

Automatic rifles

The Mechanics and A Brief History



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Introduction

Firing a gun is fun and exciting. When you go up to the firing range and pull the trigger, there is nothing quite like that exhilarating feeling you get from the sheer power of the rifle. But when you are out there enjoying your trigger finger, you might wonder, how does it work?

Automatic rifles are a type of rifle that uses self-reloading mechanism to allow continuous fire without having to manually load every bullet provided there are still rounds in the chamber. There are two main types of automatic rifles: fully-automatic and semi-automatic. It is easy to get confused with the term automatic. Many people misunderstand the term automatic with fully-automatic when it refers to the automatic loading mechanism of the rifle, not the firing mechanics.

Automatic weapons are widely used in military forces, law enforcement services and any other armed forces. This popularity is a result of ease of use among most automatic rifles. This document will show where this popularity stems from by looking at the mechanisms of those rifles and their advantages and disadvantages.

Differentiating Function Automatic Rifles

Automatic rifles' mechanism has specific and automated functions that differentiate them from other non-automatic rifles:

- Discards the used cartridge and empties the chamber
- Loads the chamber with new cartridge

These functions make automatic rifles much simpler to use since non-automatic rifle user needs to carry these steps manually.

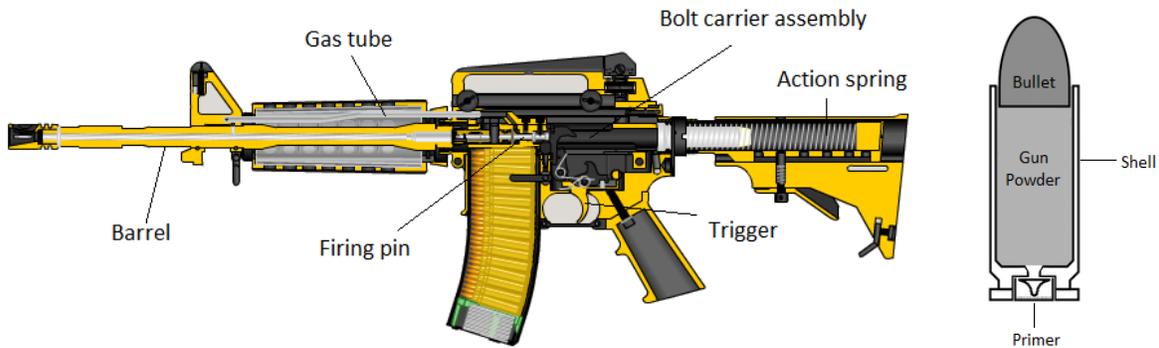
Types of Automatic Rifles

There are two types of automatic rifles: semi-automatic and fully automatic. Semi-automatic rifles are rifles that execute all the necessary steps to fire the shot again but do not automated continuous fire. One pull of a trigger only results in a single shot. Fully automatic rifles are exactly the same as semi-automatic except it supports automated continuous fire, meaning if the trigger is pulled, the rifle will fire by itself until it is out of bullets.

Many automatic rifles produced today come with both options that allow transition between semi-automatic and fully-automatic to provide versatility to the firearms. Switching between options enables the user to choose the right type of fire mode depending on the situation without having to carry firearms.

