



EUROPEAN PATENT APPLICATION

(43) Date of publication:
28.02.2024 Bulletin 2024/09

(51) International Patent Classification (IPC):
F41A 19/46^(2006.01) F41A 19/12^(2006.01)

(21) Application number: **23192769.0**

(52) Cooperative Patent Classification (CPC):
F41A 19/12; F41A 19/46

(22) Date of filing: **22.08.2023**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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(30) Priority: **26.08.2022 US 202217822680**

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(54) **AUTO-SEAR FOR A FIREARM**

(57) Various embodiments are directed to auto-sears for a firearm, firearms, and methods of operating the same. In various embodiments, an auto-sear for a firearm may comprise a body configured to being pivotally mounted within a lower receiver of the firearm, the body having a front surface defined between a leading top body surface edge of a top surface and a leading bottom surface edge of a bottom surface; wherein an upper portion of the front surface is disposed on a first plane and a lower portion of the front surface is disposed on a second plane; and wherein at least a portion of the first plane is non-planar with the second plane. In various embodiments, the top surface of the body comprises a curved shape defined along a portion of the leading top surface edge.

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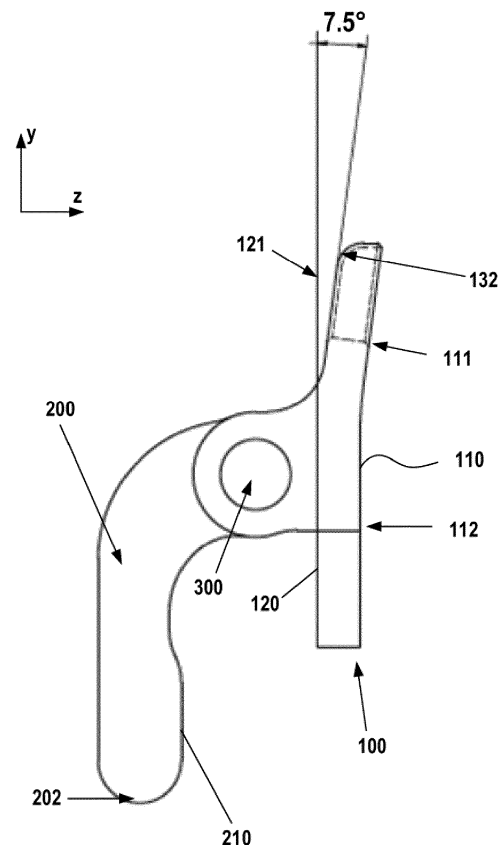


FIG. 4E

Description

FIELD OF THE INVENTION

[0001] Various embodiments described herein relate generally to automatic-firearm components. In particular, various embodiments are directed to auto-sears configured to facilitate fully-automatic operation of a firearm.

BACKGROUND

[0002] Firearm trigger assemblies may use one or more sears to hold and facilitate the release of a hammer to cause the discharge of a cartridge when the released hammer strikes the firearm's firing pin. One type of sear, known as an auto-sear, is configured to facilitate fully-automatic firing of the firearm by causing the hammer to automatically release following cycling of the bolt carrier without the operator releasing the trigger. The auto-sear may be configured for interaction with various firearm components (e.g., a hammer, a disconnecter, a trigger, a bolt connector, and/or the like) to facilitate the fully-automatic firing operation. Through applied effort, ingenuity, and innovation, Applicant has solved problems relating to auto-sears by developing solutions embodied in the present disclosure, which are described in detail below.

BRIEF SUMMARY

[0003] Various embodiments are directed to an auto-sear for a firearm. Further, various embodiments are directed to a firearm comprising an auto-sear and methods of operating the same. In various embodiments, an auto-sear for a firearm may comprise a body configured for being pivotally mounted within a lower receiver of the firearm, the body having a front surface defined between a leading top body surface edge of a top surface and a leading bottom surface edge of a bottom surface; wherein an upper portion of the front surface is disposed on a first plane and a lower portion of the front surface is disposed on a second plane; and wherein at least a portion of the first plane is non-planar with the second plane.

[0004] In various embodiments, the leading top body surface edge of the front surface may be disposed on the first plane and leading bottom body surface edge of the front surface is disposed on the second plane. In various embodiments, the upper portion of the front surface may define a first planar portion of the front surface and the lower portion of the front surface defines a second planar portion of the front surface, wherein the first planar portion is angularly offset from the second planar portion. In certain embodiments, the first planar portion may be angularly offset from the second planar portion by an angle of separation of between 6.5 degrees and 8.5 degrees. In certain embodiments, the body may comprise an angled body portion that is defined at least in part by the first planar portion of the front surface.

[0005] In various embodiments, the auto-sear may further comprise a leg configured to contact at least one interior portion of the lower receiver, wherein the leg extends opposite the front surface of the body. In certain embodiments, the leg may extend from a proximal leg end defined at a back surface of the body to a distal leg end, and wherein the leading bottom surface edge is closer to the proximal leg end than the leading top surface edge. In certain embodiments, the leading top surface edge may be provided in a forward position with respect to the leading bottom surface edge relative to the proximal leg end. In various embodiments, the top surface of the body may comprise a curved shape as defined along a portion of the leading top surface edge. In certain embodiments, the curved shape may be defined by a u-shaped profile of the portion of the leading top surface edge. Further, in certain embodiments, the body may define an upper sear trip engagement portion having two raised contact portions with a central recess provided therebetween, and wherein the upper sear trip engagement portion is defined at least in part by the curved shape of the top surface of the body such that the central recess is defined by the u-shaped profile of the portion of the leading top surface edge. In various embodiments, the auto-sear may define a pivot axis about which the auto-sear is configured to rotate; wherein a contact portion of the leg defined along at least a portion of a back surface of the body defines a vertical axis; and wherein a first axis intersecting a forwardmost part of the leading top surface edge and being parallel to the vertical axis is farther from the pivot axis than a second axis intersecting the forwardmost part of the leading bottom surface edge.

[0006] Various embodiments are directed to a firearm comprising: an upper receiver assembly comprising a bolt carrier; and a lower receiver assembly comprising a trigger, a disconnecter, a hammer, and an auto-sear, the auto-sear comprising: a body configured for being pivotally mounted within a lower receiver of the firearm, the body having a front surface defined between a leading top body surface edge of a top surface and a leading bottom surface edge of a bottom surface; wherein an upper portion of the front surface is disposed on a first plane and a lower portion of the front surface is disposed on a second plane; and wherein at least a portion of the first plane is non-planar with the second plane.

[0007] In various embodiments, the leading top body surface edge of the front surface may be disposed on the first plane and leading bottom body surface edge of the front surface is disposed on the second plane. In various embodiments, the upper portion of the front surface may define a first planar portion of the front surface and the lower portion of the front surface defines a second planar portion of the front surface, wherein the first planar portion is angularly offset from the second planar portion. In certain embodiments, the first planar portion may be angularly offset from the second planar portion by an angle of separation of between 6.5 degrees and 8.5 degrees. In certain embodiments, the top surface of the

body comprises a curved shape as defined along a portion of the leading top surface edge. Further, in various embodiments, the curved shape may be defined by a u-shaped profile of the portion of the leading top surface edge. In various embodiments, the body defines an upper sear trip engagement portion having two raised contact portions with a central recess provided therebetween, and the upper sear trip engagement portion may be defined at least in part by the curved shape of the top surface of the body such that the central recess is defined by the u-shaped profile of the portion of the leading top surface edge. In various embodiments, the firearm may be an AR10 or SR25 platform firearm.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 illustrates a perspective view of a portion of an exemplary firearm including an exemplary auto-sear in accordance with various embodiments;

FIG. 2 illustrates a side view of an exemplary firearm with portions shown in broken line for illustration of the internal components of the firearm, including an exemplary auto-sear in accordance with various embodiments;

FIGS. 3A-3C illustrate various isolated views of an exemplary firearm including an auto-sear and bolt carrier in accordance with various embodiments;

FIGS. 4A-4E illustrate various views of exemplary auto-sear in accordance with various embodiments;

FIG. 5 illustrates a side view of an exemplary firearm comprising an exemplary auto-sear in accordance with various embodiments with portions shown in broken line for illustration of the internal components of the firearm;

FIG. 6 illustrates a side view of an exemplary firearm comprising an exemplary auto-sear in accordance with various embodiments with portions shown in broken line for illustration of the internal components of the firearm;

FIG. 7 illustrates a side view of an exemplary firearm comprising an exemplary auto-sear in accordance with various embodiments with portions shown in broken line for illustration of the internal components of the firearm;

FIG. 8 illustrates a side view of an exemplary firearm comprising an exemplary auto-sear in accordance with various embodiments with portions shown in broken line for illustration of the internal components of the firearm; and

FIG. 9 illustrates a side view of an exemplary firearm comprising an exemplary auto-sear in accordance with various embodiments with portions shown in broken line for illustration of the internal components of the firearm.

DETAILED DESCRIPTION

[0009] The present disclosure more fully describes various embodiments with reference to the accompanying drawings. It should be understood that some, but not all embodiments are shown and described herein. Indeed, the embodiments may take many different forms, and accordingly this disclosure should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

[0010] It should be understood at the outset that although illustrative implementations of one or more aspects are illustrated below, the disclosed assemblies, systems, and methods may be implemented using any number of techniques, whether currently known or not yet in existence. The disclosure should in no way be limited to the illustrative implementations, drawings, and techniques illustrated below, but may be modified within the scope of the appended claims along with their full scope of equivalents. While values for dimensions of various elements are disclosed, the drawings may not be to scale.

[0011] The words "example," or "exemplary," when used herein, are intended to mean "serving as an example, instance, or illustration." Any implementation described herein as an "example" or "exemplary" embodiment is not necessarily preferred or advantageous over other implementations.

[0012] As used herein, directional terms used to describe a component, configuration, action, position, direction, and/or the like (e.g., "downwardly," "an upward vertical direction," and the like) are meant to be interpreted relative to a hypothetical firearm with its barrel pointed towards the horizon in a normal shooting position, but the terms are not to be interpreted as requiring the firearm to be in this orientation at any particular time (i.e., a firearm with a normally downwardly-oriented angled surface would still have the angled surface oriented "downwardly" relative to the firearm even when the firearm is turned upside down).

[0013] Various embodiments of the present disclosure relate to firearm auto-sears. Auto-sears, in some instances, may be used to convert a semi-automatic weapon into a fully-automatic weapon by temporarily catching and releasing the hammer as the bolt carrier cycles rearwards and then forwards during a normal cycling operation. The auto-sear may release the hammer automatically in response to an impact of a portion of the bolt carrier on a portion of the auto-sear as the bolt carrier returns toward the chamber without the user releasing and re-pulling the trigger.

[0014] In some instances, the firearm may have a selector switch that configures the firing mode of the firearm. The selector switch may engage and restrict the motion of various portions of the trigger assembly in order to facilitate the particular firing mode selected. For example,

in a fully-automatic mode, the selector switch may allow a full range of movement of the auto-sear while preventing the trigger disconnecter from engaging the hammer as the bolt carrier cycles rearward following discharge of a cartridge. In a semi-automatic mode of operation, the selector switch may limit the range of motion of the auto-sear, preventing it from catching the hammer, while allowing the disconnecter to move along its full range of motion. Various versions of auto-sears and selector switches may operate according to similar principles. An example of a trigger assembly and selector switch operable with a traditional auto sear is shown and described in U.S. Publication No. 2017/0089655, which is hereby incorporated by reference herein in its entirety.

[0015] In some embodiments, the auto-sear may be configured for an autoloading rifle, such as an AR10 or SR25. For example, the inventors of the present disclosure identified that a traditional auto-sear, as may be used with an AR15/M4 type rifle, could not perform sufficiently for larger weapons platforms, such as the AR10 or SR25 or other similar rifle platforms. The present inventors identified various improvements to the geometry of an auto-sear to facilitate improved firing and cycling.

[0016] For example, various embodiments of the present disclosure include auto-sears having an upper end defining an upper sear trip engagement portion having two raised contact portions with a central recess provided therebetween. In some embodiments, the transition of the upper edge between the raised contact portions and the central recess may be curved or multi-angled (e.g., the upper portion 110 and lower portion 112 need not be entirely planar from top to bottom) to provide a smooth, rounded transition and may create a clearance in the recess between the two contact portions. In operation, the contact portions may be configured to contact portions of the bolt carrier during rearward movement and forward movement of the bolt carrier to respectively rock the auto-sear back to engage the hammer and forward to release the hammer. In some embodiments, the bolt carrier of the firearm may include protruding portions in a central area of the underside of the bolt carrier. The central recess may provide clearance around these protruding portions of the bolt carrier.

[0017] In some embodiments, the timing of the release of the hammer and the engagement and release interaction between the auto-sear and the hammer may be improved by configuring the geometry of the auto-sear. For example, in some embodiments, the upper end of the front surface of the auto-sear defining the upper sear trip engagement portion of the auto-sear may be angled forward so as to be non-planar with a lower end of the front surface of the auto-sear. In this embodiment, the hammer may release later during the bolt carrier's forward movement and may allow for a smoother cycling operation with less wear on the internal components of the firearm than a straight faced auto-sear. In some embodiments, the shape of the auto-sear may also facilitate clearance within the lower receiver for the hammer to

operate.

