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THE DEVELOPMENT OF INFANTRY FIREARMS AND ITS IMPACT ON ARMY TACTICS

Today it is natural that army soldiers are equipped with long-range firearms. However, it must be mentioned that firearms working with gunpowder became a major instrument of tactics on battlefields quite slowly. Many difficulties had to be overcome before firearms started to dominate battlefields.

At the beginning of the Middle Ages heavily armoured knights dominated the battlefields of Europe. Although lancers and archers played a significant role in fights against the heavy cavalry, it was the infantry equipped with effective firearms that ultimately brought to an end this dominance. The warriors who believed in chivalric ideals hated and feared the new weapons which ended the time of open battles and ritual close combats. Any shooter of no rank could kill a noble knight from a long distance. Even so, many centuries passed before the infantry equipped with firearms started to dominate battlefields.

The Emergence of Firearms

The invention of gunpowder led to the emergence of firearms. They worked by burning gunpowder and thereby sending a lead or other metal bullet forward. It was in 1364 that the use of these new weapons – called “hand cannons” – was first recorded. They were [the first step](#) in the invention of guns and 14 years later handguns spread all over Europe. Several kinds of firing mechanisms were developed in history:

- 1) Matchlock: Upon the pulling of a trigger a burning wick on a spring was „locked” back into a pan of powder. The powder in the pan was ignited and sent a flame through a small hole into the barrel chamber of the weapon; then a larger amount of powder was ignited which sent the bullet forward.
- 2) Wheel lock: It emerged in the early 16th century; it included a wheel lock mechanism in which there was a wheel spun against a metal plate which in turn showered sparks into the powder pan.

- 3) Flintlock: The flintlock emerged in the yearly 17th century; it had a flint which was released by the trigger mechanism and then stroke a steel plate to shower sparks into the powder pan.
- 4) Percussion: Next, the „percussion” ignition mechanism was introduced in the 19th century. The released hammer struck a cap containing a volatile fuse and sending a flame through a small tube into the barrel chamber.

The firearms of infantrymen were an important element in army equipment as early as the 15th century. In 1479, 4000 heavy gunners and 2000 gunners fought in the army of Matthias I, King of Hungary. Regardless of this, combat arms were considered very useful at the siege of castles, but not in close combats.¹

Nevertheless, in the 15th century fire weapons were often apostrophised as „toys” and only in the Italian campaigns (1494-1559) could they prove their superiority over knights’ armour and the crossbow. At the beginning, firearms were not as accurate as contemporary bows but their production was cheaper and fusiliers’ training was faster and less expensive than archers’. By the first half of the 16th century several types of handguns had appeared on battlefields.

- 1) A relatively lighter weapon called the arquebus, which was developed in the 15th century and is known by several other names, as well;
- 2) the musket, developed in the 15th century.

The arquebus was a medium-weight gun complete with a lock, butt and barrel. Three major types of arquebuses were introduced:

1. with serpentine locks,
2. with snapping matchlocks,
3. with sear lock matchlocks,

The arquebus weighed about 5 kg. Although its bullet (30-35 g) was half the size of a musket round, the arquebus could be charged two or three times faster than the musket. The musket was introduced in Spain in the early 16th century and operated with a matchlock mechanism. Its calibre was 20 mm and at the beginning it was very heavy (8-10 kg). Therefore, it was way too difficult to aim with. Its great advantage was that its sixty-gram bullet could be lethal even from a distance of 200-300 metres and could also penetrate the armour of knights.²

During the 16th century both of these weapons were used in battles, but musketeers and arquebusiers were organised into separate military units. The Spanish and German infantries used fire weapons first to defeat Swiss soldiers at Bicocca in 1522, then the knights of Francois, King of France at Pavia in 1525.

¹ About the arms of Matthias I, cf. (Hazay Samu: Védőalkotmány, haderő és harcászat Mátyás király alatt, hadtörténelmi Közlemények, 1890. p. 222), Rohonyi László-Nagy Gábor-Tóth Gyula: Szemelvények a magyar hadtörténelem tanulmányozásához I. Hadtörténelmi Intézet, Budapest, 1955. p. 110.

