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(54) **COMPACT SEMIAUTOMATIC FIREARM**

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(72) Inventor: **Douglas F. Donnelly**, Jackson, WY (US)

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(63) Continuation-in-part of application No. 13/745,704, filed on Jan. 18, 2013.

(60) Provisional application No. 61/896,585, filed on Oct. 28, 2013, provisional application No. 61/886,049, filed on Oct. 2, 2013, provisional application No. 61/588,089, filed on Jan. 18, 2012.

Publication Classification

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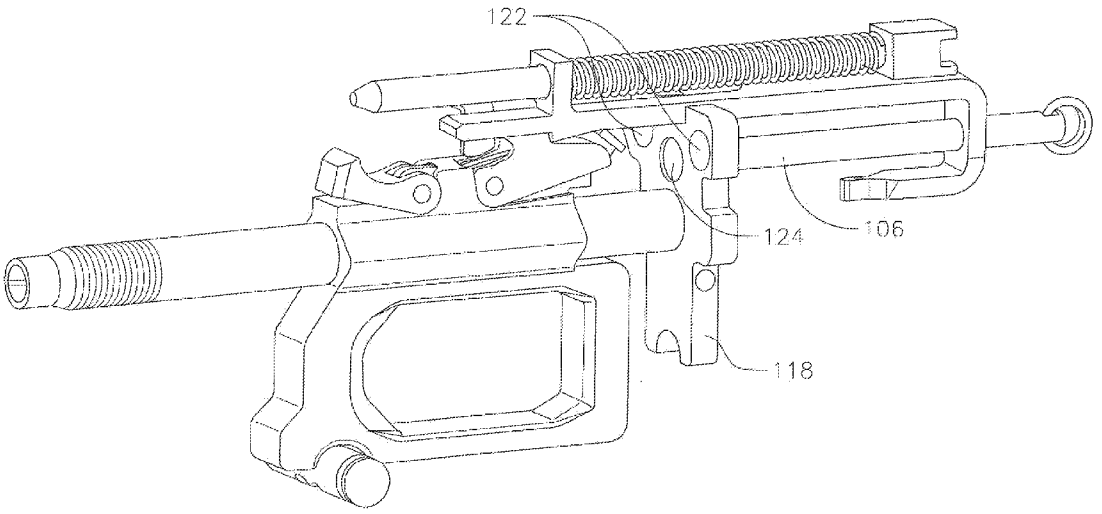
F41A 17/58 (2006.01)

(52) **U.S. Cl.**

CPC .. ***F41A 5/18*** (2013.01); ***F41A 17/58*** (2013.01)

(57) **ABSTRACT**

A semi-automatic firearm apparatus has a recoil rod having a recoil spring associated with it, wherein the recoil rod faces in a first direction and projects outwardly from the semi-automatic firearm apparatus and a hold back member connected to the semi-automatic firearm apparatus and movable between a first position where it does not block the movement of the recoil rod and a second position where it does block the movement of the recoil rod.



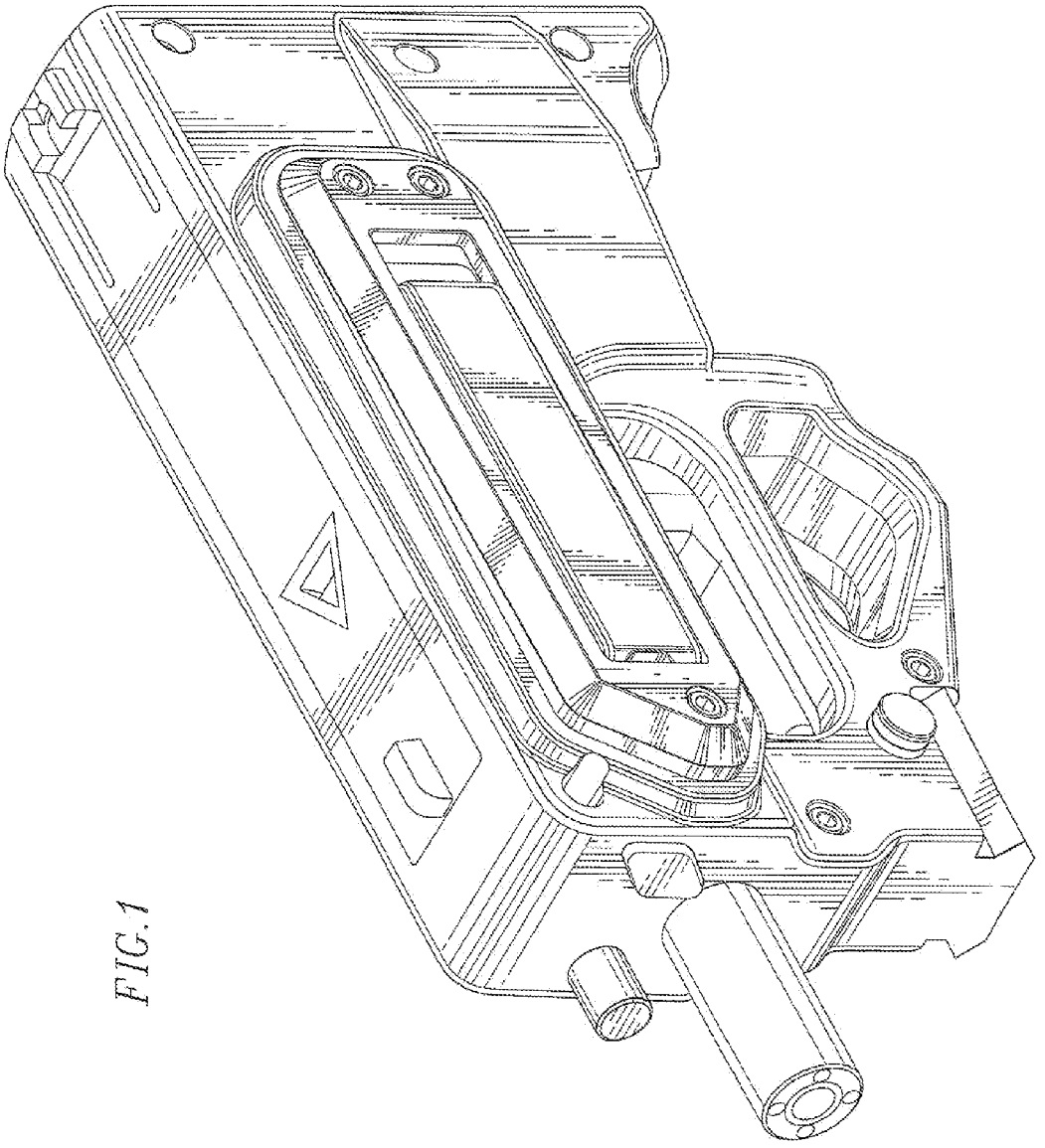


FIG. 1

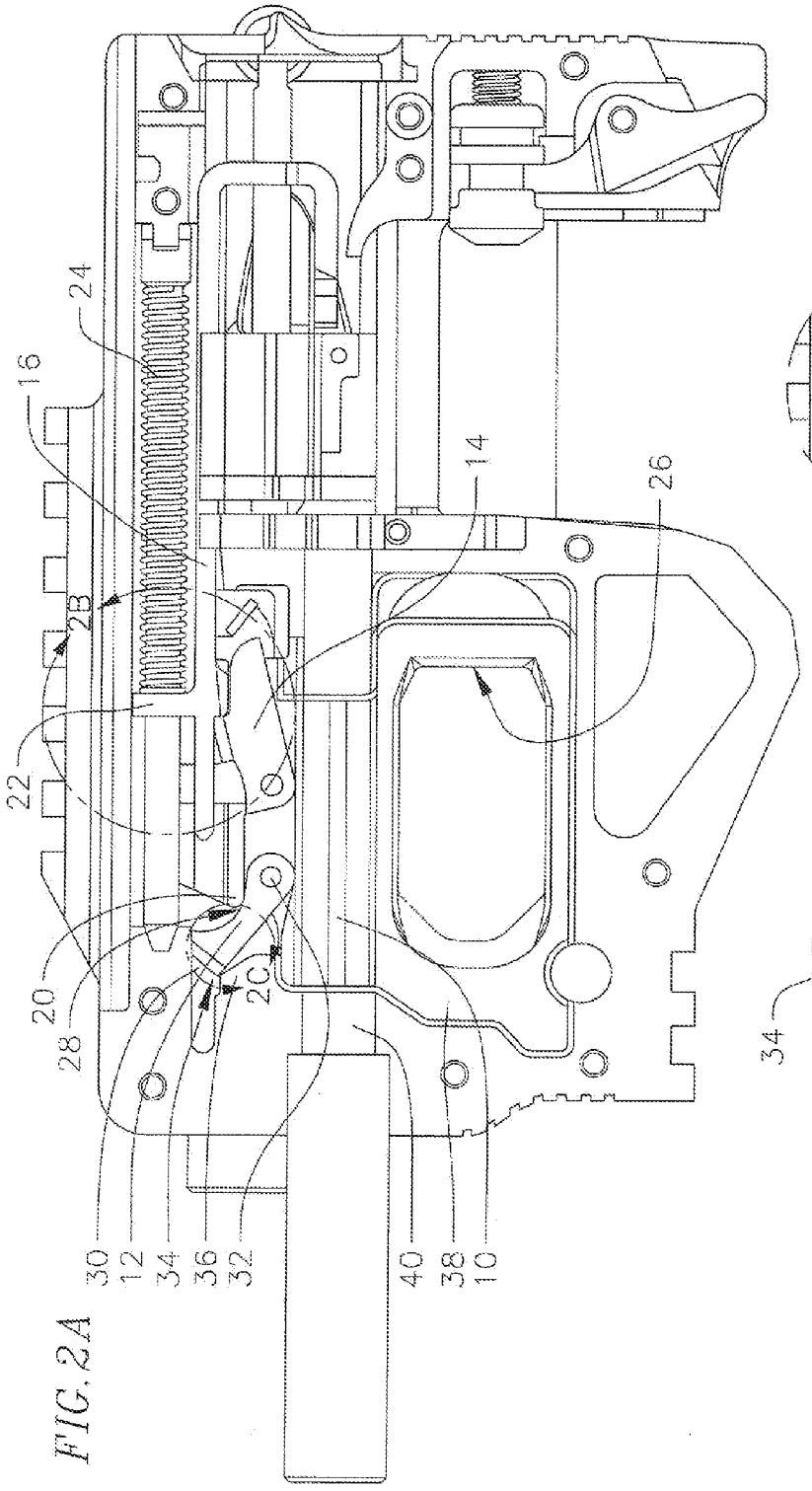


FIG. 2A

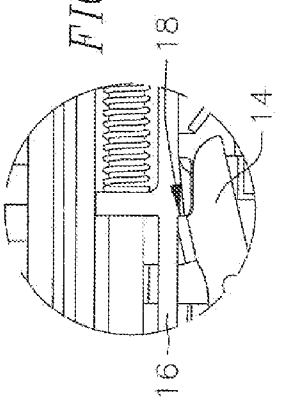


FIG. 2B

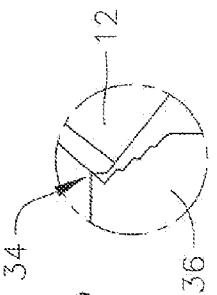


FIG. 2C

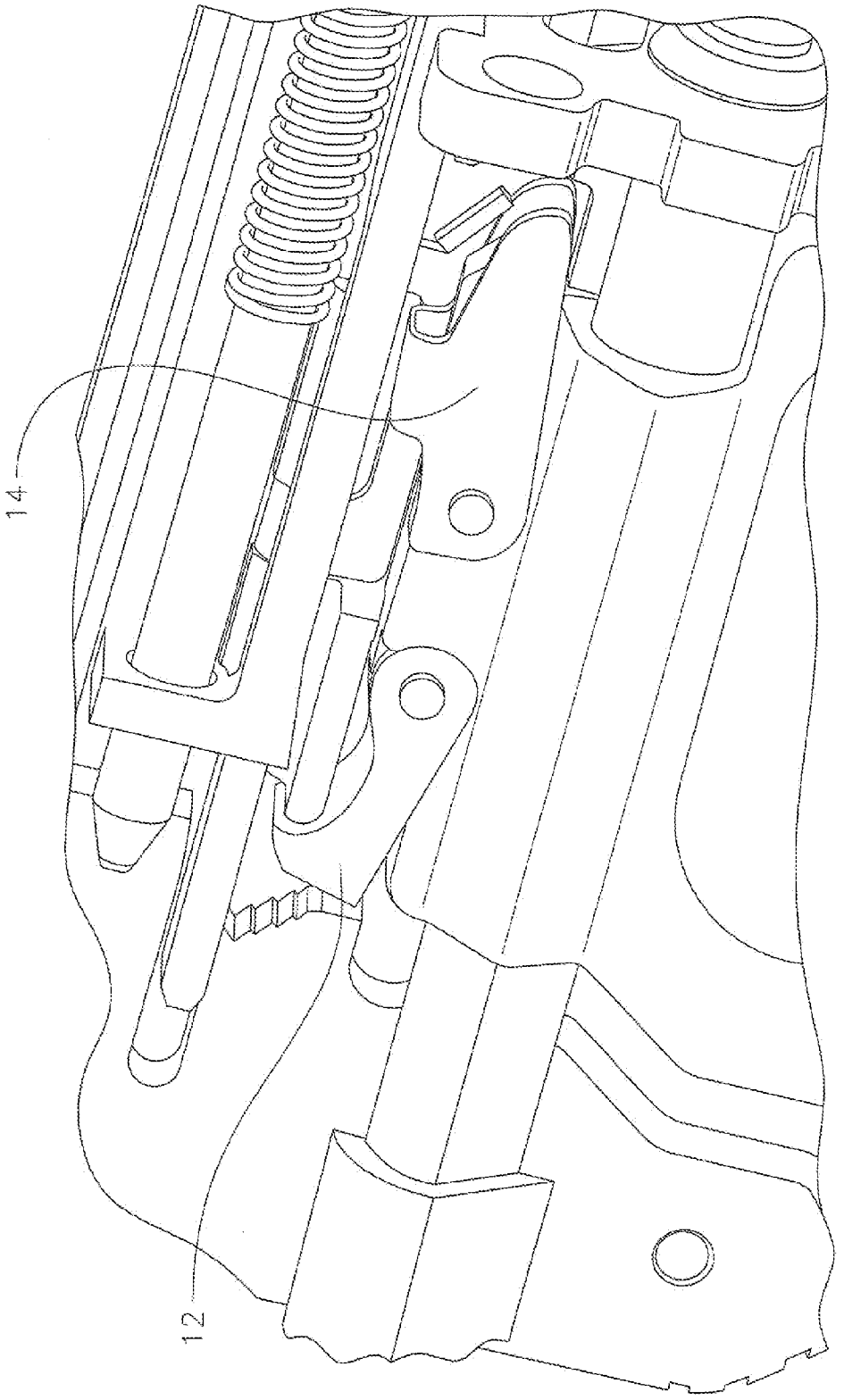
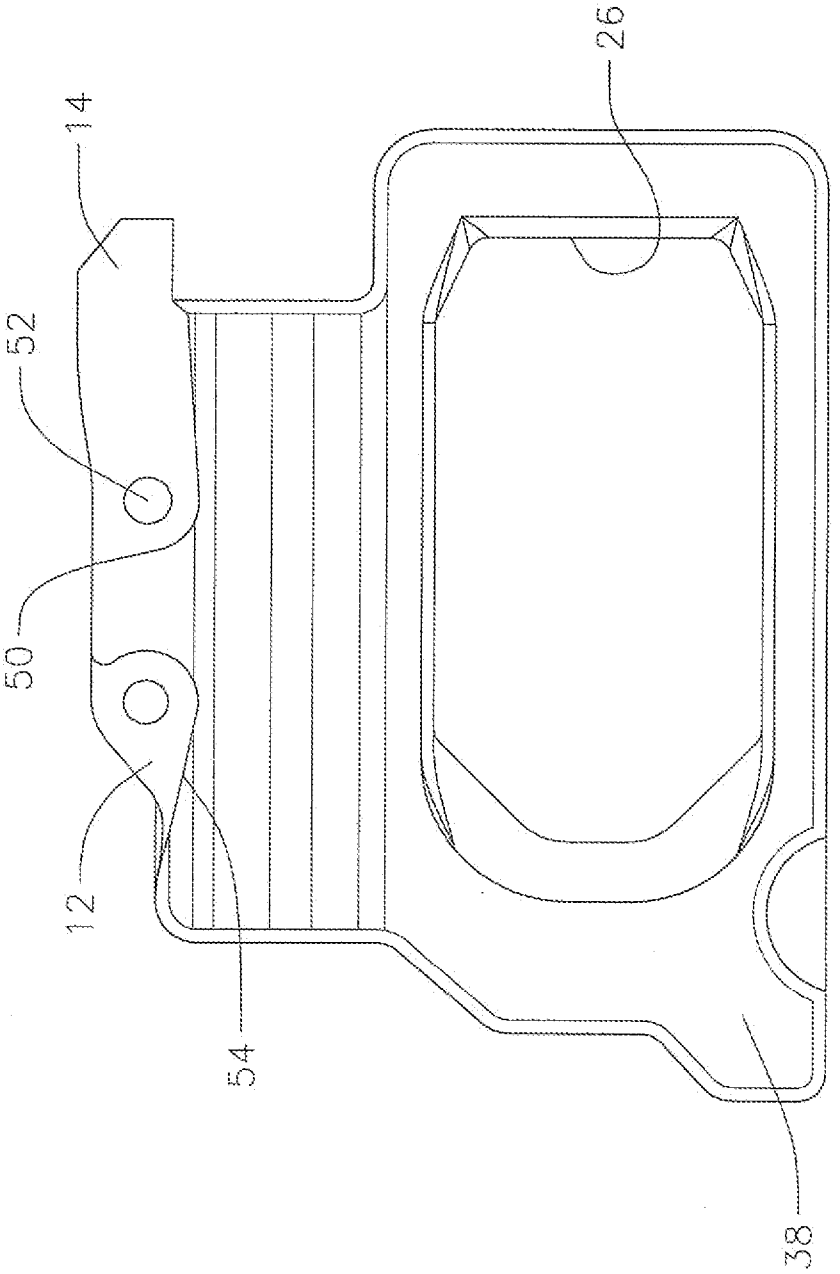


FIG. 2D

FIG. 3



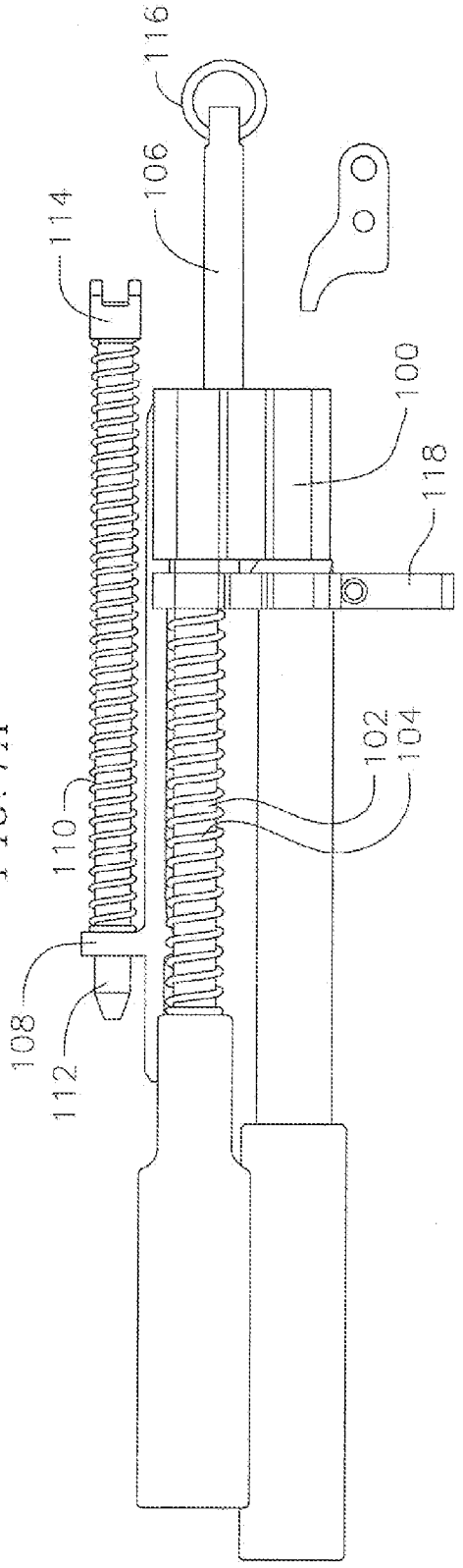


FIG. 4A

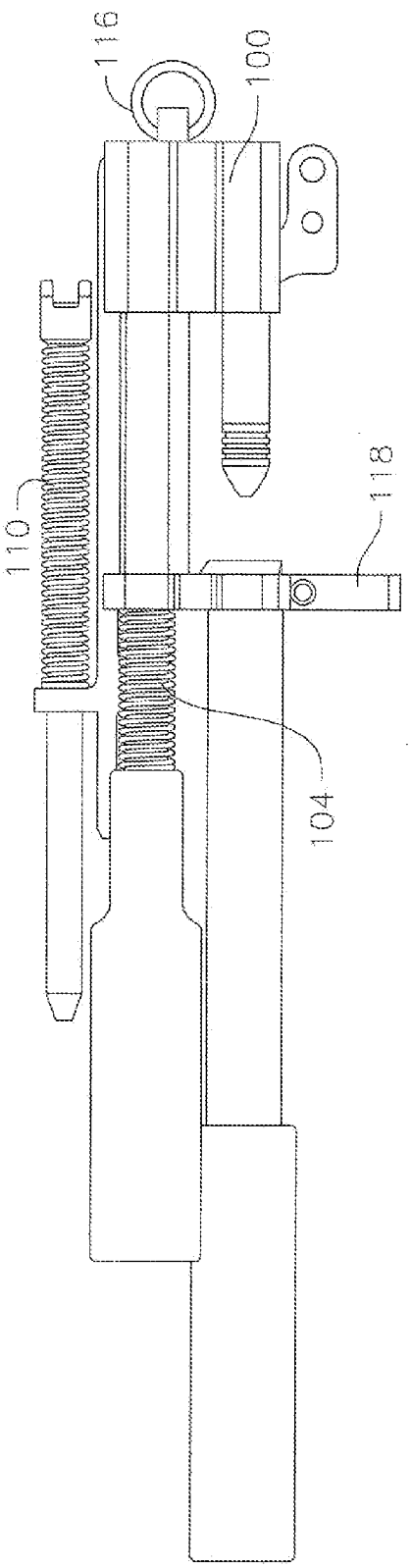


FIG. 4B

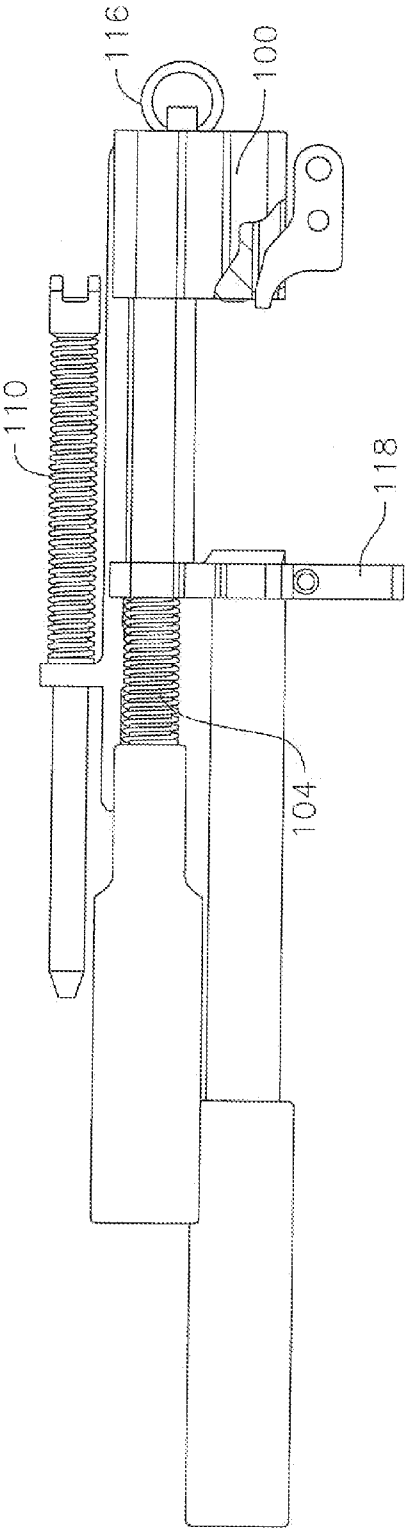


FIG. 4C

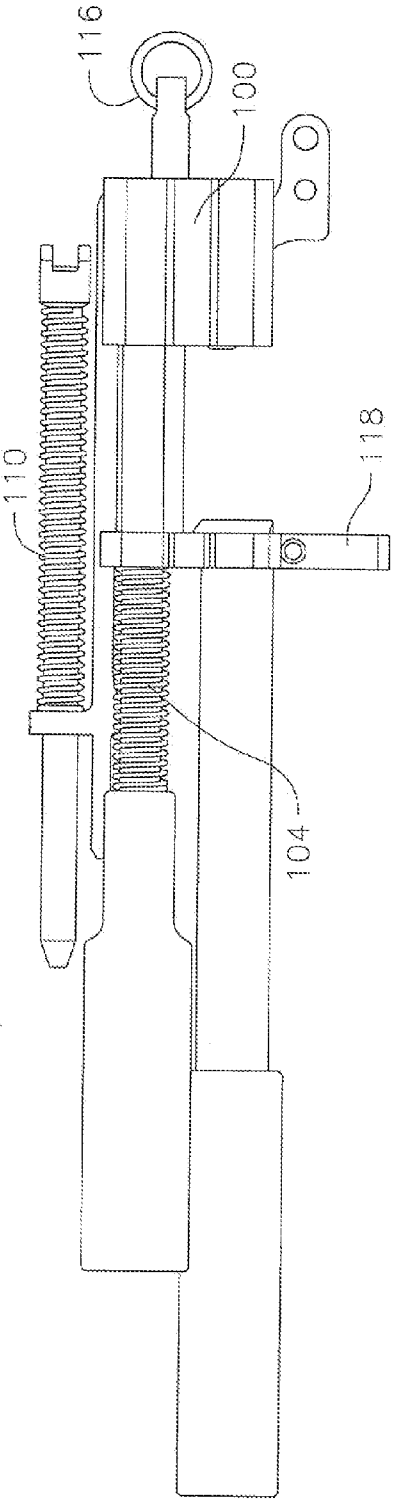


FIG. 4D

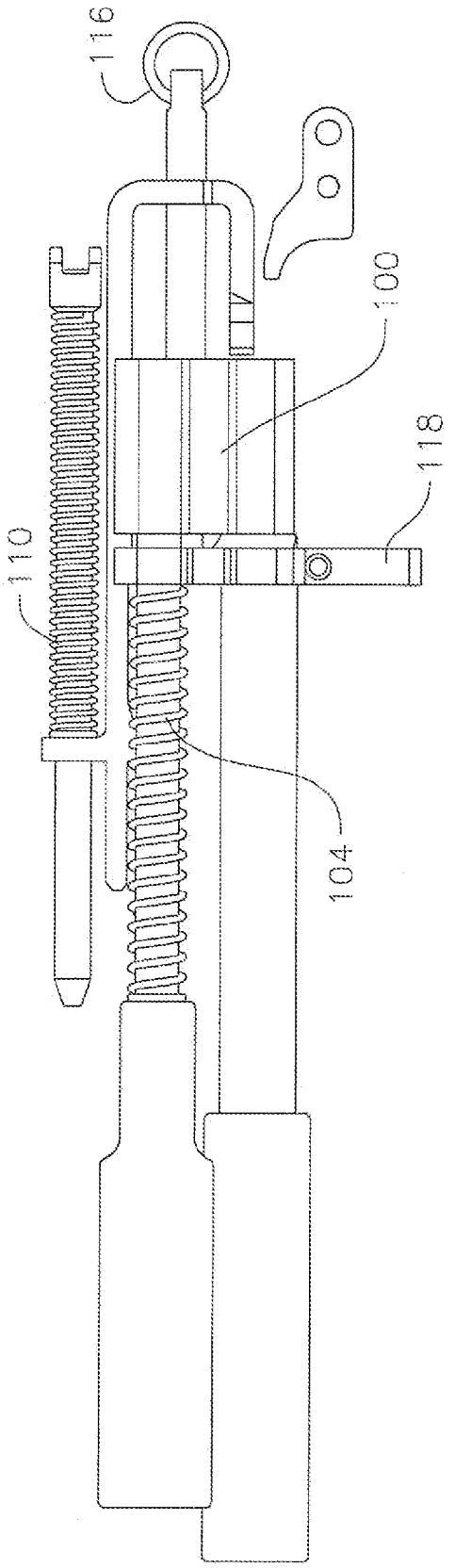


FIG. 4E

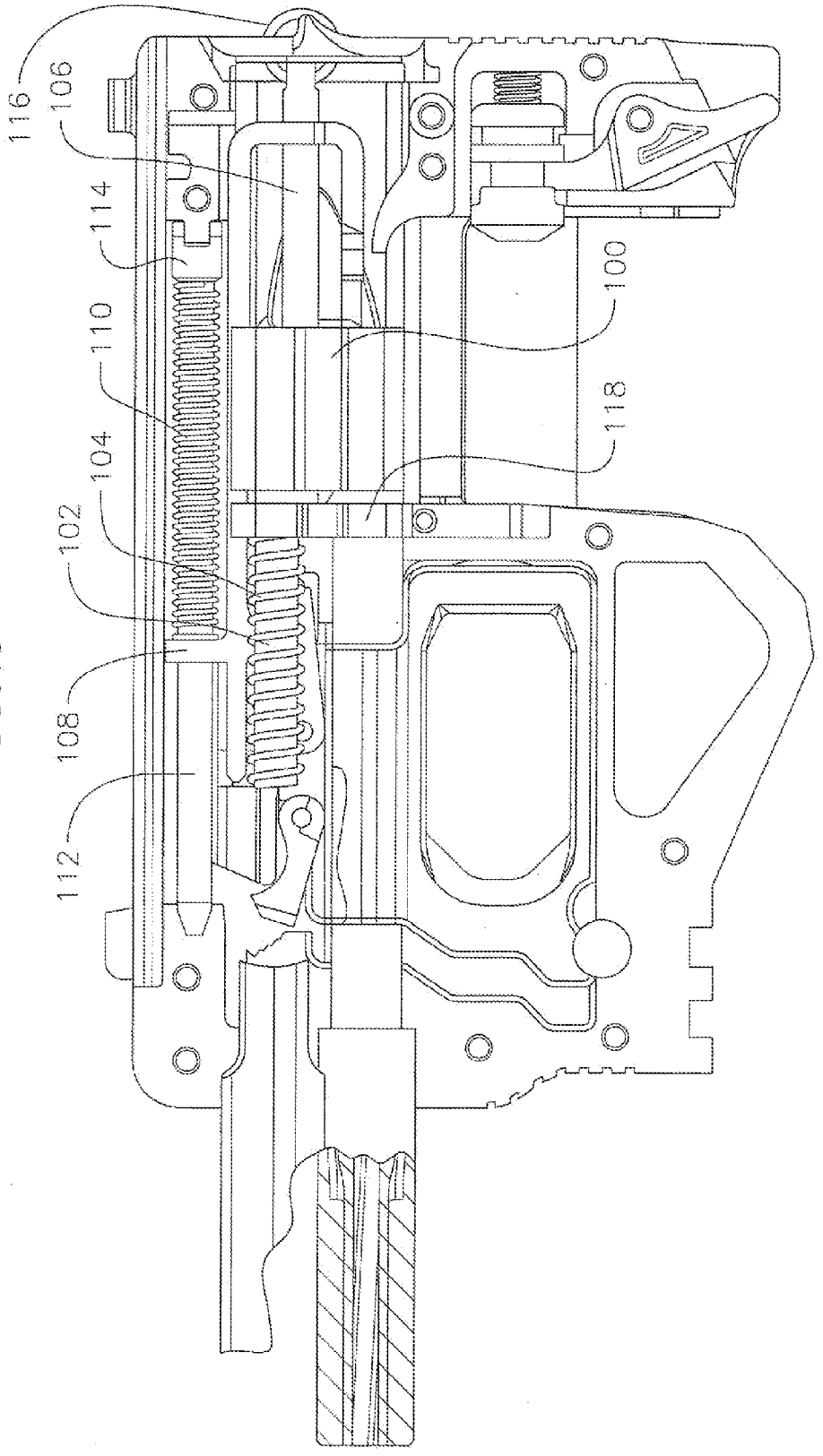


FIG. 5

FIG. 6

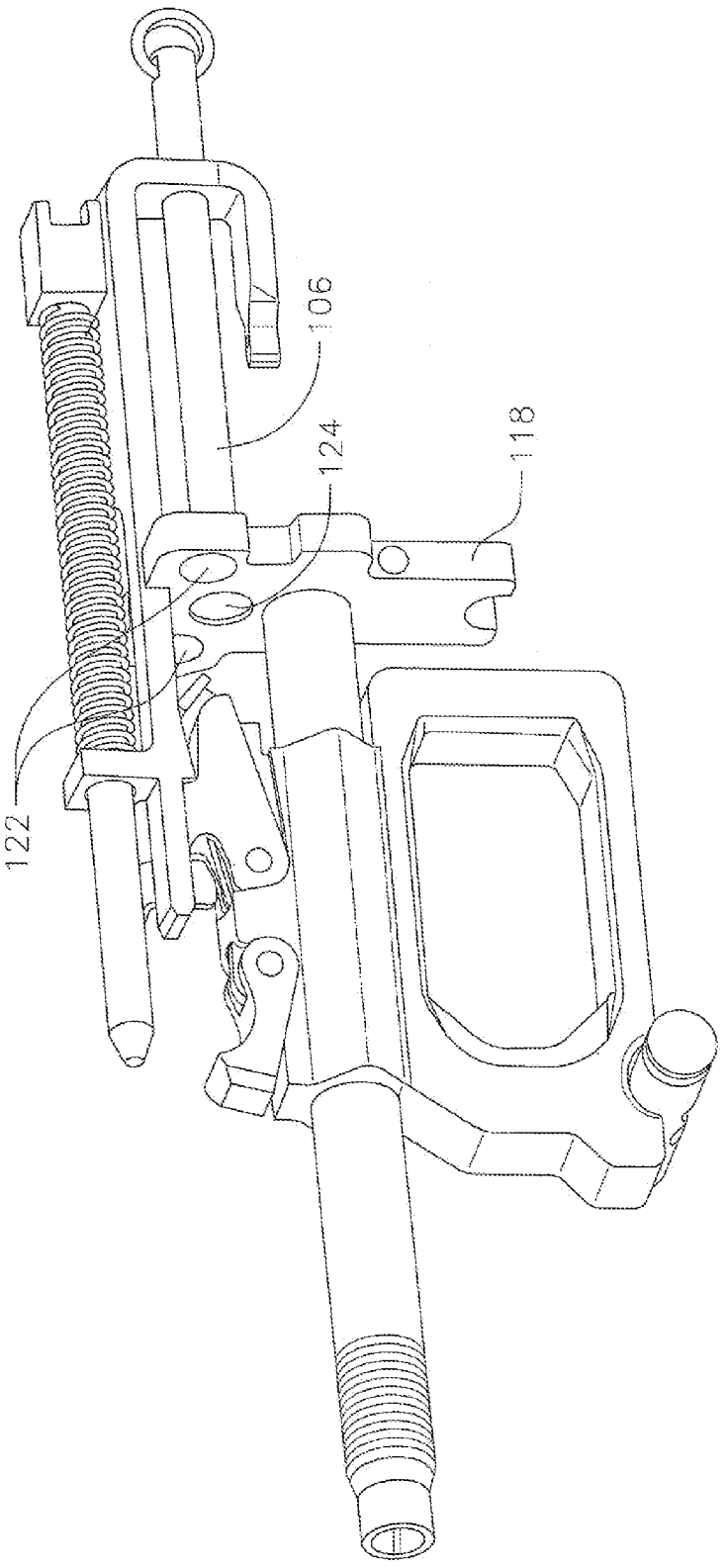
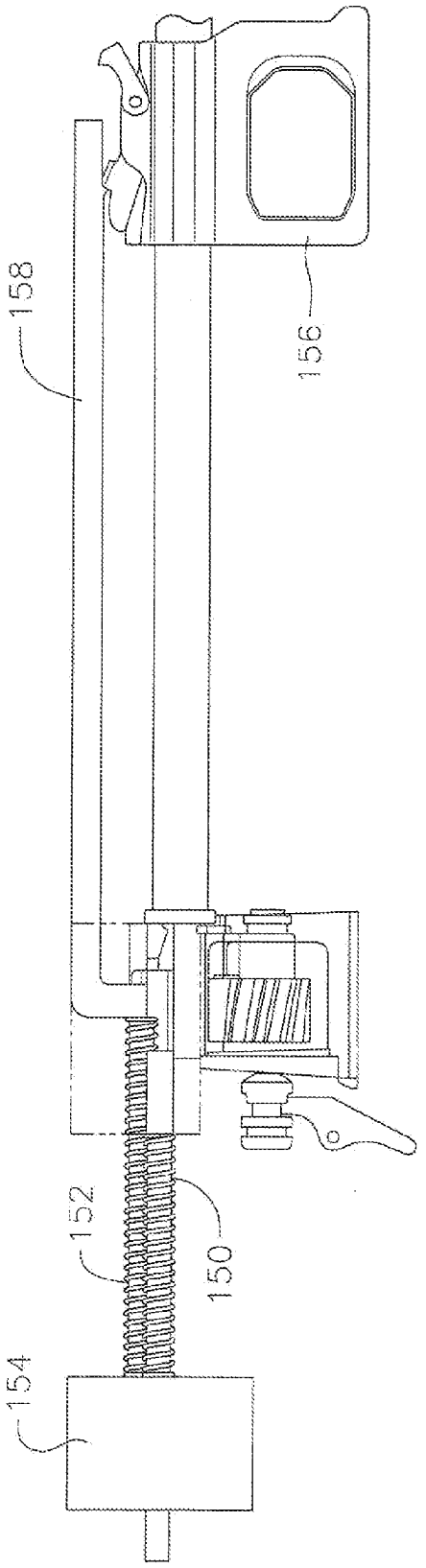


FIG. 7



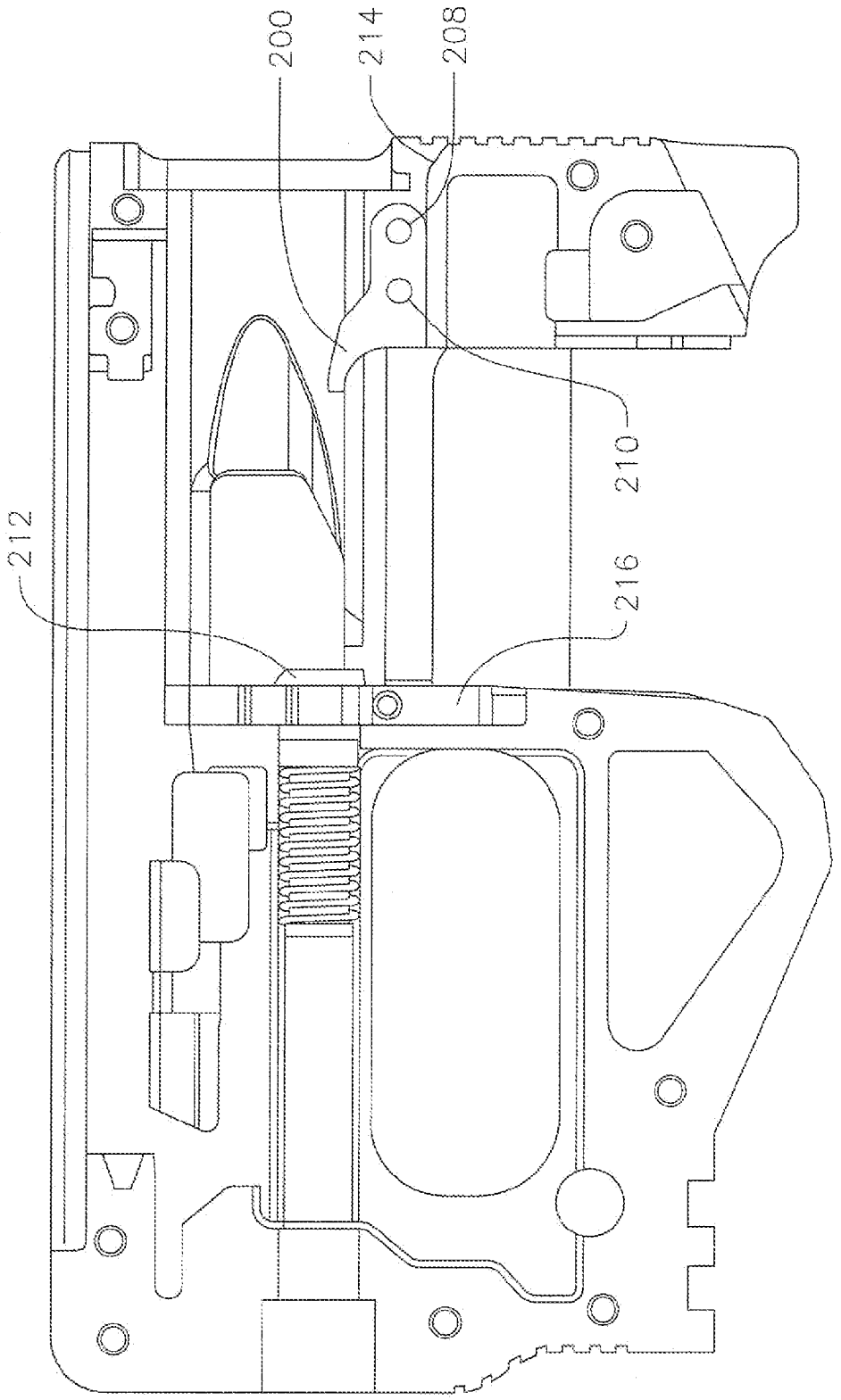
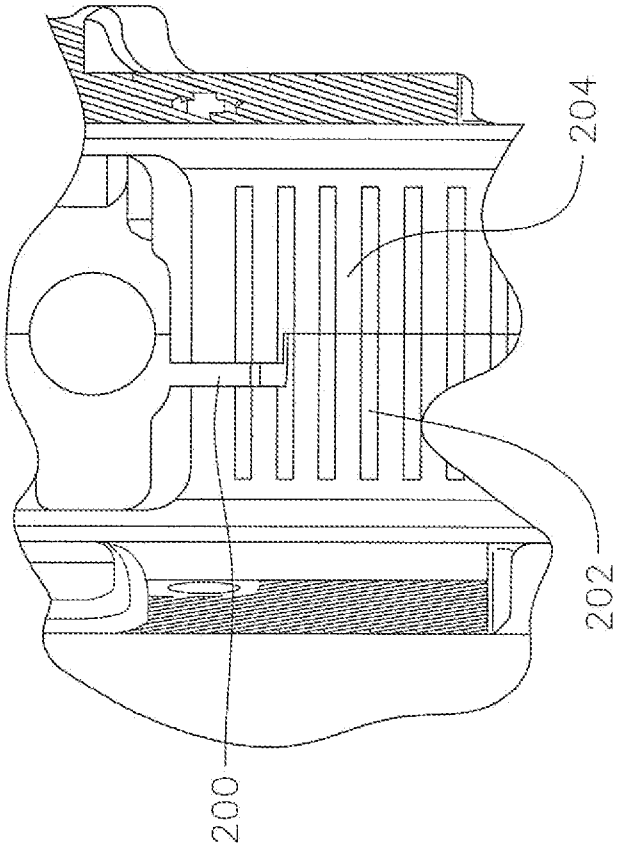


