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Button detent retension method for spring loaded linear actuating device

Abstract

Systems, device, and methods for assembling a magazine catch device are provided which may include providing a threaded rod, providing a button base that is configured to be place along the threaded rod, and threading a button onto the threaded rod such that a first set of surfaces of the button matches up with and bears against a second set of surfaces of the button base to align the button base and the button when tension is applied to the button base and button.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) The present application claims priority to U.S. Provisional Patent No. 63/388,822, filed on Jul. 13, 2022, the entirety of which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD
(1) The present invention relates to methods, devices, and systems for installation and retention of a button into a magazine catch device. The invention is applicable in a wide array of applications requiring a robust, simple, and easily installable method of attaching a button to a magazine catch device which may be spring-loaded. This may be implemented in an AR style firearm.
BACKGROUND
(2) Various mechanical devices, including certain types of firearms, use linear actuator devices with a retained button-shaped element. These are often used with spring loaded devices to provide consistent pressure. In the application of some firearms used for competition, a larger button interface is used to aid in faster engagement. However, the ability to use an enlarged button on a magazine catch is hindered by the installation method of the magazine catch. Specifically, the

button of some conventional magazine catches must be over-depressed into the receiver during installation. This over-depression often interferes with the enlarged button, and in particular, would require the button to be taller to allow for sufficient clearance within the receiver of the firearm.
(3) In an effort to overcome this problem, designers have utilized a number of work-arounds that include multi-piece button assemblies. However, these generally require screws, dovetails, and other mechanical attachment methods for a button extension. These can create problems of their own, such as additional costs and complexity of manufacturing additional attachments such as dovetails. They can also suffer from the tendency of mechanical fastening devices such as screws to come loose over time, especially in high vibration environments such as firearms, leading to alignment issues and damage to other systems from loose components.
(4) Thus, needs exist for a robust, secure, and mechanically simple solution to retaining a button in a spring-loaded linear device.

SUMMARY

(5) The systems, devices, and methods disclosed herein relate generally to retaining a button in a magazine catch device. A magazine catch is provided, which may include: a rod extending along a longitudinal axis, the rod comprising threads on a first end and a bar on a second end; a button base with a bore extending therethrough, wherein the rod is configured to extend through the bore of the button base; a spring disposed around the rod, wherein a first end of the spring contacts the button base and a second end of the spring bears against a receiver; and a button comprising a first end with a planar profile and a second end with internal threads which are configured to be threaded onto the rod, the button comprising an extension configured to be placed within the button base, wherein a first set of surfaces on the button base are configured to match up with a second set of surfaces on the button such that pressure aligns the button base and the button, wherein the receiver restrains rotational motion of the bar relative to the button base.
(6) In some implementations, magazine catch is configured to be installed within a receiver of a firearm. The first set of surfaces may include a conic profile. The second set of surfaces may include a conic profile. The second set of surfaces may include an elliptical profile. The first set of surfaces and second set of surfaces may be arranged to allow rotation of the button over a specified angular range.
(7) In some implementations, the first set of surfaces includes a first surface extending at a first angle that is normal to the longitudinal axis of the rod and a second surface extending at a second angle that that is not normal to the longitudinal axis of the rod. The second set of surfaces may include a third surface extending at the first angle that is normal to the longitudinal axis of the rod and a fourth surface extending at the second angle that that is not normal to the longitudinal axis of the rod. The first set of surfaces may include a surface extending around an entire perimeter of a first side of the button base. The first set of surfaces and the second set of surfaces may have a sawtooth shaped profile.
(8) A magazine catch configured for a firearm is also provided, which may include: a threaded rod extending along a longitudinal axis, wherein the threaded rod is configured to extend through a button base; a spring disposed around the threaded rod and configured to contact the button base and provide tension on the button base; and a button with a first set of surfaces configured to contact a second set of surfaces of the button base along a contact profile to align the button base and button, wherein the button is configured to be threaded onto the threaded rod.
(9) In some implementations, the first set of surfaces includes a conic profile. The second set of surfaces may include a conic profile. The first set of surfaces may include a first surface extending at a first angle that is normal to the longitudinal axis of the threaded rod and a second surface extending at a second angle that that is not normal to the longitudinal axis of the threaded rod. The second set of surfaces may include a third surface extending at the first angle that is normal to the longitudinal axis of the threaded rod and a fourth surface extending at the second angle that that is not normal to the longitudinal axis of the threaded rod. The first set of surfaces may include a