² A 179-centimetre-long musket weighing 20 kg is known from the 16th century, whose caliber is 21.9 mm.

By the end of the 16th century the mass application of hand-firearms decided the combat between cavalry and infantry for good. Wars demanded a huge number of disciplined foot-soldiers who were equipped with pikes and firearms.

The two types of infantry caused problems for contemporary tactics, as well. Musketeers could cause severe casualties from a great distance but at the beginning they were unsuitable for close-range fighting. This problem was solved with lancers, halberdiers and later pike men. Soldiers with firearms and pikes divided the battle order, and for this reason their cooperation had to be thoroughly organised. A major condition of standard tactics was the correct organisation of infantry units, so that the correct ratio of soldiers and the best tactical optimum, tactical configurations and procedures should be experimentally attempted and achieved. The simultaneous fight of the two different types of infantries required strict discipline and systematic drills. By the end of the 16th century the organisation of the infantry was standardised. Infantry units included pike men and musketeers in a ratio of one to two.

Thus, the major tactical problem of the 16th and 17th centuries was the optimal employment of fire and fire weapons in a united combat formation.³ The harmony of fire, movement, tactical endurance and shock-attack had to be created. The early combat formation of the infantry was called Tercio. The Tercio was a huge square of lancers with musketeers and arquebusiers at its edges. At the beginning it contained 3700 soldiers, which was decreased to 1600 by the 1580s. The phalanx-like formation was not an ideal one but for one century it provided a solution for the most important tactical problem of this historical era. It was a combat formation in which the shooters meant the firepower and the pike men the shock-action; in addition, the latter also protected the musketeers during reloading. The musketeers filled ten lines at the corners of the Tercio, while the arquebusiers stood in five lines right before the pike men. The issue of non-stop firing was solved by a complicated movement, the so-called countermarch. It meant that the soldiers who had a loaded gun moved forward, while those with an uncharged weapon moved to the rear to load. In this formation the pike men played the main part while firearms played an auxiliary role.⁴ In spite of its awkwardness the Spanish Tercio remained undefeated until the Battle of Rocroi in 1643. The close formation made the retreat of the Spanish infantry possible even in the case of the defeat of the whole Spanish army. Thus, the infantry retained its fighting efficiency, which could make victory uncertain for their enemy.

By the beginning of the 17th century the musket became the most important weapon in western armies.⁵ The calibre of the much-improved musket was still about 20 mm. It was a weapon with a matchlock, but its weight decreased to 4-5

³ Geoffrey Parker: a hadügyi forradalom védelmében, Veszprémy László: A korai stratégiai gondolkodás: Zrínyi kiadó, Budapest, 2005. p.79.

⁴ Lázár Balázs: A harmincéves háború(1618-1648) Poór János, A Kora Újkor Története, Osiris Kiadó, Budapest, 2009. p. 29.

⁵ Raimondo Montecuccoli: A hadművészet rövid tételei. (Koeln, 1704) A hadművészet középkori és újkori klasszikusai, Zrínyi katonai kiadó,1974. p. 216.

kg and its shot became more precise. The employment of hand guns demanded that the infantry should be able to keep the enemy under continuous line-firing in an open battle. This idea appeared for the first time in a treatise by Thomas Digges, which was written in 1579. Moritz of Orange, based on his experience between 1584 and 1609, suggested that infantry units should be smaller than the Tercio. He organised a new unit called the battalion, which consisted of 550 soldiers. He tried to combine the fire-power of the infantry with the close-combat formations and training systems of the Romans.⁶ He reduced the depth of the infantry formation and it filled ten lines for battle at most. After his reforms musketeers played the most significant role in battles. They had the best training and their main task was to shoot as often and quickly as possible.