FIG. 8A

FIG. 8C



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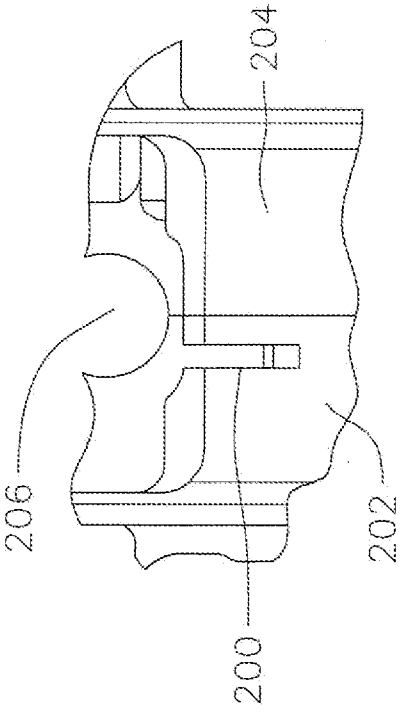


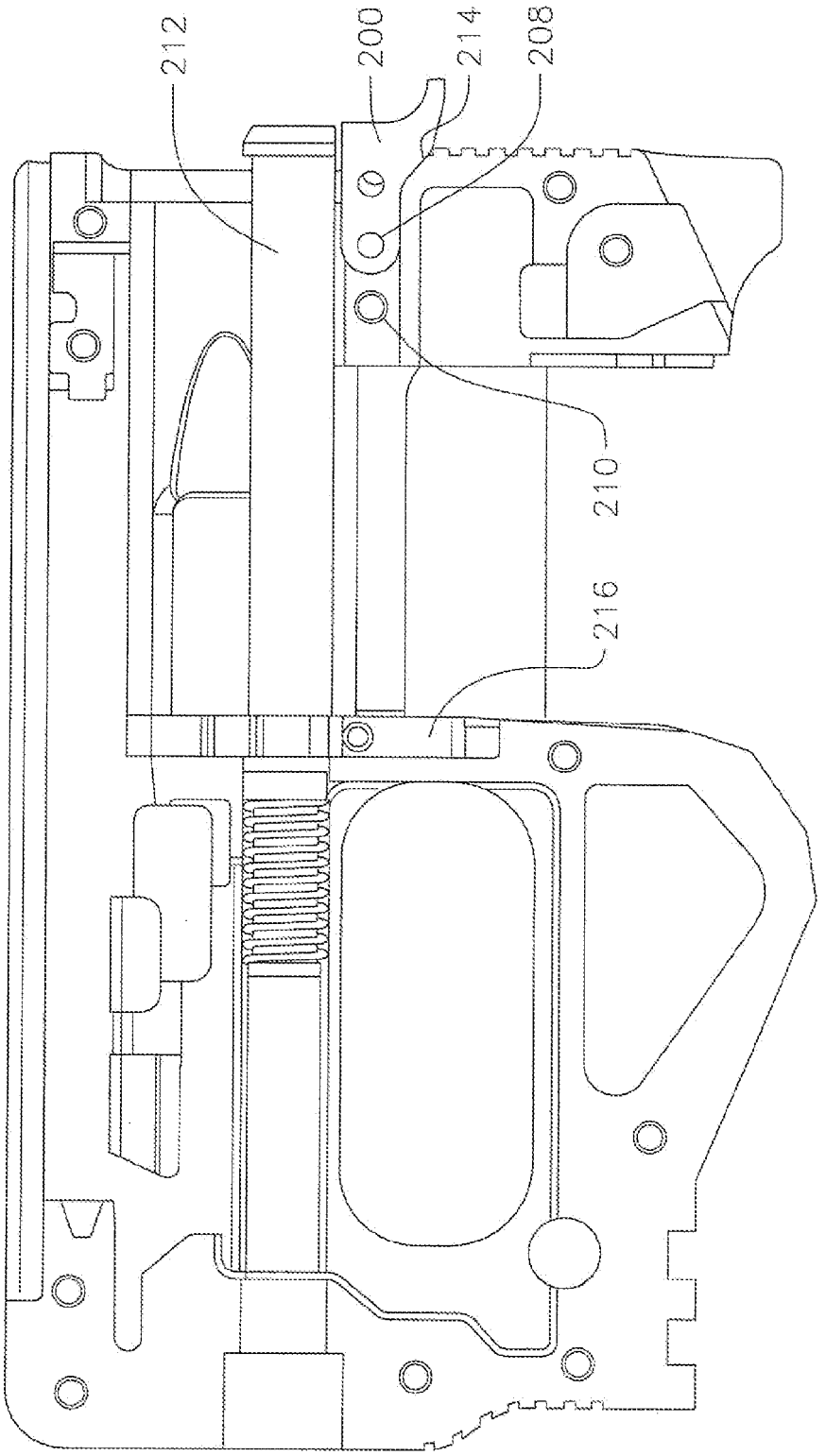


FIG. 8D

FIG. 9A

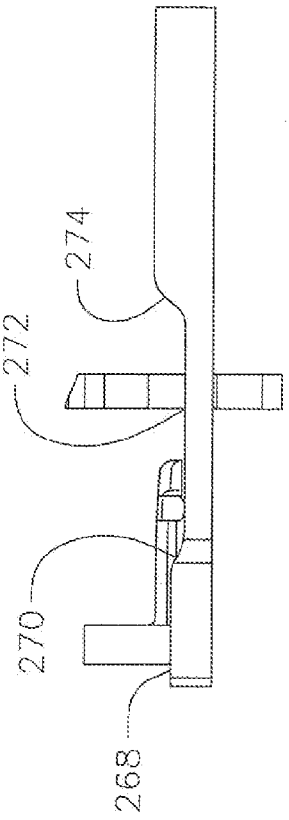
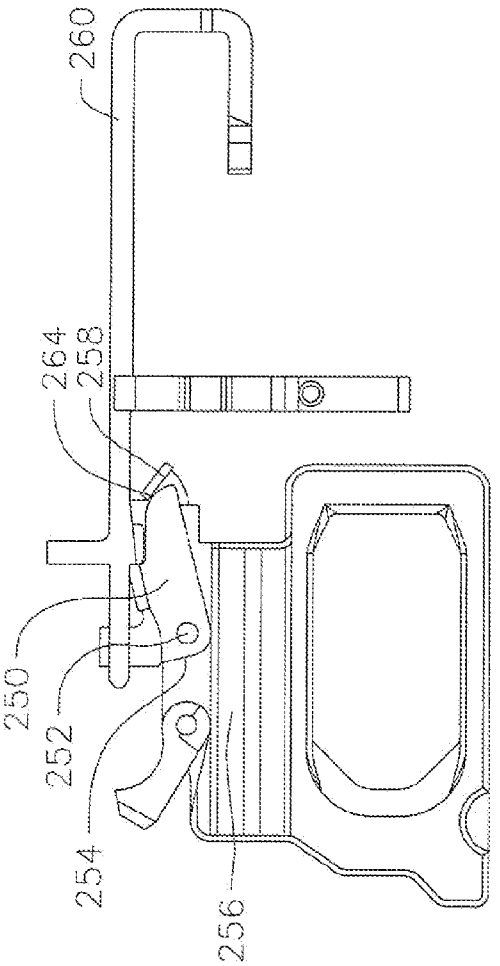


FIG. 9B



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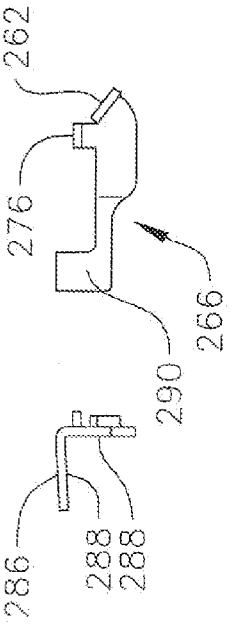
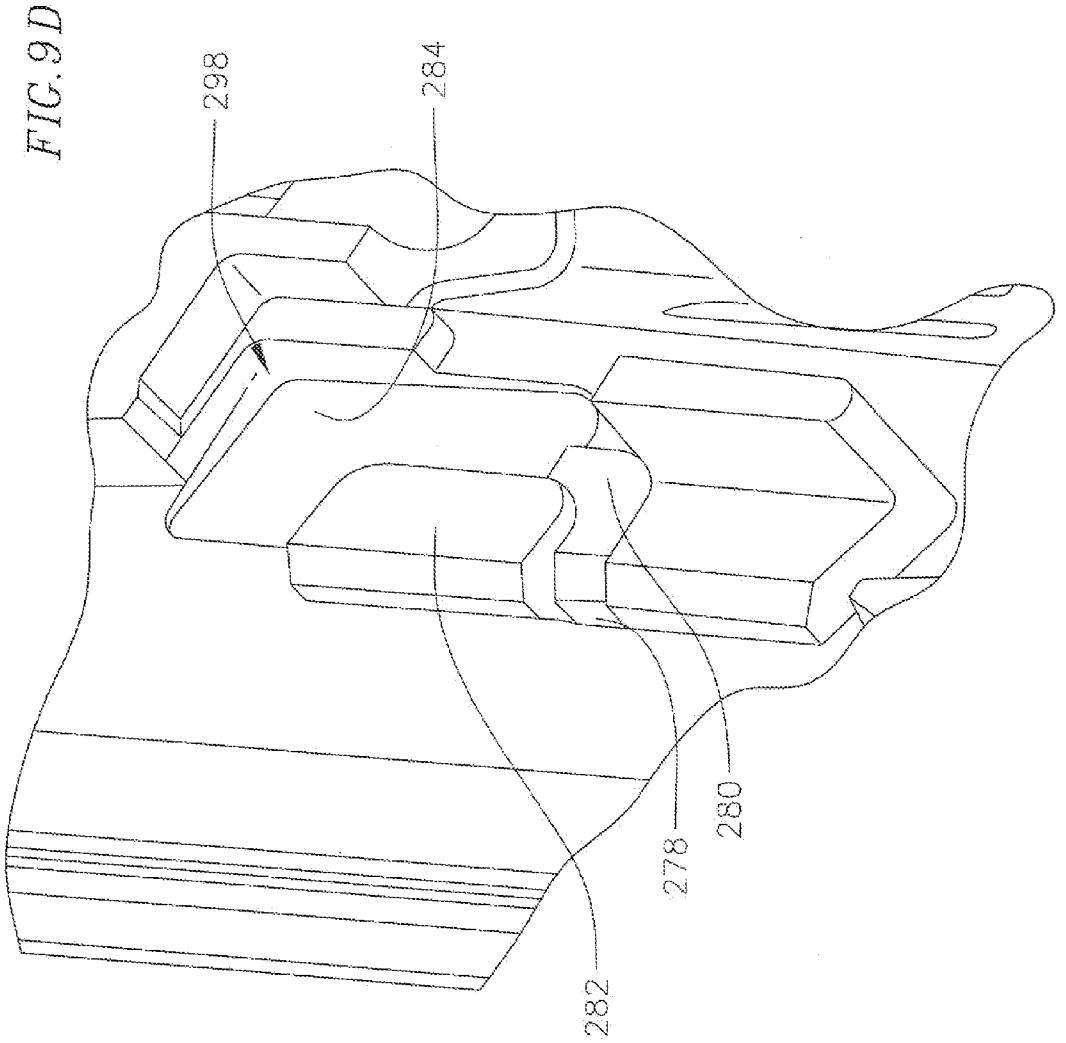
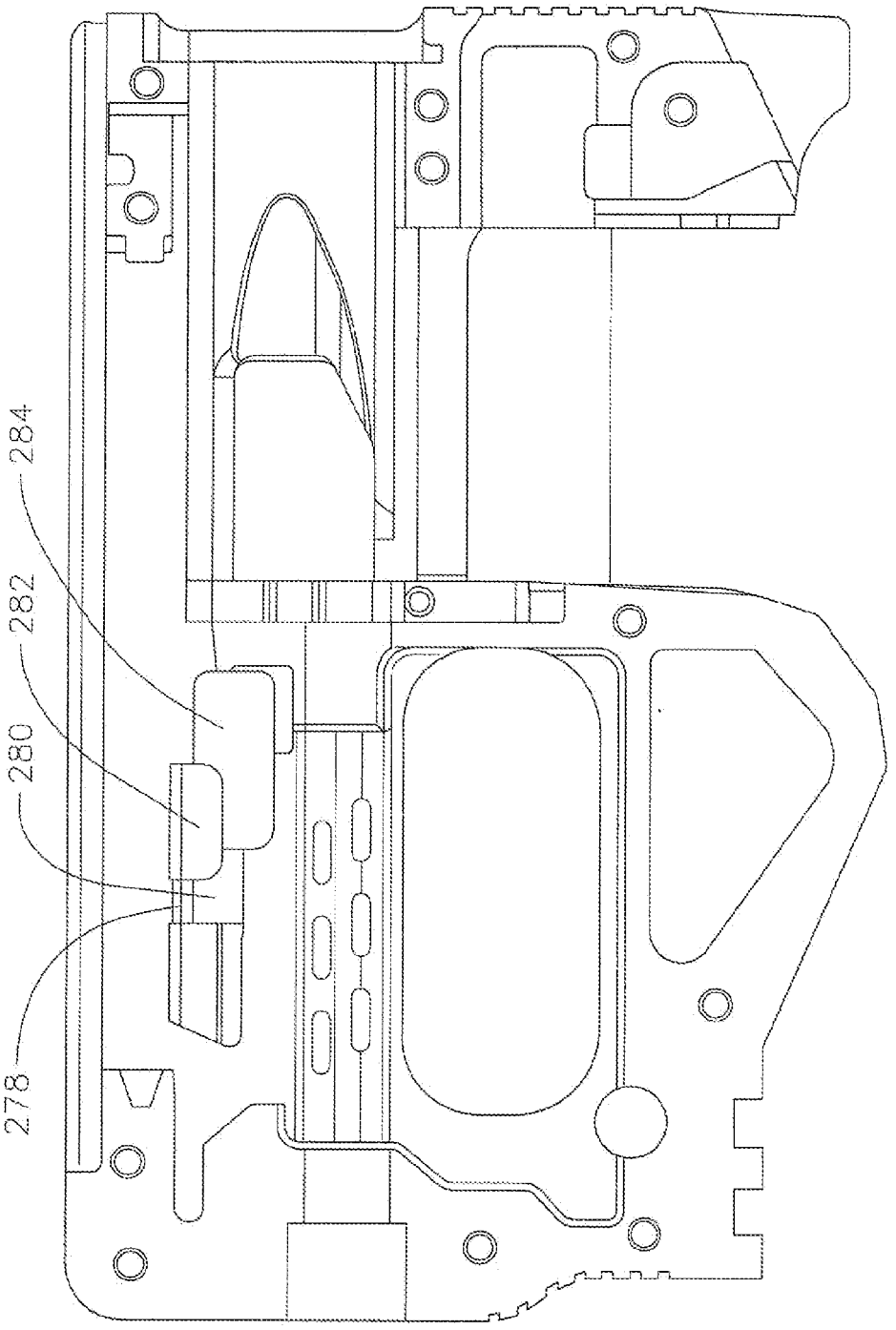


FIG. 9D





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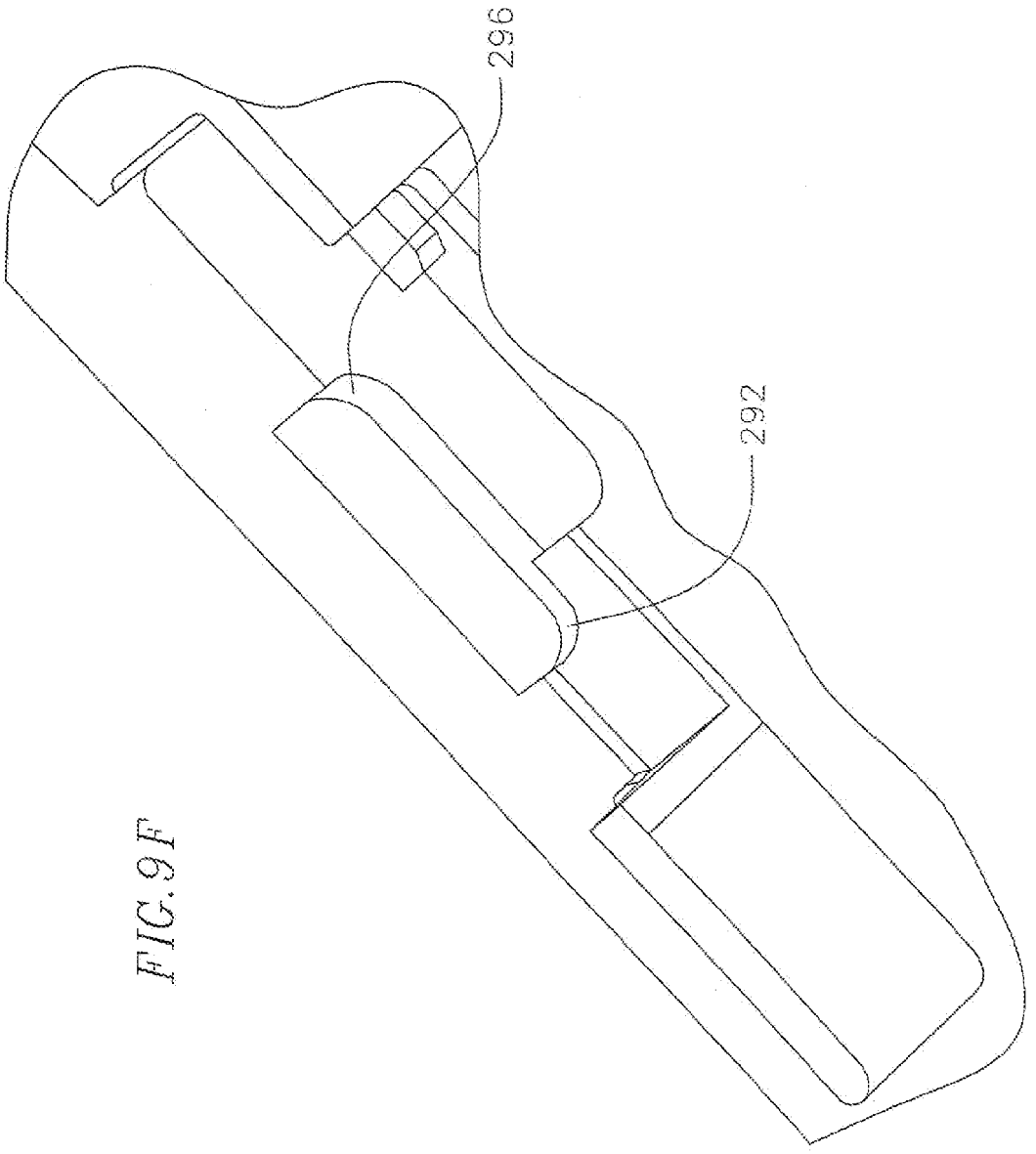


FIG. 9F

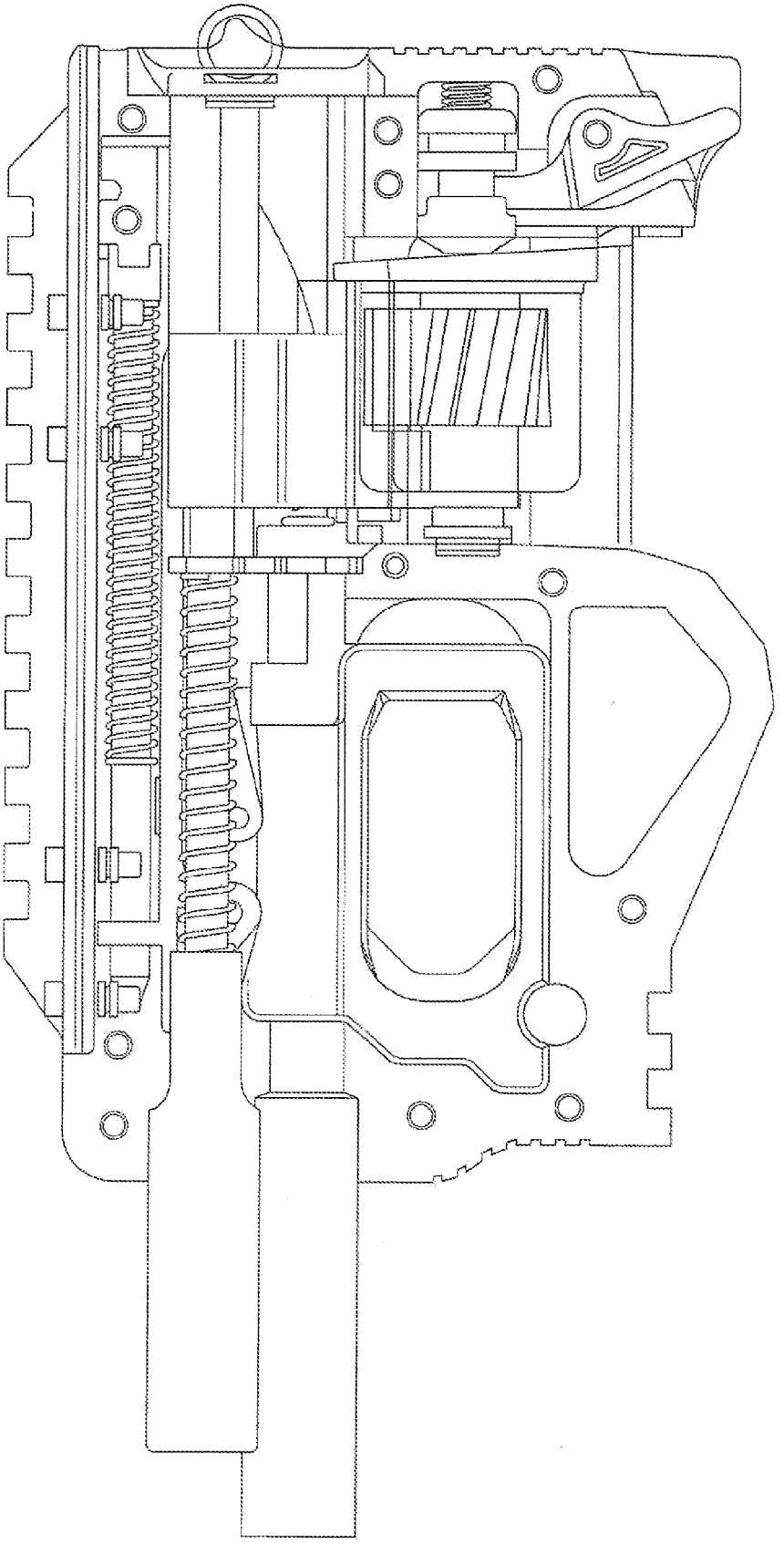
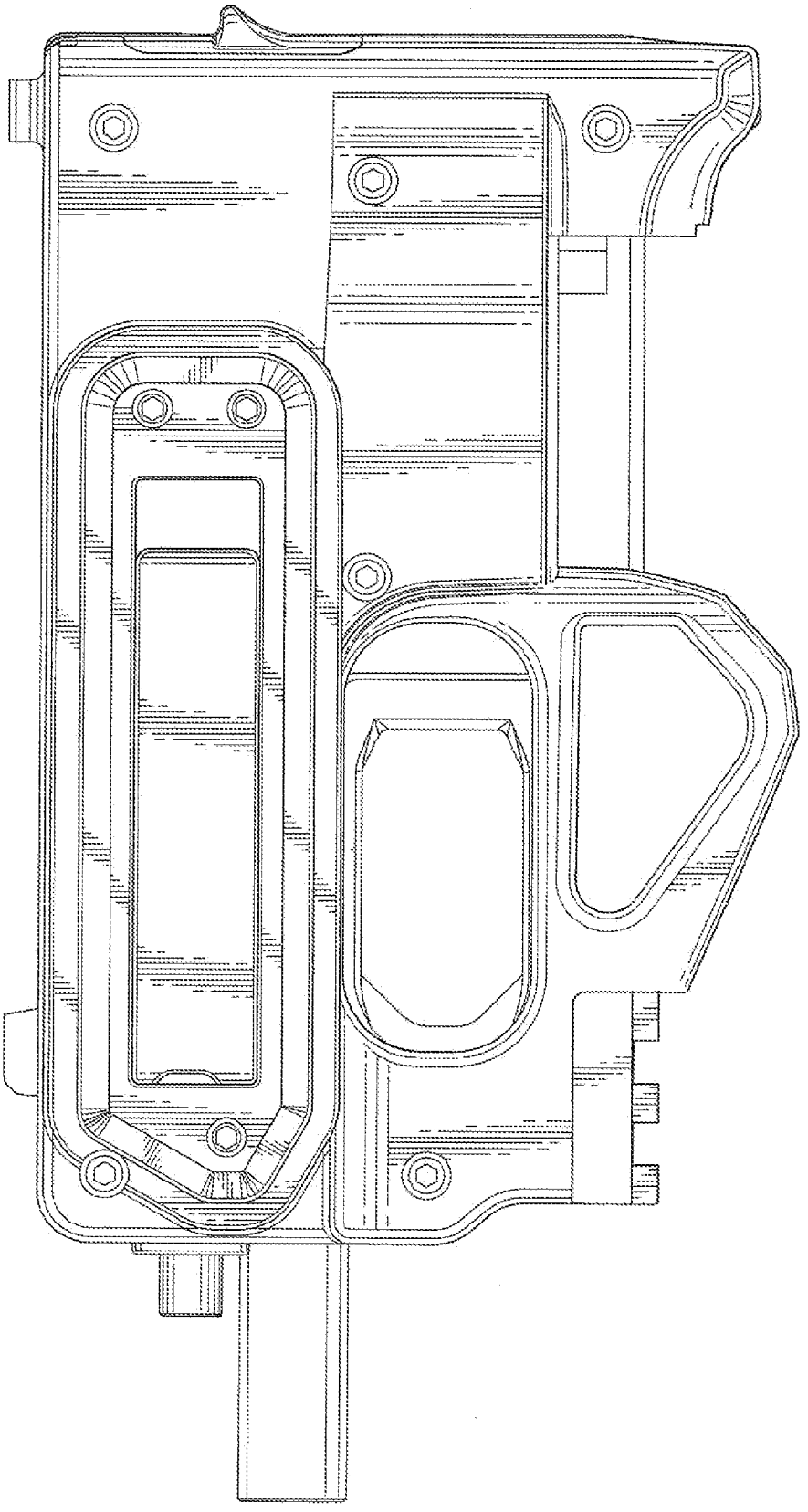


FIG. 10



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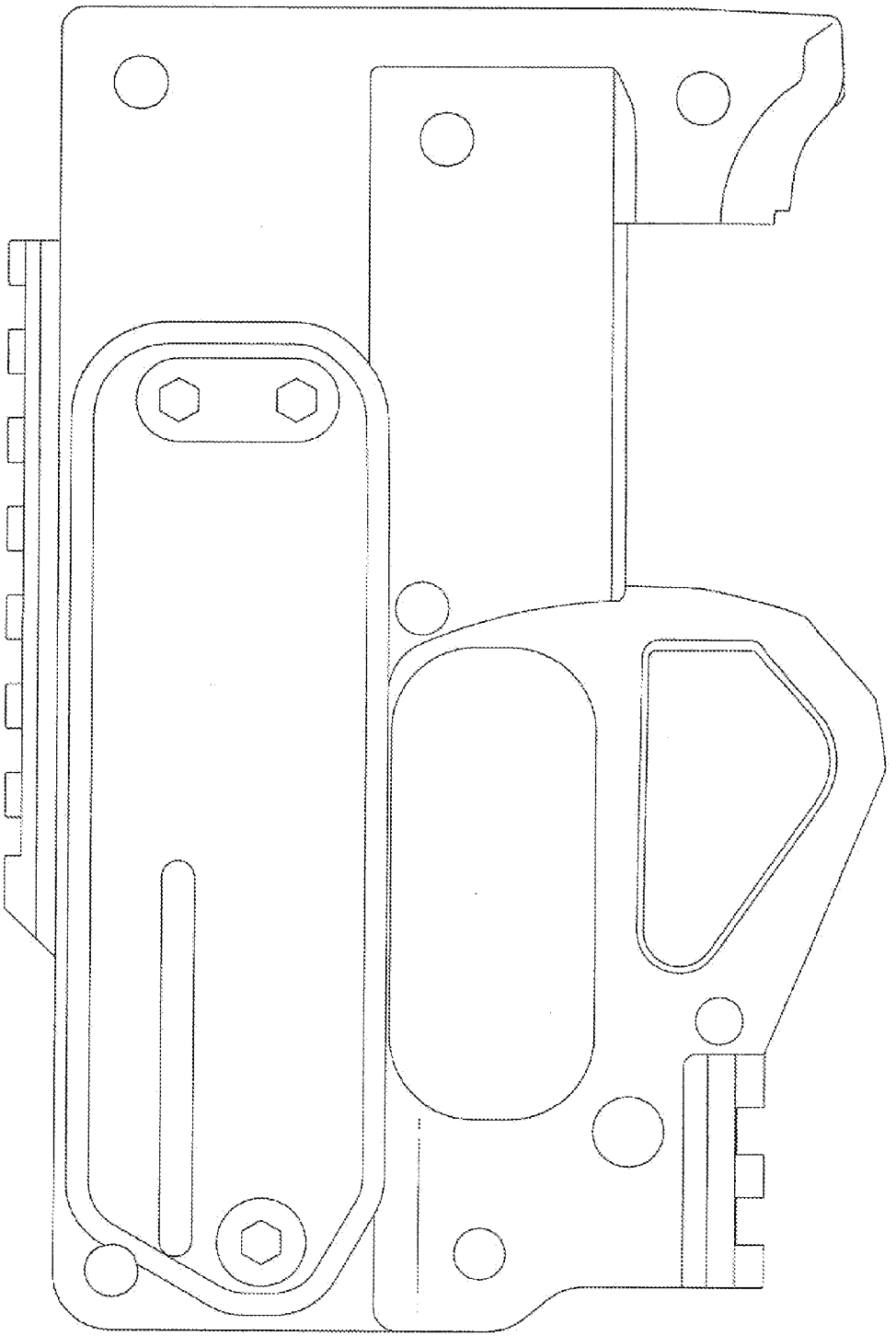

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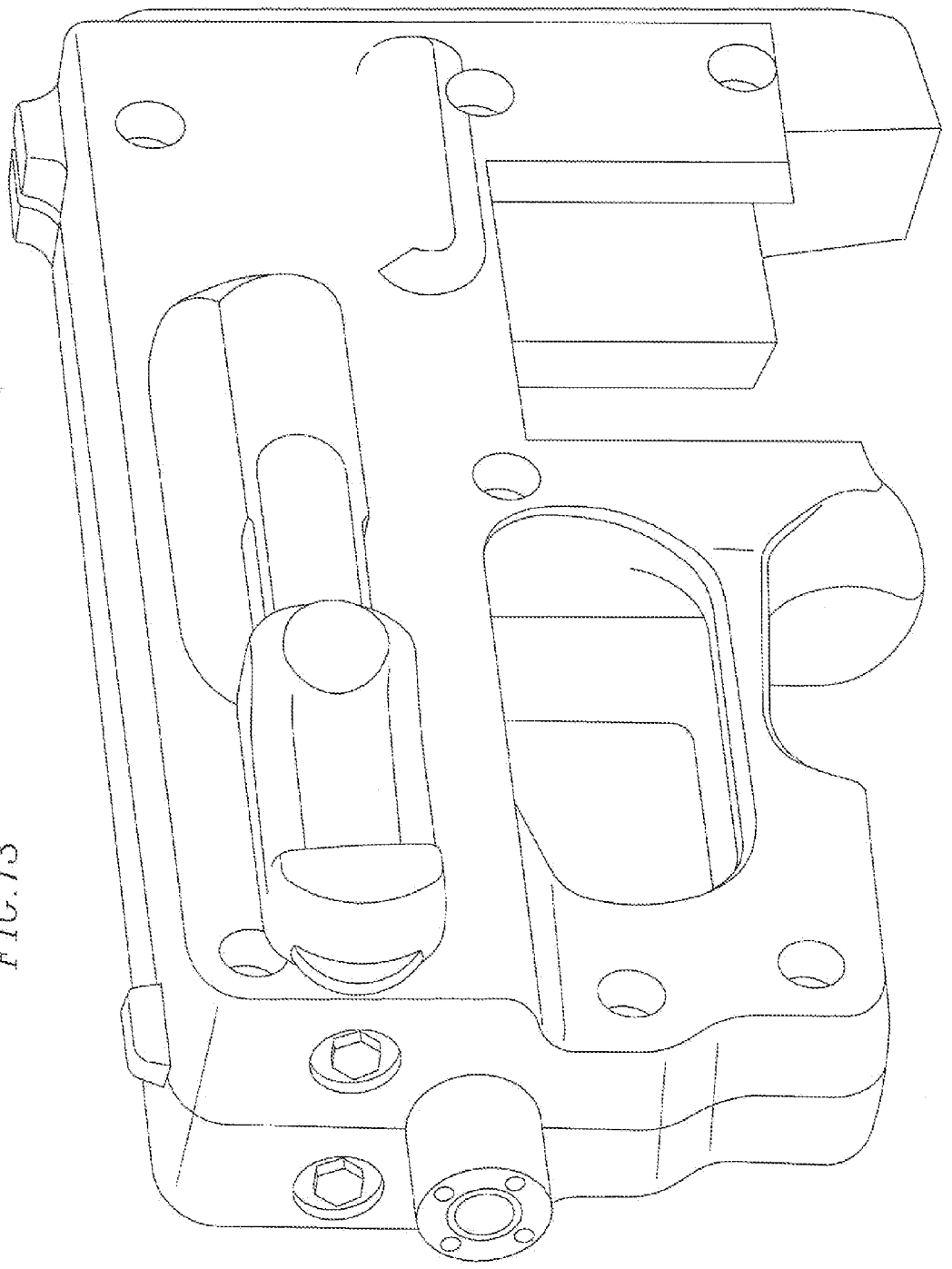


FIG. 13

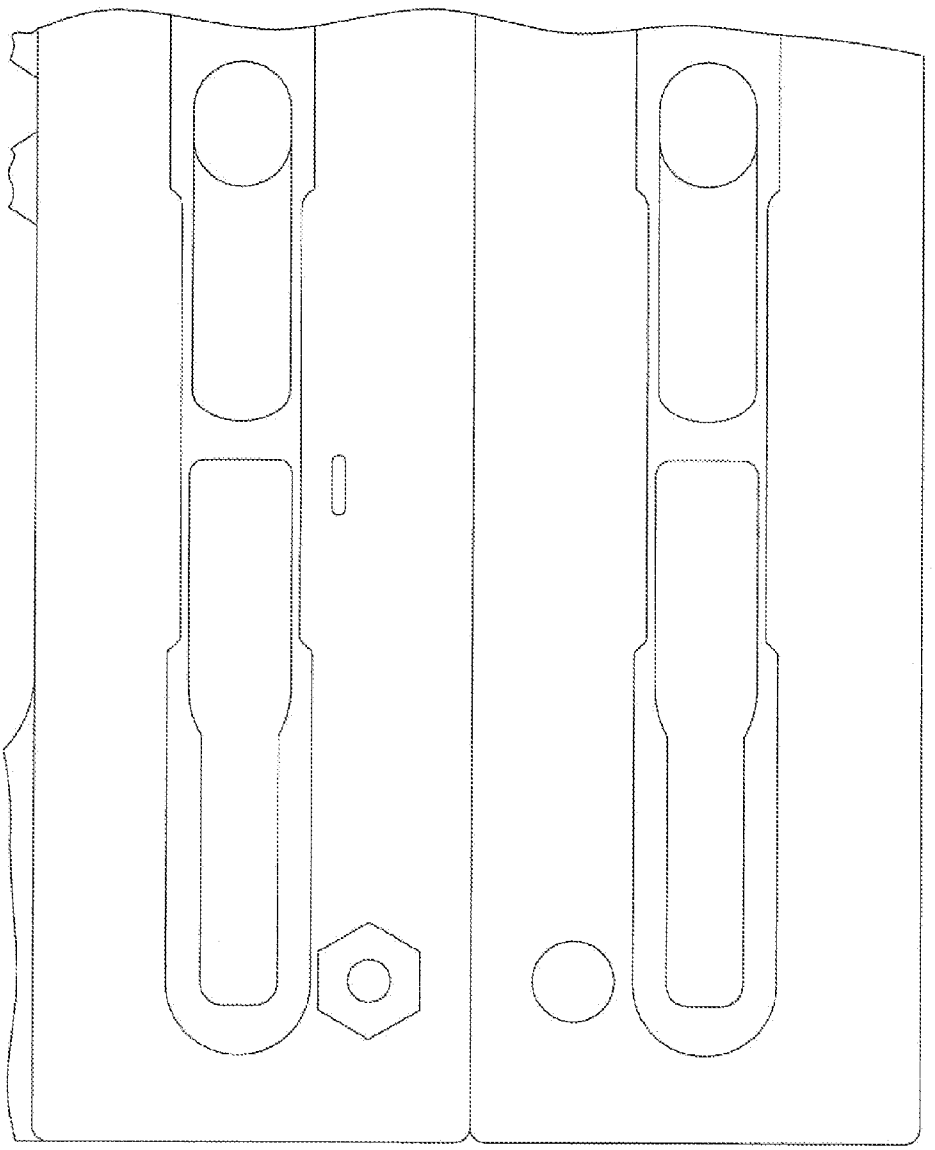


FIG. 14

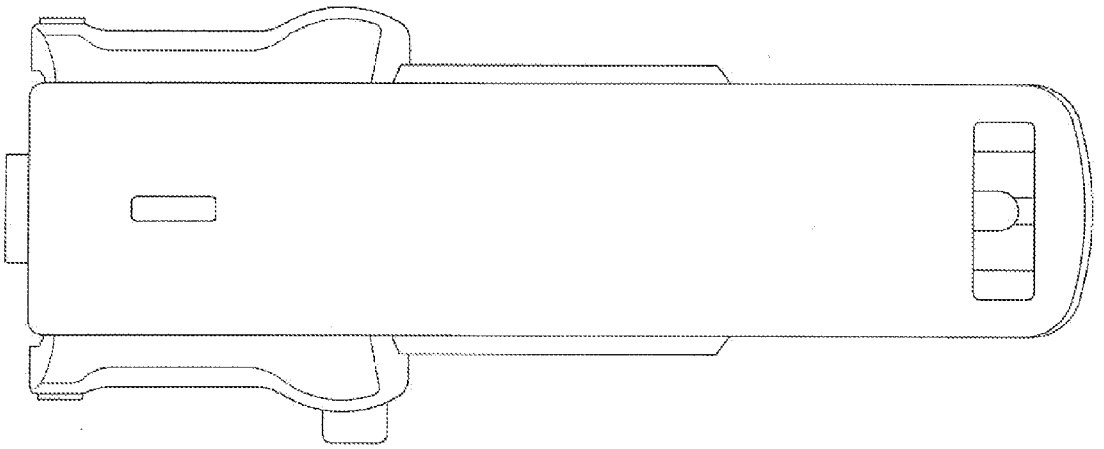


FIG.15

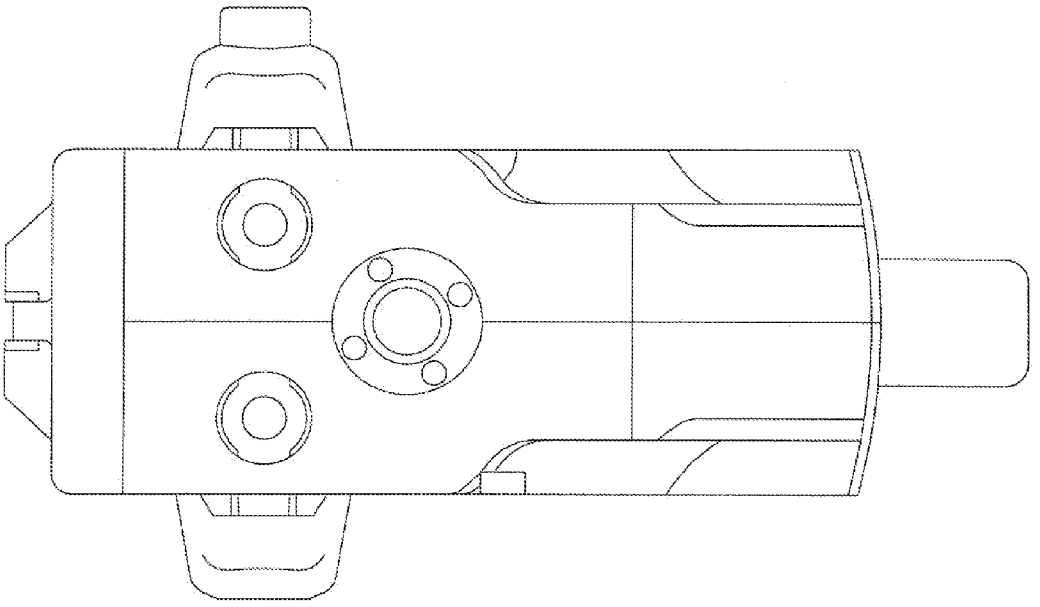


FIG. 16

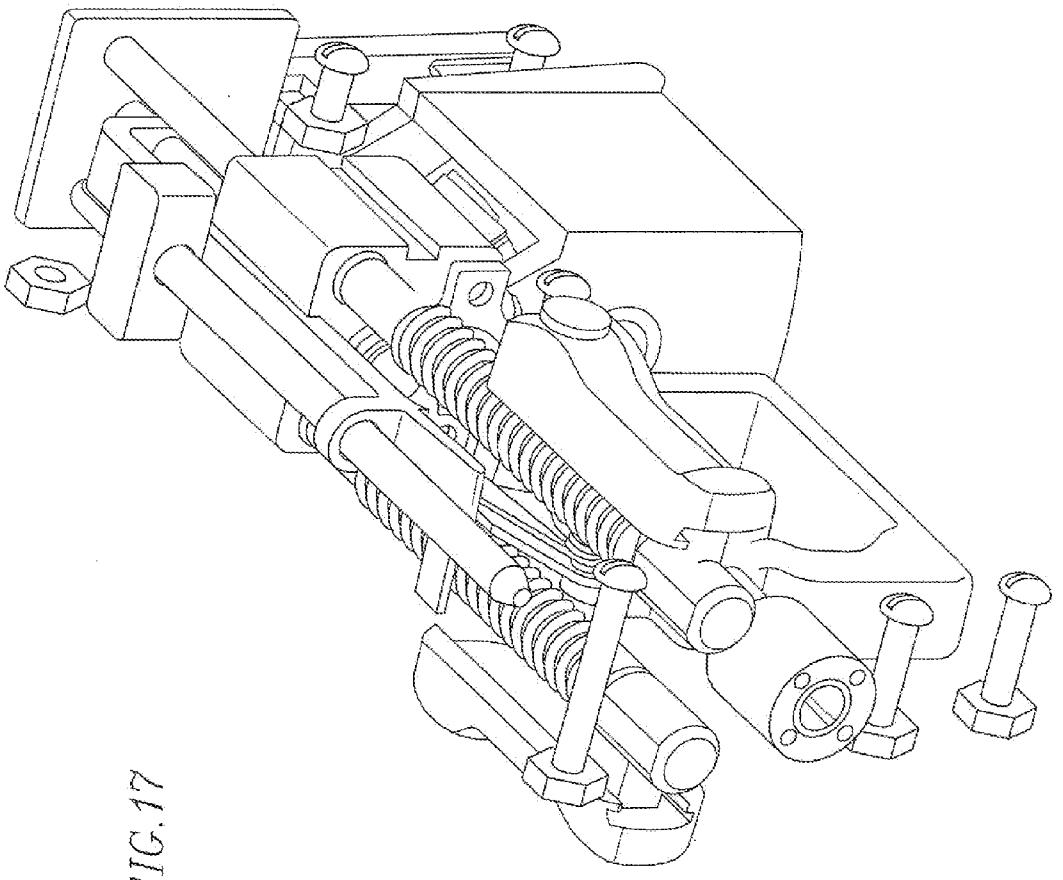
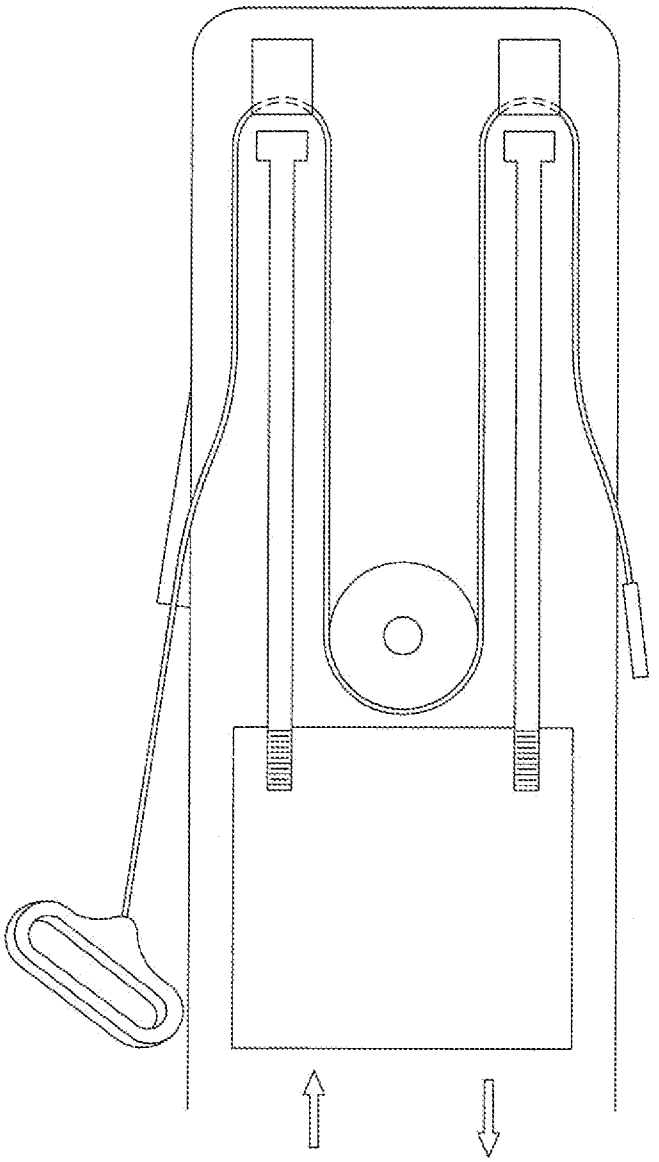