surface extending around an entire perimeter of a first side of the button base. The first set of surfaces and second set of surfaces may have a sawtooth shaped profile.
(10) A method for assembling a magazine catch is also provided which may include: providing a threaded rod extending along a longitudinal axis; providing a button base comprising a bore extending therethrough and a first set of surfaces; placing the rod within the button base such that it extends through the bore; providing a button comprising internal threads and a second set of surfaces that are configured to match up with the first set of surfaces; and threading the button onto the threaded rod via the internal threads such that the first set of surfaces of the button base contacts the second set of surfaces of the button and provides pressure to align the button base and the button along the longitudinal axis.
(11) In some implementations, the method includes a step to install a spring around the threaded rod, such that the spring provides tension to an end of the button base opposite the first set of surfaces. The first and second sets of surfaces may include a conic profile.
(12) It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory in nature and are intended to provide an understanding of the present disclosure without limiting the scope of the present disclosure. In that regard, additional aspects, features, and advantages of the present disclosure will be apparent to one skilled in the art from the accompanying drawings and the following detailed description.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The accompanying drawings illustrate implementations of the devices and methods disclosed herein and together with the description, serve to explain the principles of the present disclosure.
(2) FIG. **1** illustrates an AR style firearm with a complete assembly.
(3) FIG. **2**A illustrates a conventional magazine catch.
(4) FIG. **2**B illustrates an internal view of a conventional magazine catch in its normal resting state, installed in an AR lower receiver.
(5) FIG. **2**C illustrates an external view of a conventional magazine catch in its normal resting state, installed in an AR lower receiver.
(6) FIG. **3**A illustrates an internal view of a conventional magazine catch being installed in an AR lower receiver.
(7) FIG. **3**B illustrates an external view of a conventional magazine catch being installed in an AR lower receiver.
(8) FIG. **4**A illustrates an exemplary magazine catch in a normal resting state according to implementations of the present disclosure.
(9) FIG. **4**B illustrates an exemplary magazine catch in a state of installation according to implementations of the present disclosure.
(10) FIG. **4**C is an exploded view of an exemplary magazine catch according to implementations of the present disclosure.
(11) FIG. **5**A illustrates an exemplary magazine catch in a normal resting state according to implementations of the present disclosure.
(12) FIG. **5**B illustrates an internal view of an exemplary magazine catch in a normal resting state, installed in an AR lower receiver according to implementations of the present disclosure.
(13) FIG. **6**A illustrates an exemplary magazine catch in a state of installation according to implementations of the present disclosure.
(14) FIG. **6**B illustrates an internal view of an exemplary magazine catch being installed in an AR lower receiver according to implementations of the present disclosure.
(15) FIG. **7**A illustrates a second exemplary magazine catch in a normal resting state according to

implementations of the present disclosure.
(16) FIG. **7**B illustrates a second exemplary magazine catch in a state of installation according to implementations of the present disclosure.
(17) FIG. **7**C is an exploded view of a second exemplary magazine catch according to implementations of the present disclosure.
(18) FIG. **8**A illustrates a third exemplary magazine catch in a normal resting state according to implementations of the present disclosure.
(19) FIG. **8**B illustrates a third exemplary magazine catch in a state of installation according to implementations of the present disclosure.
(20) FIG. **8**C is an exploded view of a third exemplary magazine catch according to implementations of the present disclosure.
(21) FIG. **9** illustrates a flow chart for installing an exemplary magazine catch in a firearm receiver according to implementations of the present disclosure.
(22) The accompanying drawings may be better understood by reference to the following detailed description.

DETAILED DESCRIPTION

(23) For the purposes of promoting an understanding of the principles of the present disclosure, reference will now be made to the implementations illustrated in the drawings. Specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the disclosure is intended. Any alterations and further modifications to the described devices, systems, methods, and any further application of the principles of the present disclosure are fully contemplated as would normally occur to one skilled in the art to which the disclosure relates. In particular, it is fully contemplated that the features, components, and/or steps described with respect to one implementation may be combined with the features, components, and/or steps described with respect to other implementations of the present disclosure. For simplicity, in some instances the same reference numbers are used throughout the drawings to refer to the same or like parts.
(24) The present disclosure relates generally to magazine catch devices that are configured to be used with tension, such in a spring loaded configuration. These magazine catch devices may be used in firearms. The present disclosure may offer benefits over magazine catch devices.
(25) A two-piece button design is presented herein that allows for a button installation onto a captive spring-loaded linear actuating assembly. In some implementations, the linear actuating assembly may be used on a magazine catch for an AR style firearm. The present invention may replace the conventional single piece button used on an AR magazine catch with a two piece design, and in particular, with a button base and button that fit together. This new design may circumvent the need to over-depress the button into the receiver during installation which in turn allows for a greater variety of shapes and sizes to the button. In some implementations, the two-piece design includes a mating detent surface between the two parts that acts with the conventional magazine catch spring to retain the external button rather than the receiver itself.
(26) Therefore, the present disclosure meets the existing needs for a robust, secure, and mechanically simple solution to retaining a button in a magazine catch device.
(27) FIG. **1** illustrates an AR style firearm **100** with a complete assembly including a receiver **110**. Some implementations of the present invention may be suitable for use in such a firearm **100**, and in particular, may be integrated into the receiver **110**.
(28) FIG. **2**A illustrates a conventional magazine catch **200** that may be used with the firearm **100** shown in FIG. **1**. The magazine catch **200** includes a device **210** which may be referred to as a bar or catch, rod **212**, a spring **214**, and button **216**.
(29) FIG. **2**B illustrates an internal view of the conventional magazine catch **200** in its normal resting state, installed in an AR lower receiver **250**. The magazine catch **200** may be placed inside a bore **252** of the receiver.

