

A Safety Mechanism for a Latch

The invention relates to a safety mechanism for a latch of a trigger device of a weapon, particularly an automatic weapon, comprising a breech and a safety device. The latch can be moved between a locking position, locking the breech, and a non-locking position, not locking the breech.

Usually, fully automated automatic weapons operate in such a way that upon cocking the weapon the breech is brought into a rear locking position and locked against the spring force of one or several closing springs. The process of cocking is usually performed manually. By actuating the trigger the locking mechanism is released and by means of the spring force of the closing spring(s) the breech is moved forward in the breech path. By means of this breech movement, a cartridge is inserted into the breech path, locked in the chamber at the front end of the breech path and ignited. After releasing the breech, the breech is moved backward into its locking position by the gas pressure or the recoil and the empty cartridge casing is ejected. The feeding mechanism of the cartridge is then achieved either by way of forced control through the moving breech or through the gas pressure during the process of igniting the ammunition.

An unintentional release of a shot in the event that the weapon is cocked and the breech is released is usually prevented by a safety device, which is mechanically moved behind the trigger or which immediately keeps the breech in its locking position.

By setting constructive parameters with regard to the safety and the trigger, in some weapons the trigger can only be retracted if the breech is positioned in the rear latching position. Moreover,

designs are known in which it is not possible to intentionally engage the safety during the process of firing because it blocks the safety catch and, at the same time, keeps the triggered firing in shooting position. The closing springs then move the non-captured breech again to the front and the next firing cycle is triggered. Consequently, an intentional engagement of the safety results in continuous firing which cannot be stopped even if the trigger is disengaged.

Particularly fully automated weapons have the additional problem that it cannot be excluded that in case of a remotely controlled safety in the event of malfunction, for example, cable break, power failure, etc., the safety is activated during the process of firing. Forced control between the actuating device of the safety and the actuating device of the trigger involves the disadvantage that after releasing the trigger the breech requires an indefinite period of time to reach its rear latching position which is the only position for locking. The time period depends on the respective position of the breech.

Subsequently used position names, such as, "above", "below", "right", "left", "forward", "backward" apply to a weapon in normal aiming position firing horizontally "forward" from the view of the shooter.

Automatic weapons, for example, machine pistols or machine guns, which are designed to supply continuous fire, have a relatively simple trigger mechanism a representation of which is subsequently described in figures 3 and 4:

Below the path of movement of the breech (not shown) a hand piece is located in which hand piece a trigger (a) is swivel-mounted. The transversely extending rotation axis of the hand piece is located in the upper central region of the trigger. As a result, upon actuating the trigger, the rear, upper trigger part covers a curved path upward. This rear, upper part of the trigger impacts the front end of the latch (f) which, in turn, is mounted in the housing of the weapon or in the hand piece swiveling around a transverse axis. The rear end of the latch (f) is designed as a sear arm (s). If by means of a spring the trigger (a) is swiveled forward into its neutral position, the front end of the latch (f) swivels – also under the effect of a spring – downward, and its rear end with the sear arm (s) swivels upward. This position of the sear arm is the locking position (see Figure

3). The trigger (a) and the latch (f) can individually or together be cushioned or pretensioned by a spring which presses them into their neutral position (trigger) or locking position (latch).

If now the breech is retracted from its neutral position it moves with its bottom side the sear arm (s) and thus the rear end of the latch (f) downward while moving over the sear arm (s). If a sear catch constructed at the bottom side of the breech has moved over the sear arm (s) the sear arm shoots upward and is positioned behind the sear catch. The weapon is now tensioned and ready to fire.

If the trigger (a) is actuated the sear arm (s) is lowered until it releases the sear catch. The breech is released and the weapon starts firing continuously. If the trigger is disengaged, the sear arm (s) moves back upward into its locking position, is positioned behind the sear catch and thus keeps the breech in the position ready to fire (rear position). As a result, the continuous fire is interrupted.

Frequently, the safety device is merely a trigger safety which eliminates an unintentional activation of the trigger but, at the same time, does not prevent the sear arm from yielding because of acceleration forces if, for example, the loaded, pretensioned, and safety-engaged machine gun falls off a truck.

Therefore, some safety devices (w) fix the latch (f) alone or additionally to a safety finger (i) in its locking position. However, this has the disadvantage that if the weapon is secured the breech cannot be retracted beyond the locked latch (f), or the breech can get jammed on the latch (f), because the latch cannot yield. Figure 3 shows a safety drum (w) which involves with its peripheral surface a safety finger (i) of the latch (f). A weapon with such a safety device (w) cannot be cocked when the safety is engaged.

above are increasingly used in so-called weapon stations. In these stations, the mounted guns are adjusted in remote-controlled fashion via actuating drives and operated by Fully automated weapons which operate according to the functional principle described above are increasingly used in so-called weapon stations. In these weapon stations, the mounted weapons are adjusted in remote-controlled fashion by means of actuating devices and are actuated by

means of actuators (for example, electromagnetically) impacting the trigger and safety mechanism. In order to provide the greatest possible safety, these actuators are designed in such a way that in case of malfunction (for example, power failure) the trigger activation is interrupted and, independent of the condition of the weapon, the safety mechanism is set on "safety."

