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HAND FIREARMS IN 15TH-CENTURY POLAND. WHY DID THE BREAKTHROUGH HAPPEN?

Abstract: The first mention of the use of artillery in Poland comes from 1383. Information on hand firearms is slightly later. In 1410, the use of one *handbuchse* by municipal guards in Kraków was recorded. However, over the next decades, hand firearms in Poland did not play a significant role. According to the records of mercenary infantry from the 1470s, less than 1% of soldiers owned firearms (simple handgonnes and hackbuts). Small arms started to play a bigger role only in the 1490s. According to the lists of mercenary infantry from 1496, 27% of shooters had firearms, while the rest still used crossbows. In the following years, the percentage of soldiers with firearms increased, exceeding 80% in 1500. It should be noted that in the late 15th century in mercenary censuses there is a new type of weapon called *rusznica*, a term that should be associated with matchlock handgonnes. The weapon quickly gained recognition from mercenaries. After 1498, matchlock handgonnes also appeared in the equipment of mounted mercenaries and members of the court banner. Matchlock handgonnes almost completely replaced crossbows in the armament of mercenary infantry. The author tries to present these changes in a European context, and explain how such changes in the armament of foot soldiers were possible in such a short time.

Keywords: firearms, Poland, 15-16th century, arms, mercenaries, handgonne, hackbut

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Introduction

Despite the appearance of firearms in Europe at the end of the 13th century, it took a long time for them to play an important role in war. The reasons for this included the high costs of their production and use as well as the poor performance of the oldest types of these weapons. Gradually, the weapons were improved; but while the importance of artillery grew quickly, handguns developed more slowly. It was only in the second half of the 15th century that the improvement of their performance, with the simultaneous reduction of the costs of their production and use, led to a rapid increase in their importance.¹ Improved handguns replaced the crossbows which had been the basic long-range weapon of many European armies. In recent years, there has been an increase in interest in firearms in Poland in the

Middle Ages and Early Modern Period. Nevertheless, many aspects of the origins of gunpowder weapons still require further research. This article attempts to show on a European background the changes in the firearm equipment of the mercenary forces of the Kingdom of Poland in the years 1471-1500. The chronological scope of the article is determined by the registers of mercenaries, which are the basic source of knowledge about soldiers and allow changes in soldiers' equipment to be tracked.²

In written sources, firearms appear under different names. The most primitive form of hand-held firearm, the handgonne, had a short barrel and was mounted on either a simple stock or a stick constituting its extension.³ This

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¹ About the reasons for the initially slow development of firearms see Heuser 2012, 3-27.

² The records come from the collections of: Archiwum Główne Akt Dawnych w Warszawie [further: AGAD], Rachunki Królewskie [further: RK], vol. 16; Archiwum Skarbu Koronnego [further: ASK], Oddział 85, vol. 1-4. Registers of horse lists from 1501 were also used.

³ Szymczak 2004, 39.





Fig. 1. Handgonne from the 1st half of the 15th century, Polish Army Museum in Warsaw.
Source: <http://www.muzeumwp.pl/emwpaedia/puszkareczna-z-przelomu-xiv-xv-wieku.php>.

weapon is also found in sources as *kij* (stick), *handbuchse*, and *pixidum*. In this article, I will use the term handgonne. A weapon from the collection of the Polish Army Museum in Warsaw may be an example of this type of firearm (Fig. 1).

The second type of firearm in Polish sources was the hackbut (*hakownycza*, *haken*, *hakenbuchse*), a weapon with a hook in the lower part of the stock, used to attach to a support in order to decrease the recoil. Known throughout Europe, hackbuts were available both in a lighter version used as an individual weapon and a heavier version operated by two people. The third type of firearms appearing in Polish sources is the *rucznyca* (matchlock handgonne).⁴ The term was derived from the Old Polish adjective *ruczny* (manual), borrowed from the Czech *ručnica*, meaning manual guns. In Poland, this term is equated with a firearm with a long barrel, mounted on a wooden stock with a clearly formed butt bent downwards. It is assumed that this weapon was equipped with a matchlock.⁵ In this article, it will be referred to as matchlock handgonne. In turn, the *bombarda* that appears quite often in the sources is a term for firearms in general, not exclusively for handguns.⁶

Information on firearms in Poland appears much later than in Western Europe. The first mention of its use was recorded by Jan of Czarnków (c. 1320–1387). This chronicler, describing the civil war in Greater Poland (1382–1385), mentioned the successful firing

of cannon during the siege of Pyzdry town in 1383.⁷ In turn, the oldest certain mention of handguns in Poland comes from 1410, when one of the city guards in Kraków was noted as armed with a *handbuchse*.⁸ A large reserve of handgonnes was owned by craftsmen's guilds in Kraków in 1427. In the censuses prepared at that time at the behest of the municipal authorities, a total of 88 *hantbochsen* was recorded, along with other weapons.⁹ There are grounds to suppose that firearms in Kraków were used in the last decade of the 14th century. It is during this period that the city's purchase of lead and gunpowder is mentioned.¹⁰

Hand firearms in the 15th-century Kingdom of Poland

The primary source for learning about the role of handguns in Poland in the last decades of the 15th century are the above-mentioned mercenary infantry registers. They show that in 1471 only 4 handgonnes and 12 hackbuts were recorded among the equipment of 1,782 mercenary shooters. This means that less than 1% of mercenary infantrymen were armed with firearms at that time. In the list of weapons lost by mercenaries from 1474, only one firearm was recorded: a bombard, (therefore also a handgonne or a hackbut). Records from 1477 show that all of the 259 shooters used crossbows, and no

⁴ In this article, the term 'matchlock handgonnes' is used to describe the Polish term 'rusznica', which is an equivalent of the early arquebus.