[0018] FIGS. 1-3C illustrate various views of a firearm including an exemplary auto-sear in accordance with various embodiments of the present disclosure. In particular, FIG. 1, FIG. 2, and FIGS. 3A-3C illustrate various views of an exemplary firearm 1 comprising an auto-sear 10, in accordance with various embodiments. In various embodiments, an exemplary firearm 1 may comprise a semi-automatic or fully automatic rifle, such as, for example, an AR10 platform firearm or a Stoner Rifle-25 (SR25) firearm. Further, in various embodiments, an exemplary firearm 1 may comprise a large frame rifle. As a non-limiting example, in some embodiments, the firearm may be larger than an AR15/M4 platform rifle (e.g., the various cycling components of the action, such as the bolt carrier, may be larger). As illustrated, an exemplary firearm 1 may be defined at least in part by a length extending in a longitudinal direction (e.g., in the depicted z-direction), a width extending in a lateral direction (e.g., in the depicted x-direction), and a length extending in a vertical direction (e.g., in the depicted y-direction). In various embodiments, an exemplary firearm 1 may include a lower receiver assembly 2, an upper receiver assembly 3, and a buttstock 4 positioned about a rear portion of the firearm 1. As illustrated, in various embodiments, the lower receiver assembly 2 of the firearm 1 may comprise an auto-sear 10, a hammer 20, a disconnecter 30, and a trigger 40. For example, a body (e.g., a lower receiver) of the firearm 1 may further define a grip 50.

[0019] Further, as illustrated in FIGS. 2 and 3A-3C, the upper receiver assembly 3 of an exemplary firearm 1 may include a bolt and various bolt carrier group components, such as, for example, a bolt carrier 70. In particular, FIGS. 2 and 3A-3C illustrate a side view, a perspective view, an isolated front view, and an isolated side view respectively, of a firearm 1 including a lower receiver assembly 2 comprising an auto-sear 10 configured for selective engagement with the bolt carrier 70 of an upper receiver assembly 3 of the firearm 1 during operation of the firearm 1. As illustrated in FIGS. 2 and 3A-3C, the lower receiver assembly 2 of an exemplary firearm 1 may comprise a hammer 10, a disconnecter 30, and a trigger 40.

[0020] In various embodiments, an exemplary auto-sear 10 may be configured to facilitate a modification of a firearm to a fully-automatic ready firearm platform. In various embodiments, the auto-sear 10 may comprise a body and a leg that may be collectively defined by a one-piece singular material component or multiple, attached components pivotally supported within the lower receiver 2 of the firearm 1 in a rearward position (e.g., in a position closer to the rear end of the firearm 1) relative to a trigger 40 (e.g., measured in a z-direction as defined in the exemplary orientation illustrated in FIG. 2). In combination with the reciprocating bolt carrier 70, the auto-sear 10 provides for a fast reciprocating motion of the hammer 20 between a firing pin contacting position and a downward-most sear contacting position during a time when the trigger 40 is depressed. Further, in various embodi-

ments, as described herein, the auto-sear 10 may be configured to facilitate the fast reciprocating motion of the hammer 20 without the hammer 20 experiencing interference (e.g., physical engagement) from the disconnector 30. Other than as described herein or shown in the accompanying drawings, the auto-sear 10 may function and may be assembled in the same manner as a standard auto-sear.

[0021] In various embodiments, the lower receiver assembly 2 of the firearm 1 may comprise a trigger 40 that is operatively connected to a disconnector 30 and a hammer 20, each of which may be provided within the lower receiver 2 of the firearm 1. As illustrated, the trigger 40 may comprise a trigger sear 41 that engages a hammer tongue 22 of the hammer 20 when the trigger 40 is in a cocked position (e.g., trigger ready to pull, prior to firing in either automatic or semi-automatic firing modes) to prevent the hammer 20 from rotating about the hammer pin 23 toward a firing pin of the firearm 1 (e.g., in a clockwise direction according to the exemplary orientation illustrated in FIG. 2). The trigger 40 may be configured such that an operator pulling the trigger 40 causes the trigger sear 41 to disengage the hammer 20.

[0022] In various embodiments, the hammer 20 may define a hammer tongue 22 configured for selective engagement with a disconnector 30 and/or the trigger sear 41, and a sear engagement portion 21 configured for selective engagement with an auto-sear 10 (e.g., at a lower sear trip engagement portion 160), as described herein, to facilitate a catching of the hammer by the auto-sear 10 that allows the hammer 20 to bypass engagement with a disconnector 30 and automatically fire subsequent rounds when the auto-sear releases the sear engagement portion 21 after each cycling of the bolt carrier while the trigger remains pulled.

[0023] In various embodiments, the disconnector 30 may embody either an integrated component or a separate component relative to the trigger 40 that is configured to be positioned within the firearm 1 and rotated at least in part based on movement of the trigger 40, such as, for example, in response to a repositioning (e.g., pulling) of the trigger 40 to an engaged position by an operator. For example, in the depicted embodiment, the disconnector 30 is capable of rotating slightly relative to the trigger 40 about a trigger pin 42, while the trigger is still capable of rotating the disconnector once its limited range of rotation is reached. In various embodiments, the disconnector 30 may comprise a disconnector catch 31 configured to selectively engage and disengage a portion of the hammer 20 (e.g., a hammer tongue 22) throughout various portions of a firing operation executed by the firearm 1. As non-limiting examples provided for illustrative purposes, an exemplary trigger 40 described herein may define a trigger assembly, such as a fully automatic-type trigger assembly, configured for use with, for example, an M4 carbine, an AR15, an SR25, and/or the like. Examples of a similar trigger mechanism and trigger components are shown in U.S. Patent No. 7,600,338, which is hereby

incorporated by reference herein in its entirety.

[0024] In various embodiments, as described herein, the trigger 40 may be pivotably configured for rotation about a trigger pin 42, and the hammer 20 may be pivotably configured for rotation about a hammer pin 23 as shown in FIG. 2. As described herein, the trigger pin 42 and the hammer pin 23 may be disposed within the lower receiver of the firearm 1 and may extend between lateral sides of the receiver in order to facilitate the various mechanical actions and/or interactions associated with operation of the associated with operation of the fully-automatic (e.g., AR10/SR25 type) firearm 1, such as, for example, by arranging the various components within the lower receiver 2 in a desired cocked position, release position, and/or reset position corresponding to the discharge and reload actions that define the operation of the firearm 1.

[0025] As illustrated, the lower receiver assembly further includes a pivot pin 60 configured to be received within the pivot pin apertures of the auto-sear 10 to facilitate the pivoted configuration of the auto-sear 10 within the lower receiver of the firearm 1. The pivot pin 60 may be a tubular component defining a central axis that, upon being installed relative to the auto-sear 10, may define the axis of rotation of the auto-sear 10. In some embodiments, the lower receiver 2 may be modified to include openings for the pivot pin after manufacturing of the principal firearm, and in some embodiments, the openings for the pivot pin may be added during manufacturing. In some embodiments, the pivot pin openings may be positioned in accordance with a standard auto sear placement.

[0026] As illustrated in FIGS. 2 and 3A-3C, an exemplary upper receiver assembly 3 may comprise a bolt carrier group that includes a bolt carrier 70 configured for movement between a forward-most position and a rearward-most position during an exemplary firing operation and physical engagement with the auto-sear 10 (e.g., an upper sear trip engagement portion) as the bolt carrier 70 moves therebetween. In various embodiments, the bolt carrier 70 may be positioned in a forward-most initial position when the firing pin is struck by the hammer 20 such that the bolt carrier 70 is initially gas-discharge displaced in a rearward direction toward a rear-end of the firearm 1 after firing. The bolt carrier 70 may be biased in a forward return direction toward a front end of the firearm 1 through various biasing mechanisms, such as, for example, a spring, a buffer assembly, and/or the like (e.g., via buffer spring 80 and buffer 82 shown in FIG. 2). Further, the bolt carrier 70 may comprise a bolt carrier notch 71 configured to contact an upper sear trip engagement portion of the auto-sear 10 (e.g., contacting raised contact portions 151, 152) during a forward stroke of the bolt carrier 70 to cause the auto-sear 10 to be rotated such that the auto-sear 10 is tripped from the hammer 20 (e.g., a lower sear trip engagement portion of the auto-sear 10 disengages the hammer 20), thereby releasing the hammer 20 to rotate forward toward the firing pin to

facilitate a subsequent firing operation. In this manner, the auto-sear 10 according to various embodiments may engage the hammer 20 to temporarily hold the hammer during the rearward and part of the forward stroke of the bolt carrier 70 while the old cartridge is removed from the chamber and a new cartridge is inserted, and the auto-sear 10 may then release the hammer to discharge the next cartridge upon contact between the auto-sear 10 and the bolt carrier notch 71.

[0027] It is further noted that the operational descriptions are further limited to those components of the fire-arm firing operation controls (trigger, disconnect, hammer) and bolt carrier group which are relevant to the functionality of the auto-sear 10.

[0028] FIGS. 4A-4E illustrate various views of an exemplary auto-sear in accordance with various embodiments. In particular, FIGS. 4A, 4B, and 4C illustrate a perspective view, a side view, and a front view, respectively, of an exemplary auto-sear 10 according to various embodiments described herein. The auto-sear 10 may include a body 100 configured to be pivotally mounted within a lower receiver 2 of an exemplary firearm 1 (labeled in FIG. 1). In various embodiments, an exemplary auto-sear 10 may be made of a metal material, such as, for example, a machined steel and/or the like. For example, the auto-sear 10 may be made of a single material component (e.g., a blank) that may be bent, machined, manipulated, and/or otherwise selectively configured to provide the auto-sear 10 in the three-dimensional configuration illustrated in FIG. 4A.

[0029] In various embodiments, as illustrated in FIGS. 4A-4E, an exemplary auto-sear 10 may comprise a body 100 having a front surface 110 that is defined between a leading top body surface edge 131 of a top surface 130 of the body 100 and a leading bottom surface edge 141 of a bottom surface 140 of the body 100. In various embodiments, the front surface 110 of the body 100 may define an upper portion 111 and a lower portion 112. The upper portion 111 of the front surface 110 may be disposed on a first plane and the lower portion 112 of the front surface 110 may be disposed on a second plane, wherein at least a portion of the first plane is non-planar with the second plane.

[0030] In various embodiments, the leading top body surface edge 131 of the front surface 110 may be disposed on the first plane and the leading bottom body surface edge 141 of the front surface 110 is disposed on the second plane with the two example planes intersecting but nonplanar. For example, in some embodiments, the upper portion 111 may be defined between the leading top surface edge 131 and an upper edge of the lower portion 112, while the lower portion 112 may be defined between the leading bottom surface edge 141 and a lower edge of the upper portion 111. In such an exemplary embodiment, the upper edge of the lower portion 112 and the lower edge of the upper portion 111 may be co-linear so as to define an intersection of the upper and lower portions 111, 112 that extends between opposing

lateral sides of the body 100 and embodies a transition between the upper portion 110 and the lower portion 112 of the front surface 110. In some embodiments, the front face 110 may be curved such that the planes aligning with the front face change gradually between the leading top surface edge 131 and the leading bottom surface edge 141.

[0031] In various embodiments, the upper portion 111 and the lower portion 112 of the front surface 110 may define a first planar portion and a second planar portion of the front surface 110, respectively, wherein the first planar portion is angularly offset from the second planar portion. For example, as illustrated in FIG. 4B, the first planar portion defined by the upper portion 111 of the front surface 110 may be angularly offset from the second planar portion defined by the upper portion 112. In various embodiments, the body 100 of the auto-sear 10 may be configured such that the first plane within which the upper portion 111 is disposed being non-planar with the second plane within which the lower portion 112 is disposed may correspond to the angular offset of the first planar portion relative to the second planar portion. As illustrated, the first planar portion of the upper portion 111 being angularly offset relative to the second planar portion of the lower portion 112 may be defined by an angle of separation 400 that is defined therebetween. For example, in various embodiments, the angle of separation 400 may be defined by an angle measured between the first plane within which the upper portion 111, at least including a distal end of the upper portion, is disposed and the second plane within which the lower portion 112 is disposed, as described above. The angle of separation 400 may be measured along a plane that is perpendicular to both the first and second planes, such as, for example, the y-z plane as defined in the exemplary orientation illustrated in FIG. 4B. As non-limiting examples, in various embodiments, the angle of separation 400 may be at least approximately from 6.5 degrees to 8.5 degrees. As a particular non-limiting example, FIG. 4E illustrates an exemplary embodiment wherein the exemplary auto-sear 10 defines an angle of separation measured between an upper portion of the back surface 120 of the auto-sear body (e.g., including the top body surface edge 132) and a plane 121 defined by a lower portion of the back surface 120 of the auto-sear body. As illustrated, an exemplary auto-sear 10 may be configured such that the angular offset of the body is defined by an angle of approximately 7.5 degrees. In some embodiments, the angle may be within one degree greater or less than 7.5 degrees (e.g., from 6.5 degrees to 8.5 degrees). In some embodiments, the position of the lower portion 112 of the auto-sear and the position of the leg 200 of the auto-sear may be determined by the respective structure of the selector switch 84 and the hammer 20 (e.g., for the leg 200 to engage the selector switch in accordance with auto-sear operation, and for the lower portion 112 to engage the hammer 20 in accordance with auto-sear operation). In some embodiments, the position of the leg 200 and lower portion

112 may be the same as standard auto-sears.