Besides the problem (no cocking of a secured gun) described above, a further malfunction can be encountered, namely that even if the trigger activation is interrupted the weapon continues to fire uncontrolled. High actuating forces of the actuator for the safety mechanism can result in the fact that the safety jams the safety finger (i) in the latch (f) to the extent that the sear arm (s) remains disengaged from the sear catch at the breech. This malfunction can occur if immediately after the trigger has been activated the breech is again moving forward and power failure results in the fact that simultaneously the trigger is released and the actuator impacting the safety presses the safety in "safety" position. In this condition, the latch (f) of the weapon and the sear arm (s) are in release position and the safety finger (i) slides into the safety recess at the safety mechanism (here: the safety drum (w)). If now the actuator switches the safety drum (w) in the direction of "safety," the safety finger (i) blocks the adjustment travel of the safety drum. As a result, the side wall of the safety recess can be pressed against the safety finger (i) to the extent that despite spring effect the latch (f) cannot move into its locking position. The latch (f) is jammed above the safety finger (i) and the breech moves back and forth firing without hindrance until the ammunition supply is interrupted (see Figure 4).

Based on this problematic situation, there are trigger equipments in which the sear arm is constructed at a safety pawl pivoting at a latch (see, for example, DE 101 63 003 A1 and US 2004/0194615 A1 or US 6,907,813 B2). In a returning breech, this safety pawl is swiveled against spring force from its locking position to a position of evasion in which it can be overrun by the breech. In a forward traveling breech, the sear arm of the safety pawl engages under spring load in the sear catch and is then kept in its locking position also by the breech. At the safety pawl an additional safety element is provided which interacts with the safety mechanism (for example, a safety drum) in such a way that this safety mechanism -- independent of the position of the breech or the latch -- can always be brought into a safe position. At the same time, the safety

mechanism can have an effect on the trigger as well as on the latch.

This trigger device requires an additional spring element in order to secure the locking function, and the safety pawl and its swing mount have to accept the full force of the forward traveling breech. At the same time, the comparatively small safety pawl and its swing mount are exposed to high dynamic loads. In the worst case, a possible break or malfunction of the safety pawl, its mounting in the latch and/or the spring element have such an effect on the function of the weapon that independent of the position of the safety and the trigger the weapon continuous to fire until all ammunition has been shot. It is also important that the actuating force of the spring element is precisely adjusted to the spring force affecting the latch. Otherwise the breech overrunning the safety pawl pushes also the latch downward into the hand piece. This can possible result in damaging the interaction between the safety element and the safety drum.

The objective is therefore to provide an improved trigger device or an improved safety mechanism by means of which the above-mentioned problems are at least reduced.

This objective is achieved by means of a safety mechanism having the characteristics of Claim 1. The safety mechanism mentioned there engages to the safety device, which takes up safety position and fixes the latch in its locking position. At the same time, a spring element acting between safety device and latch exerts a locking force that fixes the latch in its locking position. The locking force exceeds a trigger force that moves the latch out of a locking position, so that the trigger force is not sufficient to move the latch out of its locking position and release a shot. On the other hand, the locking force is adjusted in such a way that under the action of the returning breech the latch allows for a deflection of the spring element (against the locking force), namely to the extent that the latch is able to safely catch the breech.

Claims 2-5 relate to further developments of the safety mechanism which expand the basic functions mentioned in Claim 1. For this purpose, according to Claim 2, a slide lock has been provided which allows for a coupling between latch and safety device. At the same time, the

spring element acts between two pushers coupled in linear fashion, which pushers allow for a steady reception and power transmission.

According to Claim 3, the coupling occurs between safety device and safety mechanism via a spring-loaded locking catch, which is located at the second pusher and supports the latch in its locking position against the safety device.

Claims 4 and 5 relate to developments in which the safety device can be activated without blocking the function of the latch (Claim 4) and a design of the safety mechanism in which the locking catch does not have any effect on the position of the safety device, independent of the moment of activating the safety device (Claim 5).

Claim 6 relates to a latch with an invention-based safety mechanism, Claim 7 to a respective trigger device, claims 8 and 9 to a hand piece with a respective trigger device and Claim 10 to a weapon which is provided with an invention-based safety mechanism or a latch of a trigger device or a respective hand piece.

Subsequently, the invention is explained in more detail by means of an embodiment with a drawing.

