breech block 26 following the firing of the shot caused by the raising of the rear arm 6^d of the trigger lever 6 immediately prior to its being locked in inoperative position, the connector 25 is moved outward by the cam surface 26^a on the breech block from the position shown in Fig. 8 until the downwardly offset portion 25^f at the outer end of the connector moves beyond the trigger lever arm 6^d, thereby permitting the spring 25^b to return the connector to the position shown in Figs. 7, 9 and 10, where it is kept in an outer position by the engagement of the shoulder formed by the downwardly offset portion 25^f with the outside surface of the raised trigger lever arm 6^d.

In order that the gun may be fired automatically, when desired, as for example, when the same is dismounted from an aircraft and used as a ground gun, the connector 25 is in position for operatively engaging the firing mechanism on the breech block even when in its outer position shown in Fig. 10, and by depressing the inner arm and holding it depressed, as shown in Fig. 8, the gun will be fired automatically. To this end, the invention provides a trigger mechanism unit having in addition to the trigger lever operated for synchronized firing, a manually-operated means for moving the connector 25 to the firing position. Said

means may comprise a manually operable trigger 29, see Figs. 1, 7 and 13, pivoted on the transverse pin 6^b, which forms also the pivot pin of the trigger lever 6, and having a vertical arm 29^b formed with a finger piece at its lower end and a horizontal arm 29^c extending under the outer end of the connector 25. A spring 29^a seated in a longitudinal recess in the part 24 and bearing with its forward end against the vertical arm 29^b of the trigger 29 serves to keep it in its inoperative position. A rearward pull on the finger piece raises the rear end of the horizontal arm 29^c of the trigger and thereby swings the connector 25 to the position shown in Fig. 8 to fire a shot. The connector 25 is formed at its inner end at the rear with a forwardly and downwardly inclined cam surface 25^e which operates the firing mechanism on the breech block 26 as the same nears its forward firing position, if the trigger 29 is held back and the inner arm of the connector 25 is thereby kept depressed, thus continuing the fire automatically as long as the ammunition is supplied to the gun.

A cover plate 23^b is rigidly secured to the top of the laterally widened portion of the frame part 23 of the trigger mechanism unit by suitable means such as the screw 23^c, see Fig. 6. This plate has a clearance groove cut in its under side to avoid interference with the movements of the outer arm of the connector 25, see Fig. 8.

The two frame parts 23 and 24 may be readily disassembled by bringing the spring-pressed stud 23^a on part 23 opposite a hole 24^c in the part 24, said hole being of slightly smaller diameter than said stud, and then pressing said stud back so as to withdraw it from the groove 24^b by inserting the bullet end of a cartridge or other tool into said hole. The part 24 may then be slid off the part 23 in forward direction. The parts are reassembled by proceeding in the reverse order.

The firing mechanism on the breech block may comprise the usual longitudinally movable firing pin 30 seated in a longitudinal seat on the breech block, see Fig. 11, and actuated in forward firing direction by the main spring 30^a, the rear end of which rests against a vertical abutment pin 31 extending through a vertical slot in rear portion of the firing pin and the forward end bearing against a shoulder on the firing pin, not shown. The firing pin is moved to the cocked position shown in Fig. 11, as usual, by the cocking lever 32 pivoted on the transverse pin 32^a, which holds the firing pin in cocked position by the engagement of a shoulder on its lower arm with a shoulder on said firing pin until, in the last of the forward movement of the breech block, the cocking lever is moved to its inoperative position in the usual manner. After the release of the firing pin by the cocking lever, the firing pin moves forward a slight distance until it engages the sear 33, and is thereby held cocked, until released by the trigger mechanism.

To provide an easy release of the firing pin, the vertically sliding sear 33 mounted in a corresponding seat at the rear of the breech block 26 is not provided with the usual square shoulder for engaging a corresponding shoulder forming the rear wall of the cocking notch on the firing pin, but has instead, a forwardly and upwardly inclined shoulder 33^a, Fig. 11, for engagement with a corresponding shoulder 30^b on the firing pin. The sear is moved to its raised position, as usual, by the spring arm 31^a extending rearward from the upper end of the abutment pin 31 and having its rear end engage under a shoulder 33^b at the upper end of the sear.

