A RECOIL REDUCING ELECTROMAGENT SYSTEM FOR FIREARMS

Field of the Invention

[0001] The present invention relates generally to recoil systems for firearms, and more particularly to an electromagnet system for use with a firearm that causes a reduction in recoil force of the firearm.

Background of the Invention

[0002] Generally, firearms include a chamber in which a cartridge with a bullet is loaded. In order. to fire the bullet from the firearm, a trigger is pulled. The trigger causes a firing pin to contact a back end of the cartridge and thus igniting explosive charges in a primer within the cartridge. The primer ignites a propellant which burns and generate pressure to eject bullet at a high speed from the firearm. When the bullet is ejected, the bullet exerts an equal force in the opposite direction in accordance with laws of physics. This causes a backward force on the firearm, in particular, a bolt of the firearm, which is felt by a user firing the firearm. This backward force is referred to as a recoil of the firearm.

[0003] Recoil of firearms causes physical stress to a user firing the firearm and reduces the comfort while firing the firearms. High recoil force also leads to loss of accuracy, specifically when firing multiple rounds in short period of time. Recoil pads may be used by users firing the firearm. however, recoil pads are an additionally accessory and do not reduce the recoil force of the firearm.

[0004] Accordingly, there is an established need for a solution to the problems mentioned above. For instance, there is an established need for a system coupled to a firearm that reduces a recoil force that is felt by a user firing the firearm. Further, there is an established need for a system that can be coupled to the firearm in an effective manner.

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Summary of the Invention

[0005] The present invention relates to an electromagnetic system coupled to a firearm. The firearm has a bolt moveable between a forward position and a backward position. The electromagnetic system comprises a first electromagnet unit comprising a conducting coil and a magnet, wherein the magnet is coupled to the bolt, and wherein the conducting coil is configured to generate a magnetic field that opposes a movement of the bolt from the forward position to the backward position. The electromagnetic system further comprises a second electromagnet unit comprising a generator coil, a generator magnet, and a connector connecting the generator magnet to the bolt such that movement of the bolt causes movement of the generator magnet, wherein the movement of the generator magnet is configured to induce a current in the generator coil. The electromagnetic system further comprises a power source in electrical connection with the conducting coil and the generator coil, wherein the power source is configured to receive induced current from the generator coil, and wherein the power source is configured to provide electric current to the conducting coil in order to facilitate generation of the magnetic field.

[0006] In an aspect, movement of the bolt causes movement of the magnet and the generator magnet in a same direction.

[0007] In an aspect, the first electromagnet unit is disposed within a stock of the firearm.

[0008] In an aspect, the second electromagnet unit is disposed adjacent a firing chamber of the firearm.

[0009] In an aspect, the first electromagnet unit opposing a movement of the bolt from the forward position to the backward position causes a reduction in recoil force.

[0010] In an aspect, the present invention is directed to a firearm comprising a first electromagnet unit, a second electromagnet unit, and a power source.

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[0011] These and other objects, features, and advantages of the present invention will become more readily apparent from the attached drawings and the detailed description of the embodiments and examples, which follow.

Brief Description of the Drawings

[0012] The preferred embodiments of the invention will hereinafter be described in conjunction with the appended drawings provided to illustrate and not to limit the invention, where like designations denote like elements, and in which:

[0013] FIG. 1 illustrates a perspective view of a bolt of a firearm having a first electromagnet unit coupled thereto, in accordance with an embodiment of the present specification;

[0014] FIG. 2 illustrates a side sectional view of the bolt and the first electromagnet unit of FIG. 1, in accordance with an embodiment of the present specification;

[0015] FIG. 3 illustrates a perspective view of a firearm comprising the first electromagnet unit and a second electromagnet unit, in accordance with an embodiment of the present specification;

[0016] FIG. 4 illustrates a sectional side view of the firearm of FIG. 3, the bolt being in a forward position, in accordance with one embodiment of the present specification;

[0017] FIG. 5 illustrates a sectional side view of the firearm of FIG. 3, the bolt being in a backward position, in accordance with one embodiment of the present specification;

[0018] FIG. 6 illustrates a top sectional partial view of the firearm of FIG. 3 with a cartridge loaded in the firing chamber and the bolt in the forward position, in accordance with one embodiment of the present specification; and

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[0019] FIG. 7 illustrates a top sectional partial view of the firearm of FIG. 3 with a cartridge being extracted from the firing chamber and the bolt in the backward position, in accordance with one embodiment of the present specification.

[0020] Like reference numerals refer to like parts throughout the several views of the drawings.

Detailed Description

[0021] The following detailed description is merely exemplary in nature and is not intended to limit the described embodiments or the application and uses of the described embodiments. As used herein, the word "exemplary" or "illustrative" means "serving as an example, instance, or illustration." Any implementation described herein as "exemplary" or "illustrative" is not necessarily to be construed as preferred or advantageous over other embodiments. All of the embodiments described below are exemplary embodiments provided to enable persons skilled in the art to make or use the embodiments of the disclosure and are not intended to limit the scope of the disclosure, which is defined by the claims. For purposes of description herein, the terms "upper", "lower", "left", "rear", "right", "front", "vertical", "horizontal", and derivatives thereof shall relate to the invention as oriented in the drawings. Furthermore, there is no intention to be bound by any expressed or implied theory presented in the preceding technical field, background, brief summary or the following detailed description. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

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[0022] In the following description, certain specific details are set forth in order to provide a thorough understanding of various disclosed embodiments. However, one skilled in the relevant art will recognize that embodiments may be practiced without one or more of these specific details, or with other methods, components, materials, and the like. In other instances, well-known elements associated with firearms and components thereof have not been shown or described in detail to avoid unnecessarily obscuring descriptions of the embodiments.