It is shown:

- Figure 1 a side view of a trigger device with an invention-based safety mechanism, in which a latch accepts locking position,
- Figure 2 the trigger device from Figure 1 with released breech,
- Figure 3 a cross-section view of a customary trigger device, in which a safety drum is in safety position,
- Figure 4 the trigger device from Figure 3, in which the latch is shown to be jammed above a stop device in safety position.

Figure 1 depicts a hand piece 1 with a housing 1a for a fully automated machine gun (not shown in detail), shown to be transverse to firing direction R (forward). The hand piece 1

comprises a latch 2 with an attached hinge spring 3, which presses the latch 2 into its locking position, in which a sear arm 2a locks a breech (not shown) to its sear catch.

A firing mechanism 4 is functionally connected to the breech latch 2. Number 5 depicts a pre-release lever for the latch 2. A securing rod 6 and a firing rod 7 are protruding from the housing 1a of the hand piece 1. A locking plate 8 is connected to the securing rod 6.

A locking catch 21, as well as a leaf spring 22 are components of a safety mechanism 20 which comprises a slide lock 23. The slide lock 23 comprises a first pusher 23a hinged to the latch 2, which pusher is coupled in linear direction with a second pusher 23b. The second pusher, in turn, can be moved in the housing 1a in a sliding guide 24 and is pivotally guided around a pivot point 24a. Between the first and the second pusher a spring assembly 23c has been arranged which presses the first pusher 23a in relation to the second pusher 23b via the coupling joint 25 against the latch 2.

A pulling block 14 of the firing mechanism 4 is functionally linked to the firing rod 7. The pulling block 14 affects in known fashion the firing mechanism 4 and swivels the firing mechanism around a pivot point 4a, if the pulling block 14 is moved together with the firing rod 7, with which it is rigidly connected, in the direction of the arrow A (here downward).

The safety device comprises the securing rod 6 with the locking plate 8 fixed to it. The locking plate 8 features a securing section 8a which in locked position I (striped depiction) supports the locking catch 21 and in unlocked position II (solid line) releases the locking catch 21.

If the safety device 6, 8, 8a in its unlocked position II, upon actuating the firing rod 7 in direction A, the pulling block 14 moves the firing mechanism 4 clockwise around the pivot point 4a in such a way that the firing mechanism 4 lifts the front end of the latch 2 upwards against the hinge spring 3 engaging at the rear end of the latch 2. As a result, the sear arm 2a located at the rear end of the latch 2 drops down and releases the attached sear catch of the breech (see figures 3 and 4). The sear catch of the breech, in turn, moves forward under the effect of the closing spring, supplies a cartridge and releases a shot.

In the process, the pusher 23, which is guided into the sliding guide 24 and swiveled into the pivot point 24a, is moved downward through the latch 2, which is engaged in the coupling joint 25 (Figure 2).

However, if the safety device 6, 8, 8a is in safety position I, the securing section 8a supports the bottom side of the locking catch 21. Upon actuating the firing rod 7, in turn, the firing mechanism 4 presses the front end of the latch 2 upward, and the rear end, which is coupled at the pivot point 25 to the first pusher 23a, pushes against the spring assembly 23c, which is supported by the second pusher 23b, which again is supported via the locking catch 21 at the securing section 8a of the locking plate 8. At the same time, the actuating force affecting the firing rod 7 in direction A and the reset force of the spring assembly 23c affecting the rear end of the latch 2 are adjusted toward each other in such a way that the actuating force affecting the firing rod 7 is not sufficient to compress the spring assembly 23c to the extent that the latch 2 with the sear arm 2a is lowered and is able to release the sear catch of the breech.

On the other hand, the reset force of the spring assembly 23c is adjusted in such a way that a returning breech is able via guide ramps merging into the latching rollers to lower the rear end of the latch 2 against the reset force of the spring assembly 23c to the extent that the breech can overrun the sear arm 2a which then, again under the effect of the spring assembly 23c, drops into its locking position in front of the sear catch at the breech. In other words, the safety mechanism 20 including the spring assembly 23c is adjusted in such a way that firing is definitely prevented if the safety device 6, 8, 8a is in locked position. However, it is possible to return the breech – depending on fire or through manual or automatic repeating.

The safety mechanism shown also allows for the safety device to move back and forth between the locked position and unlocked position, if the latch 2 is situated in a position in which the breech is not locked (see Figure 2). If now the safety device 6, 8, 8a is moved forward into locked position I, the safety mechanism is initially unaffected. The latch 2 remains in the position of not locking the breech as long as the firing rod 7 is actuated in direction A. As soon as the process of firing is interrupted by releasing the firing rod 7, the safety mechanism 20 with the latch 2 is able to move into locking position (Figure 1) and secure the latch 2 in this position, despite an

engaged safety (adjusting the safety device 6, 8, 8a from unlocked position II to locked position I).