By this construction it will be seen that the sear 33 alone does not hold the firing pin cocked, the main spring 30^a tending to force the sear down to release the firing pin because of the action of the inclined surfaces on the firing pin and sear, respectively. The sear is held raised in its operative position against this tendency by a sear catch 34 shown, detached, in Fig. 16, and in assembled position on the breech block in Figs. 7, 8, 10, 11 and 12. This sear catch 34 comprises a two armed lever pivotally supported on its integral trunnions 34^a in corresponding seats provided therefor and extending longitudinally of the breech block, see Figs. 8, 10, 11 and 12.

On its left hand side the sear 33 is provided with a notch having a shoulder 33^c at its upper end struck on a curve with the axis of the trunnions of the sear catch as a radius. The inner arm 34^c of the sear catch has a correspondingly curved locking shoulder adapted to be swung under the shoulder on the sear to keep the same in raised position. A small helical spring 34^b seated in a vertical seat in the breech block and bearing at its upper end against the outer arm 34^d of the sear catch 34 tends to move the same to its operative position.

When the breech block is in its forward firing position, see Figs. 7, 8 and 10, the end of the inner arm of the connector 25 is located above the end of the outer arm of the sear catch 34, so that when said connector arm is depressed, the sear catch is swung to withdraw the curved shoulder on its arm 34^c from beneath the corresponding shoulder 33^c on the sear, thereby releasing the sear to be cammed down under the action of the main spring 30^a and the co-operating cam surfaces 33^c and 30^b on the sear and firing pin, respectively, thus permitting the firing pin to be thrown forward to fire a shot.

On the subseqttent recoil of the breech block the firing pin is moved to the cocked position by the cocking lever 32, the sear returned to its raised position by the spring arm 31^a, and the sear catch 34 is swung to its operative position with the end of its inner arm 34^c under the shoulder on the sear, so that the parts will be in position to fire the next shot after the breech block has returned to its forward firing position.

While the firing mechanism carried by the breech block described hereinbefore is particularly adapted for use with the improved trigger mechanism and impulse generating and transmitting unit, it will be understood that it can also be advantageously used, with other types of trigger mechanisms.

Furthermore, while the three units described form a particularly efficient firing control for automatic machine guns when used together, it will be understood that the trigger mechanism could readily be adapted for use with other impulse transmitting means, such as hydraulic or electrical transmitting means, and the particular mechanical transmitting means might be used with other types of trigger mechanisms.

What I claim and desire to secure by Letter Patent is:—

1. In a firing control for an automatic machine gun, the combination of a breech casing and a trigger mechanism unit carried by said casing and constituting a part additional thereto, the said unit comprising means whereby the gun to which it is applied may be fired, at will, either in synchronism with a rapidly rotating element or automatically at the normal rate of fire of the gun.

2. In a firing control for an automatic machine gun, the combination of a breech casing, a trigger mechanism unit carried by said casing and constituting a part additional thereto, a firing member in said casing, movable means carried by said unit and extending into said casing for controlling said firing member, and means whereby said movable means may be operated, at will, either manually or in synchronism with a rapidly rotating member.

3. In a firing control for an automatic gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, a firing member, a trigger mechanism unit detachably secured to the gun, and means for controlling said firing member from said trigger mechanism unit to fire the gun, at will, either in synchronism with the aircraft propeller or automatically at the normal rate of fire of the gun.

4. In a firing control for an automatic machine gun adapted to fire in synchronism with the rotation of the propeller of an aircraft, the combination of a breech casing, a detachable frame carrying trigger mechanism supported by said casing, a firing member controlled by said trigger mechanism, said mechanism comprising manual means and synchronized means for rendering said firing member operative, and means whereby said synchronized means may be, at will, rendered operative or inoperative.

5. In a firing control for an automatic machine gun, the combination of a breech casing, a firing member within said casing, a trigger mechanism frame removably supported by said casing, a movable element carried by said frame and extending into said casing to control said firing member, and means whereby said element may be, at will, operated manually or in synchronism with a rapidly rotating member.

6. In a firing control for an automatic machine gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, the combination of a breech casing, a breech block reciprocable within said casing, a firing member and releasing means therefor carried by said breech block, a synchronized trigger and a manual operated trigger on said casing, and means for operatively connecting either of said triggers with said releasing means whereby the gun may be, at will, fired synchronously or automatically at its normal rate of fire.