FIG. 17

FIG.18



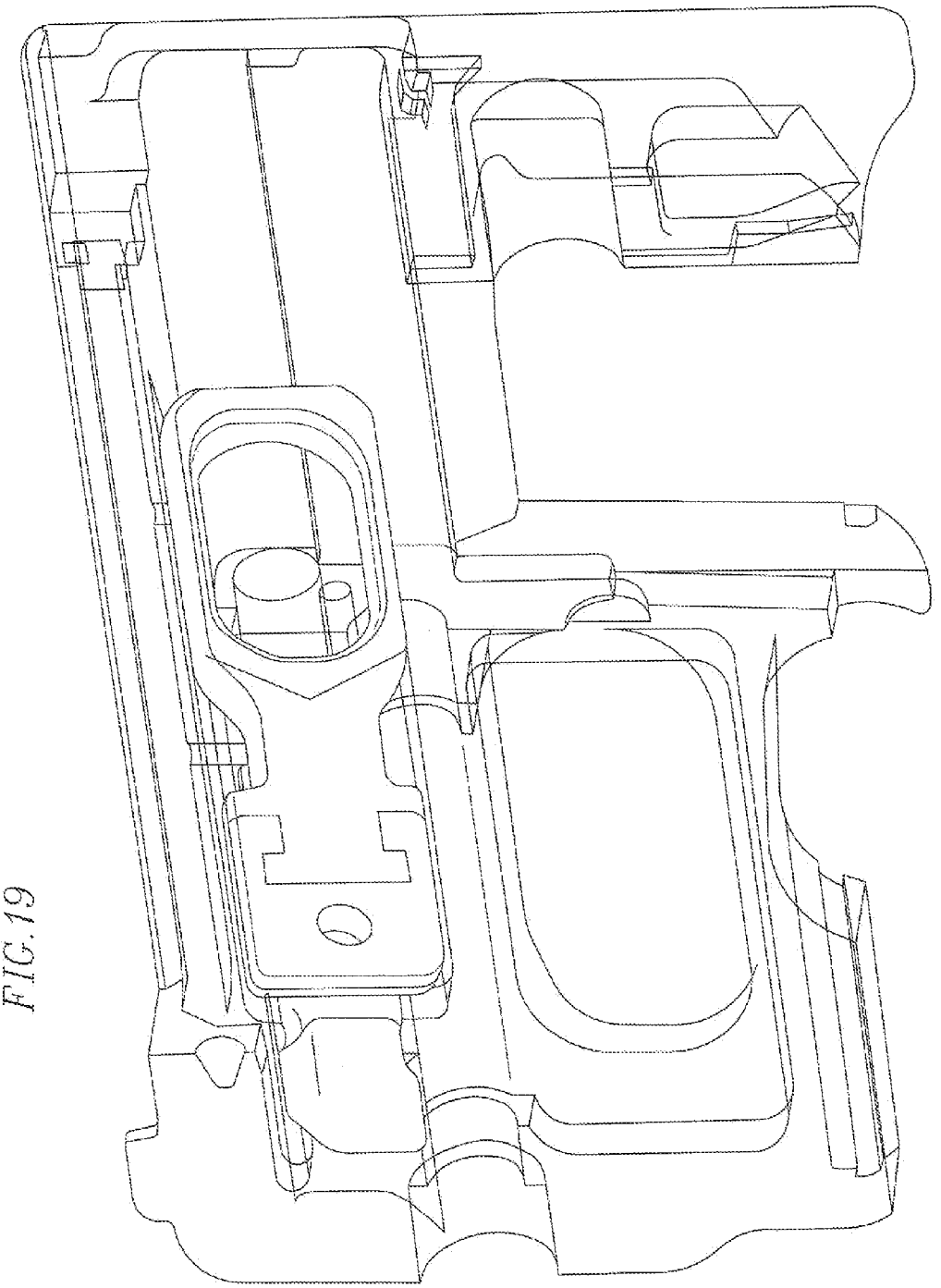


FIG. 19

FIG. 20

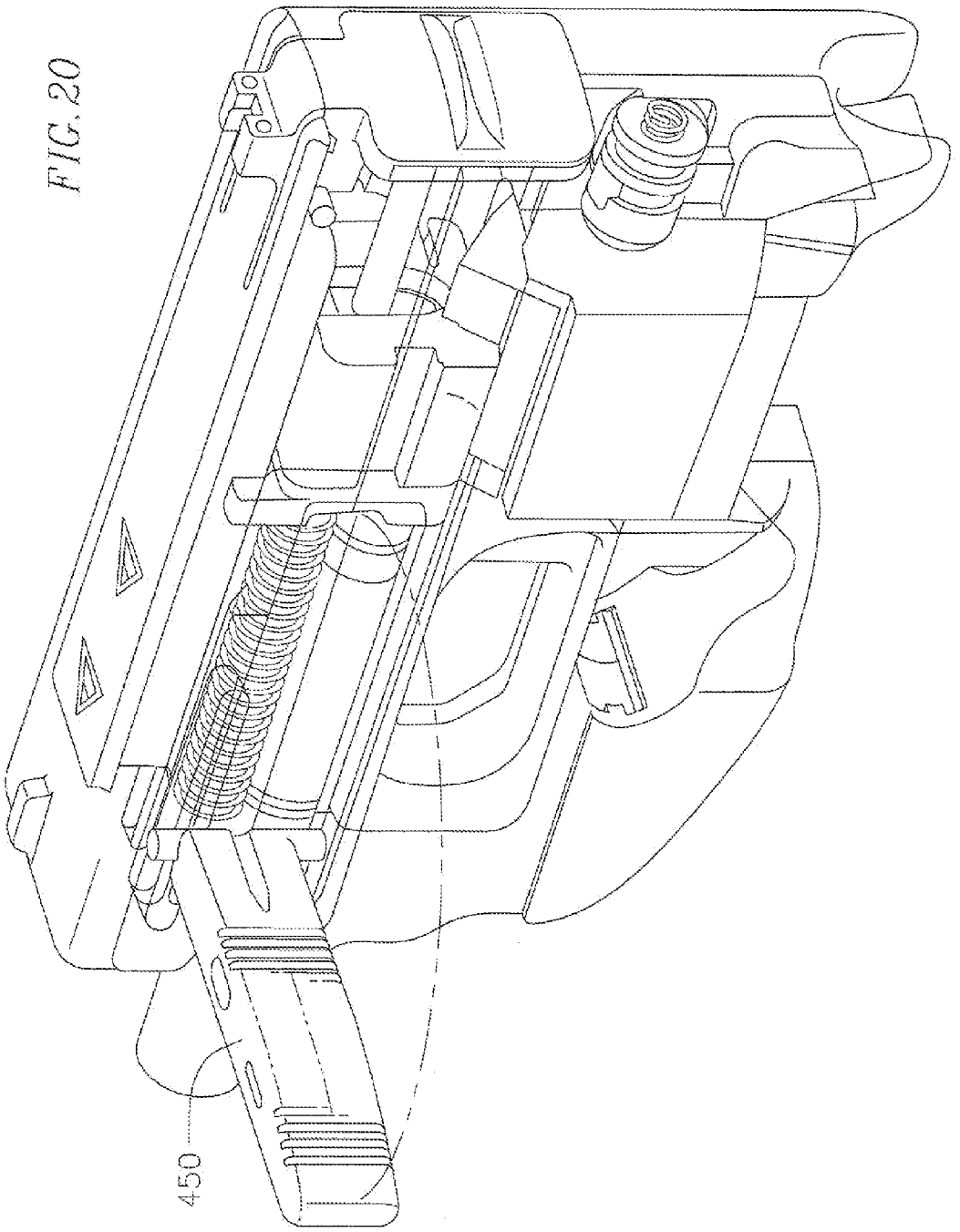


FIG. 21

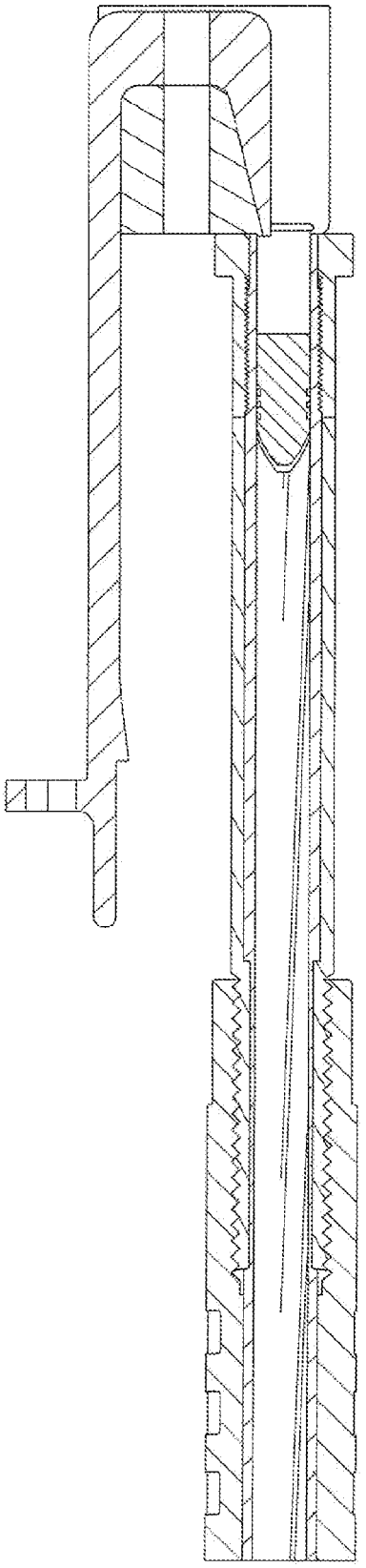


FIG. 22

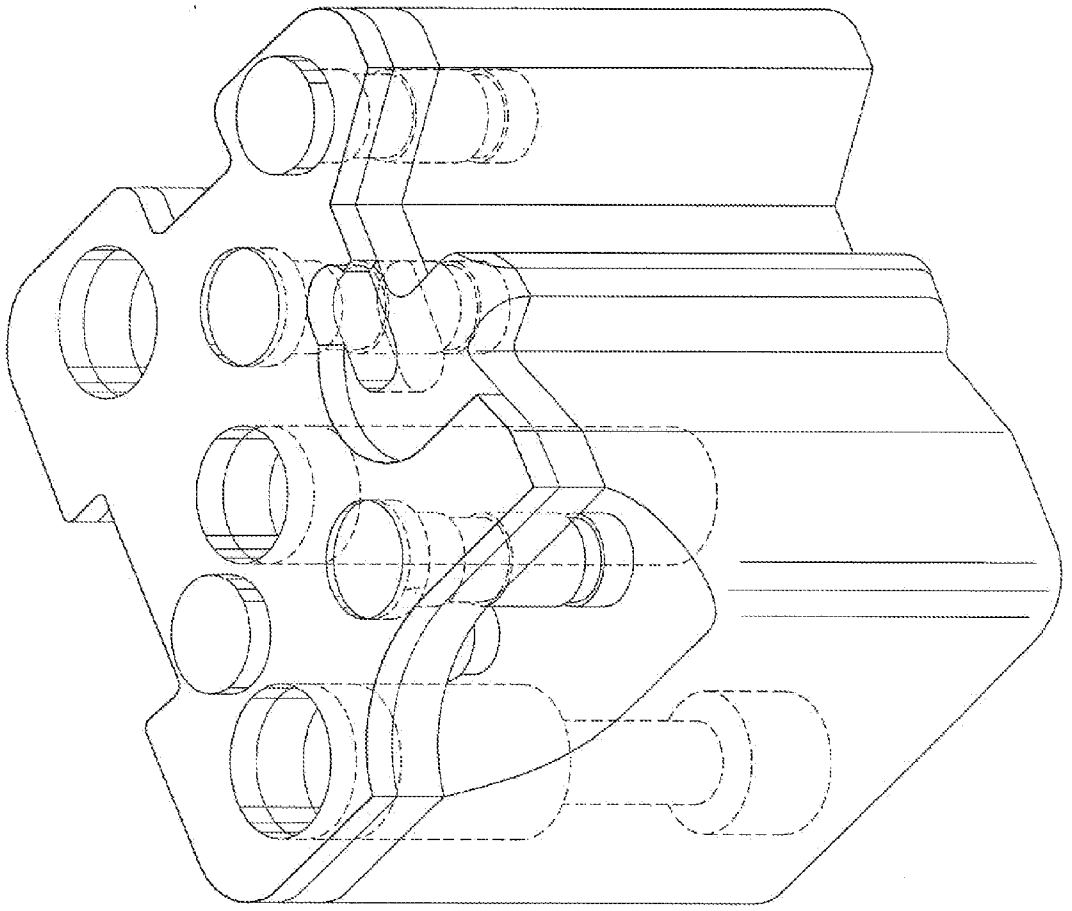
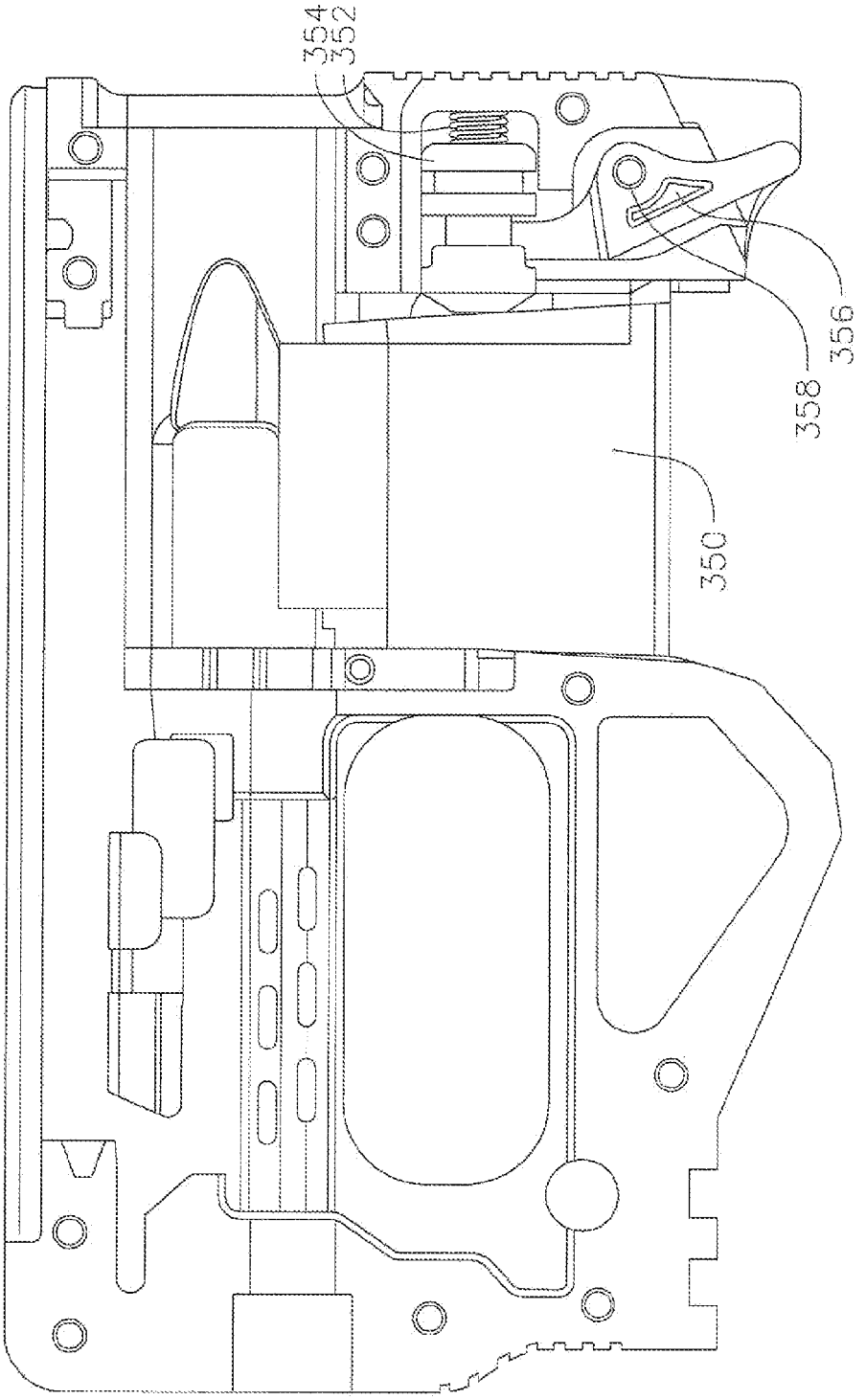


FIG. 23A



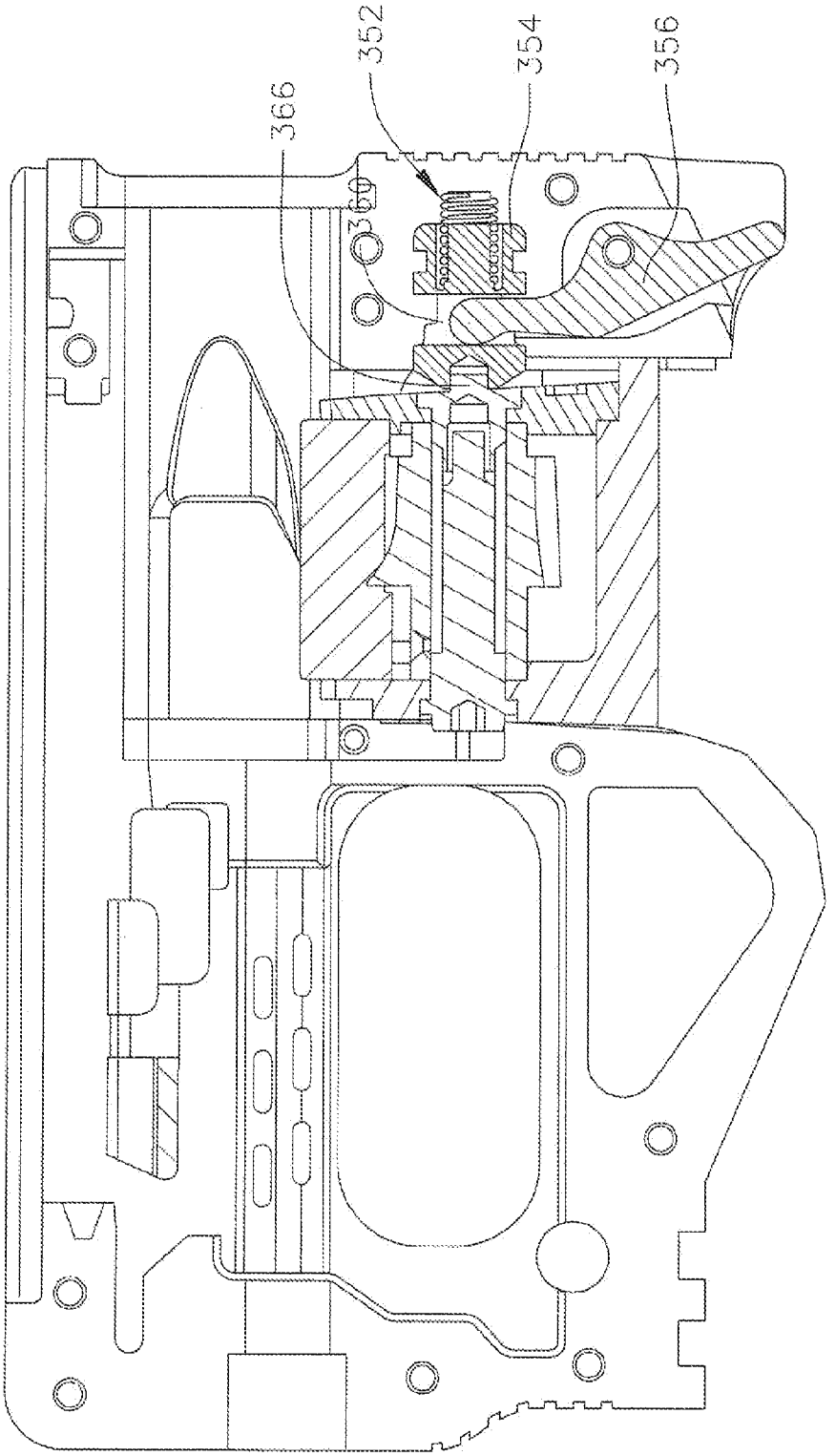


FIG. 23B

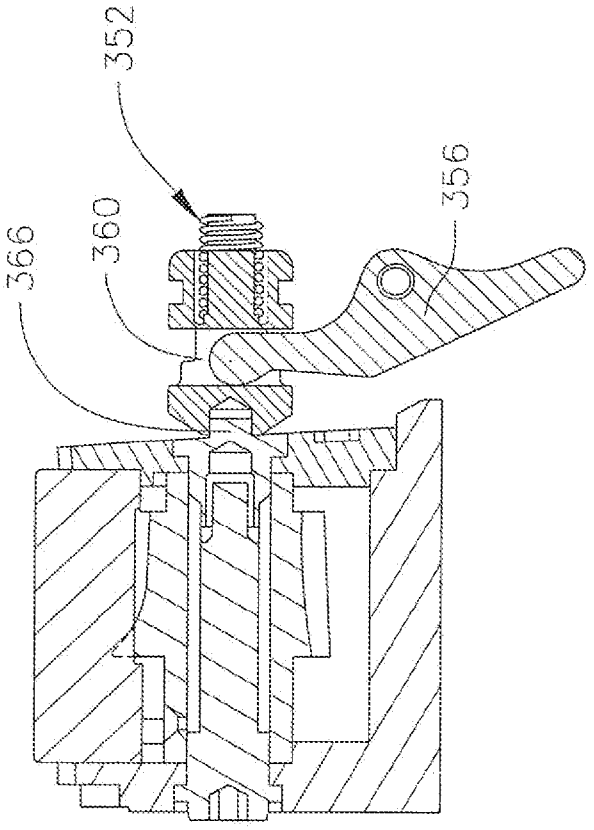


FIG. 23C

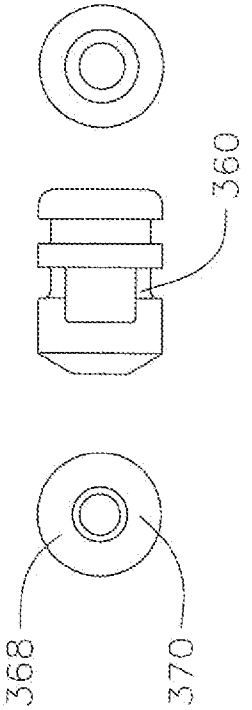


FIG. 23D

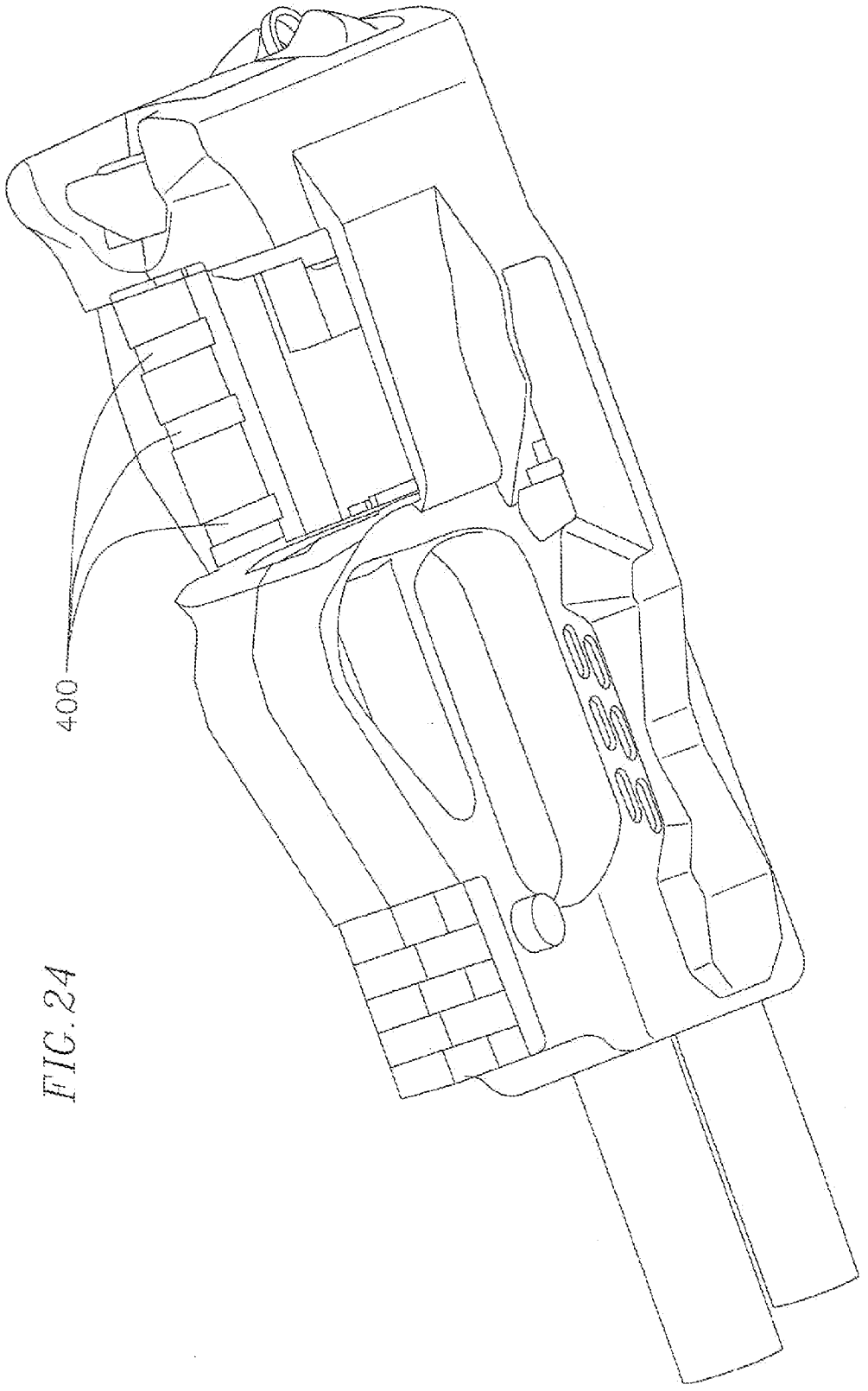


FIG. 24

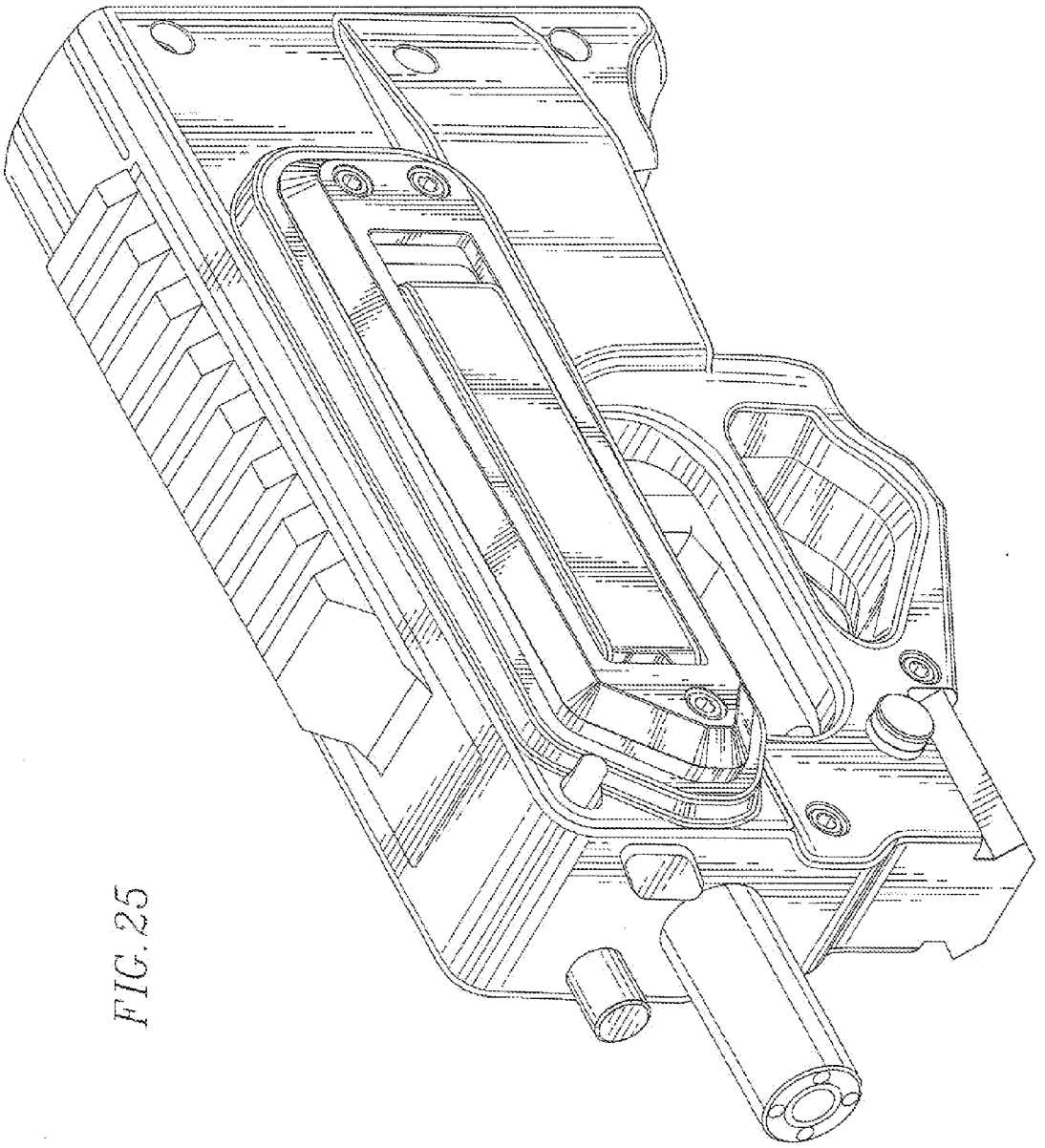


FIG. 25

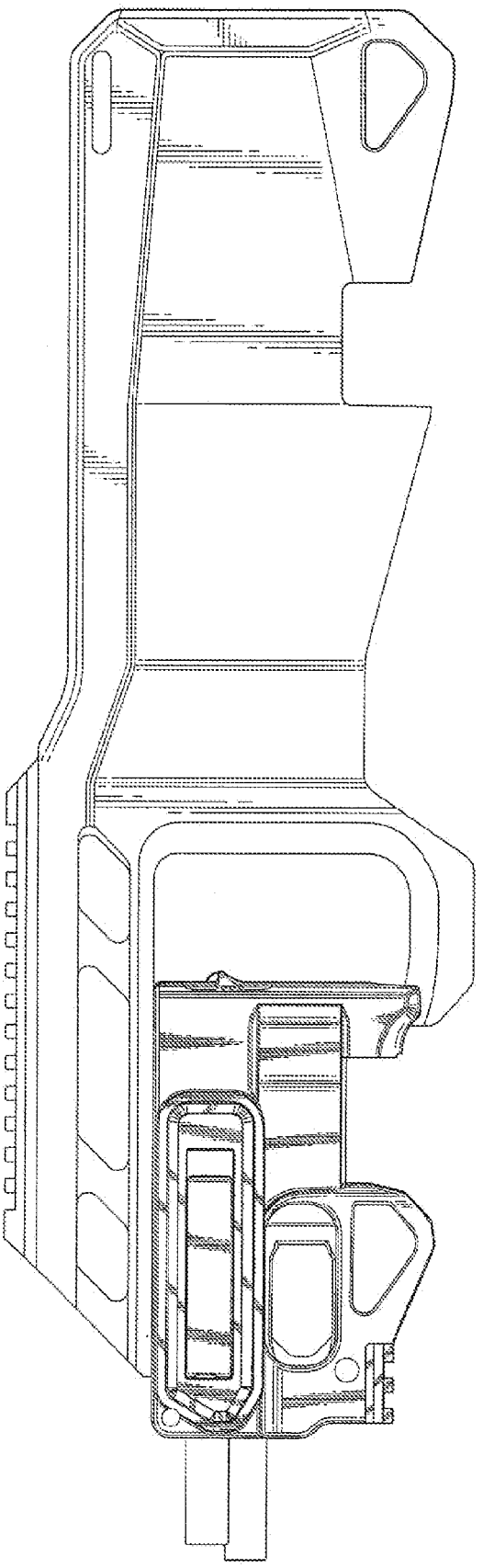
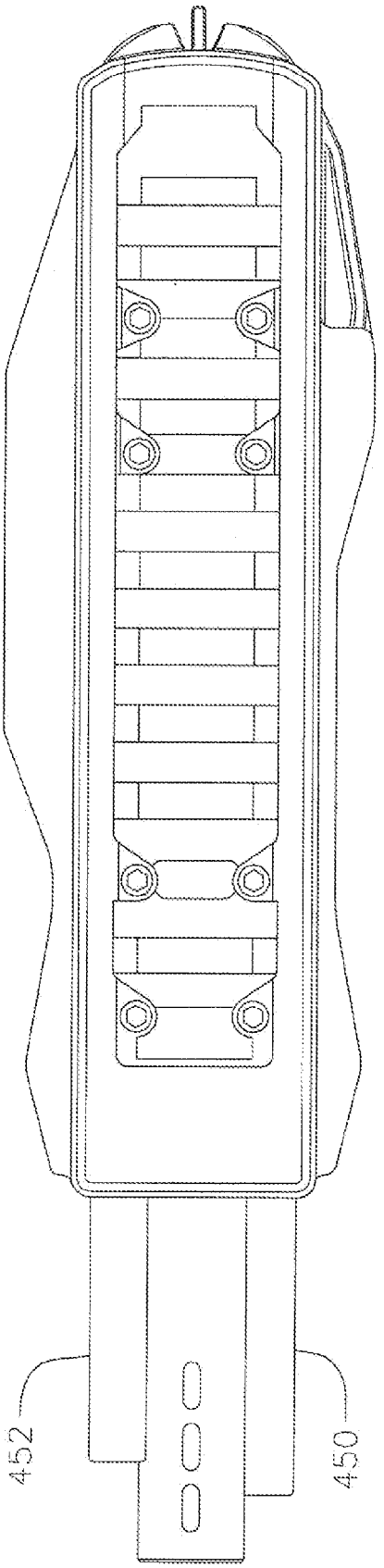
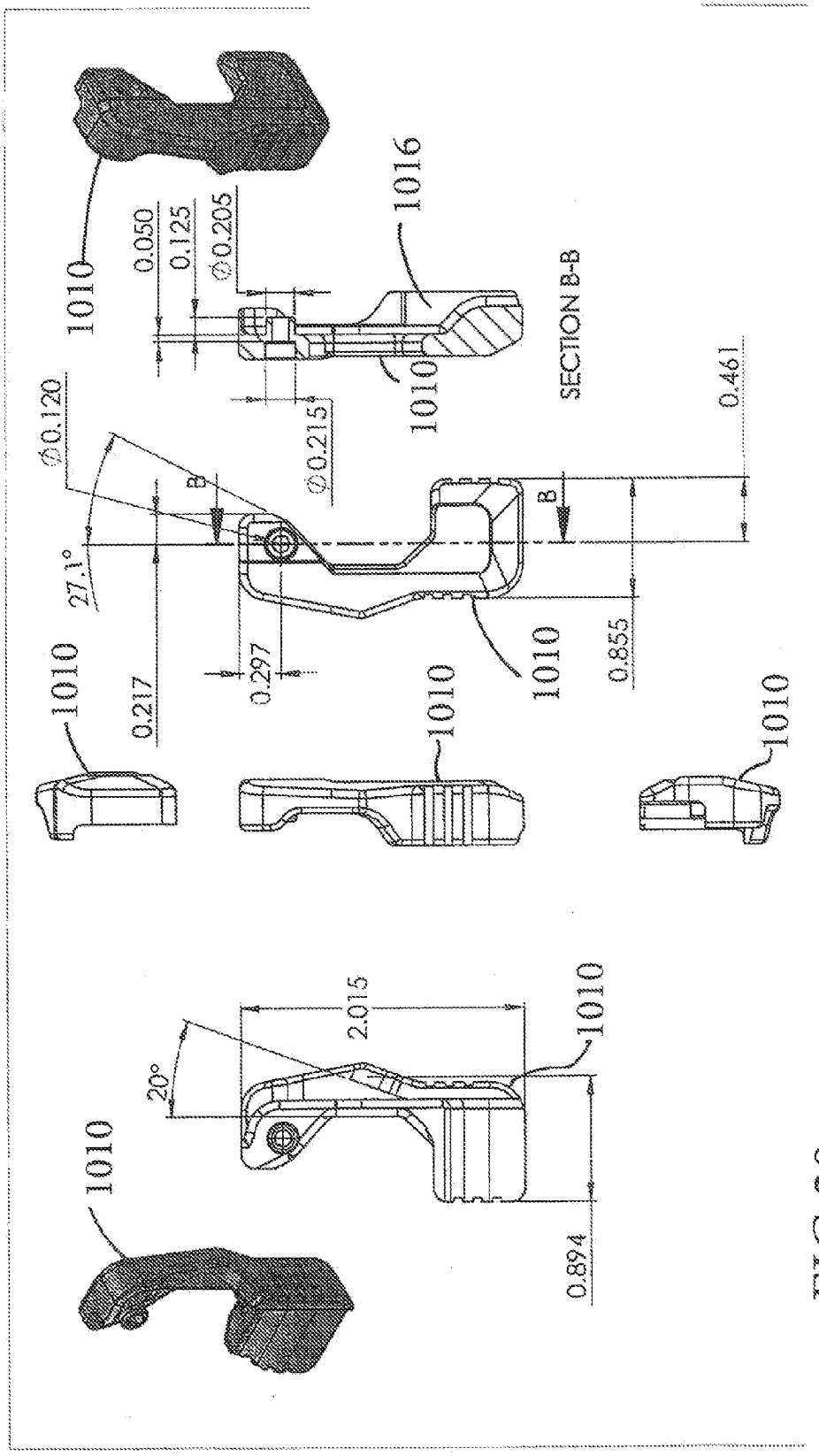