(30) FIG. **2**C illustrates an external view of the conventional magazine catch **200** in its normal resting state, installed in the AR lower receiver **250**. As shown in this figure, the bar **210** of the magazine catch **200** is visible from the exterior of the receiver **250**.
(31) FIGS. **3**A-**3**B illustrate an internal view of a conventional magazine catch **200** being installed in the AR lower receiver **250**. During installation, the button **216** of the magazine catch **200** must be over-depressed to fit into the lower receiver **250**.
(32) FIG. **4**A illustrates an exemplary magazine catch device of the present invention. Although the magazine catch may be implemented in many different contexts, in the examples of FIGS. **4**A-**8**C, the magazine catch **400** may be suitable for use in a firearm, such as the AR style firearm **100** shown in FIG. **1**. The magazine catch **400** may include a rod **412** featuring a central axis extending therethrough. The rod **412** may also include threads **413** disposed on a distal end. The threads **413** may be concentric to the central axis along one end or the entirety of the rod **412**. The bar **410** may be disposed on a proximal end of the rod **412**. In some implementations, a spring **414** encircles the rod **412**.
(33) In some implementations, a button base **416** abuts the button **418** and includes a bore **428** which extends through a central portion of the button base **416**. In some implementations, the rod **412** passes through this bore **428** such that the button base **416** is constrained to moving longitudinally along the central axis of the rod **412**. The receiver **250** may restrain rotation of the bar **410** relative to the button base **416**. The bore **428** may facilitate the integration of the rod **412** with the button **418**. In some implementations, the location of the bore **428** places the button base **416** in between the button **418** and the threads **413** of the rod **412**.
(34) The button base **416** may also include a proximal end **427** which may have a planar shape configured to bear against the spring **414** and a distal end **424**.
(35) In some implementations, the shaped central portion **421** of the button **418** and the distal end **424** of the button base **416** have a common profile that is parallel, but not concentric to the central axis of the threaded rod. This profile may be cut into a slot shaped area of the button base **416**, such that the button **418** is free to move along the axis of the rod **412** longitudinally, but is restrained from free rotation at a specified angle by the geometry of the profile.
(36) In some implementations, the distal end **424** of the button base **416** includes one or more sloped surfaces **426** and one or more flat surfaces **422** which are configured to meet with the shaped central portion **421** of the button **418**. In the example of FIGS. **4**A-**4**C, the distal end **424** of button base **416** includes two flat surfaces **422** at the ends of the button base **416** and sloped surfaces **426** which slope down from the flat surfaces **422** to other surfaces around the bore **428**. These surfaces **422**, **426** may be configured to provide a stable, movable connection to the shaped central portion of the button **418** when pressure is applied to the magazine catch **400**.
(37) The surfaces **422**, **426**, **436** of the button base **416** and button **418** may feature detent mating surfaces. These surfaces **422**, **426**, **436** may have a defined height as taken along the central axis of the threaded rod. In some implementations, the surfaces **426** and **436** are non-parallel, non-perpendicular and non-concentric to the central axis of the rod **412**. Surfaces **422** may be perpendicular to the rod **412**. They may be shaped such that if the button **418** is rotated against the button base **416**, the interaction of the surfaces **422**, **426**, **436** force the button **418** and button base **416** apart a distance that is approximately equal to the defined height. This separation can be achieved via a number of methods, including: surfaces that feature a linear boss and groove, a boss and recess, knurling, and other such geometry. Thus, in some implementations, when the button **418** is rotated, it pushes the button base **416** away, compressing the spring **414** such that the spring **414** provides resistance against rotation when the surfaces **422**, **426**, **436** are in alignment. Rotation of the button **418** is shown in FIGS. **5**A-**6**B as the magazine catch **400** is installed in a receiver **250**.
(38) The distal end of the rod **412** may be attached to the button **418**. In the example of FIGS. **4**A-**4**C, the button **418** has a distal end **420** with a textured, planar shape, a shaped central portion **421**, and a distal end **438** which extends out from the shaped central portion **421**. In some

implementations, the distal end **438** is configured to extend within the bore **428** of button base **416**. The central portion **421** may include various flat and sloped surfaces **436** which correspond to the various surfaces **422**, **426** of the distal end **424** of the button base **416** and allow for a firm, partially rotatable connection between the button base **416** and button **418**.