⁵ Strzyż 2014, 68. In Polish sources, the term 'matchlock handgonne' cannot be equated to an 'arquebus'. In Poland, the 'arquebus' appears for the first time in 1538. In his work *Consilium rationis bellicae* of 1558, hetman Jan Tarnowski (1488-1561) clearly distinguishes between these two types of weapons, writing that there are few infantrymen who have arquebuses, most of them still use 'vile matchlock handgonnes'. Polish researchers assume that the difference between the matchlock handgonne and the arquebus was a different barrel design. In arquebuses it was more durable, thanks to which it was possible to use larger gunpowder charges, as a result of which the initial velocity of the bullet increased, which translated into an increase in the range and firepower of such weapons, *Consilium...*, 53; Szymczak 2004, 47.

⁶ Strzyż 2014, 25-26.

⁷ The chronicler Jan of Czarnków (c. 1320-1387) describes this event in the following way: 'craftsman [...] threw a stone from the aerial cannon into the city gate, which, having pierced two of its closures, hit the parson Nicholas of Biechów who was looking at it and standing on the street on the other side of the gate, with such great force that he fell down from this blow and died immediately' (*artificem [...] lapidem aero de pixide in valvam civitatis jecisse, qui lapis duas clausuras valve cum vehementia pertransiens, dominum Nicolaum plebanum de Bychovia in platea civitatis ex opposito valvae aspicientem contigit, qui cadens subito exspiravit*), Joannis de Czarnkow *Chronicon...*, 726.

⁸ Szymczak 2004, 15.

⁹ 'Domini Consules facerunt conscribi arma, qua vnumquidque artificium alias *cecha* in civitate habent, non que in singulari quis habet, sed qua habent in communi thesauro ipsius artificii seu *czeche*', *Kodeks...*, 409-420, no. 105.

¹⁰ Kraków also sent its cannons to the war of Władysław Jagiełło against Władysław, prince of Opole in 1391, Szymczak 1990, 287-290.

Table 1. Firearms equipped with mercenary infantry 1471, 1477, 1496-1500.

Year	Type of hand-held firearm			Percentage of shooters with firearms
	Handgonne	Hackbut	Matchlock handgonne	
1471	4	12	–	0.8
1477	–	–	–	–
1496	–	–	230	27.1
1497	–	–	389	61.0
1498	–	–	857	55.5
1500	–	–	336	82.9
total	4	12	1,812	

Source: ASK 85, vol. 1-4; RK, vol. 16, AGAD.

firearms were recorded (see Table 1). The first mention of a matchlock handgonne in Polish sources comes from 1478. It was in the record of armaments at the castle in Łowicz, belonging to the archbishops of Gniezno. In the local armoury, among other weapons, there were two small (*parve*) matchlock handgones.¹¹ For the next dozen or so years, Polish sources do not provide information about guns, which makes it impossible to trace the changes in firearms. The information from the Silesia region of the Kingdom of Poland proves that these were the years of its growing importance. The inventory written in 1483 in Wrocław shows that the arsenal there had 107 guns and 749 handguns, of which – importantly – 240 were matchlock handgones.¹²

Much more information about hand firearms has been preserved from the last decade of the 15th century. They appear many times in the inventory of weapons stored in castles in the south-eastern territories of the Kingdom of Poland. In Kamieniec Podolski (now Kamianets Podilskyi, Ukraine) there were 38 hackbuts and 15 matchlock handgones. Inventories from 1495 show that in Lviv there were 5 hackbuts and 14 matchlock handgones, and in Hlyniany¹³ there was 1 hackbut and 20 matchlock handgones. In the second inventory of the Hlyniany castle (unfortunately not dated) 5 hackbuts and 17 matchlock handgones were noted. These inventories also note that the matchlock handgones in Kamianets Podilskyi and Hlyniany were damaged (*fractae*). In the inventories of the castles in Lviv and Hlyniany, the writer noted that the matchlock handgones stored there had barrels made of iron.¹⁴

Matchlock handgones in Central Europe

In Poland, we observe significant changes in the armament of the infantry in the 1490s (Table 1). According to the records of mercenary infantry from 1496, 826 shooters were in service, 230 of whom had matchlocks and 596 had crossbows. The percentage of firearms fluctuated in individual divisions within the range of 24-39%, with the average for all shooters being 27.1%. Infantry registers compiled a year later show that soldiers were more and more willing to use firearms. There were 640 shooters in service at the time, 389 of which (61%) had matchlock handgones. It is worth noting that in one unit of 102 shooters, 99 soldiers had firearms, while only 3 had crossbows. The lists of mercenary infantrymen from 1498 contain information about 1,543 shooters, of which 857 (55.5%) had matchlock handgones.¹⁵ Dated the same year is the list of weapons lost by the infantrymen from the detachment of captain Hynek in the clash with the Ottoman army, which then invaded the south-eastern part of the Kingdom of Poland. As it appears on this list, Polish mercenaries lost, among others, 16 crossbows and 13 matchlock handgones.¹⁶ This, therefore, confirms the considerable popularity of firearms at that time. The next registers of mercenary infantry being accepted for service come from 1500. In the three units listed, out of 405 shooters, 336 had matchlock handgones (83%).¹⁷

After 1497, matchlock handgones became more and more popular in Poland, appearing in the equipment of riders, both mercenaries and courtiers of the court banner (*curienses*).¹⁸ From 1501, 13 registers of units of mounted mercenaries have been preserved. Six registers reported riders armed with hand-held firearms,

¹¹ *Acta...*, 501, no 2173.