[0023] Unless the context requires otherwise, throughout the specification and claims which follow, the word "comprise" and variations thereof, such as, "comprises" and "comprising" are to be construed in an open, inclusive sense, that is, as "including, but not limited to."

[0024] As used in this specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the content clearly dictates otherwise, and the vice versa. It should also be noted that the term "or" is generally employed in its broadest sense, that is, as meaning "and/or" unless the content clearly dictates otherwise.

[0025] The headings and Abstract of the Disclosure provided herein are for convenience only and do not interpret the scope or meaning of the embodiments.

[0026] Reference is initially made to FIGS. 1-2 in which FIG. 1 illustrates a perspective view of a bolt 110 of a firearm having a first electromagnet unit 100 coupled thereto while FIG. 2 illustrates a side sectional view of the bolt 110 and the first electromagnet unit 100. The bolt 110 refers to the component in a firearm that facilitates loading of cartridge in a firearm as well as unloading of an empty cartridge from the firearm after use.

[0027] A firearm, for instance a semi-automatic firearm, generally comprises a firing chamber in which cartridges are positioned for firing. The cartridges are initially positioned in a magazine and for loading of a cartridge, the bolt interacts with the cartridge in the magazine and

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moves forward thereby shifting the cartridge into the firing chamber. Upon pulling a trigger of the firearm, a firing pin interacts with the cartridge for activating the bullet which is then fired from the firearm at high velocity. Post the firing of the bullet, the bolt retracts backwards and pulls the empty cartridge which is extracted from the firing chamber by means of an extractor. One firing round is thus completed. For a second round, the bolt again moves forwards to load another cartridge and the same steps are repeated for firing and extraction of cartridges.

[0028] It is appreciated that the term 'forward' and 'backward' refers to directions along a longitudinal axis of a firearm. A firearm generally has a barrel opening through which the bullet escapes the firearm and a stock which acts as a shoulder support portion and provides structural support. As used herein, the forward direction refers to a direction moving from the stock to the barrel opening, and the backward direction refers to direction moving from the barrel opening to the stock.

[0029] Further, the firearm additionally comprises a recoil spring positioned at a rear of the bolt configured to contain the recoil when the firearm is fired. The force generated upon firing causes the firearm to pull back towards a user and the recoil spring works to lessen the impact of the recoil force that the user receives from the pull back of the firearm.

[0030] As seen in FIGS. 1-2, the bolt 110 comprises an engaging portion 112 at a forward end thereof, the engaging portion 112 being configured for loading and unloading of a cartridge. A recoil spring 114 is coupled around a rear end of the bolt 110, the recoil spring 114 being configured to absorb recoil of the firearm. When the firearm is fired, the bolt 110 moves in the direction A thereby compressing the recoil spring 114. Thereafter, the recoil spring 114 decompresses and moves the bolt 110 in the direction B back to the original position.

[0031] The bolt 110 comprises a magnet 116 attached at the rear end thereof. In some embodiments, the magnet 116 is a permanent magnet. In some embodiments, the magnet 116

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forms an integral part of the bolt 110. In some embodiments, the magnet 116 is connected to the bolt 110. As the bolt 110 moves in the directions A and B, the magnet 116 is also caused to move together with the bolt 110. In some embodiments, the magnet 116 acts as a buffer weight for the bolt 110 and may be configured to have a predetermined weight.

[0032] A first electromagnet unit 100 is coupled to the bolt 110 at the rear end of the bolt 110. The first electromagnet unit 100 comprises a chamber 102 extending between rims 104 and 106. In some embodiments, the chamber 102 is a hollow chamber and is configured to receive the magnet 116 of the bolt 110. The chamber 102 further allows the magnet 116 to be displaced forwardly and backwardly there within, as shown by arrow C in FIG. 2. In some embodiments, the magnet 116 forms a component of the first electromagnet unit 100, the magnet 116 being attached to the bolt 110.

[0033] The first electromagnet unit 100 further comprises a conducting coil 108 disposed over the chamber 102. The conducting coil 108 is formed of a conducting material having a high electrical conductivity. Some non-limiting examples of materials for the conducting coil 108 include copper, copper-beryllium, copper coated aluminum, brass and aluminum alloy, etc. In some embodiments, the conducting coil 108 forms a solenoid. In some embodiments, the conducting coil 108 assumes a spiral or helix shape. In some embodiments, the conducting coil 108 may be formed for multiple smaller coils.

[0034] The conducting coil 108 is in an electrical connection with a power source (not seen in FIGS. 1-2) that causes a current to pass through the conducting coil 108. When a current passes through the conducting coil 108, a magnetic field is generated based on the principles of Ampere-Maxwell law. As would be understood to a skilled person, the direction of the magnetic field would depend on the direction of flow of current in the conducting coil 108.

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[0035] When the bolt 110 moves backwards in the direction A due to the recoil force generated upon firing the firearm, the magnet 116 also moves backwards within the chamber 102. The current flowing in the conducting coil 108 causes generation of a magnetic field that opposes the movement of the magnet 116 within the chamber 102, i.e., the generated magnetic field has a opposite polarity to the magnet 116. It is appreciated that the direction of current flowing in the conducting coil 108 can be predetermined based on the direction of magnetic field to be generated.

