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(54) **BUFFER ASSEMBLY FOR FIREARM RECIPROCATING BOLT**

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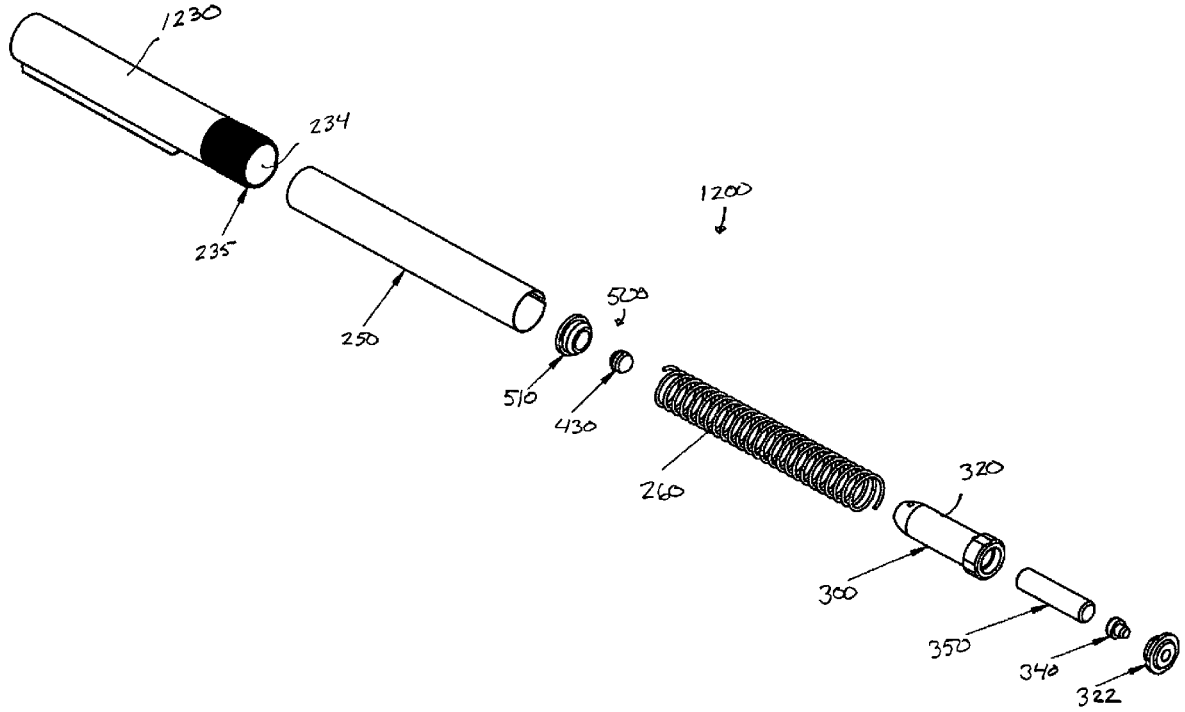
(57) **ABSTRACT**

A buffer assembly for a firearm has a tubular receiver extension. A damper assembly is positioned within the receiver extension adjacent the receiver extension rear end, and a spring is positioned within the receiver extension with the rear end of the spring surrounding the damper assembly. A buffer is positioned within the receiver extension at the opposite end of the spring from the damper assembly. The receiver extension has a liner that surrounds the spring creating a layer between the spring and the receiver extension. The liner may be a friction reducing material such as a polymer material.