¹² Goliński 1990, 47-48.

¹³ Formerly Gliniany, about 40 km east of Lviv.

¹⁴ The inventory registry also included the number of cannons, bullets, and gunpowder, but in this place I limit myself to providing data only for hand-held firearms, Górski 1902, 218-220; Szymczak 2004, 322-327.

¹⁵ Grabarczyk 2000, 142-156.

¹⁶ AGAD, RK, vol. 310, fol. 2-2v. More about the Ottoman foray into Poland in 1498 see Spieralski 1963.

¹⁷ Grabarczyk 1996, 33-42.

¹⁸ Grabarczyk 2002, 3-10; Grabarczyk 2015, 84-85.

but at that time crossbows were still the primary weapon of cavalry shooters, and only a few riders had bows. It should be noted that the horse registers use the term ‘matchlock handgonne’, the same term used in infantry registers.¹⁹ Unfortunately, there is no information on how the riders used them in combat.²⁰

Information on firearms in Poland is worth comparing with that from the Kingdom of Bohemia. In the second half of the 15th century, information on firearms in Bohemia was mainly provided by castle inventories and armament lists of citizens sent to the war as part of their obligations. Thus, according to the lists of soldiers issued by the town of Slaný and the surrounding villages, crossbows were still dominant in the years 1469–1474: 76 (19.2%) of shooters were armed with firearms, and 320 (80.8%) with crossbows. The registers mention two types of hand held firearms: *pišťaly* – handgones of the old type – and hackbuts. There is no evidence yet that the soldiers from Slaný used handgones at that time.²¹

At about the same time (1462), there were 48 old-type handgones (*pišťaly*) made of iron, 15 *pišťaly* (both small and large) made of copper (*měděné*), and 1 small copper *pišťal* on the stock at the castle in Helfenburk. The inventories dated 1467–1470 show that at Velešín castle there were 8 old-type handgones, including two that were damaged (*roztržené* = torn), and 5 crossbows. In Nový Hrad there were 4 iron old-type handgones and 6 that were probably made of copper; in Chusník castle there were only old-type handgones: 6 made of iron, 1 new (*pišťala nova*, 5 made of copper, 6 damaged, and another 21 *pišťaly* with no descriptive information. In the Meidstein and Zvíkov castles 15 and 24 *pišťaly* were recorded, respectively. According to the inventory, at the aforementioned Helfenburg castle there were only old-type handgones: 29 probably made of iron, 9 made of copper, and 1 copper *pišťala* on the stock.²² It is worth noting that these inventories do not include crossbows, but there are bolts for them in large numbers, which indicates the use of this weapon by the castle crews.

Information on firearms in Bohemia is supplemented by military registers from the city of Cheb. In 1512

the city commissioned among others, 421 soldiers, of whom 165 (39.1%) had firearms and 256 (60.9%) had crossbows. In 1530 the proportions were the opposite: out of 74 soldiers, 48 (64.9%) had firearms and 26 had crossbows (35.1%). In the Cheb lists, firearms appear as ‘*puxen*’, ‘*puchssen*’, and only once as ‘*hantpuxe*’. It is possible that the latter term denoted a new type of weapon – the matchlock handgonne (*rusznica*) – however, this is only a hypothesis based on an interpretation of the word. There is no doubt, however, that the popularity of firearms in Cheb increased significantly over the course of 18 years, but crossbows were still used by a significant percentage of soldiers.

Summarising the information on small arms in Bohemia, it should be stated that in sources from the turn of the 60s and 70s of the 15th century that concern the armament of townspeople, there are old types of firearms. It is possible that modern matchlock handgones were used by the townspeople at the beginning of the 16th century. It is not possible to state it unequivocally, because the terminology used in the above-mentioned sources with reference to handguns is imprecise. The lack (or a small number) of new types of weapons in the city’s arsenals may also be a result of cities not keeping up with changes. The armament of professional troops could have looked differently; unfortunately there is no information on this now. Based on this random information, it can only be concluded that in the last decades of the 15th century, firearms were quite numerous in the arsenals of Czech cities and castles. However, the relatively small number of sources and problems with assigning specific terms used in the sources to individual types of firearms do not allow us to trace the process of transformations in Bohemia at the end of the 15th century. It is certain, however, that until the 1470s, handgones were not used.

A valuable supplement to the information about the matchlock handgones is a letter from robbers marauding in the mountains on the border of Poland and Hungary, dated 1493 (Fig. 2). In a letter addressed to the city council of Bardejov (now Slovakia), they demanded compensation for the hanged members of their gang, threatening the townspeople with death in the event of failure to pay them the required sum. They made their threats credible with images of weapons placed under the text, including firearms.²³ The figure shows a handgun with a long barrel on a stock, with lock, with a clearly-marked downward-pointed butt. The weapon shown in the illustration clearly differs from old-style handgones and hackbuts. The appearance of the weapon and the date of the letter suggest that the picture shows a matchlock handgonne.