[0036] In some embodiments, when the magnet 116 moves backwards (during recoil), the generated magnetic field of the conducting coil 108 opposes the movement of the magnet 116, and when the magnet 116 moves forwards (for loading next round), the current in the conducting coil 108 is made to flow in an opposite direction so as to generate a magnetic field in an opposite direction that supplement the movement of the magnet 116. In some embodiments, when the magnet 116 moves forwards, the current in the conducting coil 108 may be stopped.

[0037] In some embodiments, the current in the conducting coil 108 may be made to flow such that the magnetic field holds the bolt 110 in the backward position, thus allowing more control of the bolt 110 as well as facilitating various bolt settings .For instance, the bolt 110 may be held back in the backward position after firing of a round in order to prevent the loss of empty cartridges (shell casings) extracted from the firearm after firing.

[0038] In some embodiments, the first electromagnet unit 100 may comprise biasing means 105 within the chamber 102 that compresses when the magnet 116 interacts therewith during the backward movement and decompresses to facilitate the forward movement of the magnet 116.

[0039] Accordingly, the first electromagnet unit 100 acts as a recoil absorbing means that reduces the recoil felt by a user during firing of a firearm by virtue of the magnetic repulsion

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between the magnetic field generated by the conducting coil 108 and the magnet 116 of the bolt 110.

[0040] Reference is made to FIG. 3 that illustrates a perspective view of a firearm 120 comprising the first electromagnet unit 100 and the bolt 110 described above with reference to FIGS. 1-2. The firearm 120 comprises a barrel opening 122 through which a bullet exits the firearm when fired and a firing chamber 124 which houses cartridge to be fired and the bolt 110 (best seen in FIG. 4). The firearm 120 comprises a trigger 126 that leads to firing of the bullet from a loaded cartridge. The firearm 120 further comprises a stock 128 that forms a shoulder support for a user firing the firearm 120.

[0041] The first electromagnet unit 100 is positioned within the stock 128 of the firearm 120. The bolt 110 extends from the firing chamber 124 at least partially within the stock 128. The firearm 120 comprises a power source 125 configured to provide supply of current to the conducting coil 108 of the first electromagnet unit 100 causing generation of a magnetic field for reducing recoil effect when the firearm is fired by a user. In some embodiments, the power source 125 is a rechargeable battery. In some embodiments, the power source 125 is electrically connected to the conducting coil 108 of the first electromagnet unit 100 by a wired connection. In some embodiments, the power source 125 may be at least partially powered by solar power.

[0042] The firearm 120 further comprises a second electromagnet unit 130 coupled to the firearm 120, the second electromagnet unit 130 being configured to facilitate generation of electric energy, as will be described further below. The first electromagnet unit 100 together with the second electromagnet unit 130 forms an electromagnetic recoil control system that can be utilized with the firearm 120 for efficiently reducing the recoil felt by a user firing the firearm 120. In some embodiments, the electromagnetic recoil system may allow the user to set and adjust multiple recoil parameters.

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[0043] Reference is made to FIGS. 4-5 illustrating a sectional side view of the firearm 120 with the electromagnetic recoil control system attached thereto, in which, FIG. 4 illustrates the bolt 110 in a forward position, and FIG. 5 illustrates the bolt 110 in a backward position. The bolt 110 is disposed in the firing chamber 124 and extends as least partially within the stock 128. The bolt 110 is configured to move forwards and backwards during use of the firearm, in that, the bolt 110 moves backwards in direction A (also seen in FIGS. 1-2) due to recoil force and to extract a fired cartridge while the bolt 110 moves forwards in direction B (also seen in FIGS. 1-2) to load the next cartridge for firing.

[0044] The second electromagnet unit 130 comprises a container 132 that is attached to the firearm 120, for instance, adjacent the firing chamber 124 of the firearm 120. In some embodiments, the container 132 is a hollow container allowing one or components to move there-within. The second electromagnet unit 130 further comprises a connector 134 disposed within the container 132 and articulated to the bolt 110 such that movement of the bolt 110 results in movement of the connector 134 in the same direction. In some embodiments, the connector 134 is fixedly articulated to the bolt 110. In some embodiments, the connector 134 is detachably articulated to the bolt 110.

[0045] The connector 134 comprises a generator magnet 136 at a free end portion thereof, i.e., at an end opposite to the end articulated to the bolt 110. The generator magnet 136 moves together with the connector 134 within the container 132. The container 132 further comprises a generator coil 138 disposed therein. The generator coil 138 may have a hollow spiral or helical configuration so as to allow the generator magnet 136 to freely move there-through. In some embodiments, the generator coil 138 may be formed for multiple smaller coils.

[0046] Initially, the bolt 110 is in the forward position as seen in FIG. 4. When the bolt 110 moves backwards in direction A to assume the backward position, the connector 134 and the

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generator magnet 136 also move backwards, as seen in FIG. 5. Simultaneously, the magnet 116 of the bolt 110 also moves relative to the conducting coil 108 of the first electromagnet unit 100, as seen in FIG. 5.