FIG. 26

FIG. 27

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20°
0.894

FIG 28

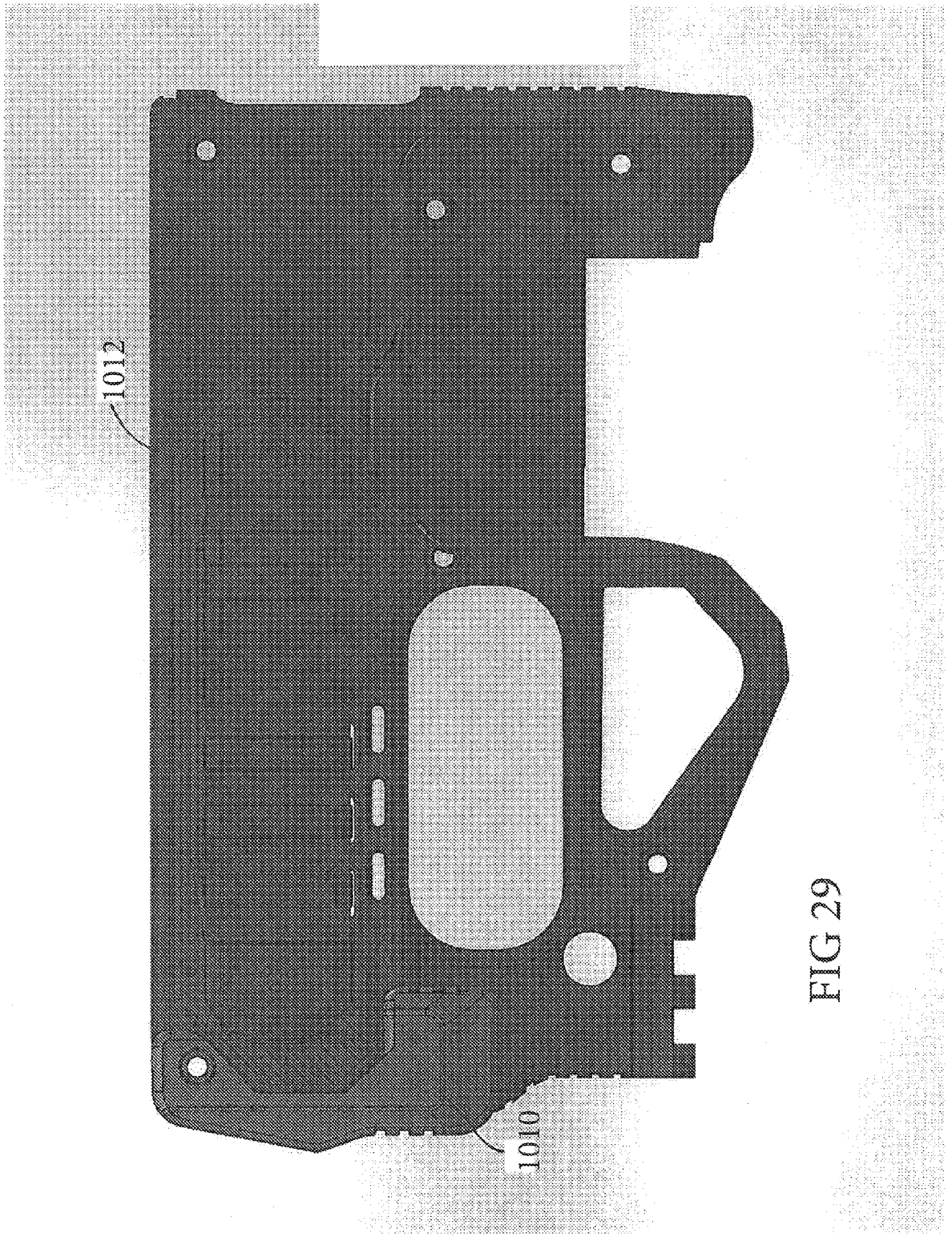


FIG 29

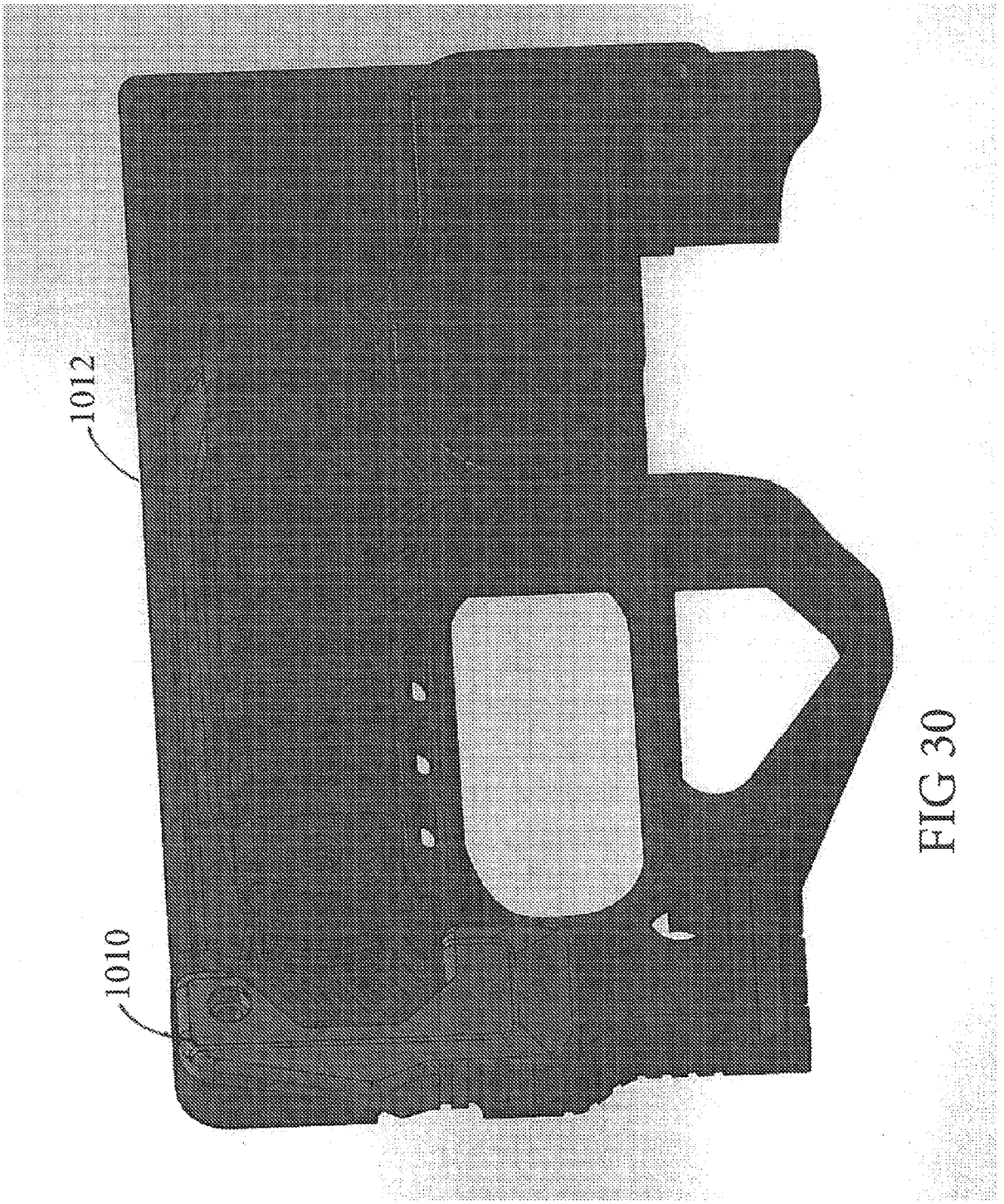


FIG 30

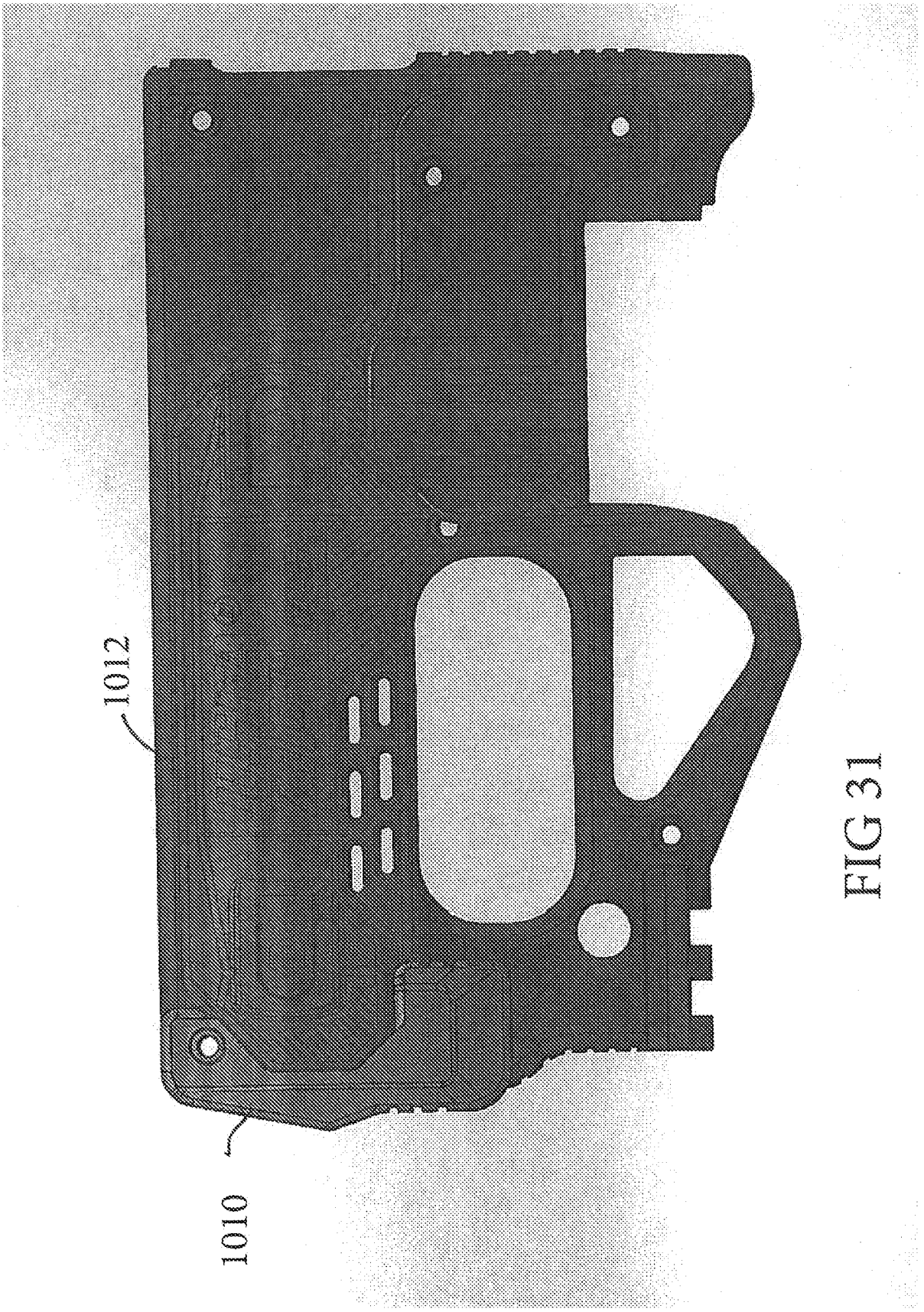


FIG 31

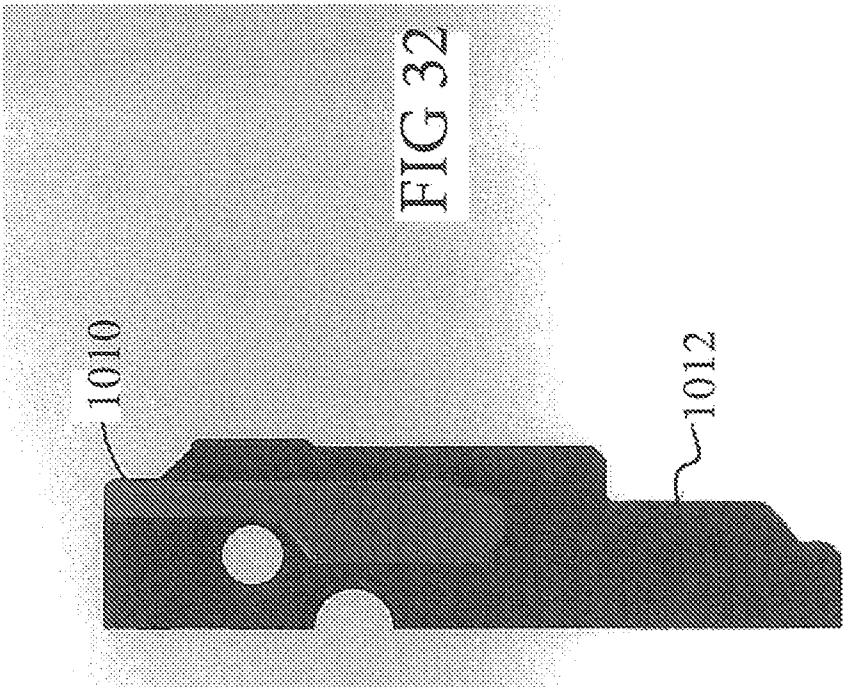


FIG 32

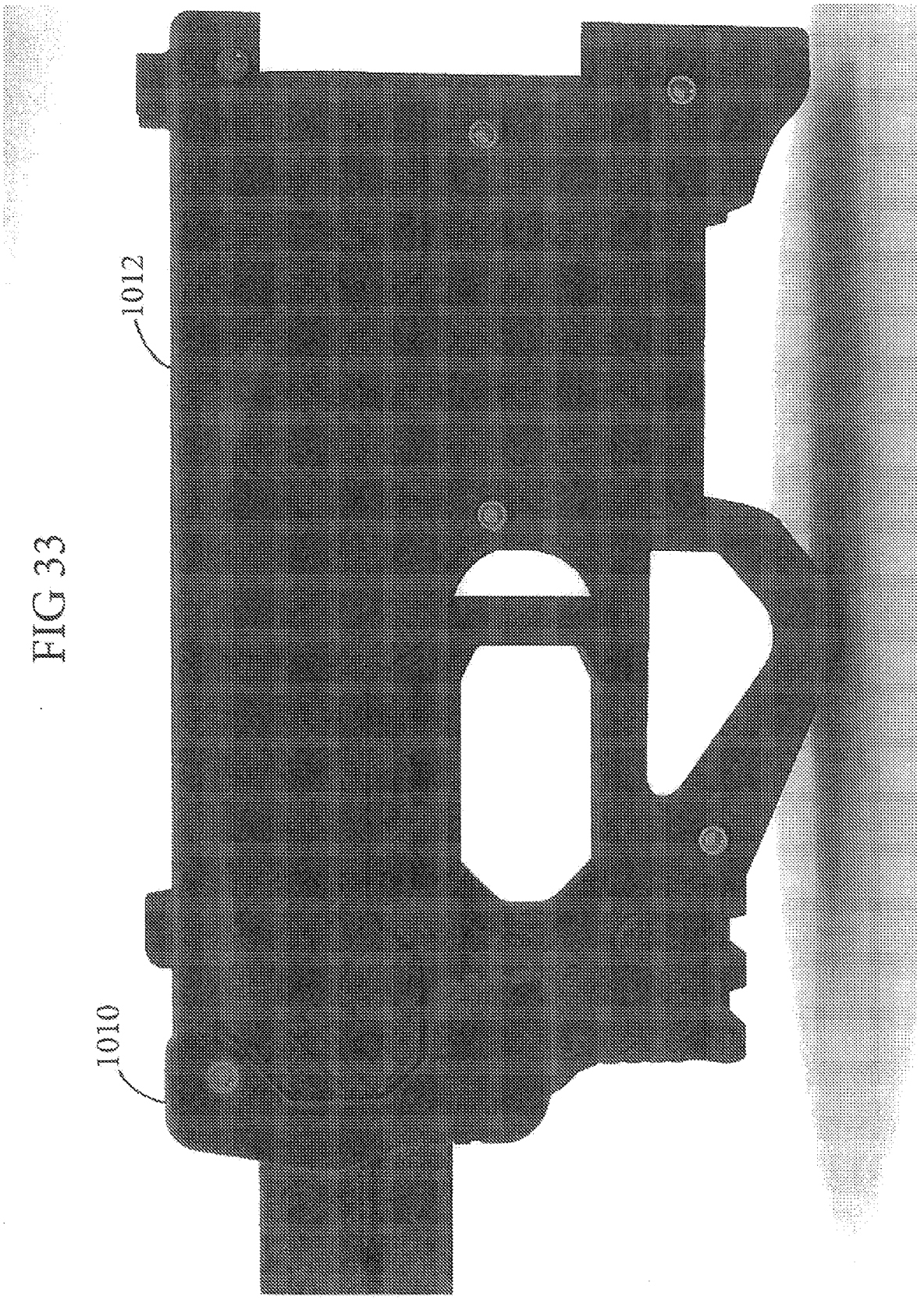


FIG 33

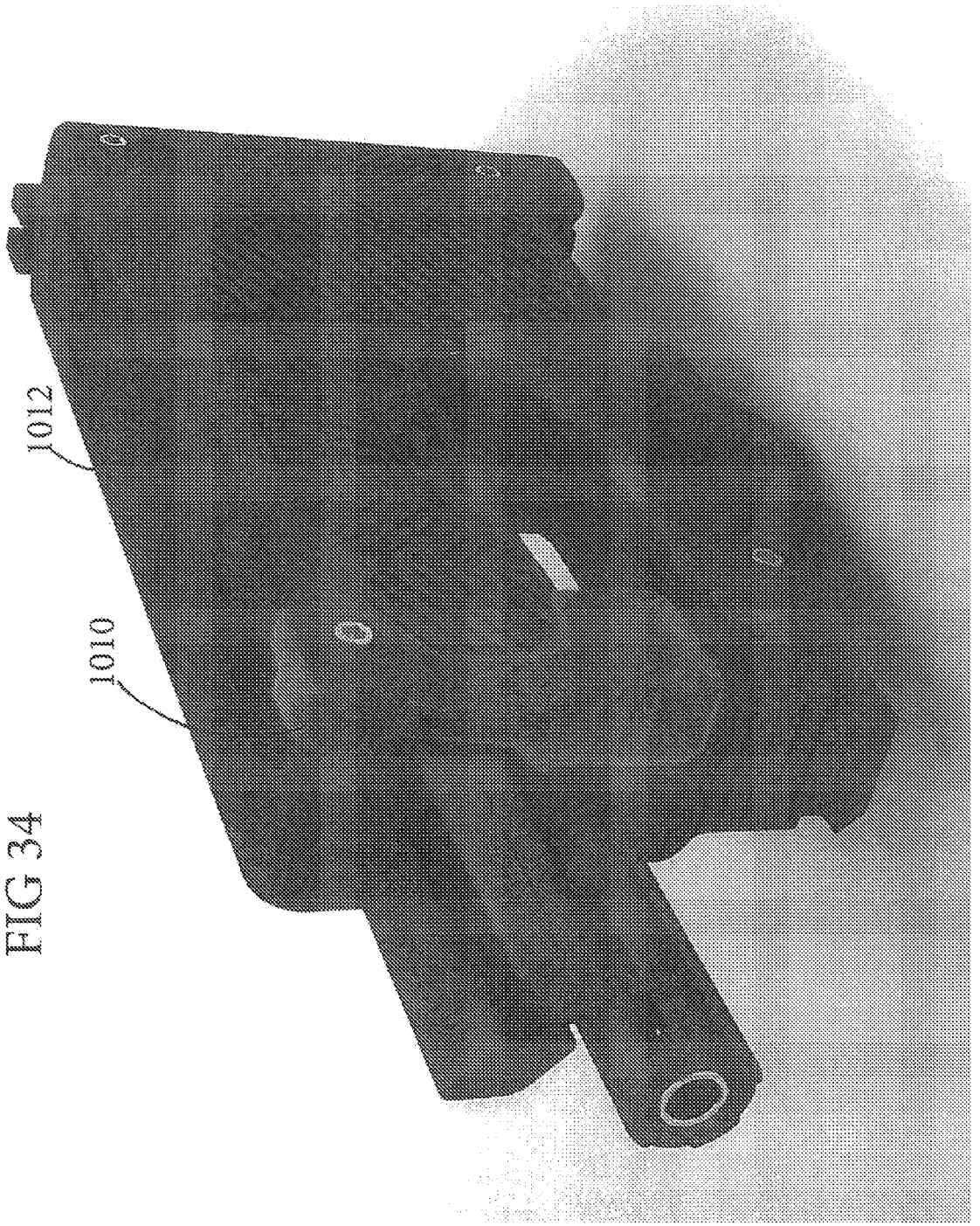


FIG 34

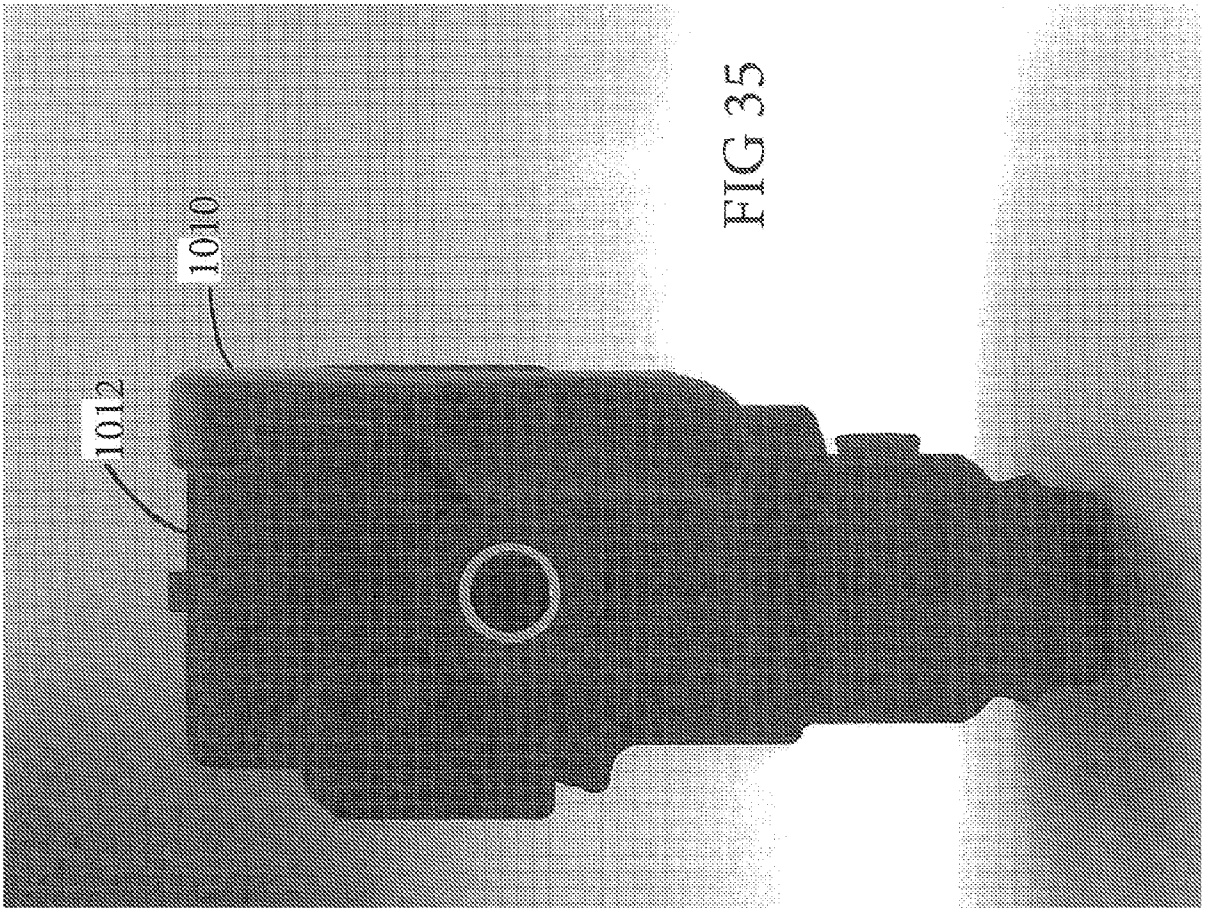


FIG 35

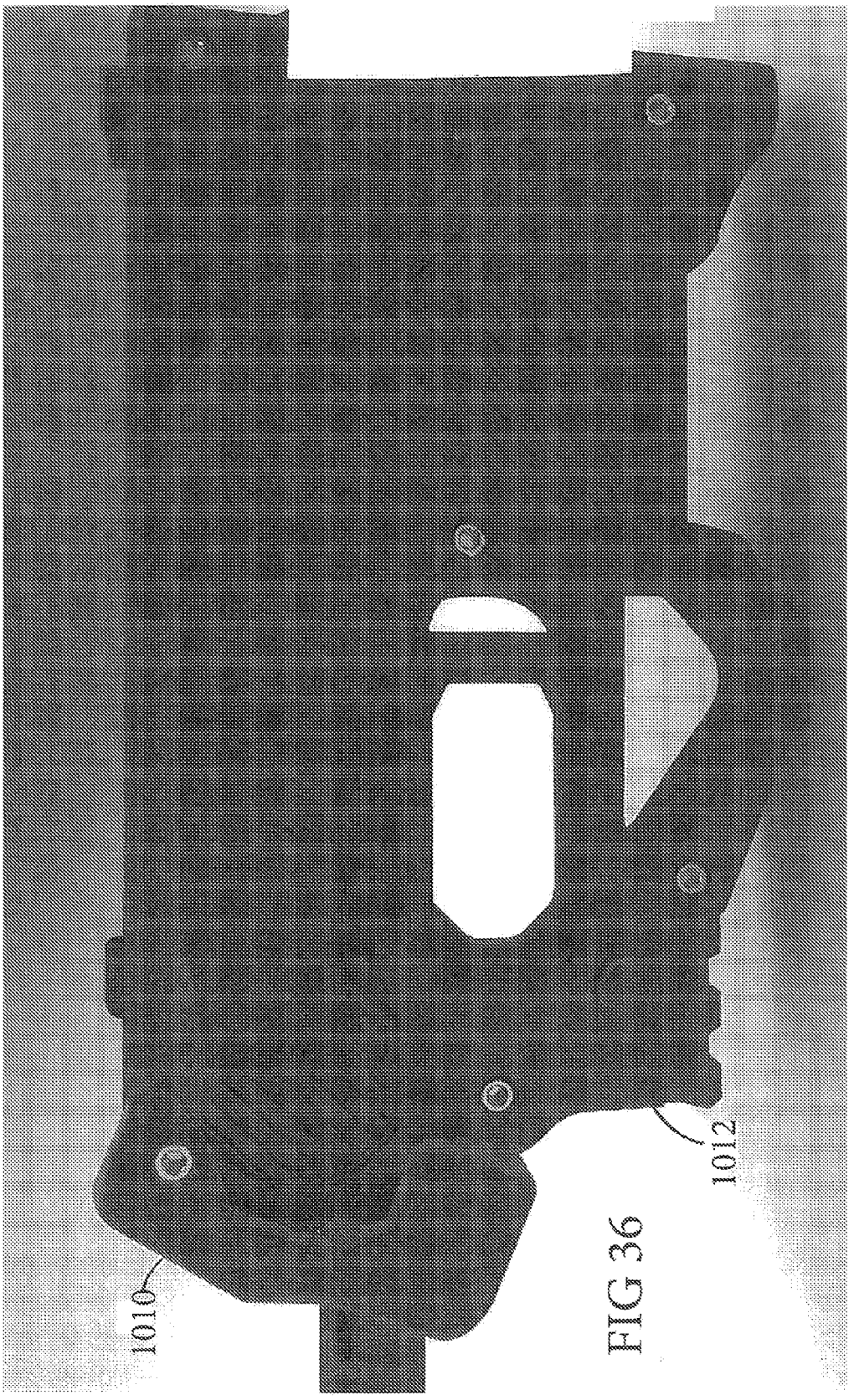


FIG 36

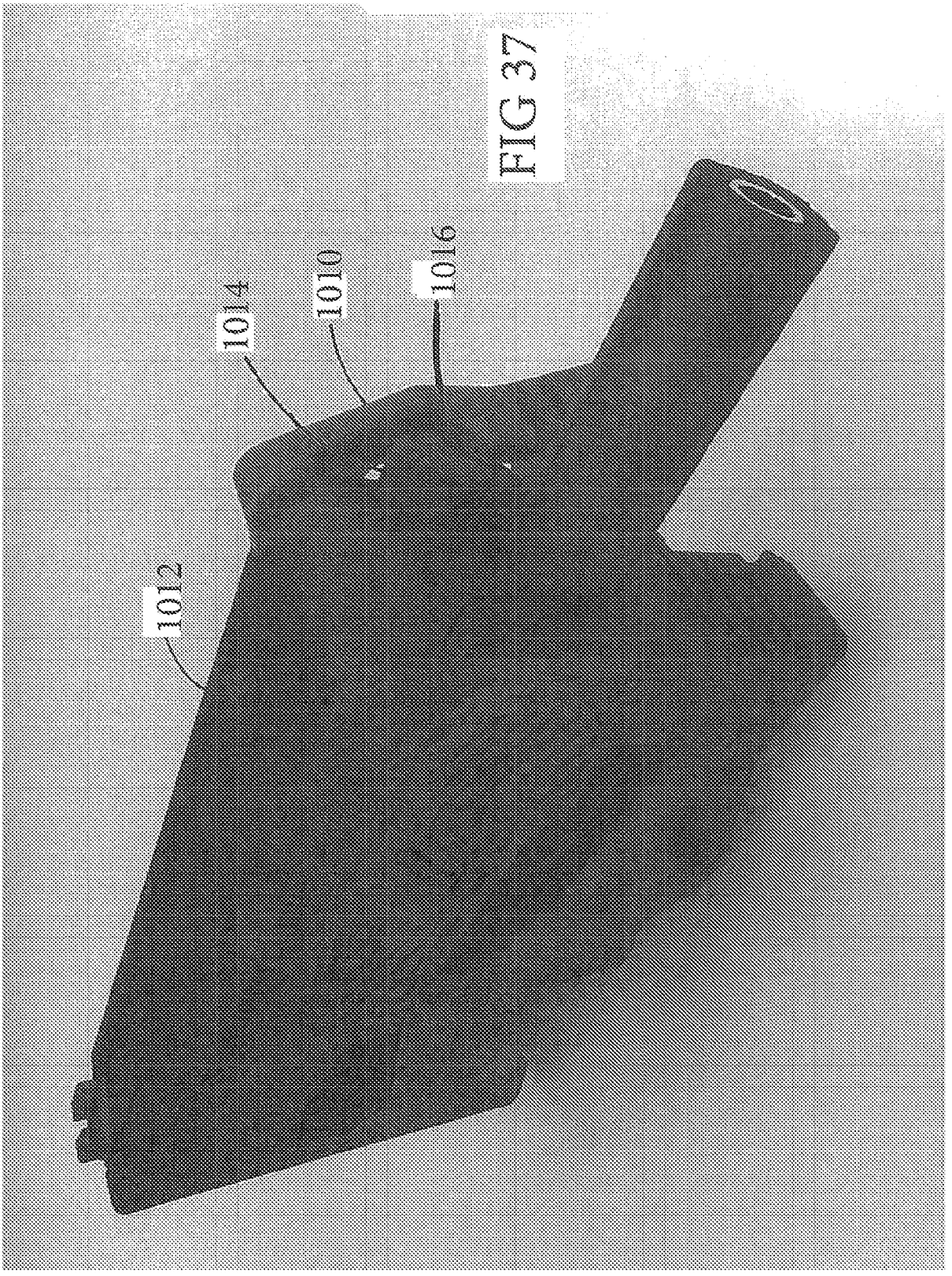


FIG 37

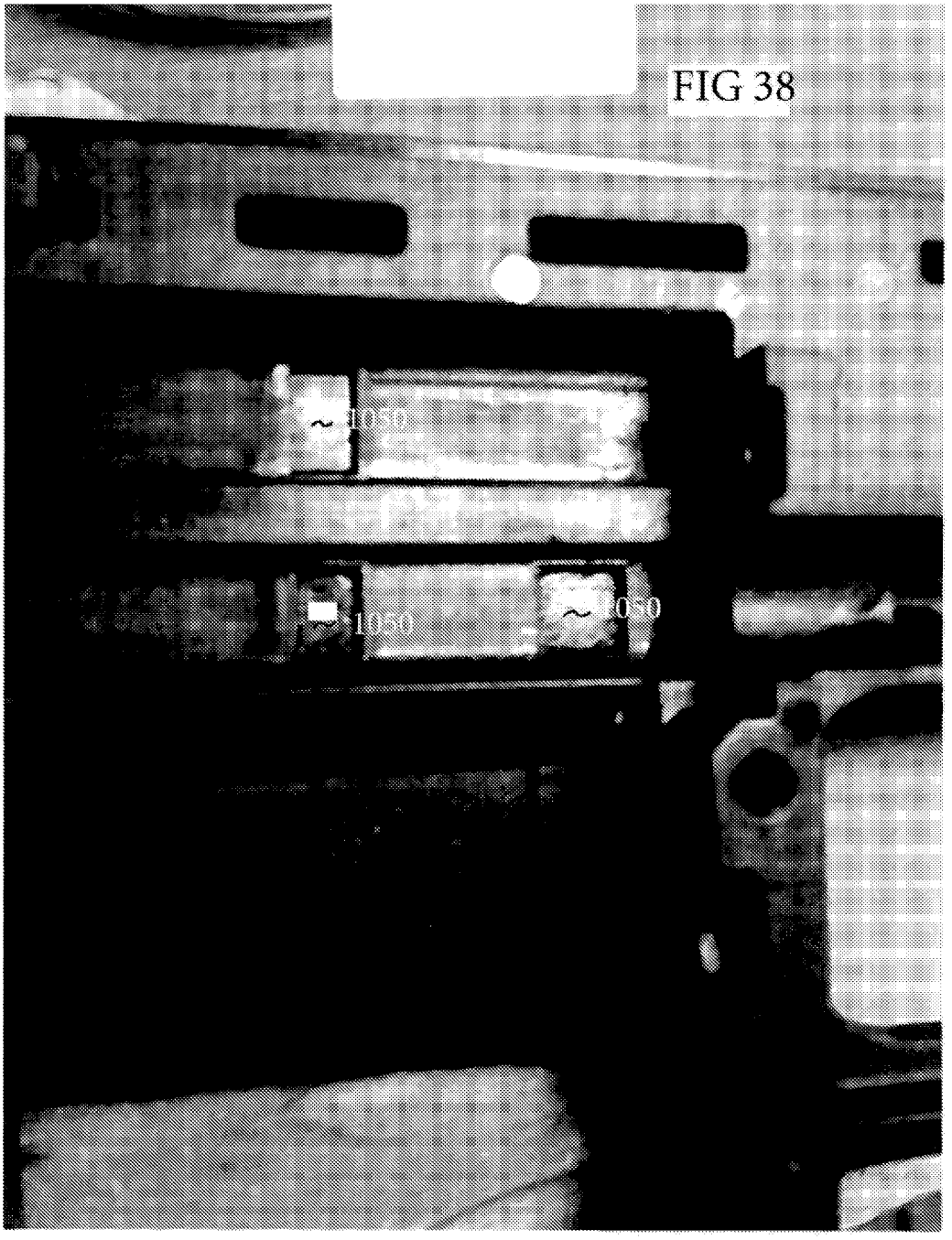
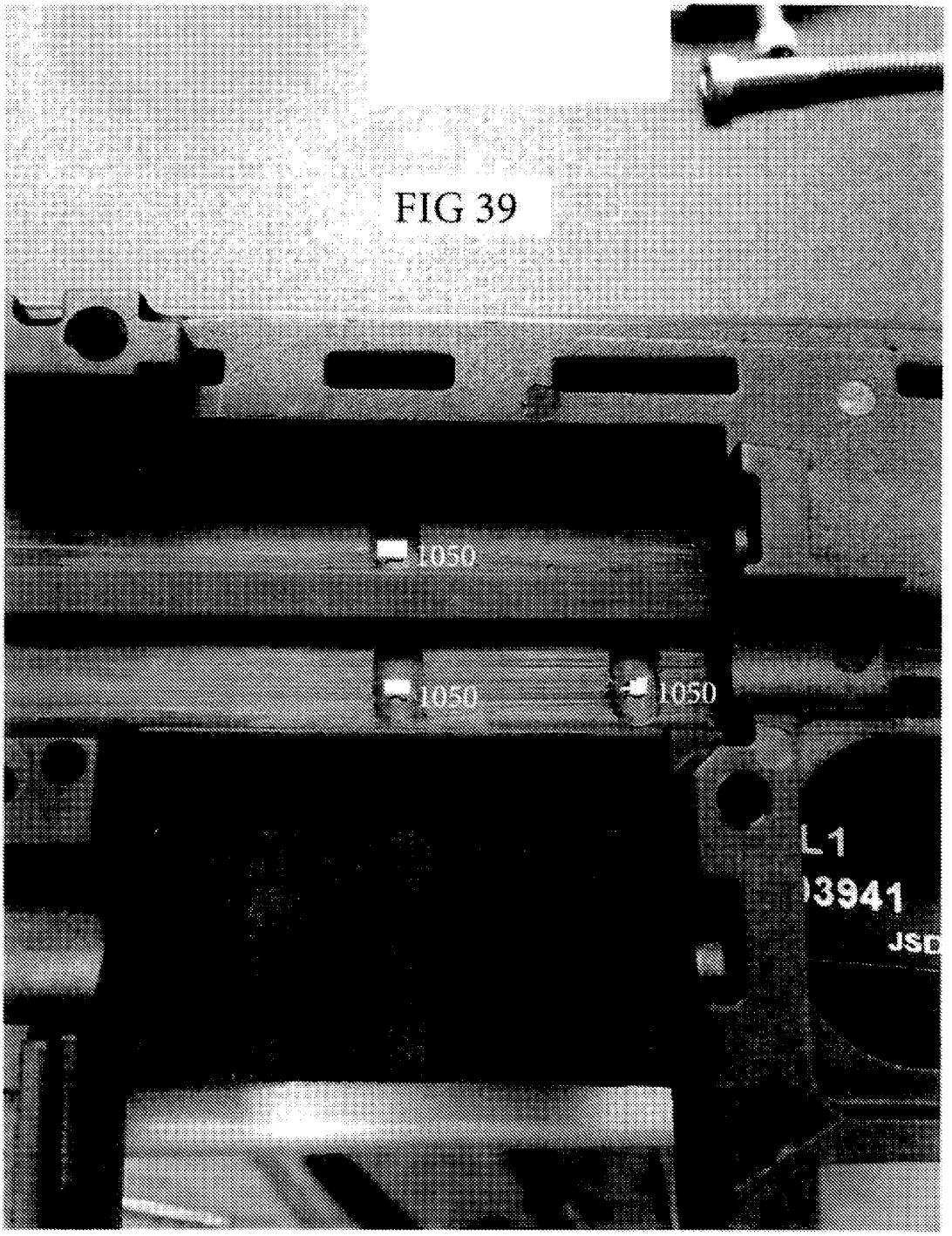