¹⁹ It appears as follows: in the unit of captain Jan Buczacki, 3 matchlock handgones and 102 crossbows; Stanisław Struś, 2 matchlock handgones and 19 bows (no crossbows in this branch); Jan Hynek, 4 matchlock handgones and 119 crossbows; Henryk Mikowski, 6 matchlock handgones and 123 crossbows; Jakub Węgrowski, 3 matchlock handgones and 127 crossbows; Jakub Morawiec, 1 matchlock handgonne and 134 crossbows, AGAD, ASK 85, vol. 5, k. 3v, 4v, 12v, 15, 47v, 49, 50, 60v, 62v, 71, 82, 83v, 88.

²⁰ About the use of firearms by horse riders in Western Europe, cf. Merlo 2014.

²¹ Mały 1961, 193, 202–203.

²² Šimůnek 2002, 243–253.

²³ Magistrát mesta Bardejov, Štátny archív v Prešove – pobočka Bardejov, no. 3110/a; Biesaga and Sroka 2007, 50.

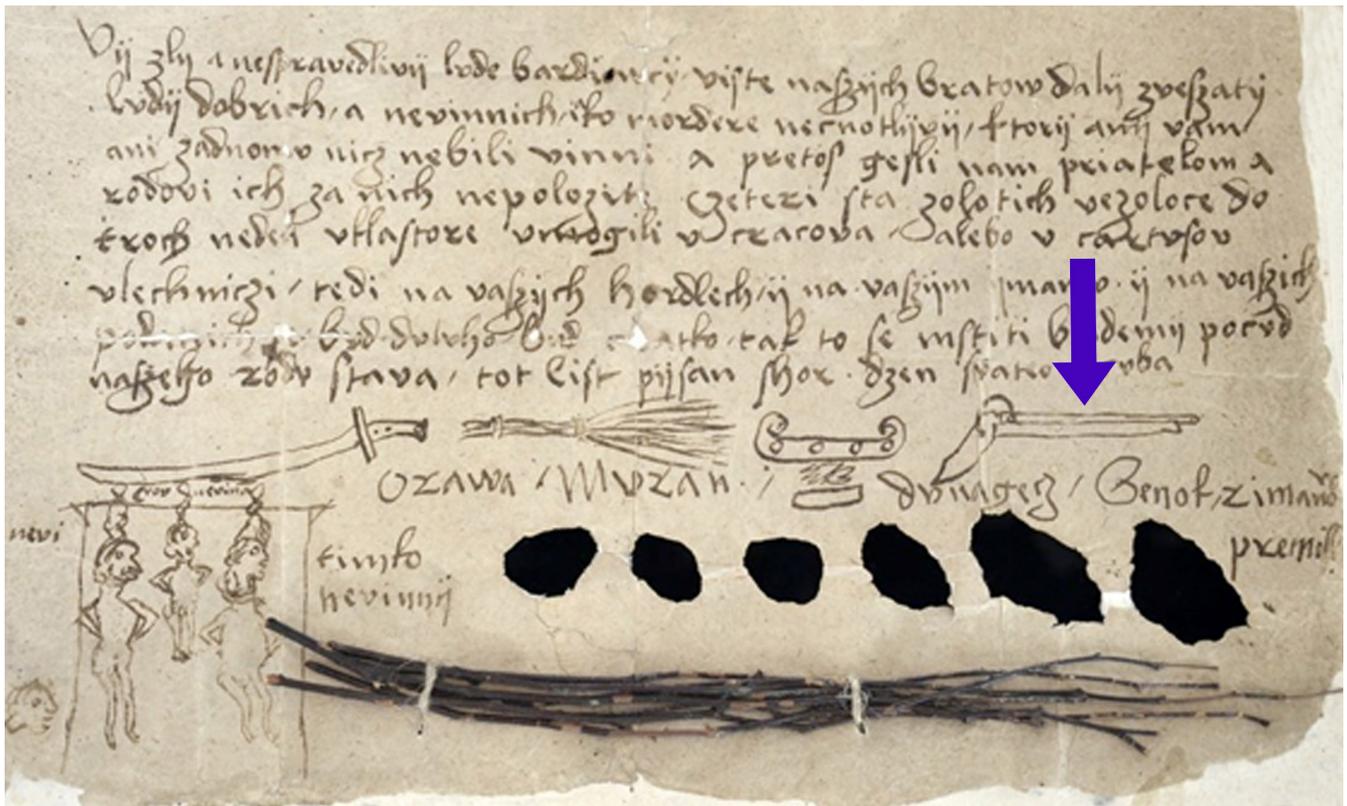


Fig. 2. Letter of robbers to Bardejov, dated 1493 (Magistrát mesta Bardejov, Štátny archív v Prešove – pobočka Bardejov, no. 3110/a). Photo T. Grabarczyk.

Matchlock handgonnes in Western Europe

The process of replacing crossbows with firearms in the army of the Kingdom of Poland was a bit different than in Western Europe. Thus it is worthwhile to take a look at these differences, but also to point out the similarities. Although the changes taking place in the West are quite difficult to place precisely in time, as they took place in different countries at different speeds, there is no doubt that in most Western European armies, matchlock handgonnes appeared earlier.