[0047] The movement of the generator magnet 136 relative to the generator coil 138 causes generation of an electromotive force (emf), i.e., a voltage is generated in the generator coil 138 in accordance with Faraday's law. This further leads to generation of an induction current in the generator coil 138. The generator coil 138 is electrically connected to the power source 125 so as to provide the generated induction current to the power source 125, thereby charging the power source 125. It is appreciated that the direction of the flow of induction current may be predetermined based on the polarity of the generator magnet 136.

[0048] The second electromagnet unit 130 thus functions as an electric energy generator by virtue of the relative movement of the generator magnet 136 and the generator coil 138. The induced current in the generator coil 138 charges the power source 125, which further provides current to the conducting coil 108 of the recoil-absorbing first electromagnet unit 100. Accordingly, an efficient electromagnetic recoil control system comprising the first electromagnet unit 100 and the second electromagnet unit 130 is provided that can be utilized with the firearm 120 for efficiently reducing the recoil felt by a user at least partially by using energy generated by the movement of the bolt 110 itself.

[0049] Reference is made to FIGS. 6-7 to illustrate the motion of the bolt 110 relative to the conducting coil 108 of the first electromagnet unit 100. FIG. 6 illustrate a top sectional view of the firearm 120 in which a cartridge 140 with a bullet is loaded in the firing chamber 124. The bolt 110 is in the forward position and the recoil spring 114 is de-compressed. When the firearm is fired, the bullet escapes the firearm 120 and the empty cartridge is extracted from the firearm, as shown by arrow D in FIG. 7. The bolt 110 moves backwards to facilitate extraction of the

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cartridge 140, and at the same time, the magnet 116 of the bolt 110 also moves backwards relative to the conducting coil 108.

[0050] The conducting coil 108 is electrically connected to the power source 125 (not shown in FIGS. 6-7) and current flows in the conducting coil 108 leading to a magnetic field which opposes the backward motion of the magnet 116 and the bolt 110, thus reducing a recoil felt by a user firing the firearm. In some embodiments, the power source 125 is activated upon pressing of the trigger of the firearm, thus leading to flow of current in the conducting coil 108 in response to the firearm being fired.

[0051] Simultaneously with the movement of the magnet 116 relative to the conducting coil 108 of the first electromagnet unit 100, the second electromagnet unit 130 (not shown in FIGS. 6-7) also functions to generate electric energy. The connector 134 and the generator magnet 136 move together with the bolt 110, the movement of the generator magnet 136 being relative to the generator coil 138 and causing generation of an induced current in the generator coil 138. The induced current can then be provided to the power source 125 in order to charge the power source 125 and regain some of the energy being provided by the power source 125 to the conducting coil 108 of the first electromagnet unit 100.

[0052] The first electromagnet unit 100 and the second electromagnet unit 130 thus form an electromagnetic system and function in tandem to reduce a recoil felt by the user firing the firearm as well as allow charging of the power source that is providing energy to reduce the recoil effects of the firearm. A user using a firearm having the electromagnetic system, or even one of the first electromagnet unit 100 and the second electromagnet unit 130, does not feel a hard recoil from firing the firearm.

[0053] Since many modifications, variations, and changes in detail can be made to the described preferred embodiments of the invention, it is intended that all matters in the foregoing

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description and shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. Thus, the scope of the invention should be determined by the appended claims and their legal equivalents.

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What is claimed is:

1. An electromagnetic system coupled to a firearm, the firearm having a bolt moveable between a forward position and a backward position, the electromagnetic system comprising:

a first electromagnet unit comprising a conducting coil and a magnet, wherein the magnet is coupled to the bolt, and wherein the conducting coil is configured to generate a magnetic field that opposes a movement of the bolt from the forward position to the backward position;

a second electromagnet unit comprising a generator coil, a generator magnet, and a connector connecting the generator magnet to the bolt such that movement of the bolt causes movement of the generator magnet, wherein the movement of the generator magnet is configured to induce a current in the generator coil; and

a power source in electrical connection with the conducting coil and the generator coil, wherein the power source is configured to receive induced current from the generator coil, and wherein the power source is configured to provide electric current to the conducting coil in order to facilitate generation of the magnetic field.

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A RECOIL REDUCING ELECTROMAGENT SYSTEM FOR FIREARMS

Abstract of the Disclosure

An electromagnetic system coupled to a firearm is described. The firearm has a bolt moveable between a forward position and a backward position. The electromagnetic system comprises a first electromagnet unit comprising a conducting coil and a magnet, wherein the magnet is coupled to the bolt, and wherein the conducting coil is configured to generate a magnetic field that opposes a movement of the bolt from the forward position to the backward position. The electromagnetic system further comprises a second electromagnet unit comprising a generator coil, a generator magnet, and a connector connecting the generator magnet to the bolt such that movement of the bolt causes movement of the generator magnet, wherein the movement of the generator magnet is configured to induce a current in the generator coil. The electromagnetic system further comprises a power source in electrical connection with the conducting coil and the generator coil, wherein the power source is configured to receive induced current from the generator coil, and wherein the power source is configured to provide electric current to the conducting coil in order to facilitate generation of the magnetic field.

