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1. Learning Outcomes

After studying this module, you shall be able to know about-

- Manual types Firing Mechanisms
- Classification of Manual firing mechanisms
- Mode of Action of various manual firing mechanisms

2. Introduction

From the advent of firearms, it was a fascination that how a firearm works. From simple Roman Candles to present day Fully Automatic Assault Rifles, the firearm industry has seen a change beyond belief. As a layman when it is a curiosity about the features and capability of a particular firearm, there is an implemented interest on the mechanism forensically. Initially, the mechanism of firearms were very elemental type and obviously much simple bearing only some easy fundamentals. But nowadays, modern scientific techniques and advanced technology made the firearm development more sophisticated. Where, the initial firearms used to fire only single projectile and that too with the help of manual loading, the present day firearms literally doesn't need to be loaded manually with added modifications. Firearms can be basically classified into following types based upon the mechanism:

- 1) Manual Mechanisms
- 2) Automatic Mechanisms

In the manual mechanism firearms, the important feature is that the cartridge is loaded to the chamber manually after firing of every round. In these type of mechanisms, the cartridge filled magazine is locked into the firearm, if it support auxiliary feeding mechanism, from which every single cartridge shall be loaded and fired from the firearm.

When the part of the action is moved, it catches the cartridge from the magazine or otherwise feeding sections, and push it into the chamber where it is ready to be fired. But merely loading is not sufficient to fire a cartridge, there are certain other parameters which are needed to be taken care off and one of such factor is the cocking of the firearm. In order to hit the percussion cap of the cartridge, it is important that the cartridge case should be in the line of firing pin and that firing pin must exert sufficient force which subsequently creates a primary detonation to the primer composition. Bolt action, type of breech mechanism that was the fundamental to the development of the actually operative repeating rifle and a milestone for Manual Mechanisms. In the Bolt- Action mechanism, the hanging bolt is moved in a particular direction to load a live cartridge into the chamber and to cock the firing pin simultaneously. The bolt closes the breech opening and is generally locked in the same place, during the firing and leaving of projectile from the barrel, until the pressure is reduced to safe level, after which the breach can be opened either by hand or by some other means. If an extractor is attached to the bolt head, the empty case can be withdrawn and subsequently ejected from the weapon, and as the bolt goes backwards it can be made to compress a spring, storing the energy which can be subsequently used to drive the bolt forward again. In this section we will discuss about the manual loading and semi-automatic loading or self-loading actions of a firearm. The main difference between the former and latter one is based upon the mechanism of extraction and ejection of the empty round (cartridge case) and the loading of new round.

3. Major Parts of Firearm

3.1 Action

The action is the working mechanism of a firearm, for example, bolt action. It contains the moving components of the firearm that enable loading, firing, unloading and ejection of the used cartridge casings. Action is the part of the firearm that loads the cartridge and ejects it and consists of lever, pump, bolt and semi-automatic action.

Of these four actions lever, pump and bolt are found in firearms which fires a single round. Firearms that can shoot multiple rounds or repeaters include all these types of actions, but only the semiautomatic does not require manual operation between rounds. A truly automatic action is found on a machine gun.

3.2 Receiver

The receiver is the frame which contains the operating (or moving) parts of the firearm and includes the breech, which is usually the part of the barrel that includes the chamber into which a cartridge or projectile is loaded, and firing mechanism.

3.3 Bolt

The bolt blocks the rear of the chamber and is a mechanical moving part of a firearm. It is the locking and cartridge head supporting mechanism of some firearm designs that contains the firing pin, extractor, and sometimes the ejector.

3.4 Trigger Mechanism

The starting point of firing and the mechanism of firing is the trigger. When the trigger is pulled via the trigger mechanism, the hammer is released. The hammer strikes the firing pin or primer directly (depending on the firing mechanism).

3.5 Barrel

The projectile passes through a long hollow tube called as the barrel. That portion of the barrel through which the projectile exits is the muzzle end. The barrel of the firearm may be rifled or smooth bored and the inner portion of the barrel is termed as bore.