(39) In some implementations, the button **418** is constrained from fully rotation in the button base **416** but allowed to rotate for a specified amount (as shown in FIG. **4**B). In this case, the button **418** is out of detent with the button base **416**. In some implementations, the surfaces **422**, **426** keep the button **418** and button base **416** in alignment such that rotation is constrained. However, in some implementations, there is some angular range where the button base **416** is camming out/in of detent lock as well as a second angular range where the button base **416** can rotate freely fully out of detent.

(40) In some implementations, the button **418** functions as a button type device attached to the rest of the magazine catch **400**. The button **418** may include internal threads that match with the threads **413** of the rod **412**.

(41) The spring **414** may be placed and sized such that it can act to press the button base **416** and button **418** in a distal direction by applying pressure on the proximal end of the button base **416**. This may place the button **418** and button base **416** in tension against the threads **413** (or other connection device between the button and rod **412**) such that the mating surfaces of the button **418** and button base **416** rest against each other. The spring **414** may be a coil spring with a central axis coincident with the central axis of the threaded rod and may be arranged such that its distal end rests on the proximal end of the button base **416** and its proximal end rests against the receiver **250**.

(42) In some implementations, the arrangement of elements in the magazine catch **400** allows for the installation of the button **418** and button base **416** by simply threading the button **418** onto the threads **413** of the rod **412** over the button base **416** and spring **414** until the button base **416** and button **418** are rotationally captive within the receiver **250**. For example, the button base **416** has a profile that keys into a mating bore within the receiver to prevent rotation. The detent surfaces between the button base **416** and button **418** may prevent the button **418** from passively unthreading by vibration or accidental impact.

(43) FIGS. **7**A-**7**C shows a second implementation of a magazine catch featuring an alternative mating surface **700** between the button base **416** and button **418**. In these examples, the button base **416** may include a flat surface **704** extending around the perimeter of the button base **416** as well as internal sloped surfaces **702** that match up with corresponding surfaces **706**, **708** of the button **418**. Similar to the implementation shown in FIGS. **4**A-**6**B, in this implementation, when the button **418** is rotated, it pushes the button base **416** away, compressing the spring **414** such that the spring **414** provides resistance against rotation when the surfaces **702**, **704**, **706**, **708** are in alignment.

(44) FIGS. **8**A-**8**C shows a third implementation of a magazine catch **400** featuring an alternative mating surface **800** between the button base **416** and button **418**. In these examples, the button base **416** may include sloped surfaces **802** in a sawtooth shape that match up with corresponding surfaces **804** of the button **418**. Similar to the implementations shown in FIGS. **4**A-**6**B and **7**A-**7**C, in this implementation, when the button **418** is rotated, it pushes the button base **416** away, compressing the spring **414** such that the spring **414** provides resistance against rotation when the surfaces **802**, **804** are in alignment.

(45) FIG. **9** shows an exemplary method **900** or installing a magazine catch as shown in any of FIGS. **4**A-**8**C. Method **900** may start with a step **904** to provide a threaded rod such as rod **412**. This rod **412** may be installed in the receiver of a firearm. The method may continue with step **904** to provide a button (such as button **418**) and a button base (such as button base **416**). These devices may include corresponding surfaces that are configured to mate together and provide pressure between the devices.

(46) The method may include a step **906** to install the button base onto the threaded rod. In some implementations, the button base includes a threaded bore which the rod may extend through. A

spring may be installed around the rod such that it bears against the button base when it is installed on the rod. The spring may also bear against the receiver.
(47) The method **900** may include a step **908** to thread the button onto the threaded rod. In some implementations, the button includes internal threads that match up with the external threads of the threaded rod. The button may then be rotated around until it is adjacent to the button base such that the corresponding surfaces of the button base and button are in contact and the button base is rotationally captive in the receiver. The tension provided by the spring or other tensioning device may then keep the button base and button aligned in the rest state, and may help to prevent the button from passively unthreading from the threaded rod when vibrations or accidental impacts occur. This also allows the button to rotate a specified amount when pressure is applied and the button base is camming out of detent lock.
(48) Persons of ordinary skill in the art will appreciate that the implementations encompassed by the present disclosure are not limited to the particular exemplary implementations described above. In that regard, although illustrative implementations have been shown and described, a wide range of modification, change, and substitution is contemplated in the foregoing disclosure. It is understood that such variations may be made to the foregoing without departing from the scope of the present disclosure. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the present disclosure.

