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Dafinov

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(54) **GAS OPERATED SEMI-AUTOMATIC RIFLE**

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(51) **Int. Cl.**
F41A 5/18 (2006.01)

(52) **U.S. Cl.** **89/191.01**

(58) **Field of Classification Search** 89/153, 89/179, 191.01, 192, 193
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,093,922	A *	6/1963	Ivy	42/62
3,261,264	A	7/1966	Wilson	
3,618,457	A *	11/1971	Miller	89/185
3,960,053	A *	6/1976	Conley	89/149
3,990,346	A	11/1976	Irwin	
4,061,075	A	12/1977	Smith	
4,232,583	A *	11/1980	Harrison	89/153
4,635,530	A *	1/1987	Weldle	89/159
4,909,129	A *	3/1990	Reynolds	89/191.01
5,123,329	A	6/1992	Irwin	
5,351,598	A	10/1994	Schuetz	
5,520,019	A	5/1996	Schuetz	
5,834,678	A *	11/1998	Kalb	89/187.01
5,886,281	A *	3/1999	Kirstein	89/185
5,939,659	A	8/1999	Dobbins	
5,983,774	A *	11/1999	Mihaita	89/187.02
6,227,098	B1 *	5/2001	Mason	89/193
6,606,934	B1	8/2003	Rock et al.	
6,619,592	B2 *	9/2003	Vignaroli et al.	89/191.01
6,622,610	B2 *	9/2003	Adkins	89/193
6,848,351	B1 *	2/2005	Davies	89/191.01
2007/0131104	A1 *	6/2007	Botty	89/193

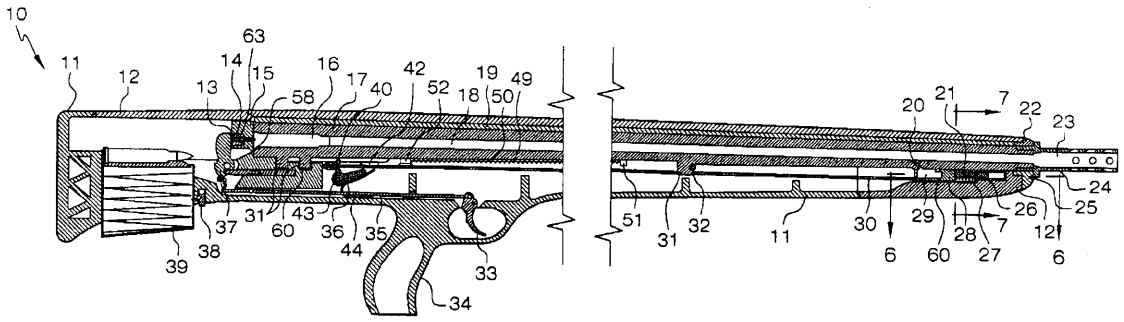
* cited by examiner

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(57) **ABSTRACT**

A gas operated semi-automatic rifle is disclosed having a forwardly moving gas piston located under the discharge end of a barrel. The gas piston is connected to a locking mechanism. The locking mechanism is engaged with a breechblock. As the gas piston moves a short distance forward after a round has been fired from the rifle, the locking mechanism moves rearward and disengages from the breechblock. The breechblock is biased rearward by being disengaged from the locking mechanism. The breechblock strips a new cartridge from a magazine, and reloads the rifle.