FIG 38

FIG 39



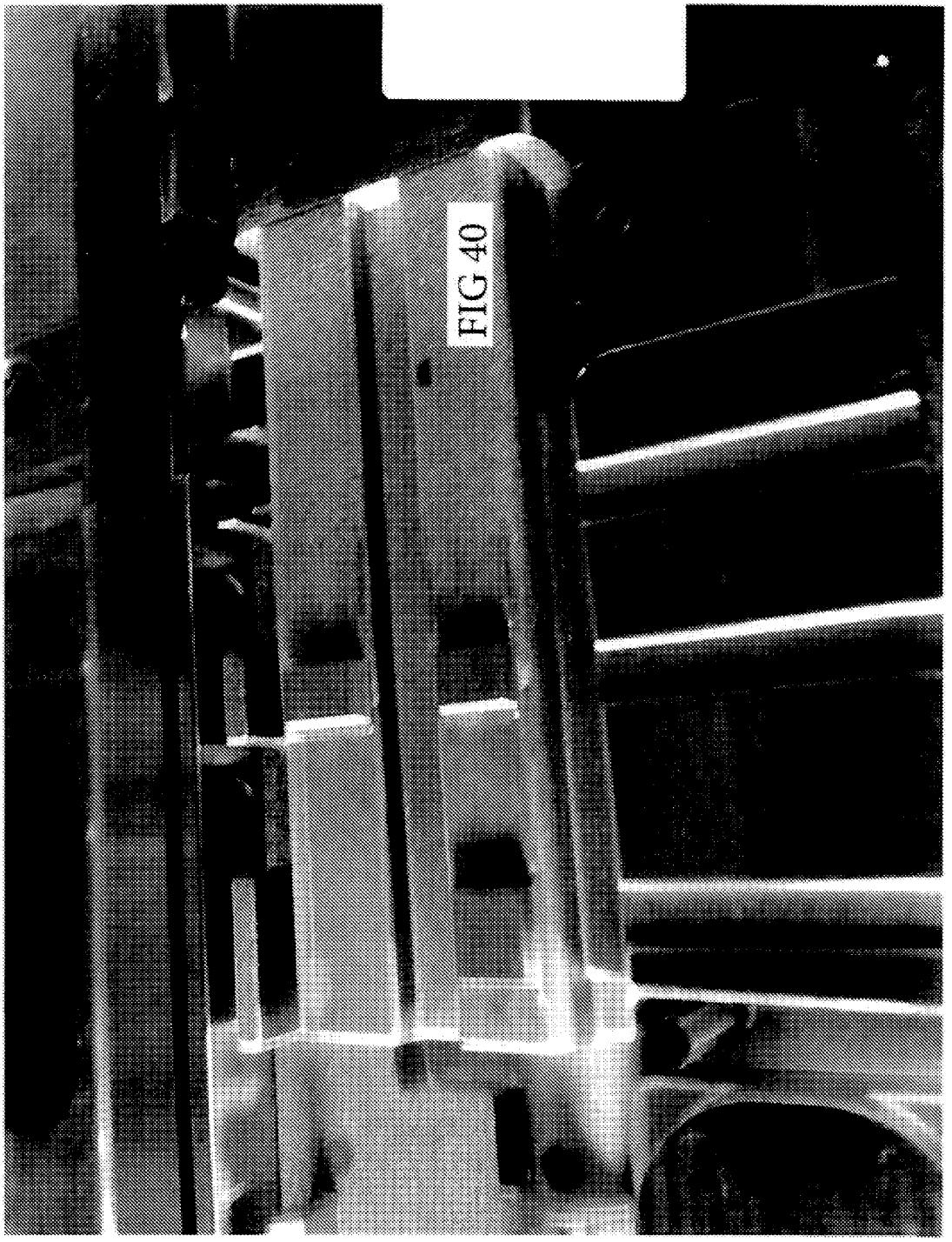


FIG 40

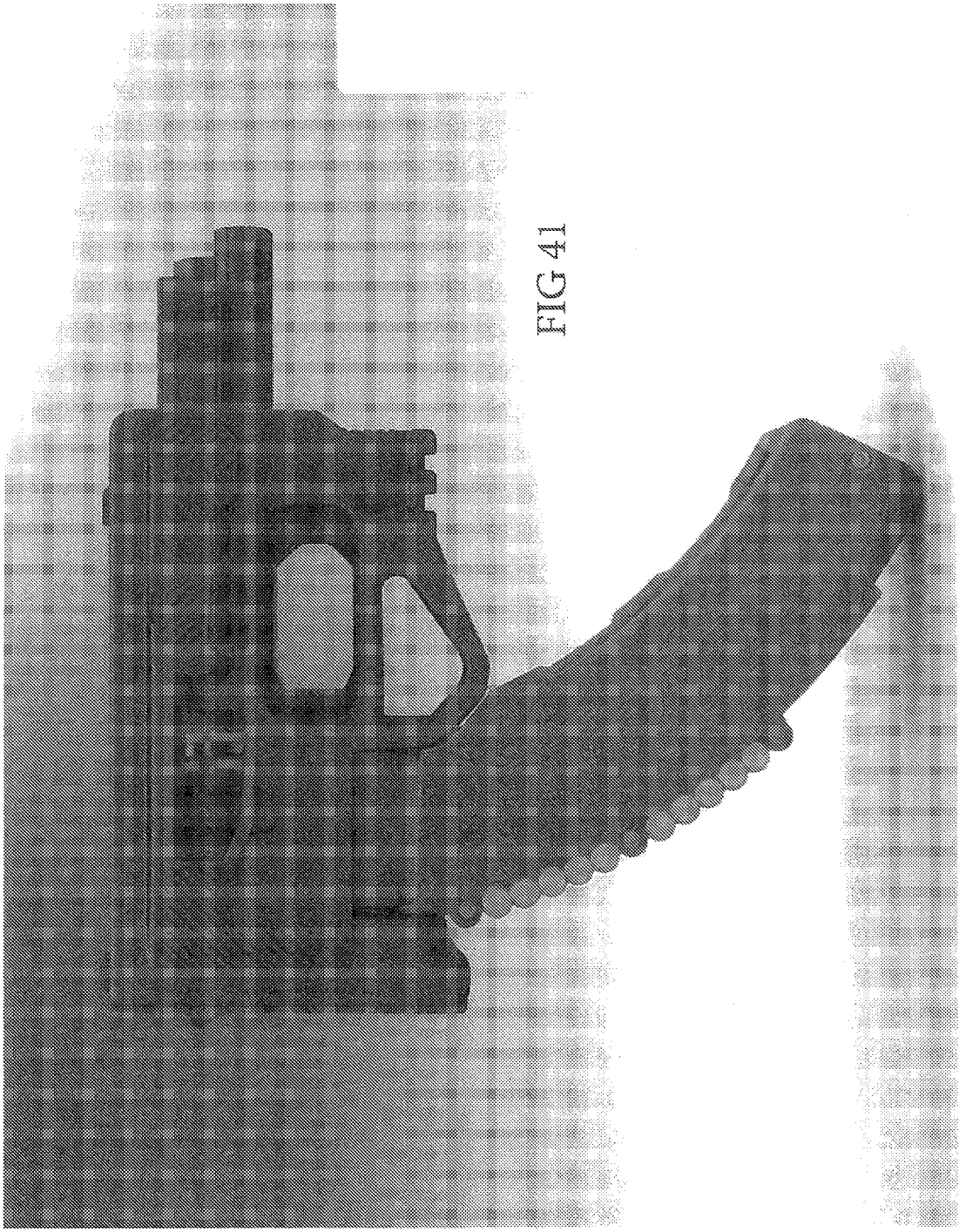


FIG 41

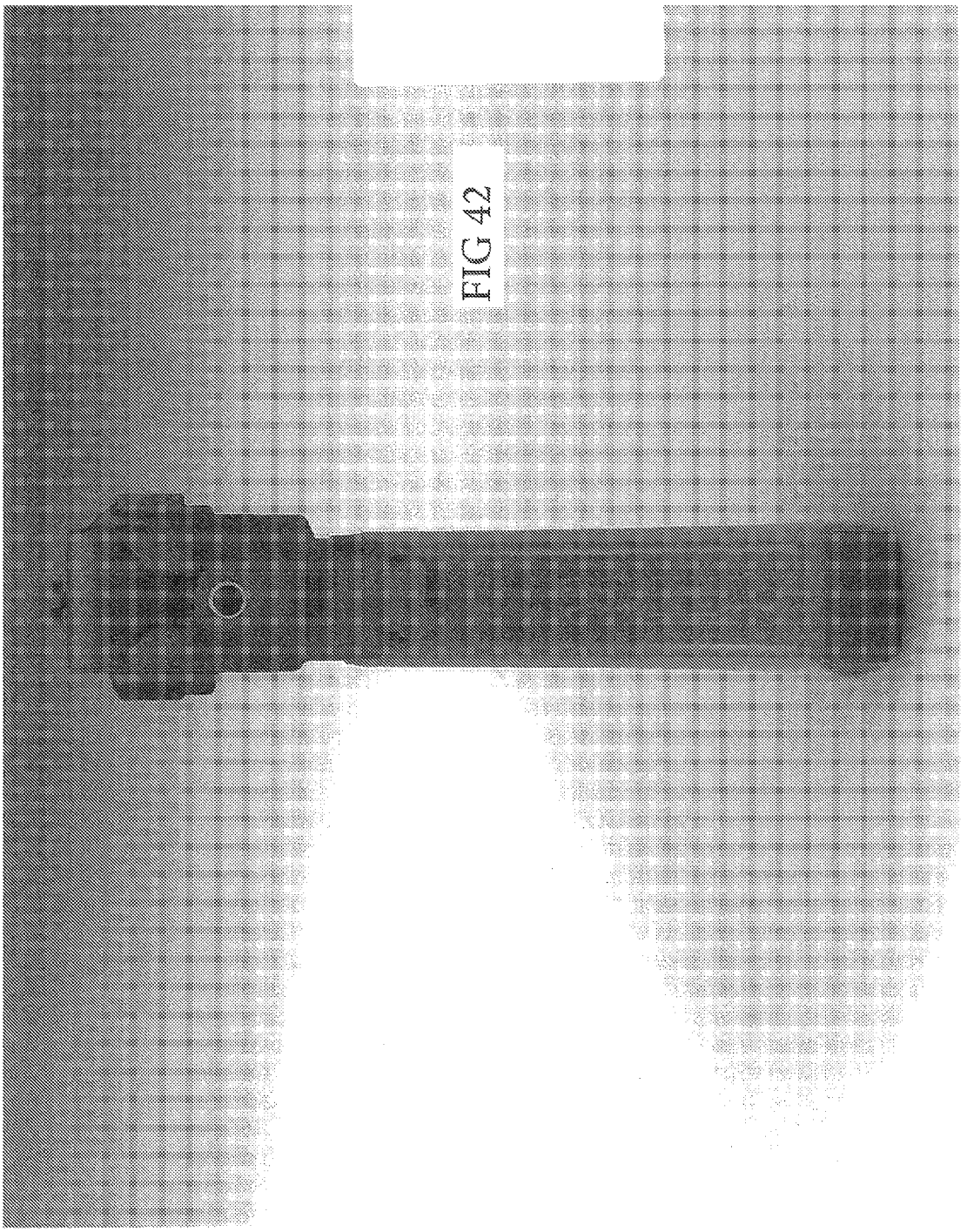


FIG 42

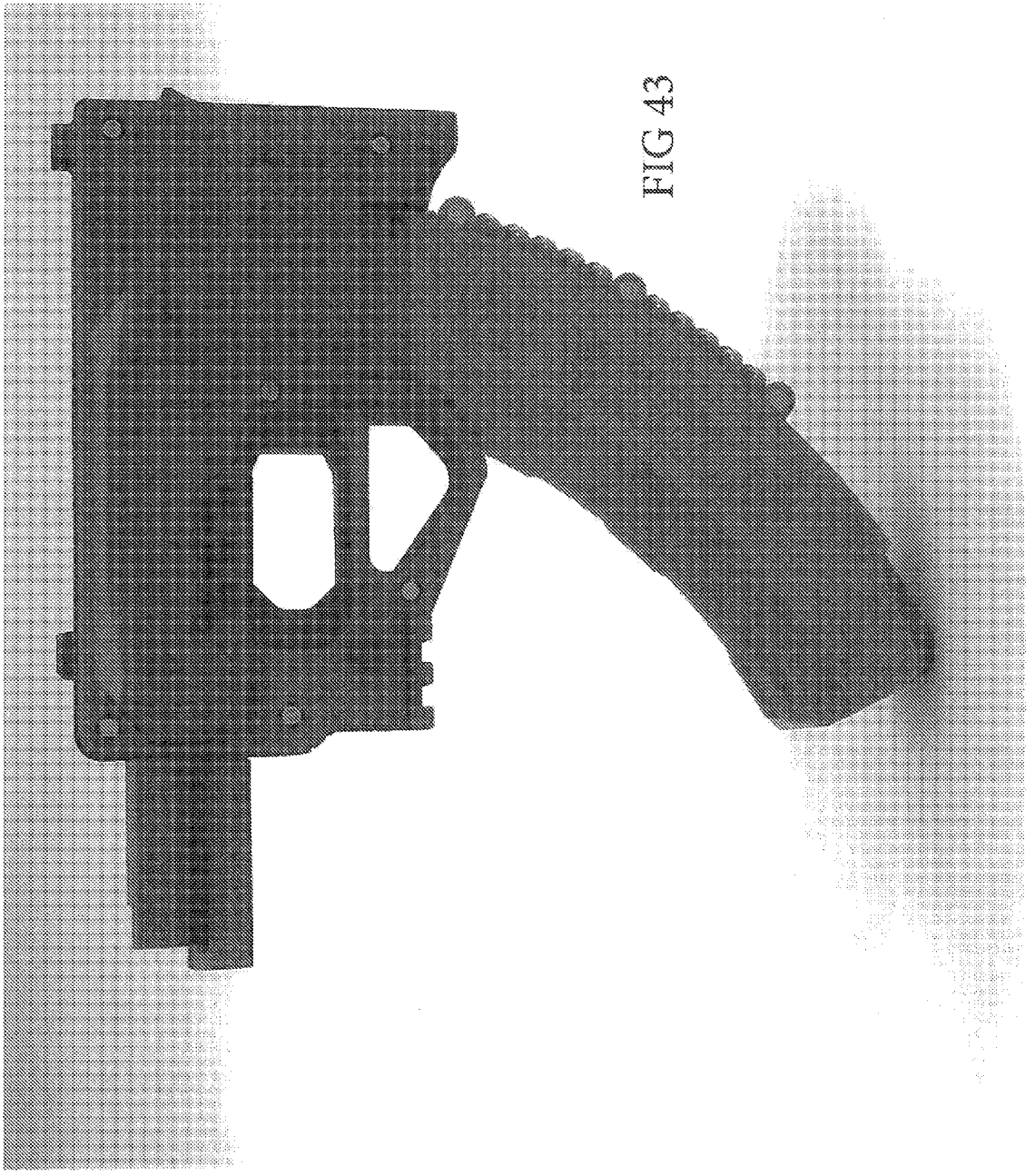


FIG 43

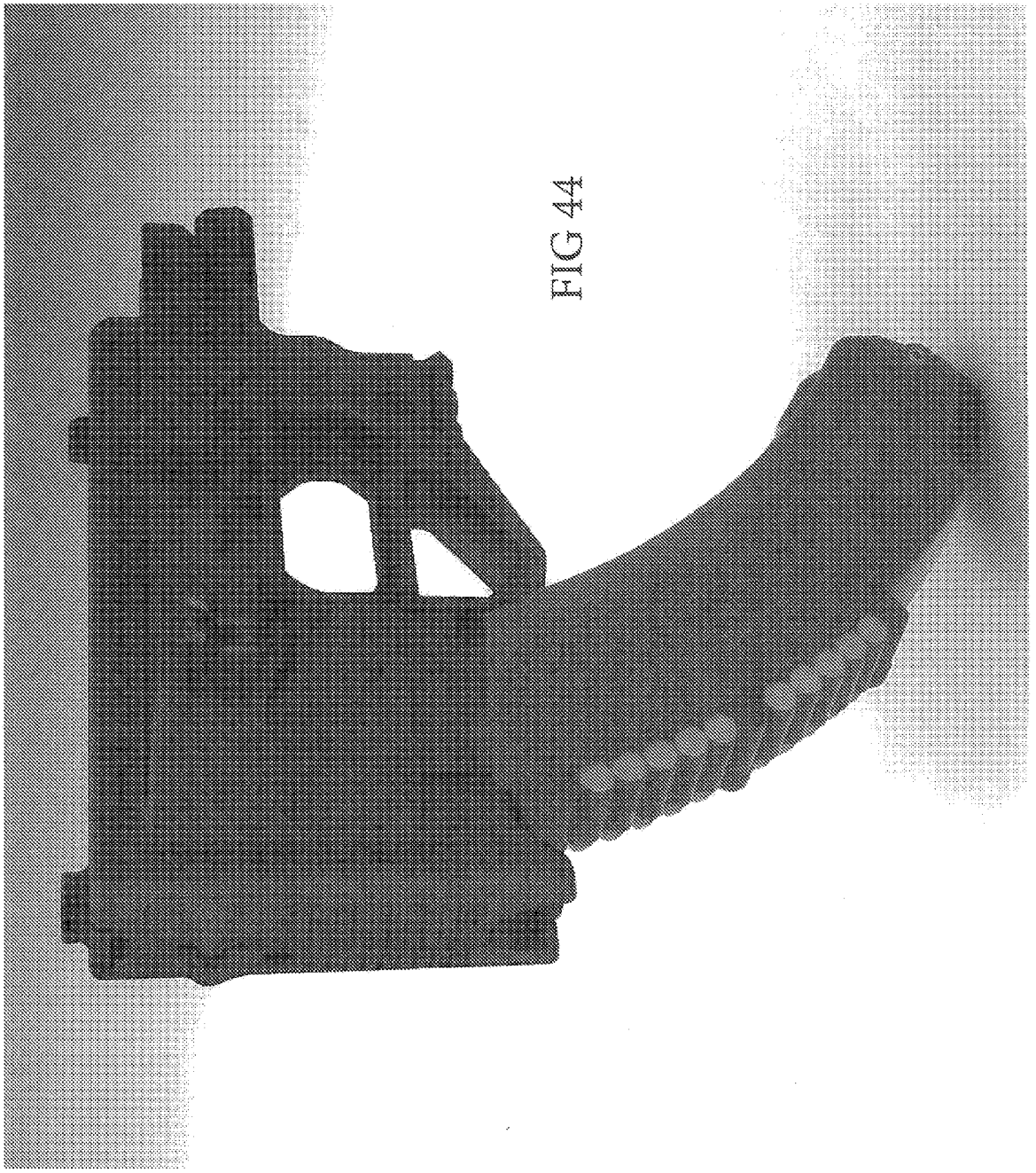


FIG 44

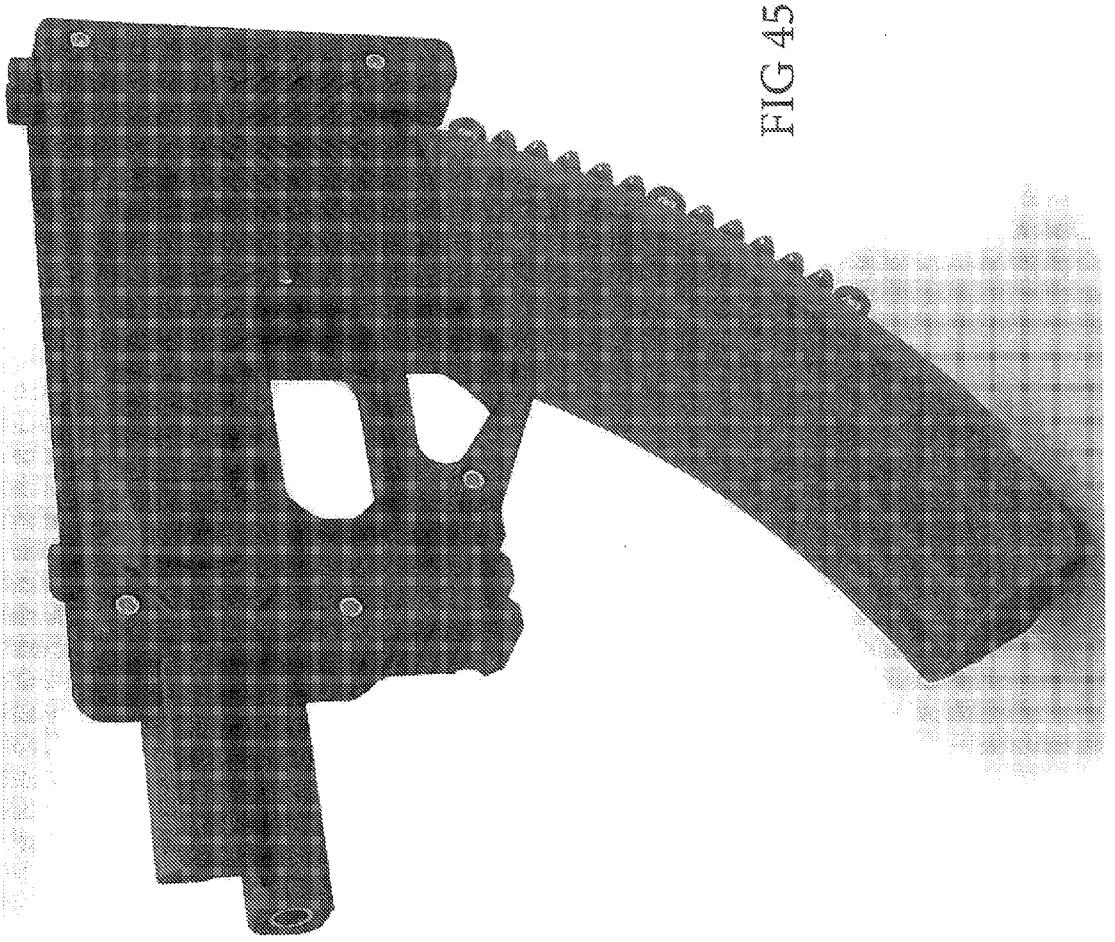
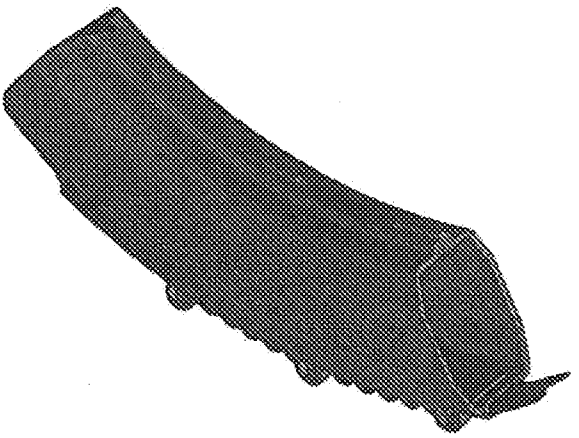


FIG 45

FIG 46



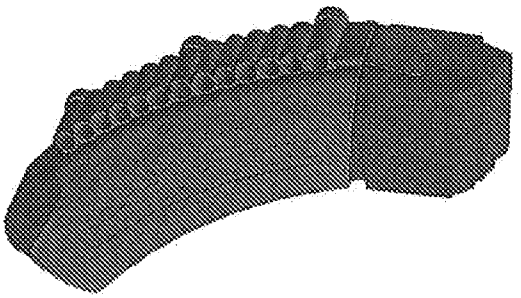


FIG 47

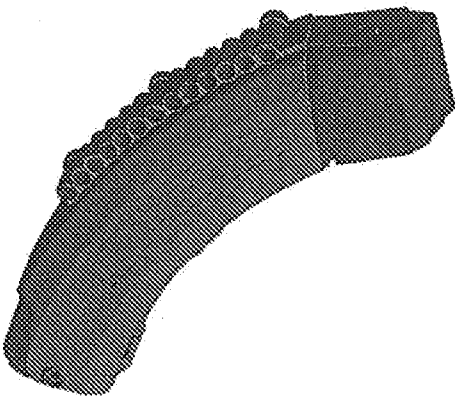


FIG 48

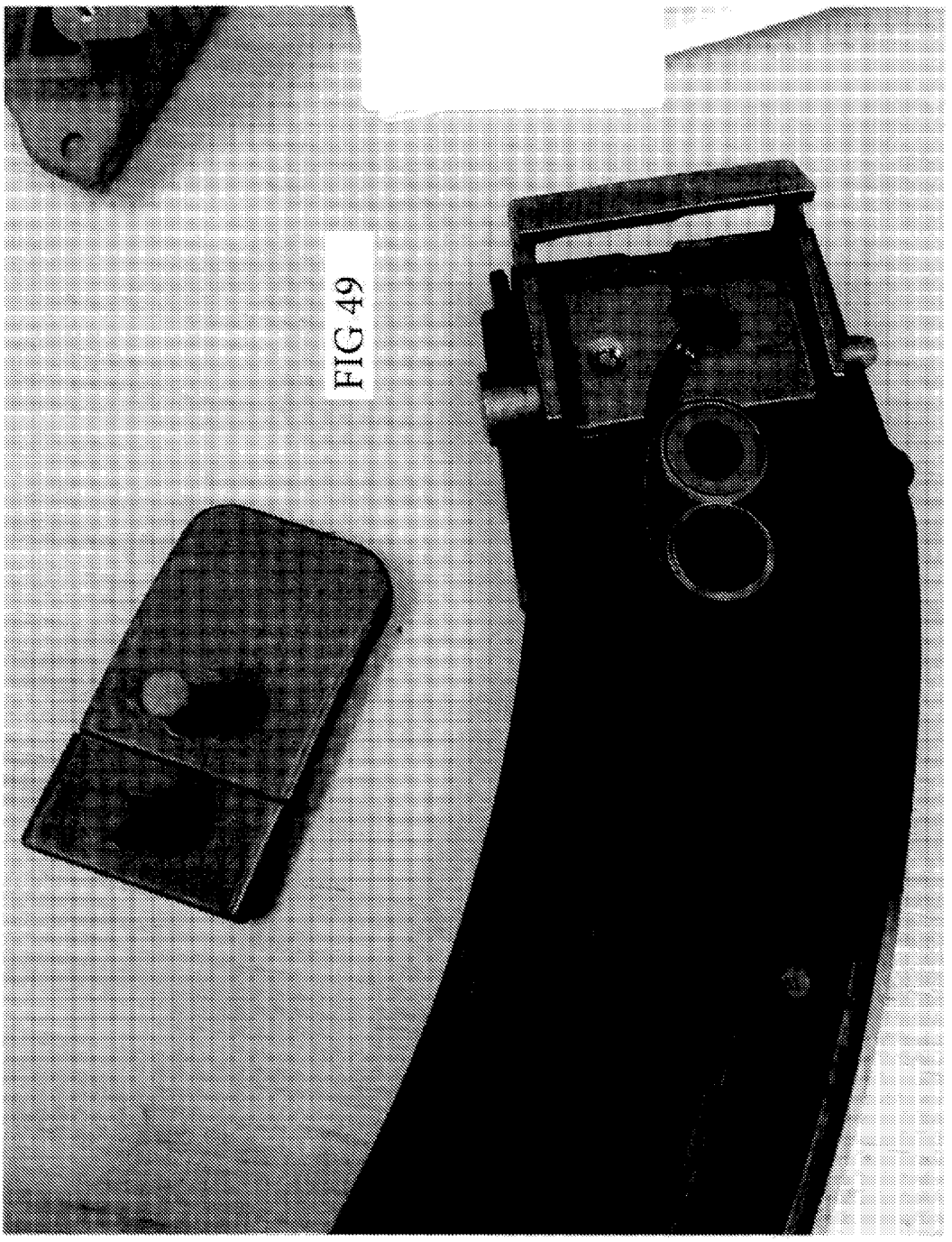


FIG 49

FIG 50

FIG 51

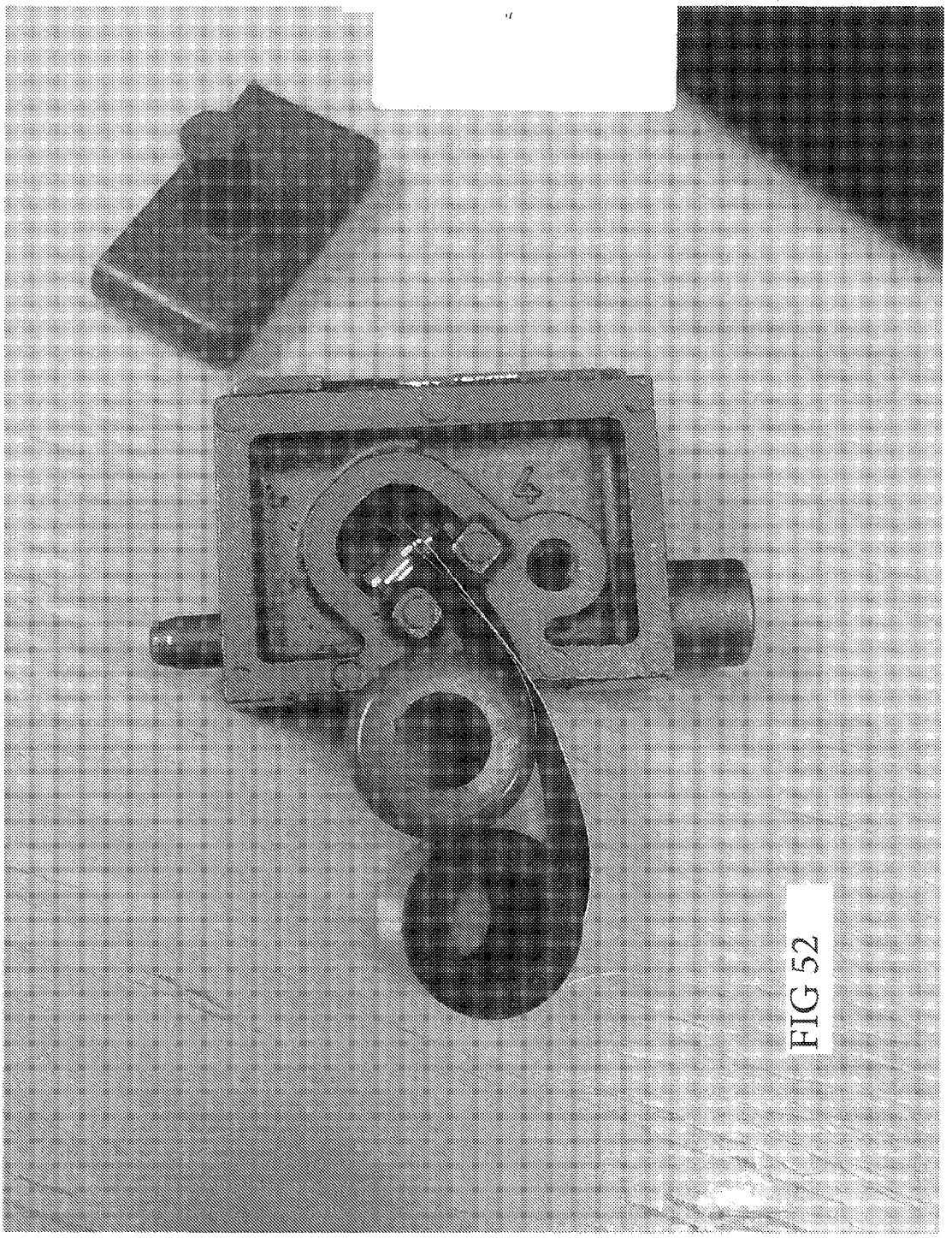
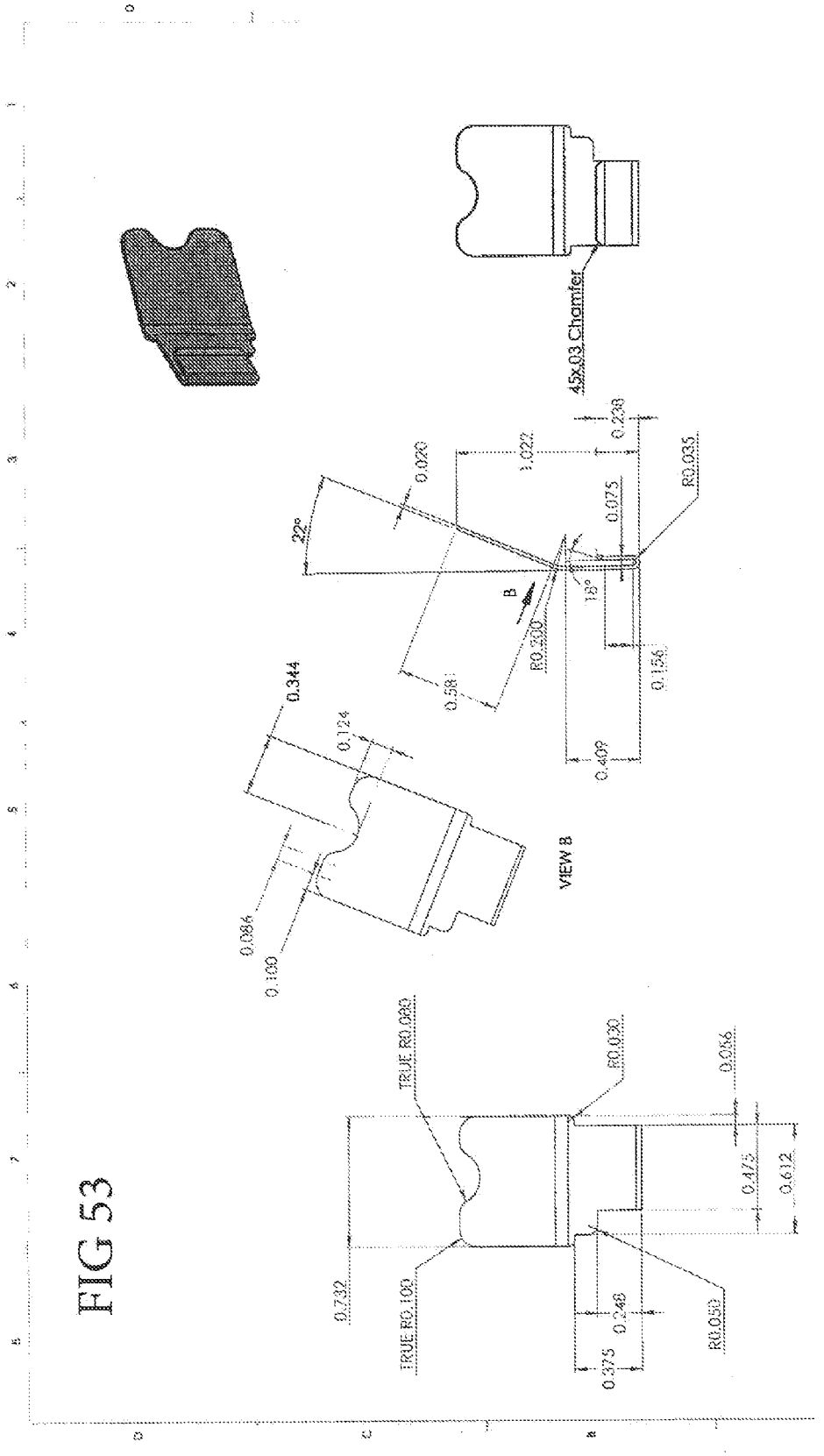


FIG 52

FIG 53


45x.03 Chamfer
0.238
1.022
0.020
22°
0.075
R0.035
18°
B
R0.330
0.581
0.156
0.409
0.344
0.124
VIEW B
0.084
0.100
TRUE R0.080
R0.020
0.086
0.475
0.612
0.732
TRUE R0.100
0.246
0.375
R0.050