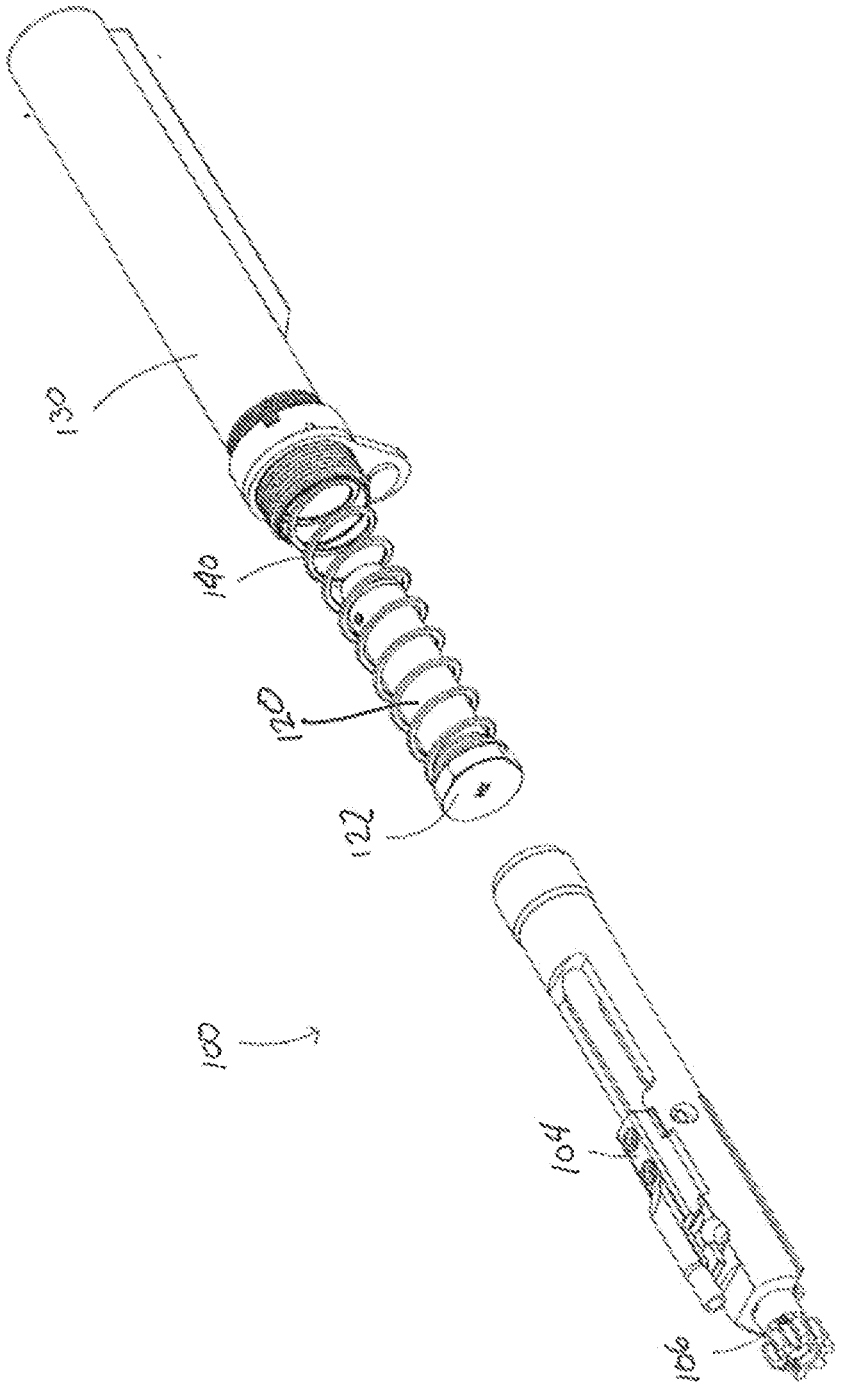


FIG. 1

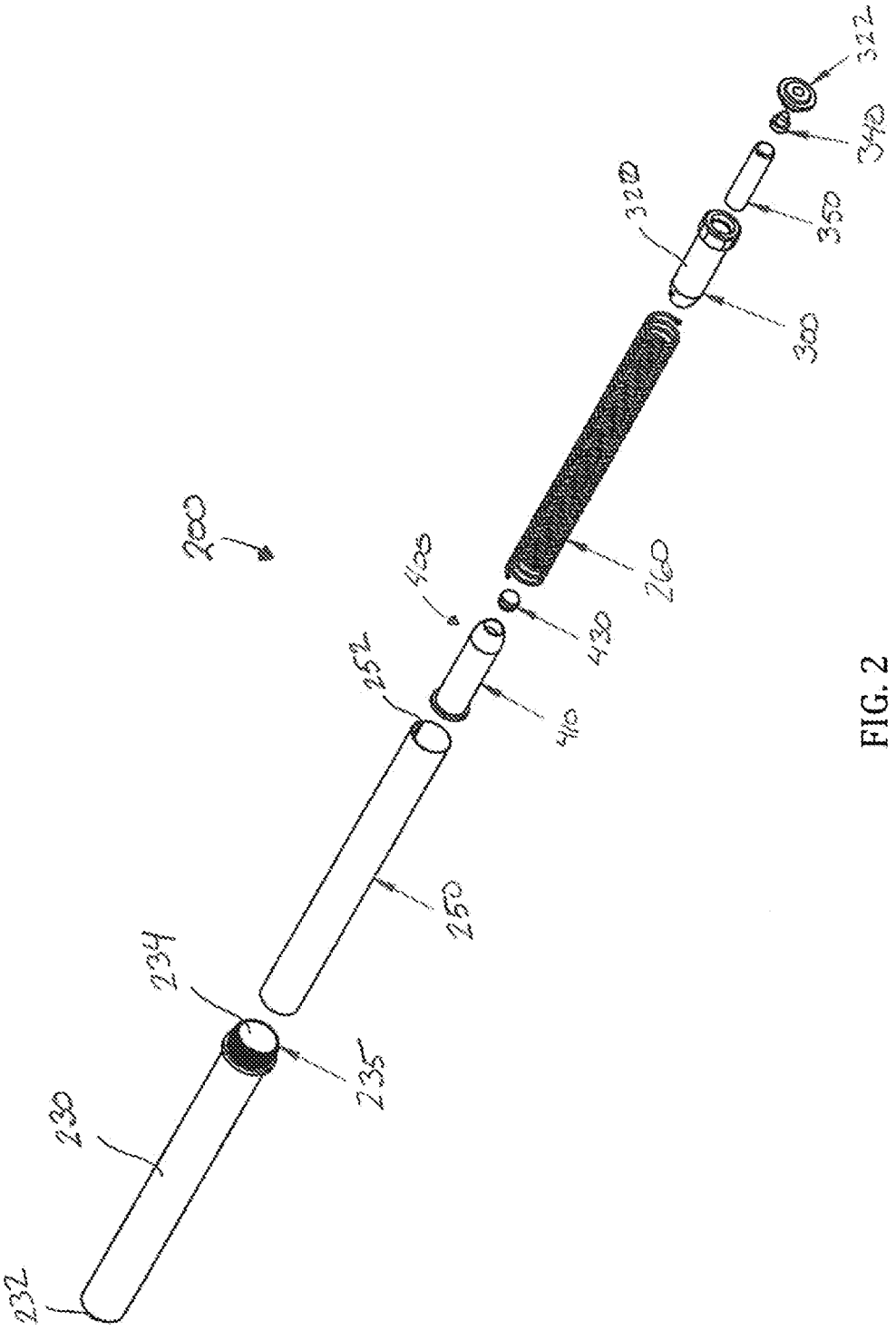


FIG. 2

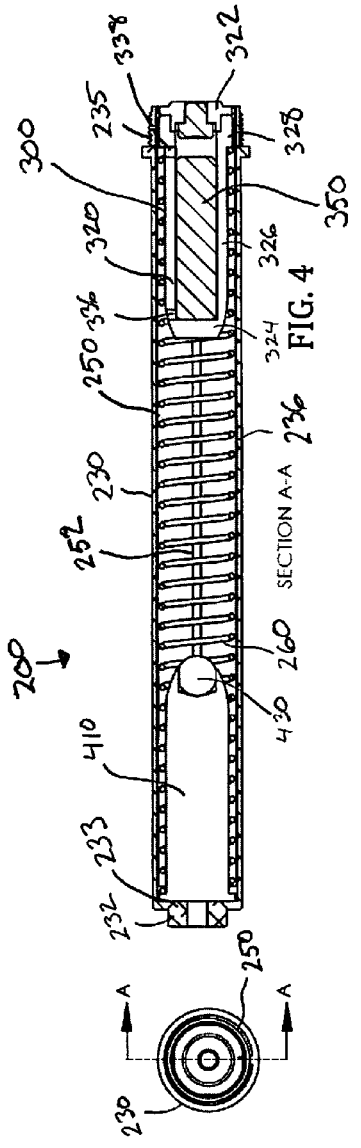


FIG. 3

FIG. 4

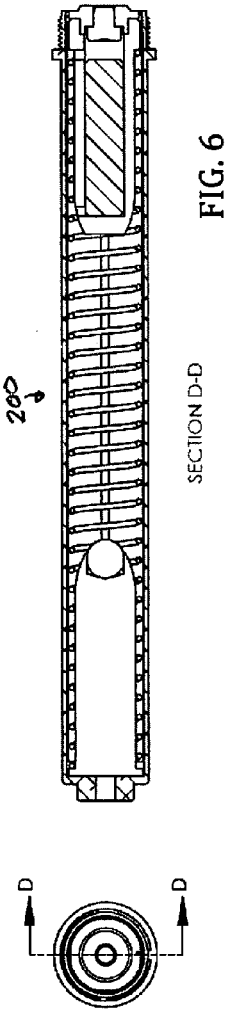


FIG. 5

FIG. 6

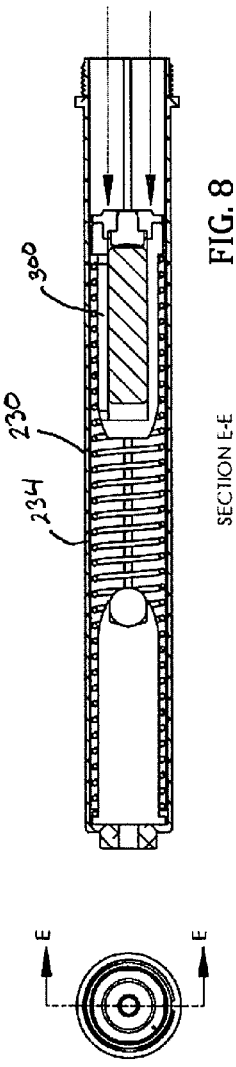


FIG. 7

FIG. 8

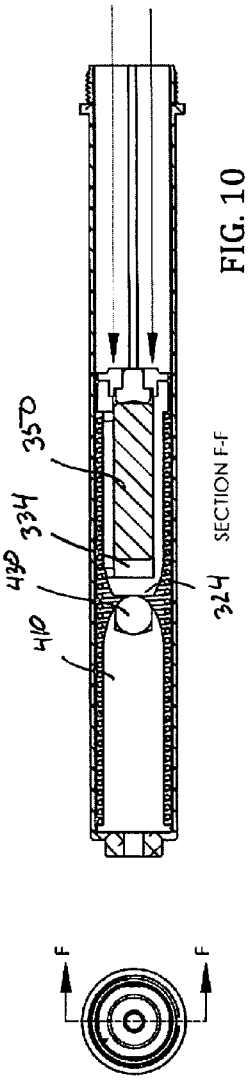


FIG. 9

FIG. 10

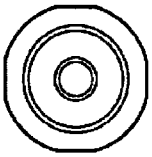


FIG. 14

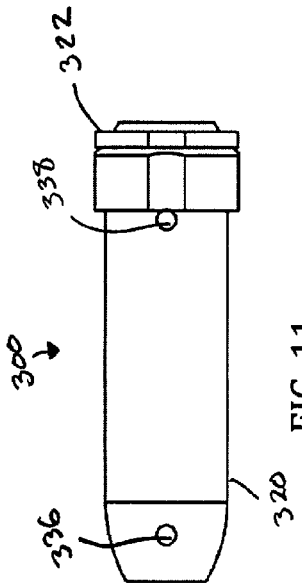


FIG. 11

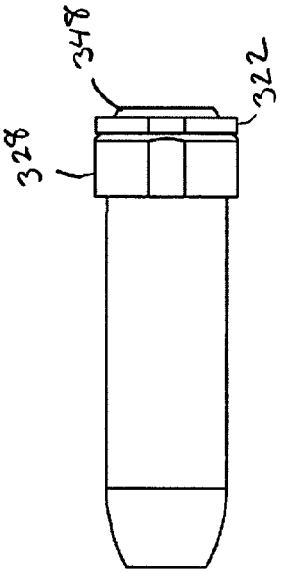


FIG. 13

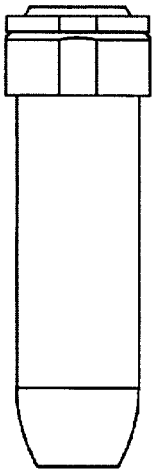


FIG. 15

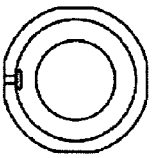
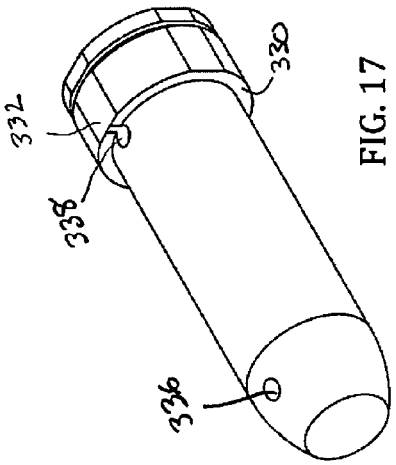


FIG. 12