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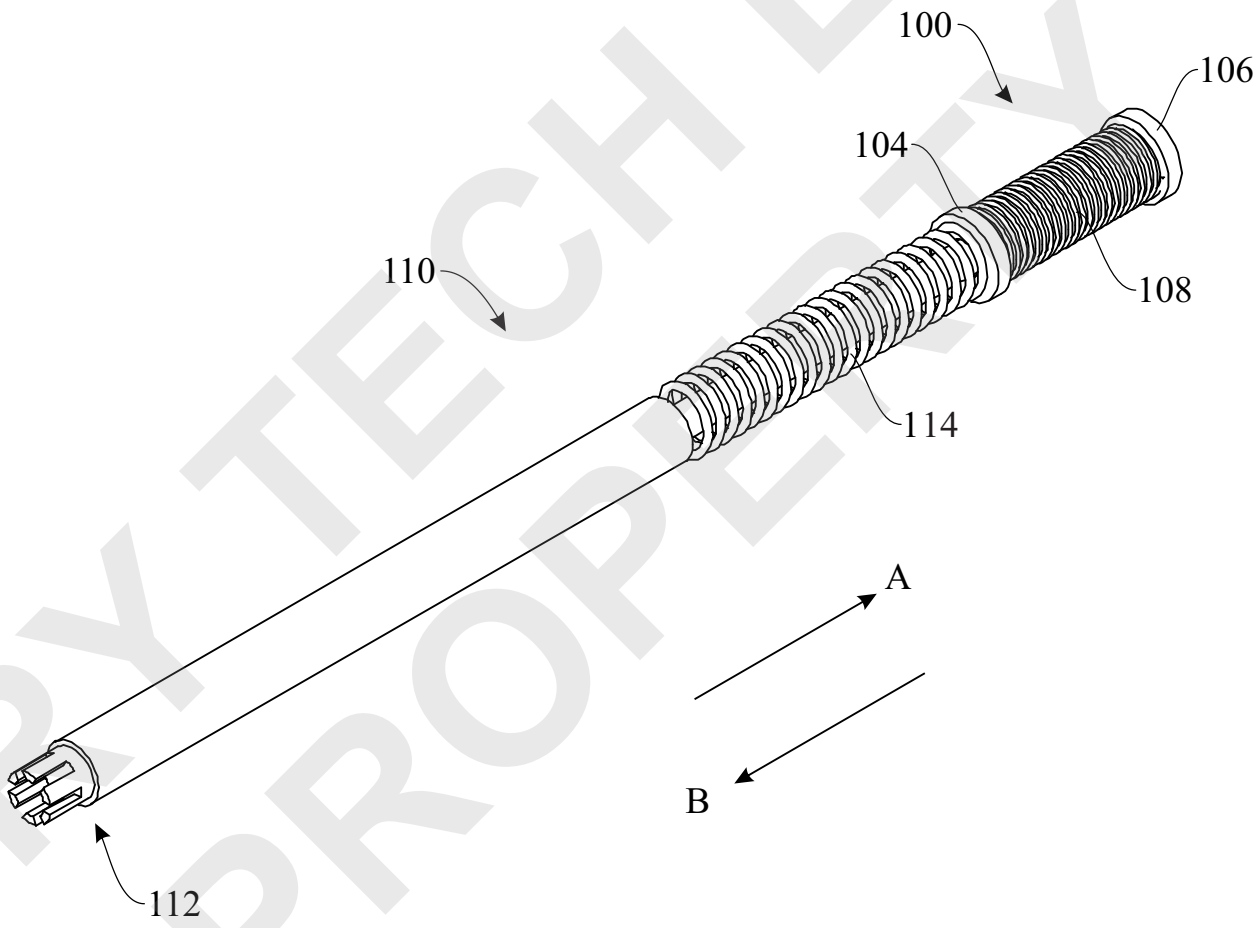