7. In a fire control for an automatic machine gun adapted to be mounted on an aircraft and fired through the field swept by the propeller blades, the combination of means for generating impulses in synchronism with the rotation of the propeller, impulse transmitting means actuated by said generating means, a firing member, and a trigger mechanism on the gun operatively associated with said transmitting means and with said firing member, said trigger mechanism comprising means for, at will, rendering said transmitting means inoperative and thus permitting the gun to be fired automatically at its normal rate and also comprising manually controlled means for causing the automatic operation of said firing member.

8. In a fire control for an automatic machine gun, the combination of a longitudinally reciprocating breech block, a firing member carried by said breech block, a member having pivotal as well as endwise movement for controlling said firing member, means for operating said controlling member movable in synchronism with the rotation of a rapidly rotating element, and means for manually operating said controlling member, said synchronized operating means being automatically disconnected from said controlling member after the firing of a shot but said manual operating means being at all times in operative relation to said controlling member.

9. In a firing control for an automatic

machine gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, the combination of a breech casing, a breech block mounted for longitudinal reciprocating movement in said casing, a spring-actuated firing pin on said breech block, means for holding said pin in cocked position, means for actuating said holding means comprising a manually-operated trigger, a synchronized trigger and a lever operatively connecting said triggers with said holding means, said connecting lever having endwise as well as pivotal movement, and cam means on said breech block whereby said lever is moved endwise after firing a shot to break its operative connection with the synchronized trigger but without breaking the connection between it and the manually-operated trigger.

10. In a firing control for an automatic gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, the combination with the breech casing of the gun and the reciprocating breech block therein, of a firing mechanism carried by the breech block, a trigger carried by the casing independently of the breech block and movable into and out of a position for causing firing when the breech block and firing mechanism are in their forward positions, impulse transmitting means for moving the trigger into and out of the said position in synchronism with the rotation of the propeller, and a spring-actuated element having a cam surface for moving the trigger to and holding it in a position at which the transmitting means is inoperative to move it, the said element being manually movable to release the trigger from the last said position.

11. In a fire control for an automatic machine gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, the combination of a firing member, means for holding said firing member in cocked position, an element adapted to oscillate in synchronism with the rotation of the propeller of the aircraft, means operatively connecting said holding means and said element, and means for rendering the same connection inoperative comprising a manually-controlled part and a longitudinally reciprocating member.

12. In a fire control for an automatic machine gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, the combination of a firing member, means for holding said firing member in cocked position, an element movable in synchronism with the rotation of the aircraft propeller, means for so moving said element, means operatively connecting said holding means and said element, and means for, at will, breaking the operative connection between said element and said moving means and also between said element and said connecting means.

13. In a firing control for an automatic firearm, the combination of a firing member, means for holding said member in cocked position, means for releasing said holding means comprising a lever having a compound movement and an element for imparting movement to said lever about an axis parallel with the firearm axis to thereby release said holding means to fire a shot, and a longitudinally reciprocating member adapted to impart another movement to said lever to break the connection between said lever and said element, whereby said element is inoperative to fire another shot until it is returned again to its original position.

14. In a firing control for an automatic firearm, the combination of a firing member, means for holding said member in cocked position, means for releasing said holding means comprising a lever having endwise movement as well as pivotal movement about an axis parallel with the firearm axis, a trigger for swinging said lever about its pivot thereby releasing said holding means to fire a shot, and a longitudinally reciprocating member adapted to recoil after the firing of a shot and to break the connection between said lever and said trigger by moving the lever endwise, whereby said trigger is inoperative to fire another shot until it is returned to its original position.

15. In a firing control for an automatic machine gun adapted to be mounted on an aircraft and fired through the field swept by the propeller blades, the combination of a breech casing, a longitudinally reciprocating breech block, a firing member, means for controlling the release of said firing member comprising a lever mounted to swing in a vertical transverse plane and to have also a limited endwise movement, an element operated in synchronism with the rotation of the aircraft propeller to swing said lever about its pivot to release the firing member, and a cam surface on said breech block whereby said lever is moved endwise after the firing of a shot to break the operative connection between the same and said element until said element is again returned to its inoperative position.

16. In a firing control for an automatic machine gun, the combination of a breech casing, a firing member within said casing, a frame member mounted on the outside of said casing for limited longitudinal movement, an element movable in a plane parallel to the axis of the gun carried by said frame member, and means operatively connecting said firing member with said element for all positions of said frame member within the limits of its movement.