Gustavus Adolphus, King of Sweden (1594-1632) reduced the infantry formation to six lines. Although he had fewer soldiers, his formation was wider. Thus, this order of battle was effective because more soldiers could shoot at the same time. After the line-firing of the musketry, pike men had to attack the enemy in the Swedish army. The Swedish musketry could fire non-stop because they could stand in combat formation in three lines. If the enemy managed to approach the musketry too closely, the shooters went back behind the pike men. European armies started to imitate the Swedish combat mode and by the end of the 17th century line tactics was developed. Because of the firearms the organisation and drill of the cavalry was also changed. From that time on, the cavalry was also divided into branches according to their task and equipment. Knights disappeared from the battlefield and the heavy cavalry appeared instead, which received a thorough training for fighting in formation. In the early 16th century the wheel-lock was invented, in which the hammer hit a rotating friction-wheel and the nascent spark lit the gunpowder. The new handgun was very expensive but it could be used on horse-back. Therefore, it became the weapon of the cavalry. Based on this weapon, a new cavalry combat formation named caracole emerged. The cavalry started the attack line by line, they approached the enemy in full gallop and fired at them; then they went back to the rear to reload their guns. In the Thirty Years War the cavalry tactics returned to its former spirited and aggressive attacks, and cavalry soldiers had to be able to use both sword and pistol. The great invention of the Thirty Years War war was the paper cartridge, which made reloading and aiming faster. Later, the carefully prepared and already measured gunpowder and the bullet were packed into a paper sleeve.

The middle of 17th century saw the invention of flint-locks. At the same time bayonets were introduced. The use of the stable rifle superseded the pike and at the beginning of the 18th century the united infantry evolved.

⁶ Geoffrey Parker: a hadügyi forradalom védelmében, Veszprémy László: A korai stratégiai gondolkodás: Zrínyi kiadó, Budapest, 2005. pp. 68-69.

The Infantry in the 18-19th Centuries

The infantry of the 18th century deployed in line for battle. The basic tactical unit was the battalion, including 600-1000 men. Battalions usually drew up in battle line next to each other. The number of their lines gradually decreased. Ultimately, the order of battle consisted of three lines of troops standing within 200-300 metres behind one another. The second and third lines were the reserve for supplies in case of casualties or a need for re-enforced attack. Thus, breaking the first line was not enough for a final victory, because the fight continued in the second or third lines. The infantry started fire at a distance of 200 metres from the enemy, stopping in their march to discharge a volley and taking turns line by line. Soldiers were required to reach high shot rates and therefore to reload their weapons very quickly.

It was during the French Revolution that a combined line and column tactics was established. The column was responsible for the breakthrough, while skirmishers were sent forward to progress in a loose chain and paralyse enemy orders of battle with rifle shots. The new battle process specifically demanded firearms and trained soldiers to use them. In the Napoleonic Wars, especially in the British army, the use of rifles became increasingly common and the modern light infantry emerged all over Europe.

However, flints were far from being perfect weapons because they did not work in windy weather. Under normal circumstances, they missed fire once out of five to six shots and beyond 250 metres the penetration force of their bullets practically dropped to zero. According to an experiment carried out at the beginning of the 19th century, a target sized 1.8x36 metres was hit only by 75% of the shots fired from these weapons from a distance of 75 metres.

In the early 19th century attempts were made to improve the safety of the rifles' operation. In the fuse and percussion firing mechanisms it was not a spark produced by a collision of flint and steel any more that released the shot, but a percussion cap or fuse hit by the cock and producing a jet lance.

In the 19th century flintlocks were converted into the more reliable percussion systems. Such guns included, for example, the Consol musket introduced in 1835 and the musket planned by Baron von Augustin which the Austro-Hungarian Army used, including the time of the Hungarian War of Independence (1848-49).⁷

In the 16th century barrels were rifled in straight lines for easier cleaning. It was recognised even then that if the projectile engages the rifling, the shot is more accurate and the shooting distance is longer. Later on, helical grooves were introduced, which spin the projectile and thus stabilise it, thereby enabling the projectile to fly with high precision and more power. The severe drawback of rifling was that with muzzleloaders great strength and a long time were required for charging, even when soft lead bullets were used.

⁷ Horváth Árpád- Kovács Zoltán: *A Haditechnika Évezredei*, Zrínyi katonai Kiadó, Budapest, 1977. p. 41.