Due to the fact that the increase in importance of the weapon was a result of the development of its construction, it would be helpful for tracing the chronology of changes in order to date the handguns preserved in museum collections accurately. Unfortunately, dating by identifying changes in construction is usually uncertain and imprecise.²⁴ Often a weapon that has a long barrel, a lower handguard with a stock, and a fuse lock is dated c. 1500, which makes it of little use in considering the chronology of the development of firearms.

Iconographic sources that show this type of handgun with its construction details can be useful in tracking

changes in the construction of firearms. Of course, this applies only to iconography of which the time of creation is known. When looking for illustrations showing matchlocks in the period in question, attention should be paid to *Feuerwerksbuch* by Martin Merz (c. 1425-1501).²⁵ The author of this work was already a recognised specialist in the 1460s, since the elector of the Palatinate, Frederick I Wittlesbach, appointed him the head of firearms (*Büchsen- und Geschützmeister*) in his army.²⁶ One of the illustrations in *Feuerwerksbuch* shows a firearm with a matchlock, a barrel equipped with sight, and a wooden stock with a butt. The work of Martin Merz dates to c. 1473 - c. 1480, which means that by that time this weapon was already in the hands of soldiers. The weapon shown in the illustration is elaborated in the smallest details, as evidenced by the precisely made lock and the flash pan with a cover protecting the gunpowder from getting wet, and by the carefully contoured buttstock (Fig. 3).

Handguns were also shown on the Pastrana Tapestries, depicting the conquest of the Moroccan cities of

²⁵ *Feuerwerksbuch...*, k. 21.

²⁶ Röss 1960, 21; Rappel 1983, 523. Dating of Martin Merz's work is based on the watermark on the paper used to produce the book, Leng 2002, 201-202.

²⁴ Strzyż 2011, 11.

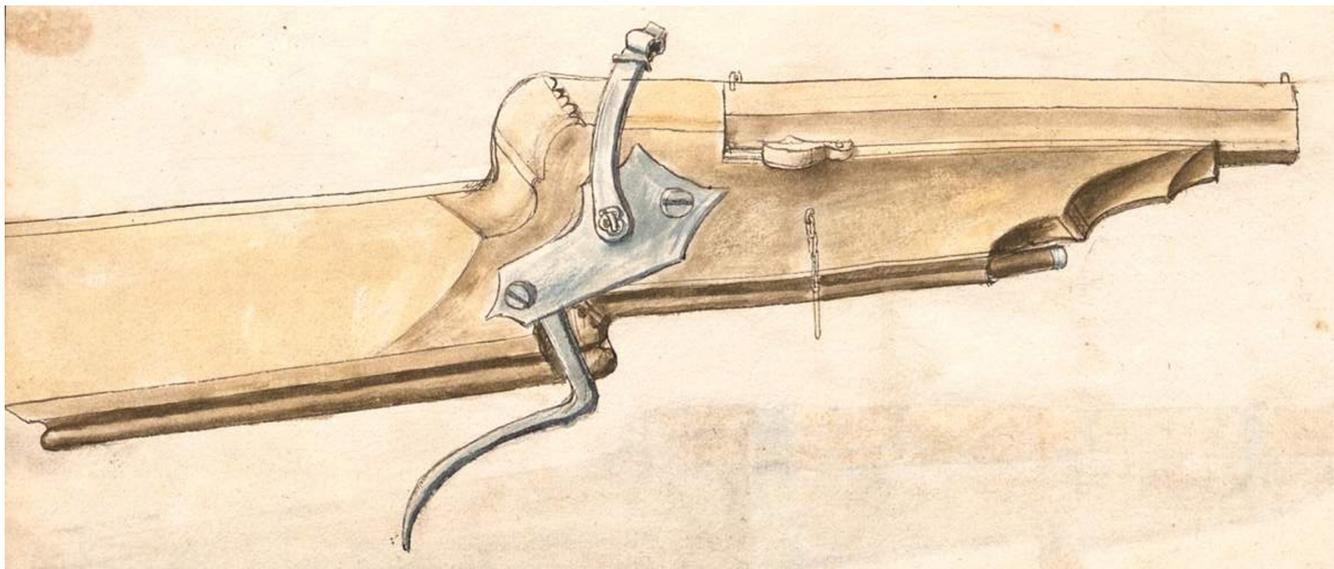


Fig. 3. Matchlock handgonne from *Feuerwerksbuch*, Martin Merz, c. 1473-1480, Bayerische Staatsbibliothek, BSB Cgm 599, fol. 10.
Source: <https://www.digitale-sammlungen.de/en/details/bsb00045460>.



Fig. 4. Portuguese infantrymen with handgonnes, Colegiada de Pastrana Museum in Pastrana, Spain, end of 15th century.
Source: <https://artsandculture.google.com/partner/museo-parroquial-de-tapices-de-pastrana>.