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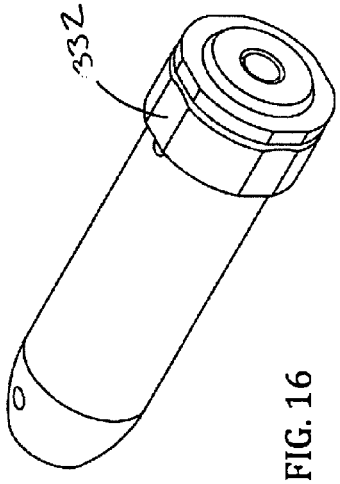

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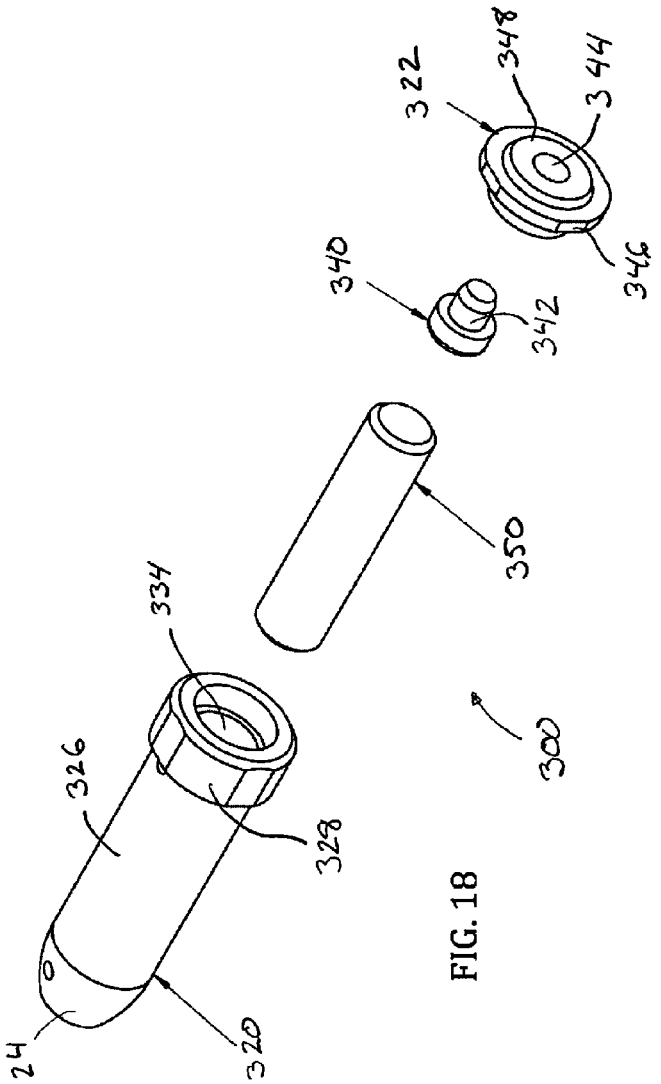


FIG. 18

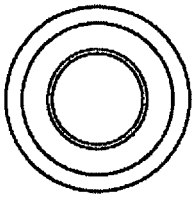


FIG. 22

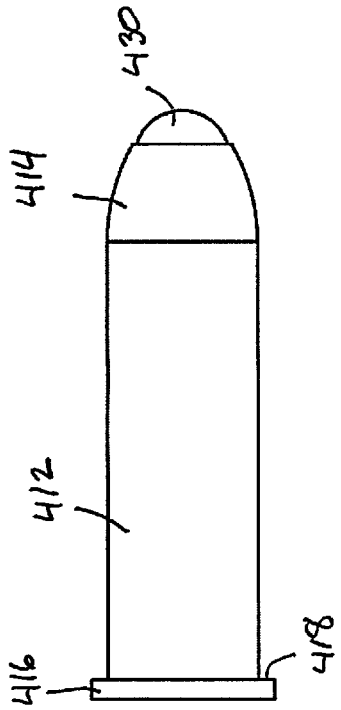
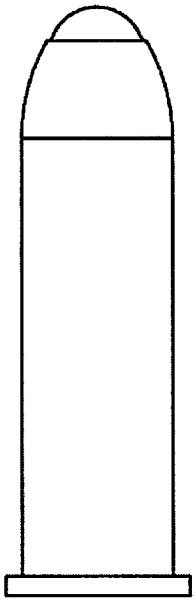


FIG. 19



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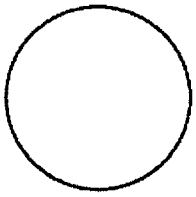

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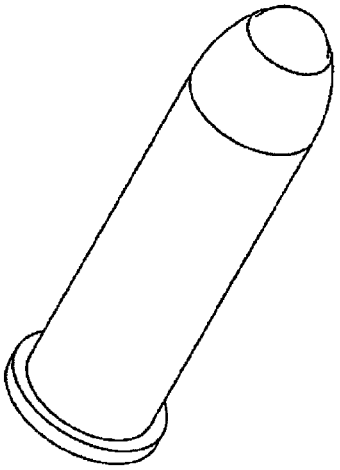

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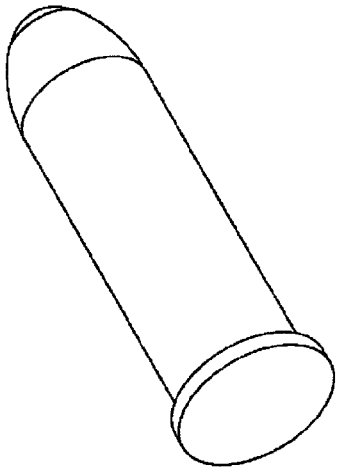