„Loading a gun lasted about three minutes, leaving soldiers exhausted, so it was impossible to take aim precisely after a few charges.”⁸

During the charging time soldiers were vulnerable to shock-action. Thus, it was often the case that while one of them was shooting, another was charging a shotgun. As a last resort, soldiers also used ammunition with a diameter smaller than that of the barrel, except that in this case a gun with a rifled barrel was no better than a smoothbore weapon.⁹

The problem of quickly reloading rifle-bore muzzleloaders was solved by Captain Minié, a Frenchman. He used soft projectiles made of lead, which were smaller in diameter than the barrel. At the base of these bullets there was a conical cavity. When the weapon was being charged, the projectile could be slipped into the barrel easily, but when the rifle was fired, the expanding gases were pressed into the cavity, deforming the bullet so that it should engage the rifling. Both individual soldiers and task forces could be accurately aimed at from a distance of 3-400 and 7-800 metres, respectively. These guns were used in the Crimean War (1853-56) for the first time and afterwards every army adopted them. Rifle-bore guns were employed in large numbers in the Austro-Piedmontese War in 1859. The benefits of the new weapon were recognized by the French Army as early as the siege of Sevastopol. After the war, a light infantry battalion was organised in all French infantry divisions which consisted of trained riflemen. The select soldiers could fire precision shots at enemy soldiers in cover from 200 metres, at uncovered ones from 400 metres, and at fighting formations from 700 metres.

The rifles (Minié, Lorenz) had a decisive impact on the contemporary battlefield. The deployment of troops in close order became obsolete, because the enemy could open fire and shoot with great accuracy from a distance four times larger than before. Smaller, more open formations and faster, more decisive movement were needed. The double march became the main form of movement on the battlefield. Soldiers often performed it intermittently, running forward from cover to cover. Unfortunately, military leaders did not always recognise the need for innovation; therefore, it was often the troops who suffered terrible losses.

The next step was the introduction of breechloaders. The protagonist of the Austro-Prussian War of 1866 was the Dreyse rifle, which had been introduced in 1841. With this weapon it was possible to take aim from 750 metres and its fire-rate was five to six times bigger than that of muzzleloaders. Dreyse put a bullet and gunpowder in cartridge-paper. When the trigger was pulled, a needle pierced the fuse and the shot was fired.

The fearsome fire-rate of Dreyse rifles decided the 1866 war, because in the face of such firepower Austro-Hungarian offensive tactics proved ineffective. The tactical rules of the Austro-Hungarian Army were written in the year 1862 and based on the war experience gained in 1859. Austrian generals believed that

⁸ Kedves Gyula: Elöltöltős kézi lőfegyverek, VENATUS, February 1991. p. 17.

⁹ Kedves Gyula: Elöltöltős kézi lőfegyverek, VENATUS, February 1991. p. 17.

if French troops moving in double march had managed to penetrate quickly the dangerous zone under the fire of the still muzzle-loading Lorenz rifles, they could apply the same method fighting against the Prussians. However, the much higher rate of fire of the Prussian needle guns repulsed every attack. The large, slow moving Austro-Hungarian units were easy targets and suffered catastrophic losses. While the Prussian Army was trying to adjust to the new circumstances, the Austro-Hungarian was not.

That said, the Dreyse rifle had some serious drawbacks notwithstanding all its tactical advantages. The locking mechanism could only be manufactured by slow hand-tooling. The spare parts were not interchangeable. In use, worn weapons emitted hot gas at the rear end. The Dreyse rifle was followed by the French Chassepot rifle as early as 1866. The French rifle had a fire range of 1300-1500 metres, while its fire-rate was 5-12 rounds/minute.

The invention of smokeless gunpowder and the introduction of the metal case enabled the development of new weapons. The role of the infantry continued to grow because the fire power of infantry troops had increased significantly their defence capability.

Weapons in Modern Warfare

As early as the 15th century there had been experiments with the development of firearms which could shoot multiple times in succession without reloading. The prime condition for constructing such weapons was the invention of combined ammunition. However, for the production of metallic cartridges nineteenth-century technological developments were required. The metal cartridge case includes the powder, primers and bullets, which simplifies the use of ammunition and weapons. Its other advantage is that the flexible metal casing prevents the emittance of gases at the rear end. This innovation led to the spreading of first repeating rifles with a magazine attached, and then of machine guns. The first firearms made for this type of ammunition were revolvers, which were followed by repeating rifles. It was in the American Civil War (1861-65) that the first repeaters were used in larger quantities.