8 Claims, 10 Drawing Sheets



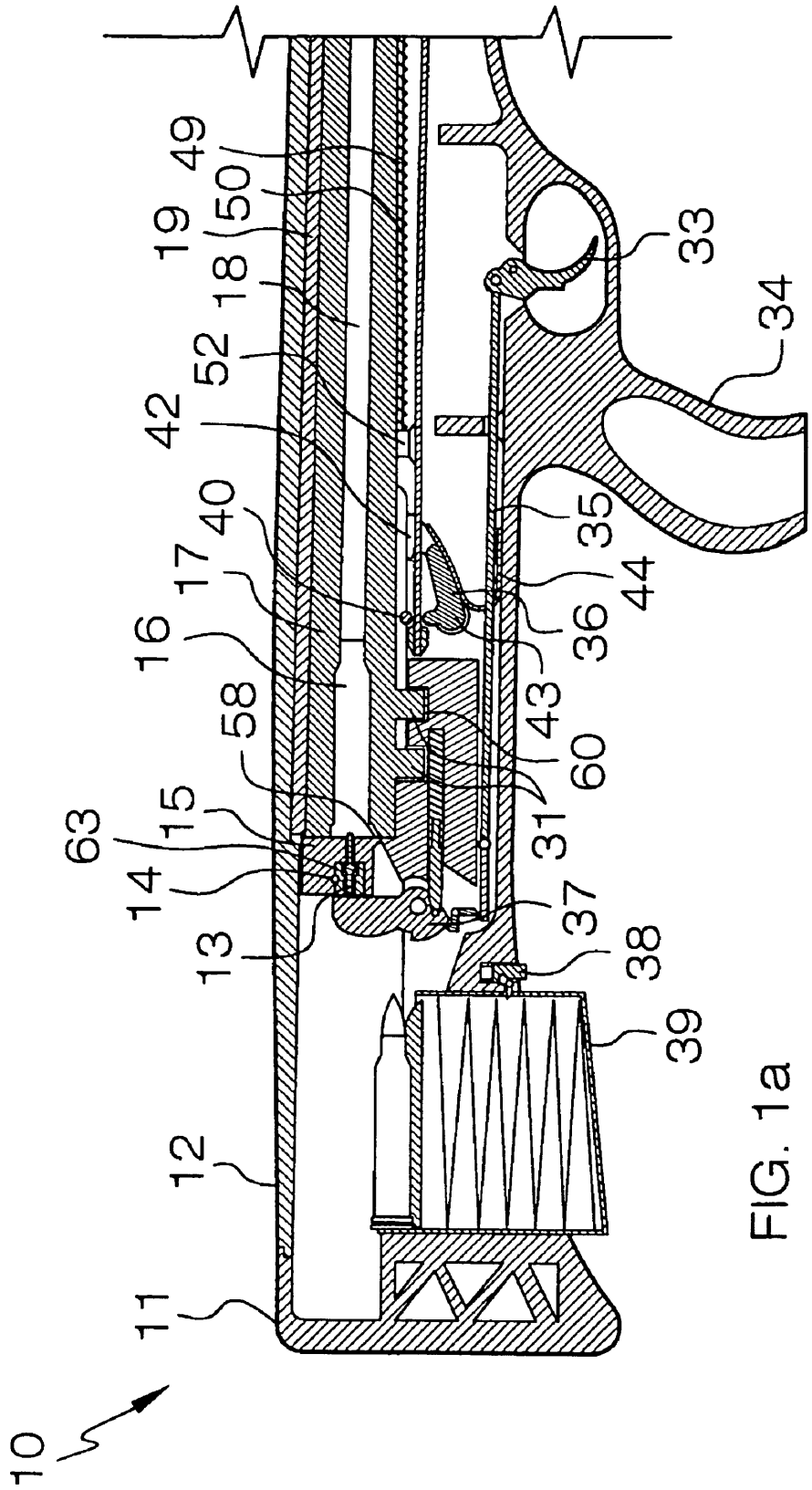

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FIG. 1a

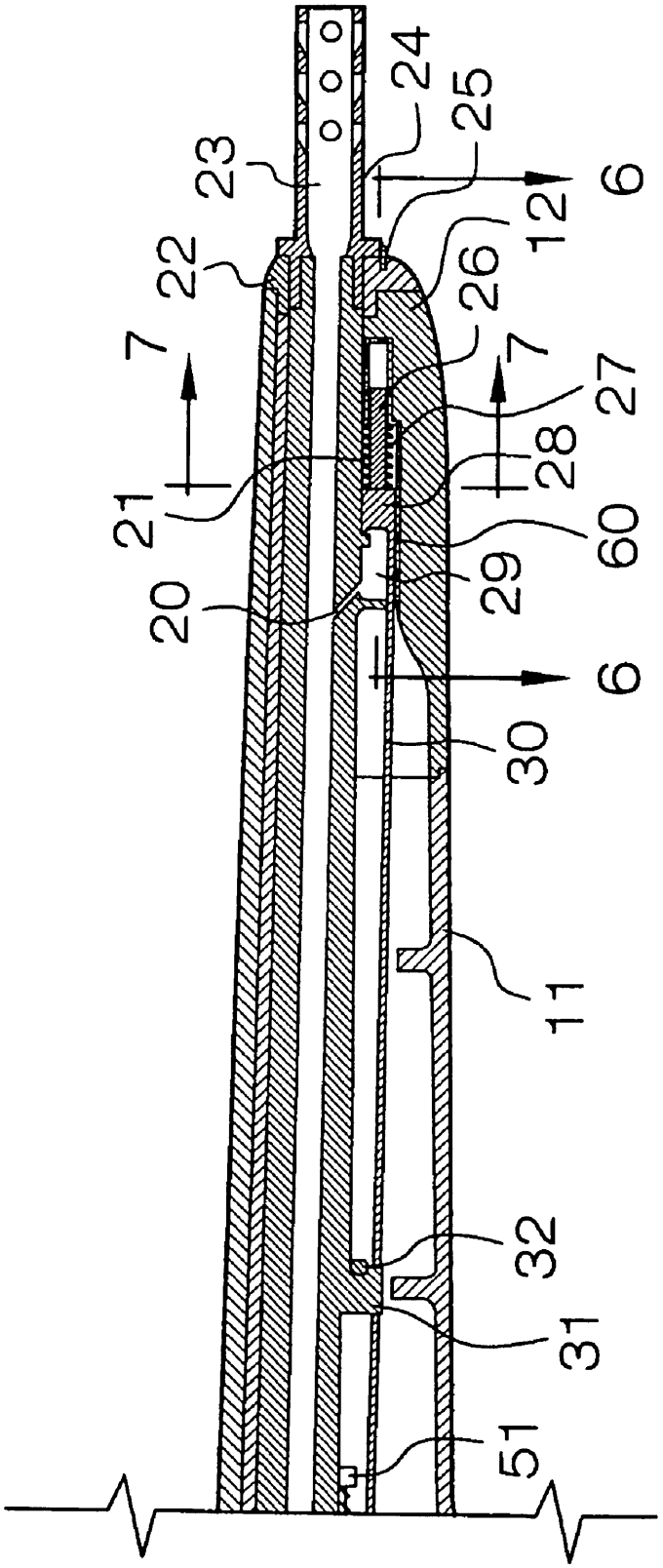


FIG. 1b

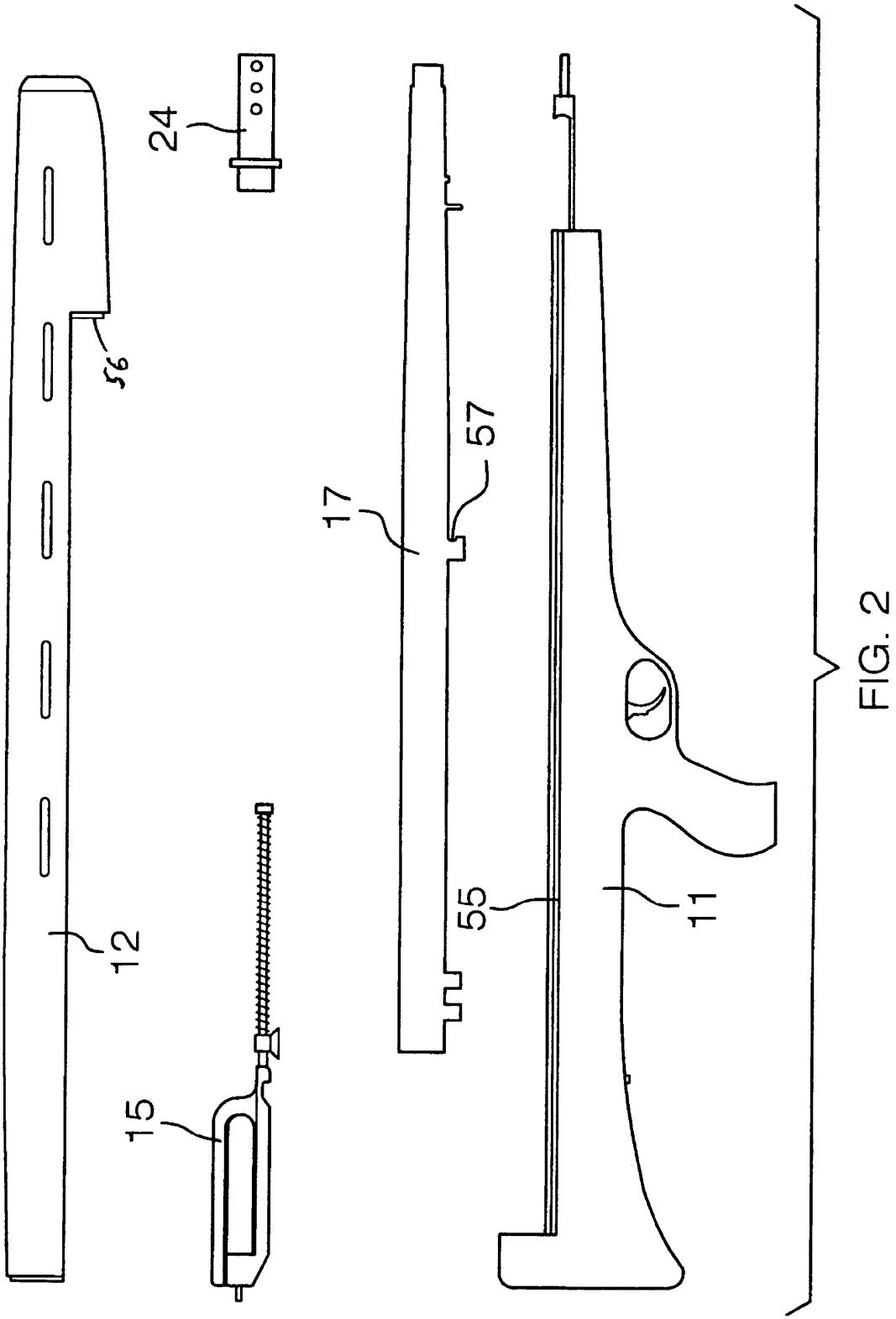


FIG. 2

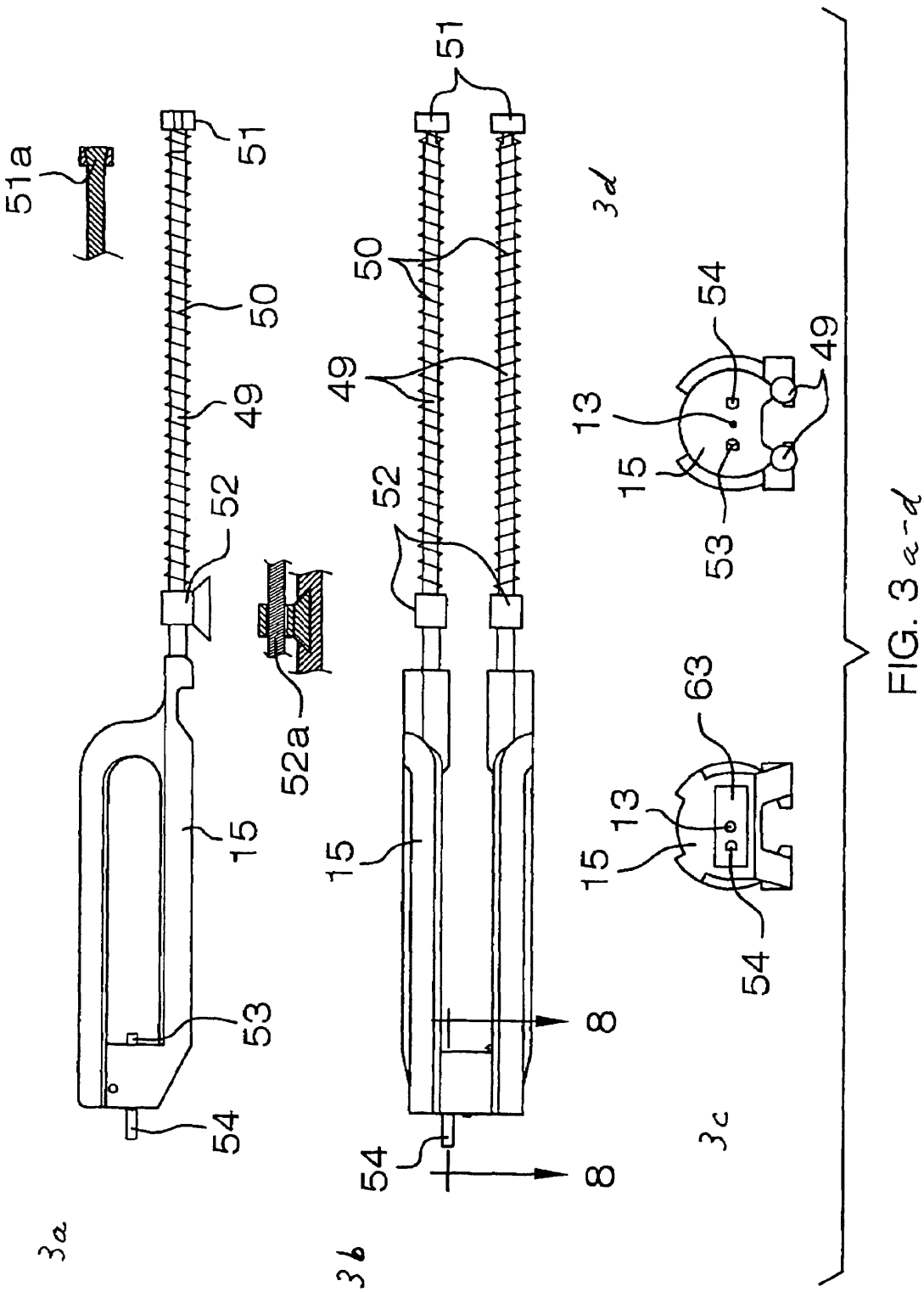

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3c

FIG. 3a-d

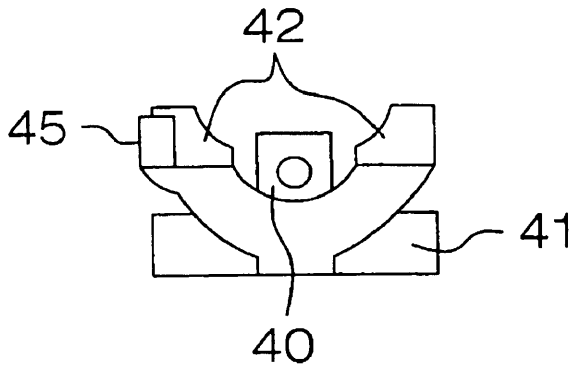


FIG. 4B

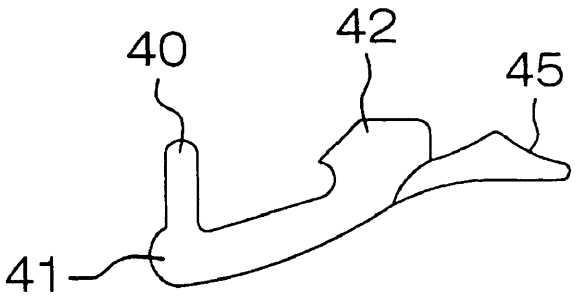


FIG. 4A

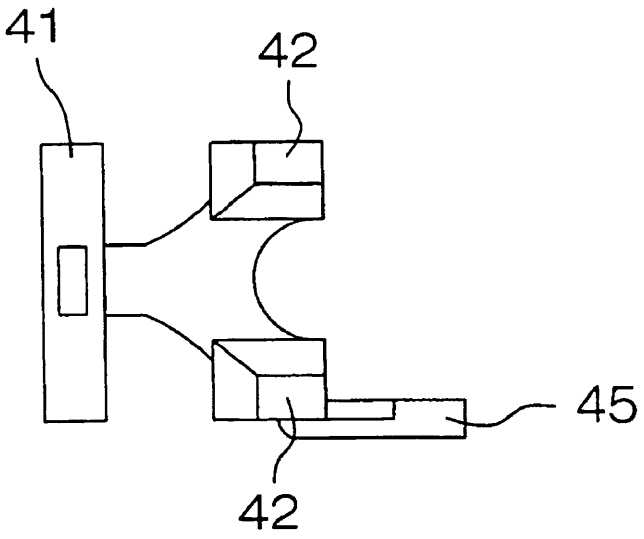


FIG. 4C

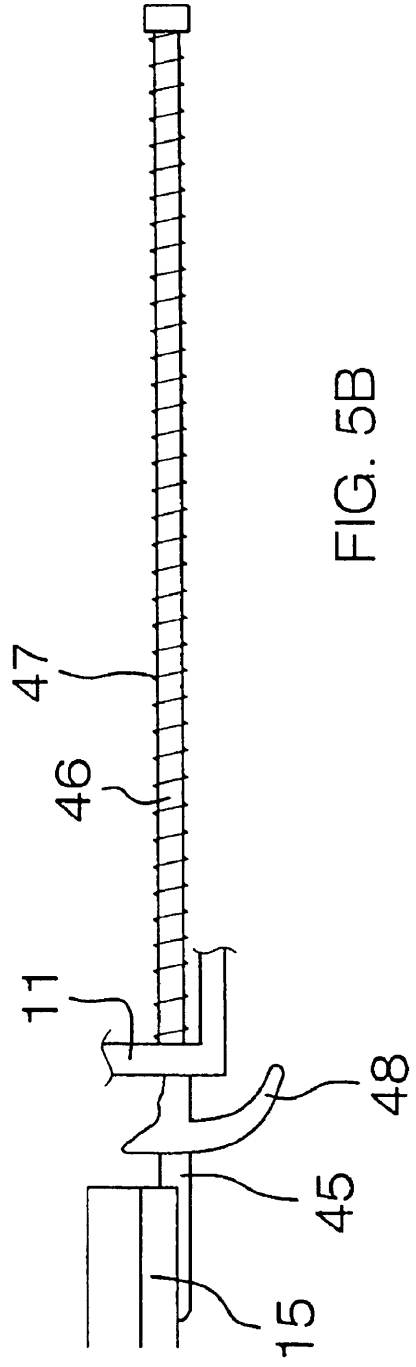


FIG. 5B

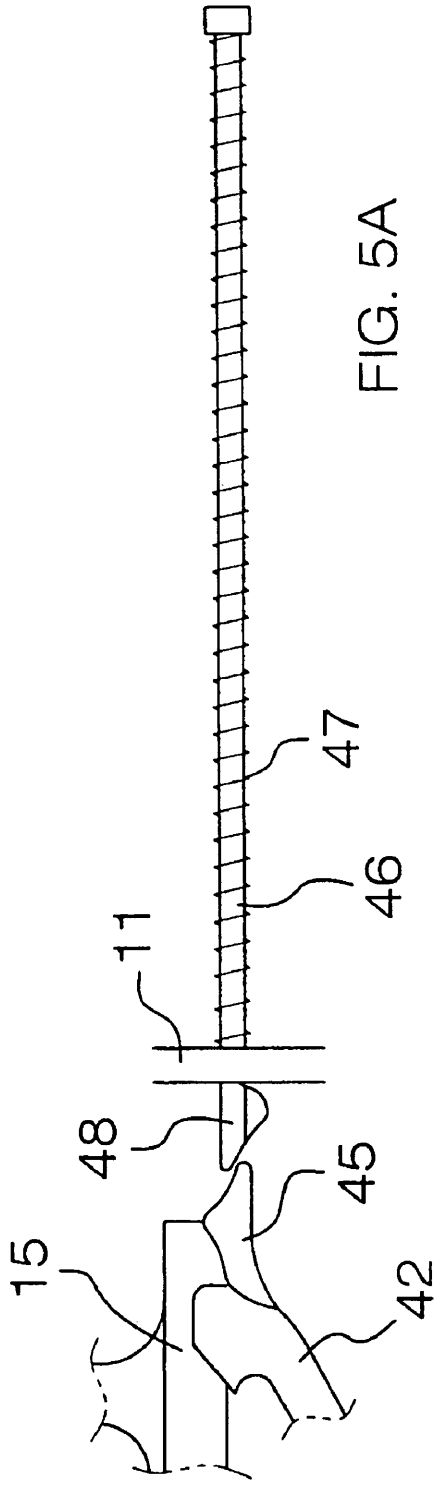


FIG. 5A

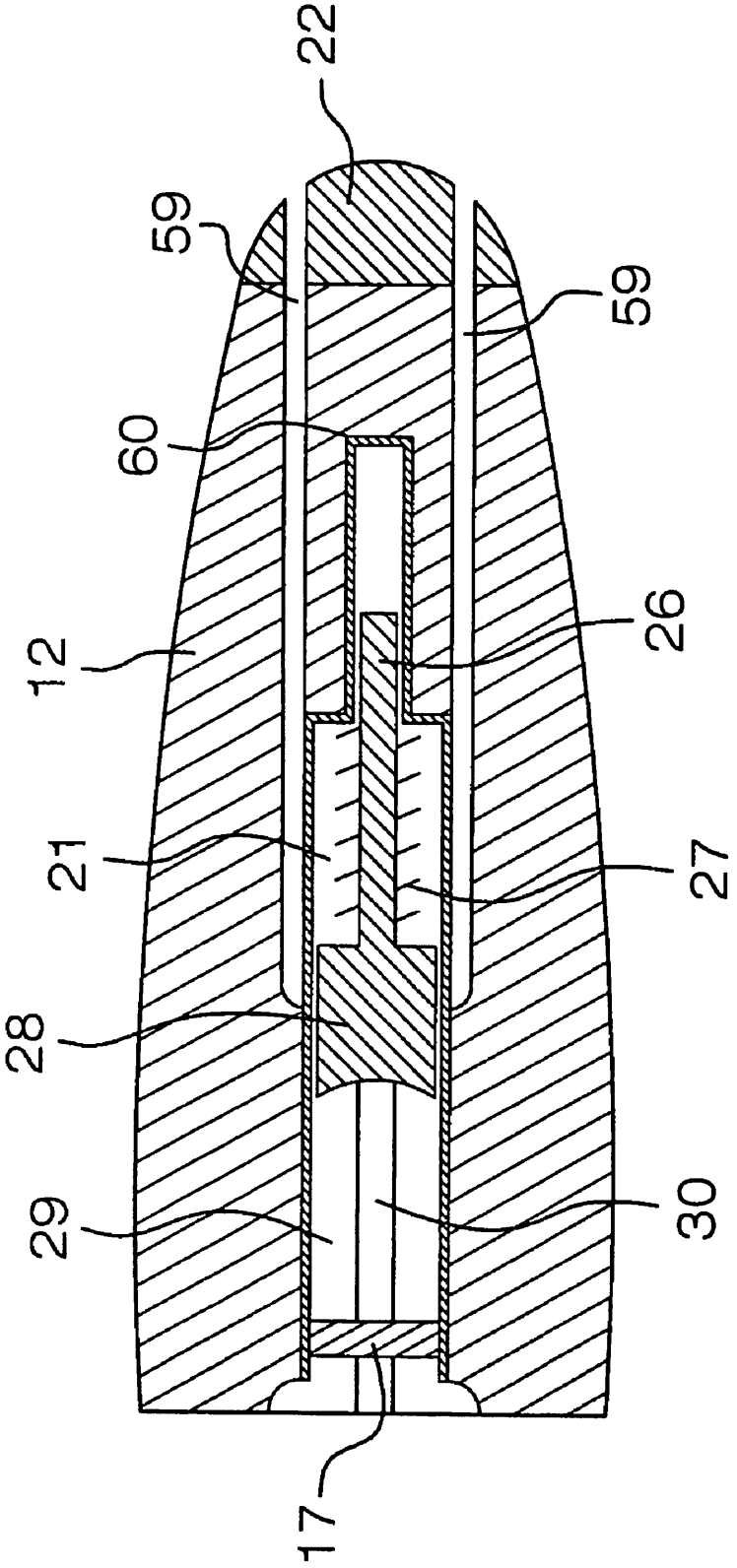


FIG. 6

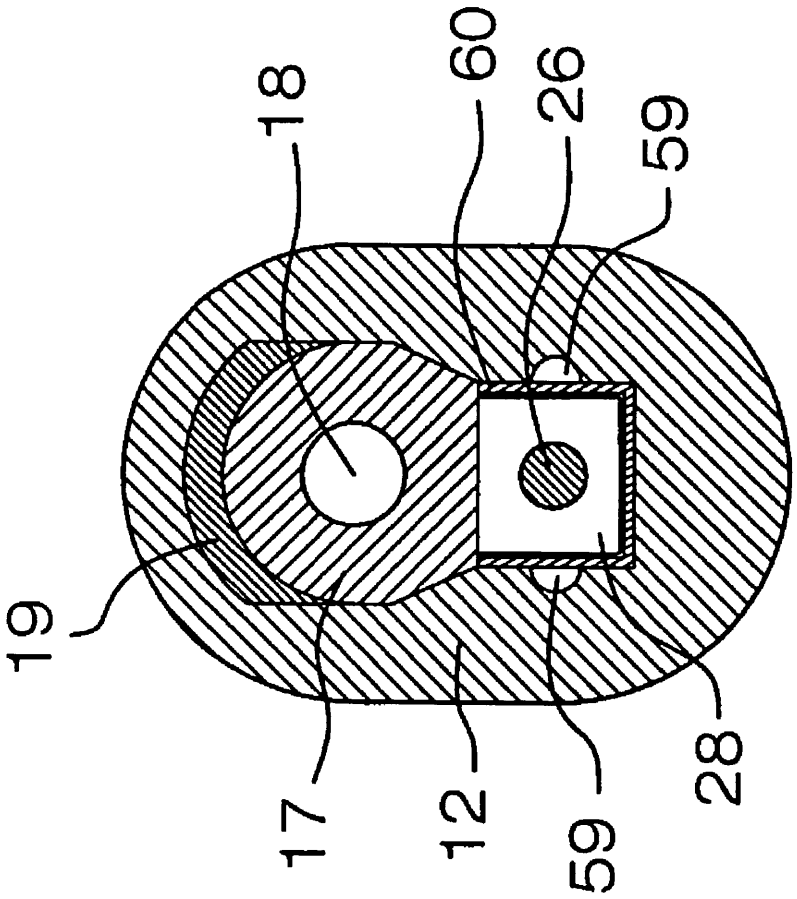


FIG. 7

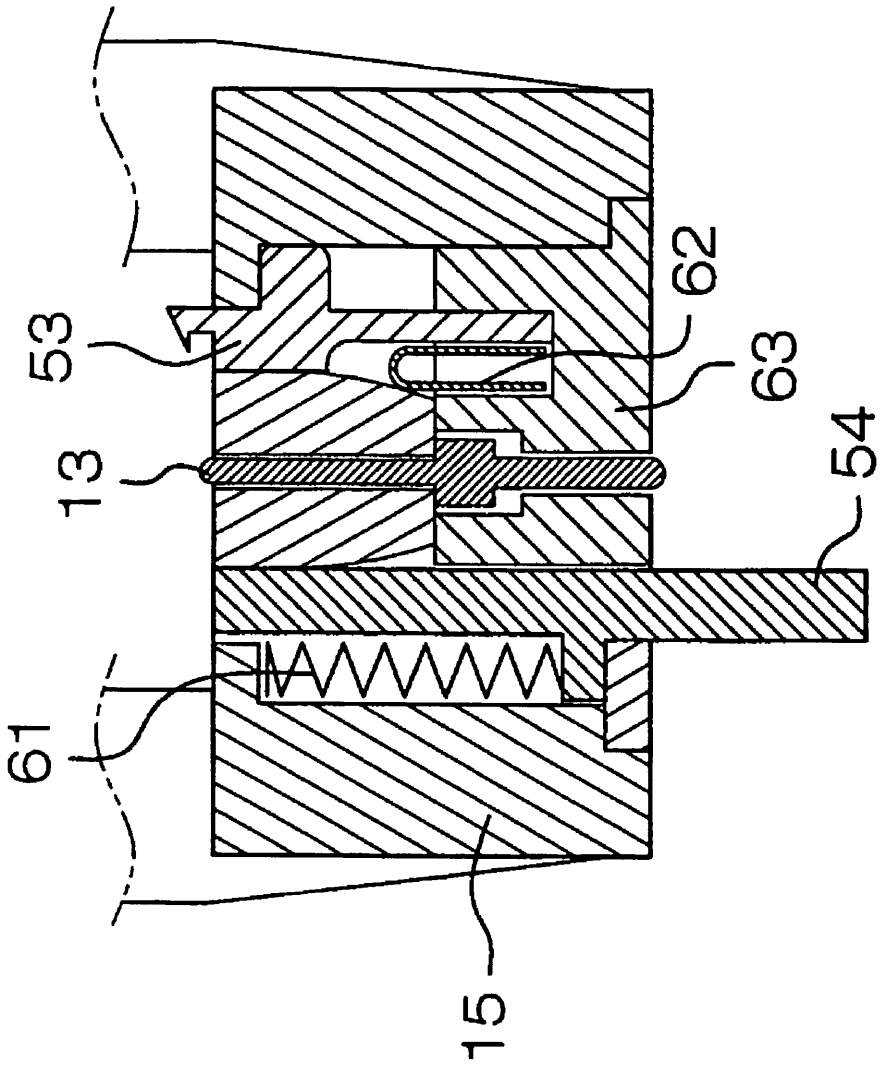


FIG. 8

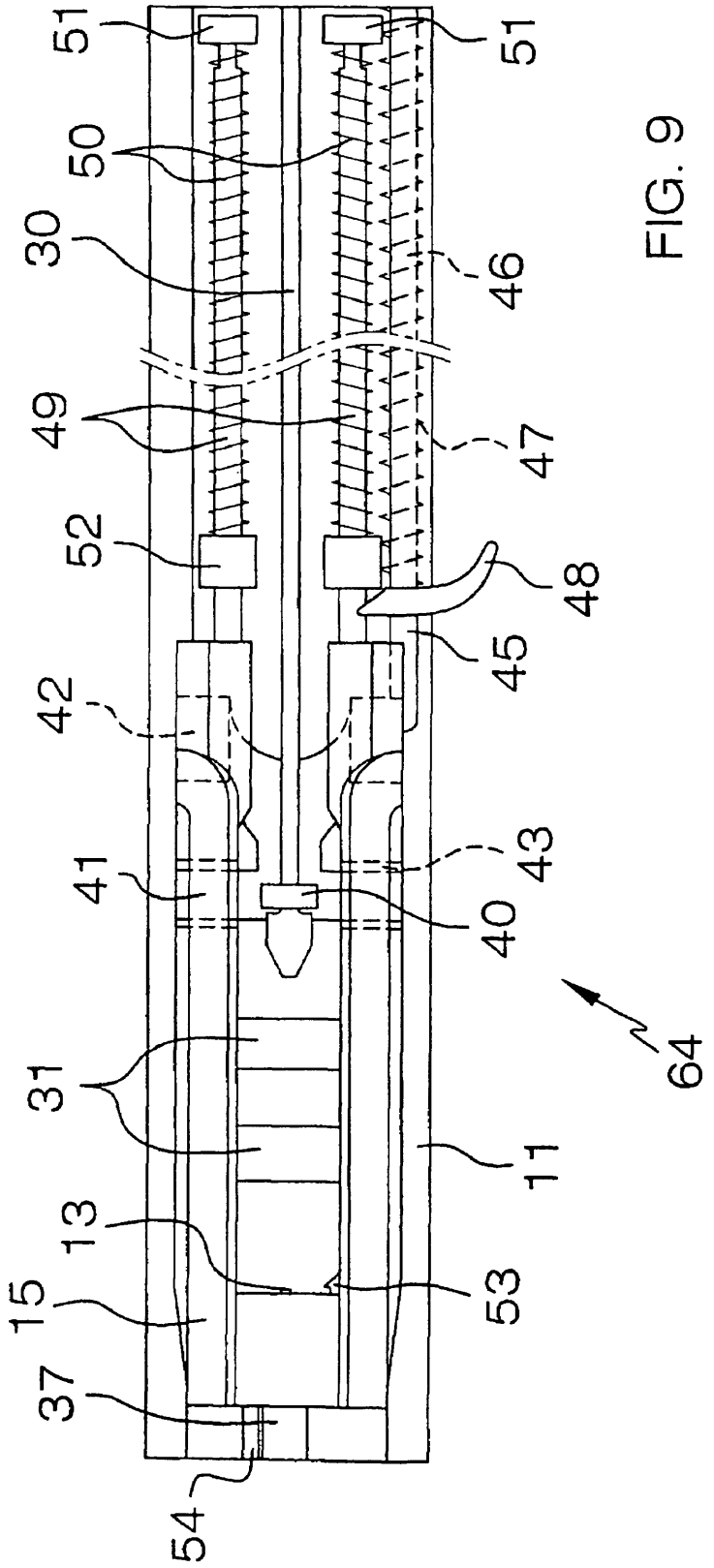


FIG. 9

GAS OPERATED SEMI-AUTOMATIC RIFLE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application 60/721,679, filed Sep. 30, 2005.

BACKGROUND OF INVENTION

The present invention relates to a gas operated semi-automatic rifle having a forwardly moving gas piston which allows a breechblock of the rifle to not pass totally beyond a cartridge magazine to load a new cartridge.

Currently most semi-automatic rifles are gas operated, with expanding gases in the rifle barrel developed by the firing of a cartridge causing a gas piston/piston rod combination to move rearward. The piston rod moves rearward and is connected to a bolt assembly for extraction of a cartridge, and the loading of another cartridge from the rifle's magazine. The bolt assembly must clear the magazine entirely before a new cartridge is placed in the chamber for firing.