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FIG. 1

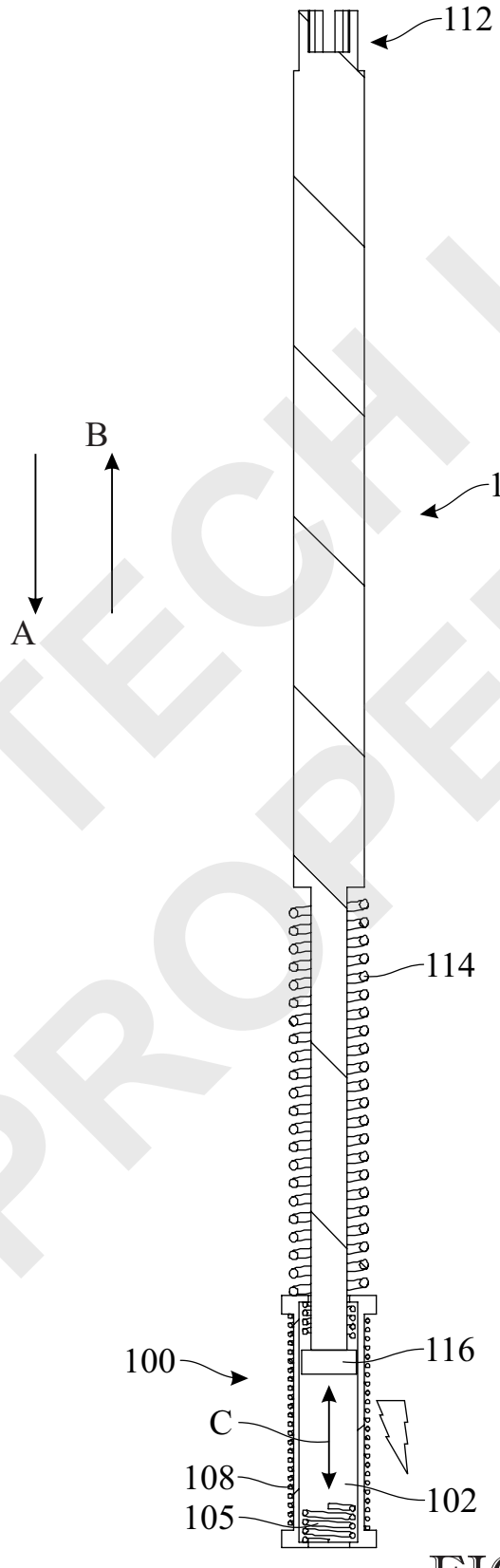

FIG. 2

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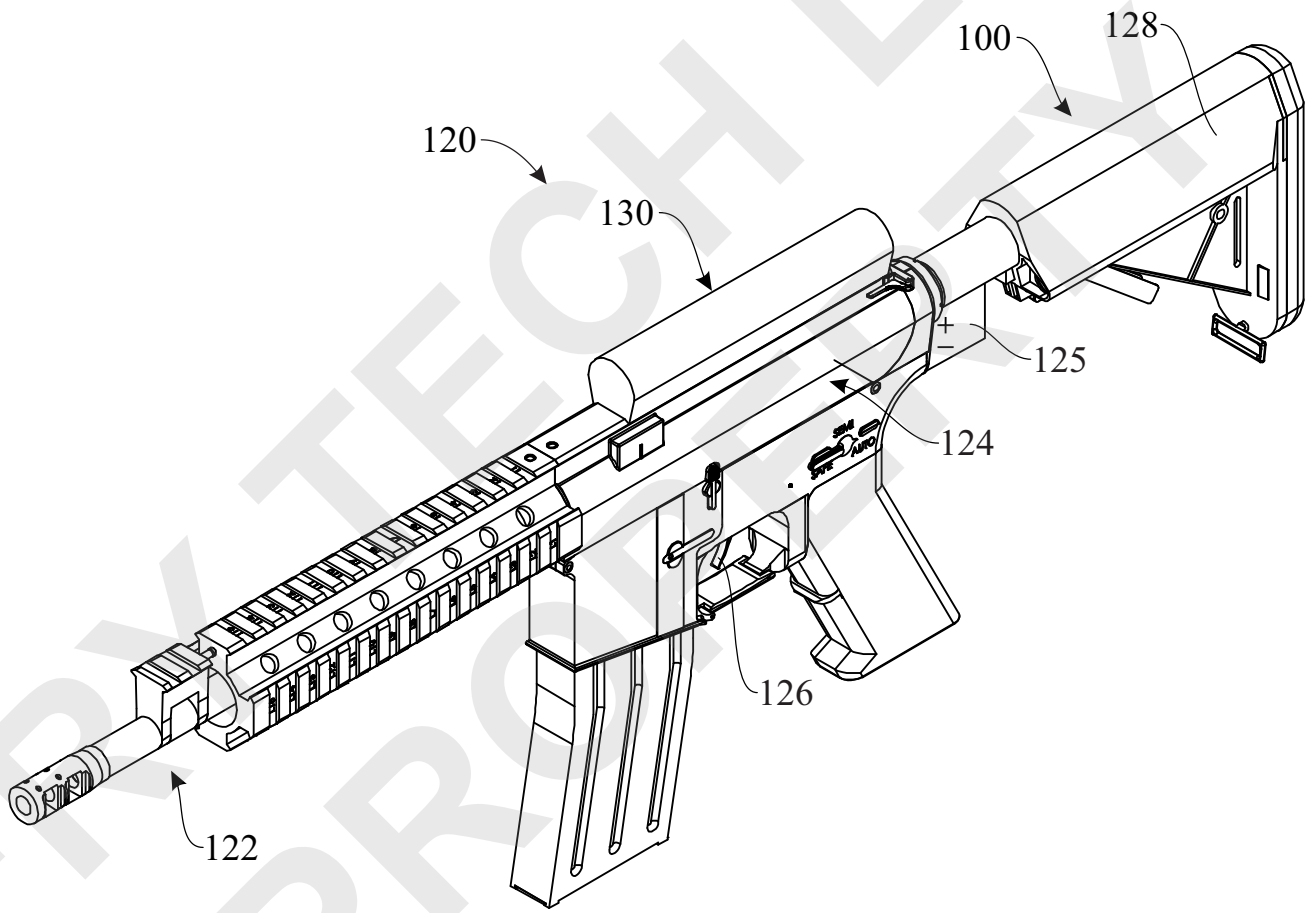