At the end of the 19th century black powder, which generates smoke, was ousted by nitrogen compounds whose smoke is barely noticeable. Called smokeless powder, they include such chemicals as the French Poudre B, employed since 1885, and the British cordite introduced in 1890. The use of better-quality powder made it possible to reduce the calibre of weapons. It also increased the muzzle velocity of projectiles, and thus improved the weapons' effective range and made the line of fire more easily concealable, as well.¹⁰

The technical improvements that play a decisive role in modern warfare appeared as early as before World War I. The first real machine gun was invented by American Hiram Maxim in 1883. He put the ammunition in a hemp cartridge belt, which was exchanged for a metal one in later warfare. The

¹⁰ The first of these rifles, the French Lebel was introduced in 1886.

machinery of the gun moved the cartridge belt forward to provide ammunition for charging. The cycle of charging and shooting is repeated as long as the shooter activates the trigger.

At the end of the 19th century armies used two different types of ammunition. High-power rifle rounds were fired by rifles and machine guns, while small ammunition was used for pistols. The effective range of the rifles was high (900-1000 m), but their fire-rate was low (10-15 rounds/minute). The fire range of machine guns could be as much as 2500 metres; their rate of fire could be as high as 2-300 rounds/ minute. Their major disadvantage was their heavy weight (30-50 kg). Therefore, they were hardly ever moved on the battlefield and were considered defence weapons. During World War I, the role of repeating rifles decreased, while the number of automatic weapons increased.

It is the machine gun that had the greatest effect on the fights of infantry in the Great War. It was a deadly weapon because the infantry attacking in open battle order was not able to defend itself against massive machine gun fire. It was able to stop any infantry attack, however superior in numbers. Generalship was powerless in the face of this firearm. The collapse of conventional offensive tactics occurred by the River Somme 1 July, 1916. On this day, the British infantry lost about 60 000 soldiers during its futile attacks. Against the machine gun fire, the striker chain deploying infantry formations in itself was of no great help.

Machine guns were way too heavy and used a lot of ammunition. When the artillery had shelled the battle field, machine guns were often left behind and could not support the infantry. Therefore, infantry troops could only defend themselves against the attacks of the enemy with their rifles. It was necessary to provide the infantry with a light and high fire-rate weapon which they could carry forward and which could secure their fire support.

This weapon, which was invented in 1904, has many names in military terminology.¹¹ The best-known of these are the light machine gun, widespread in English- and German-speaking countries, and the automatic rifle, used in Eastern parts of Europe. These types of weapons included the French Chauchat Modèle 1915, or the British Lewis guns. Automatic rifles also used rifle rounds, but they were lighter (7-13 kg) than machine guns. They were mostly supplied from magazines with shots discharged in short series (4-5 shots) from the rifles mounted on bipods. The German MG-34 and MG-42 were the first general-purpose machine guns because mounted on tripods or bipods they could function as both light machine guns and automatic rifles, respectively.

Soldiers often needed a high fire-rate weapon for trench warfare, where long-range weapons were unnecessary. The emerging new weapon fired pistol ammunition and was called the submachine gun. Based on the experiences of trench warfare, it was introduced as a melee weapon. Between the two world

¹¹ In 1904, a part of the Russian cavalry was equipped with Danish-developed Madsen light machine guns weighing 7.5 kg.

wars, a lot of types of submachine guns were mass-designed. By the start of World War II most infantries had such weapons.

Self-loading rifles were developed before the end of the 19th century. The first selective fire (semi or full auto) rifle was the Italian 6.5 mm Cei-Rigotti. It was developed between 1900 and 1905, but this was not adopted by other countries. It used small-calibre Italian rifle ammunition (6.5 mm). The first service weapon which can be identified as conforming to the specifications of an assault rifle dates back to World War I; this is the Russian Federov Avtomat of 1916. It was a selective fire weapon, but it operated with the 6.5 mm Japanese rifle ammunition Arisaka. Therefore my opinion is that it was not a real assault rifle and the Russian army actually did not adopt it to its armament.