The mechanism behind automatic rifles

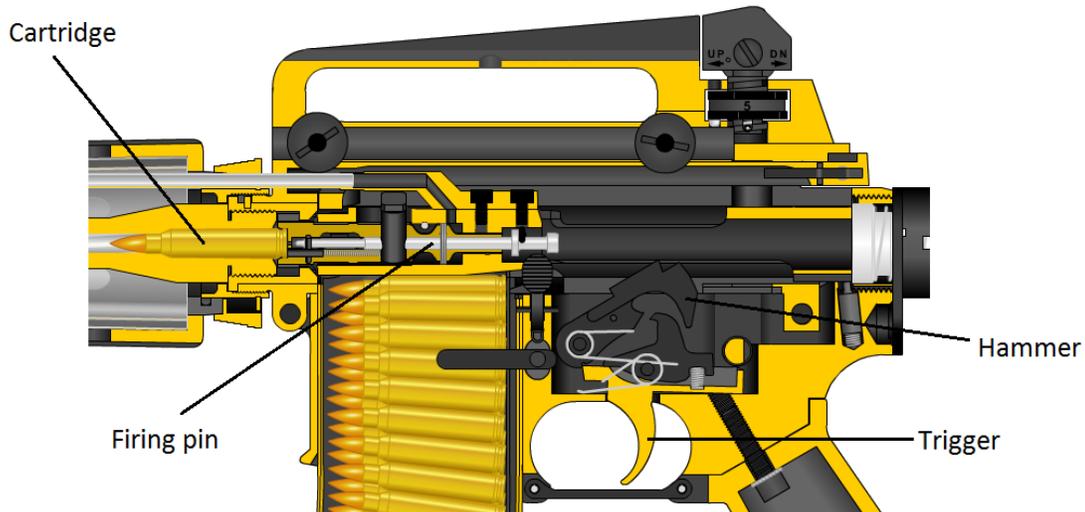
There are many models of automatic rifles. Different models have different anatomy and their mechanisms may differ slightly. In this section, we will be looking at a very familiar and widely used rifle in this country: AR-15 variant, which is the basis for commonly used rifles such as M16. Many of today's automatic rifles, including the AR-15, use a mechanism called direct gas impingement – automatic loading mechanism where gas from the burnt propellants is used to move the bolt and bolt carrier to remove the empty cartridge and load the next projectile.



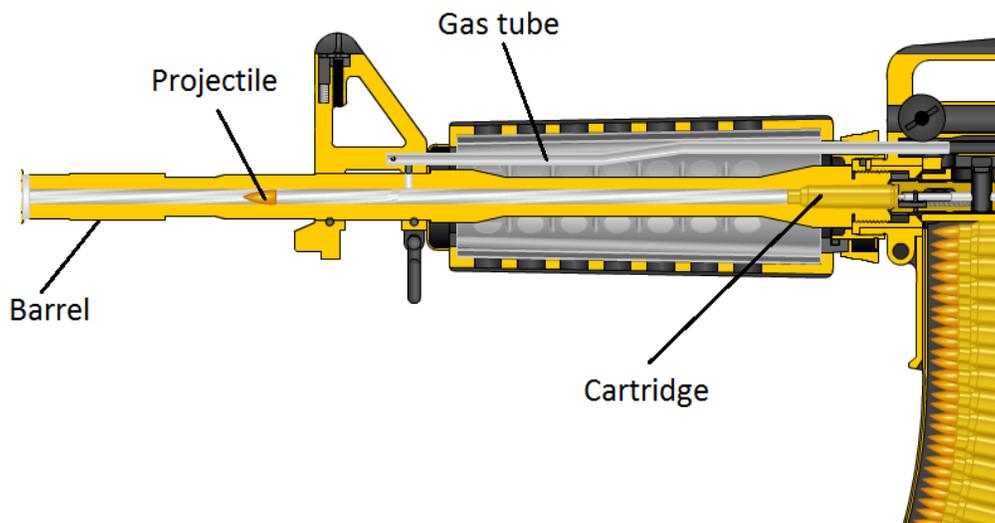
Cross sectional view of a typical AR-15 variant