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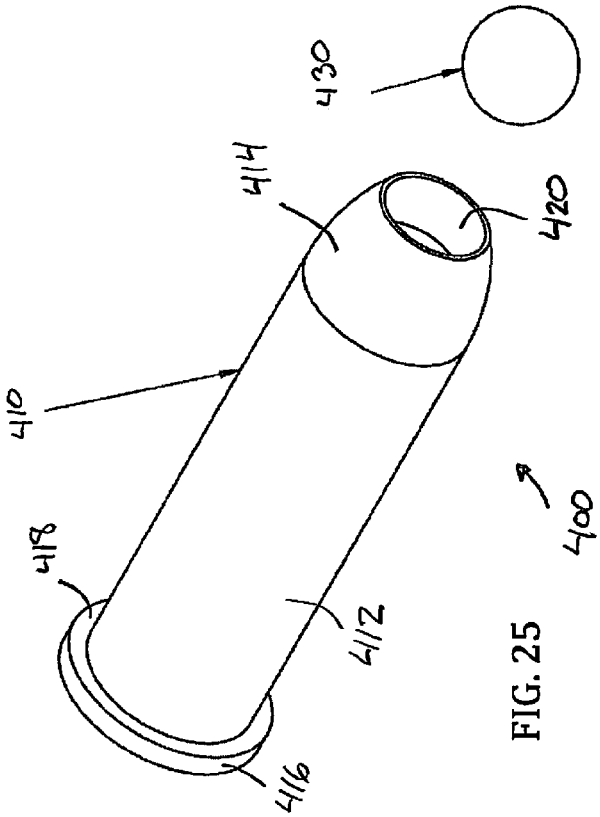

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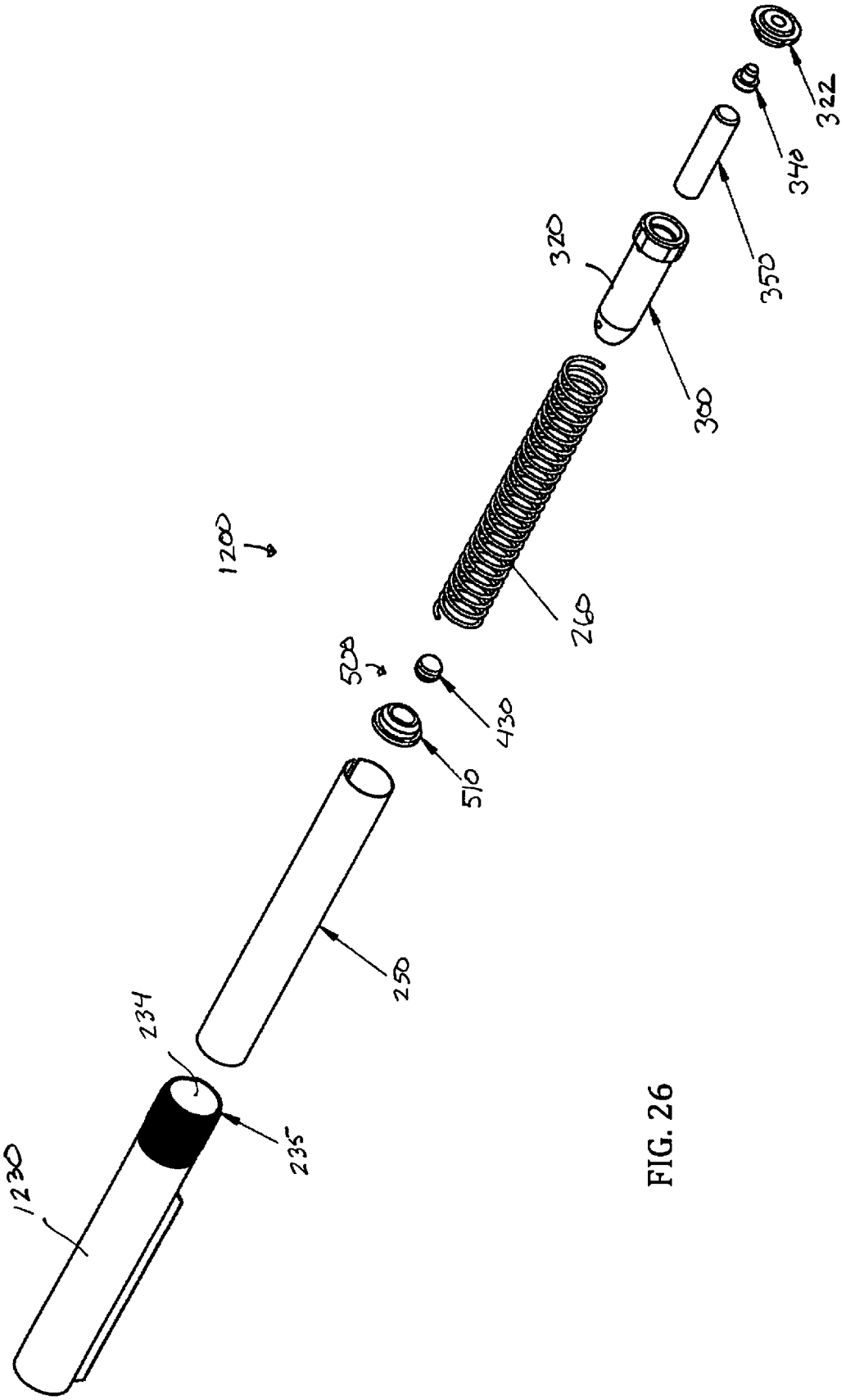

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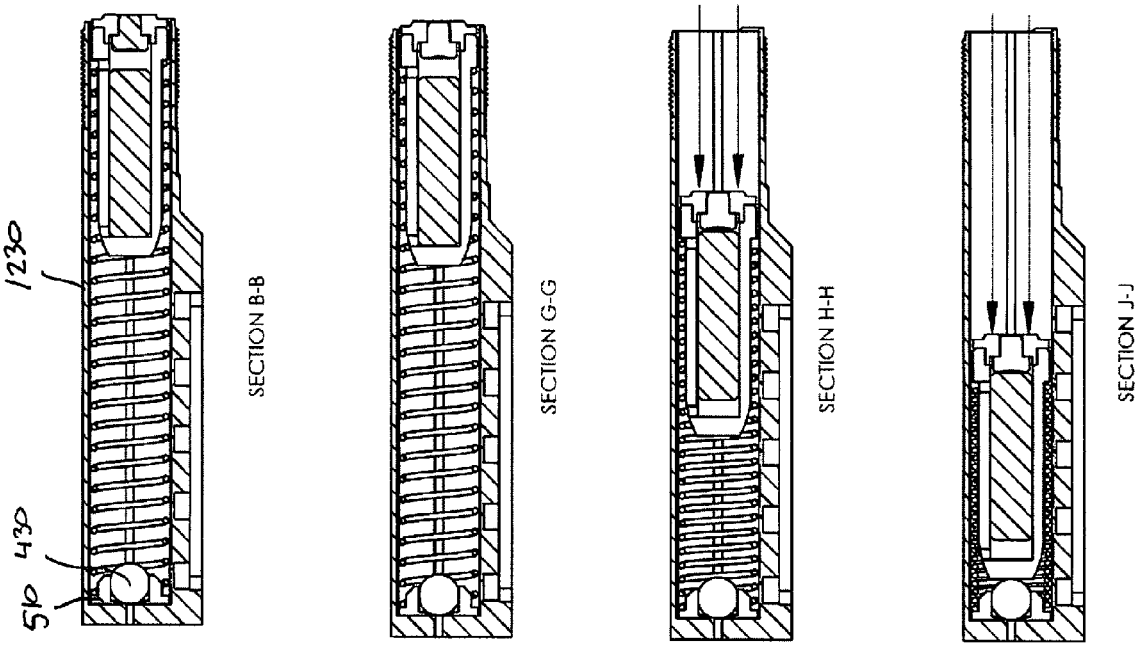