3.6 Stock

It is the portion of the gun that is held or shouldered. This term is usually used for long arm firearms and refers to the end of the firearm which is positioned into the shoulder for the purpose of supporting the firearm during aiming and firing and transferring some of the recoil. The part of the firearm, which is under the receiver and barrel, is called the fore-end stock.

3.7 Magazines

A magazine on the other hand is a container that holds the cartridges. Sometimes magazines themselves are loaded with cartridges by clips. On most firearms a magazine is detachable and replaceable.

3.8 Ejector

It is the mechanism on a firearm which ejects or expels a cartridge or cartridge case from a firearm. In order to fire smoothly and uninterruptedly, the empty case must be removed from the action so the succeeding round can be fed. The ejector customarily ejects the case out of the firearm by pressing against the rear of the case opposite the ejection port. The ejector can be an immovable piece of metal which strikes the case when it and the bolt reach a certain position. This is called a fixed ejector. Another type of ejector is a spring driven plunger in the face of the bolt. When the case is free of the chamber, the plunger forces the case to flip out of the port.

3.9 Extractor

It is the mechanism on a firearm that withdraws a cartridge or cartridge case from the chamber of a firearm. In bolt-action, lever-action, pump-action, and semi- or fully automatic firearms, extractors characteristically work in combination with ejectors to get rid of a completely fired, empty cartridge case from the weapon. The extractor removes the cartridge case from the chamber, principally dragging the case to the rear. At some point in the backward travel, the case usually makes contact with the ejector, which expels the used case out of the firearm, making area for an unfired cartridge to be loaded.

3.10 Firing Pin

A characteristic firing pin is a small rod of steel, with the end that strikes the primer rounded into a hemispherical contour and toughened. The rounded end make certain that the primer is indented rather than punctured, as would happen if the firing pin were sharply pointed. Most firing pins have a spring to impulse them out of interaction with the primer, and often will have an incorporated passive safety mechanism, such as a block that precludes them from moving forward except the trigger is depressed.

4. Classification of Manual Firing Mechanism

4.1 Bolt Action Mechanism

Bolt action firearms operate by opening and closing a bolt. The bolt can be lifted up and back to see whether the chamber is loaded. Generally, if the chamber is loaded a cartridge is ejected when the bolt is opened. In bolt – action weapons, a turning bolt slides in an extension to the barrel, this is basically the same system as in a turn bolt used to lock a door. Pushing the bolt forward brings the bolt face into battery with the breech end of the barrel and cocks the striker (or firing pin). Turning the bolt then locks it into place via bolt lugs engaging with slots in the barrel extension. The mechanism combines the firing pin, a spring, and an extractor, all contained in a locking breechblock.

The spring-loaded firing pin slide back and forth inside the bolt, which itself is the breechblock. The bolt is moved back and forth, and partially rotated, in the receiver by a projecting handle with a round knob. One or more lugs at the front or rear of the bolt (or at both) fit into slots in the receiver and lock the bolt firmly in place against the base of the cartridge chamber when the rifle is to be fired. As the bolt is thrust forward, it pushes a cartridge into the chamber and cocks the piece. The trigger releases the spring-driven firing pin inside the bolt. After firing, the extractor on the head of the bolt removes the spent cartridge and ejects it. The bolt moves a new cartridge from the magazine and repeats the process. Other bolt – action weapons cock the striker on the opening of the bolt. Straight – pull bolt actions also exist in which the rotary motion required to turn the bolt locking lugs into their recesses is applied by studs on the bolt which slide in spiral grooves cut into the barrel extension. Bolt – action weapons are generally magazine fed, either by a tubular magazine under the barrel, through the butt stock or via a box magazine under the bolt. Some bolt actions lock without rotating. Straight-pull bolts are used in the Canadian Ross, the Austrian Mannlicher, and the Swiss Schmidt-Rubin rifles. Bolts that turn to lock have been standard in the Krag-Jorgensen, Lee-Enfield, Springfield, and Lebel rifles, among others.