For example, U.S. Pat. No. 5,123,329 discloses a trigger mechanism that when activated causes an inner movable barrel to move towards the breech block. A piston attached to the muzzle provides momentum to forwardly move the barrel past the cartridge feeding mechanism. When moving backwardly the inner barrel picks up a new cartridge to force against the firing pin of the breech block. U.S. Pat. Nos. 5,351,598 and 5,520,019 reveal the M16 gas piston assemblies variation wherein the piston moves rearward in relation to the bolt assembly. These semi-automatic rifles are based upon the piston moving rearward and activating the breechblock with a turning locking head.

It is an object of the present invention to provide a gas operated semi-automatic rifle having a gas piston under the discharge end of the barrel which ultimately moves the breechblock. Such a design allows the gas piston to be connected to a locking mechanism which in turn provides the rearward impetus for the breechblock in reloading a cartridge from the rifle magazine.

It is a further object of the invention to provide a breechblock which moves fore and aft, without a turning head, to load a new cartridge after discharge.

It is a feature of the invention that the gas piston, locking mechanism and breechblock combination move in synchrony using fewer moving parts and providing greater stability in operation of the rifle.

It is an advantage of the present invention that a gas operated semi-automatic rifle is provided which is lightweight and shorter in length, thus leading to ease of use and greater accuracy.

SUMMARY OF THE INVENTION

The general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new and improved semi-automatic rifle with less movement of heavier parts.

To attain this, the present invention comprises, in combination, a rifle with a gas piston located under its barrel. During operation, when the piston receives the expanding gases from a fired cartridge, the piston moves a short distance forward. The gas piston is connected to a locking mechanism via a piston rod. The piston rod is not connected to a breechblock, as is present in many current models of gas operated semi-automatic rifles. When the gas piston and the piston rod move forward, the gas piston and piston rod disengage the locking mechanism from the breechblock.

The breechblock is located at the entry end of the rifle barrel. The barrel is positioned in a lower corps, and the breechblock is engaged to the barrel by the locking mechanism. When the locking mechanism disengages from the breechblock, the breechblock moves rearward and loads a new cartridge from a rifle magazine. The magazine is located rearward of the breechblock and trigger mechanism.

