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SEAR LOCKING DEVICE FOR AUTOMATIC FIREARMS

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Fig-1-

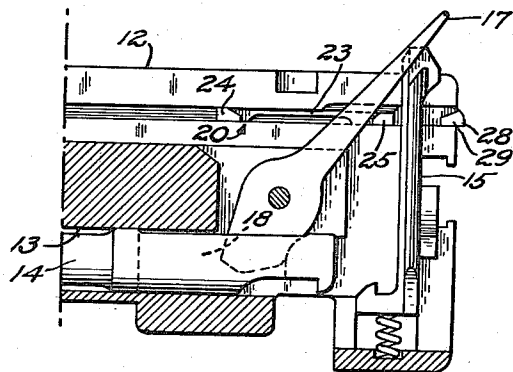


Fig-2-

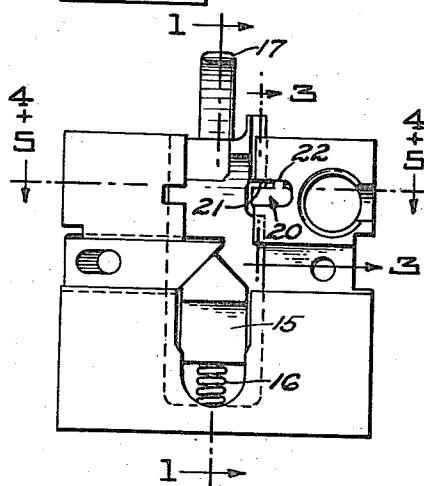


Fig-4-

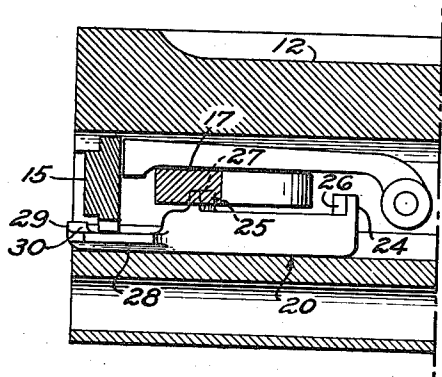


Fig-5-

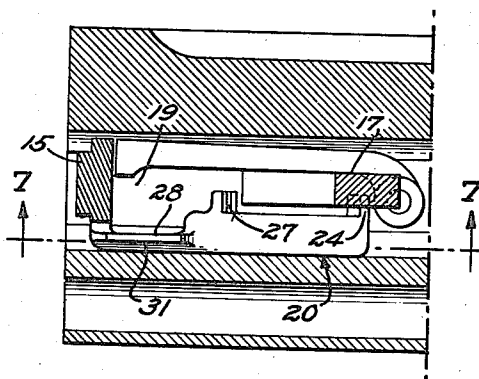


Fig-6-

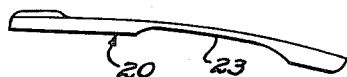
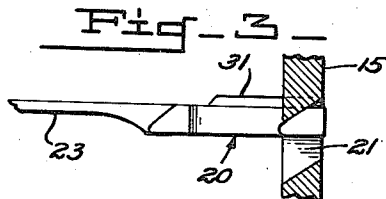


Fig-7-



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SEAR LOCKING DEVICE FOR AUTOMATIC FIREARMS

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2 Claims. (Cl. 89—149)

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sec. 266)

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The invention described in the specification and claims may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

This invention relates to means for preventing the premature release of the firing member of an automatic firearm and is particularly directed to an improved device for positively locking a sear against such movement as would permit the accidental release of a firing member therefrom prior to the locking of a reciprocating bolt in battery position.

In automatic firearms of the type disclosed in Patent No. 1,628,226 to John M. Browning, there is provided a spring-biased firing member slidably mounted in a reciprocable bolt for longitudinal movement between a cocked and a firing position. The firing member is retained in the cocked position by the engagement thereof with a spring-biased sear slidably mounted in the bolt for vertical reciprocal movement therein. When the sear is depressed by suitable means, the firing member is released therefrom and moves forwardly under the bias of its spring to discharge a chambered cartridge. During the ensuing recoil movement of the bolt, a cocking lever pivotally mounted therein is rotated to force the firing member rearwardly into re-engagement with the sear which in the meantime has been returned from its depressed position by the bias of its spring. During counter-recoil movement of the bolt, the cocking lever is rotated out of the path of movement of the firing member whereupon the latter is free to move forwardly upon release by the sear and effect another cycle of operation.