17. In a firing control for an automatic

machine gun, the combination of a breech casing, a trigger mechanism frame mounted thereon, said frame comprising a part fixed to the casing and a part having a limited longitudinal movement relative thereto, a breech block, a firing member thereon, means for controlling said firing member carried by said fixed part, and means for moving said controlling means mounted on said movable part, said controlling means and said moving means being so constructed and arranged as to maintain their co-operative relation for all operative positions of said parts of the frame.

18. In a firing control for an automatic machine gun adapted to be fixedly mounted on an aircraft to fire through the field swept by the propeller blades, firing mechanism on the gun comprising an element mounted on a frame part having limited longitudinal movement relative to the gun, an impulse generator driven from the aircraft motor, mechanical means for transmitting impulses from said generator to said element, and rigid spacing means connecting said frame part to said impulse generator, whereby the time of firing of the gun is not affected by longitudinal vibrations thereof.

19. In a firing control for an automatic machine gun, the combination of a breech casing, a breech block having longitudinal movement within said casing, an element of the firing mechanism carried by said breech block, an actuator for said element mounted on a part having limited movement longitudinally of said casing, an impulse generator, means comprising a push rod connecting said impulse generator and actuator, and spacing means whereby said movable part is kept at a constant distance from said impulse generator thereby insuring the proper timing of the firing of the gun.

20. In a firing control for an automatic machine gun, trigger mechanism, an impulse generator, and mechanical means for operating said trigger mechanism in response to the impulses transmitted from said generator, said means comprising a spacing tube between said generator and the gun, a rod within the tube and of smaller diameter than the bore of said tube for transmitting the impulses from said generator to the trigger mechanism, and means for guiding and supporting said rod within said tube comprising bearing bushings arranged at intervals in said tube.

21. In a firing control for an automatic gun, trigger mechanism, an impulse generator, mechanical means for operating said trigger mechanism in response to the impulses transmitted from said generator, said means comprising a spacing tube having one end thereof adjacent to said generator and a rod guided in said spacing tube and adapted to transmit impulses from said generator to said trigger mechanism, and means for automatically withdrawing said rod from operative relation with the impulse generator when the synchronized fire is stopped, said last-named means comprising a helical spring surrounding said rod and having one end operatively secured to the spacing tube and the other to the rod.

22. In a firing control for an automatic gun, the combination of trigger mechanism including a spring tending to hold the mechanism in its inoperative position, an impulse generator, mechanical means for operating said trigger mechanism in opposition to the said spring in response to the impulses transmitted from said generator, said means comprising a spacing tube having one end thereof adjacent to said generator and a rod guided in said spacing tube and adapted to transmit impulses from said generator to said trigger mechanism, and means for automatically withdrawing said rod from operative relation with the impulse generator when the trigger mechanism is manually moved to its inoperative position, said last-named means comprising a helical spring surrounding said rod and having one end operatively secured to the spacing tube and the other to the rod.

23. In a firing control for an automatic machine gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, the combination with the breech casing of the gun, a trigger mechanism frame carried by the said casing, a firing member and an element for controlling said member carried by said frame, of means for actuating said trigger mechanism comprising a cam shaft rotating in synchronism with the rotation of the propeller of the aircraft, a pair of push rods arranged at an angle to each other, one of said rods extending substantially parallel to said element and the other of said rods having its end remote from the first-named rod and in operative relation with the cam shaft, a rocker operatively connecting the adjacent ends of the rods, a support for the rocker, and spacing means between the actuating means and the rocker support and between the rocker support and the trigger mechanism.

24. In a firing control for an automatic machine gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, the combination with the breech casing of the gun, a trigger mechanism frame carried by the said casing, a firing member and an element for controlling said member carried by said frame, of means for actuating said trigger mechanism comprising a cam shaft rotating in synchronism with the rotation of the propeller of the aircraft, a pair of push rods arranged at an angle to each other, one of

said rods extending substantially parallel to the gun and having its rear end in operative relation to said element and the other of said rods having its end remote from the first-named rod and in operative relation with the cam shaft, a rocker operatively connecting the adjacent ends of the rods, a support for the rocker, and two tubes enclosing and guiding the respective rods, the said tubes serving as spacing means between the actuating means and the rocker support and between the rocker support and the trigger mechanism.