[0032] In various embodiments, as illustrated in the exemplary embodiments shown in FIGS. 4A-4E, the body 100 of the auto-sear 10 may comprise an angled body portion that includes the upper portion 111 (e.g., the first planar portion) of the front surface 110 and is arranged in an angularly offset configuration relative to a second portion of the body 100. For example, angular body portion of the body 100 of an exemplary auto-sear 10 may be defined by the non-planar configuration of the first plane and the second plane within which the upper portion 111 and the lower portion 112 of the front surface 110 are disposed, respectively.

[0033] In various embodiments, an exemplary auto-sear 10 may further comprise a leg 200 that extends opposite the front surface 110. In various embodiments, the leg 200 of an exemplary auto-sear 10 pivotably mounted within a lower receiver of a firearm may be configured to contact at least one interior portion (e.g., surface) disposed within the lower receiver as the auto-sear 10 is rotated about a pivot pin in order to at least partially define a range of motion (e.g., rotational motion) of the auto-sear 10. For example, the leg 200 may be configured to limit the range of rotational motion of the auto-sear 10 in one or more rotational directions based at least in part on the leg 200 contacting a fire control selector switch component (e.g., switch 84 shown in FIGS. 1-3A and 8-9) such that the auto-sear 10 is prevented from rotating further in the one or more rotational directions. For example, a contact portion 210 of the leg 200 may be configured to engage a surface of a fire control selector switch 84 component disposed within the lower receiver to prevent further rotation of the auto-sear 10 in a first rotational direction such that the auto-sear 10 may be at least partially secured in a configuration and/or position relative to the hammer 20 that allows for the auto-sear 10 to interact with the hammer 20, as described herein, to execute an exemplary shooting operation. In various embodiments, the surface of the fire control selector component that the leg 200 of the auto-sear 10 is configured to contact may depend on the operating setting defined by the fire control selector component, such as, for example, a fully automatic ("AUTO") setting, at a particular time firing a given firing operation. For example, the selector switch 84 may be disposed in the position shown in FIGS. 8-9 in an instance in which the firearm is in the AUTO setting, enabling the auto sear to contact the hammer. In other embodiments, such as a single fire mode of operation, the selector switch may be rotated to engage the auto-sear earlier (e.g. farther to the left in the view shown in FIGS. 8-9), which may prevent the auto-sear from engaging the hammer and prevent subsequent rounds from being fired until the trigger is fully released and reset.

[0034] In various embodiments, for example as shown in FIGS. 4A-4B, the leg 200 of an auto-sear 10 may extend from a back surface 120 of the body 100, which may be defined by a surface of the body 100 that is opposite the front surface 110. For example, the back surface 120

may be defined between a trailing top body surface edge 132 of the top surface 130 and a trailing bottom surface edge 142 of the bottom surface 140. As illustrated, the leg 200 of the auto-sear 10 may extend from a proximal leg end 201 to a distal leg end 202. In various embodiments, the proximal leg end 201 of the leg 200 may be defined along at least a portion of the body 100 such that the proximal leg end 201 defines an interface plane, axis, and/or point between the body 100 and the leg 200. For example, as illustrated, the proximal leg end 201 may be defined at and may join with the back surface 120 of the body 100. In such an exemplary configuration, as illustrated in FIG. 4B, the leading bottom surface edge 141 may be closer to the proximal leg end 201 than the leading top surface edge 131 is to the proximal leg end 201. Based on the non-planar configuration of the first and second planes within which the upper and lower portions 111, 112, respectively, are disposed, a first linear distance between the leading top surface edge 131 and a plane 121 (shown in FIG. 4B) within which the proximal leg end 201 is at least partially disposed may be greater than a second linear distance between the leading bottom surface edge 141 and the plane 121, as measured in a direction perpendicular to the lower portion 112 of the front surface 110 (e.g., in the z-direction as defined in the exemplary orientation illustrated in FIG. 4B). Accordingly, in various embodiments, the leading top surface edge 131 may be provided in a forward position with respect to the leading bottom surface edge 141 relative to the orientation of the proximal leg end 201 of the leg 200.

[0035] In various embodiments, an auto-sear 10 may comprise one or more pivot pin apertures 300 defined within the leg 200 and/or an opposing lateral protrusion of the auto-sear 10 within which the auto-sear 10 may receive a pivot pin to define the axis of rotation of the auto-sear 10, as described herein. For example, an exemplary auto-sear 10 may include a second leg provided along an opposing lateral side of the body 100 from the leg 200, each of which may include a pivot pin aperture 300 defining a respective central axis that is at least substantially coaxial relative to the central axis of the opposing pivot pin aperture 300. In such an exemplary configuration, a pivot pin installed relative to the auto-sear 10 may extend between opposing lateral ends of the auto-sear (e.g., in the x-direction as defined in the exemplary orientation illustrated in FIG. 4A). For example, the one or more pivot pin apertures 300 defined by the auto-sear 10 may define the pivot axis along which the auto-sear 10 may rotate in response to a contact from the bolt carrier, as described herein. In some such embodiments, the second leg may include a pin aperture 300 without a distal end and contact portion 210 of the leg for engaging the fire control selector switch 84.

[0036] In various embodiments, an exemplary auto-sear 10 may define a pivot axis 301, and a contact portion 210 of the leg 200 may define a vertical axis (e.g., an axis parallel to the y-axis shown in FIG. 4B). While de-

scribed as a "vertical axis" the axis need not be absolutely vertical relative to any fixed reference point or vertical in all instances because the auto-sear is configured to rotate. The auto-sear 10 may be configured such that a first axis intersecting a forwardmost part of the leading top surface edge 131 and being parallel to the vertical axis is farther from the pivot axis 301 than a second axis intersecting the forwardmost part of the leading bottom surface edge 141 and being parallel to the vertical axis (e.g., the leading top surface edge 131 may be farther forward in the z-direction of FIG. 4B than the leading bottom surface edge 141). This configuration may create a non-planar front surface 110 of the auto-sear 10 configured to allow the hammer to rotate generally along the arc of the intersecting planar surfaces after being released by the leading bottom surface edge 141.

[0037] In various embodiments, as illustrated in FIG. 4C, a top surface of the body 100 of an exemplary auto-sear 10 may comprise a curved shape as defined along at least a portion of the leading top surface edge 131. In various embodiments, the curved shape may be defined by a u-shaped profile of at least a portion of the leading top surface edge 131. In various embodiments, the body 100 of the auto-sear 10 may define an upper sear trip engagement portion 150 having two raised contact portions 151, 152 with a central recess 153 provided therebetween. For example, in various embodiments, the two raised contact portions 151, 152 of the body 100 may be provided on opposing lateral sides of the body 100. As described herein, the two raised contact portions 151, 152 may define respective contact surfaces at which the auto-sear 10 is configured to engage a bolt carrier 70 (e.g., a bolt carrier notch 71) as the bolt carrier 70 moves from a rearward-most position within the firearm in a forward direction (e.g., toward a front end of the firearm). The two raised contact portions 151, 152 may, in some embodiments, be configured to engage a forward portion of the bolt carrier 70 as the bolt carrier moves rearward (e.g., toward a rear end of the firearm) prior to returning in the forward direction. This engagement with the forward portion of the bolt carrier 70 may be configured to rotate the leading top surface edge 131 of the auto-sear rearwards to facilitate engagement between the leading bottom surface edge 141 and the hammer. The physical contact of the bolt carrier 70 with each of the two raised contact portions 151, 152 of the upper sear trip engagement portion 150 (e.g., at respective contact surfaces, axes, and/or points defined at each raised contact portion) may cause the auto-sear 10 to rotate about a pivot axis in a rotational direction that may cause the auto-sear 10 to trip from the hammer 20. For example, the contact surfaces defined by the two raised contact portions 151, 152 of the upper sear trip engagement portion 150 may be respective portions of the top surface 130 of the body 100.

[0038] As illustrated, the upper sear trip engagement portion 150 defined by the body 100 of the auto-sear 10 may be defined at least in part by the curved shape of

the top surface of the body 100 such that the central recess 153 provided between the two raised contact portions 151, 152 is defined by the u-shaped profile of a portion of the leading top surface edge 131 that extends between the two raised contact portions 151, 152. In various embodiments, the curved shape (e.g., the u-shaped profile) defining central recess 153 of the upper sear trip engagement portion 150 may be configured to prevent and/or at least substantially minimize contact between the auto-sear 10 (e.g., the upper sear trip engagement portion 150) and the bolt carrier 16 as the bolt carrier 16 moves relative to the auto-sear 10 during a firing operation (e.g., as at least a portion of the bolt carrier 16 passes through the central recess 153).

[0039] For example, with reference to FIG. 3B, a clearance between a lower central protrusion 72 of the bolt carrier 70 and the recess 153 may be created by the curved shape of the recess 153 to allow the bolt carrier to slide longitudinally relative to the auto-sear without the lower central protrusion contacting the auto-sear. In some embodiments, the lower central protrusion 72 and the curved shape of the recess 153 may be complementary. In some embodiments, the two raised contact portions 151, 152 may be configured to contact respective lateral portions of the bolt carrier 70 that are adjacent and vertically above the lower central protrusion 72 during at least a portion of the stroke of the bolt carrier (e.g., as the bolt carrier moves rearward). A smaller firearm, such as an AR15, lacks a lower central protrusion on the forward portion of the bolt carrier that is large enough to negatively affect operation of a traditional auto sear, such that a u-shaped central recess may not be required for smaller arms. In such embodiments, a traditional auto sear for an AR15 may include a central, upper protrusion similar in shape to the lower portion 112 that is configured to contact a midpoint on the bolt carrier notch 71 rather than lateral sides of the bolt carrier notch 71 as shown in the embodiment of FIG. 3A. The bolt carrier notch of an AR15 bolt carrier may be the same or substantially the same as the bolt carrier notch 71 of an AR10/SR25. An AR10/SR25 rifle may include a bolt carrier that defines a larger outside diameter in the front half than an AR15 and a standard AR15 diameter in the rear half. For example, as illustrated in the exemplary embodiment shown in FIGS. 3B and 3C, a firearm 1 may include an exemplary auto-sear 10 configured such that the front surface 110 of the auto-sear body 100 is not contacted by the front portion of the bolt carrier 70 as the bolt carrier is moved in a rearward direction relative to the auto-sear 10, and whereby a bolt carrier notch 71 is configured to engage the auto-sear as the bolt carrier moves back forward.

[0040] In various embodiments, with reference to FIG. 4C, the portion of the leading top surface edge 131 that makes up the u-shaped profile defining (e.g., at least in part) the upper sear trip engagement portion 150 may include a first linear segment 131a embodying a portion of the leading top surface edge 131 that is adjacent to

and/or at least substantially contiguous with the portion of the leading top surface edge 131 defined along a top (e.g., uppermost) portion of a first raised contact portion 151. In various embodiments, the first linear segment 131a may extend from the adjacent portion of the leading top surface edge 131 defined at the first raised contact portion 151 in a downward direction that is at least substantially perpendicular to the adjacent portion of the leading top surface edge 131, such as, for example, in the negative y-direction as defined in the exemplary orientation illustrated in FIG. 4C. As an illustrative example, in various embodiments, such as, for example, in the exemplary orientation of the auto-sear 10 illustrated in FIG. 4C, the first linear segment 131a of the leading top surface edge 131 may define an at least substantially vertical segment of the leading top surface edge 131.

[0041] Further, the u-shaped profile of the leading top surface edge 131 may include a first curved segment 131b that is adjacent to and/or at least substantially contiguous with the first linear segment 131a. The first curved segment 131b may extend from the first linear segment 131a to a central linear segment 131c to define a curved transition between the first linear segment 131a and the central linear segment 132c. In various embodiments, the first curved segment 131b may be defined by a radius of curvature of at least approximately between 0.0 inches and 0.220 inches. For example, in various embodiments, the radius of curvature of the first curved segment 131b may be at least substantially uniform throughout the first curved segment 131b (e.g., between the first linear segment 131a and the central linear segment 131c).

[0042] With reference to FIGS. 4C-4D, in various embodiments, the "u-shaped" profile of the leading top surface edge 131 may be configured such that the first curved segment 131b that is adjacent to and/or at least substantially contiguous with the first linear segment 131a may define a right-angle transition between the first linear segment 131a and the central linear segment 132c. For example, rather than having a first curved segment 131b as curved segment defined by a radius of curvature of at least substantially greater than zero, as described above with respect to the exemplary embodiment illustrated in FIG. 4C, the leading top surface edge 131 may define a discrete transition from the first linear segment 131a to the central linear segment 131c such that the first linear segment 131a and the central linear segment 131c form a substantially right angle of at least approximately 90 degrees. In various embodiments, the first curved segment 131b may have a segment width defined between by a lateral distance between the first linear segment 131a and the central linear segment 131c as measured in a lateral direction at least substantially parallel to the central linear segment 131c. The segment width of the first curved segment 131b may be sufficiently small to enable the passage of a bolt carrier through the central recess 153 without physical contact therewith. For example, in various embodiments, the segment length of segment width of the first curved segment 131b may be

at least approximately between 0.01 inches and 0.150 inches. For example, FIG. 4D illustrates an embodiment wherein the segment width of a segment of the leading top surface edge 131 defined between the central linear segment and a second linear segment provided at least substantially perpendicular thereto along one side of the central recess 153 (e.g., a segment width of a curved segment defining a transition between the central linear segment and a second linear segment of the leading top surface edge 131) may be at least approximately 0.146 inches. In any of the various embodiments herein, the second linear segment 131e and second curved segment 131d (if any) may mirror the shapes of the first linear segment 131a and first curved segment 131b (if any), including the aforementioned segment widths.

