May 24, 1927. 1,629,651

J. M. BROWNING

FIRING MECHANISM FOR AUTOMATIC FIREARMS

Filed Sept. 19, 1924

Fig. 3

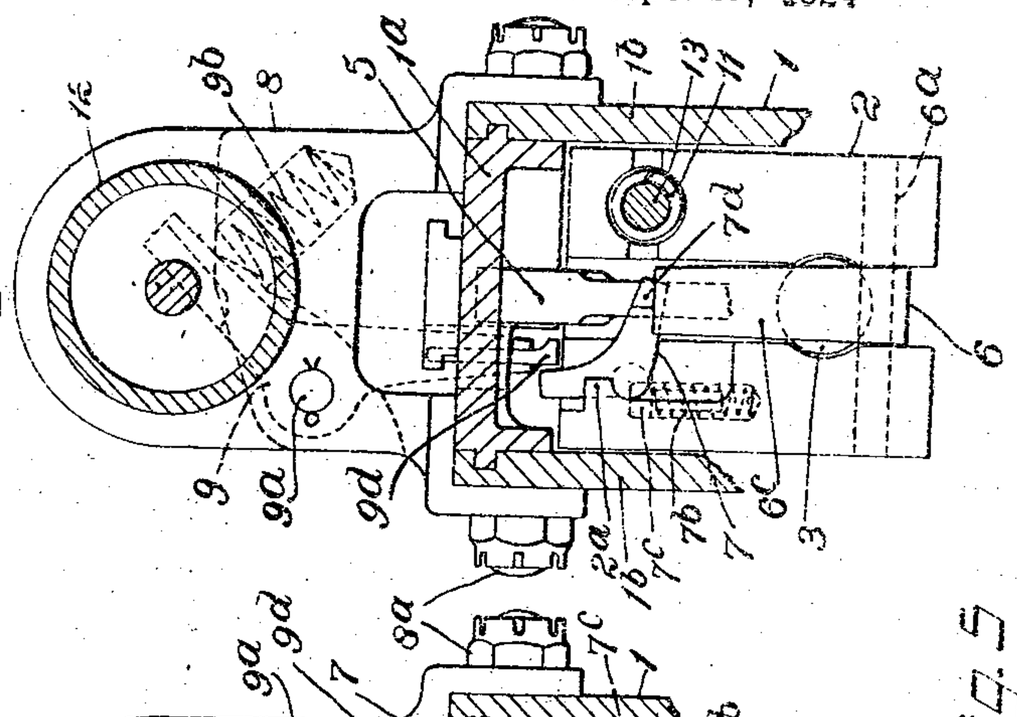


Fig. 6

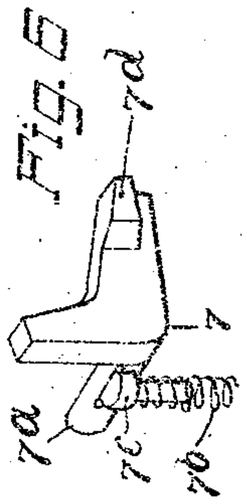


Fig. 2

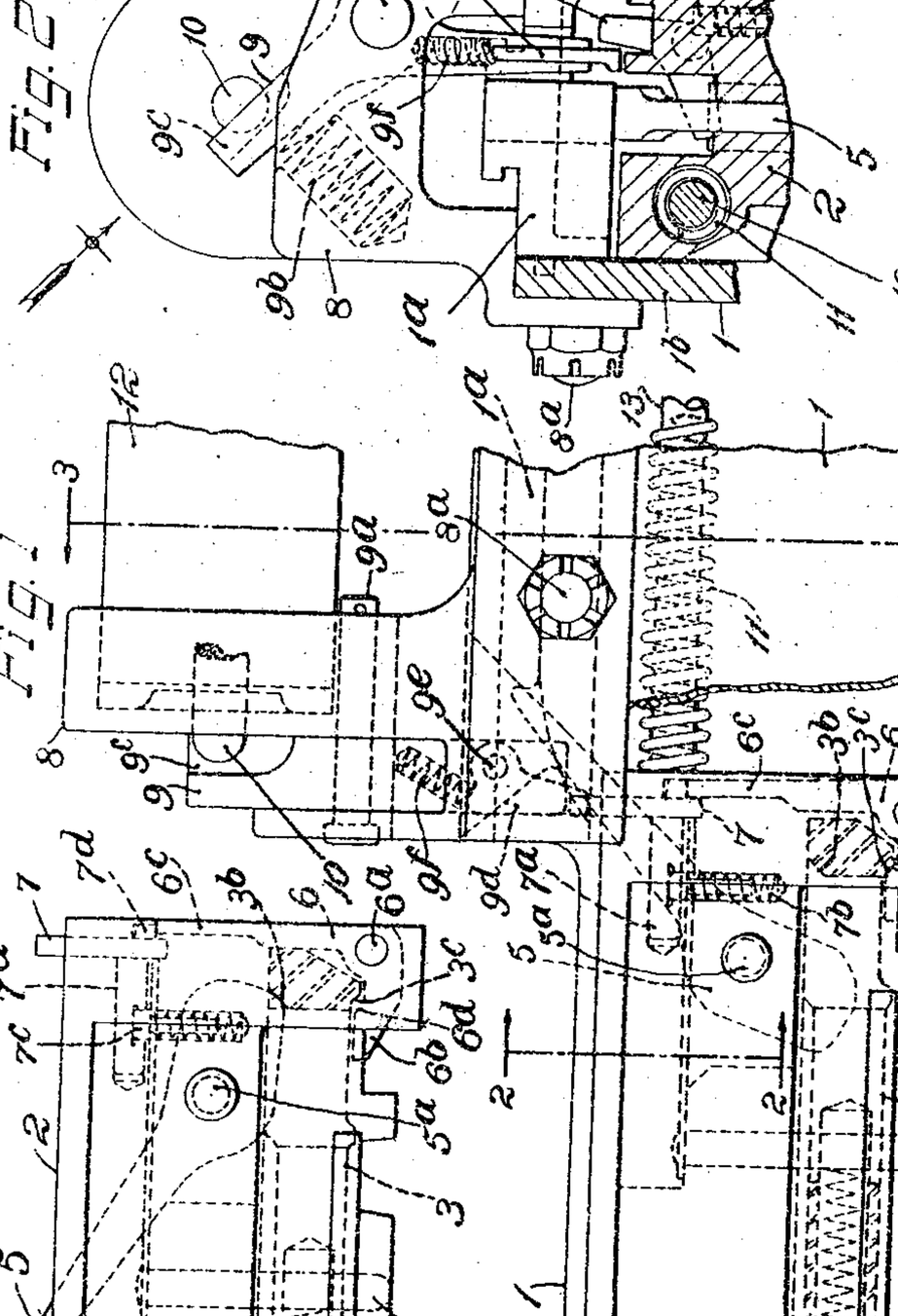


Fig. 5

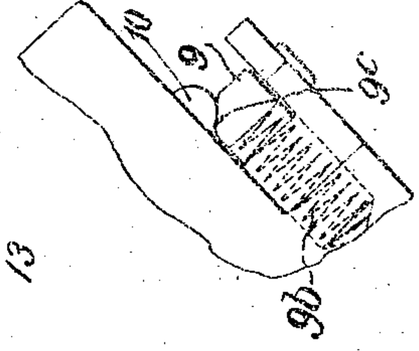
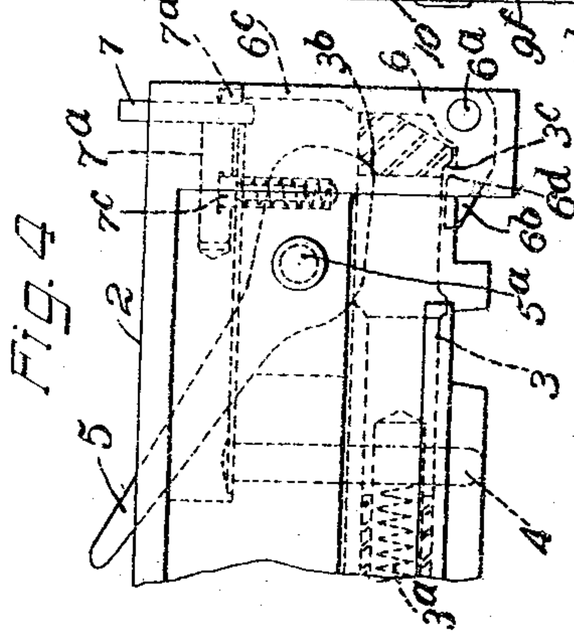


Fig. 1

Fig. 4



Inventor
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UNITED STATES PATENT OFFICE.

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FIRING MECHANISM FOR AUTOMATIC FIREARMS.

Application filed September 19, 1924. Serial No. 738,375.

The invention relates generally to firing mechanisms for automatic machine guns, and more particularly to such mechanisms adapted for use with automatic machine guns mounted on aircraft and synchronized to fire through the plane swept by the propeller blades without injury to said blades.