Most semi-automatic rifles currently in service are based on gas-propelled piston moving rearward and activating a breechblock with a turning locking head. This requires a number of heavy parts moving together. An advantage of the present invention is that the gas piston only moves a short distance forward and the breechblock moves rearward when loading a cartridge without turning in relation to its longitudinal axis.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. **1***a* is a cross sectional side view of the rear area of the present invention.

FIG. **1***b* is a cross sectional side view of the front area of the present invention.

FIG. **2** is an exploded side view of some components of the present invention.

FIGS. **3***a*, **3***b*, **3***c* and **3***d* are, respectively, a side view, top view, rear view and front view of the breechblock of the present invention.

FIGS. **4***a*, **4***b* and **4***c* are, respectively, a side view, front view and top view of the locking mechanism of the present invention.

FIGS. **5***a* and **5***b* are, respectively, a side view and top view of the initial loading mechanism of the present invention.

FIG. **6** is a cross sectional view of the gas piston and chamber of FIG. **1***b* taken at line **6-6** of FIG. **1***b*.

FIG. **7** is a cross sectional view of the gas piston and chamber of FIG. **1***b* taken at line **7-7** of FIG. **1***b*.

FIG. **8** is a cross sectional view of the breechblock of FIG. **3***b* taken at line **8-8** of FIG. **3***b*.