Asil and Tangier in the summer of 1471 by the army of Alfonso V, King of Portugal. The ruler, who wanted to commemorate the victorious expedition, personally commissioned the making of the tapestries. It is not known exactly when the tapestries were ordered, but it

had to have taken place before the death of Alfonso V in 1481.²⁷ Considering that the design of the tapestries

²⁷ The tapestries were most likely based on drawings made by the royal painter Nuno Gonçalves (d. 1490). It is estimated that the



Fig. 5. Infantry with handgonnes, Diebold Schilling, *Amtliche Berner Chronik*, c. 1478-1483, Bern, Burgerbibliothek, vol. 2, Mss.h.h.I.2, fol. 77, p. 141. Source: <https://www.e-codices.unifr.ch/en/list/one/bbb/Mss-hh-I0002>.

was most likely created during the king's lifetime, the armaments depicted on the tapestries should be dated to the 1470s. The tapestries show various types of firearms: primitive hand cannons, hackbutts, and the most modern weapons – matchlock handgonnes with a long barrel, a stock with a butt, and a matchlock²⁸ (Fig. 4). Portuguese handgunners were mixed with infantrymen armed with crossbows and pole arms. This composition of Portuguese infantry is confirmed by sources from that period.²⁹ It is assumed that the equipment of the Portuguese army is shown faithfully on the tapestries, which despite all doubts related to the chronology of their creation, makes them a useful source for tracing

the development of handguns during the last decades of the 15th century.³⁰

Many engravings showing foot soldiers with matchlock handgonnes are included in Diebold Schilling's *Official Chronicle of Bern* (*Amtliche Berner Chronik*), created in the years 1478–1483.³¹ In this richly illustrated work, many illustrations show soldiers armed with handguns (Figs. 5-8). Occasionally they have hackbutts, while many have weapons that can be identified as early matchlock handgonnes. This weapon has a long barrel and a stock with a butt. The details drawn on the side of the stock of the weapon attract attention. Many feature an S-shaped element, which can be identified as a curved lever known as the *serpentine*. Some of the soldiers armed in this way hold lit fuses in their hands, which they put in the clamp on the serpentine immediately before firing (Figs. 7 and 8). The figures in this chronicle also show a variant of this weapon, differing in the absence of a *serpentine*. There is only a small

tapestries faithfully portray the weapons used by the Portuguese during the African campaign. The order was carried out by Passchier Grenier (d. 1493), a merchant from Tournai, and completed by local weavers. The date of completion of the tapestries is not known exactly; it is assumed that the work took up to 20 years and was completed between 1491 and 1501, Tatsch and Nascimento 2016, 108.

²⁸ La Rocca and Donald 2010, 38.

²⁹ Cook Jr. 1993.

³⁰ La Rocca and Donald 2010, 40.

³¹ Diebold Schilling, *Amtliche Berner Chronik*.



Fig. 6. Two foot soldiers with handgonnes, Diebold Schilling, *Amtliche Berner Chronik*, c. 1478-1483, Bern, Burgerbibliothek, vol.1, Mss.h.h.I.1, fol. 94v, p. 190. Source: <https://www.e-codices.unifr.ch/en/list/one/bbb/Mss-hh-I0001>.

circle where it should be. Besides that, the hand-held firearms are identical. Therefore it is possible that two versions of the same weapon were produced, one with and one without a lock. The stocks of the handguns were prepared for the attachment of the serpentine as the standard. When buying a gun, it was possible to decide which model to choose. With this solution, the lock could always be purchased and installed. It is worth noting that D. Schilling took part in the Burgundian wars as a soldier, so it is difficult to accuse him of ignorance of the weapons and the realities of war. In the illustrations in the *Chronicle of Bern*, he notes that a large part of the infantry already had handguns, which suggests that this was the case at the time when this work was created.

In the illustrated inventory of armaments from Landshut in Bavaria from 1485, the following figures are presented: *Aeltere Handtpuchsen* – old handgonnes, *Alt Hagknpuchsen* – old hackbuts, *Hagkenpuchsen* – hackbuts, and *Handpuchsen* – handgonnes (Fig. 9). The difference that stands out between the ‘old’ weapon (*Altere, Alt*) and the other two is the shape of the stock.

While the “old” guns have straight stocks, which constitute the barrel extension, the “new” stocks resemble those known from the above-mentioned drawing published in *Feuerwerksbuch* by M. Merz. All the engravings posted on *Zeughausinventar von Landshut* show handguns without matchlocks. On the front of one of the examples shown (third from the top) there is a small circle, possibly representing a hole in which a fuse lock could be attached, similar to the ones shown in the figures in the *Chronicle of Bern*.³²

Infantry with firearms are also shown in the manuscript *Fasciculus temporum* by Werner Rolevnick. The work, dated 1498, shows infantry with firearms in one of the engravings (Fig. 10). These have stocks with rounded butts and long barrels, attached to the handguard with clamps. Unfortunately, the illustration does not show whether the weapon has a matchlock.³³ The weapon in the engraving is similar to that of the Musée d’Art et d’Histoire collection, dated c. 1470.

³² *Zeughausinventar von Landshut*, k. 36r, 36v, 38ra, 38va, 42r.

³³ *Fasciculus temporum*, fol. 150.



Fig. 7. Infantry with handgonnes. The soldier on the left holds a burning fuse in his hand, Diebold Schilling, *Antliche Berner Chronik*, c. 1478-1483, Bern, Burgerbibliothek, vol.1, Mss.h.h.I.1, fol. 208v, p. 418. Source: After <https://www.e-codices.unifr.ch/en/list/one/bbb/Mss-hh-10001>.