It is an object of the invention to provide a firing mechanism of this class in which the firing member, while securely held in the cocked position, is nevertheless adapted to be released by the application of a small force, thereby making said mechanism especially adapted for use with an electrical synchronizing gear or under other conditions in which an easy release of the firing member is necessary or desirable.

Other and further objects will become apparent 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 left-hand side elevation a portion of the breech casing of a gun having the invention applied thereto; the left hand side of the breech casing is broken away to show the rear portion of the breech block in elevation; the rear portion of the firing pin is shown in dotted lines in central vertical longitudinal section and the parts of the mechanism are in the firing position.

Fig. 2 represents the upper portion of the gun in a vertical transverse section taken approximately on the line 2—2 of Fig. 1, as seen from the front.

Fig. 3 represents the upper portion of the gun in a vertical transverse section taken approximately on the line 3—3 of Fig. 1.

Fig. 4 represents the rear portion of the breech block in a left hand side elevation showing the position of the parts after the recoil of the breech block, when the firing pin is held cocked by the cocking lever.

Fig. 5 is a detail view of parts of the firing mechanism as seen when looking in the direction indicated by the arrow in Fig. 2.

Fig. 6 represents, in a perspective view and on an enlarged scale, the sear catch and the spring pressed plunger co-operating therewith to move it in one direction.

In the drawings, the invention is shown applied to an automatic firearm of the class shown and described in the patent to J. M. Browning, No. 1,293,021, dated Feb. 4, 1919, for automatic machine gun, in which the breech closing block recoils together with the barrel and barrel extension a limited distance, after which said block is unlocked and continues its rearward movement against the tension of a reaction spring to open the breech; after the recoil of the breech block, the reaction spring returns it forward and in its final forward movement it is again locked against the breech of the barrel. In such movements of the breech block, the firing member is cocked, the spent shell is extracted from the barrel and ejected, and a new cartridge is inserted into the barrel chamber so that everything is in readiness to fire the next shot.

The breech casing within which the breech block reciprocates is designated as a whole by the reference numeral 1 and the breech block by the reference numeral 2. Parts of the firing mechanism to which the invention relates are carried by the breech block and parts by the breech casing.

In a longitudinally extending seat in the lower portion of the breech block, the firing pin 3 has a longitudinal reciprocating movement, being actuated in forward direction by the main spring 3^a, which transmits its tension at its forward end to said pin and at its rear end against a vertical abutment pin 4. The firing pin is moved rearwardly to its cocked position in a usual manner by the cocking lever 5, which is pivoted on the transverse pin 5^a and has its short lower arm extending into a longitudinal slot in the firing pin and its long upper arm into co-operative relation with a cocking slot in the top plate 1^a of the breech casing 1. During the recoil of the breech block 2 after firing a shot, the cocking lever 5 is moved from the position shown in Fig. 1 to the position shown in Fig. 4, where its lower arm is shown resting against an inclined shoulder 3^b on the firing pin to hold the same in cocked position. The breech block is returned forward by the usual reaction spring 11 guided by the rod 13; in the last of the forward movement of the breech block, the cocking lever is again moved to its inoperative position.

To hold the firing pin cocked after its release by the cocking lever novel improved

means are provided, which are so constructed and arranged as to provide a very easy release of the firing pin.

Such means may comprise a sear having the form of a lever 6 pivoted on a transverse pin 6^a at the rear end of the breech block and having a forwardly extending arm 6^b and a vertically extending arm 6^c, the latter arm being preferably much longer than the former. The arm 6^b is provided with an upward projection at its forward end forming a shoulder 6^d for co-operation with a corresponding cocking shoulder 3^c on the firing pin. The co-operating shoulders 6^d and 3^c on the sear and firing pin, respectively, are so inclined forwardly and inwardly, that the tension of the mainspring 3^a automatically swings the sear, when the same is released, to its inoperative position. The arm 6^c of the sear lever projects upwardly in rear of the firing pin, and is adapted to be engaged by the end of said firing pin when the same is moved to its cocked position, thereby swinging the sear to its operative position. By this construction, the usual spring for moving the sear into its operative position is dispensed with, thus facilitating the releasing movement of the sear.

To keep the sear from being swung to its inoperative position, as soon as the firing pin is released to the action of its mainspring by the movement of the cocking lever from the position shown in Fig. 4 to its inoperative position, a sear catch 7 is provided which positively locks the sear in its operative position.