FIG. 28 FIG. 30 FIG. 32 FIG. 34

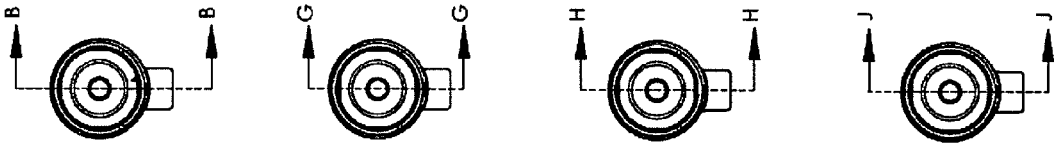
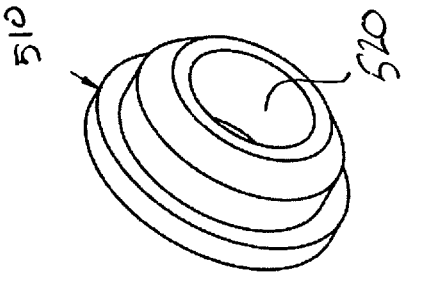


FIG. 27 FIG. 29 FIG. 31 FIG. 33



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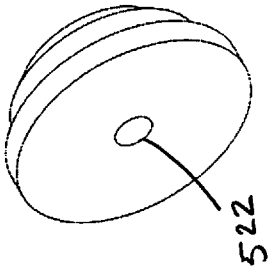

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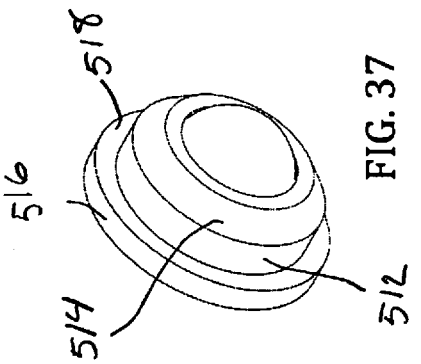

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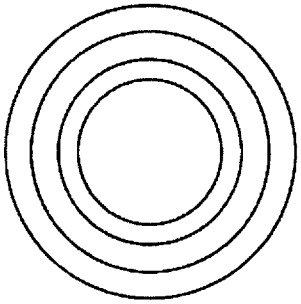
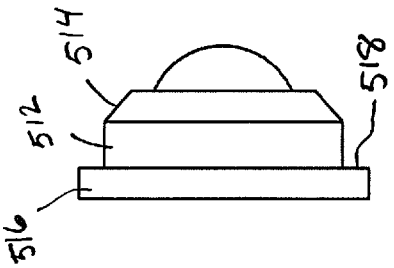


FIG. 40



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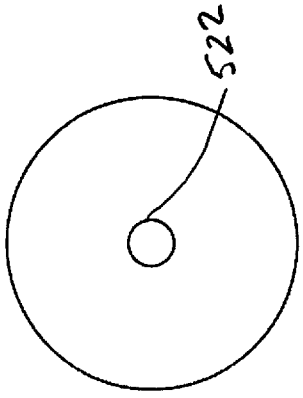

FIG. 38

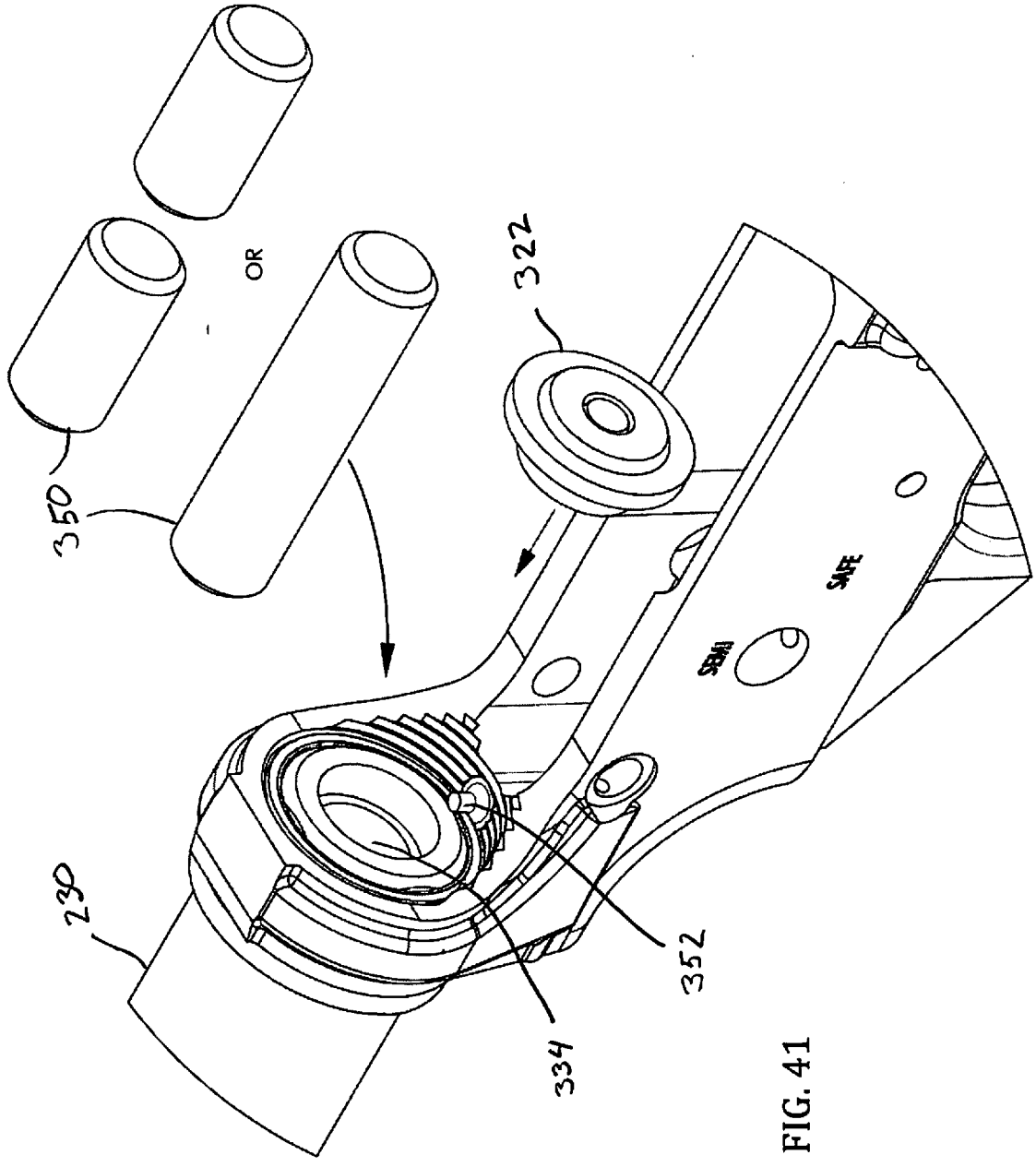

FIG. 41

BUFFER ASSEMBLY FOR FIREARM RECIPROCATING BOLT

FIELD OF THE INVENTION

[0001] The present invention relates to the action of a firearm. In particular, the present invention relates to a buffer assembly used in conjunction with a reciprocating bolt firearm.