In the return movement of the safety mechanism 20, which is coupled with the latch 2, the spring 3, which engages at the pivot point 25, pushes the latch 2 together with the coupled safety mechanism 20 upward. At the same time, the rear edge of the locking catch 21 slides along the front edge of the securing section 8a and is displaced counterclockwise around the pivot point 26. The locking catch 21 returns to its starting position as soon as it passes the locking plate 8, then retracts the securing section 8a and thus secures the latch 2 in its locking position by fixing the safety mechanism 20.

In a different embodiment (not shown), the locking catch 21 can also be rigidly fixed to the first pusher 23a. In this case, the slide lock 23 or the first pusher 23a is hinged in the coupling joint 25 not only in pivotable fashion, but in a way that it can be moved forward and backward in almost horizontal direction. For this purpose, a respective sliding guide has been provided either in the latch 2 or in the first pusher 23a. In this embodiment, in the context of the return movement described above, not only the locking catch 21, but the entire slide lock 23 is swiveled around the pivot point 24a and displaced accordingly in the coupling joint. Also in this embodiment, the locking catch 21 engages again above the locking plate 8, which is located above the securing section 8a. Also in this case, the engaging movement is implemented by means of a spring engaging at the slide lock 23, which spring pulls the slide lock 23 backward. Then this spring accepts the function of the leaf spring 22.

In the embodiments described above, the safety mechanism 20 is described in combination with a hand piece 1, namely in connection with a so-called automatic hand piece in which the safety device 6, 8, 8a, as well as the trigger rod can be activated with remote control via control devices. In other embodiments, the safety device can also be activated manually, and the pulling block 14 can be replaced by a finger-operated trigger mechanism. In a different embodiment, the spring assembly 23c shown is replaced by a suitable elastomer block.

The following claims will enable the expert to develop further embodiments.

CLAIMS

1. A safety mechanism (20) for a latch (2) of a trigger of a weapon, particularly an automatic weapon, comprising a breech and a safety device (6, 8, 8a), in which the latch (2) can be moved between a locking position, locking the breech, and a non-locking position, not locking the breech, and in which the safety mechanism (20)
 - engages on the safety device (6, 8, 8a) when it is in the safety position, and thus secures the latch (2) in the locking position, and
 - the safety mechanism (20) comprises a spring element (23a) acting between the safety device (6, 8, 8a) and the latch (2), affecting a locking force that fixes the latch (2) in the locking position thereof, said force being adjusted in such a way that it
 - is, on the one hand, greater than a trigger force that moves the latch (2) out of a locking position and,
 - on the other hand, allows for a deflection of the latch (2) under the action of the returning breech while deforming the spring element.
2. A safety mechanism (20) according to Claim 1, which comprises a slide lock (23) actuating in displacement direction of the latch (2), which slide lock (23) comprises a first pusher (23a) hinged to the latch (2) and a second pusher (23b) running in displacement direction of the latch (2), whereas the first and second pusher are coupled in such a way that they can be moved in linear fashion towards each other and the spring element (23c) is acting between the two ushers (23a, 23b).
3. A safety mechanism (20) according to Claim 2, in which a locking catch (21) is arranged at the second pusher (23b), which locking catch (21) retracts in fixed fashion the safety device (6, 8, 8a) of the second pusher (23b), when this safety device (6, 8, 8a) accepts its locked position and the latch (2) accepts its locking position.
4. A safety mechanism (20) according to Claim 3, in which the locking catch (21) is designed and arranged in such a way that it allows the latch (2) in combination with the slide lock (23) to move from a position not locking the breech into the locking position

even if the safety device (6, 8, 8a) accepts its locking position.

5. A safety mechanism (20) according to Claim 3 or 4, in which the locking catch (21) is kept in spring-loaded fashion in its catching position and in which the second pusher (23b) is arranged in a pivotable manner in such a way that, upon a movement of the latch (2) into its locked position, the locking catch (21) is deflected from its catching position by the safety device (6, 8, 8a) accepting its locking position without restricting the movement of the slide lock (23) and thus the latch (2), and that it again accepts its catching position as soon as the safety device (6, 8, 8a) has passed and the latch (2) is accepting its locking position.
6. A latch (2) with an engaging safety mechanism (20) according to any one of the preceding claims.
7. A trigger device with a latch (2) according to Claim 6.
8. A hand piece (1) with a trigger device according to Claim 7.
9. A hand piece (1) according to Claim 8, in which the trigger device or the safety device is coupled with a remote-controlled control device in order to actuate the trigger or safety device.
10. A weapon with a safety mechanism (20) according to any one of claims 1 to 5, a latch (2) according to Claim 6, a trigger device according to Claim 7 or with a hand piece according to Claim 8 or 9.