In the embodiment of the invention selected for illustration, this sear catch has the shape of a bell crank lever having an integral pivot stud 7^a seated in a hole extending longitudinally of the breech block and in the upper left hand side thereof. One arm of said sear catch extends inwardly for cooperation with the upper end of the sear lever arm 6^c to normally prevent forward swinging movement of said arm, see Figs. 2 and 3, and the other arm of the catch 7 extends upwardly and projects some distance above the top of the breech block, where it is in position to be actuated by suitable means, such as the trigger mechanism to be described later on. It will be evident that the sear catch might readily be given other forms so as to adapt it for operation by a trigger mechanism mounted at the side of the breech casing, such, for example, as the mechanism disclosed in my prior application, Serial No. 725,868, filed July 14, 1924.

The sear catch 7 is moved to its operative position by the tension of a light helical spring 7^b seated in a vertical recess in the breech block, and acting through a plunger 7^c against a shoulder formed by a recess cut into the side of the pivot pin 7^a, see Figs. 2, 3 and 6. The head of this plunger 7^c also serves to limit the movement of the catch 7 in a clockwise direction, see Fig. 3, when the sear has been removed from the breech block. The sear catch is kept in its seat by the inward projection 2^a, see Fig. 3, on the breech block which extends some distance across the rear side of the upwardly extending arm of the catch.

After the sear has been removed by driving out its pivot pin, the sear catch can be readily disassembled from the breech block by inserting a thin rod or wire or other tool into the upper end of the seat for the spring 7^b and its plunger 7^c, which seat extends to the top of the breech block, and then depressing the plunger 7^c until it is clear of the recess in the pivot 7^b, when the sear catch can be turned clockwise to swing its upper arm from in front of the inward projection 2^a on the breech block, and the sear catch can then be rearwardly withdrawn from its seat.

The operation of the parts of the firing mechanism mounted on the breech block will now be briefly described. When the firing pin is in the uncocked position, the downward projection thereon rearward of the cocking shoulder 3^c rests on top of the elongated top surface of the upward projection on the forward arm 6^b of the sear 6, and thus keeps said arm depressed and the upper arm 6^c of the sear in its forward position, where its end engages the under side of the inwardly extending arm of the sear catch, and keeps the same in its raised inoperative position. When the breech block is moved rearwardly, the cocking lever moves the firing pin to cocked position, and in such movement, the rear end of the firing pin engages the upwardly extending arm 6^c of the sear and moves it rearwardly, see Fig. 4, thereby raising the cocking shoulder 6^d on the sear in front of the cocking shoulder 3^c on the firing pin and releasing the inwardly extending arm of the sear catch 7 to permit it to be moved by its spring 7^c in front of the upper end of the arm 6^c of the sear. After the firing pin is released by the cocking lever in the forward movement of the breech block, the firing pin moves forward a slight distance until the inclined cocking shoulders 6^d and 3^c on the sear and firing pin and the forward face of the end of the lever arm 6^c of the sear and the rear face of the inwardly extending arm of the sear catch 7 are brought into engagement as shown in Fig. 1.

A stop projection 7^d extending rearwardly from the upper portion of the inwardly extending arm of the sear catch 7 engages the upper end of the sear arm 6^c to normally limit the clockwise movement of said catch, see Fig. 3. Because of the difference in the length of the arms of the sear lever 6, a

very small force acting against that portion of the sear catch 7 which projects above the breech block, suffices to move it outwardly and to simultaneously raise the inwardly extending arm of said catch thereby releasing the sear, which is then free to be moved to its inoperative position under the combined action of the mainspring and the inclined shoulders 6^a and 3^c, thus permitting the firing pin to move forward to fire a shot.

In the embodiment of the invention selected for illustration the means for actuating the parts of the firing mechanism carried by the breech block is shown mounted on top of the breech casing, and to avoid interference with existing elements of the gun such as the hinged top cover and the latch therefor (not shown), such means is arranged in a very compact manner to give it as small a longitudinal dimension as possible.

To this end, a bracket 8 having an arched formation, see Figs. 2 and 3, rests on top of the breech casing of the gun and has flanges extending downwardly outside the side plates 1^b of the casing, which are secured to said casing by any suitable means such as the bolts 8^a. A trigger lever 9 is pivoted in this bracket on a longitudinally extending pivot pin 9^a and has an arm extending down through a slot in the top plate 1^a of the breech casing into position for co-operation with the upwardly projecting arm of the sear catch 7. The lever 9 is moved to its inoperative position, shown in Figs. 2 and 3, by a spring 9^b seated in a recess in the bracket 3 and bearing against the upper laterally inclined arm of the trigger lever 9.