BACKGROUND OF THE INVENTION

[0002] Existing reciprocating bolt firearms, including carbines and rifles, such as the AR15/M16 among others, employ a buffer assembly to reduce the effect of recoil on the operator and as part of the firing cycle of the firearm. The buffer assembly typically includes a buffer tube, a buffer spring and a buffer. However, existing buffer assemblies suffer from a number of deficiencies. For example, existing assemblies are heavy, noisy, operate in course or rough manner that distracts the operator, require significant maintenance, and are not easily adjusted to meet individual requirements.

BRIEF DESCRIPTION OF THE FIGURES

[0003] Advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings.

[0004] FIG. **1** is an exploded isometric view of a buffer assembly in accordance with existing firearms.

[0005] FIG. **2** is an exploded isometric view of a rifle-length buffer assembly in accordance with embodiments of the present invention.

[0006] FIG. **3** is a view of the front end of a buffer assembly in accordance with the embodiment of FIG. **2**.

[0007] FIG. **4** is a cross sectional view of a buffer assembly as seen at section A-A of FIG. **3**.

[0008] FIGS. **5-10** are front end and cross sectional views of the buffer assembly of FIGS. **3-4** as seen at various times during the buffer retraction cycle.

[0009] FIGS. **11-15** are various side and end views of a buffer in accordance with embodiments of the present invention.

[0010] FIGS. **16-17** are isometric views of a buffer in accordance with the embodiment of FIGS. **11-15**.

[0011] FIG. **18** is an exploded isometric view of a buffer in accordance with the embodiment of FIGS. **11-15**.

[0012] FIGS. **19-22** various side and end views of a damper post in accordance with embodiments of the present invention.

[0013] FIGS. **23-24** are isometric views of a damper post in accordance with the embodiment of FIGS. **19-22**.

[0014] FIG. **25** is an exploded isometric view of a damper post in accordance with the embodiment of FIGS. **19-22**.

[0015] FIG. **26** is an exploded isometric view of a carbine-length buffer assembly in accordance with embodiments of the present invention.

[0016] FIG. **27** is a view of the front end of a buffer assembly in accordance with the embodiment of FIG. **26**.

[0017] FIG. **28** is a cross sectional view of a buffer assembly as seen at section B-B of FIG. **27**.

[0018] FIGS. **29-34** are front end and cross sectional views of the buffer assembly of FIGS. **3-4** as seen at various times during the buffer retraction cycle.

[0019] FIG. **35** is an exploded isometric view of a damper disc in accordance with embodiments of the present invention.

[0020] FIGS. **36-37** are isometric views of a damper disc in accordance with the embodiment of FIG. **35**.

[0021] FIGS. **38-40** are various side and end views of a damper post in accordance with the embodiment of FIG. **35**.

[0022] FIG. **41** is an isometric view of a buffer assembly in accordance with embodiments of the present invention as positioned in connection with a lower receiver.

DETAILED DESCRIPTION

[0023] Throughout this application, the directional references, such as forward, rearward, left, right, bottom and top, will be used. These and other such references are relative to the firing direction of the firearm, which fires in a forward direction. Such references are used for ease in describing the present invention and should not be construed as limiting the scope of the invention. As used in the description herein and throughout the claims, the following terms take the meanings explicitly associated herein, unless the context clearly dictates otherwise: the meaning of "a," "an," and "the" includes plural reference, the meaning of "in" includes "in" and "on." Also, reference designators shown herein in parenthesis indicate components shown in a figure other than the one being discussed.

[0024] FIG. **1** shows an embodiment a prior art carbine buffer assembly used with the AR15/M16 family of firearms. The buffer assembly **100** includes a carbine length buffer tube (also known as a receiver extension) **130**, spring **140**, bolt carrier **104**, bolt **106** and buffer **120**. The rear end of the bolt carrier **310** abuts the front of the buffer **320** when the host rifle is fully assembled. The buffer **120** is contained within the buffer tube **130** and the bolt carrier **104** within an upper receiver when in battery. While the carbine buffer tube **130** does not receive the entire length of the bolt carrier **104** during its reciprocating motion, the length of the buffer tube is required to facilitate sufficient rearward movement of the bolt carrier **104** and compression of the spring **140** for proper function of the firearm. The spring **140** and buffer **120** are required to provide a surface and force that resists the rearward movement of the bolt carrier **104**. The weight of the buffer **120** maybe selected to minimize bolt bounce and assist in the proper operation of a gas operating system.

[0025] In existing buffer assemblies, the buffer has mass, the inertia of which must be overcome by the building forces within the operating system of the rifle. This imparts a desired delay in the cycle of the mechanism. The buffer contains weights that can be changed out for more or less desired weight, depending on the mass required for the correct operation of any number of specific weapon configurations. These weights are made from steel rod, with an oxide finish. The steel weights may be separated by rubber disks intended to dampen impact and noise. The steel oxide finish and rubber disks create significant friction and resistance to free motion.

[0026] The weights inside the buffer are allowed to move fore and aft approximately 0.080" to delay the impact force of the buffer body at both extremes of its travel. The purpose of the free weight inside the buffer is to create a "double blow" or a delayed impact to hold the buffer unit stationary for a moment at each end of its travel cycle. This delay is required to allow time for the magazine to present a cartridge into the path of the reciprocating bolt, and at the "battery"

position, to hold the bolt closed- to prevent a condition called "bolt bounce" that can halt normal firing function.

[0027] The body diameter of the buffer is significantly smaller than the inside dimension of the buffer spring, and the diameter of the spring is significantly smaller than the inside diameter of the receiver extension, to allow for variation in manufacturing and also to facilitate assembly or disassembly. The buffer body is traditionally made from aluminum and anodized.

[0028] The disparities in interfacing dimensions create compound coiling as the spring compresses. This action creates excessive noise and friction; as the spring compresses and takes on a secondary spiral it grows and creates a braking force against the walls of the receiver extension. This increasing side load and friction contributes to inconsistent cyclic timing and ultimately sporadic malfunction. Prior buffer assemblies have significant differences between buffer body and spring inside diameter, the spring outside diameter and receiver extension inside diameter, and the buffer "head" outside diameter and receiver extension inside diameter. These differences in these dimensions generally exceed 0.030 inches. These large tolerances contribute to noise, friction, binding, wear, and rough operation.

[0029] The buffer head **122**, where it contacts the rear face of the bolt carrier **104**, is a smooth flat surface. These two parts are allowed to shift out of alignment in any direction; further increasing the potential and frequency that the carrier may rub or contact the inside surface of the receiver extension. As the carrier is allowed to pitch and yaw, increased wear will result inside the upper receiver.

[0030] Each of these incidences of friction, and/or misalignment can combine to create a compounded effect that results in a rifle with rough, noisy, and inconsistent and ultimately unreliable operation. This incremental decay of the integrity of the system will lead to poor accuracy, and diminished service life of the firearm. In addition, the spring is considered a wear item that needs routine and regular replacement.

[0031] Accordingly, there exists a need for a buffer assembly that is lighter, quieter, smoother, and easier to tune and adjust to meet individual requirements. Advantages of such an improved buffer assembly may include enhanced performance and capability to the shooter. Accuracy, speed, control, and recovery between shots may also be positively affected.

[0032] FIGS. **2-4** shows a buffer assembly **200** in accordance with embodiments of the present invention. The buffer assembly **200** includes a receiver extension **230** (also referred to as a buffer tube). The receiver extension **230** is generally tubular in shape with a rear end **232** and an open front end **234**. The rear end **232** may include a reduced diameter such that a shoulder **233** is formed or may be closed. The front end may include a threaded outside diameter **235** that is adapted to engage a threaded inside diameter of the lower receiver of a firearm. The receiver extension **230** illustrated in FIG. **2** has a length appropriate for a rifle configuration of a firearm such as an AR-15.