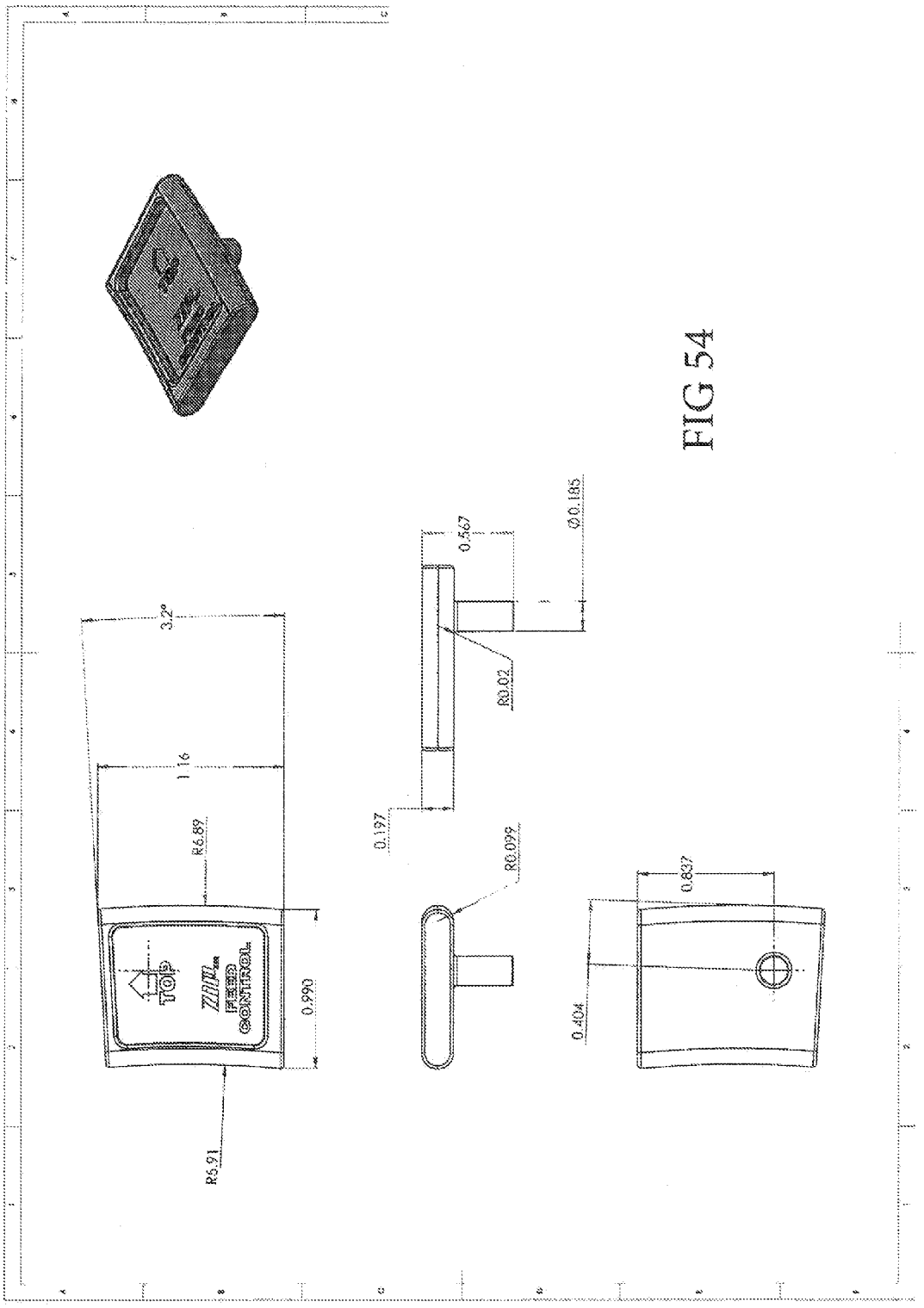

3.2"
1.16
R6.89
0.990
R5.91
TOP
ZIM
FEED CONTROL
0.567
Ø0.185
R0.02
0.197
R0.099
0.837
0.404

FIG 54

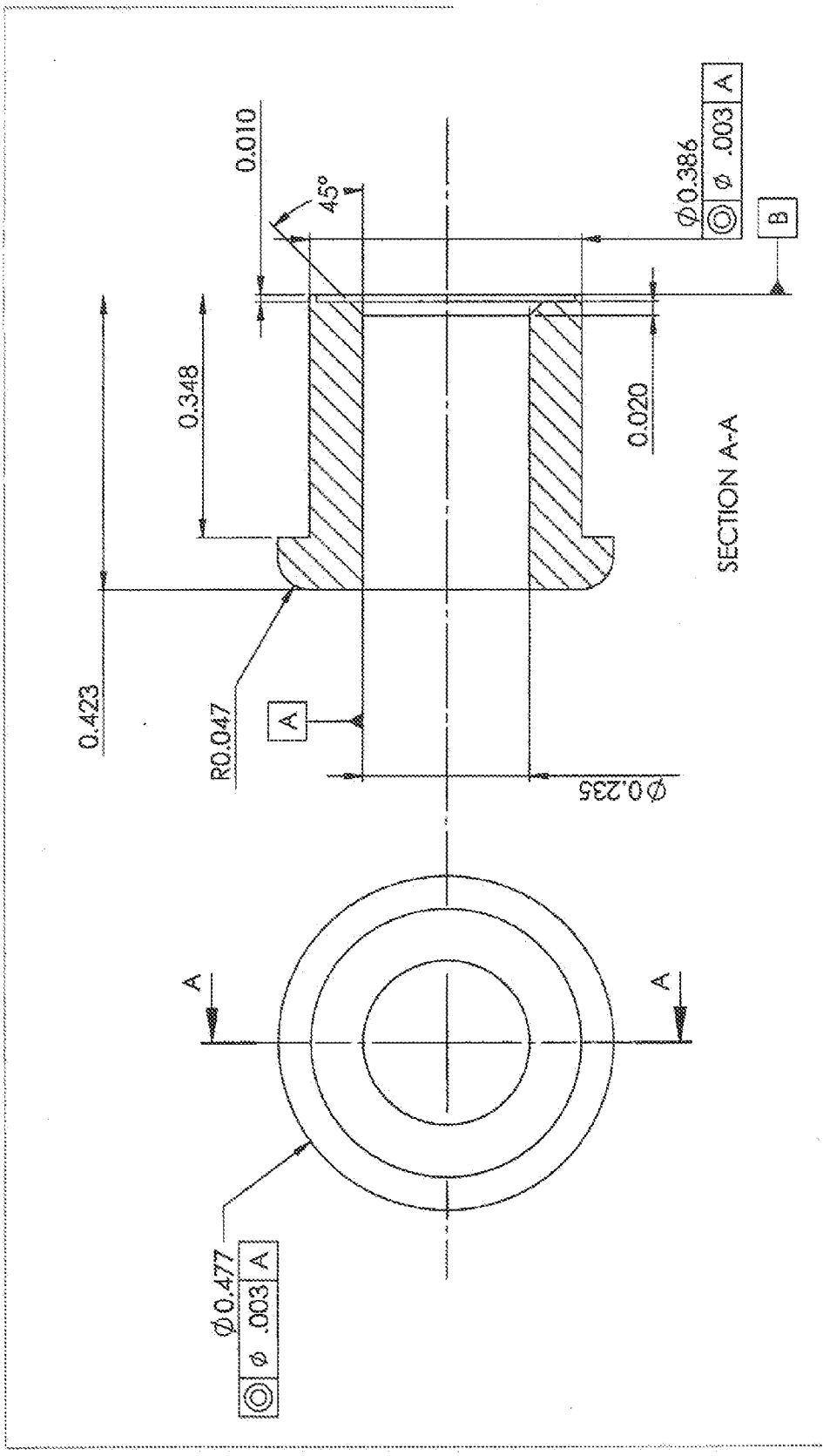

0.010
45°
Ø0.386
Ø .003 A
B
0.348
0.020
SECTION A-A
0.423
R0.047
A
Ø0.235
A
A
Ø0.477
Ø .003 A

FIG 55

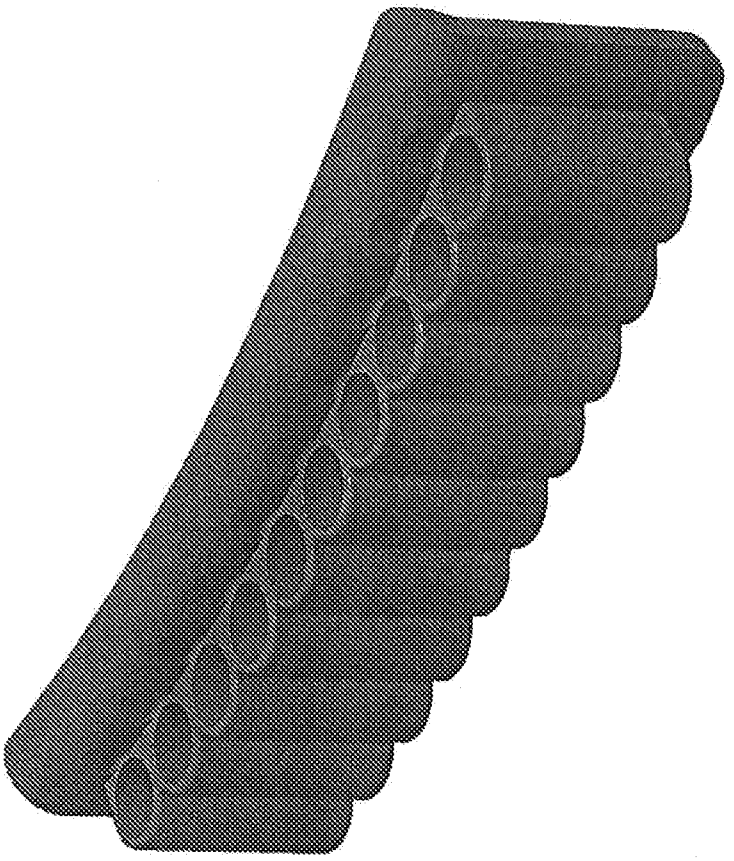


FIG 56

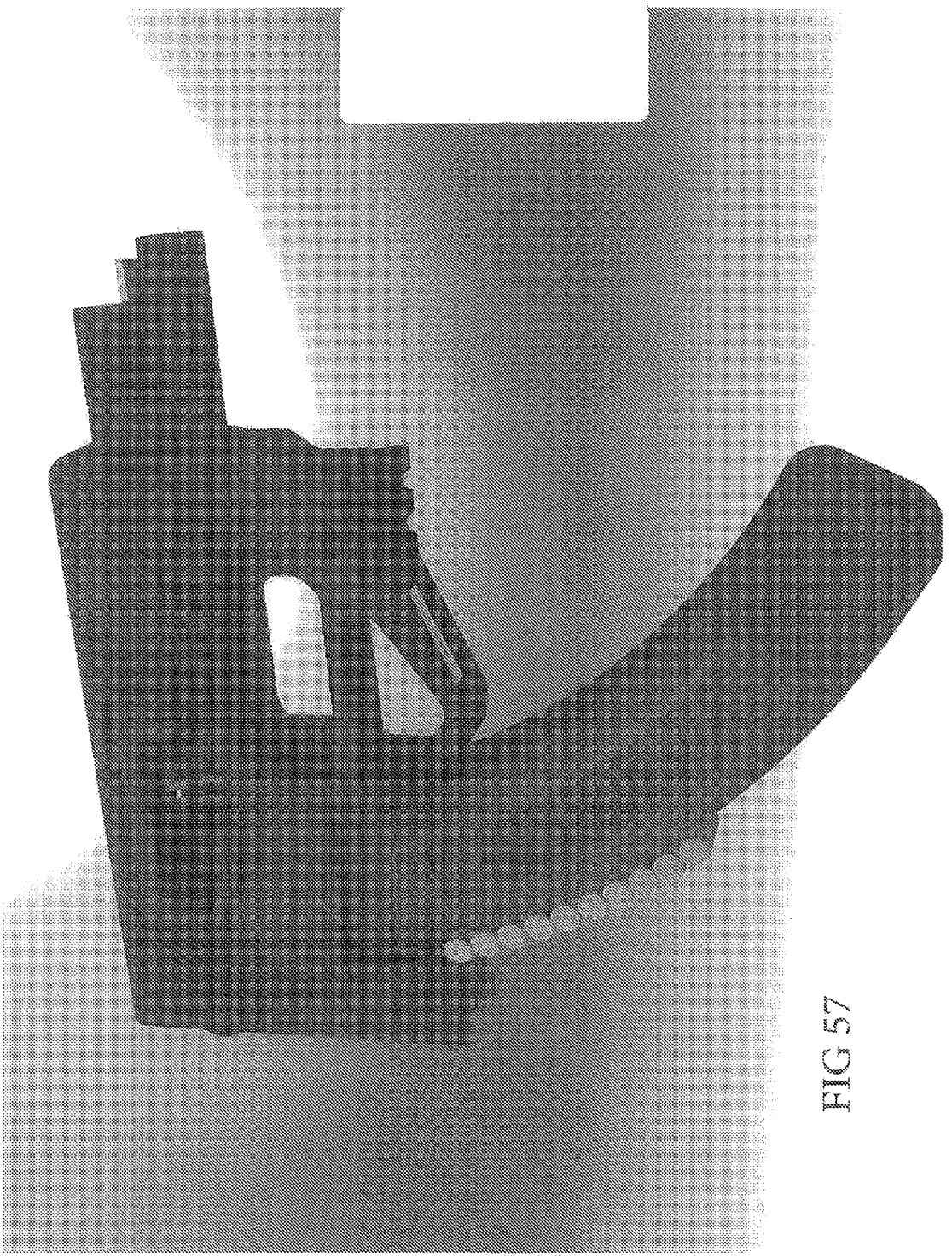


FIG 57

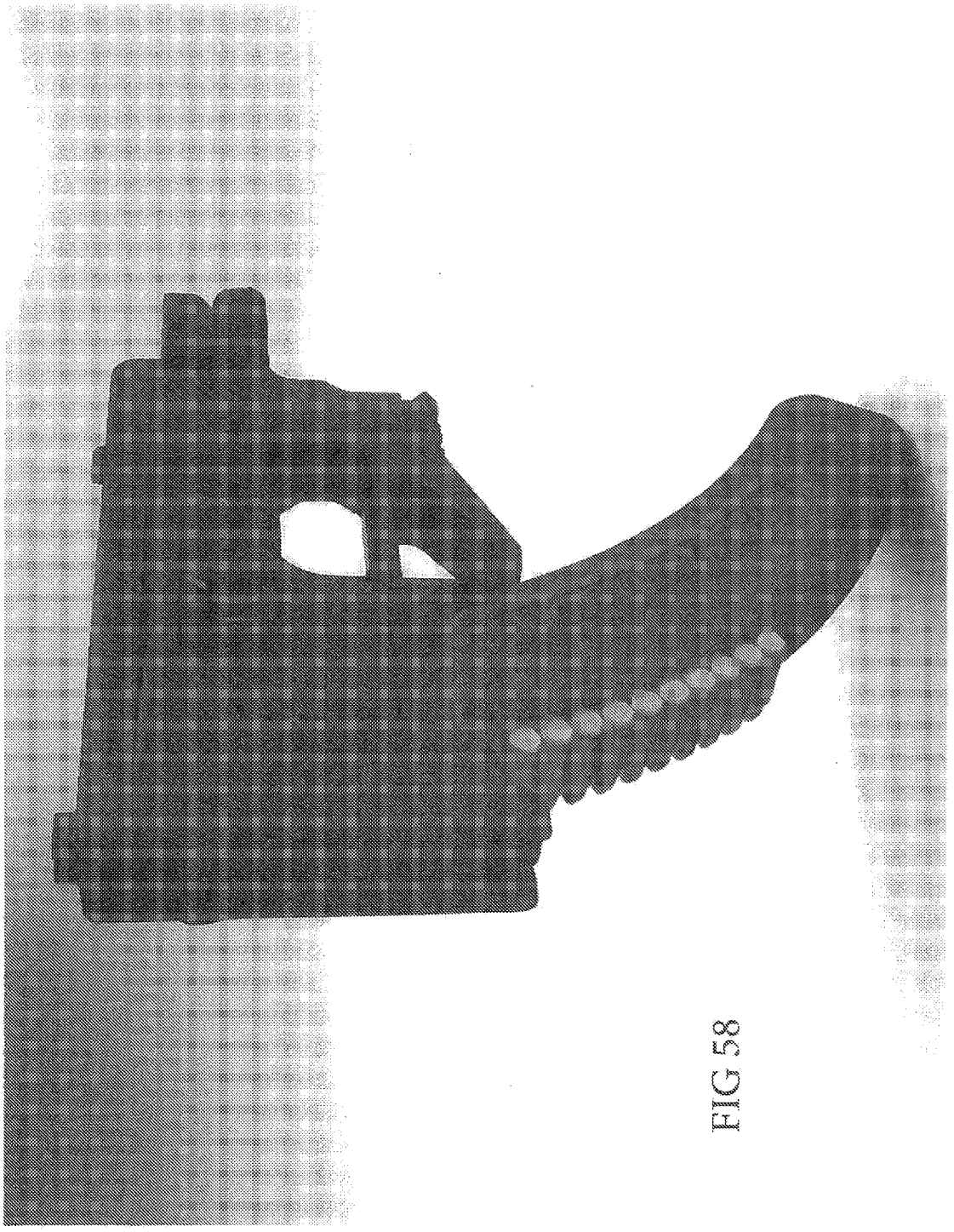


FIG 58

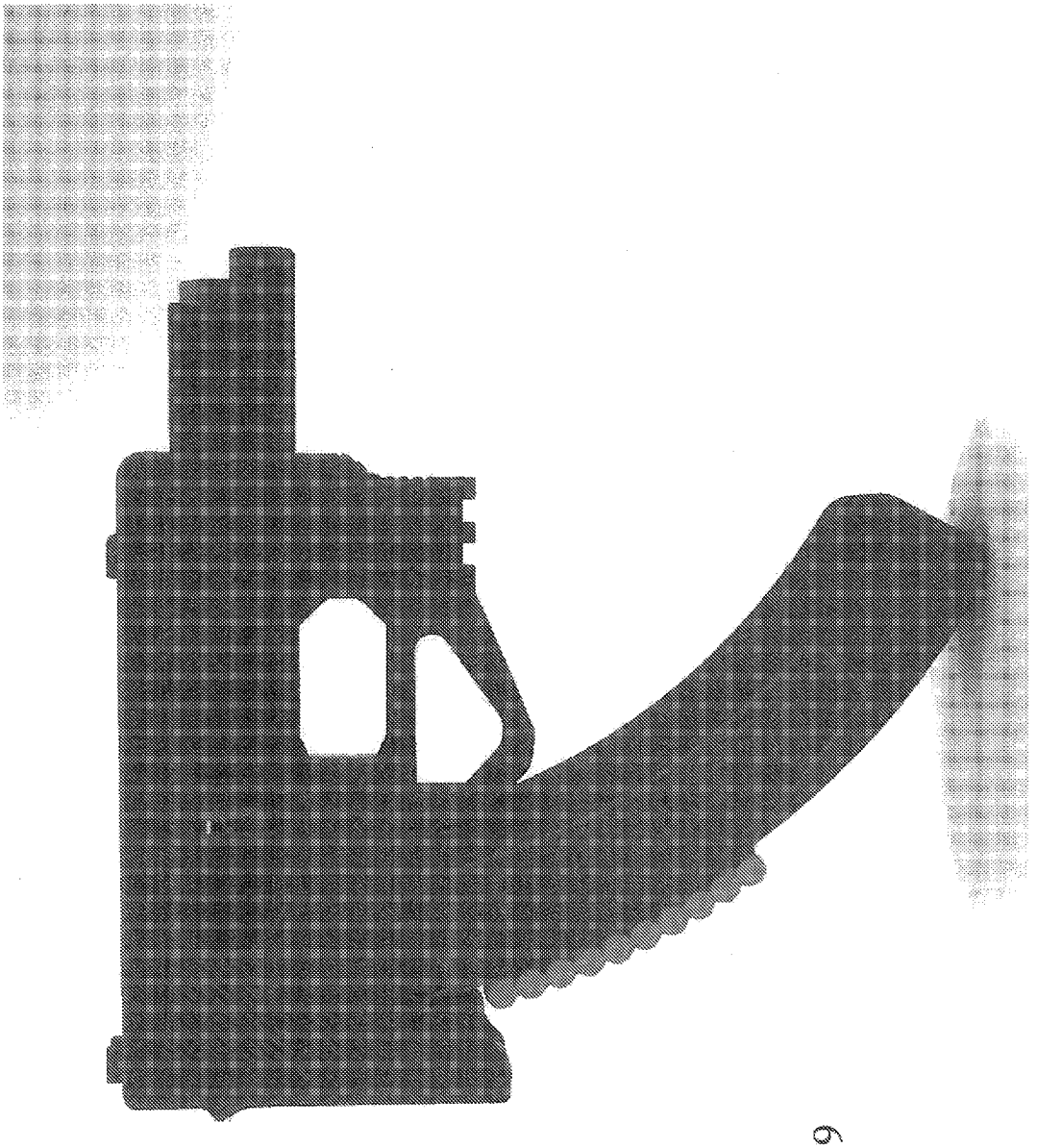


FIG 59

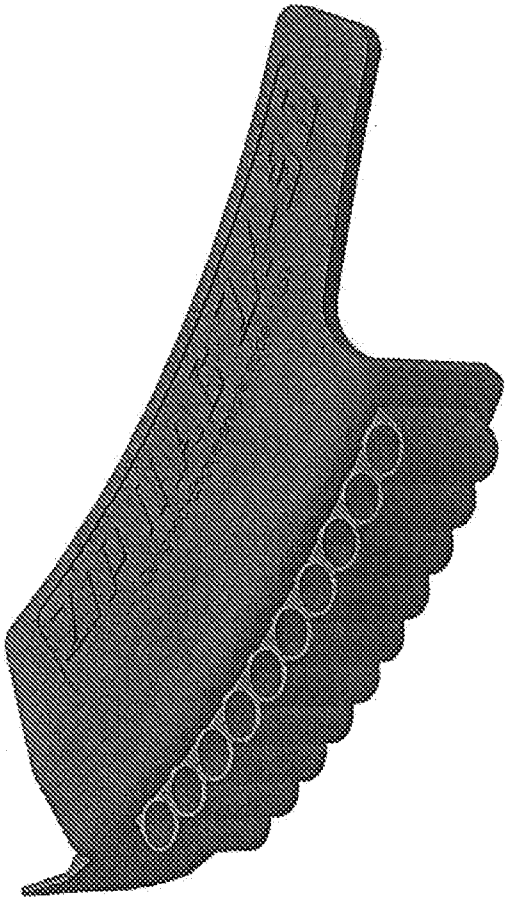


FIG 60

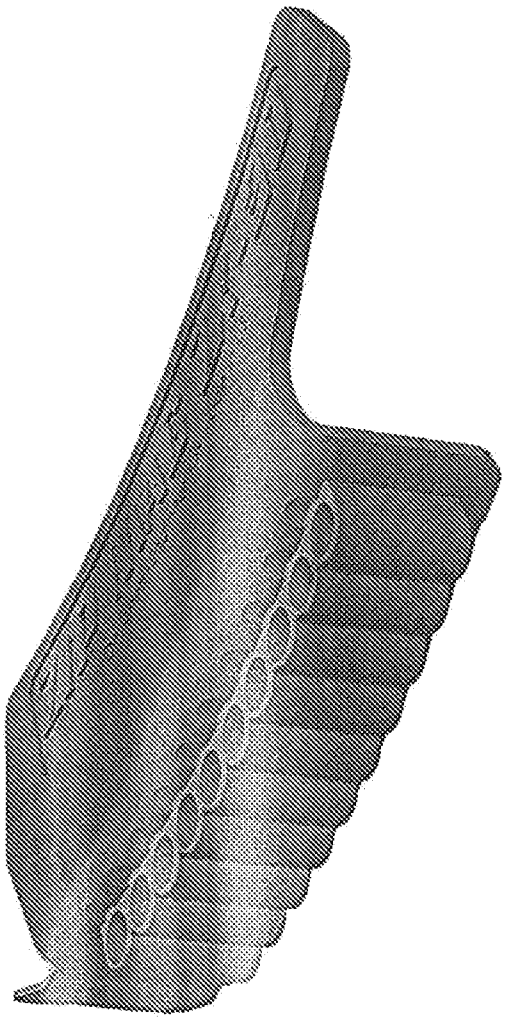


FIG 61

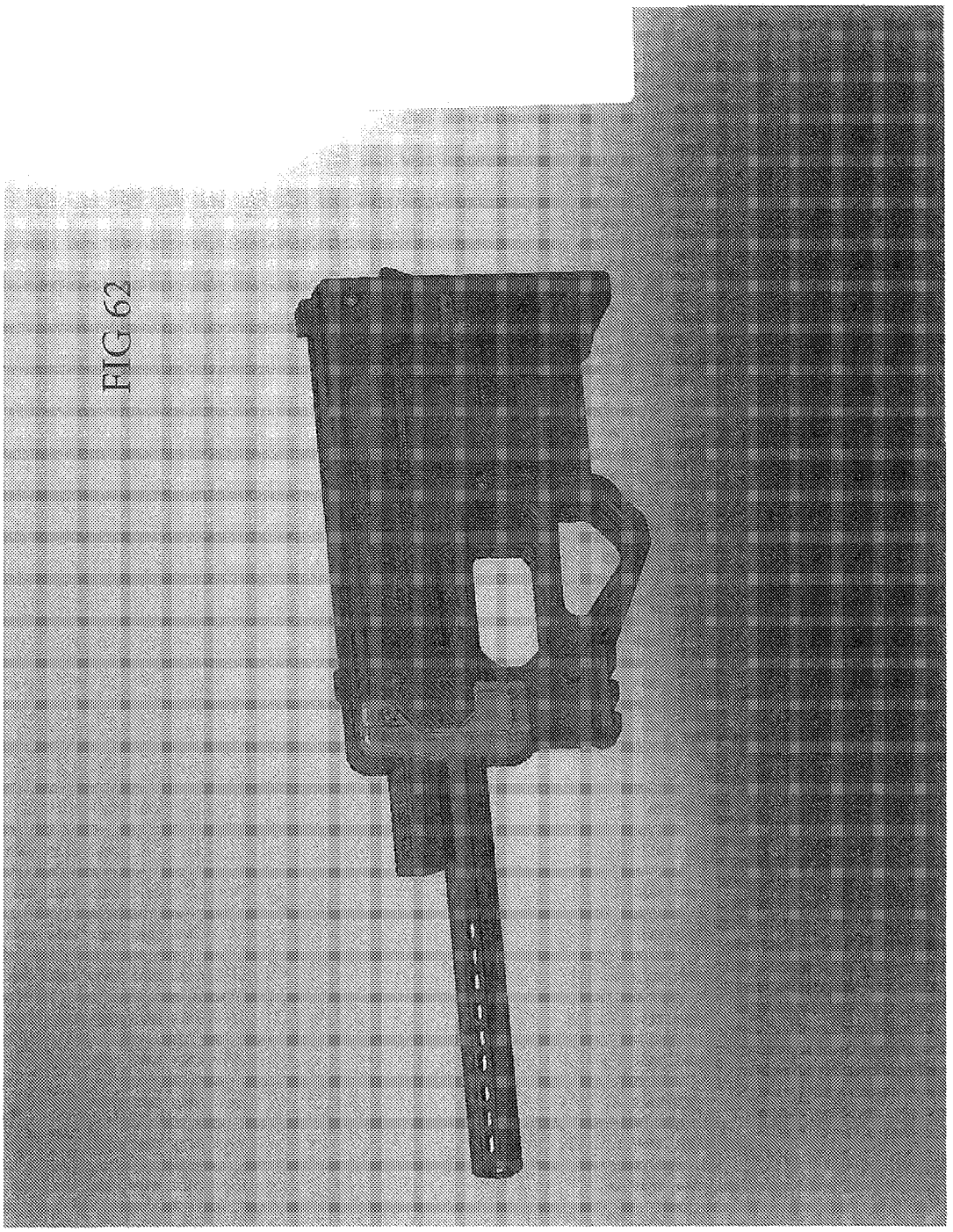


FIG 62

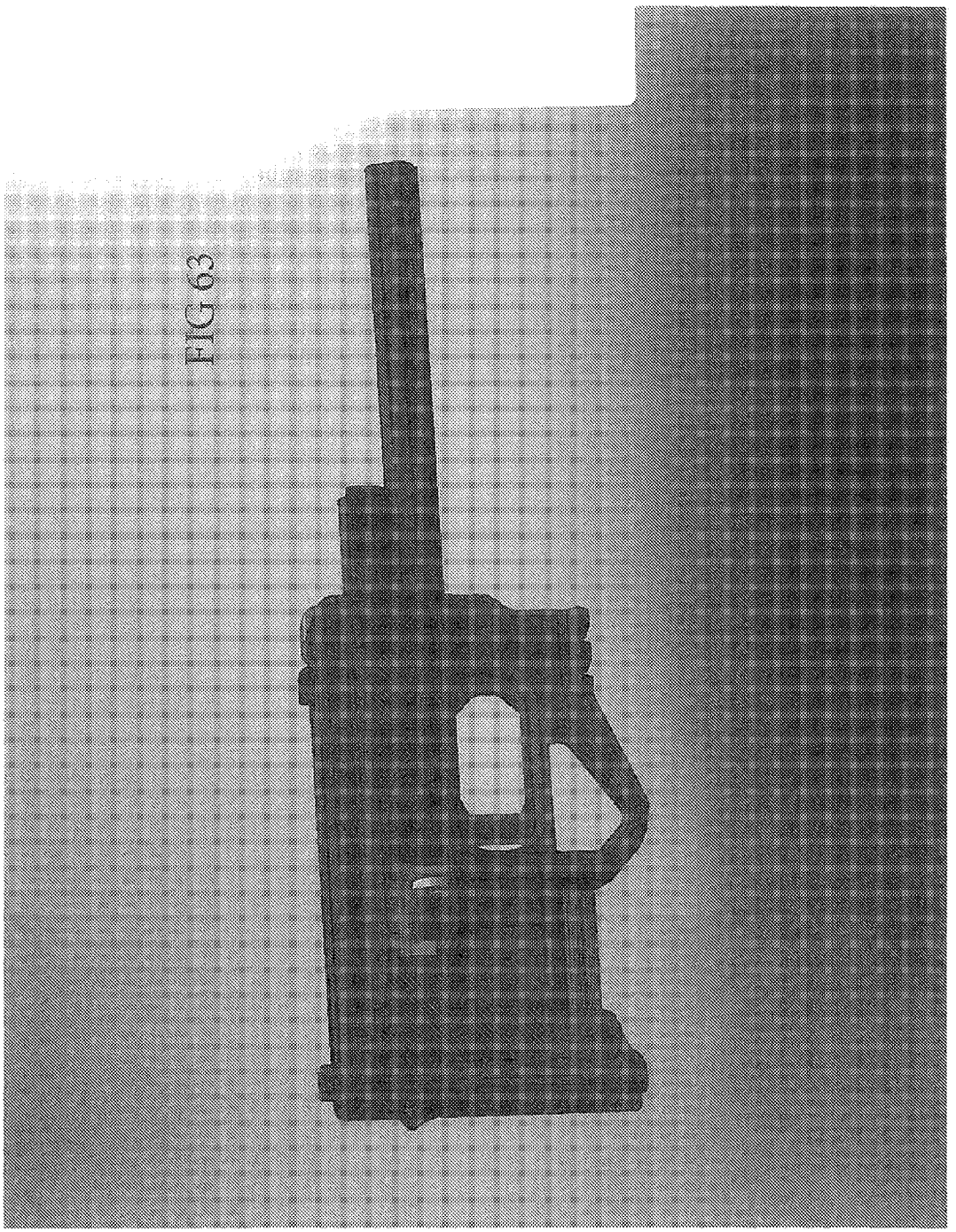


FIG 63

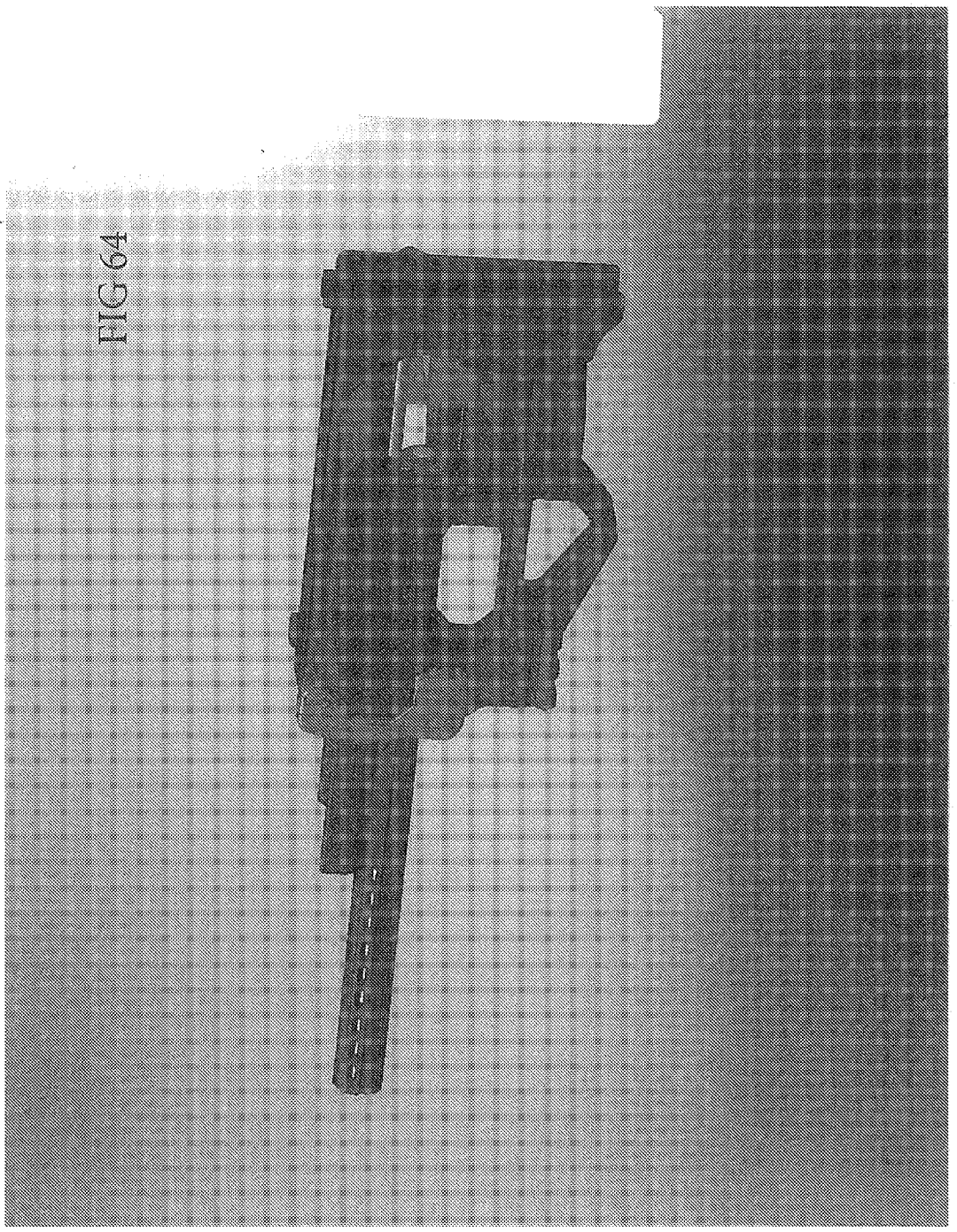


FIG 64

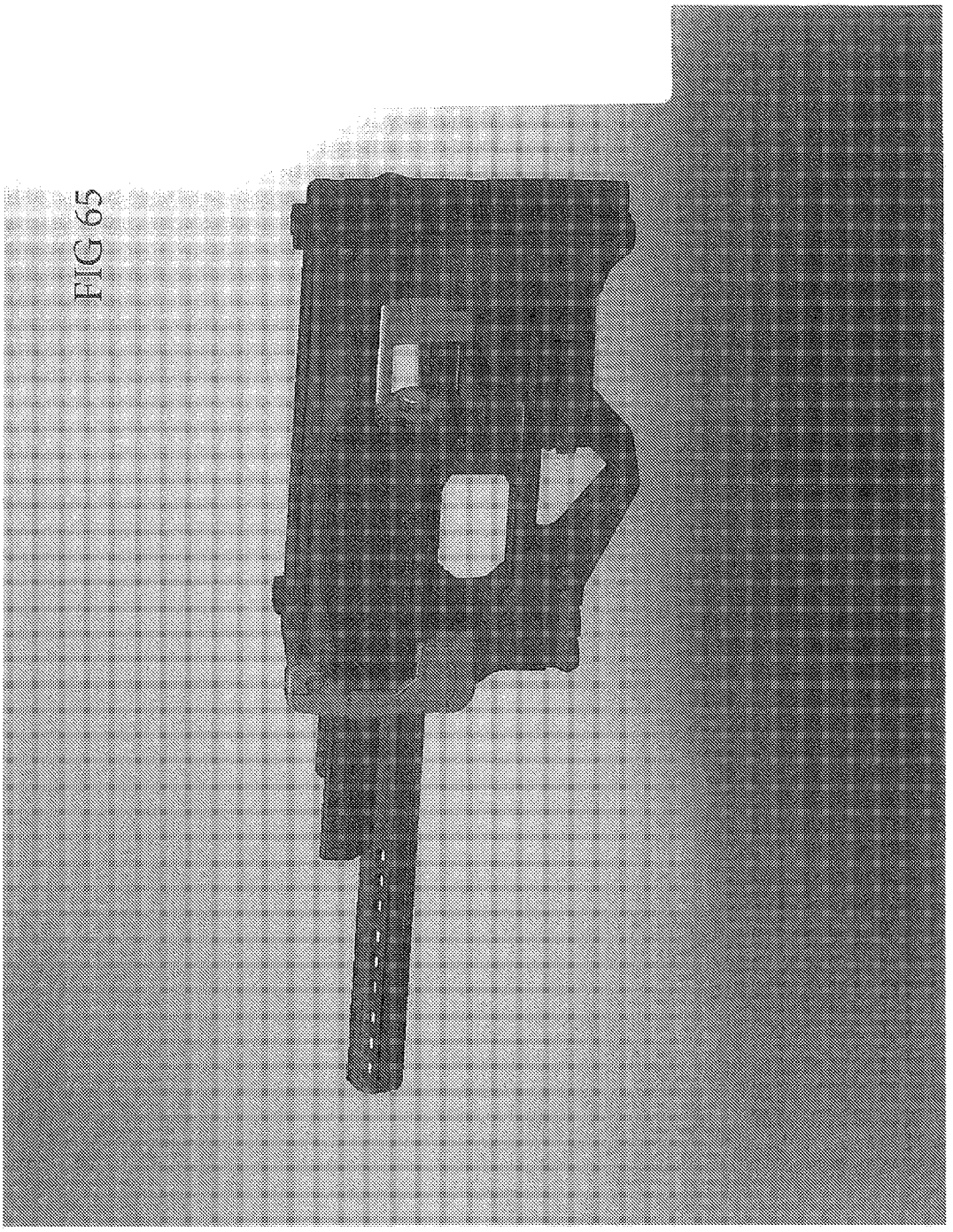


FIG 65

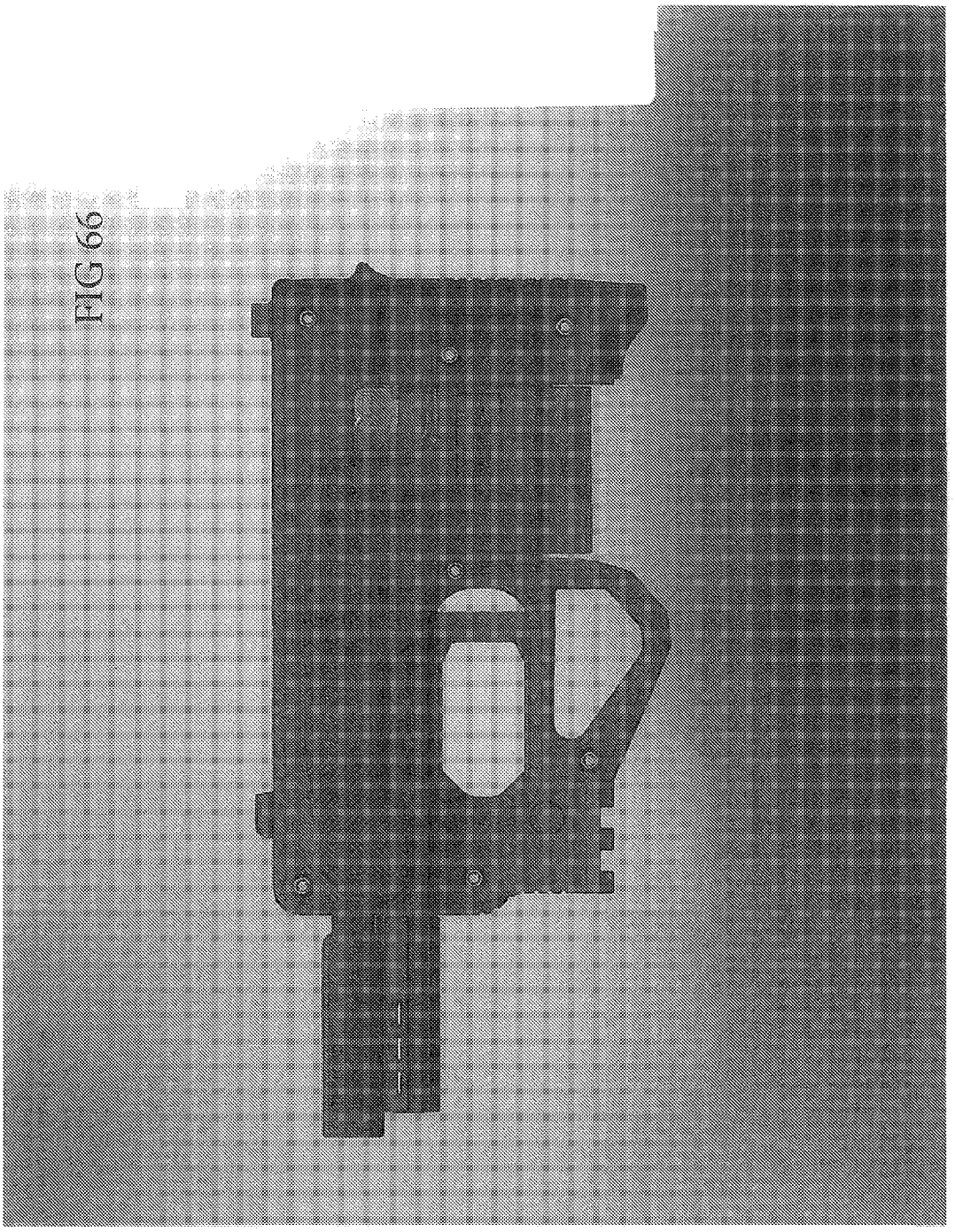


FIG 66

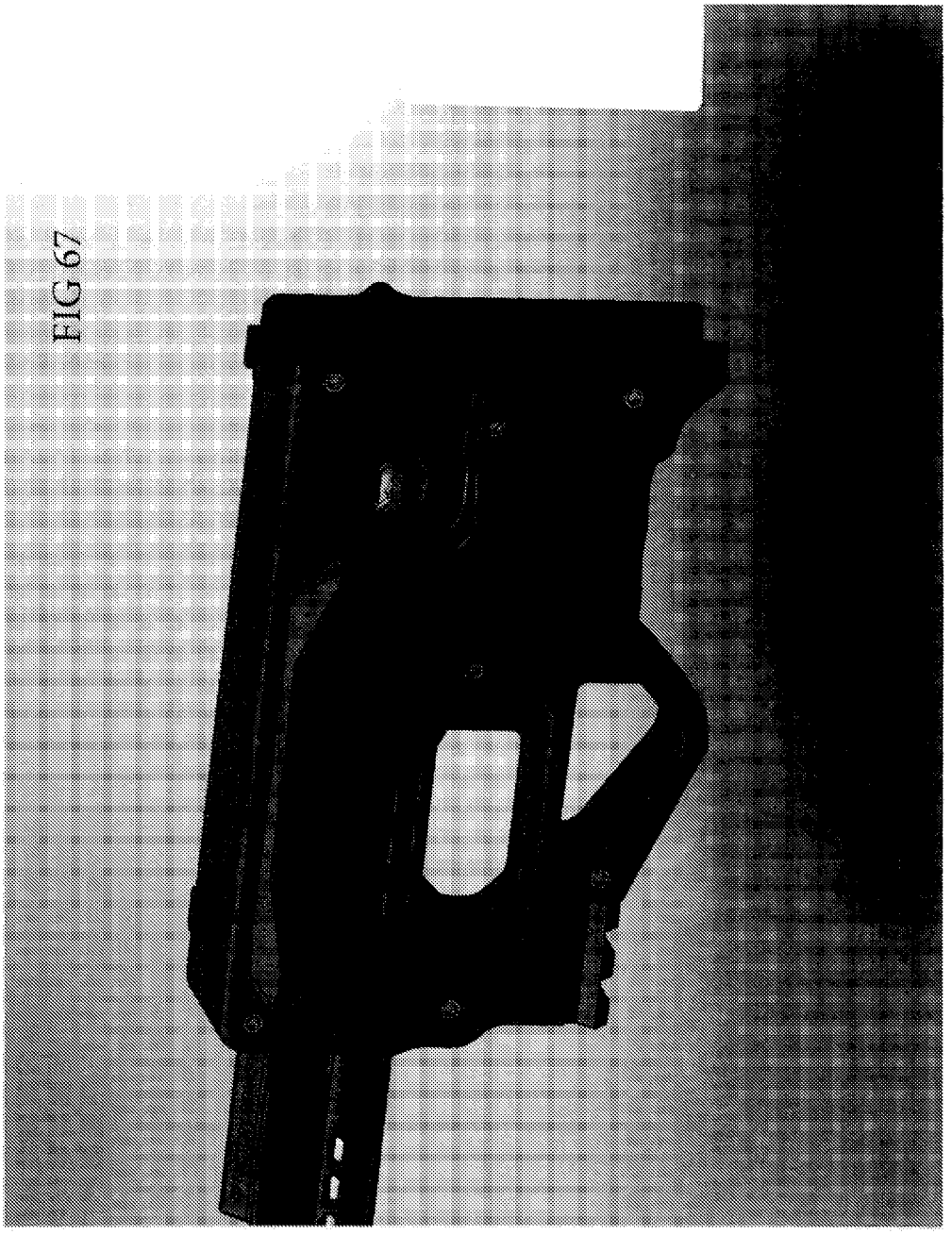


FIG 67

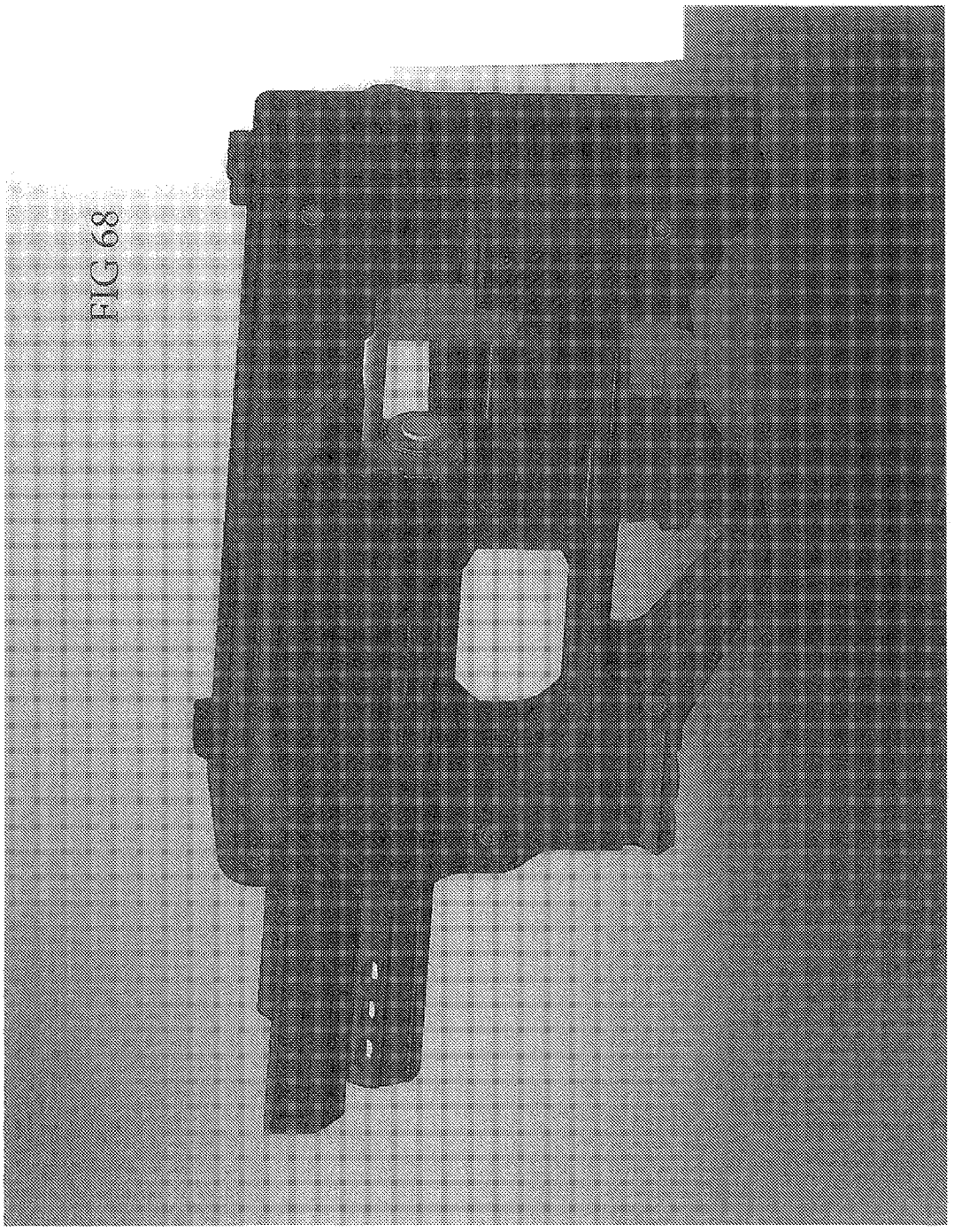


FIG 68

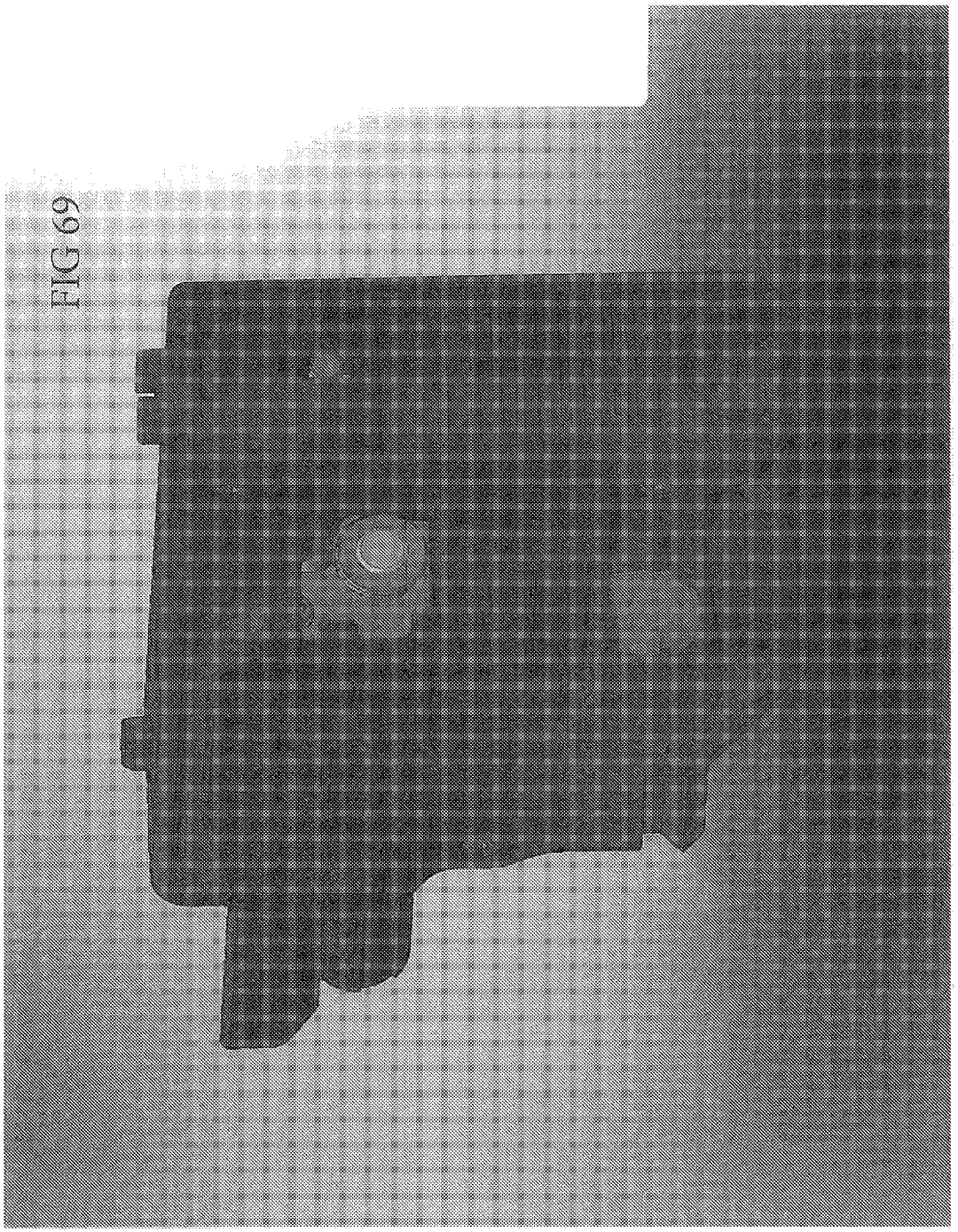


FIG 69

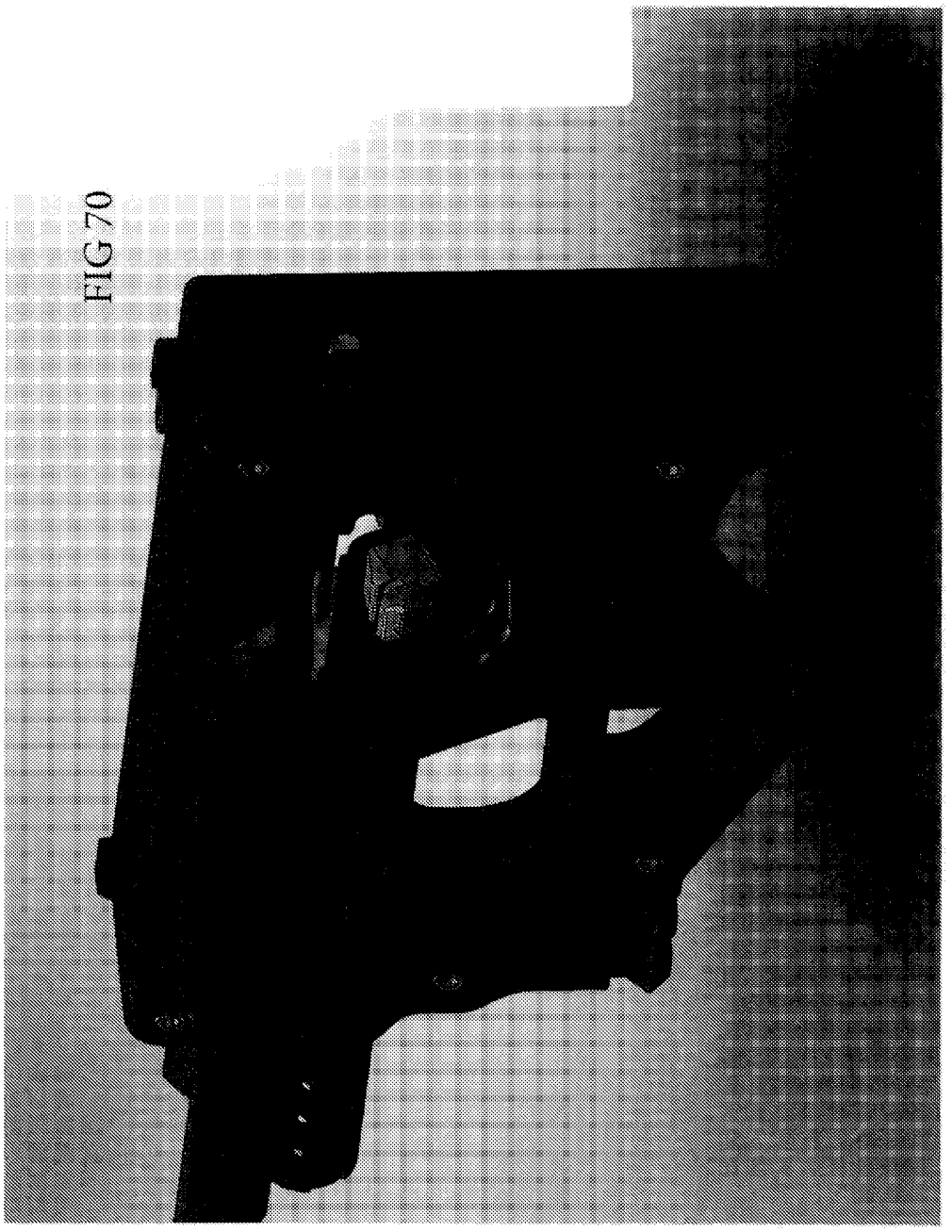


FIG 70

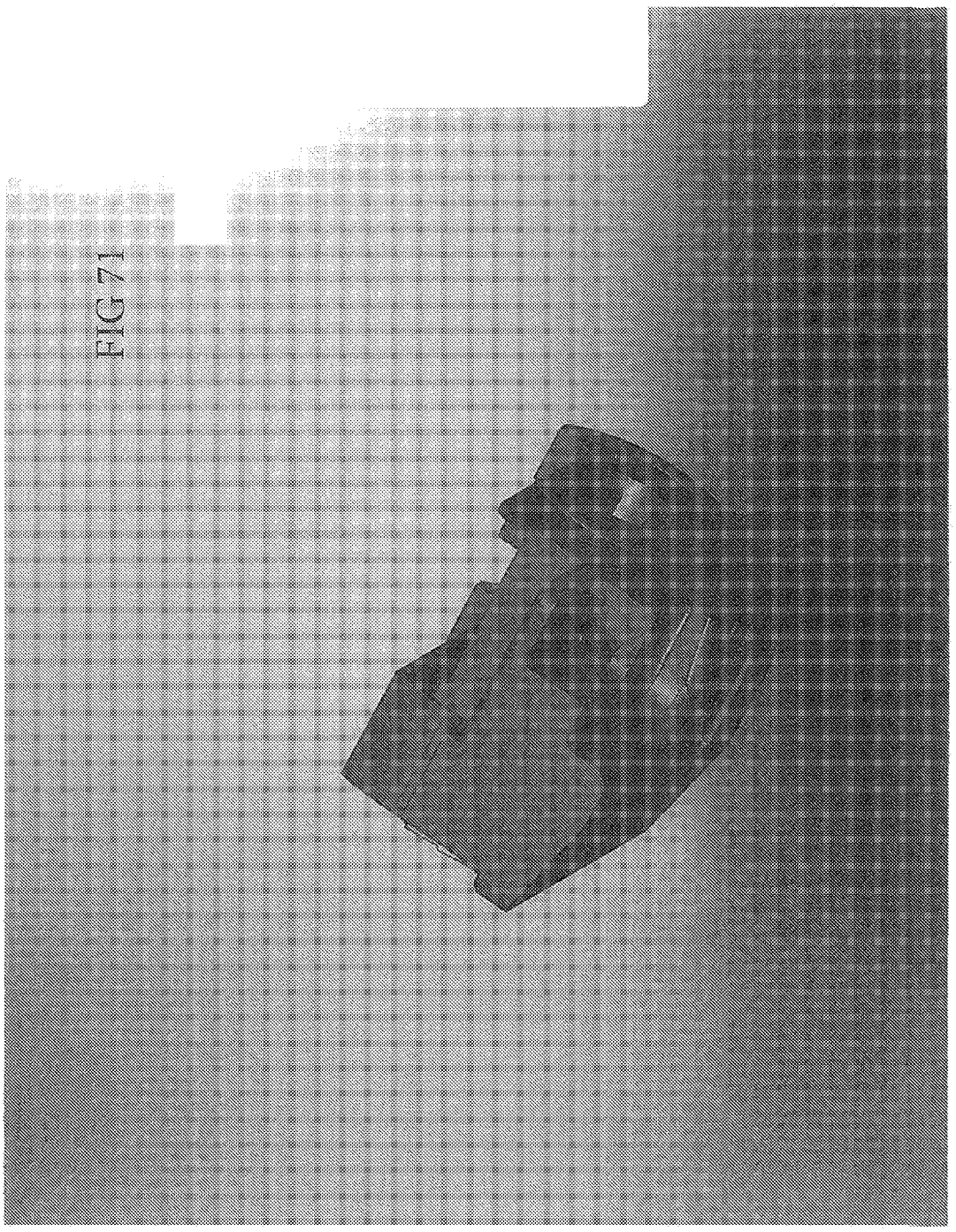


FIG 71

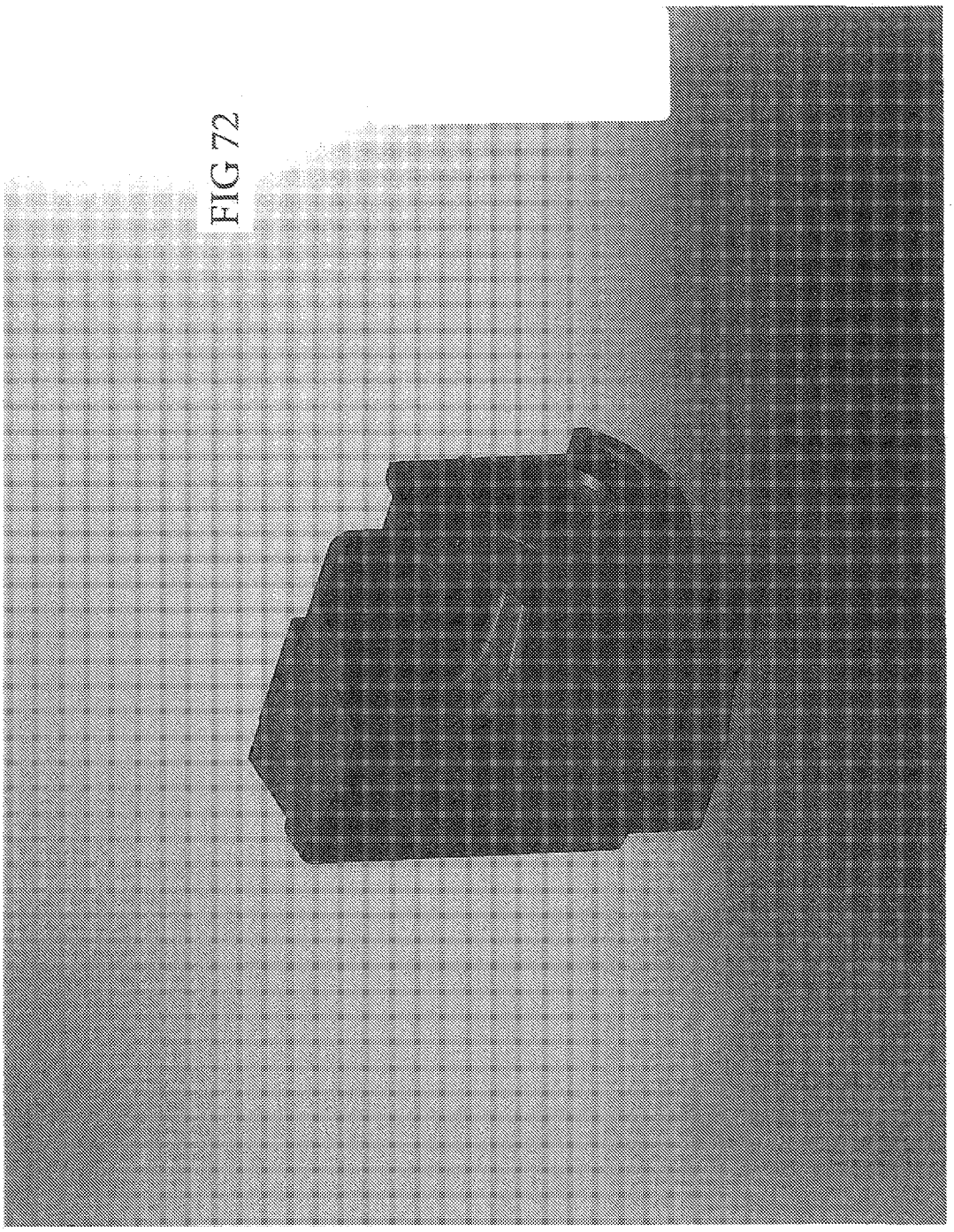


FIG 72

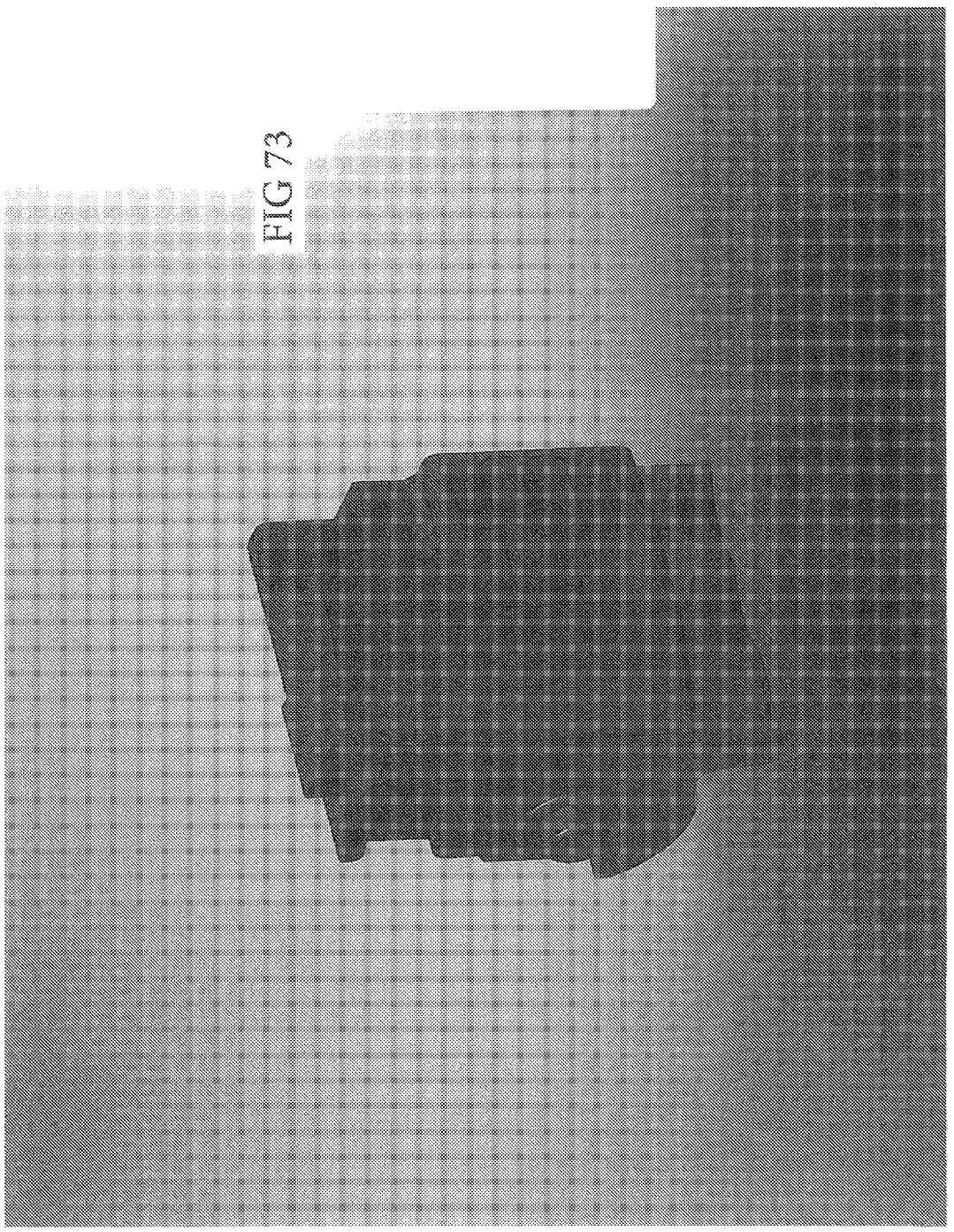


FIG 73

FIG 74

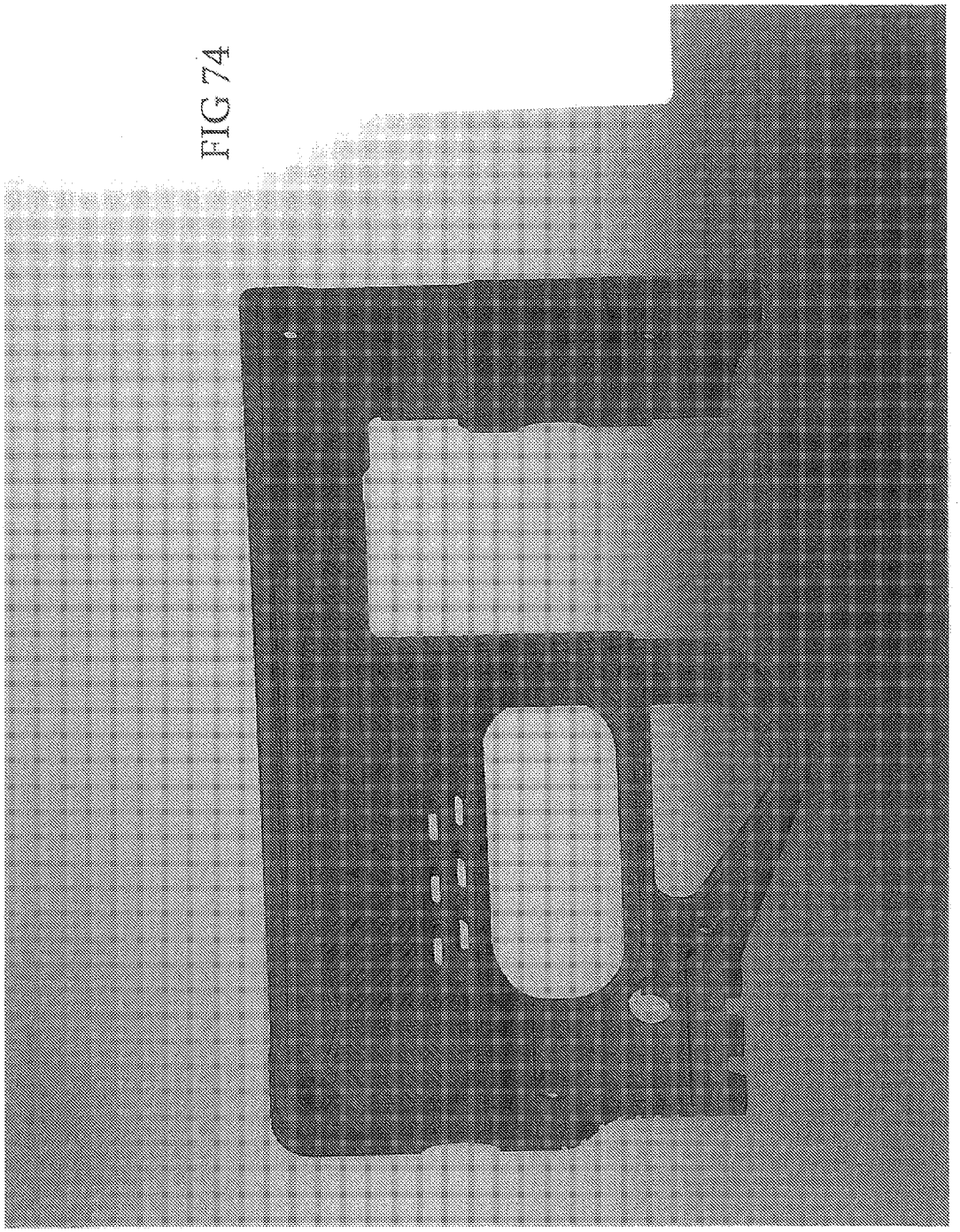
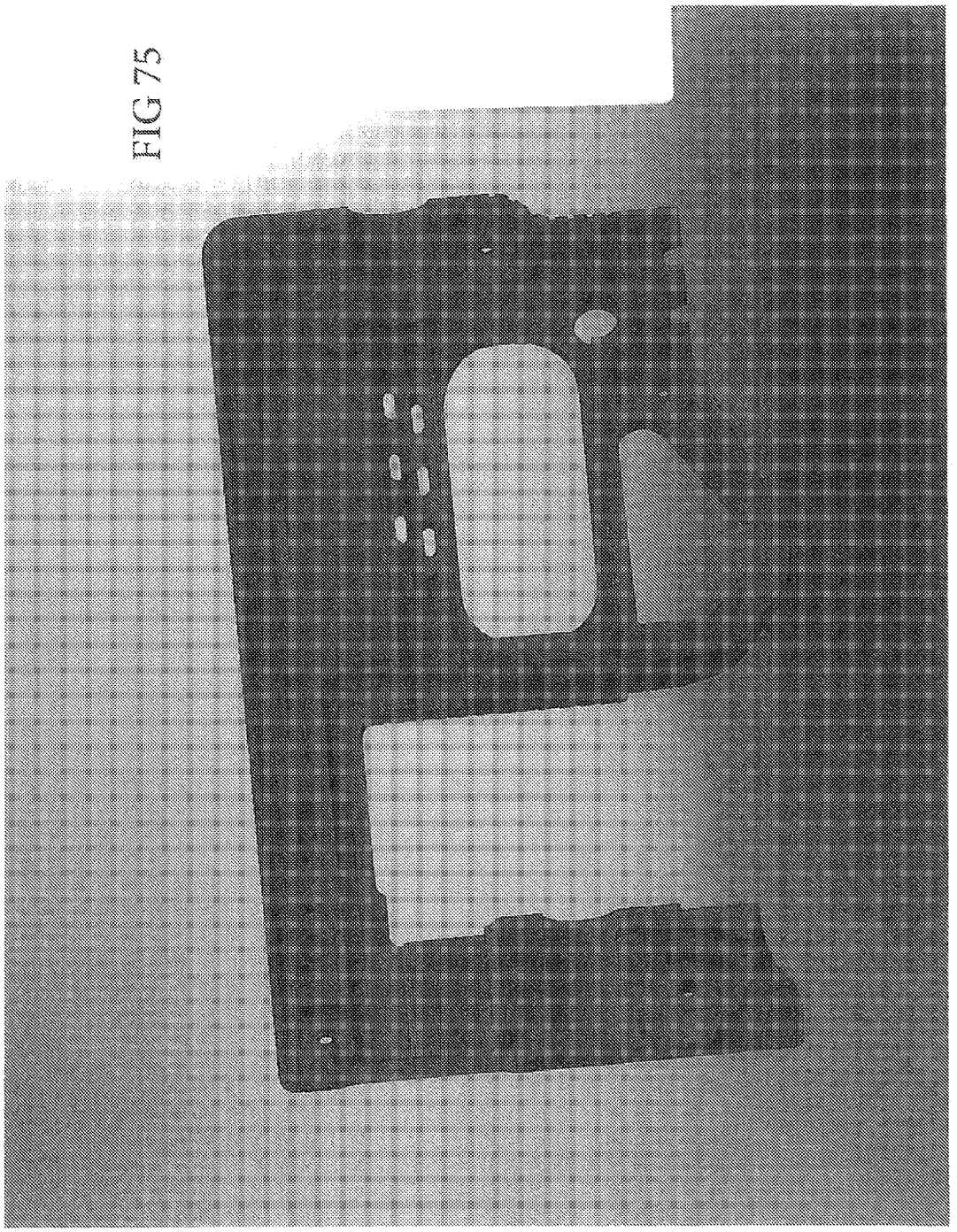


FIG 75



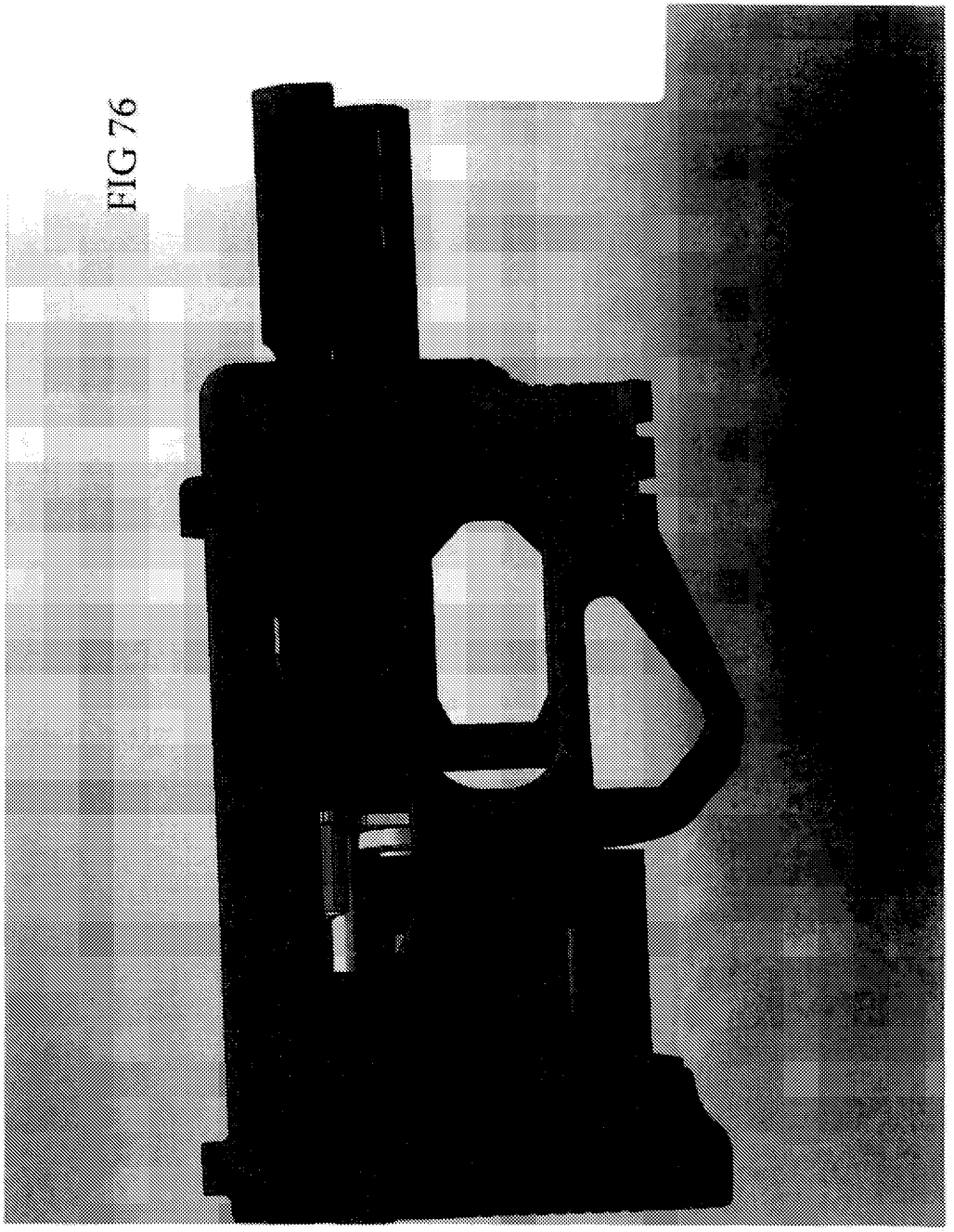


FIG 76

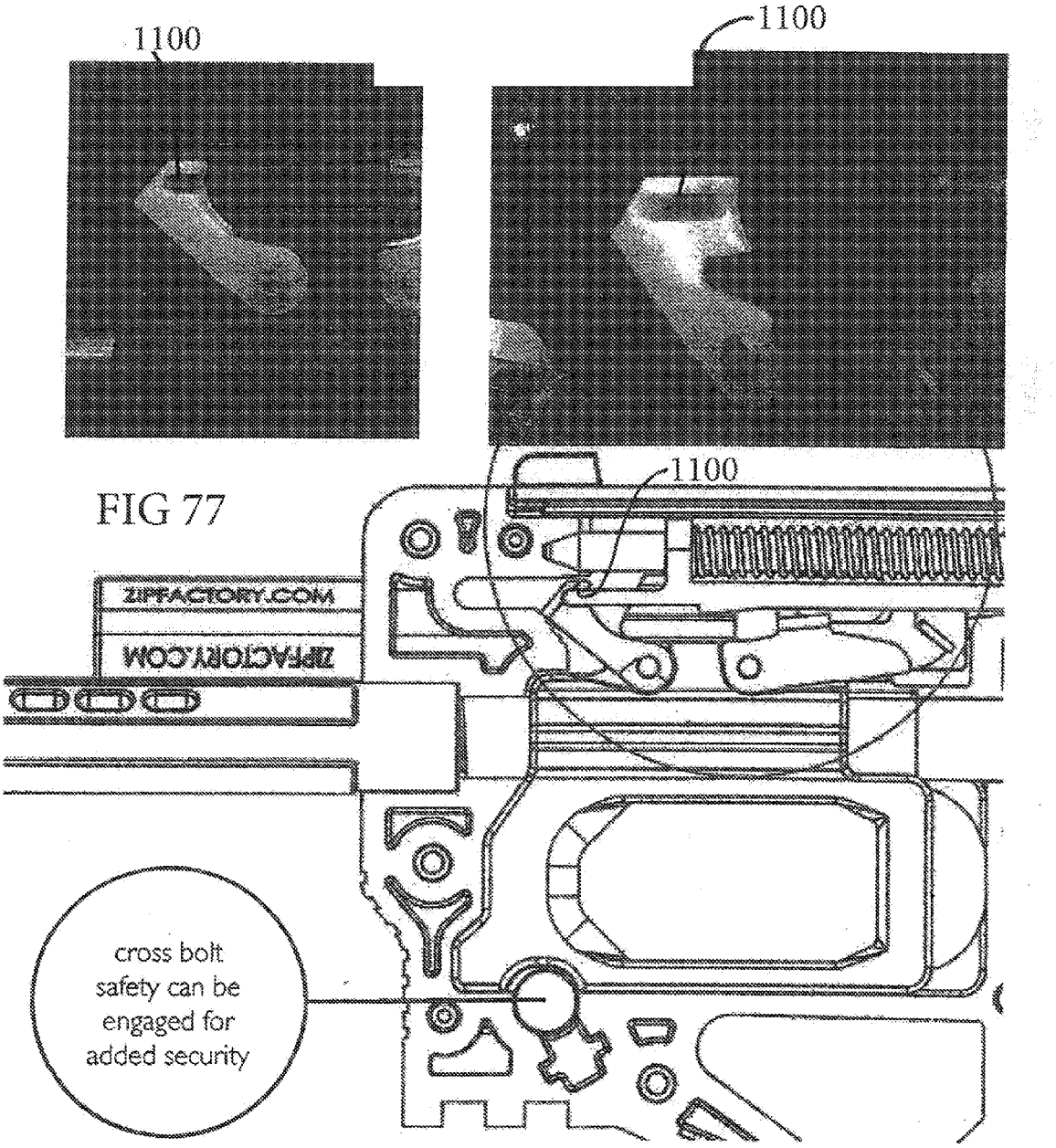

1100
1100
1100
ZIPFACTORY.COM
cross bolt safety can be engaged for added security

FIG 77

COMPACT SEMIAUTOMATIC FIREARM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to and the benefit of U.S. Provisional Application No. 61/896,585, filed Oct. 28, 2013, entitled "COMPACT SEMIAUTOMATIC FIREARM" the entire content of which is incorporated herein by reference in its entirety. This application also claims priority to U.S. Provisional Application No. 61/886,049, filed Oct. 2, 2013, entitled "COMPACT AUTOMATIC FIREARM", the entire content of which is incorporated herein by reference. This application is also a continuation-in-part of U.S. patent application Ser. No. 13/745,704, filed on Jan. 18, 2013, entitled "COMPACT SEMIAUTOMATIC FIREARM", which claimed priority to and the benefit of U.S. Provisional Application No. 61/588,089, filed on Jan. 18, 2012, entitled "COMPACT SEMIAUTOMATIC FIREARM", the entire content of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to the field of firearms, and more particularly semi-automatic or "small arms" and either semi-automatic long guns or carbines as well.

[0004] 2. Description of Related Art

[0005] Typical Prior Art—Old Designs (e.g. 1911, Glock, Beretta)

[0006] A modern breech loading semi-automatic (small arms) uses a slide/barrel assembly that moves longitudinally along a frame and can overtravel across the top of the shooting/loading hand. A spring located between the front of the slide and frame holds the slide/barrel assembly in a forward and locked position when in battery. A cartridge chamber exists within this barrel assembly. When in battery, forward position, the rear end of the barrel is covered by the breech face upon the slide. A hole in the breech face provides access to the cartridge chamber for a firing element to pierce the primer of the pistol cartridge, thereby discharging the cartridge and expelling the bullet.

[0007] The firing pin can be driven forward by a hammer striking it, or in the case of a striker, it can be moved backward under spring pressure and released to drive the firing pin forward through the breech face to contact the bullet. In either instance, the hammer or the striker firing pin itself is connected through mechanical means to a trigger.

[0008] Upon discharge of a cartridge, a bullet travels forward out through the barrel, the slide/barrel assembly moves rearward for a specific distance where the barrel moves slightly downward and stops, the slide continues to move rearward over the hand, opening the cartridge chamber. Through recoil pressure, the fired casing keeps in contact with the breech face as the assembly continues rearward, the ejector (mounted in the frame) contacts the spent cartridge casing, pushing it away from the breech face, causing the extractor to be overcome and to expel the empty cartridge from the pistol.

[0009] Now at maximum rearward travel, and now having travelled over the shooting hand, the slide has completed its rearward cycle. Spring pressure pushes the slide forward, contacting the next cartridge from the magazine and delivering it to the cartridge chamber which closes as the slide moves forward. With the slide fully forward, the pistol is loaded and ready to fire again.

[0010] The above generally describes the operation of a semi-automatic firearm with a locked breech mechanism, fired either by striker or hammer operation. A straight blowback mechanism operates similarly, except that the barrel is not part of a slide/barrel assembly; it is integrally and rigidly mounted to the frame and simply acts as a stop from which the head space is created to the breech.

[0011] Various embodiments of the present invention represent a dramatic departure from the above-described mechanisms and a great improvement upon such mechanisms. At least in part, the improvement resides in:

[0012] 1. reducing the total part count;

[0013] 2. reducing the expense of manufacture; and

[0014] 3. increasing reliability and safety.

[0015] Having described the above preexisting mechanisms, there is no "similar type" of the present invention except to loosely say a "semi-automatic mechanism." Various embodiments of the present invention provide no over the hand travel, an extremely compact form factor, and a robust and simple internal mechanism. While the Borchart Type/Luger Type also has no over the hand travel per se, it does break an imaginary line running vertically from the shooters hand. Embodiments of the present invention do not have even this limited over travel and no exposed toggle top on top either, i.e. no external slide. The present invention establishes a new class of personal weapon.

[0016] A representative example for discussion of the prior striker style is the Gaston Glock (Austria) Model disclosed in 1979.

[0017] Specific to the Glock firearm (U.S. Pat. Nos. 4,539,889; 4,825,744 and 4,893,546) is a pre-tensioned striker fired action mechanism. This device has characteristics of the type known as the double action only ("DAO") style as well. It must be manually "cocked" before the first discharge, and sequential firings require only trigger actuation. The sequential trigger operations serve to actuate the firing element from a pre-tensioned position to the critical point where searing or release takes place. This design allows a trigger pull distance that is less than in the DAO and greater than in the single-action. However, it has the complex and typical long rotational trigger and overly complicated trigger bar winding its way around a magazine well (which is also true for the 1900 trigger by Browning evolved as the 1902, 1903, 1905, 1910, and most famously, the 1911). Such complications are found in the class of modern striker fired systems employed by Glock, Smith and Wesson, Ruger et. al.

[0018] The modern striker fired systems are importantly dependent upon a tiny coil spring, located and attached in the mechanism's rearward portion in a plastic casement harbored inside the frame. The tiny coil spring, which embodiments of the present invention eliminate, is responsible for the active control of the trigger bar. It is to be noted that Smith and Wesson has used various methods to deaden errant vibration (to prevent falling off and/or breakage) with the use of some kind of dampening material, like a cotton swab or Q-Tip, to safeguard the operation of the spring. Similarly, Glock continues to enlarge the diameter of this spring material in a quest for increased reliability within their confined space. It is this pesky alignment/tensioning spring which is among certain parts eliminated to make more robust embodiments of the disclosed new invention.

[0019] Additionally, this tiny coil spring (held by two open and opposite loops at its ends, thereby rendering it susceptible to falling off) maintains the trigger bar in a groove, to ensure a partially "cocked" or pre-tensioned position. However, accidental discharge by dropping the weapon is remote, because the pre-tensioned position of the firing element is blocked by a "series 80" type drop safety which blocks any forward travel of the firing pin element through the breech face if caused to release by errant vibration or "dropping."

[0020] Until about 1980, semi-automatic firearms have been substantially all metal. Gaston Glock's introduction of polymer has materially changed the manufacturing process and cost structure and, to a high degree, the acceptance of plastic replacing metal components for consumers. The Glock model in particular, after the introduction of certain cellulose-type plastics or hard rubber which have been known in the industry for 100 years, was the first "modern firearm" after the then "newest introduction" of the Armalite AR-180, in Santa Ana, Calif. (mid 1950's) which included a plastic stock, a hand guard, and an internal buffer, as well as some other gun parts. The basic design rights were then sold off to Fairchild Machine Tool, and then finally to Colt for manufacturing license rights which finally ended 50 years later in 2009, although the patent rights had expired decades before. The constant shift to plastic where possible included a make-over of the M14 in 1969, when it was finally decided to produce the gun with a plastic front end and eventually an entire plastic rifle stock shortly thereafter. It was not always a smooth transition, but the "Glock" now has become public domain as far as its mechanical/design rights as well.

SUMMARY OF THE INVENTION

[0021] Embodiments of the present invention are a highly developed improvement on this type of "modern action" design where no slide is present and there is no rearward travel, i.e. no piercing of the vertical plane past the hand. This "no over the hand travel" is highly advantageous to the user and allows for a compact form factor which will also allow deployment of the arm as an accessory/backup unit when attached on the underside of such platforms, such as the AR-15 or FN SCAR type.

[0022] According to an aspect of the present invention, a semi-automatic firearm may include: a recoil rod having a recoil spring associated with it, wherein the recoil rod faces in a first direction; a head segment disposed at a first end of the recoil rod, wherein the head segment is configured to be attenuated and propelled forward by the recoil spring; an internal recoil body located at a second end of the recoil rod; a striker guide rod located adjacent the recoil rod and having a striker spring associated with it, wherein the striker guide rod faces in the first direction; a striker attached to the striker rod and configured to be attenuated and propelled forward by the striker spring; and a floating bolt guide rod facing in a second direction opposite to the first direction and located adjacent the recoil rod.

[0023] The floating guide rod may be held in loose association at its end that faces in the second direction. The floating guide rod may further include a safety ring coupled to an end of the floating guide rod. The internal recoil body may be stopped from not traveling beyond the safety ring.

[0024] The striker spring may be configured to attenuate recoil forces. Both the recoil spring and the striker spring may be configured to extend immediately after a bullet is fired. Both the recoil spring and the striker spring may be configured to attenuate the recoil forces resulting from the bullet fired, wherein the recoil spring, the striker spring, the internal recoil body, and the striker may be configured to travel together as one mass. The striker spring may be configured to cease movement upon the striker being captured by a sear, and wherein the masses of the striker spring and the striker separate from the masses of the recoil spring and the internal recoil body. The recoil spring may be coiled around the recoil rod. The striker spring may be coiled around the striker guide rod.

[0025] According to another aspect of the present invention, a method of attenuating recoil forces in a semi-automatic firearm may include: combining the masses of a recoil group and a striker group; capturing the striker group with a sear; stopping travel of the striker group upon capture by the sear; and continuing travel of the recoil group.

[0026] According to another aspect of the present invention a semi-automatic firearm may include: a trigger; a barrel located above the trigger; and a trigger sear located immediately above the trigger and the barrel.

[0027] According to another aspect of the present invention a safety mechanism of a semi-automatic firearm may include: a trigger; and a safety block located immediately above the trigger, wherein the safety block is configured to travel downwards as the trigger travels rearwards.

[0028] The safety mechanism may include reinforcement steps located underneath the safety block, wherein the safety block descends the reinforcement steps as the trigger travels rearwards. The safety block may prohibit the firing of the firearm for a substantial distance of the rearward travel of the trigger.

[0029] According to another aspect of the present invention, a trigger assembly of a semi-automatic firearm may include: a trigger body; and a trigger sear, wherein rearward pressure exerted on the trigger body is converted to linear motion that controls the trigger sear.

[0030] According to another aspect of the present invention, a semi-automatic firearm may include: a barrel; a frame of the semi-automatic firearm; and a trigger body located within a hollow of the frame, and wherein the trigger body is pendant to the barrel.

[0031] The trigger body may be configured to travel rearward to control the firing of the firearm and the frame may be configured to stop the rearward travel of the trigger body.

[0032] According to another aspect of the present invention, a trigger body of a semi-automatic firearm may include triangular shapes that radiate out from the center of the trigger body.

[0033] According to another aspect of the present invention, a semi-automatic firearm may include: a left frame of the semi-automatic firearm; a right frame of the semi-automatic firearm, wherein the left frame and the right frame are coupled to form the body of the firearm; and an ejector located between the left frame and the right frame.