While the foregoing arrangement is extremely simple and efficient, the fact that the sear rests directly upon the free end of a coil spring introduces the possibility that the vibration and impact forces encountered during the automatic operation of the firearm may cause sufficient movement of the sear to permit premature release of the firing member therefrom. If such accidental release occurs after the cocking lever has been rotated out of the path of movement of the firing member but prior to the locking of the bolt in battery position, the consequent premature discharge of the cartridge could effect serious injury not only to the firearm itself but also to any personnel in the immediate vicinity thereof. On the other hand, should such accidental release occur while a portion of the cocking lever is still in the path of movement of the firing member, the normal striking power thereof will be reduced to the point where no ignition of the cartridge primer will result. This type of firearm malfunction is commonly referred to in the art as a "light blow" and has caused consid-

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erable difficulty in the continuous function of the Browning type machine guns herewith concerned since the bolt must be actuated to re-cock the firing member before operation of the gun can be again resumed.

Various attempts have heretofore been made to lock the sear against accidental movement prior to the locking of the bolt in battery position. However, none of the suggested devices or mechanisms have proven entirely satisfactory from a practical standpoint due to their inconsistency of operation. Furthermore, some of these prior art devices have either required excessive modification of the gun or have added an undesirable number of new components thereto.

One of such prior art devices consists of a locking member pivotally mounted in the bolt by means of a vertical pin and arranged to be laterally cammed by the cocking lever into and out of engagement with a transverse notch provided in the side of the sear. A spring-biased detent is also required to engage the front end of the sear locking member in order to prevent accidental movement thereof. While such device offers several worthwhile features, it also introduces other problems which the present invention has been specifically designed to overcome.

For example, motion picture records and other exhaustive testing has indicated that comparatively heavy impact forces are encountered when the rear end of the bolt strikes the buffer in the back plate of the firearm receiver at the conclusion of recoil. Similar impact forces are also present during counter-recoil when a shoulder on the underside of the bolt strikes the claws of an accelerator member. In fact, it has been found that in some cases these impact forces are so severe that a spring-biased detent of the type found in the above-mentioned prior art device is ineffective in preventing such accidental movement thereof as would permit premature unlocking of the sear.

Furthermore, with the sear locking device of the prior art, the timing relationship between the vertical movement of the sear and the pivotal sear-engaging movement of the lock member is extremely critical. When the cocking lever begins to cam the forward end of the lock member outwardly relative to the sear, the sear notch must be in exact alignment with the rear end of the lock member. However, since the upward movement of the sear is readily affected by such factors as the tension in the sear spring, the speed of bolt recoil, and the shock produced by the above-mentioned impact forces, the consequent erratic movement of the sear obviously fails to produce the desired alignment in every cycle of

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operation. As a result, breakage of parts leading to frequent stoppages of fire can be expected or, at best, the corners of the sear notch will be seriously mutilated in a relatively brief interval of firearm operation.

Still another unsatisfactory feature of the prior art device lies in the pivotal type of movement utilized for the sear lock member. In the necessity for keeping the number of firearm parts to a minimum, the cocking lever pin was used to retain the pivot pin of the sear lock member. As a result, the fulcrum point of the lock member was located nearer to the rear end thereof than to the front end. Thus, as the cocking lever cammed the front end of the lock member outwardly, the relative slower movement of the rear end served to increase the period of time in which the sear remained unlocked thereby permitting the possible misalignment of the notch therein with the engaging end of the lock member due to the factors previously mentioned.

Accordingly, it is an object of this invention to provide an improved means for locking the sear of an automatic firearm in order to prevent the release of a firing member therefrom until after the bolt has reached a fully locked battery position.

It is a further object of this invention to provide in an automatic firearm bolt a slidable self-retaining lock member for preventing the premature release of a firing member from a sear prior to the locking of the bolt in battery position.

Another object of this invention is to include in mechanism for locking a reciprocable sear against prematurely releasing a firing member therefrom an improved means for facilitating positive engagement of the lock with the sear despite the variations existing between each cycle of sear movement.

It is still another object of this invention to provide in an automatic machine gun of the Browning type a slidable lock member for preventing premature release of the firing member from the sear wherein the lock is arranged to be self-retained in the bolt.