25. In a firing control for an automatic machine gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, the combination with the breech casing of the gun, a trigger mechanism frame carried by the said casing, a firing member and an element for controlling said member carried by said frame, of means for actuating said trigger mechanism comprising a cam shaft rotating in synchronism with the rotation of the propeller of the aircraft, a pair of push rods arranged at an angle to each other, one of said rods extending substantially parallel to said element and the other of said rods having its ends remote from the first-named rod and in operative relation with the cam shaft, a rocker operatively connecting the adjacent ends of the rods, a support for said rocker, and spacing tubes for guiding the said rods, the adjacent ends of the said spacing tubes being adjustably secured to said support to permit rotary as well as endwise adjustment of the said tubes relatively to the said support.

26. In a firing control for an automatic machine gun, an impulse transmitting unit, a trigger mechanism unit on the gun comprising a fixed part and a movable part, and means whereby said impulse transmitting unit may, at will, be readily connected or disconnected from the movable part of the trigger mechanism unit, said means comprising a spring-actuated element on one of said units adapted to interlock with the other unit.

27. In a firing control for an automatic machine gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, the combination of a firing member, a trigger mechanism unit mounted on the gun and comprising a frame part having limited longitudinal movement relative to the gun, an element movably mounted on said part and operatively connected with said firing member, an impulse generator spaced longitudinally from said trigger mechanism frame and driven in synchronism with the rotation of the aircraft propeller, spacing means for maintaining a constant distance between said frame part and said generator, mechanical means for transmitting impulses from said generator to said element, the said mechanical means being supported and guided by said spacing means, and a readily detachable connection between said spacing means and said frame part, whereby a gun connected with said impulse transmission means may be readily dismounted and another gun substituted therefor without necessitating any change in the adjustments of said transmitting means.

28. In a firing control for an automatic machine gun, an impulse transmitting rod, a tube for guiding said rod, a trigger mechanism frame on the gun having a movable part and carrying an element adapted to be actuated by the impulses transmitted by said rod, and means whereby said tube may, at will, be readily connected or disconnected from the movable part of the trigger mechanism frame, said means comprising a spring-actuated locking member.

29. In a firing control for an automatic machine gun adapted to be mounted on an aircraft to fire through the field swept by the propeller blades, a trigger mechanism unit having a movable part attached to the gun, an impulse transmitting unit having a portion thereof extending substantially parallel to the gun, and adapted to be detachably connected to said movable part of the trigger mechanism unit, whereby a gun with a trigger mechanism unit thereon may be readily dismounted or mounted in position on the aircraft without disturbing the adjustments of the impulse transmitting unit.

30. In a firing mechanism for an automatic machine gun, the combination of a breech block, a spring-actuated firing pin having a beveled cocking shoulder, a vertically sliding sear having a correspondingly beveled shoulder for engagement with said cocking shoulder, and means for preventing lowering movement of the sear when the firing pin is held cocked, said means comprising a sear catch pivoted on the breech block and having a shoulder thereon for engagement with a corresponding shoulder on the sear.

31. In a firing mechanism for an automatic machine gun, the combinaton of a breech block, a spring-actuated firing pin carried by said breech block and having an inclined cocking shoulder, a sear also carried by said breech block and having a correspondingly inclined shoulder for engagement with said cocking shoulder, said inclined shoulders and said firing pin spring tending to move the sear to inoperative position, and means normally preventing such movement of the sear comprising a lever mounted on the breech block and operatively engaging said sear.

32. In a firing mechanism for an auto-

ic machine gun, the combination of a ch block, a spring-actuated firing pin ied thereby, and having an inclined ing shoulder, a sear movable to bring a espondingly inclined shoulder thereon the path of said cocking shoulder, and ns for locking the sear in such position nst the action of the firing pin spring, said means comprising a lever adapted to swing in a vertical transverse plane and having integral trunnions fitting in corresponding seats on the breech block.

This specification signed this 2nd day of July, A. D. 1924.

JOHN M. BROWNING.

CERTIFICATE OF CORRECTION.

Patent No. 1,628,227 Granted May 10, 1927, to

JOHN M. BROWNING.

It is hereby certified that the above numbered patent was erroneously issued to John Browning, Executor of the Estate of said John M. Browning, Deceased, whereas said Letters Patent should have been issued to John Browning, Administrator of the Estate of said John M. Browning, Deceased, as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of June, A. D. 1927.

Seal.

M. J. Moore,
Acting Commissioner of Patents.