Claims

1. A magazine catch, comprising: a rod extending along a longitudinal axis, the rod comprising threads on a first end and a bar on a second end; a button base with a bore extending therethrough, wherein the rod is configured to extend through the bore of the button base; a spring disposed around the rod, wherein a first end of the spring contacts the button base and a second end of the spring bears against a receiver; and a button comprising a first end with a planar profile configured to be pressed by a user to release a magazine and a second end with internal threads which are configured to be threaded onto the rod, the first end with the planar profile and the second end with the internal threads being integrally formed, the button comprising an extension configured to be placed within the button base, wherein during rotation of the button a first set of surfaces on the button base are configured to engage with a second set of surfaces on the button such that pressure aligns the button base and the button, wherein the receiver restrains rotational motion of the bar relative to the button base.
2. The magazine catch of claim 1, wherein the magazine catch is configured to be installed within a receiver of a firearm.
3. The magazine catch of claim 1, wherein the first set of surfaces includes a conic profile.
4. The magazine catch of claim 1, wherein the second set of surfaces includes a conic profile.
5. The magazine catch of claim 1, wherein the second set of surfaces includes an elliptical profile.
6. The magazine catch of claim 1, wherein the first set of surfaces and second set of surfaces are arranged to allow rotation of the button over a specified angular range.
7. The magazine catch of claim 4, wherein the first set of surfaces comprises a first surface extending at a first angle that is normal to the longitudinal axis of the rod and a second surface extending at a second angle that that is not normal to the longitudinal axis of the rod.
8. The magazine catch of claim 7, wherein the second set of surfaces comprises a third surface extending at the first angle that is normal to the longitudinal axis of the rod and a fourth surface extending at the second angle that that is not normal to the longitudinal axis of the rod.
9. The magazine catch of claim 1, wherein the first set of surfaces comprises a surface extending around an entire perimeter of a first side of the button base.
10. The magazine catch of claim 1, wherein the first set of surfaces and the second set of surfaces have a sawtooth shaped profile.

11. A magazine catch configured for a firearm, comprising: a threaded rod extending along a longitudinal axis, wherein the threaded rod is configured to extend through a button base; a spring disposed around the threaded rod and configured to contact the button base and provide tension on the button base; and a button with a first set of surfaces configured to contact a second set of surfaces of the button base along a contact profile to align the button base and button, wherein the button is configured to be threaded onto the threaded rod such that during rotation of the button, the first and second surfaces are engaged and are configured to drive the button base against the spring.
12. The magazine catch of claim 11, wherein the first set of surfaces includes a conic profile.
13. The magazine catch of claim 11, wherein the second set of surfaces includes a conic profile.
14. The magazine catch of claim 11, wherein the first set of surfaces comprises a first surface extending at a first angle that is normal to the longitudinal axis of the threaded rod and a second surface extending at a second angle that that is not normal to the longitudinal axis of the threaded rod.
15. The magazine catch of claim 14, wherein the second set of surfaces comprises a third surface extending at the first angle that is normal to the longitudinal axis of the threaded rod and a fourth surface extending at the second angle that that is not normal to the longitudinal axis of the threaded rod.
16. The magazine catch of claim 11, wherein the first set of surfaces comprises a surface extending around an entire perimeter of a first side of the button base.
17. The magazine catch of claim 11, the first set of surfaces and second set of surfaces have a sawtooth shaped profile.
18. A method for assembling a magazine catch, comprising: providing a threaded rod extending along a longitudinal axis; providing a button base comprising a bore extending therethrough and a first set of surfaces non-parallel to the longitudinal axis; placing the rod within the button base such that the rod extends through the bore; providing a button comprising internal threads and a second set of surfaces non-parallel to the longitudinal axis that are configured to match up with the first set of surfaces; and threading the button onto the threaded rod via the internal threads, during rotation of the button the first set of surfaces of the button base contacts the second set of surfaces of the button and provides pressure to align the button base and the button along the longitudinal axis.
19. The method of claim 18, further comprising a step to install a spring around the threaded rod, such that the spring provides tension to an end of the button base opposite the first set of surfaces.
20. The method of claim 18, wherein the first and second sets of surfaces comprise a conic profile.