Simple cross sectional view of a cartridge

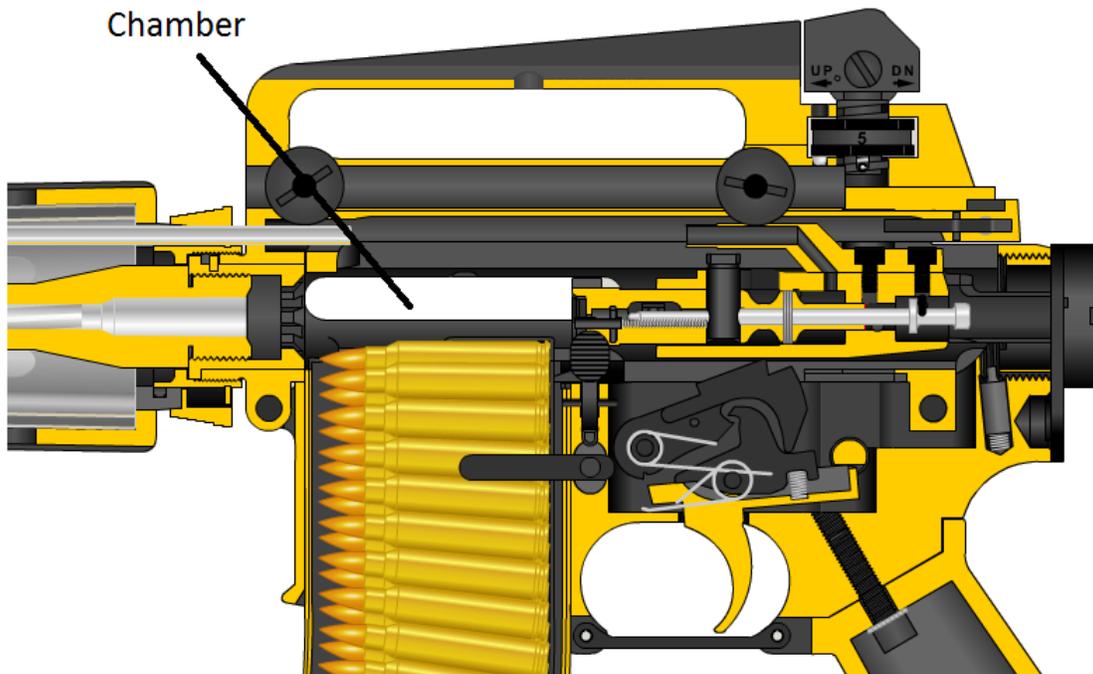
Step-by-step demonstration of firing rounds



1. The trigger is pulled and activates the hammer
2. The hammer hits the firing pin which in turn stimulates the primer in the cartridge
3. Gunpowder inside the cartridge ignites and the gas pressure from burnt powder builds up inside the cartridge and explodes, pushing the bullet out through the barrel at high speed



4. As the bullet moves along the barrel, it passes the gas tube where some of the gas that was pushing the projectile out of the barrel is expelled into.



5. This leaked gas has enough force to jerk the bolt carrier backwards which enables the empty cartridge to be expelled and makes room for the next round.



6. Then the action spring inside the stock pushes the bolt carrier back to the original place, sliding the next cartridge into the chamber. At this point, the rifle is ready to fire again.

For more comprehensive demonstration of the fire mechanism, watch the animated version in the following website:

http://www.bushmaster.com/anatomy_bushmaster.asp

Advantages vs. Disadvantages

As mentioned above, many automatic rifles come with option of switching between fully-automatic and semi-automatic firing modes. For this reason, it might be pointless to discuss the pros and cons of different modes. However, it is necessary to know the strengths and weaknesses to be able to decide on the right mode for various situational needs.

Fully – automatic rifles

Advantages	Disadvantages
Automated Continuous fire	Fast ammunition consumption
Higher rate of fire	Significantly higher recoil
No need for manual loading	

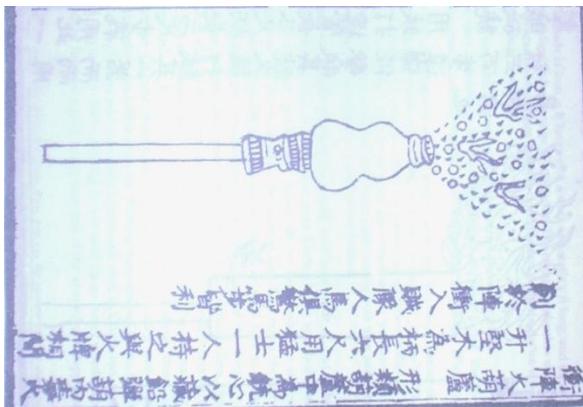
Semi-automatic rifles

Advantages	Disadvantages
Ability to control every shot	Slower rate of fire
Higher accuracy	Need to pull the trigger for every shot
No need for manual loading	

History of Firearms

Firearms have existed for a significant amount of time. First firearms date back to 13th century and they required manual replacement of projectiles and propellants which resulted in long downtime between shots. As technology developed, the firearms evolved to become more advanced, powerful and easy to use. Propellants and projectiles were integrated into one cartridge and reloading mechanics allowed for continuous shots.