[0043] As illustrated, the central linear segment 132c may be provided in a direction that is at least substantially perpendicular to the direction of the first linear segment 131a, such as, for example, in the positive x-direction as defined in the exemplary orientation illustrated in FIG. 4C. Further to the non-limiting example described above and shown in the exemplary orientation of the auto-sear 10 of FIG. 4C, the central linear segment 131c may define an at least substantially horizontal segment of the leading top surface edge 131. In various embodiments, the central linear segment 131c may extend from the first curved segment 131b to a second curved segment 131d that embodies a curved transition from the central linear segment 131c to a second linear segment 131e that arranged adjacent to and/or at least substantially contiguous with the portion of the leading top surface edge 131 defined along a top (e.g., uppermost) portion of a second raised contact portion 152. In various embodiments, the second curved segment 131d and the second linear segment 131e may define a mirrored configuration of the first curved segment 131b and the first linear segment 131a, respectively. For example, as illustrated, u-shaped profile of the leading top surface edge 131 may be configured such that the central recess 153 defines a concave configuration relative to the top (e.g., uppermost) portions of the first and second raised contact portions 151, 152. For example, the central recess 153 defined by the upper sear trip engagement portion 150 may face in a direction away from the lower sear trip engagement portion 160 of the auto-sear 10 (e.g., in a positive y-direction as defined in the exemplary orientation illustrated in FIG. 4C).

[0044] Further, in various embodiments, a lower sear trip engagement portion 160 defined by the body 100 of the auto-sear 10 may be defined at least in part by the bottom surface 140 of the body 100, such as, for example, a leading bottom surface edge 141. As described herein, in various embodiments, the lower sear trip engagement portion 160 may be configured for engagement with a sear engagement portion 21 of the hammer 20 during the execution of a firing operation, including catching the hammer 20 in a downwardly pivoted position after the hammer 20 is forced into the aforementioned pivoted position by the rearwardly displacing bolt carrier 70. Further,

the lower sear trip engagement portion 160 may be configured to rotate about a pivot axis to disengage the downwardly pivoted hammer 20 as the forwardly displacing bolt carrier 70 contacts the upper sear trip engagement portion 150, thereby enabling a release of the hammer 20 in a rotational direction towards the firing pin for subsequent firing actions.

[0045] FIG. 4D shows different configurations for various segments of a leading top surface edge 131. For example, as illustrated, the left side of the upper sear trip engagement portion 150 may include a segment of the leading top surface edge 131 that defines a curved transition between the central linear segment and a first linear segment of the leading top surface edge 131 having an at least substantially large radius of curvature. For example, FIG. 4D illustrates an overlaid segment of the leading top surface edge 131 along the left side of the central recess 153 having a radius of curvature of 0.220 inches. A similar radius of curvature may be mirrored on the right side of the leading top surface edge 131. In some embodiments, 0.220 inches may be a maximum radius of curvature for the respective left and right sides of the leading top surface edge 131 to allow clearance for the bolt carrier.

[0046] FIG. 4D further depicts an example angle between the horizontal center of the leading top surface edge and a vertical surface of the right upper sear trip engagement portion (e.g., a respective length and height of the segment). In the depicted embodiment, the segment width is 0.146 inches and the segment angle (e.g., the second curved segment 131d labeled in FIG. 4C) is 45 degrees, indicating a segment height of 0.146 inches before the leading top surface edge 131 becomes vertical. In some alternative embodiments, a segment of the leading top surface edge 131 between the central linear segment and the respective first and second linear segments of the leading top surface edge 131 may define a linear, angled configuration relative to the central linear segment. For example, the transition between the central linear segment and the respective first and second linear segments may be a 45 degree, linear surface rather than being curved in a u-shape.

[0047] FIGS. 5-9 illustrate various side view of an exemplary firearm comprising an exemplary auto-sear in accordance with various embodiments described herein. In particular, FIGS. 5-9 illustrate various side views of an exemplary firearm 1 comprising an auto-sear 10 as the firearm 1 executes a sequential series of actions to facilitate a fully-automatic operation of the firearm 1 based at least in part on the interaction between the auto-sear 10 and the various components of the lower and upper receiver assemblies 2, 3. In various embodiments, an exemplary firearm 1 may be configured such that prior to the initiation of an automatic firing operation, the lower receiver assembly 2 of the firearm 1 may be arranged according to the exemplary embodiment illustrated in FIG. 2, as described herein. For example, the firearm 1 may define a nominal configuration wherein the lower

receiver assembly 2 is arranged such that the trigger 40 is in a cocked position in which the trigger sear 41 is engaged with a hammer tongue 22 defined by the hammer 20 so as to prevent the hammer 20 from rotating about the hammer pin 23 (e.g., in a clockwise direction according to the exemplary orientation illustrated in FIG. 2). In the configuration of FIG. 2, the trigger is ready to be pulled but not yet pulled by the user.

[0048] Proceeding to the exemplary firearm 1 illustrated in FIG. 5, the firearm 1 may be configured such that pulling the trigger 40 may cause the trigger sear 41 to disengage the hammer 20 (e.g., via releasing the hammer tongue 22). In the embodiment depicted in FIG. 5, the trigger has been pulled and the hammer 20 rotated in a first rotational direction about the hammer pin 23 (e.g., in a clockwise direction according to the exemplary orientation illustrated in FIG. 5) towards a firing pin. In the depicted embodiment, the hammer 20 has struck the firing pin of the firearm 1 within the bolt carrier 70, causing ignition of the propellant and starting movement of the bolt carrier 70 of the upper receiver assembly 3 in a rearward direction (represented by arrow 7) at least substantially toward a rear end of the firearm 1, such as, for example, in the negative z-direction as defined in the exemplary orientation illustrated in FIG. 6).

[0049] FIG. 6 is a succeeding illustration to FIG. 5 showing the bolt carrier 70 in a rearward-most position after having moved in the rearward direction in response to the hammer 20 striking the firing pin and ignition of the cartridge propellant. As the bolt carrier 70 travels in the rearward direction, the bolt carrier 70 engages the hammer 20 and, in some embodiments the auto-sear 10, as so as to force the hammer 20 to rotate in a second rotational direction about the hammer pin 23 (e.g., in a counter-clockwise direction according to the exemplary orientation illustrated in FIG. 6) towards a pivoted position defined by the sear engagement portion 21 of the hammer 20 being disposed beneath at least a portion of the lower sear trip engagement portion 160 of the auto-sear 10 (e.g., beneath the leading bottom surface edge 141). The bolt carrier 70 in its rearward-most position may remain in contact with the hammer 20, thereby preventing the hammer 20 from rotating back in the first rotational direction, as described above.

[0050] As described herein, the body of the auto-sear 10 defines an upper sear trip engagement portion 150 having two raised contact portions with a central recess provided therebetween, with the upper sear trip engagement portion 150 being defined at least in part by the curved shape of a top surface of the auto-sear 10 body such that the central recess is defined by a u-shaped profile of a portion of the leading top surface edge of the auto-sear 10. The curved shape (e.g., the u-shaped profile) defining central recess of the upper sear trip engagement portion 150 is configured to provide clearance and reduce friction between the auto-sear 10 and at least a portion of the bolt carrier 70 (e.g., the lower central protrusion 72) that passes through the central recess as the

bolt carrier 70 travels in the rearward direction.

[0051] FIG. 7 is a succeeding illustration to FIG. 6 showing the bolt carrier 70 contacting the auto-sear 10 as it returns in a forward direction toward the front end of the firearm 1 following the rearward motion of FIG. 6, such that the lower sear trip engagement portion 160 is in contact the sear engagement portion of the hammer 20 as the bolt carrier begins to contact the auto-sear 10. In the position shown in FIG. 7 both the disconnecter 30 and the trigger sear 41 have released the hammer 20 and the hammer is held from firing by the auto-sear 10. Upon bolt carrier 70 reaching rearmost position, the bolt carrier 70 begins to travel back in the forward direction towards the front end of the firearm 1, such as, for example, in the positive z-direction as defined in the exemplary orientation illustrated in FIG. 7. As the bolt carrier 70 moves in the forward direction, a bolt carrier notch 71 arranged along an underside of the bolt carrier 70 at a rearmost edge of a central void of the bolt carrier contacts the upper sear trip engagement portion 150 of the auto-sear 10, causing the auto-sear 10 to rotate in a first rotational direction about the pivot pin 60 such that the upper sear trip engagement portion 150 rotates in a forward direction towards the front end of the firearm 1 and the lower sear trip engagement portion 160 rotates in at least partially rearward direction toward the rear end of the firearm 1 and/or an at least partially downward direction. FIG. 7 shows the auto-sear 10 having been positioned such that the lower sear trip engagement portion 160 of the auto-sear 10 is in contact with the sear engagement portion 21 of the hammer 20 arranged beneath the auto-sear 10, as the bolt carrier 70 initially contacts, but has not yet moved, the auto-sear. The contact of the lower sear trip engagement portion 160 with the sear engagement portion 21 prevents the hammer 20 from rotating back in the first rotational direction, as described above. As illustrated, the hammer 20 may be at least partially secured in position by the auto-sear 10 without the hammer 20 being in contact with either the disconnecter 30 or the trigger 40.

[0052] FIG. 8 is a succeeding illustration to FIG. 7 showing the auto-sear 10 arranged so as to define a tripping point relative to the hammer 20. During the forward motion depicted in FIGS. 7-8, a cartridge (not shown) is also stripped from the magazine and fed into the chamber for firing. As illustrated in FIG. 8, the bolt carrier 70 continues to travel in the forward direction towards the front end of the firearm 1, causing further rotation of the auto-sear 10 in the first rotational direction until the auto-sear 10 reaches the illustrated tripping point at which the auto-sear 10 (e.g., the lower sear trip engagement portion 160) disengages the hammer 20. For example, the auto-sear 10 tripping the hammer 20 may be caused by the bolt carrier 70 engaging the upper sear trip engagement portion 150 of the auto-sear 10 with the bolt carrier notch 71 to force the auto-sear 10 to rotate until the lower sear trip engagement portion 160 reaches the tripping point and disengages the sear engagement portion 21 of the ham-

mer 20, which thereby allows the hammer spring to drive the hammer into the firing pin.

[0053] FIG. 9 is a succeeding illustration to FIG. 8 showing the bolt carrier 70 in a forward-most position after having caused the auto-sear 10 to trip the hammer 20, the forward-most position of the bolt carrier 70 being the initial position of the bolt carrier 70 during the initial strike of the firing pin by the hammer 20. Upon the tripping of the auto-sear 10 from the hammer 20, the hammer 20 rotates forward in the first rotational direction about the hammer pin 23 towards the firing pin. The bolt carrier 70 is locked in its forward-most position when the hammer 20 contacts the firing pin such that. The bolt carrier 70 may thereby be positioned to facilitate a subsequent discharge of the newly chambered cartridge that is initiated by the hammer 20 striking the firing pin for a second time. Such an exemplary configuration allows the firearm 1 to automatically execute a subsequent firing operation without requiring that an operator release the trigger 40. The firearm 1 being configured such that the hammer 20, upon tripping from the auto-sear 10, rotates forward to strike the firing pin subsequent to the bolt carrier 70 being arranged in the initial position prevents misfires of the firearm 1 and avoids various other firearm failures that may result in dangerous operating conditions for an operator for the firearm. In the depicted embodiments, the trigger may remain pulled without being released from the operations shown in FIG. 5 through those shown in FIG. 9. Likewise, the embodiment shown in FIG. 9 corresponds to the component positions in FIG. 9, indicating a full cycling and firing action of the firearm has taken place and a subsequent firing action after the position shown in FIG. 9 may continue through the positions shown in FIGS. 6, 7, and 8 before again returning to FIG. 9 to fire a third cartridge. Firing may continue until the magazine is empty or the trigger is released in a fully-automatic mode of firing.