To actuate the lever 9 in a direction to cause its lower arm to swing outwardly and thereby engage the upper arm of the sear catch to move it outwardly to trip the sear, any suitable means operated in synchronism with the rotation of the propeller shaft may be provided. Such means which may be controlled electrically, hydraulically or mechanically, is represented in the drawings by a plunger 10 adapted to be reciprocated, in a cylindrical casing 12 secured in the upper portion of the bracket 8, in synchronism with the propeller shaft. The forward portion of this plunger 10 is supported and guided by a hole in the bracket 8, and its end is rounded and cooperates with an inclined cam face 9^c, see Figs. 1 and 5, on the upper arm of the lever 9 to move said lever against the action of its spring to fire the gun.

The lower end of the downwardly extending lever arm of the trigger lever 9 is so constructed as to yield forwardly if it should happen to be swung to its operative position when the breech block approaches its forward firing position. To this end a pawl 9^d is pivoted on the pin 9^a near the end of said trigger arm so as to have a limited swinging movement thereon in a plane extending longitudinally of the gun. A spring 9^e tends constantly to keep said pawl in its operative position, shown in Fig. 1, and to return it to such position, if it has been moved therefrom by the engagement of the sear catch 7 with the rear face of said pawl, at the next movement of the trigger lever 9 to its inoperative position.

What I claim and desire to secure by Letters Patent of the United States is:—

1. In an automatic firearm, the combination of a reciprocating breech block, a spring-actuated firing pin carried thereby and having a forwardly and inwardly inclined cocking shoulder, a two-armed sear pivoted on said breech block and having a short arm extending substantially in the direction of movement of the firing pin and a long arm substantially at right angles to said short arm, said short arm having an inclined shoulder adapted to co-operate with the inclined shoulder on the firing pin to prevent firing movement of said pin, and means to engage the long arm of the sear to keep the same in its operative position against the tension of the firing pin spring.

2. In an automatic firearm, the combination of a reciprocating breech block, a spring-actuated firing pin, means for moving said firing pin to cocked position in the movements of said breech block, a sear on said breech block, and means whereby said sear is automatically and positively moved to its operative position in the cocking of said firing pin.

3. In an automatic firearm, the combination of a reciprocating breech block, a spring-actuated firing pin carried thereby and having a cocking shoulder, a two-armed sear pivoted on said breech block and having one arm extending substantially parallel to the movement of said firing pin and provided with a corresponding cocking shoulder and the other arm extending transversely of the path of said firing pin, whereby, in the movement of said firing pin to cocked position, it engages said second-named arm to positively move said cocking shoulder on the sear in front of the cocking shoulder on the firing pin.

4. In an automatic firearm, the combination of a spring-actuated firing member, means for automatically moving said member to cocked position, a sear for engagement with said firing member to hold the same in cocked position, and means whereby, in the cocking movement of said member, said sear is positively moved to its operative position.

5. In an automatic firearm, the combination of a reciprocating firing element, a spring for actuating said element in one di-

said element having an inclined shoulder, a pivoted two-armed sear a corresponding shoulder on one arm adapted to be positioned in front of clined shoulder on the firing pin, ans whereby, in the movement of said lement to the cocked position, said engages said sear and positively aid shoulder on the same in front of esponding shoulder on the firing pin, mber for automatically locking the such position.

an automatic firearm, the combina- reciprocating breech block, a firing ng-actuated in one direction and car- said breech block, said pin having a ly and inwardly inclined cocking , a pivoted sear carried by said lock, and having a correspondingly shoulder for co-operation with the on said firing pin, whereby, when g pin is in cocked position, the firing ng tends to swing the sear to its ive position, means for positively the sear to its operative position in ing of said firing pin, and an ele- positively locking said sear in op- position.

n automatic firearm, the combination of a reciprocating breech block, a spring-actuated firing pin carried thereby, a sear pivotally carried by said breech block, means for moving said firing pin to cocked position in the movements of said breech block, means whereby said sear is positively moved to its operative position in the last of the cocking movement of said firing pin, and a spring-actuated catch for automatically locking said sear in its operative position.

8. In an automatic firearm, the combination of a breech casing, a breech block mounted for longitudinal reciprocating movement within said casing, a firing member carried by said breech block, an element for rendering said firing member operative, said element being pivoted on said breech block to swing on an axis parallel to the direction of movement of said breech block, a lever for actuating said element mounted on said casing to swing on a longitudinally extending axis, said lever carrying a spring-pressed pawl for engagement with said element, said pawl being adapted to yield forwardly, as and for the purpose specified.

This specification signed and witnessed this 18th day of September, A. D. 1924.

JOHN M. BROWNING.