It is a particular object of this invention to provide an improved sear locking device for an automatic machine gun of the Browning type wherein such device comprises a single member requiring but a minimum of modification of the existing gun parts.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from the following description of a preferred embodiment as shown in the accompanying drawing in which:

Fig. 1 is a cross-sectional view taken along the line 1—1 of Fig. 2 to show the cooperation of the sear, firing member, cocking lever, and sear lock member;

Fig. 2 is a rear end view of the firearm bolt in which the elements of Fig. 1 are incorporated;

Fig. 3 is a fragmentary cross-sectional view taken along the line 3—3 of Fig. 2 which shows particularly well the manner in which the rear end of the sear lock member engages the notch in the sear;

Fig. 4 is a cross-sectional view taken along the line 4—4 of Fig. 2 and showing the lock member disengaged from the sear;

Fig. 5 is a cross-sectional view similar to Fig. 4 but showing the lock member engaged with the sear;

Fig. 6 is a side view of the sear lock member of this invention; and

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Fig. 7 is a cross-sectional view taken along the line 7—7 of Fig. 5.

There is illustrated in Fig. 1 a bolt 12 of the well-known Browning type having a longitudinal hole 13 therethrough arranged to accommodate a spring-biased reciprocable firing member 14. A vertically disposed sear 15 is slidably mounted in the rear end of bolt 12 and is normally biased upwardly by a coil spring 16 into position to engage the rear end of firing member 14. Accordingly, sear 15 serves to hold firing member 14 in the cocked position. When bolt 12 goes into battery, sear 15 is depressed by suitable means (not shown) and firing member 14 is released to move forwardly under its spring tension and initiate another cycle of operation. A cocking lever 17 is pivotally mounted in bolt 12 about a transverse axis so that the lower end of such lever projects into a longitudinal slot 18 (Fig. 1) in firing member 14. Thus, as bolt 12 recoils, cocking lever 17 is pivoted in a counter-clockwise direction by suitable mechanism (not shown) so that the lower end thereof abuts the rear end wall of slot 18 and thereby forces firing member 14 rearwardly into engagement with sear 15. Upon counter-recoil movement of bolt 12, cocking lever 17 is pivoted in a clockwise direction so that the lower portion thereof will not interfere with the firing movement of member 14. A longitudinal recess 19 is provided in the top of bolt 12 to permit the above-described movements of cocking lever 17.

The foregoing describes conventional structure which is more fully explained in the aforementioned Patent No. 1,628,226. However, as previously mentioned, there are occasions where sear 15 may be accidentally depressed before bolt 12 reaches battery position thereby leading either to the premature firing of the gun or to a stoppage produced by a light blow of firing member 14 on the primer of a cartridge.

To avoid these specific malfunctions, the present invention proposes the addition of a novel sear locking member 20 requiring but slight modifications to existing firearm parts. One of these modifications is the provision of a notch 21 angularly formed into one side of sear 15 as best shown in Fig. 3. The second modification is the addition of a longitudinal slot 22 extending forwardly from the rear end of bolt 12 and arranged to communicate with recess 19. Sear lock 20 is arranged to be slidably mounted in slot 22 and essentially comprises a substantially rectangular body portion having a central bowed section 23 therein of reduced thickness relative to the rest of lock 20. A pair of oppositely disposed lugs 24 and 25 project outwardly from the side of lock 20 for a purpose to be explained. Lug 24 is provided with an upwardly and forwardly extending inclined surface 26 while lug 25 has a similar but oppositely inclined surface 27 thereon. Extending rearwardly from the body portion of lock member 20 is a relatively narrow portion 28 having an offset lug 29 at the rear end thereof which projects outwardly in the same direction as lugs 24 and 25. Lug 29 is provided with an upwardly and rearwardly inclined surface 30. A longitudinal rib 31 projects upwardly from narrow portion 28 and is so located thereon that the inner side of such rib 31 serves to increase the bearing surface area between lug 29 and the rear end of the body portion of lock member 20. The height of the rear portion of bolt slot 22 is increased as shown at 32 in Fig. 7 in order to provide access for sear lock rib 31.

It will be noted that the normal vertical distance from the top surface of bowed section 23 to the bottom surface of the remainder of lock 20 is greater than the vertical distance between the walls of slot 22. Accordingly, when lock 20 is assembled therein with lugs 24 and 25 projecting into bolt recess 19, bowed section 23 is compressed by the walls of slot 22 into a substantially linear plane. As a result, lock member 20 is resiliently retained in bolt slot 22 and yet is free to reciprocate therein when sufficient force is applied thereto as will be hereinafter explained.