Notable Technological Advancement of Firearms



Ancient drawing of a fire lance, demonstrating the discharge of the projectiles

Fire Lance – 13th Century

This is one of the most primitive forms of firearms. A tube filled with gunpowder was attached to the end of a spear. The tube was filled with metal scraps as well to use as projectiles.

This was considered as more of a disposable weapon since the components were fragile and reloading required lot of time.



An image of a flintlock pistol – illustrates familiar characteristics we often see in movies

Flintlock – 17th Century

A familiar firearm that makes appearance in movies such as Pirates of Caribbean series.

More advanced form of firearm. The overall structure is more sturdy and supported use over extended amount of time.

Gunpowder and projectiles were loaded into the barrel from the front. The cock and flint would be used to ignite the gunpowder and fire the projectiles.



Marlin Model 1894C lever action rifle

Repeaters – 19th Century Another familiar firearm that makes its appearance in many of the western films.

Once metallic cartridges were invented, which integrated the propellant and the projectiles together, firearms such as Marlin

Model shown above entered development. These types of rifles were called ‘repeaters’, representing their mechanism of loading each shot with repeated motion.

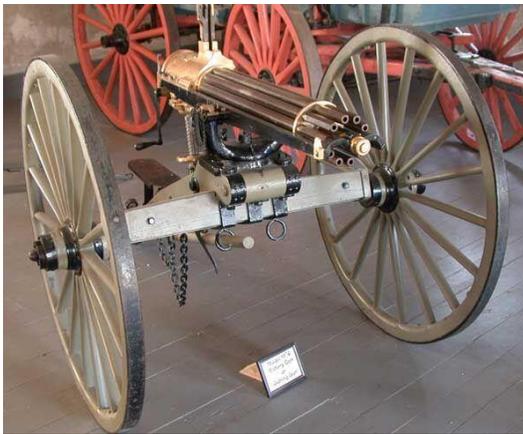


Image of 1876 Gatling gun

Gatling gun – 19th Century

Gatling gun marked the appearance of the first ‘fully-automatic’ firearm. This firearm was manually cranked to turn the barrels to fire consecutively with a belt feeding the machine with the cartridges.

Conclusion

Automatic rifles are made up of many working parts. The automatic firing requires every part of the firearm to work in sync. This document describes the basic mechanism and the major components that play their role in the automatic firing mechanics of rifles. The mechanism is a series of events that is started off by the pull of a trigger. The trigger activates the hammer which in turn stimulates the primer of the cartridge and ignites the gunpowder within the bullet. This ignition causes increase in gas pressure which accelerates the projectile out through the barrel. On the way out of the barrel, some of the gas moves backwards through the gas tube and pushes the bolt carrier backwards, emptying the chamber. Then the bolt carrier is pushed back into original place by the action spring, sliding a new cartridge on its way back.

Glossary

Action spring	- Strong spring placed behind the bolt carrier. Relocates the bolt after each shot.
Bolt carrier assembly	- Part of firing mechanism and is placed at the back of the chamber to direct the propellant gas forward. It also moves to exchange the cartridges.
Chamber	- Part of the barrel in which cartridge is inserted for firing.
Cartridge	- A packaging that includes the projectile, propellant and a primer made to fit into a chamber of a rifle.
Firing pin	- Part of the firing mechanism used to stimulate the primer of cartridges
Hammer	- Firearm component used to strike the firing pin.
Primer	- A metal cup containing a very sensitive explosive in the center of base of the cartridge. It is used to ignite the gunpowder within the cartridge.

Reference

Title page:

http://s102.photobucket.com/user/firebretha/media/firearms/DSC_6959_Edited_800px.jpg.html

AR – 15 cross sectional view – screen shots taken here

http://www.bushmaster.com/anatomy_bushmaster.asp

Fire lance

http://en.wikipedia.org/wiki/File:Chinese_Fire_Lance_with_Pellets.JPG

Flintlock

http://en.wikipedia.org/wiki/File:Pistolet-IMG_3196-b.jpg

Marlin Model 1894

http://en.wikipedia.org/wiki/File:Marlin_Model_1894C_.357_Magnum.jpg

Gatling gun

http://en.wikipedia.org/wiki/File:Gatling_gun.jpg