[0054] As described herein, an exemplary auto-sear 10 having a body 100 comprising a front surface 110 with an upper portion 111 that is angularly offset from a lower portion 112 thereof, as described herein, may increase the distance that the bolt carrier 70 has to travel in the forward direction (e.g., in the positive z-direction according to the exemplary orientation illustrated in FIG. 7) in order for the bolt carrier notch 71 to engage the upper sear trip engagement portion 150 (e.g., the two raised contact portions 151, 152). For example, at least a portion of the upper portion 111 may be angularly offset relative to the lower portion 112 of the front surface 110 such that the leading top surface edge 131 is provided in a forward position relative to the leading bottom surface edge 141, as defined relative to the front end of the firearm 1 and/or the pivot axis defined by the auto-sear 10 (e.g., in the positive z-direction according to the exemplary orientation illustrated in FIG. 7). Such an exemplary auto-sear configuration may correspond to an increased distance between the bolt carrier notch 71 of a bolt carrier 70 positioned in a rearward-most position, as described herein,

and the upper sear trip engagement portion 150 (e.g., the two raised contact portions 151, 152) of the auto-sear 10 (e.g., as measured in the z-direction according to the exemplary orientation illustrated in FIG. 7). Such an exemplary auto-sear configuration may function to delay the moment during a firing operation that the auto-sear 10 is tripped from the hammer 20 such that the bolt carrier 70 causes the auto-sear 10 to trip from the hammer 20 when the bolt carrier 70 is in a position closer to the initial (e.g., forward-most) position. Accordingly, such an exemplary auto-sear 10 configuration effectively decreases the risk that the hammer 20, upon disengaging the lower sear trip engagement portion 160 of the auto-sear 10, will fully rotate and execute a subsequent strike of the firing pin prior to the bolt carrier 70 reaching its forward-most initial position or without locking the bolt completely. Such a configuration may slow the firing and cycling action slightly while reducing wear on the components of the firearm and improving firing. In addition, the hammer 20 may still pass by the auto-sear without inadvertently contacting the auto-sear after being tripped, which may be facilitated by the rearward position of the leading bottom surface edge 141 relative to the leading top surface edge 131.

[0055] Additional statements of invention are set out below:

Statement 1. An auto-sear for a firearm, the auto-sear comprising:

a body configured for being pivotally mounted within a lower receiver of the firearm, the body having a front surface defined between a leading top body surface edge of a top surface and a leading bottom surface edge of a bottom surface;

wherein an upper portion of the front surface is disposed on a first plane and a lower portion of the front surface is disposed on a second plane; and

wherein at least a portion of the first plane is non-planar with the second plane.

Statement 2. The auto-sear of statement 1, wherein the leading top body surface edge of the front surface is disposed on the first plane and leading bottom body surface edge of the front surface is disposed on the second plane.

Statement 3. The auto-sear of statement 1, wherein the upper portion of the front surface defines a first planar portion of the front surface and the lower portion of the front surface defines a second planar portion of the front surface, wherein the first planar portion is angularly offset from the second planar portion.

Statement 4. The auto-sear of statement 3, wherein the first planar portion is angularly offset from the second planar portion by an angle of separation of

between 6.5 degrees and 8.5 degrees.

Statement 5. The auto-sear of statement 3, wherein the body comprises an angled body portion that is defined at least in part by the first planar portion of the front surface.

Statement 6. The auto-sear of any preceding statement, further comprising a leg configured to contact at least one interior portion of the lower receiver, wherein the leg extends opposite the front surface of the body.

Statement 7. The auto-sear of statement 6, wherein the leg extends from a proximal leg end defined at a back surface of the body to a distal leg end, and wherein the leading bottom surface edge is closer to the proximal leg end than the leading top surface edge. Statement 8. The auto-sear of statement 7, wherein the leading top surface edge is provided in a forward position with respect to the leading bottom surface edge relative to the proximal leg end.

Statement 9. The auto-sear of any preceding statement, wherein the top surface of the body comprises a curved shape as defined along a portion of the leading top surface edge.

Statement 10. The auto-sear of statement 9, wherein the curved shape is defined by a u-shaped profile of the portion of the leading top surface edge.

Statement 11. The auto-sear of statement 10, wherein the body defines an upper sear trip engagement portion having two raised contact portions with a central recess provided therebetween, and wherein the upper sear trip engagement portion is defined at least in part by the curved shape of the top surface of the body such that the central recess is defined by the u-shaped profile of the portion of the leading top surface edge.

Statement 12. The auto-sear of any preceding statement, wherein the auto-sear defines a pivot axis about which the auto-sear is configured to rotate; wherein a contact portion of the leg defined along at least a portion of a back surface of the body defines a vertical axis; and wherein a first axis intersecting a forwardmost part of the leading top surface edge and being parallel to the vertical axis is farther from the pivot axis than a second axis intersecting the forwardmost part of the leading bottom surface edge.

Statement 13. A firearm comprising:

an upper receiver assembly comprising a bolt carrier; and

a lower receiver assembly comprising a trigger, a disconnecter, a hammer, and an auto-sear, the auto-sear comprising:

a body configured for being pivotally mounted within a lower receiver of the firearm, the body having a front surface defined between a leading top body surface edge of a top surface and a leading bottom surface

edge of a bottom surface;
 wherein an upper portion of the front surface
 is disposed on a first plane and a lower por-
 tion of the front surface is disposed on a
 second plane; and
 wherein at least a portion of the first plane
 is non-planar with the second plane.

Statement 14. The firearm of statement 13, wherein
 the leading top body surface edge of the front surface
 is disposed on the first plane and leading bottom
 body surface edge of the front surface is disposed
 on the second plane.

Statement 15. The firearm of statement 13, wherein
 the upper portion of the front surface defines a first
 planar portion of the front surface and the lower por-
 tion of the front surface defines a second planar por-
 tion of the front surface, wherein the first planar por-
 tion is angularly offset from the second planar por-
 tion.

Statement 16. The firearm of statement 15, wherein
 the first planar portion is angularly offset from the
 second planar portion by an angle of separation of
 between 6.5 degrees and 8.5 degrees.

Statement 17. The firearm of any of statements 13
 to 16, wherein the top surface of the body comprises
 a curved shape as defined along a portion of the
 leading top surface edge.

Statement 18. The firearm of statement 17, wherein
 the curved shape is defined by a u-shaped profile of
 the portion of the leading top surface edge.

Statement 19. The firearm of statement 18, wherein
 the body defines an upper sear trip engagement por-
 tion having two raised contact portions with a central
 recess provided therebetween, and wherein the up-
 per sear trip engagement portion is defined at least
 in part by the curved shape of the top surface of the
 body such that the central recess is defined by the
 u-shaped profile of the portion of the leading top sur-
 face edge. Statement 20. The firearm of any of state-
 ments 13 to 19, wherein the firearm is an AR10 or
 SR25 platform firearm.

[0056] Many modifications and other embodiments will
 come to mind to one skilled in the art to which this dis-
 closure pertains having the benefit of the teachings pre-
 sented in the foregoing descriptions and the associated
 drawings. Therefore, it is to be understood that the dis-
 closure is not to be limited to the specific embodiments
 disclosed and that modifications and other embodiments
 are intended to be included within the scope of the ap-
 pended claims. Although specific terms are employed
 herein, they are used in a generic and descriptive sense
 only and not for purposes of limitation.

Claims

1. An auto-sear for a firearm, the auto-sear comprising:

5 a body configured for being pivotally mounted
 within a lower receiver of the firearm, the body
 having a front surface defined between a leading
 top body surface edge of a top surface and a
 leading bottom surface edge of a bottom sur-
 face;
 wherein an upper portion of the front surface is
 disposed on a first plane and a lower portion of
 the front surface is disposed on a second plane;
 and
 wherein at least a portion of the first plane is
 non-planar with the second plane.

2. The auto-sear of claim 1, wherein the leading top
 body surface edge of the front surface is disposed
 on the first plane and leading bottom body surface
 edge of the front surface is disposed on the second
 plane.

3. The auto-sear of claim 1, wherein the upper portion
 of the front surface defines a first planar portion of
 the front surface and the lower portion of the front
 surface defines a second planar portion of the front
 surface, wherein the first planar portion is angularly
 offset from the second planar portion.

4. The auto-sear of claim 3, wherein the first planar
 portion is angularly offset from the second planar
 portion by an angle of separation of between 6.5 de-
 grees and 8.5 degrees.

5. The auto-sear of claim 3, wherein the body compris-
 es an angled body portion that is defined at least in
 part by the first planar portion of the front surface.

6. The auto-sear of any preceding claim, further com-
 prising a leg configured to contact at least one interior
 portion of the lower receiver, wherein the leg extends
 opposite the front surface of the body.

7. The auto-sear of claim 6, wherein the leg extends
 from a proximal leg end defined at a back surface of
 the body to a distal leg end, and wherein the leading
 bottom surface edge is closer to the proximal leg end
 than the leading top surface edge.

8. The auto-sear of claim 7, wherein the leading top
 surface edge is provided in a forward position with
 respect to the leading bottom surface edge relative
 to the proximal leg end.

9. The auto-sear of any preceding claim, wherein the
 top surface of the body comprises a curved shape
 as defined along a portion of the leading top surface

edge.

10. The auto-sear of claim 9, wherein the curved shape is defined by a u-shaped profile of the portion of the leading top surface edge. 5
11. The auto-sear of claim 10, wherein the body defines an upper sear trip engagement portion having two raised contact portions with a central recess provided therebetween, and wherein the upper sear trip engagement portion is defined at least in part by the curved shape of the top surface of the body such that the central recess is defined by the u-shaped profile of the portion of the leading top surface edge. 10 15
12. The auto-sear of any preceding claim, wherein the auto-sear defines a pivot axis about which the auto-sear is configured to rotate; wherein a contact portion of the leg defined along at least a portion of a back surface of the body defines a vertical axis; and wherein a first axis intersecting a forwardmost part of the leading top surface edge and being parallel to the vertical axis is farther from the pivot axis than a second axis intersecting the forwardmost part of the leading bottom surface edge. 20 25
13. A firearm comprising the auto-sear of any preceding claim.
14. The firearm of claim 13, further comprising: 30
an upper receiver assembly comprising a bolt carrier; and
a lower receiver assembly comprising a trigger, a disconnecter, a hammer, and the auto-sear. 35
15. The firearm of claim 13 or 14, wherein the firearm is an AR10 or SR25 platform firearm.

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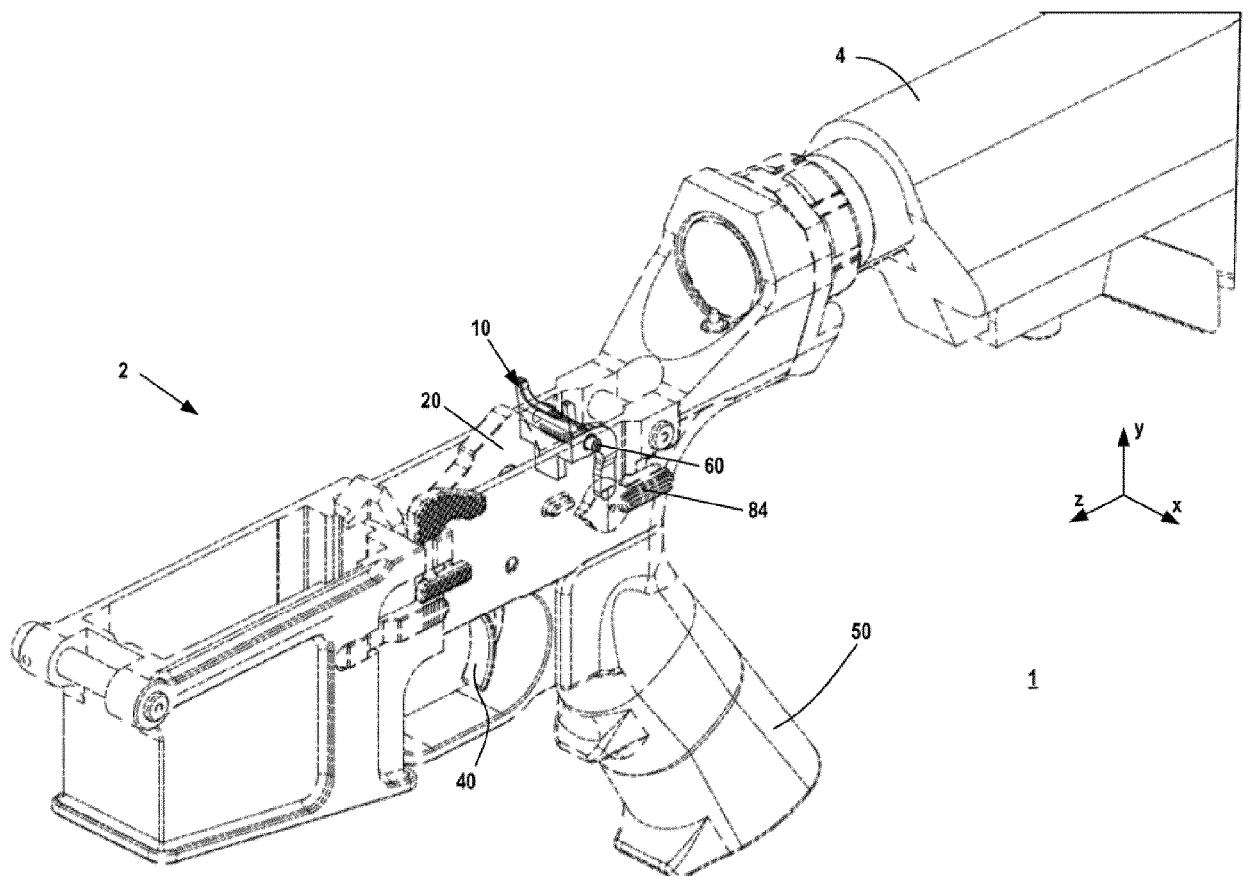