Between the two World Wars, many countries formulated the need for a weapon whose effect combines those of rifles and machine guns. Engineers realised that rifle range is unnecessarily long (1000 metres), while that of machine guns is too small (50-100 metres). The basic requirement was that soldiers should be both able to shoot with great accuracy within a reasonable combat range (400 metres) and use their weapon as an automatic firearm within a short range (maximum 50 metres). The new weapon combined the virtues of the machine gun and rifle. The requirements could be met only with a new type of ammunition, which has various names in military terminology.

Without doubt, it was the Germans who developed the first military weapon and ammunition of this new type, in 1943. The new weapon was named MP-44. Germans used the 7,92 x33 mm, so-called „kurz” ammunition for it. The MP-44 was a weapon of very characteristic shape and design, which had a deep impact on all subsequent weapon development. A new category of weapons was born, named the assault rifle. The next weapon of a similar type was invented in the Soviet Union in 1947. The Soviets used 7.62x39 mm ammunition, called 43 M. The popularity of the AK-47 assault rifle and its enhanced version can not be disputed. Its different versions were manufactured in a quantity of approximately 80-100 million, and are to be found in various parts of the world. The simple and robust weapon is easy to handle and works under the most extreme conditions. Within 4-500 metres it has enough penetration force and allows for sufficiently precise shots.

The NATO countries did not follow suit for a long time. The NATO standard ammunition of 7.62 x51 mm was chosen as rifle ammunition. Their infantry was equipped with automatic or semi-automatic weapons, such as M14, the M15, FN FAL or HK G3, which operated with rifle ammunition. The first NATO rifles constructed for standard cartridge were not assault rifles. Some of the early rifles which worked with the 7.62x51 NATO round, such as the American M14, were also capable of fully automatic fire, but the recoil problem made them incapable of accurate fire on full-auto; therefore, they cannot be classified as assault rifles. The powerful ammunition allowed for accurate and effective single shots, but kicked back and overtaxed the shooter's strength during a series of shots. The experience of local wars in the 1950s and 1960s,

together with the uselessness of American M-14 automatic rifles in Vietnam, coupled with other causes led to new developments. A new type of ammunition with a calibre of 5.56 mm was designed, and a new weapon was developed to suit it. The new assault rifle (according to the American terminology automatic rifle) was named M 16 and has a calibre of 5.56x45 mm. Many legends surround this automatic rifle, which are based on partial truths. The NATO countries developed and introduced different types of weapons based on the new ammunition. Their example of calibre reduction was followed by the Soviet Union, but they introduced a different kind of ammunition with a calibre of 5.45x39 mm. Many weapons called machine guns and light machine guns have been designed for the short ammunition, but they are not real machine guns, since their performance is much lower. The terminological confusion has escalated and today few can find their way in the world of weapons.

Summary

Firearms turned the infantry into the dominant force of the battlefield over the centuries. The most dramatic development of weapons and military organisations occurred during the 19th century in Europe. The infantry's combat strength grew and it became the most important branch of armies. The impact of new weapons required that armies should adapt to the new conditions and develop their tactics and equipment accordingly. Smokeless powders increased the range of targeted fire. Armed forces could not risk attacking in closed formations in battles any more and this ended the period of medieval military prowess. Throughout history, not all generals understood the requirements of new eras. The old military ethos often caused great losses in the armies and it was the simple soldiers who paid with their lives for the stupidity of their leaders.

The machine gun also had a thorough-going influence on the development of infantry tactics. The weapons and ammunition used today were developed before World War I and the new weapons rewrote the rules of the military mathematics of former ages.

At the end of World War II, new categories of weapons were developed, which determine infantry tactics today. The development of infantry weapons, of course, has not stopped. For sure, small-calibre ammunitions and related weapons seem to have more legendary than real abilities. Information in professional literature on arms is often deceptive; therefore, it is to be handled with some reservations. In my opinion, military policy is inseparable from business and the introduction of innovations is not always based on technical and professional merits exclusively.

In the wars that have started since the disintegration of the cold war bipolar world order, several tactical problems have occurred which did not exist in the past. The penetration force of relatively low-power small-calibre ammunitions is not enough against wide-spread personal protective equipment, and this calibre can become ineffective in the near future. For this reason, until the introduction

of new weapons armies often fight with older weapons that have proven their power.

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