The Geneva relic has a bushing on the side of the barrel and an inverted serpentine lock (Fig. 11).³⁴

The increase in the importance of handguns in the last three decades of the 15th century is also confirmed by written sources. One example is the information on the weapons stock in Calais, where an English garrison had been stationed since the Hundred Years' War (1337-1453). The first mention of handguns in the local resources comes from 1468. However, at the beginning of the 1470s there was a sharp increase in the number of handguns in the local garrison. In 1471, there were 60, while a year later, that number had increased to 280. In the following years, the garrison there had at least 200 handguns, and in 1485 their number even exceeded 500. In 1481 the arsenal in Calais, including 100 hackbuts and 150 matchlock

handgonnes, was to be transferred to English ships.³⁵ Although the data from Calais concerned an English crew, it is not possible to refer to the condition of infantry equipment in the British Isles. Firearms were not very popular there, and their spread was slower than in other countries.³⁶

In France at this time, handguns started to play an increasingly important role as well. According to the regulation issued on November 13, 1472 in Bohain-en-Vermandois, 4,800 horsemen and 5,600 foot soldiers were mobilised at that time, including 2,000 pikemen, 1,000 archers and 600 soldiers with firearms.³⁷ During the so-called 'Salt War' (1482-1484), the

³⁴ This weapon is 86.5 cm long, the barrel (62.8 cm long) is made of bronze, calibre 14.5 mm, weight 6 kg, Ville de Genève, Musées d'art et d'histoire, no. inv. AD 8171. Available online: 28.08.2020: <https://collections.geneve.ch/mah/oeuvre/arquebuse-meche/ad-8171>.

³⁵ Grummitt 2000, 266; Spencer 2016, 39, 84, 94, see: Line Chart 5 – Total quantities of handguns at Calais from 1375-1485, p. 192 and Column Chart 1 – Numbers of guns and handguns at Calais in 1481, 1485, and 1488, p. 193. As D. Spencer wrote (2016, 248): 'In the late fifteenth century this term [handgun] was used to refer to an arquebus type of handgun'.

³⁶ In castles in Wales and Coventry, until 1471 there were single examples of hand-held firearms, Spencer 2016, 120.

³⁷ McLachlan 2010.



Fig. 8. Infantry with handgonnes, Diebold Schilling, *Amliche Berner Chronik*, c. 1478-1483, Bern, Burgerbibliothek, vol.1, Mss.h.h.I.1, fol. 74v, p. 150. Source: <https://www.e-codices.unifr.ch/en/list/one/bbb/Mss-hh-10001>.

Milanese infantry sent with the support of Ferrara by Ludovico Sforza, called the Moor (*il Moro*) had 1,250 soldiers with handguns and only 233 with crossbows.³⁸ The above examples show the growing importance of firearms in the armies of Western European states from the 1470s.

Understandably, the larger number of firearms on battlefields increased the need for gunpowder. Although it had been produced in Europe since the 14th century, in the last quarter of the fifteenth century there was a dynamic increase in its production with a simultaneous reduction in production costs.³⁹ An excellent example of this is Italy, where this industry developed dynamically. New workshops and even new production centres were being created. Producers received mass orders for gunpowder. The boom in gunpowder production was accompanied by a fall in its prices at that time, and this trend affected many countries.⁴⁰ The rapid development of gunpowder-producing centres at the end of the

15th century is another proof of the growing importance of and, at the same time, demand for firearms.

Iconography shows that in Western Europe, an effective and functional handgun (which should be considered a matchlock handgonne) appeared in the equipment of infantrymen in the 1470s.⁴¹ It was matchlock handgonnes that caused an increase in the importance of handheld firearms on battlefields. However, they did not replace crossbows or older types of firearms right away – it happened gradually over a period of 25 years.⁴²

Conclusion

On the basis of the above-mentioned examples, it can be argued that in the 1470s, hand-held firearms achieved a level of functionality that made them competitive with crossbows. This was due to the use of a long barrel with a shell on its side and a stock with a butt. The last structural element increasing the functionality was the lock, initially in the form of a simple

³⁸ Nicolle 2002, 18.

³⁹ Szymczak 2004, 124; Smith 2010, 231.

⁴⁰ Szymczak 2004, 138-139; Ansani 2016, 4-6.

⁴¹ Foard and Curry 2013.

⁴² Cf. McLachlan 2010, 4-5.



Fig. 9. Handgonnes from inventory of Landshut, c. 1485, *Zeughausinventar von Landshut*, Universitätsbibliothek Heidelberg, Codices Palatini germanici 130, fol. 38v. Source: <https://digi.ub.uni-heidelberg.de/diglit/cpg130/0001>.

serpentine, which was eventually superseded by a fuse lock with a spring trigger mechanism. The sum of these design solutions improved the accuracy of and, consequently, the effectiveness of the firearm, which translated into a rapid increase in its popularity. Consequently, this led to a decline in the importance of crossbows. In Western Europe, as early as the 1470s, firearms played a significant role during the Burgundian Wars (1474-1477), and the outbreak of the Italian Wars (1494-1559) contributed to a further increase in their importance. It should be noted that in the 1480s, in the west, infantrymen used other types of handguns alongside matchlock handgonnes.