[0033] Embodiments of the buffer assembly **200** further comprise a liner **250**. The liner **250** may comprise a thermoplastic polymer, for example PET (polyethylene terephthalate) or PETG (PET glycol-modified). Alternatively, the liner **250** may comprise another appropriate material as would be understood by one of ordinary skill in the art, including PTFE (polytetrafluoroethylene), phenolics, nylon, acetal, UHMWPE (ultrahigh-molecular-weight polyethylene) or other materials. In embodiments of the invention it is advantageous to use a material that reduces the friction of the internal components against the interior sidewall **236** of the receiver extension. In some embodiments, the liner may have a thickness of between 0.010 and 0.020 inches and more preferably between 0.015 and 0.018 inches.

[0034] The liner **250** may, as shown in FIGS. **2-4**, be formed from a sheet of material that is rolled into a tubular shape and inserted into the bore of the receiver extension such that a seam **252** extends longitudinally along a side of the bore. Alternatively, the liner may be formed in as a tube or may be sprayed or otherwise applied to an interior sidewall **236** of the extension **230**.

[0035] Embodiments of the buffer assembly **200** further comprise a spring **260**. In the illustrative embodiment, the spring is a coil spring. The liner **250** is positioned between an interior sidewall of the receiver extension **230** and an outside diameter of the spring **260**. Among other advantages, the liner reduces friction between the spring and the receiver extension sidewall. The internal diameter of the liner **250** is very close to the outside diameter of the spring **260**. In some embodiments, the difference between outside diameter of the spring and the inside diameter of the liner is 0.030 inches or less across the diameter, and preferably less than 0.010 inches across the diameter.

[0036] Embodiments of the buffer assembly may be used in any AR-15 patterned rifle. In carbine applications (short stock), a standard spring intended for the AR-10 carbine may used. In rifle applications (fixed, long stock), an AR-10 rifle spring or an AR-15 rifle spring may be used. The spring rate may be chosen as would be understood by one of ordinary skill in the art. Higher rate springs may have an increase rate of deceleration, which contributes to decreased felt recoil, and a more positive forward stroke of the system.

[0037] Embodiments of the buffer assembly **200** also comprise a buffer **300**. The buffer is shown in more detail in FIGS. **11-18**. The buffer may include a buffer body **320** and a buffer head **322**. The buffer body includes a reduced diameter nose portion **324** at a rear end of the buffer body, a generally cylindrical central portion **326**, and a bearing surface or guide ring **328** at a forward end of the buffer body **320**. The guide ring **328** has a larger diameter than the central portion **326**, forming a shoulder **330** where the two sections meet. The guide ring **328** is generally cylindrical, but may have one or more flat or concave portions **332** formed at intervals around its circumference. The guide ring may act as a bearing surface between the buffer body **320** and an interior surface of the receiver extension **230** or liner **250**.

[0038] The buffer body **320** also includes a generally cylindrical cavity **334** that extends longitudinally into the buffer body from the forward end. The buffer body also includes air passageways **336**, **338** extending through the sidewall of the buffer body near the forward and rearward ends. The buffer body **320** may be formed of any appropriate material, but is preferably formed from a polymer, for example a PET.

[0039] The buffer head **322** is removably connected to the buffer body **320** to enclose the cavity **334**. The buffer head may comprise a bumper **340**. The bumper **340** may be connected to the buffer head **322** by pressing a post **342** formed on a forward portion of the bumper into a hole **344**

extending through the buffer head. The buffer head main portion **346** may be formed of aluminum, and in particular, a relatively hard aluminum (2xxx or 7xxx series). The bumper **340** may be formed of a polymer. In particular, the bumper **340** may be a relatively hard polymer damper for mitigating impact forces caused by the impact of the buffer weight(s) (discussed below) as the system returns to battery at its forward position.

[0040] The buffer head may serve as a bearing surface for the hardened steel bolt carrier (**104**). The forward surface of the head (that which contacts the carrier) is shaped as a truncated cone **348**, sufficient to interact with the bolt carrier on the datum of the cone. Engagement between the bolt carrier and the cone **348** helps ensure proper coaxial and perpendicular alignment of the bolt carrier group and the buffer assembly. This measure ensures the bolt experiences no tilt or pitch, which can contribute to poor function and excessive wear.

[0041] This guide ring **328** of the buffer body **320** has larger diameter than the head **322** to prevent the head from contacting the receiver extension sidewall **236**. Accordingly, in some embodiments, the polymer guide ring **328** my contact the sidewall **236**, but the aluminum buffer head **322** will not.

[0042] When the buffer **300** is inserted into the receiver extension **230**, the spring **260** surrounds the nose **324** and central portion **326** of the buffer body **320**. An end of the spring seats against a shoulder **330** formed between the central portion **326** and guide ring **328** of the buffer body. The outside diameter of the buffer body central section **326** is very close to the inner diameter of the spring **260**. In some embodiments, the difference between inside diameter of the spring and the outside diameter of the buffer body is 0.030 inches or less across the diameter, and preferably less than 0.010 inches across the diameter.

[0043] The Buffer **300** may also comprise one or more weights **350**. The weight **350** is inserted into the cavity **334** of the buffer body **320**. In some embodiments, the weight has a generally cylindrical shape that coincides with the shape of the cavity. However, the weight is shorter than the cavity **334** so that the weight **350** can reciprocate within the cavity. The weight may be polished to reduce friction and ease movement within the cavity, particularly if the buffer body is constructed of a polymer material.

[0044] The weight **350** may include a single weight or multiple weights in various configurations. The total mass inside the buffer body may be altered by substituting different materials and/or structures. Weight examples include tungsten, steel, or aluminum, formed into bars or pellets or balls, or steel or lead or tungsten granulated media. Other suitable materials include brass, nickel, carbide, copper, zinc, or alloys such as Babbitt or Mallory. Adjusting the buffered mass inside the buffer body may allow a user to fine tune the system's timing and the energy imparted by the buffer to balance recoil forces of the rifle.

[0045] As illustrated in FIG. **41**, the buffer head **322** is easily removable, while the rest of the system remains inside the rifle. This way, the operator may make changes to the buffer mass without requiring tools or cleaning supplies. The user is not required to remove the greased or otherwise chemically treated components from the rifle. In embodiments of the present invention, the buffer head **322** is not otherwise affixed to the buffer body **320**; it is maintained between the carrier (**104**) and buffer body **320** by the buffer spring **260** tension. When the rifle is "opened" to allow cleaning or maintenance, the buffer retainer **352** is responsible for keeping the buffer head contained.

[0046] Returning to FIGS. **2-4**, embodiments of the buffer assembly **200** further comprise a damper assembly **400**. The damper assembly **400** is shown in more detail in FIGS. **19-25**. The damper assembly **400** is positioned adjacent the rear end of the receiver extension **230**. The assembly comprises a damper post **410** and a damper ball **430**. The damper post **410** comprises a central section **412** with a generally cylindrical shape. The damper post further comprises a nose section **414** having a reduced diameter at a forward end of the damper post and a head section **416** at a rearward end of the damper post. The head **416** has a diameter that is larger than the diameter of the central section **412**. The damper post **410** extends for forward from the rear end of the receiver extension, thereby spacing the nose portion **414** some distance from a rear end of the receiver extension. Preferably, the spaced distance is greater than the diameter of the receiver extension bore **234** for rifle embodiments illustrated in FIGS. **2-4**. The length of the post **410** may act as a guide rod to maintain control of the spring **260** as it compresses and extends.

[0047] The damper post head **416** has a larger diameter than the central portion **412**, forming a shoulder **418** where the two sections meet. When the damper assembly **400** and the spring **260** are inserted into the receiver extension **230**, the spring **260** surrounds the nose **414** and central portion **412** of the damper post **410**. An end of the spring seats against a shoulder **418** formed between the central portion **412** and head **416** of the post. The outside diameter of the damper post central section **412** is very close to the inner diameter of the spring **260**. In some embodiments, the difference between inside diameter of the spring and the outside diameter of the damper post is 0.030 inches or less across the diameter, and preferably less than 0.010 inches across the diameter.