[0034] According to another aspect of the present invention, a reset mechanism for a semi-automatic firearm may include: a trigger sear located beneath the striker and configured to restrain and release the striker; a reset bar located next to the trigger sear and configured to control the upward and downward movement of the trigger sear in order to restrain or release the striker; and a striker timing groove located on the striker, wherein the striker timing groove controls the inward and outward movement of the reset bar.

[0035] According to another aspect of the present invention, a magazine assembly of a semi-automatic firearm may

include: a drum; a square bore channel in the center of the drum; and a lever, part of which is located within the square bore channel.

[0036] The drum may include two surfaces and the drum may provide a new surface for operation of the magazine assembly by rotating the drum on its axis.

[0037] According to another aspect of the present invention, a magazine assembly of a semi-automatic firearm, may include: a magazine retainer; and a plurality of offset ribs located longitudinally along the frame of the magazine retainer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] The patent or application file contains at least one drawing/photograph executed in color. Copies of this patent or patent application publication with color drawing/photograph(s) will be provided by the Office upon request and payment of the necessary fee.

[0039] FIG. **1** is an external view showing a firearm according to an exemplary embodiment of the present invention.

[0040] FIG. **2**A is a view showing a firearm according to an exemplary embodiment of the present invention.

[0041] FIG. **2**B is a view showing a sear and a striker mechanism according to an exemplary embodiment of the present invention.

[0042] FIG. **2**C is a view showing a drop safety mechanism and its reinforcement steps according to an exemplary embodiment of the present invention.

[0043] FIG. **2**D is a view showing a drop safety and a sear mechanism according to an exemplary embodiment of the present invention.

[0044] FIG. **3** is a view showing a trigger apparatus according to an exemplary embodiment of the present invention.

[0045] FIGS. **4**A through **4**E are views showing an internal recoil group and a striker group at various phases of firearm action according to an exemplary embodiment of the present invention.

[0046] FIG. **5** is a view showing a firearm according to an exemplary embodiment of the present invention.

[0047] FIG. **6** is a skewed view showing an interior of a firearm according to an exemplary embodiment of the present invention.

[0048] FIG. **7** is a view showing an interior of a firearm according to an alternative embodiment of the present invention.

[0049] FIGS. **8**A to **8**D are views showing an ejector assembly according to exemplary embodiments of the present invention.

[0050] FIGS. **9**A to **9**C are views showing a reset bar assembly according to an exemplary embodiment of the present invention.

[0051] FIGS. **9**D to **9**F are views showing a firearm body according to an exemplary embodiment of the present invention.

[0052] FIGS. **10** and **11** are views showing charging systems according to exemplary embodiments of the present invention.

[0053] FIG. **12** is a view showing a frame of a charging station according to an exemplary embodiment of the present invention.

[0054] FIG. **13** is a view showing a charging handle according to an exemplary embodiment of the present invention.

[0055] FIG. **14** is a view showing a rail assembly according to an exemplary embodiment of the present invention.

[0056] FIGS. **15** to **17** are views showing a charging handle according to exemplary embodiments of the present invention.

[0057] FIG. **18** is a view showing a pull charging system according to an exemplary embodiment of the present invention.

[0058] FIG. **19** is a view showing a charging system according to an exemplary embodiment of the present invention.

[0059] FIG. **20** is a view showing a charging system according to an exemplary embodiment of the present invention.

[0060] FIG. **21** is a view showing a firing pin assembly according to an exemplary embodiment of the present invention.

[0061] FIG. **22** is a view showing an internal breech bolt according to an exemplary embodiment of the present invention.

[0062] FIGS. **23**A to **23**D are views showing a magazine retention system according to exemplary embodiments of the present invention.

[0063] FIG. **24** is a view showing a magazine holder according to an exemplary embodiment of the present invention.

[0064] FIG. **25** is a view showing a firearm and mounting top according to an exemplary embodiment of the present invention.

[0065] FIG. **26** is a view showing a firearm mounted on a rifle frame according to an exemplary embodiment of the present invention.

[0066] FIG. **27** is a view showing a top view of a firearm according to an exemplary embodiment of the present invention.

[0067] FIG. **28** is various views of a bolt hold back or bolt hold open device.

[0068] FIG. **29** is a side view of the bolt hold back device mounted at the front end of one side of a firearm frame.

[0069] FIG. **30** is a front right perspective view of the bolt hold back device in place on a firearm frame.

[0070] FIG. **31** is a side view of the bolt hold back device in place on an alternate firearm frame.

[0071] FIG. **32** is a front view of the bolt hold back device in place on a firearm frame half.

[0072] FIG. **33** is a side view of the bolt hold back device attached to a finished/assembled firearm.

[0073] FIG. **34** is a front right perspective view of the bolt hold back device attached to a finished/assembled firearm.

[0074] FIG. **35** is a front view of the bolt hold back device attached to a finished/assembled firearm.

[0075] FIG. **36** is a side view of the bolt hold back device attached to a firearm and pivoted to be in the in-use position.

[0076] FIG. **37** is a front left perspective view of the bolt hold back device attached to a firearm and pivoted to be in the in-use position.

[0077] FIG. **38** is a side view of the inside of a firearm half frame showing carbon pockets or anti-fouling recesses.

[0078] FIG. **39** is a side view of the inside of a firearm half frame showing an alternate embodiment of carbon pockets or anti-fouling recesses.

[0079] FIG. **40** is a side view of a mold for a firearm half frame showing the projections that form the carbon pockets or anti-fouling recesses in a frame.

[0080] FIG. **41** is a left side view of a firearm with a higher capacity, forward curving magazine inserted.

[0081] FIG. **42** is a front view of a firearm with the magazine inserted.

[0082] FIG. **43** is a right side view of a firearm with the magazine inserted.

[0083] FIG. **44** is a rear right perspective view of a firearm with the magazine inserted.

[0084] FIG. **45** is a front right perspective view of a firearm with the magazine inserted.

[0085] FIG. **46** is a perspective view of the outer shell of a magazine looking up at the end to be inserted into a firearm.

[0086] FIG. **47** is a perspective view of a magazine separate from a firearm looking up at the end to be inserted into a firearm.

[0087] FIG. **48** is another perspective view of a magazine separate from a firearm looking up at the end to be inserted into a firearm.

[0088] FIG. **49** is a view of the interior of a magazine with the followers removed from the spring drums.

[0089] FIG. **50** is a view of the interior of a magazine with the followers in place in the spring drums.

[0090] FIG. **51** is a close up interior view of a magazine centered on the spring drums.

[0091] FIG. **52** is a view of the spring drums outside of the magazine along with the primary follower.

[0092] FIG. **53** is various views of a magazine shield.

[0093] FIG. **54** is various views of secondary follower.

[0094] FIG. **55** is various views of a magazine spring drum.

[0095] FIG. **56** is a perspective view of an extra ammo storage component of a magazine.

[0096] FIG. **57** is a perspective view of a firearm with an alternate higher capacity, forward curving magazine inserted.

[0097] FIG. **58** is another perspective view of a firearm with the alternate magazine inserted.

[0098] FIG. **59** is a side view of a firearm with the alternate magazine inserted.

[0099] FIG. **60** is a perspective view of an extra ammo storage component of the alternate magazine.

[0100] FIG. **61** is another perspective view of an extra ammo storage component of the alternate magazine.

[0101] FIG. **62** is a front right perspective view of a semiautomatic firearm modified to a single shot firearm.

[0102] FIG. **63** is a rear left perspective view of the semiautomatic firearm modified to a single shot firearm.

[0103] FIG. **64** is a rear right perspective view of the semiautomatic firearm as modified with a portion rotated down and out to show interior details.

[0104] FIG. **65** is a closer view of FIG. **37**.

[0105] FIG. **66** is a side view of an alternate semiautomatic firearm as modified to a single shot firearm.

[0106] FIG. **67** is a rear right perspective view of the alternate semiautomatic firearm as modified to a single shot firearm.

[0107] FIG. **68** is a rear right perspective view of the alternate semiautomatic firearm as modified with a portion rotated down and out to show interior details.

[0108] FIG. **69** is another rear right perspective view of the alternate semiautomatic firearm as modified with a portion rotated down and out to show interior details.

[0109] FIG. **70** is another rear right perspective view of the alternate semiautomatic firearm as modified with the rotated portion only somewhat out of the in-use position.

[0110] FIG. **71** is a top right perspective view of a modification housing.

[0111] FIG. **72** is a rear right perspective view of the modification housing.

[0112] FIG. **73** is a front right perspective view of the modification housing.

[0113] FIG. **74** is a side view of a right half of a firearm frame adapted to receive a modification housing.

[0114] FIG. **75** is an internal side view of a right half of a firearm frame adopted to receive a modification housing.

[0115] FIG. **76** is a left side view of an assembled firearm as modified to a single shot firearm.

[0116] FIG. **77** is various views of a striker lock and trigger lock system.

DETAILED DESCRIPTION

[0117] FIG. **1** shows an external view of a firearm according to one embodiment of the present invention.

[0118] Linear Trigger and Drop Safety Block

[0119] FIG. **2**A is a view showing a firearm according to an exemplary embodiment of the present invention.

[0120] Referring to FIG. **2**A, one feature of this design is the sliding linear bearing (**10**) of the trigger body. Rather than the typical long rotational trigger and complicated trigger bar winding its way around a magazine well (included in the common 1911 trigger, and common in a range of modem firearms), this unique design simply guides all pressure in an efficient forward and back motion.

[0121] The trigger body has two appendages. One is the safety block (**12**) and the other is the trigger sear (**14**). These are arranged in what might be best described as a butterfly wing fashion. It might be helpful to think of it that way, because as you pull the trigger, both of these appendages move like butterfly wings, i.e. they move up and down as you move the trigger back and forth.

[0122] For example, FIG. **2**D shows the positions of the safety block (**12**) and the trigger sear (**14**) after the trigger has been fully pulled (i.e. after a bullet has been fired). As illustrated in FIG. **2**D, both the safety block (**12**) and the trigger sear (**14**) have moved downward in response to the trigger pull. As comparison, FIG. **2**A shows the safety block (**12**) and the trigger sear (**14**) in an upward position while the trigger is unpulled and at a rest position.

[0123] The trigger sear (**14**) (located towards the rear of the trigger) is unique because of its location on top of the trigger. It is in a totally different location than any trigger sear that's been devised in modem firearms today. The forward location of the sear in the gun is specifically on top of the trigger, and additionally on top of the barrel. The long axis gives it very good stability and a more central location for its job, which is to both let go of the striker (**16**) (searing/firing phase), and after a certain point in time (during the recoil phase), recapture the striker (**16**). FIG. **2**B illustrates the recapture of the striker (**16**) by the trigger sear (**14**) at point (**18**).

[0124] The second appendage on the front of the trigger is the safety block (**12**). The safety block (**12**) is unique in this linear trigger because it follows the assembly as you pull the trigger; it continues blocking the path for the striker through about 80% of the trigger travel. In other words, whenever you engage the trigger, should you only pull it half way, and should there be a vibration or a knocking or a jarring to the action and should the striker overcome the sear and slip past it, the striker path will still be blocked by the safety block (**12**). If you choose not to pull the trigger and to allow the trigger to return to the home or stop position, the safety block will follow the cam (**20**) and will return to its home position in the fully up and blocked position as well. It should be noted that

the safety block itself will continue to block the path of the striker channel for nearly all of the trigger travel.

[0125] The safety block (**12**) is important in these kinds of designs of striker fired guns because of the nature of the action. The nature of a striker fired design is that at the end of the loading cycle, the firearm is in a pre-charged condition. Therefore, there is some pressure on the striker urging it to be moved forward to fire, illustrated at location (**22**). It is the trigger pressure or the pulling of the trigger which provides the additional loading (in addition to the pre-load) of the striker spring (**24**), which gives the mass of the striker enough inertia (hitting force) when released to fire the cartridge.