FIG. 3

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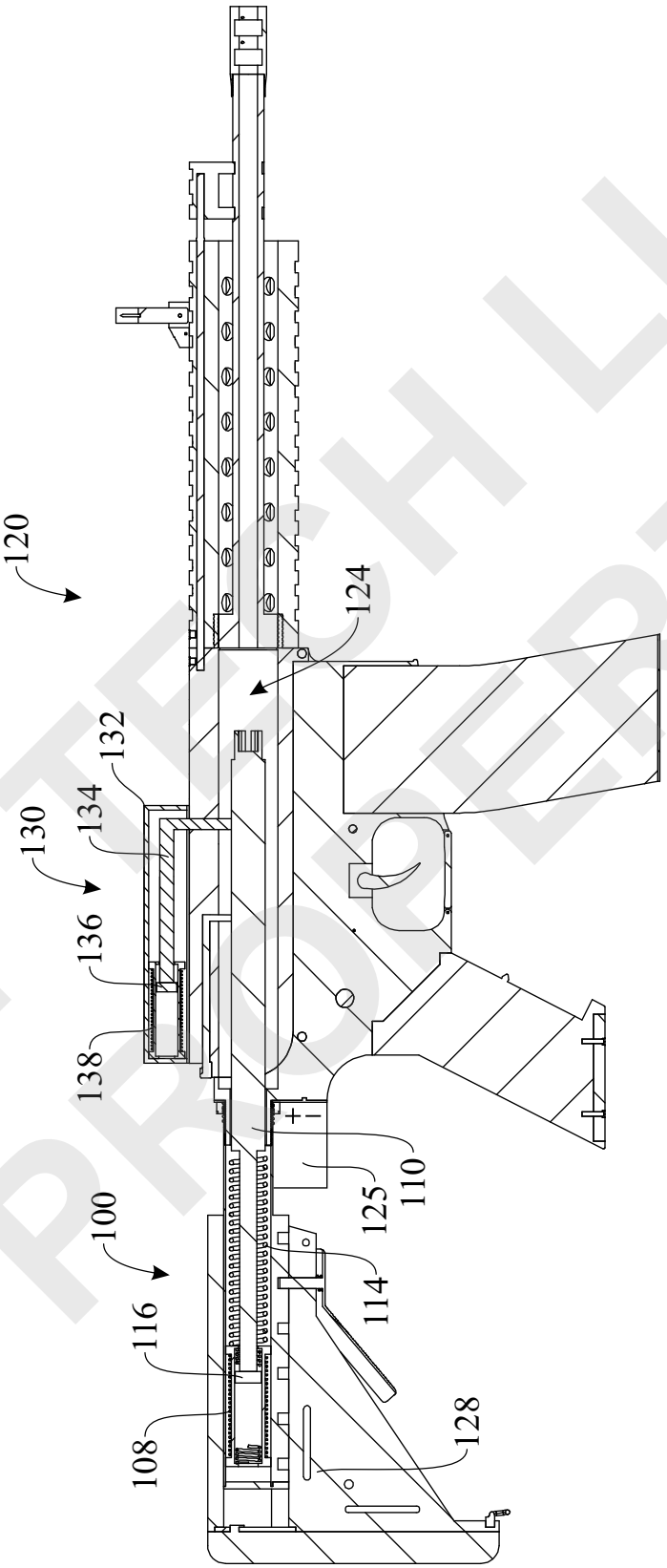

FIG. 4

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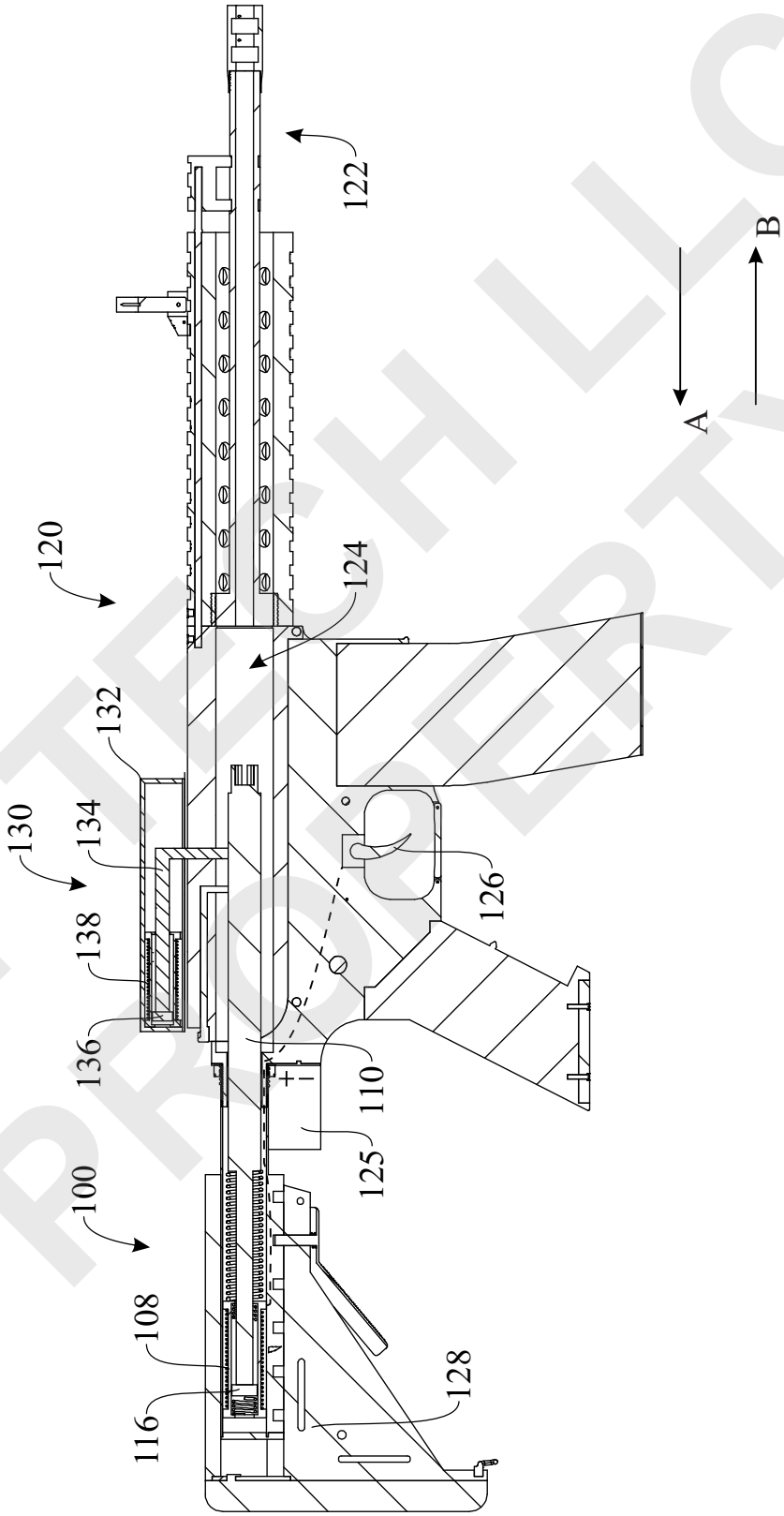