[0048] Embodiments of the damper post **416** include a cavity **420** or recess formed within the nose portion **414**. In the illustrative embodiments, the cavity **420** is centered in the post, generally cylindrically shaped, and extends to a depth that is less than its diameter.

[0049] The damper assembly further comprises a damper ball **430**. The damper ball may be formed, at least in part, from a fluoropolymer material, for example, Viton® from DuPont, that absorbs and dissipates energy and impact forces. Other materials may be used as would be understood by one of skill in the art. However, it is preferable that the material that reduces return energy and rebound impact forces. A rapid return of energy in the system may negatively attenuate the intended effect of the buffer. The energy absorbing nature of a fluoropolymer material, for example, leaves the buffer spring solely responsible for initiating the return stroke of the system.

[0050] The damper ball **430** may be positioned in a cavity **420** formed in a forward end of the damper post **410**. The damper ball may be sized such that it is press-fit into and retained by the cavity. Alternatively, the damper ball may be adhered or otherwise fixed to the post. The damper ball is described and illustrated as a ball having a generally spherical shape. However, the damper ball may be of any appropriate shape, including, for example, a cylinder, a hemisphere, a disc, a cube or any other shape that would allow it to extend beyond the end of the damper post **410**.

[0051] FIGS. **5-10** illustrate the recoil stroke of the buffer assembly **200**. FIG. **6** shows the buffer assembly in fully forward position, for example when the bolt of the firearm is closed at the beginning of the firing portion of the firearm's cycle. As the bolt (**106**) and bolt carrier (**104**) of the firearm begin to move backward, the buffer **300** is driven backward within the bore **234** of the receiver extension **230**. At the end of the rearward stroke, the nose portion **324** of the buffer body **320** contacts the damper ball **430** attached to a forward end of the damper post **410**. The movement of the buffer **300** causes the weight **350** to move back and forth within the buffer body cavity **334**.

[0052] FIGS. **26-28** shows a buffer assembly **1200** in accordance with embodiments of the present invention. The buffer assembly **1200** is generally similar to the buffer assembly embodiments shown in FIGS. **2-4** except that it is adapted for use with a carbine configuration of a firearm. Accordingly, the receiver extension **1230** illustrated in FIG. **26** has a length appropriate for a carbine configuration of a firearm such as an AR-15. In addition, the damper post (**410**) of the rifle configuration is replaced with a damper disc **510**.

[0053] Embodiments of the buffer assembly **1200** comprise a damper assembly **500**. The damper assembly **500** is shown in more detail in FIGS. **35-40**. The damper assembly **500** is positioned adjacent the rear end of the receiver extension **1230**. The assembly comprises a damper disc **510** and a damper ball **430**. The damper disc **510** comprises a central section **512** with a generally cylindrical shape. The damper disc further comprises a nose section **514** having a reduced diameter at a forward end of the damper disc and a head section **516** at a rearward end of the damper disc. The head **516** has a diameter that is larger than the diameter of the central section **512**.

[0054] The damper assembly **500** further comprises a damper ball **430** as described above. In contrast to the damper post (**410**) of the rifle configuration, the damper disc **510** does not space the damper ball **430** away from the rear wall of the receiver bore **234**. Rather, the damper disc may comprise a cavity **520** formed in the nose portion **514** that extends through a significant portion of the length of the damper disc. In some embodiments, the cavity extends completely through the damper disc such that an opening **522** is formed on the rear side of the damper disc. The damper ball **430** may be positioned in a cavity **520** formed in the damper disc **510**.

[0055] Illustrative embodiments of the invention show the use of a damper post (**410**) or a damper disc (**510**). However, one of skill in the art would understand that the damper post/disc is not limited to the specifically illustrated lengths and that a post/disc of any length in between may be appropriate depending on the length and configuration of the firearm's stock and receiver extension.

[0056] The damper disc head **516** has a larger diameter than the central portion **512**, forming a shoulder **518** where the two sections meet. When the damper assembly **500** and the spring **260** are inserted into the receiver extension **1230**, the spring **260** surrounds the nose **514** and central portion **512** of the damper disc **510**. An end of the spring seats against a shoulder **518** formed between the central portion **512** and head **516** of the disc. The outside diameter of the damper disc central section **512** is very close to the inner diameter of the spring **260**. In some embodiments, the difference between inside diameter of the spring and the outside diameter of the damper disc is 0.030 inches or less across the diameter, and preferably less than 0.010 inches across the diameter.

[0057] FIGS. **29-34** illustrate the recoil stroke of the buffer assembly **1200** similar to that shown in FIGS. **5-10**.

We claim:

1. A buffer assembly for a firearm compromising:
- a receiver extension having a tubular shape, the receiver extension comprising a rear end, an open front end, an inner surface and an outer surface;
- a damper assembly positioned within the receiver extension adjacent the receiver extension rear end;
- a spring positioned within the receiver extension, wherein the spring comprises an outer surface, a front end and a rear end, wherein and the spring rear end at least partially surrounds the damper assembly;
- a buffer positioned within the receiver extension, wherein the buffer comprises a weight and the spring front end at least partially surrounds the buffer;
- a liner at least partially covering the inner surface of the receiver extension, wherein the liner is positioned between at least a portion of the spring outer surface and a portion of the receiver extension inner surface.

2. The buffer assembly of claim **1** wherein the buffer further comprises a buffer body and a buffer head.

3. The buffer assembly of claim **2** wherein the buffer body comprises a cavity and the weight is positioned within the buffer body cavity.

4. The buffer assembly of claim **3** wherein the buffer body cavity comprises an open end and the buffer head is removably connected to the buffer body to enclose the cavity.

5. The buffer assembly of claim **2** wherein the buffer body comprises a polymer material.

6. The buffer assembly of claim **2** wherein the buffer head comprises aluminum.

7. The buffer assembly of claim **1** wherein the spring comprises a coil spring having an inside diameter and an outside diameter.

8. The buffer assembly of claim **7** wherein the damper assembly comprises a damper post.

9. The buffer assembly of claim **8** wherein the damper post comprises a head section, a central section having an outside diameter and a nose section.

10. The buffer assembly of claim **9** wherein a difference between the inside diameter of the spring and the outside diameter of the damper post central section is 0.030 inches or less across the diameter.

11. The buffer assembly of claim **9** wherein a difference between the inside diameter of the spring and the outside diameter of the damper post central section is less than 0.010 inches across the diameter.

12. The buffer assembly of claim **1** wherein the damper assembly comprises a damper ball.

13. The buffer assembly of claim **1** wherein the liner comprises a thermoplastic polymer.

14. The buffer assembly of claim **1** wherein the liner has a thickness of between 0.010 and 0.020 inches.

15. The buffer assembly of claim **1** wherein the liner has a thickness of between 0.015 and 0.018 inches.

16. The buffer assembly of claim **1** wherein the liner comprises a sheet of material rolled into a tubular shape and inserted into the receiver extension such that a seam extends longitudinally along a side of the receiver extension inner surface.

17. The buffer assembly of claim **1** wherein the liner comprises a tube.

18. The buffer assembly of claim **1** wherein the liner comprises a material that is sprayed onto the receiver extension inner surface.

19. The buffer assembly of claim **7** wherein a difference between the outside diameter of the spring and an inside diameter of the liner is 0.030 inches or less across the diameter.

20. The buffer assembly of claim **7** wherein a difference between the outside diameter of the spring and an inside diameter of the liner is less than 0.010 inches across the diameter.

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