FIG. **9** is a cross sectional top view of the present invention of the breechblock, the locking mechanism and the loading mechanism, when the barrel is removed.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **2** illustrates the main housing components of the invention **10** having an upper corps **12** and a lower corps **11**. The relative positioning of a barrel **17**, a breechblock **15** and a barrel compensator **24** are also illustrated in FIG. **2**.

Now with reference to FIGS. **1***a*, **1***b* and **2**, the lower corps **11** has a bottom surface, side walls and a front and rear section, along with a top perimeter channel **55**. A cavity is defined by the side walls. A locking mechanism **36**, a gas piston **28** and piston rod **30** are contained within the cavity of the lower corps **11**. Near the rear section of the lower corps **11**, a magazine **39** with rifle cartridges is located and is secured to the lower corps **11** via a magazine ketch **38**. The barrel **17** is securely mounted within the inner channel of the lower corps **11**. Preferably the channel is lined with sheet metal to increase the strength of connection with the barrel **17**. The lining of the channel is further constructed as channels to

direct the movement of the breechblock **15**. The top perimeter edge **55** allows the lower corps **11** to mate with the upper corps **12**. Space for the magazine **39** is also provided, and the lower corps **11** has lining comprised of sheet metal **60** to increase its strength and to receive the barrel **17**.