FIG. 1

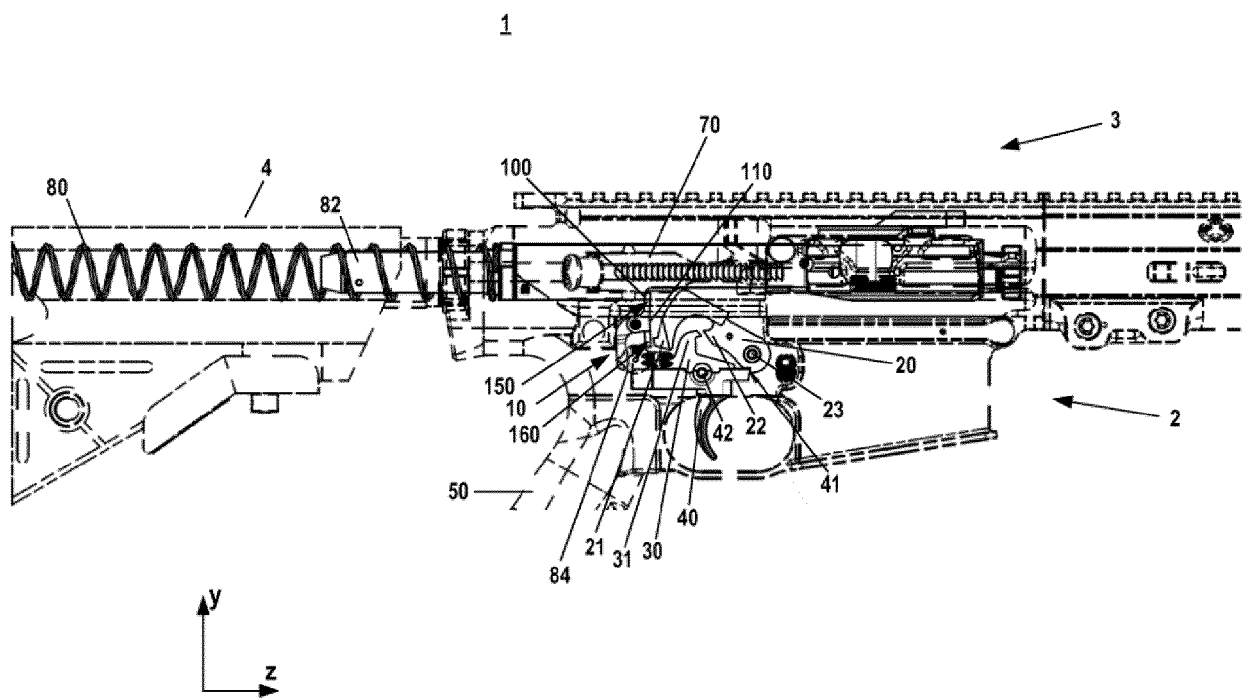


FIG. 2

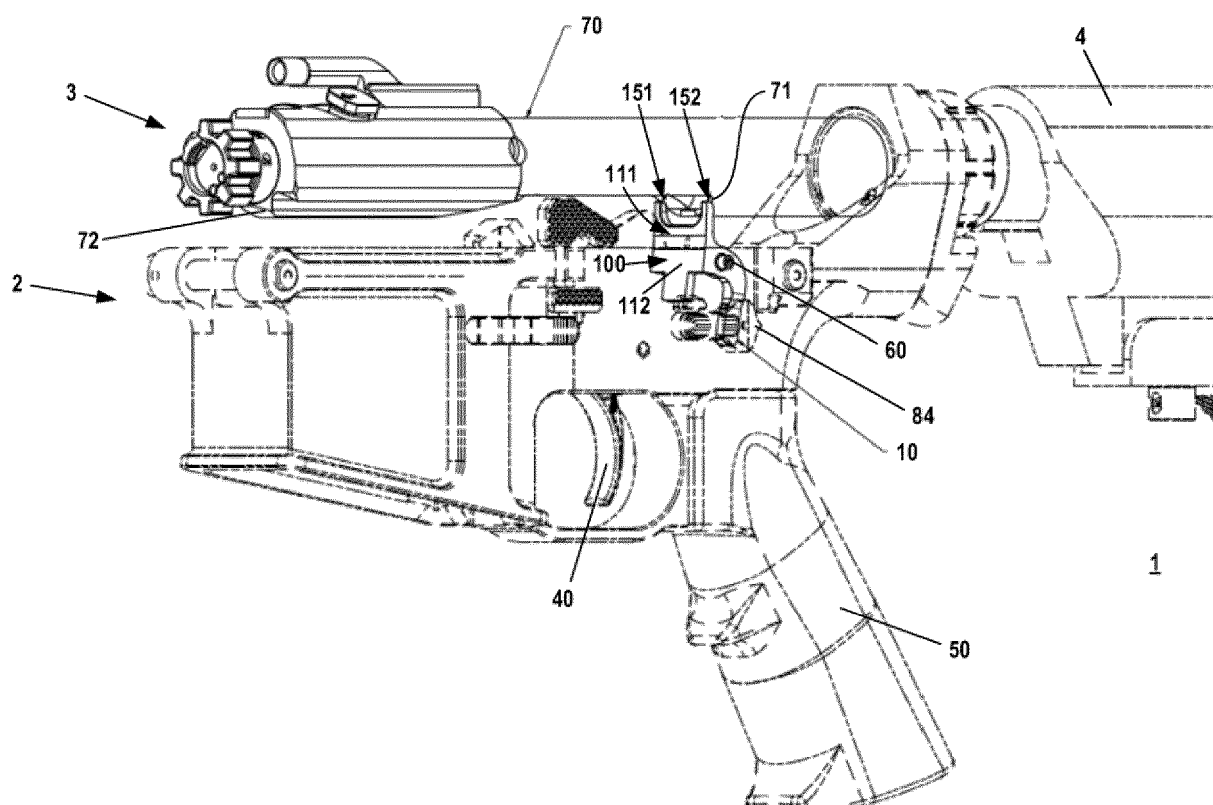


FIG. 3A

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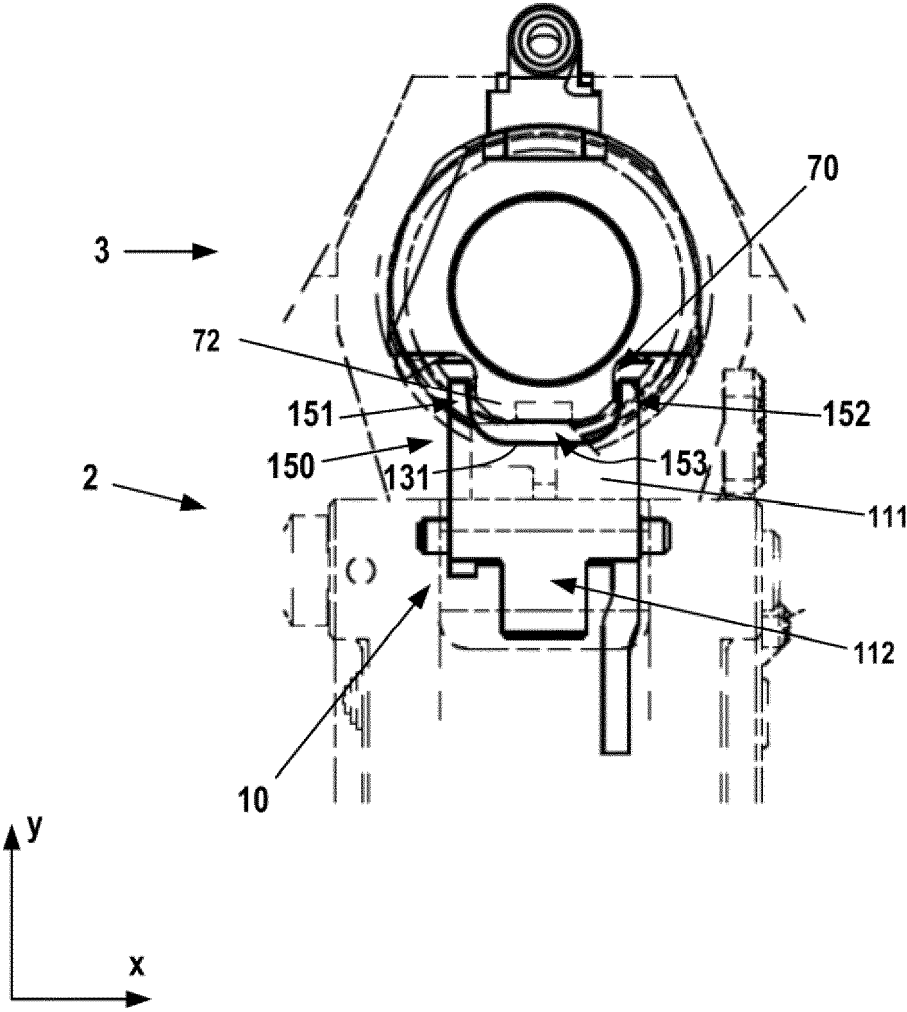