At the instant the firearm is discharged, cocking lever 17 lies in the position shown in Fig. 1. The recoil movement of bolt 12 serves to pivot cocking lever 17 in a counter-clockwise direction as viewed in Fig. 1 whereupon the lower end thereof cams firing member 14 rearwardly. When the hook end of firing member 14 has moved past the mating hook portion of sear 15, the arm of cocking lever 17 strikes inclined surface 26 on lug 24 with sufficient force to overcome the resilient engagement between lock member bowed section 23 and the walls of bolt slot 22. The resulting forward movement of lock member 20 continues until the rearward travel of firing member 14 is halted upon contact of the rear end thereof with the front face of sear 15. During this overtravel of firing member 14 relative to sear 15, lug 29 of sear lock member 20 has entered into sear notch 21 to positively lock sear 15 against vertical downward movement. In the event sear notch 21 is not precisely aligned with lug 29 at the instant of locking due to the erratic sear movement hereinbefore discussed, inclined surface 30 of lug 29 will contact the oppositely inclined underside of the upper wall of sear notch 21 and thereby cam sear 15 upwardly to the extent required for complete locking thereof. The increased surface area formed by the inner side of rib 31 bears fully against the side of sear 15 immediately above angular sear notch 21 and thus prevents the excessive wear thereon which would result if lock member 20 contacted only the triangular portion formed by the upper wall of sear notch 21.

Upon counter-recoil of bolt 12, cocking lever 17 is pivoted in a clockwise direction as viewed in Fig. 1 and consequently strikes inclined surface 27 of lug 25 thereby forcing lock member 20 rearwardly. Thus, as bolt 12 moves into battery position, the continued rearward movement of sear lock 20 brings lug 29 thereon completely out of engagement with sear notch 21 and frees sear 15 for the downward vertical movement necessary to release firing member 14. This rearward sliding movement of sear lock 20 is halted when bolt 10 reaches the position wherein no further pivotal movement is imparted to cocking lever 17. It will be noted that the force with which cocking lever 17 strikes lugs 24 and 25 is substantially cushioned by the resiliency of sear lock 20.

From the foregoing description it is readily apparent to those skilled in the art that there is here provided a simple yet highly successful means for positively locking the sear of a Browning type machine gun for the purpose of preventing premature release of a firing member from such sear. The reciprocable sliding movement of the sear lock member assures an extremely rapid locking and unlocking movement which is particularly effective in prolonged the period of time in which the sear can be locked against accidental vertical movement. Furthermore, the self-retaining feature of the sear lock member elimi-

ates the necessity for introducing any additional detent means for securing the lock to safely resist any accidental movement which might be induced by the excessive vibration and impact forces encountered in the automatic operation of the gun. Moreover, due to the camming action between the upper wall surface of the sear notch and the inclined surface on the locking lug of the sear, positive locking of the sear is assured despite the erratic vertical movement imparted thereto by the spring arrangement found in the Browning type machine guns. Finally, inasmuch as the present invention introduces but one new firearm component and only two slight modifications to existing components, it can readily be seen that the incorporation thereof in the regular manufacture of the guns or the modification of existing guns would be a relatively simple and inexpensive procedure.

I claim:

1. In an automatic firearm, a longitudinally reciprocable bolt arranged for movement between a recoiled and a counter-recoiled position, a spring-biased firing member slidably mounted in said bolt for longitudinal movement between a cocked and a fired position, a cocking lever mounted in said bolt for reciprocating pivotal movement in a plane parallel to the plane of bolt movement, said cocking lever arranged to actuate said firing member into cocked position, said bolt having a longitudinal slot therein extending forwardly from the rear end thereof and disposed adjacent to and parallel with the path of movement of said cocking lever, a spring-biased sear slidably mounted at the rear end of said bolt for vertical movement into and out of engagement with said firing member, said sear having an angular notch in one side thereof communicating with said bolt slot when said sear lies in position to engage said firing member, and a longitudinal slidable member frictionally mounted in said bolt slot, said member comprising a relatively thin body portion having a pair of spaced-apart aligned lugs projecting outwardly therefrom into the path of movement of said cocking lever, and a narrow rearwardly extending portion having an offset lug at the terminal end thereof, said offset lug being arranged to engage in said angular notch in said sear as said cocking lever strikes the foremost of said outwardly projecting lugs and actuates said slidable member forwardly whereby said sear is locked against premature release of said firing member, said offset lug being also arranged to withdraw from said sear notch as said cocking lever strikes the rearmost of said projecting lugs and actuates said slidable member rearwardly whereby said sear is unlocked to permit release of said firing member therefrom.

2. The combination defined in claim 1 including an inclined cam surface on said offset lug operative on the upper angular wall surface of said sear notch for camming said sear upwardly in the event of incomplete alignment of said offset lug with said sear notch.

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