As mentioned above, such an improved firearm was known in Poland as early as 1478, but it was not until the 1490s that matchlock handgonnes became the basic weapon of an infantry shooter. In relation to Western Europe, the revolution of replacing crossbows with matchlocks took place several years later. However, it happened very quickly, while in 1496 there were slightly more than 25% of shooters with matchlock

handgonnes, while in 1500 over 80% of shooters had this weapon.⁴³ It is worth noting that in some units there were no shooters with crossbows at all. The process of replacing crossbows with matchlock handgonnes happened much faster than in the West. The reasons for the faster conversion of replacing crossbows with firearms can be found in the structure of infantry formations. In Western Europe, the strength of the infantry was determined by the soldiers armed with pole arms, while shooters were only supplementary to these formations. The increase in the percentage of infantrymen with firearms was associated in Western Europe with the need to reorganise military structures, which was certainly not easy to carry out in a short time. Even more difficult was changing the way of fighting. The tactic of using large infantry units armed mainly with pikes and

⁴³ According to the data from 1522-1536, the percentage of soldiers with matchlock handgonnes in the Polish mercenary infantry fluctuated around 70%, while in the years 1538-1542 around 60%, Böldyrew 2011, 231.



Fig. 10. Infantry with firearms. After: Werner Rolevnick, *Fasciculus temporum*, fol. 150r.

halberds was successfully used from the 14th century. It was not possible to change this tactic in a short time. On the other hand, in England, where the main force of the infantry were shooters armed with longbows, the slow spread of firearms was associated with a strong belief in the superiority of these weapons over guns. Consequently, soldiers using longbows were not tempted to replace them with matchlock handgonnes.⁴⁴

However, there was a different situation in the Polish infantry. In the second half of the 15th century, shooters constituted about 80% of the soldiers in the Polish infantry. The replacement of crossbows by the matchlocks handgonnes, which took place at the end of the 1490s, was not associated with any major changes in the structure of infantry units or their tactics. The shooters readily gave up their crossbows in favour of matchlock handgonnes. That is why in Poland, unlike in Western Europe, the exchange of crossbows for handgonnes was able to take place in such a short time. Annotations in registers from 1498 record that some

mercenary shooters were not able to load their matchlock handgonnes, implying that such firearms were to them a novelty.⁴⁵ It is worth noting that, unlike some Western European armies, mercenary shooters in Polish service received the same pay regardless of whether they used a crossbows or hand-held firearms. Thus, it can be concluded that in an organisational sense they were treated equally.

Another aspect that should be noted is the scale of the phenomenon. In Poland, mercenary infantry was only a supplement to the mounted army and, as can be seen from preserved sources, its number at the end of the 15th century was in the range of 500-2000 soldiers. Compared to the number of infantry in the armies of Western European countries at that time, these numbers are small, which significantly facilitated rapid changes in weapons.

Rearming the Polish infantry with firearms over such a short period of time would probably not have been possible if it had not been for the experience of the

⁴⁴ Ostrowski 2010, 513-534.

⁴⁵ ASK 85, vol. 3, fol. 109v.



Fig. 11. Matchlock handgonne. Probably from the end of the 15th century, Geneva, Musée d'Art et d'histoire, inv. no. AD 8171.
Source: <https://collections.geneve.ch/mah/oeuvre/arquebuse-meché/ad-8171>.

Hungarian army. King Matthias Corvinus (1443-1490) of Hungary created one of the best European armies at that time. The infantry of his so-called 'Black Army' is known to have had 20% of its shooters armed with firearms by 1481.⁴⁶ There were many Poles among the mercenaries serving in the Hungarian army. When the 'Black Army' was dissolved after Corvinus's death, many of them returned to their homeland, where they continued their service as mercenaries. Hungarians also came to Poland with them in search of income, among them experienced commanders – a few of whom we see on Polish payrolls in the 1490s.⁴⁷ The strengthening of political and military cooperation between Poland and Hungary at that time was further facilitated by the fact that both thrones were occupied by representatives of the Jagiellonian dynasty. The influx of soldiers from the Hungarian army to Poland had an impact on the structure of infantry units of the Kingdom of Poland, which at that time resembled that of Matthias Corvinus.⁴⁸ It should be noted, however, that Hungarian patterns were also introduced in units commanded by Poles and Bohemians serving in the army of the Kingdom of Poland.

With all this in mind, one can see Hungarian influence as a factor that contributed to the fact that the Polish infantry abandoned crossbows in favour of the most modern firearms at that time – matchlock handgonnes.

When comparing changes in the armament of handguns in the Polish infantry with those in Western Europe, significant differences can be noticed. First of all, the replacement of crossbows with handguns took place in the Polish army later than in the West by at least a dozen or so years. The second difference is the pace at which these changes took place. In Poland, the near complete rearming of the infantry took place within 5 years. Over that time, the share of matchlocks in the shooters' equipment changed from 27.1% to 82.9%, and matchlocks also appeared in riding equipment. In the Polish army, the process of replacing crossbows with firearms took less time than in the West. It seems that it was possible thanks to borrowing proven organisational patterns from Hungary and the use of technological achievements already well developed in the West.

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⁴⁶ Szabó 2010, 152.

⁴⁷ Rázsó 1990, 80–102; Szabó 2014, 432.

⁴⁸ In the 1470s, there were two types of man-at-arms in the Polish infantry: shooters and pavise-bearers. In the 1490s, in addition to these two categories, there were also spearmen. This was the composition of the infantry in the Hungarian army.

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