[0126] The safety block (**12**) is acted on when you pull the trigger (**26**). The safety block is moved into and out of position by a camming surface (**28**), and it is the action of this surface on the cam that keeps the safety block in that progressive blocking position (and blocking the channel) (**30**) through about 80% of the trigger travel. This means that you have to intentionally want to pull the trigger to fire the gun.

[0127] The function of the safety block (**12**), when it is activated, is that should the striker (**16**) not be under the control of the sear and consequentially fly forward and try to occupy the striker channel (**30**), the striker (**16**) will be blocked in its path. The striker (**16**) will put pressure on the safety block (**12**) causing the safety block (**12**) to rotate on its axis (**32**) on the pin, and the forward section of the safety block (**34**) will rotate down to a reinforcement step (**36**) that is molded into the frame, thereby providing the striker (**16**) with a hard stop.

[0128] It is this arrangement and the angles of these hard stops which form a staircase like feature in the frame, and by arranging this staircase in such a way that embodiments of the present invention are able. to cover up to nearly the entire trigger stroke to the actual firing, or (as is said in the industry) "searing of the striker", FIG. **2**C shows a close-up view of the reinforcement steps (**36**) underneath the forward section of the safety block (**34**).

[0129] The trigger (**26**) is unique in that the trigger body (**38**) itself moves, and is operated in a linear fashion. In this case, the barrel (**40**) provides the long bearing surface. The trigger does not operate in a rotational fashion for its actuation, so any pressure put on the trigger by the finger is converted into linear motion and not into rotational motion. Conversely, in a modern trigger any rotational force is then converted to linear force by moving a usually complicated trigger bar.

[0130] In this embodiment, the mass of the trigger body itself is given location and a bearing surface via the barrel (**40**). In this design, it doesn't have to be a barrel but could simply be a reinforcement bar. Due to compactness and streamlining of the design, a trigger body that actually hangs and is located off of the barrel, using that very long longitudinal access (**10**) as a way to give support and guidance for the entire trigger assembly, is preferred.

[0131] The shape of the interior part of the trigger, i.e. where the finger goes, is also something that is predicated on an ergonomic design and function of the trigger body as a whole. The rear surface of the trigger body itself, when the trigger is fully deployed or when fully pulled, must have already gone through all of its steps, so there is not unlimited travel in the trigger. The trigger has specific locations for certain activities within the stroke travel of the trigger. Its most rearward surface acts as a stop when in contact with the frame.

[0132] Thus, the trigger is unique because it is located in a hollow of the left and right frame and is pendant to the barrel. The trigger is also unique because it is made out of plastic and is "linear", but without the complicated and fragile "loop" which must wind its way around a typical 1911 magazine. The trigger of the present invention is different because the sear component, formerly located in the rear of a traditional gun of this type, is located on top of the barrel for closer proximity to the striker and related components.

[0133] If the barrel were too large to fit, the trigger could be pendant to a simple tubular or rod shape with such further refinement in the proximity of the barrel so as to allow interrelation of the various components.

[0134] The trigger has a unique shape to do all of its jobs with stability. One feature is the projections of triangular shapes, which radiate out from the center pendant portion. The design could have simply a round shape to follow the contour of the barrel, but the plastic walls would then be thinner. The shape depicted was adopted to give the further benefit of both strength and guidance from the complimentary frame sides and the barrel.

[0135] FIG. **3** is a view showing the trigger body of an exemplary embodiment of the present invention. Referring to FIG. **3**, another feature on the trigger is the incorporated "sear limit stop" or sear rise stop (**50**). Indicated on the top surface, the rear wall of the sear cavity actually provides this stop as measured by its pivot point (**52**) (the securing pin location of the sear). Incorporated into the trigger shape is the cross bolt safety cavity stop as well. It is this efficient design that is able to incorporate so many features and components.

[0136] Another stop surface (**54**) is built at the top front portion and related to the drop safety. This surface (**54**) helps to bottom out the drop safety (**12**).

[0137] The rear and front portions of the trigger serve as the maximum forward and rear limit areas which serve as the "proper stops". The trigger does not rely on the small components to bottom out (which induces stresses), as the trigger body (**38**) is used as the proper motion stop. There exist spring cavities interior to the trigger as well for both the sear and drop safety.

[0138] The spring pressure exerted by the drop safety (**12**) against the associated frame cam actually assists (doubles as) a trigger return spring (i.e. the drop safety has a tendency to move the trigger forward), although the striker spring is chief/principal in serving this function.

[0139] The interior finger portion of the trigger is also configured to specifically aid in the design and strength of the trigger body as a whole. The flat interior rear is the trigger surface (**26**) for actuating the trigger. The largeness of the space is to accommodate gloves or large hands/fingers.

[0140] The trigger's entire profile then assists in keeping it square (bottom, sides, and triangle wings) and directing forces where they are needed (proximate location, sear next to reset bar and striker, drop safety to cam and drop safety "staircase" in frame, and cross bolt safety, etc.) while incorporating many useful components and features usually found distributed one by one elsewhere in a normal firearm. They are concentrated here in embodiments of the present invention while being located forwardly and more ergonomically displaced (comfortably) forward in the design pendant to the barrel.

[0141] Variable Mass Action

[0142] Historically, semi-automatic arms have made use of heavy mass recoil bodies (in the form of heavy metal bolts or

bolt carriers, such as the AK-47, or AR-15 platform) to build inertia for the proper functioning of the action. In these actions, the hammer body contacts the firing pin and to some degree mates to the bolt carrier surface, but resides there only for a fraction of an instant, as it is rotationally related only and is pushed out of the path of the rearward moving bolt by the mass "rolling over" it. Embodiments of the current invention allow the mass of the striker group to live with and travel with the bolt group during many critical functions, and by doing so, increase the mass of the traveling assembly.

[0143] In embodiments of the invention, "variable mass action" ("VMA") reduces the need for physically carrying the mass around (making heavy guns), yet still provides the necessary mass/inertia at the appropriate times for the action mechanism to work successfully, indeed achieving a better balanced mechanism.

[0144] The VMA action is a concept where the action portion of the mechanism is divided into three separately interacting groups of components. The components involved in one exemplary embodiment are shown in FIGS. **4**A through **4**E. However, during certain phases of the action two component groups (the recoil group and the striker group) combine their mass:

[0145] 1. FIG. **4**A shows an embodiment just at detonation, during the high peak pressure moment, where inertia is built. Both the recoil spring (**104**) and the striker spring (**110**) are extended to their maximum length.

[0146] 2. FIG. **4**B shows the combined mass of the recoil group and striker group, with the spring bodies (**104** and **110**) attenuating the recoil force. FIG. **4**B shows the springs **104** and **110** in a condensed state as the two springs work against the recoil force.

[0147] 3. Referring to FIG. **4**C, at this point, and with both masses still combined; cartridge ejection occurs. Note the combined compression of both recoil spring (**104**) and striker spring (**110**).

[0148] 4. Furthermore, in order to provide a full stop to the internal recoil body (**100**) and prevent overtravel, safety ring (**116**) ensures no further movement of the internal recoil body (**100**).

[0149] 5. Referring to FIG. **4**D, the component bodies, the recoil group and the striker group, continue forward together and travel forward together for a certain distance). Furthermore, the combined component groups (i.e. the recoil group and the striker group) pick up speed after coming from a dead stop just after ejection, as discussed above. As shown in FIG. **4**D, both the recoil spring (**104**) and the striker spring (**110**) are simultaneously in a more extended state than what is shown in FIG. **4**C.

[0150] 6. Referring now to FIG. **4**E, due to the timing of the sear, the striker group is caused to separate from the total mass due to the sear catching and restraining the striker group. However, the internal recoil body (**100**) is urged forward to chamber the next cartridge (given some additional help in force by the striker group before it is separated from the recoil group by the sear). Having begun to strip/load the next cartridge, the internal recoil body (**100**) then comes to full rest against the barrel face (specifically against the monoblock plate (**118**)) where the necessary head space is created by a relief cut in the internal recoil body (**100**) for the newly chambered cartridge to live. As shown in FIG. **4**E, the striker spring (**110**) has ceased to extend, as caused by the sear, while the recoil spring (**104**) continues to extend towards its default position.

[0151] As shown in FIGS. **4**A to **4**E, the end opposite of the internal recoil body (**100**) of the recoil rod (**102**) includes an enlarged head segment. It is against this head segment that the recoil spring (**104**) is located. As described above, the recoil spring (**104**) functions to attenuate and propel this head segment during normal operation of the firearm according to embodiments of the present invention.

[0152] Recoil Group

[0153] FIG. **5** shows a side view of an embodiment of the present invention. Referring to FIG. **5**, the first group is composed of an internal recoil body (**100**) which is tensioned by two recoil rods (**102**) (threadibly located by screws from the rear) and recoil/loading springs (**104**) and a unique orientation of a novel "floating bolt guide rod" (**106**). The internal recoil body (**100**) performs all the functions of loading and extraction and acts as the breech face against which the recoil forces are to be placed.

[0154] The floating bolt guide rod (**106**) is unique because it faces rearward and is held in a backwards facing condition. This backwards facing condition means that the head of the rod is secured by an insertable breech plate (**118**). The head is located at the approximate center of the gun and the rod is held in a floating manner (i.e. loose association) with the breech plate for a very intentional reason.

[0155] 1. First, the backward facing guide rod (**106**) is facing to the rear of the firearm so that as the gun is in its recoil phase, it develops so much tension that it is important for those forces that build up to be released or allowed to roll off the rod by having the rod end basically unsupported. By having the guide rod (**106**) face in a rearward fashion, (i.e. not supported) this allows the recoil forces to "slip off the rod end" and not be "captured" by any rearward wall or abutment.

[0156] 2. Additionally, the backwards facing guide rod (**106**) gives guidance to the rear portion of the striker group, whereby it facilitates the firing pin to fire the cartridge and ensures proper alignment for the various functions.

[0157] The result is a remarkably balanced and smoothly felt recoil.

[0158] 3. And, when the internal recoil body (**100**) is in battery (i.e. forward and ready to fire), the backwards facing guide rod is able to hold both the recoil group and the striker group in a correctly supported fashion for proper alignment.

[0159] Striker Group

[0160] The second group is composed of the striker (**108**), striker spring (**110**), striker guide rod (**112**) and striker guide rod block (**114**). This component group is slidably engaged on top of the recoil group by virtue of the fact that it rests and is guided by two guide rods, one of which is the striker spring guide rod (**112**) (located on top), which includes the striker spring (**110**), and the other of which is the floating bolt guide rod, located and projecting from the rear (which also guides the internal recoil body).

[0161] The striker group is served by a coiled striker spring (**110**) which;

[0162] 1. Is the sole spring which urges the striker forward to fire in the one instance.

[0163] 2. provides the sole necessary trigger tension against which you pull the trigger to sear the mechanism; and

[0164] 3. is the spring which (when the masses join in recoil) is recruited (compressed) to help attenuate recoil (only the present invention has developed this ability in this mechanism).

[0165] Both groups of the action are kept in orientation by using the backward facing guide rod (**106**). The backward

facing guide rod also incorporates an over limit stop at its furthest end in the form of a simple ring (**116**).

[0166] Linear Trigger Sear and Drop Safety

[0167] The function of this is covered in another section. It is this group which brings the striker group to the necessary sear compression to fire, and which captures and separates both the striker group and the internal recoil group at the critical moment of re-engagement or capture and eventual relaxing of the linear trigger components to a rest (reset) position.

[0168] FIG. **6** shows a different perspective of the embodiment of the invention. The monoblock plate (**118**) serves the following specific functions:

[0169] 1. Barrel Location Monoblock (**120**).

[0170] Here, the rear surface has a relief cut to accept the head of the barrel and functions to provide a known and repeatable location for the chamber end of the barrel and related components in a plastic shell or unibody firearm body. The barrel is timed with a flat to further seat in a "keyway" for additional location and orientation and the distal end is held and brought to tension (headspace for recoil body) by the firm seating of a barrel nut. In this embodiment, a small wrench is provided with pin holes timed to those of the barrel nut.

[0171] 2. Recoil Force Bearing Surface (**122**) (Spring Location and General Guidance Of Recoil Rods)

[0172] Here, the plate's forward surface serves as a barrier where the spring load may be concentrated, and allows the recoil rods to pass through, while compressing the springs, as the recoil body is propelled rearward.

[0173] 3. Location for Floating Guide Rod (**124**)

[0174] Here, the plate's forward face has a location for the capture of the backward facing guide rod. This location is closely thought to be located in the approximate center of the gun. This balance point helps to keep the action running smoothly in this confined space.

[0175] 4. Frame Reinforcement and Method of Securing Shells

[0176] Here, the job of frame reinforcement is handled simply by the nature of the material (steel), to give increased strength to a plastic body. The frame reinforcement may be simply inserted at time of assembly, and there is no requirement for over molding. In embodiments of the present invention, over molding should not be needed as the gun hemispheres are arranged in halves and not as a fully integrated assembly like a lower unit, such as Glock et. al. The concept of this plate also allows the shells (left and right) to be physically attached by a simple screw method to the base plate and helps to reinforce the frame.

[0177] FIG. **7** shows an embodiment of the present invention with an alternative design for variable mass recoil. This alternative embodiment still uses the three springs, two recoil springs (**150**) and one striker spring (**152**), with the striker spring still performing the same functions as described above. However, the location of the springs has been switched to the rear of the firearm and is more in line with the striker firing pin. This arrangement, while not practical in a pistol design (no over the hand travel), is beneficial for a rifle design.

[0178] Note that securing screws are turned backwards as well, but that all three rods now face backwards and that there is a simple block (**154**) to absorb the various tensions at different times, as this is still an embodiment of the variable mass action.

[0179] Also, you can see that in this example, both the trigger (**156**) and striker (**158**) have been largely pushed away up ahead, yet are still able to function as desired. This has many advantages.

[0180] Ejector Placement

[0181] FIGS. **8**A-**8**D show an exemplary embodiment of the present invention featuring an embodiment of the ejector component. Referring to FIG. **8**A, novel to this design is the clam shell placement of the ejector (**200**) between the two halves (**202** and **204**), as illustrated in FIGS. **8**B and **8**C, of the shell frame.

[0182] As shown in FIG. **8**B, a viable method of alternate installation of a simple slot (**206**) biased to be in one frame is possible, but due to the collapsing potential of the thin wall section neighboring that simple slot in FIG. **8**B, the preferred embodiment is to incorporate the simple slot into an entire frame section, as shown in FIG. **8**C.

[0183] The method of retention in the frame is accomplished by a simple transverse pin (**208**), as shown in FIG. **8**A. The transverse pin (**208**) is made to be rigid within the frame, with a secondary retention positioned forward and provided by a simple threaded screw (**210**), which provides location for the ejector and the necessary closing force to close up the left and right frame sections.

[0184] Installation and Removal of Barrel

[0185] The barrel is blocked by the natural position of the ejector within the frame sections. Note ejector (**200**) blocking the end (**212**) of the barrel in FIG. **8**A. Also note how ejector (**200**) rotates in FIG. **8**D and note how the barrel position changes.

[0186] Rotation for Clearance of Pathway, Installation/Removal of Barrel.

[0187] Referring to FIG. **8**D, a novel purpose for the use of the forwardly mounted screw (**210**) is that for barrel installation or removal, simple removal of the screw will allow the ejector (**200**) to rotate on its axis to a rearward facing attitude onto surface (**214**) such that the pathway is clear from the monoblock (**216**) for the insertion and/or removal of the barrel (**212**).

[0188] Reset Bar

[0189] The reset bar and its operation are illustrated in FIGS. **9**A to **9**F.

[0190] The sear (**250**) pivots at (**252**) and is limited in its pivot at (**254**) on the trigger body (**256**). The sear (**250**) interacts with the reset bar (**266**), which is held in the frame. The reset bar is a highly developed spring which acts as a cam for the driving of the sear, down and away from the striker (**260**). The cam (**262**), which when the trigger body (**256**) is moved rearward, drives the sear end (**264**) into the cam channel (**258**) and guides the sear (**250**) down so that the striker can pass over it and fire the cartridge(s).

[0191] The reset bar, as its name implies, also has a second job which allows the sear (**250**) to pop up (reset) at a certain point in time during the recoil phase (or during the charging phase) of the mechanism in order to recapture the striker and hold it in a pre-charged condition during normal operation. This timing can be seen in FIG. **9**A at locations **268**, **270**, **272**, and **274**. The protrusion (**276**) follows a striker timing groove described by the bold line in FIG. **9**A. This striker timing groove moves with the striker body (it is novel to position this on the striker body, as the present invention has no slide) and drives the head or protrusion (**276**) of the reset bar. At location **268**, the reset bar controls the sear to restrain the striker. At location **270**, the reset bar drives the sear downwards to

release the striker. At location **272**, the reset bar controls the sear to maintain its downward position. And finally at location **274**, the reset bar drives the sear upwards to recapture the striker.

[0192] FIGS. **9**D and **9**E show how the reset bar location is carefully designed for support at **278**, **280**, **282**, and **284**. The embodiment illustrated uses the right hand frame, but flexibility of the design will allow attachment to the left side wall or to the top or bottom if desired (obviously the other components will adjust to this new position if wished). Its location and surrounding support walls (**278**, **280**, **282**, and **284**) support the reset bar through its entire motion and specific jobs.

[0193] The stem of the reset bar (**286**) is rigidly held at location (**278**) and bent at particular angle (**288**), which helps to locate the bar in the frame. With the elbow of the reset bar (**290**) allowed to sit on a specific plane, the plane is recessed in a groove at location (**280**) with a support head wall at (**292**, **294**, and **296**) and the groove is tapered inwardly at location (**284**) to provide a safe clearance to allow the entire head to flex past the plane described by **280**. Notice the compound angle at (**298**).

[0194] The reset bar's protrusion (**276**) traces all along, and is in communication with at all times, the striker timing groove (the bold line in FIG. **9**A). The striker has a timed groove (**268**, **270**, **272**, and **274**) in which the reset bar runs. In fact, it is the striker that allows the reset bar to open and close to do the job to reset it (the striker), and the sear is what stops the striker from moving past its particular return condition during the automatic operation of the mechanism.

[0195] This "operation" is common for many Glock style firearms however the placement and arrangement of the parts is simpler in this embodiment, and in fact this embodiment eliminates the sensitive and vulnerable coil spring which is the "weak link" in the other widely used systems. That small coil spring is a biasing member in the rear of the frame chassis (Glock, Ruger, Smith and Wesson et al.) which helps the trigger and complex trigger bar to move.

[0196] Embodiments of the present invention are also different in the fact that the striker mechanism has the timing groove not in the slide component, as is so common in a variety of other striker fired systems, but integrated into the striker itself. Due to the fact that it is without a slide and due to the unique engineered nylon plastic shell and arrangement of parts, it is able to enclose the mechanism in this way with no "over the hand travel" in a small working space.

[0197] Charging System.

[0198] Here it should be understood that embodiments of the present invention can in fact interchange their charging systems. The displayed version shown in FIG. **10** is Version 1.0 and the image shown in FIG. **11** is Version 2.0, but both share an ability to trade out the charging systems.

[0199] Simple removal of screws of the left frame and charging rod will allow removal, while replacement with the Version 2.0 frame left side onto the Version 1.0 frame right side will allow a different and new charging system to be used. In embodiments of the present invention, the right half of the frame holds the necessary components of the gun made at factory, while the left side of the frame can be removed from the right half and replaced with a left frame that contains a different feature. The result is a gun that is versatile due to its ease of upgradability, and a gun that allows various third party companies to manufacture a left frame (i.e. the upgraded component) for the gun.

[0200] All that need accompany the changeover is the new recoil rope, Pope hat with spring, special rope with plastic molded ends, and the handle and cover.

[0201] FIG. **12** shows the Version 2.0 left frame, without cover, rope, handle, or Pope hat, etc.

[0202] The slot in the frame is graduated to assist in camming the rope and the rearward portion has a defined rolled over edge to protect the rope in its most extreme position. The raised platforms for inserts can also be seen in FIG. **12**, as the raised portions, or islands, are for locating the cover and the provisions for screw nuts for clamping the cover to the left frame.

[0203] For operation of the Version 2.0 charging system, there is a dyneema rope fixed at each end that is of a precise length. The rope has its end inserted into a hole. The free end is bent double and passed through another hole parallel to the first, thereby having it turn a corner to prevent slippage. The free end is then traced out through the Pope hat with spring already attached; the free end is then passed back through the charging hole and out the side provision. Some free rope will slacken here once the Pope hat seats on top of the recoil rod. Then the free end is passed through a provision in the handle and laced around until the absolute free end finally is rigidly held in a provided close tolerance hole across the thickness of the handle, with all other passing of the rope having a corner on which to disperse the load. The issue then is to center the handle and pass the cover over the handle and into position for securing.

[0204] It should be noted that FIG. **13** shows yet another style of charging system possible with embodiments of the present invention.

[0205] FIG. **13** shows a non-reciprocal charging handle of a different design which also shows a blue hold back button. The slide rails are interrupted to allow the button to be inserted, then, once on the rails, the guide rod can be inserted to keep the button from dislocating.

[0206] Shown in FIG. **14** are the special interrupted rails where a protrusion or boss is inserted, which allow the button to get close to the rail section. The rail section is interrupted and allows the button rails to engage, then, with small pressure forward, the button finally seats on the rails. As stated before, there are guide rods which run through the bosses on the buttons which then keep the buttons retained even if they should cross into open rail sections; the maximum compression distance of the action actually prevents this occurrence.

[0207] FIGS. **15**, **16**, and **17** show dual non-reciprocal charging handles. They are swappable for bolt hold back, left for right, etc.

[0208] FIG. **18** shows a basic system of a pull charging system where the handle is non-reciprocal in nature and stores into a slot in the frame. FIG. **19** shows a final working concept with the handle now contained within a frame, and the face plate secured to the side by screws.

[0209] As shown in FIG. **20**, the charging system may include several components: Pope hat and spring, the charging handle with allowance for rope slot, and a method of lacing the rope thru the handle to secure it. (See provision in frame and corresponding slot in handle.) By being secured to a fixed point inside the gun, embodiments of the present invention are able to utilize a labor saving ratio in charging using this fulcrum of the Pope hat on top of the recoil rod. The extra spring tension to the Pope spring is able to enliven the handle and cause it to spring rotate home even during firing.

[0210] The gun is charged by a swift motion rearwards of the handle (**450**) to actuate the mechanism.

[0211] Provision for a chamber check rod on right side can even be seen at this stage.

[0212] The striker of various embodiments of the present invention is very unique in design. When compared to a modern Glock type, the difference is noticeable, characterized by the inclusion of the timing groove which communicates with the reset bar (all others have this feature attached to the slide) that is actually part of the functioning of the striker.

[0213] First, the striker was fashioned with the addition of a timing reset groove.

[0214] Second, the striker spring was relocated to the top of the striker but guided by a long rod, instead of a two part plastic guide collar.

[0215] Third, the drop safety was moved to the trigger instead of as part of the slide. Fourth, the extractor was done away with due to the nature of the design of embodiments of the present invention.

[0216] In addition, embodiments of the present invention do away with the tiny coil reset trigger spring.

[0217] Additionally, the striker design is heaviest toward the rear. It is weighted toward the rear in order to assist in carrying through the pressure of the strike.

[0218] Also, the striker is part of the recoil system in that its mass and related spring tension join with the mass and recoil spring bodies to attenuate and distribute recoil at a certain time, and so the masses vary depending upon where the mechanism is in cycle.

[0219] The timing groove is seen in FIG. **21**. Also, it is important to note, the change in the orientation of the firing pin to a decidedly left or 3 o'clock position. This is for two reasons, one for discharge of the rimfire casing, to actually hit more rim and more chance of proper detonation, and second to aid in ejection. As the firing pin is rotated in this attitude its surface protrudes and encourages the shell to leave with a slight beginning push horizontally to the right (i.e. toward the ejection window).

[0220] Internal Functioning Composite Molded Recoil Body

[0221] The present invention relates to a novel internal reciprocating "internal recoil body" where it reciprocates internally within a given space or volume. This invention presents a novel and unique way of achieving the functions and maintaining the mass/volume and weight balance needed for basic operation, while allowing significant cost reduction and increase in high quality molded volume production.

[0222] While it is well known in the art of firearms that all internal bolts in firearms like the UZI or AR-15, AK-47/HK-91-94, FN SCAR Types have been made of steel, the present invention relates to a novel design in a compact pistol or rifle with no over the hand travel made in a polymer. This design has no slide. Moreover, the replacement of the internally reciprocating steel bolts with polymer is a real solution for cost reduction.

[0223] An internal breech bolt design, like various embodiments of the present invention, can also have a steel or stamped face plate which, through a special design, is mechanically interlocked with a normal or moderate "high gravity" nylon compound to effectively replace the machined stock of the bolt while maintaining ballast weight of the former steel. The interlocked plates, as shown in FIG. **22** can vary in size and one plate can wrap its arm around another to secure both as well. The plates allow the striker nose to fire the cartridge, with the plates being differently sized to accommodate the cartridge relief without having to machine it.

[0224] This mechanical lock can be achieved in alternative ways. The interlock can be overmolded to securely bond the plastic matrix to the steel by designing a series of projections or arms which are positioned in such a way as to allow the plastic to flow and be captured from all torsional directions. Alternatively, those same plates could have the arms removed and a series of close tolerance rivets simply driven or secured through by ultrasonic welding or over molding.

[0225] The "G" forces being applied are such that any attempt to simply apply a face without further ensuring its attachment would soon see that face parted from the recoil body. One aspect of embodiments of the present invention's internal recoil body is to keep those pieces bonded in a permanent way, thereby bypassing the normal machine form solid route all other designs to date had to follow for such internal components. Thus, this invention has no external moving component such as a slide and it only moves within a given volume, which does not break out over the hand. Therefore, embodiments of the present invention have no over the hand travel.

[0226] Embodiments of the present invention use a very highly designed plastic as, the internal recoil body. This design of firearm also has no extractor or ejector as is usually found in firearms. The ejector is part of the magazine design and, as such, any inclusion of an ejector in the gun is redundant. The nature of this gun is a true blow black mechanism, where the expelling gases and recoil forces do the work to extract any cartridge. A normal extractor found in any gun of today is simply there to remove a live or dud round, which can, in embodiments of the invention, be accomplished by the use of one's own finger if it does not fall out by itself. There is much excess room due to the large size of the magazine cavity, along with ample room to work with a simple tool. Thus, embodiments of the invention may have no extractor.

[0227] The recoil body is kept under tension by the dual recoil springs. It is pretensioned by the securing screws of the recoil rods through either side of the bolt body.

[0228] The springs are tensioned because they mount up on the face of the barrel support on the monoblock.

[0229] The diamond shape head of the over molded recoil rods are simple shapes to fit the space and other designs could be chosen.

[0230] An alternative method of providing a breech face surface is to use steel as part of the design. This particular embodiment may use inserted pins to locate plates.

[0231] Highly Compact Magazine Retention System.

[0232] FIG. **23**A shows the basic parts: existing magazine (**350**) retained by the spring (**352**) loaded drum (**354**) and a lever (**356**) pivoting on (**358**).

[0233] This embodiment is a highly compact solution which reorganizes and redesigns the parts while maintaining full-functioning and multiple wear surfaces.

[0234] Referring to FIGS. **23**B to **23**D, this embodiment provides a novel thru square bore channel (**360**) in the center of the compact drum (**354**), and a lever/fulcrum combination (**356**) to fit in the compact space needed.

[0235] Due to the constant wear of the magazine locating pin (**366**) on the drum, embodiments of the present invention provide a novel solution to provide a new surface by simply rotating the drum on its axis. After one surface has been sufficiently worn, a user can simply turn the drum to replace the old surface with a new one.

[0236] In the exemplary embodiment, there are two surfaces (**368** and **370**) due to one central channel. However, one could broach two intersecting channels to provide four wear surfaces.

[0237] An additional feature is that the tension spring (**352**) is on the inside of the drum and protected or sealed by the drum, contrary to the existing Ruger design of a spring located around the drum with the lever then extended far to the rear of the action.

[0238] Mounted Tops

[0239] Embodiments of the present invention may include a mounted top secured by the way provisions made beneath the standard top. In this embodiment, the top is a standard pica tinny rail for mounting accessories to the gun. The rail may be the Universal Special Rail (USR) to allow the ZIP to become an accessory on a larger platform. Legal to perform the attachment (as an SBR short barreled rifle) with filing of proper paperwork.

[0240] Embodiments of the present invention may have eight mounting positions (referring literally to the eight insert provisions) for the interchangeable tops for the securing of the various tops for accessories, or to become an accessory itself to a larger weapon system. The standard top does not use these mounting points.

[0241] A top cover for the gun may be provided in various embodiments of the present invention that is able to perform one or more of eight jobs.

[0242] 1. Provide a closure to the gun interior—removal and installation without tools. Protects from dirt, etc.

[0243] 2. Provide a multiplicity of different tops—exchangeable for various applications.

[0244] 3. Provide sights on one continuous plane—maintaining sight relationship.

[0245] 4. Provide Fire Control Indicator—Triangle shape which allows viewer to know the charged status of the striker.

[0246] 5. Provide secure wrench storage for takedown tool.

[0247] 6. Provide an integral wrench for securing the barrel/barrel nut.

[0248] 7. Is retained in position by use of the body of such top cover becoming a spring for retaining itself, two parallel cuts are found to "enliven" the material with a provision for securing the top in the frame and finger relief to frame to allow such easy access.

[0249] 8. The ease of removal allows access for re-strike capability where the user has gained a no tools entrance to the striker, manually recocks the gun and replaces the cover, or alternatively, the re-strike rod can be actuated to perform the re-cocking if the strike to any faulty cartridge does not detonate after the first hit from the striker. This use of the re-strike rod may allow for unlimited re-strikes without need to touch the cartridge or magazine, and the length of the restrike rod is such that its proper use will not cause double feeding when trying to restrike:

[0250] Barrel

[0251] In embodiments of the present invention, the barrel may be fitted with a barrel nut. There may be double flats on the chamber far end, which are both used to torque on this piece to the metal liner via threads and to indicate the alignment in the frame via a bulkhead monoblock support (barrel support) so when tensioned in the frame, the barrel will not slip free when the barrel nut is made secure using the top cover, which has this provision inlet into its underside.

[0252] Embodiments of the invention may include a barrel having a chamber end, a metal bore liner, a special undercut for better cross-sectional purchase of the thread and then the metal liner fully exposed back to the normal diameter.

[0253] Embodiments of the invention may include an abutment of the chamber nut, metal liner, and the plastic over mold. Here, the plastic abutment enlarges the barrel diameter (from the economic barrel liner) so that the trigger may more securely trace back and forth using the plastic as a smooth bearing surface.

[0254] This embodiment includes a "pocket or relief" taken from the liner and given to the plastic feature to embolden thread.

[0255] The beneficial thickness supports the thread and the relief wall (forward and rear) gives the thread its own bulkhead against stripping. It should also be understood that all along the periphery of the barrel liner may be varied knurled surfaces appropriate for the plastic surface to grab and hold the plastic from twisting, both on the uniform surface and in the relief notch.

[0256] The normal placement of the barrel in the steel barrel supports the mono block, with backwards facing pin, and trigger in front and pendant on the barrel.

[0257] While the thread is normally used to secure barrel to frame, provisions may be made for an adapter with its own thread to attach yet more functionality to a gun. For example, a gun with suppressor attached.

[0258] Fire Control Indicator ("FCI")

[0259] Various embodiments of the present invention may incorporate an ability for the mechanism to keep a constant status of the striker regarding whether it is charged or not. The red indicator is the actual top of the striker in a certain (precharged) condition to allow users to be immediately apprised of control status. The gun can be charged and not loaded. This FCI could be "glow in the dark" paint or use a tritium capsule normally used for sights.

[0260] Magazine Stability Ribs

[0261] FIG. **24** shows a good view of the magazine stability ribs or projections (**400**). These projections could be developed into a solid surface, but when working in plastic it is important to remain uniformly as thin as practical due to warping and shrink, and so this method of using distinct rails is akin to coring. However, it should be understood that the benefit from the offset ribs related to improved magazine function on the left frame could also be accomplished by enlarging the magazine itself (left wall), thereby gaining the rigidity accomplished by the frame ribs.

[0262] Referring to FIG. **24**, the solution of embodiments of the invention to the alignment problem with the Ruger magazine was a matter of placing a prejudice of stability toward the ejection side of the gun. That is, a series of surfaces are built up shoving the magazine into a position to better ensure the ejection of various ammunitions, without having to consider any height issue. The issue is not one of height but of the Ruger design being allowed to turn on its axis and thereby defeat its own built-in ejector.

[0263] These reinforcements on the left frame not only provide coring to the design to eliminate unnecessary plastic cross-section, but also increase strength in the area.

[0264] Mounting to Other Frames

[0265] Various embodiments of the present invention may have the additional ability to be used for different applications. For example, the gun can itself be mounted to any suitable object such as a rifle platform with picatinny rail. FIG. **25** shows a gun according to an embodiment of the present invention with the picatinny mounting rail located on

top of the gun. FIG. **26** shows a gun according to an embodiment of the present invention that is mounted onto a rifle platform.

[0266] Cleaning

[0267] Formerly, many guns had a rod in the front of the rifle for cleaning, but never was this rod an actual piece of the workings of the whole. Consequently, many rifles are found without rods. In embodiments of the present invention, the safety of the device turns into the headspace gage, and certain rods which are part of the functional gun, such as the striker rod and the backwards facing pin, actually can be used as a cleaning kit. Embodiments of the present invention are therefore unique in that they can store these extra uses of the components while they act to drive the gun.

[0268] Embodiments of the present invention are also able to maintain the cleanliness of certain parts of the firearm. Specifically, the trigger group remain clean due to its location being forward of the barrel chamber and sealed off from most or all of the firing gasses.

[0269] Furthermore, embodiments of the present invention allow for certain major components to be cleaned without full disassembly of the gun. These components may include the barrel, the striker components, and the recoil components among other major parts of the gun.

[0270] Cross Bolt Safety

[0271] In embodiments of the present invention, the cross bolt safety acts as a functional gage to determine the headspace on the internal recoil body which can indicate to a user whether it is time to replace the internal recoil body.

[0272] Maintenance

[0273] In embodiments of the present invention, the gun can be kept in factory new condition with the periodic replacement of a few components of the gun. These components may include the recoil and striker springs and the internal recoil body. In embodiments, it may only be necessary to replace these few components to ensure unlimited service life of the gun.

[0274] Load and Restrike

[0275] In embodiments of the present invention, the gun includes a load rod for charging the striker and for loading the gun. Furthermore, the gun may include a restrike rod for recharging the striker should a round fail to fire. A user need simply depress the load rod or the restrike rod until a certain point to perform these functions. Both rods may also be utilized to de-cock the striker and to perform a chamber check to see how many rounds are left in the barrel or at the top of the magazine. FIG. **27** shows the load rod (**450**) and the restrike rod (**452**). The load rod and the restrike rod may have the capability to be switched so as to be ambidextrous.

[0276] In the context of a compact semi-automatic firearm, described in detail above, further developments are described below. These developments can be used with the firearms as described above, or may be used with other firearms as appropriate. The above discussion provides detailed background information on one or more contexts in which the present developments could find utility.

[0277] The bolt hold back **1010** (see FIG. **28**) is an external attachment on a firearm frame **1012** where an action rod **1014** is intercepted by a certain face **1016** of that attachment. It is user deployed. The bolt hold back is pivotally or rotatably attached to the front upper corner of the firearm frame. When not in use, it rests against the frame as shown in FIGS. **29-35**. In this position, it does not block or impede the movement of the action rod. When deployed by the user, it rotates so that its back surface **1016** catches the action rod and holds it in place, thereby holding the bolt of the firearm in an open position. The use position is shown in FIGS. **36** and **37**.

Anti-Fouling Recesses

[0278] An improvement to the firearm design was made where anti-fouling recesses or "Carbon Pockets" **1050** were introduced to perform two jobs:

[0279] To clean away residue carbon to prevent fouling in the main channel surfaces.

[0280] To act as more coring support to deflect plastic away from collapse and provide more stable structure.

[0281] The recesses or pockets can be a variety of shapes (see FIGS. **38** and **39**), and are preferably molded into the side frame of the firearm. (see FIG. **40**.)

Higher Capacity Magazine

[0282] An increased capacity magazine was developed that is an improvement on Rugers BX-25 design. It is a 2 spring in-line design. It is not an "inner wound" design since the "race track concept" means each spring has a different rate, but a 2 spring system where each distal end is secured at the same point, and the spooling effect is allowed to self adjust with an independent second drum spool and follower. Each spring is independent. Both can have different rates of travel self adjust. Two followers are used. Prior designs are dependent or attached to a main carrier. The design shown in FIGS. **41-61** is novel and helps to encourage a better force engagement, like independent front suspension in a car. Both drum axles or wheels do not touch so as to remain as friction free as possible.

[0283] Additionally, the design has a component attached to the outside which helps to "cancel the slop" or movement of the improved BX-**25** magazine when seated in any Ruger 10/22 type or ZiP 22 type of magazine well design. This outer shell is affixed to the users own magazine and includes provisions for extra ammo storage. While the internal upgrade reduces the ammo capacity to 20 or so by design, it adds 10 to the "external storage" thereby providing 30 cartridges at the users disposal. There is thought of offering as well a 10 shot stripper clip which can "side saddle" the main attachment which would increase the total to 40.

[0284] Ruger makes a "BX-25X2" or BX-50 with which a user would need 2 of the present kits and to which two of the "slop cancelers" would be affixed. Here too, 2 additional 10 round storage clips could be affixed bringing the total to 20+20+10+10+10+10=80

[0285] The reduction in capacity from 25 to perform the internal upgrade could really only be a loss of 2 rounds=23 total, but marketing and a sense of keeping the load quantity a standard number- and ensuring enough residual spring pressure for the proper operation meant specially increasing the size of the "ZiP Feed Control" taking up the space for #23, #22, and #21. The secondary follower is merely larger in size to take up the space needed to reduce the magazine capacity to a standard number.

Single Shot Conversion

[0286] A modified housing turns a firearm into a single shot pistol of multiple calibers, (22 Long Rifle and 22 Magnum) with few components where the user can simply swap certain

key components (left frame for example) and arrive at a new weapon with different function (i.e. not semi-automatic.) See FIGS. **62-76**.

[0287] Due to California Law, this is the preferred way to enter the market there, where most will buy the single shot version and buy the conversion kit to further adapt it to semi auto capability. The kit would sell in an unrestricted manner since it does not represent a "firearm" as such, and in CA users are still allowed to do their own "gunsmithing"

[0288] Usually in firearms, the ability to swap calibers is not new, but to change the "character" from semiautomatic to single shot is new, and also combining that with change of calibers as well is new.

[0289] The change of duties within the firearm is also novel. Where the prior "load rod function" now changes to become an extractor. Where the "re-strike rod function" becomes the way in which the user initially charges the striker and performs a novel locking closed of the action after firing. So that one must "charge the striker" to remove it from this forward locking position, to a position which will allow a novel clamping door to be unclamped and the entire breach to be rotated away from the action to expose the chamber. The left frame can be replaced for such upgrade or further adaptability. The rotating breach has a relationship in "head space" with the barrel such that to change calibers only the barrel needs replacing. The breech block having the capacity to accept multiple head spaces due to the chamber relationship, which in the case of 22 MAGNUM is recessed to achieve the proper "normal headspace" of the previous cartridge.

[0290] Where the mag drum in firearm now (not required to hold a magazine) now performs as a rotational bearing and in addition a "retarded lock" head shape to use the spring force engagement to further secure the rotating breach into battery. The same striker is used. The rotating breach has a driven off axis segment that prevents accidental firing of the striker while the breach is OPEN, and where even when progressively closing still performs this blockage until such time as at least one lock can engage automatically (Mag Drum Retarded Lock).

[0291] The same barrel installation and removal are maintained. A variety of muzzle devices can be employed due to the extended length of the intended high performance barrels.

[0292] It was not possible until now, in conventional designs where there is a slide and frame body mounted one on top of the other, to convert a semi-automatic to a single shot

[0293] In the present design, because of the 2 part split down the center configuration, the previously filed firearm design was afforded certain flexibility in design stream and future use.

[0294] The single shot conversion is just such an example. Simple swap out of the "left half" of the frame has allowed the former semi-automatic design to be converted to a single shot design with the action rods performing different duties and where the cycling block (recoil body) is replaced with a rotating breech block which engages several locking features to close the action for firing.

[0295] The former mag release for the magazine is now a performing tension bearing surface and retarded lock. By pushing in the same manner, it can allow the rotating block to being open and when closed the former mag drum is now a biased or retarded locking surface which is one of three locking surfaces of the design.

[0296] The other two are the lock door top jam feature (interior pressure-frame) and an under lever engaged by pressure from the outside by simple surface snapping into an engage able slot or surface.

Other Developments

[0297] ZiP 9/mm.

[0298] A unique construction where the usual pistol components are missing/rearranged and or replaced in the "ZiP Concept".

[0299] Slide-Less Automatics

[0300] A recoiling system where the main recoil spring in a pistol is wound around the barrel and is of such tension that the charging group is temporarily disconnected to be easily charged, whereby upon return the charging system automatically locks itself to the main recoil system ready for discharge.

[0301] ZiP Ghost.

[0302] A unique concept where we have molded the principle frame/components in "Glow in the Dark" material—where finding it in a camping or low light environment would be easier.

[0303] ZiP Striker Lock and Trigger Lock.

[0304] The new ZiP-Action has a striker lock/trigger lock position.

[0305] ZiP must be in an uncharged condition, if not the operator or user should perform a de-cock procedure. (Remove mag and make certain that the ZiP barrel chamber is empty). See FIG. **77**. The trigger group has a natural tendency to want to move forward and occupy the space left by the nose of the striker due to the cam action of the safety block and spring.

[0306] In the event that the operator does not fully charge (sear does not engage striker) as in the pre-charged phase, or the ZiP operator wishes to lock the ZiP . . . the trigger group will move forward (as charging is happening) and upon "short stroke" (or intent to lock) "short release" of either rod, the striker nose will recess into a special slot **1100** in the safety block. This recess lock is shaped in such a way as to not allow the striker to move further forward or the trigger to move rearward due to the striker nose now acting as a shelf preventing normal cam rotation. (The operator should make certain the ZiP barrel chamber is empty.) Procedure: test by compressing either rod about half way—seeing that the trigger has moved to its forward position—release the rod slowly—then try to pull the trigger. This test ensures that the striker nose is locked when it enters the block (should the operator want to lock the ZiP or happen to "short charge" the action) and that the trigger cannot move. If desired, the cross bolt safety can also be engaged for additional security.

[0307] As shown in FIG. **77**, the striker is locked by the drop safety. Trigger pull is then not possible. To restore function, the operator simply uses the Load/Restrike rod to reset the striker and enliven action.

[0308] Thus, while certain preferred embodiments of the present invention have been disclosed and described herein for purposes of illustration and not for purposes of limitation, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A semi-automatic firearm apparatus, comprising:

a recoil rod having a recoil spring associated with it, wherein the recoil rod faces in a first direction and projects outwardly from the semi-automatic firearm apparatus; and

a hold back member connected to the semi-automatic firearm apparatus and movable between a first position where it does not block the movement of the recoil rod and a second position where it does block the movement of the recoil rod.

2. A semi-automatic firearm apparatus according to claim **1** wherein the hold back member is connected to the semi-automatic firearm apparatus so that it is rotatable from the first position to the second position.

3. A semi-automatic firearm apparatus according to claim **1** wherein in the second position the hold back member holds a bolt of the semi-automatic firearm apparatus in an open position.

4. A semi-automatic firearm apparatus, comprising:

a side frame with an internal surface; and

at least one recess in the internal surface.

5. A semi-automatic firearm apparatus according to claim **4** wherein the at least one recess is molded into the internal surface.

6. A semi-automatic firearm apparatus according to claim **4** wherein there are a plurality of recesses in the internal surface.

7. A safety mechanism of a semi-automatic firearm, comprising:

a trigger;

a striker; and

a safety block located immediately above the trigger, wherein the safety block is configured to travel downwards as the trigger travels rearwards and to engage a portion of the striker so as to prevent its further forward movement.

8. A safety mechanism of a semi-automatic firearm according to claim **7** wherein the safety block has a recess shaped to receive a nose of the striker.

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