The upper corps **12** has a top surface, side walls and a front and rear section, along with a bottom perimeter ridge **56**. The bottom perimeter ridge **56** slides into the top perimeter channel **55** of the lower corps **11** to mate the upper corps **12** with the lower corps **11**. As illustrated in FIG. **6**, a chamber **21** is integrally formed in the upper corps **12** for the gas piston **28** near the front end of the upper corps **12**. Longitudinal channels **59** can be provided on the walls of the gas piston chamber **21**. When in the back position the piston **28** covers the channels **59**. After its movement forward, the piston **28** passes in front of the channels **59** and relieves excessive amount of gases. The upper corps **12** contains a vibration-absorbing pad **19**, which after assembly stays on top of the barrel **17** and presses the barrel **17** down. At the distal end of the upper corps **12** a metal ring **22** is contained, and the ring **22** surrounds the front end of the barrel **17** and makes contact with the barrel compensator **24**. The ring **22** also contains a small fixing pin **25**, which keeps the compensator **24** in position after the compensator **24** is tightened.

The barrel **17**, having a rifled bore **18** extending forwardly along a longitudinal axis toward a discharge end, a cartridge chamber **16**, and having a breech **58** integrally formed with the bore **18**. The barrel **17** has hills **31** to provide stability in the lower corps **11** and a generally circular shaped ketch **57** (illustrated in FIG. **2**) where an eccentric pin from the lower corps **11** fixes its position. The lower surface of the breech **58** is shaped sloping to direct the cartridge, when pushed by the breechblock **15**. At its discharge end the barrel **17** is outwardly threaded to mate with the compensator **24**.

In typical operation, the rifle as illustrated in FIGS. **1***a* and **1***b* has a live round loaded in a cartridge chamber **16**. The rifle is fired utilizing a trigger **33**, grip **34**, and a trigger rod **35** connected to a hammer **37**. The cartridge is ignited by a firing pin **13**. The gas piston **28** and the piston rod **30** are mounted in the lower corps **11**, with the gas piston **28** being located under the barrel **17**. The gas piston **28** and piston rod **30** are flexibly connected to the locking mechanism **36**, and form a lever system. Gases are produced by the explosion of a rifle cartridge and movement of the round down the barrel **17**. The expanding gases from the cartridge explosion enter an opening **20** in the barrel wall approximately 100 mm before its discharge end, and enter an expansion chamber **29** formed rearward of the gas piston **28**. The expanding gases move the gas piston **28** approximately 15 mm forward. The piston rod **30** pulls the locking mechanism **36** and rotates the locking mechanism **36** along its axis. The rotational movement pulls down the locking mechanism **36**, and the breechblock **15** is released.

As illustrated in FIG. **6**, the gas piston **28** is generally square in cross-section, and its top surface is juxtaposed to slide along the bottom surface of the barrel **17** when in operation. The gas piston **28** is surrounded on three of its sides by the upper corps **12**.

As further illustrated in FIGS. **6** and **7**, the distal end of the gas piston **28** is integrally formed as a bar **26**, with a spring **27** surrounding the bar **26**. The bar **26** is mounted within the lower corps **11**, and the spring **27** fixes the movement of the gas piston **28**, reduces its speed and returns the gas piston **28** to its back position. The expanding gases from the cartridge explosion entering the expansion chamber **29** delay the movement of the gas piston **28** so that the breechblock **15** opens at the first end of the barrel **17** only after the pressure in the bore **18** is reduced.

A detailed illustration of the locking mechanism **36** is shown in FIGS. **4***a*, **4***b* and **4***c*. The locking mechanism **36** is mounted in the lower corps **11** of the rifle. Two locking fingers **42** and an operating lever **40** are integrally formed as part of the locking mechanism **36**. An arm **41**, mounted in cylinders **43** (illustrated in FIG. **1***a*) built into the side walls of the lower corps **11**, allows the locking mechanism **36** to rotate along its axis. As shown in FIG. **1***a*, a spring **44** keeps the locking mechanism **36** in an upper position. The right locking finger **42** has an appendage **45** with a sloping surface which contacts with a loading handle **48** for initial loading. The piston rod **30** passes between the locking fingers **42** and through the operating lever **40** of the locking mechanism **36**.

The loading mechanism **64** is located in the right wall of the lower corps **11**, and illustrated in FIGS. **5***a*, **5***b* and **9**. It is comprised of a rod **46** with a spring **47** and the loading handle **48**. When pulled back manually by a user of the rifle the handle **48** makes contact with the appendage **45** of the right locking finger **42** of the locking mechanism **36**, and pushes the right locking finger **42** downwardly. The breechblock **15** is released and is pushed back manually with the handle **48**. Moving rearward the breechblock **15** engages and rotates the hammer **37**, which is then set in a cocked position. At the final rearward the spring **47** is compressed. When the loading handle **48** is released the spring **47** returns to its former position. The breechblock **15** is now disengaged, and recoil springs **50** bias the breechblock **15** forward. The breechblock **15** strips a new top cartridge from the magazine **39** and positions the new cartridge within the cartridge chamber **16** formed in the barrel **17**, loading the rifle. The loading mechanism **64** remains immovable during firing.

Details of the breechblock **15** are illustrated in FIGS. **3** *a-d* and FIG. **8**. The breechblock **15** has a first and second end, and surrounds the entry end of the barrel **17**. The breechblock **15** is coupled with the hammer **37**. When in the front position the breechblock **15** is juxtaposed behind the barrel **17**. At its final rearward position, after striping a cartridge from the magazine **39**, the breechblock **15** will pass approximately only 20 mm behind the magazine **39**. The total length of the rifle is thus reduced.

Recoil rods **49**, having first and second ends, extend from the first end of the breechblock **15**. Recoil springs **50** are positioned on the recoil rods **49**. The recoil rods **49** are engaged to fixing rings **51** at the second end of the recoil rods **49**. The second end of the recoil rods **49** and the fixing rings **51** are shaped conically which allows the rods **49** and the fixing rings **51** to engage. The sliding rings **52**, having an opening with a diameter greater than the diameter of the recoil rods **49**, are mounted in an immobile position in the lower corps **11**. The recoil rods **49** are extended through the opening of the sliding rings **52**. The breechblock **15**, when disengaged from the locking mechanism **36**, can move rearward along a longitudinal axis. The breechblock **15**, recoil rods **49** and fixing rings **51** move as an integral unit longitudinally. The recoil springs **50** bias the movement of the breechblock **15** during reloading. The breechblock **15**, and gas piston **28** and piston rod **30**, move fore and aft, and in opposite directions.