4.2 Lever Action Mechanism

In the Lever Mechanism a handle is fixed below the trigger and acts as the trigger guard in the normal position. When it is pushed forward, a rod is pulled backward and it extracts the fired cartridge and cocks the firearm. Simultaneously, the carrier bolt is pushed upward which carries live cartridge. When the lever is brought to its normal position, the rod places the live cartridge in the chamber and the carrier block takes its original position and the firearm is ready to fire. Once a lever-action gun is cocked, the only way to uncock it is to clutch the hammer and squeeze the trigger. In contrast to bolt-action, semi-automatic, or selective-fire weapons, most lever-action firearms are rifles, but some lever-action shotguns and a few pistols have also been produced. One of the most celebrated lever-action firearms is the Winchester Model 1873 rifle. Due to the sophisticated rate of fire and shorter overall length than most bolt-action rifles, lever-actions have persisted prevalent to this day for sporting use, specifically short- and medium-range hunting in forests, scrub, or bush land.

4.3 Slide Action Mechanism

In Slide – action weapons, which are also referred to as Pump – action or Trombone Action, the breech block is attached, via operating rods, to a moveable fore end. On pulling back the fore – end, the mechanism locking the breech block to the barrel is released. By pulling the fore – end to the rearmost extent of its travel then pushing it forward, the empty cartridge case is ejected, a fresh round is loaded into the chamber and the action is cocked. Pump actions are common on shotguns. In pump action shotguns the mechanism works by pulling the fore-stock to the rear to open the chamber, eject the empty cartridge case, and pick up the next round from the magazine. Pushing it forward again chambers the new round. Most often fed from tubular magazines but examples with detachable box magazines can be found.

4.4 Break Action Mechanism

A break action is a type of firearm where the barrel(s) are hinged and can be “broken open” to expose the breech. There is a knob under the barrels through which a pin passes and the barrels swivel on this pin. There is also an aperture cut into the other side of the knob. When the barrels are closed back in place, the user turns the lever in front of the trigger guard, which pushes a projection into the slot, thereby keeping the barrels from moving upwards. When the barrels are tilted upwards, the user can remove the old cartridges, insert the new cartridges into the barrels and then close and lock the mechanism. Multi-barrel break action firearms are usually subdivided into over-and-under or side-by-side configurations for two barrel configurations or “combination gun” when mixed rifle and shotgun barrels are used.

7. Summary

- Initial firearms were used to be of simple mechanism of manually loading, usually, from the muzzle end and had no specific mechanism of firing as comparable to the modern day firearms.
- Since, the propellant mixtures and the projectile were used to fed in the barrel manually, the former would burn (either completely or partially) but the latter would expelled from the barrel. Hence, no as such requirement of explicit mechanisms.
- As soon as the developments were advanced in the field of firearm manufacture, the experts as well as the users felt the requirement of some sort of dedicated machinery which could work in a precised manner to operate the firearm which were now more advanced as compared to the older days firearms.
- During the course of inventions, different categories of firing mechanisms were designed. Some of them were still required the manual involvements, be it the initial loading of the first cartridge or at every stage of loading of the cartridge.
- Firing Mechanisms were therefore categorized into two broad categories, first was Manual Firing Mechanism containing the Bolt- Action mechanism, Lever- Action Mechanism, Pump- Action Mechanism and the second one is the Automatic Mechanisms like Gas Operated Mechanism, Blow Back Mechanism, Recoil Mechanism and nevertheless the Semi- Automatic Mechanism.
- The Bolt- Action mechanism is the widely used mechanism in the present day firearms especially in the long rifles due to its robust working potential. It could be said as a simplest mechanism in the set of Manual Mechanism.

- The other mechanism like Pump- Action or the Trombone action mechanism are generally found in the Shotguns containing more than one cartridges in the housing chamber or magazine.
- Lever Action mechanisms were not in vogue in the present days because of uncommon loading mechanism. However, in the foreign countries they are still proving themselves in the sports.