FIG. 3B

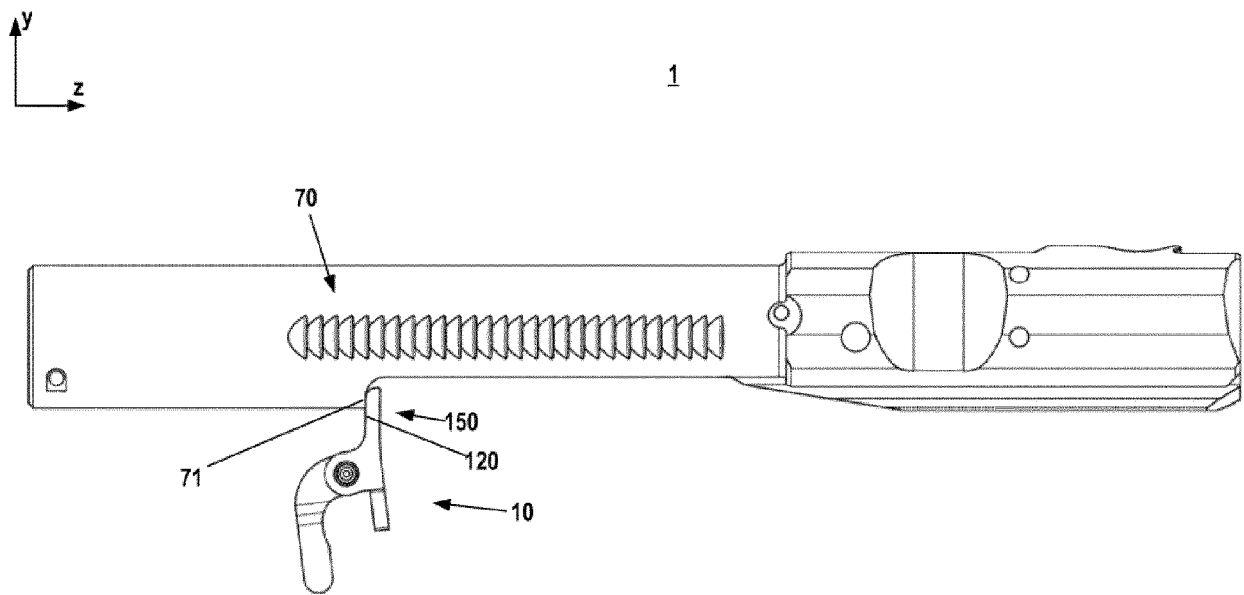


FIG. 3C

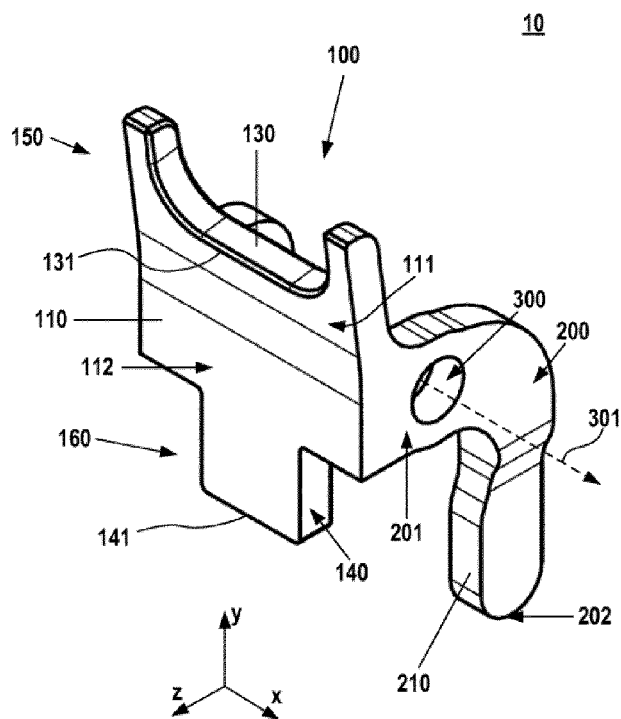


FIG. 4A

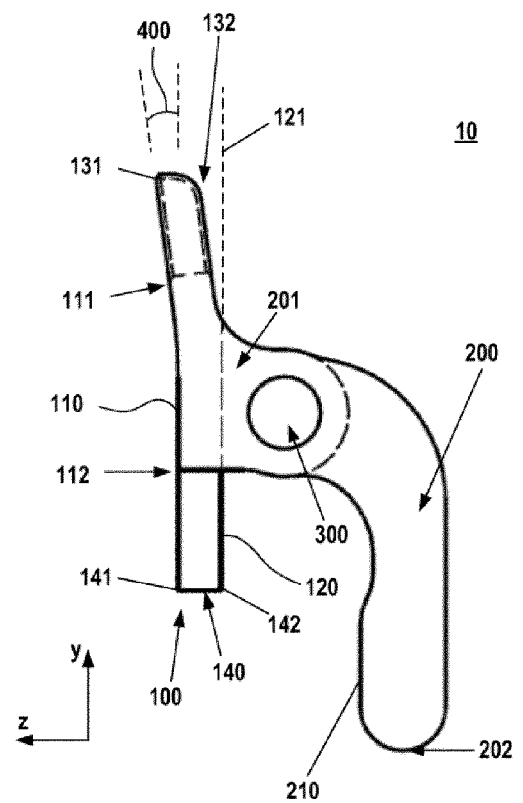
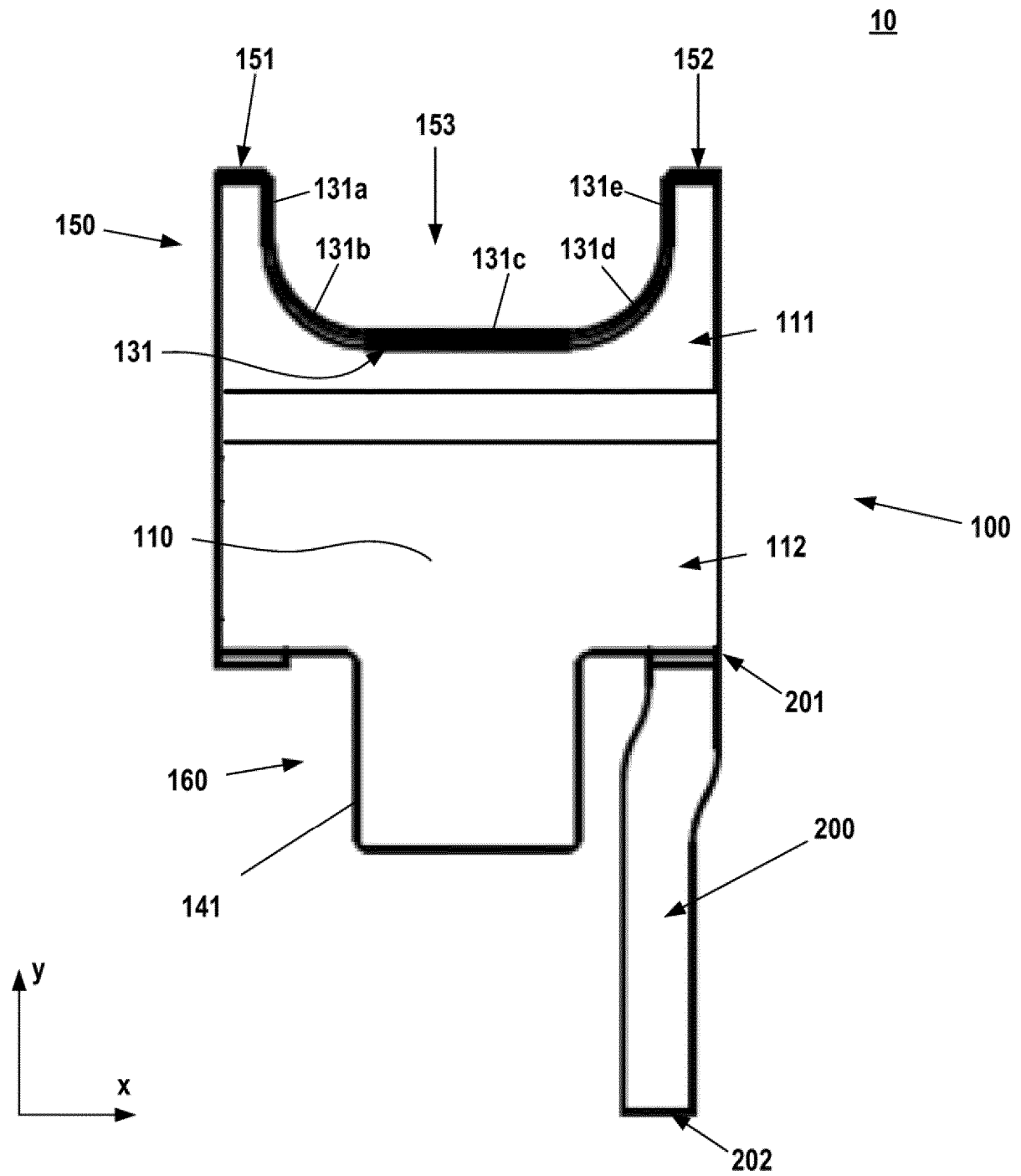


FIG. 4B

**FIG. 4C**

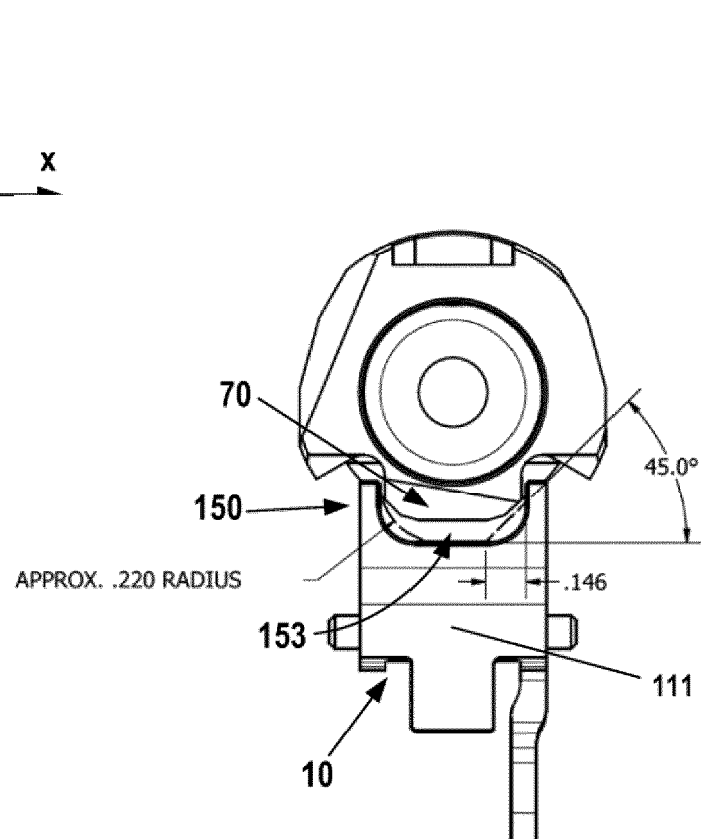
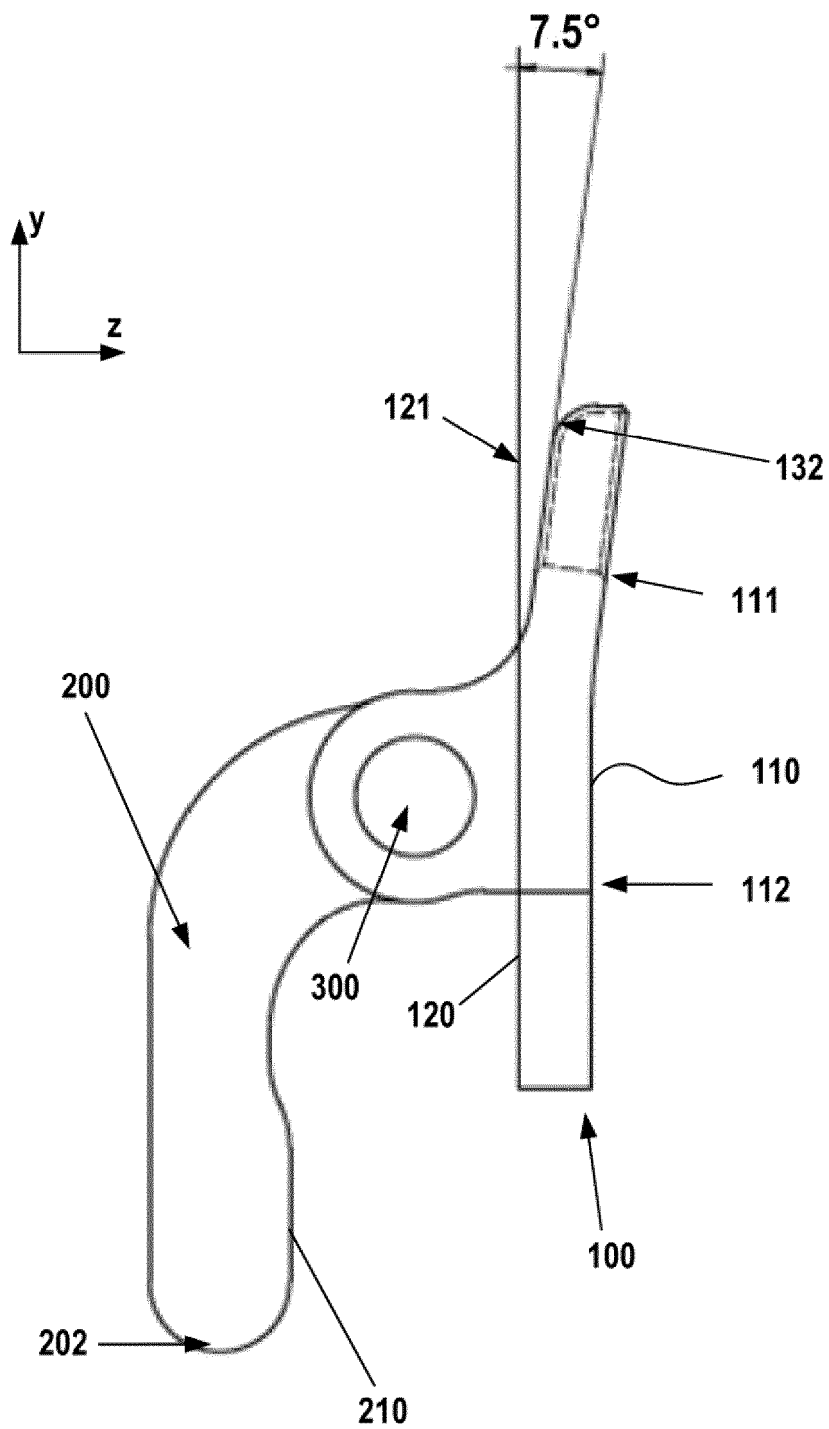