As illustrated in FIG. **8**, the breechblock **15** has a firing pin **13**. An extractor **53**, extractor spring **62**, an ejector **54** and ejector spring **61**, act in combination to remove spent cartridges. A breechblock plug **63** is mounted in position in the breechblock **15**, and the extractor **53** and the ejector **54** are positioned therein. The breechblock plug **63** keeps the extractor **53** and ejector **54** in position and limits the movement of

the firing pin **13**. A fixing pin **14** (shown in FIG. **1**A) keeps the breechblock plug **63** in position. The extractor **53** and the ejector **54** are interchangeable for use by left or right handed shooters by changing the positions of the extractor **53** and the ejector **54**, and by rotating the breechblock plug **63**.

The extractor **53** has a first end and a second end, with a hooked shaped portion depending from the first end of the extractor **53**. After firing of a round, and as the breechblock **15** moves rearward, the hooked shaped portion of the extractor **53** removes the spent cartridge from the cartridge chamber **16**. The ejector **54** propels the spent cartridge form the rifle **10**, and allows the breechblock to reload another round.

The barrel compensator **24**, in addition to reducing recoil, completes the rifle assembly. The barrel compensator **24** is inwardly treaded to mate with the discharge end of the barrel **17**. When in its fixed position, the compensator **24** moves the barrel **17** forward. Since the barrel **17** is already fixed in the lower corps **11** the tightening of the compensator **24** pushes the upper corps **12** rearward. As a result the front end of the barrel **17** is secured against vibrations. The fixing pin **25** of the upper corps **12** keeps the compensator **24** on final position. A chamber **23** is integrally formed at the beginning of the compensator **24** to collect burning gases from the projectile explosion.

To assemble the rifle, first insert the rear end of the barrel **17** into the breechblock **15** and place both the barrel **17** and breechblock **15** into the lower corps **11**. The position of the barrel **17** is fixed with an eccentric pin **32**. Rear rings **52** of the recoil springs **50** are secured. The upper corps **12** is slide fully rearward, and the barrel compensator **24** is mounted to the barrel **17** to bias the upper corps **12** rearward. The barrel compensator **24** is fixed into position with the pin **25**.

With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function, and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

Therefore, the foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, if is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

I claim:

1. A gas operated semi-automatic rifle comprising the combination of:

a lower corps having a bottom surface, side walls, first end, second end and a top perimeter channel, having an open cavity defined by the side walls, having an expansion chamber defined within the cavity positioned near the second end, and having a cartridge magazine adapted to fit near the first end;

an upper corps having a top surface, side walls, first end, second end and a bottom perimeter ridge which is slidably mated with the top perimeter channel of the lower corps;

a barrel, having a first end and a discharge end, mounted within the lower corps and having a rifled bore extending forwardly toward the discharge end, the barrel further comprising a cartridge chamber and a breech integrally formed with the bore therein, and the barrel having a gas port opening passing from the bore into the expansion chamber of the lower corps;

a breechblock mounted near the first end of the lower corps, and having a first end, a second end and a firing pin, and the breechblock being juxtaposed near the first end of the barrel;

a gas piston having a first end and a second end, a piston rod connected to the first end of the gas piston contained within the cavity of the lower corps, the piston rod flexibly connected to a locking mechanism mounted in the lower corps, the gas piston and the piston rod positioned forward of the expansion chamber of the lower corps, and the locking mechanism being engaged with the breechblock;

a trigger, a grip and a trigger rod connected to a hammer; the hammer being positioned to be cocked by the breechblock; and

as the cartridge chamber receives a rifle cartridge, the cartridge is ignited by the firing pin of the breechblock by pulling the trigger engaging the hammer with the breechblock, whereby expanding gases entering the expansion chamber act upon the gas piston to rotate the locking mechanism, disengaging the breechblock, and allowing the breechblock to reload another cartridge.

2. The rifle of claim **1**, further comprising:

a bar integrally formed at the second end of the gas piston;

a spring fixedly mounting the bar within a chamber formed in the upper corps to allow bias movement of the gas piston by the spring.

3. The rifle of claim **1**, whereby the locking mechanism further comprises a first and a second locking finger, the second locking finger having an appendage with a sloping surface, and the locking mechanism being rotatably mounted in cylinders disposed in the lower corps.

4. The rifle of claim **3**, further comprising:

a loading mechanism located in the lower corps having a spring positioned on a rod, the rod having a first end and a second end;

a loading handle extending from the first end of the rod, the loading handle contacting the appendage of the second locking finger of the locking mechanism to allow downward movement of the second locking finger upon the rearward movement of the loading handle; and

whereby the breechblock is disengaged from the locking mechanism upon the downward movement of the second locking finger allowing the breechblock to load a cartridge from the magazine.

5. The rifle of claim **1**, further comprising:

a pair of recoil rods, having first and second ends, extending from the first end of the breechblock;

a pair of recoil springs surrounding the recoil rods;

a pair of fixing rings engaged to the second end of the recoil rods; and

a pair of sliding rings each having an opening therethrough and being securely located in the lower corps, whereby the recoil rods are projected through the openings of the sliding rings.

6. A gas operated semi-automatic rifle comprising the combination of:

a lower corps having a bottom surface, side walls, first end, second end and a top perimeter channel, having an open cavity defined by the side walls, having an expansion chamber defined within the cavity positioned near the second end, and having a cartridge magazine adapted to fit near the first end;

an upper corps having a top surface, side walls, first end, second end and a bottom perimeter ridge which is slidably mated with the top perimeter channel of the lower corps;

a barrel, having a first end and an outwardly threaded discharge end, mounted within the lower corps and having a rifled bore extending forwardly toward the discharge end, the barrel further comprising a cartridge chamber and a breech integrally formed with the bore therein, and the barrel having a gas port opening passing from the bore into the expansion chamber of the lower corps;

a breechblock mounted near the first end of the lower corps, and having a first end, a second end and a firing pin, and the breechblock being juxtaposed near the first end of the barrel;

a gas piston having a first end and a second end, a piston rod connected to the first end of the gas piston contained within the cavity of the lower corps, the piston rod flexibly connected to a locking mechanism mounted in the lower corps, the gas piston and the piston rod positioned forward of the expansion chamber of the lower corps, and the locking mechanism being engaged with the breechblock;

a barrel compensator having a first end and a second end, the first end being inwardly threaded, the first end of the barrel compensator being mated with the discharge end of the barrel;

a trigger, a grip and a trigger rod connected to a hammer; the hammer being positioned to be cocked by the breechblock; and

as the cartridge chamber receives a rifle cartridge, the cartridge is ignited by the firing pin of the breechblock by pulling the trigger engaging the hammer with the breechblock, whereby expanding gases entering the expansion chamber act upon the gas piston to rotate the locking mechanism, disengaging the breechblock, and allowing the breechblock to reload another cartridge.

7. The rifle of claim **6**, further comprising:

a bar integrally formed at the second end of the gas piston;

a spring fixedly mounting the bar within a chamber formed in the upper corps to allow bias movement of the gas piston by the spring.

8. The rifle of claim **6**, further comprising:

a pair of recoil rods, having first and second ends, extending from the first end of the breechblock;

a pair of recoil springs surrounding the recoil rods;

a pair of fixing rings engaged to the second end of the recoil rods; and

a pair of sliding rings each having an opening therethrough and being securely located in the lower corps, whereby the recoil rods are projected through the openings of the sliding rings.

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