FIG. 5

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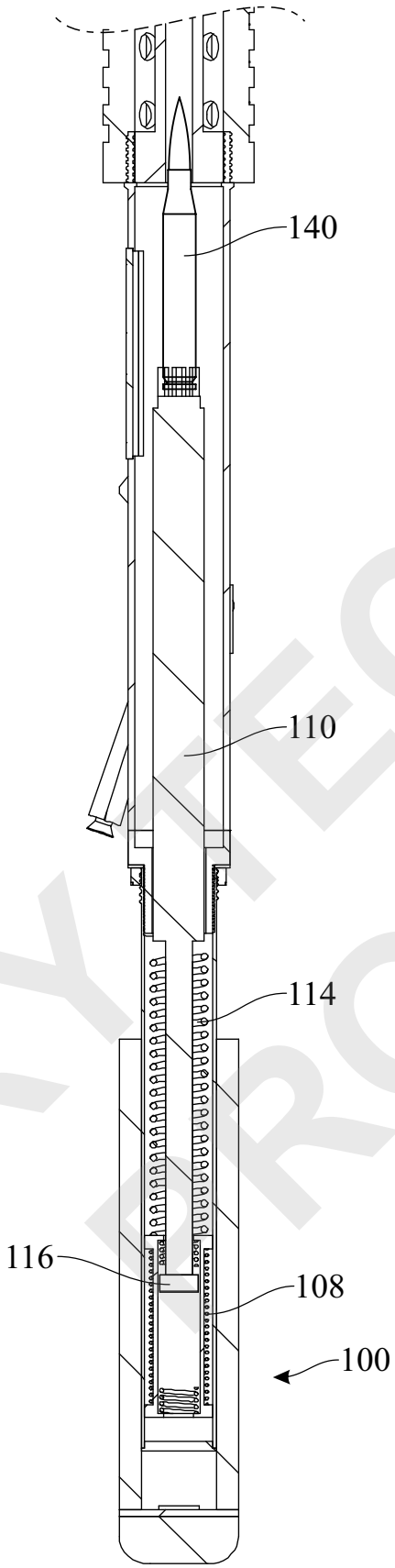

FIG. 6

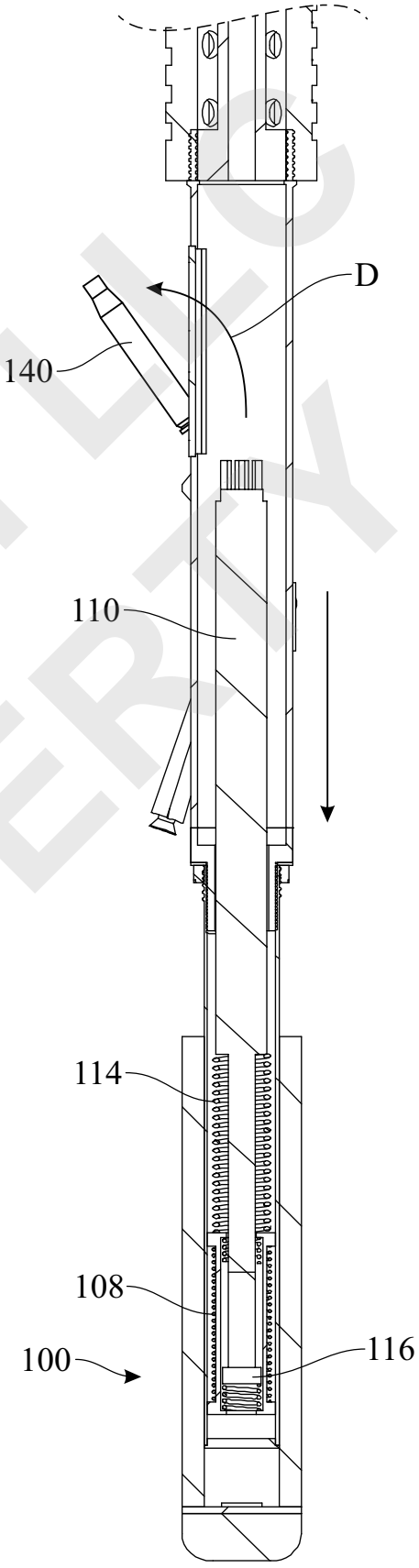

FIG. 7

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