FIG. 4D

**FIG. 4E**

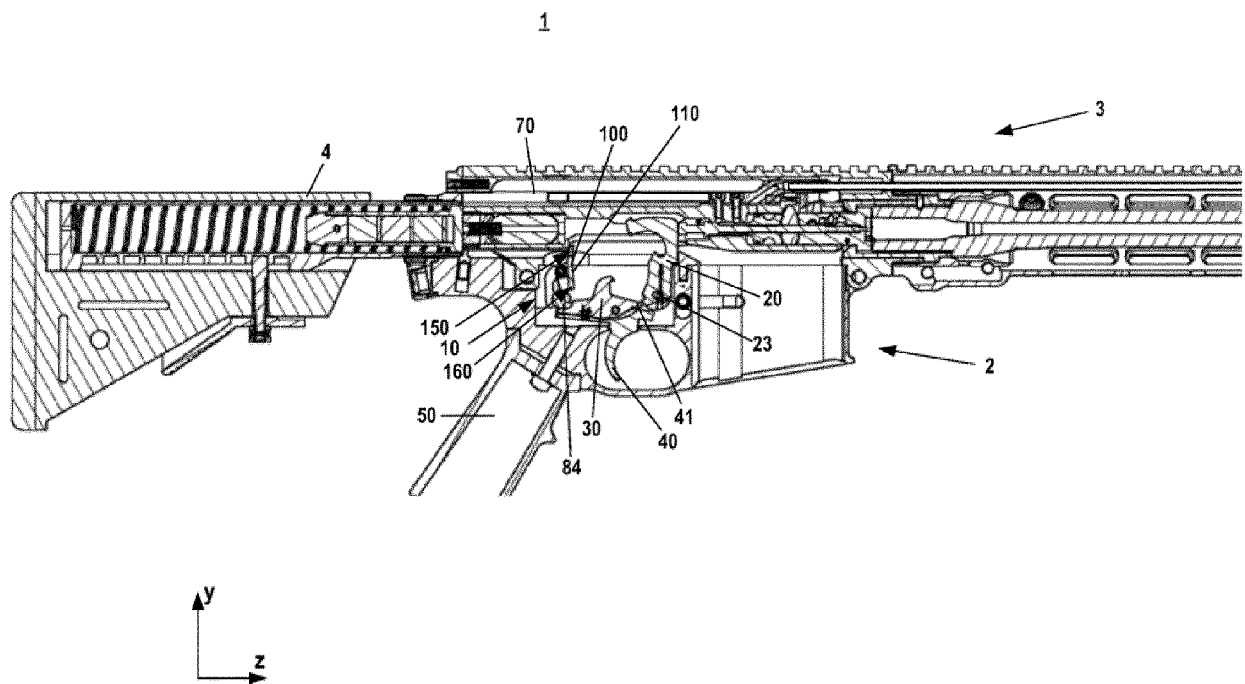


FIG. 5

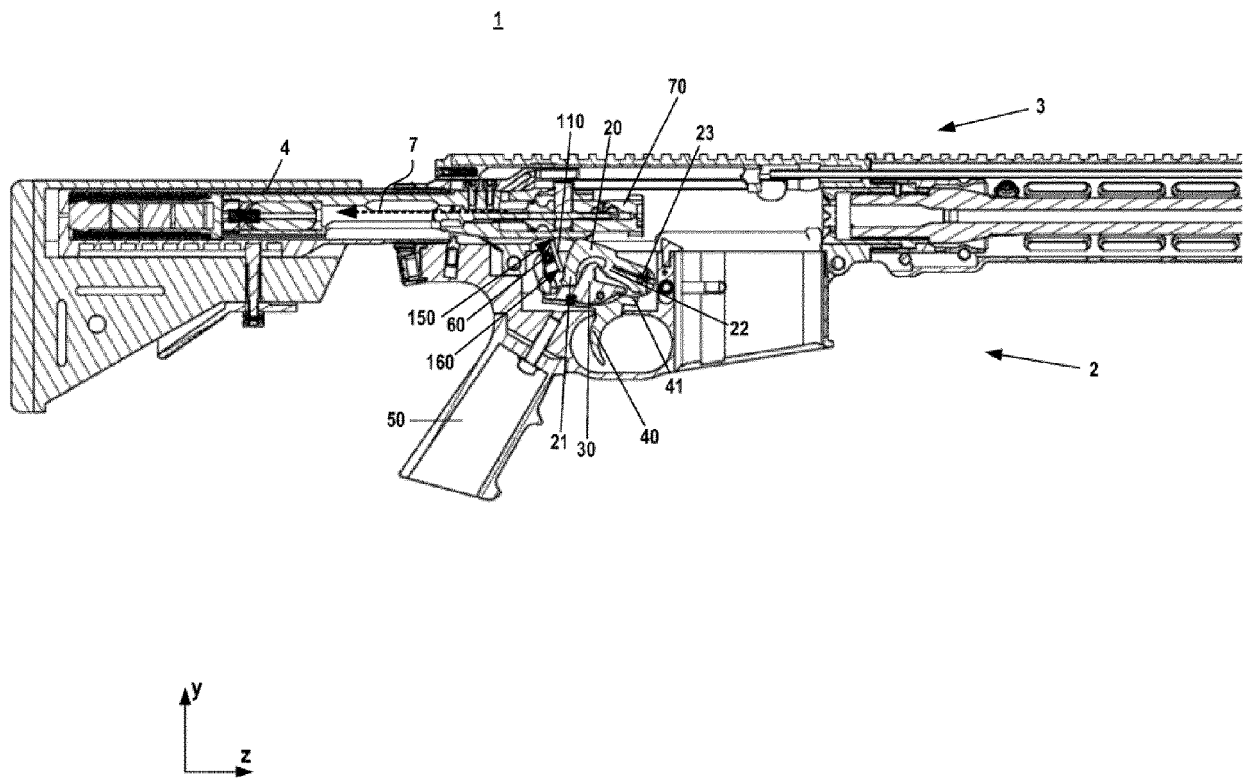


FIG. 6

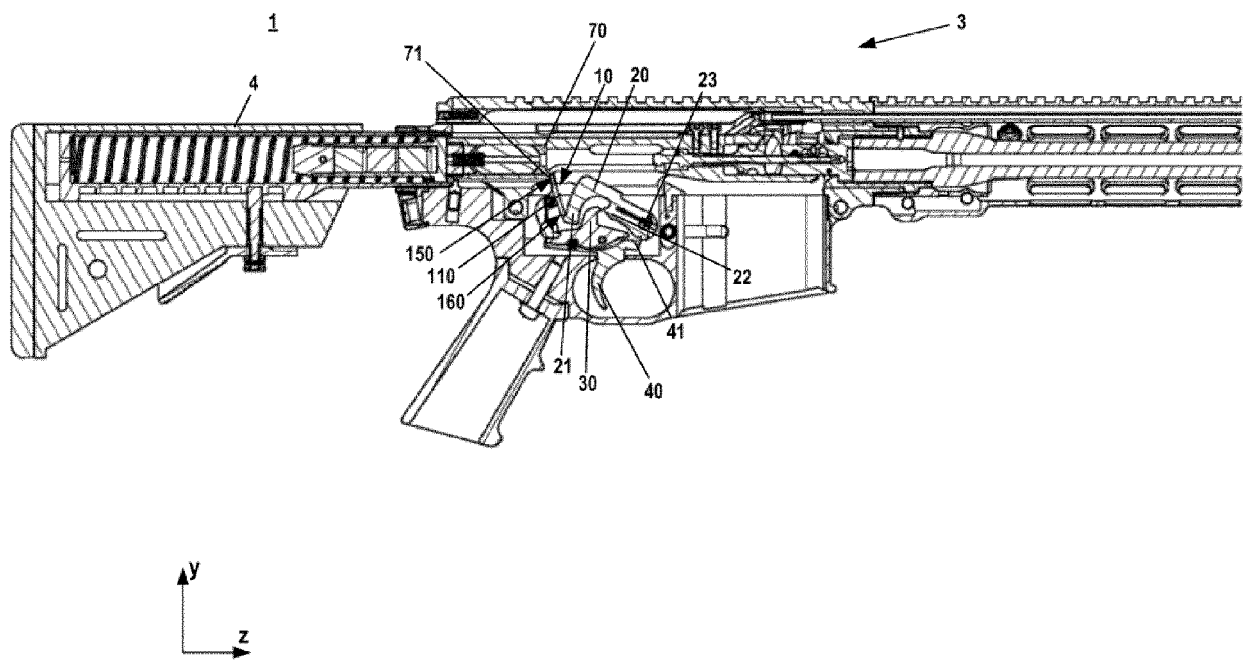


FIG. 7

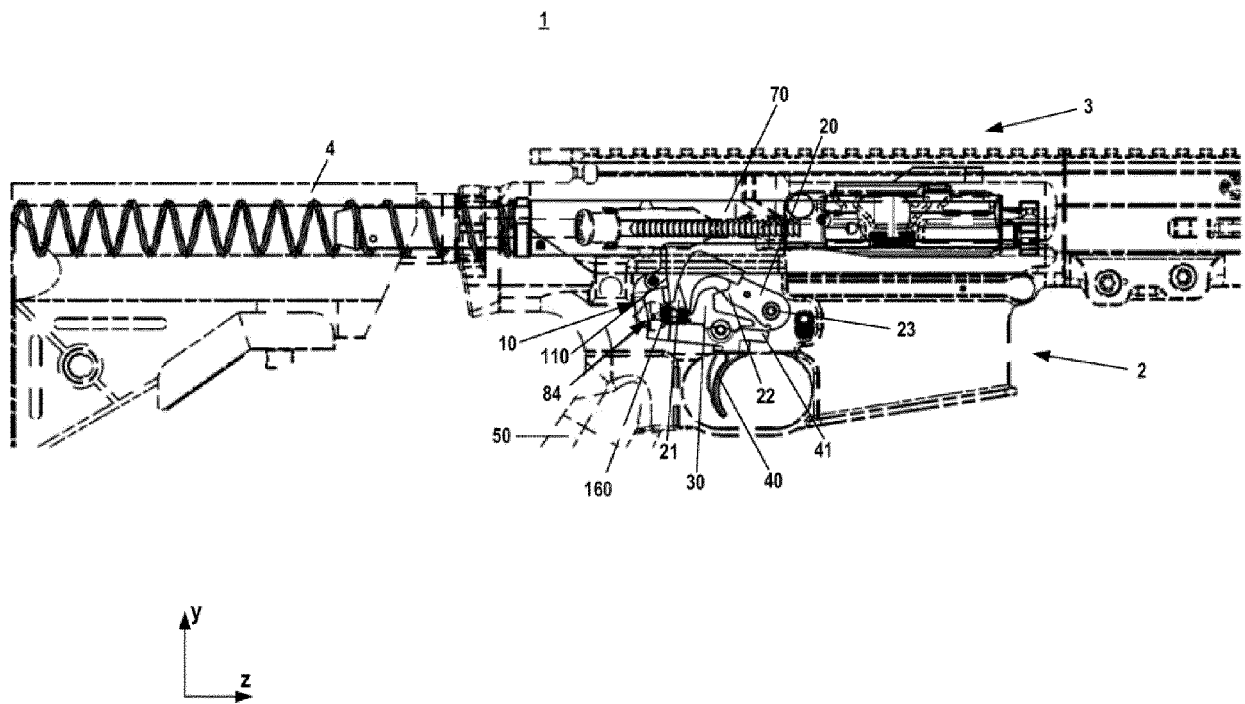


FIG. 8

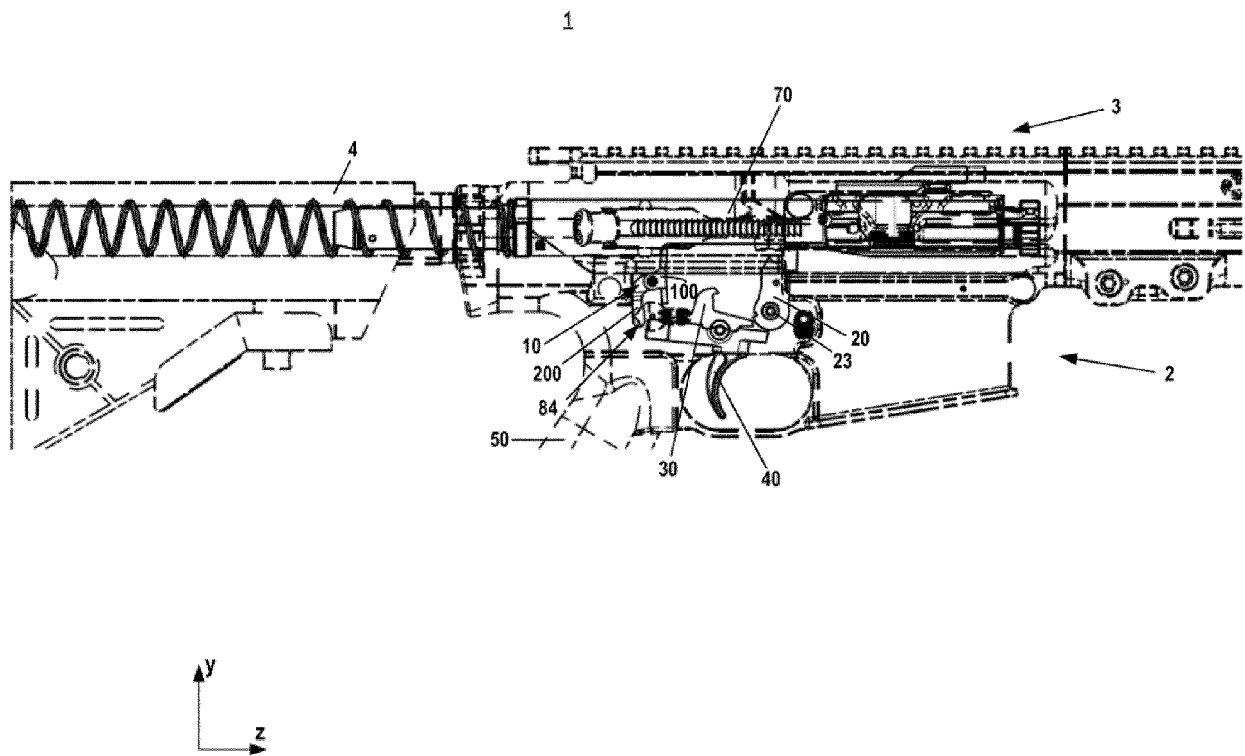


FIG. 9



EUROPEAN SEARCH REPORT

Application Number

EP 23 19 2769

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 433 610 A (TATRO HENRY J [US]) 28 February 1984 (1984-02-28)	1-8, 12-15	INV. F41A19/46
Y	* column 2, line 45 - column 6, line 68; figures 1-10 *	9-11	F41A19/12
Y	----- US 10 436 535 B1 (BRADSHAW TYSON [US] ET AL) 8 October 2019 (2019-10-08) * column 4, line 8 - column 6, line 52; figures 1-7 *	9-11	

			TECHNICAL FIELDS SEARCHED (IPC)
			F41A
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 January 2024	Examiner Kasten, Klaus
CATEGORY OF CITED DOCUMENTS			
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ON EUROPEAN PATENT APPLICATION NO.

EP 23 19 2769

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The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-01-2024

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	US 4433610	A	28-02-1984	NONE
15	US 10436535	B1	08-10-2019	NONE
20				
25				
30				
35				
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- US 20170089655 A [0014]
- US 7600338 B [0023]