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HABSBURG ARTILLERY AT THE CLOSE OF THE 15TH AND THE BEGINNING OF THE 16TH CENTURIES

1. In Place of an Introduction

The close of the 15th and the beginning of the 16th centuries witnessed a major expansion of field and siege artillery. According to the chronicle of the town of Perugia, the hand bombards, made *at hands length*, of the 14th century were transformed by founders into the large demolition guns of the 15th century within a hundred years. *Dulle Griete of Ghent*, which was over 5 metres long and weighed 16 and a half tons, could fire stone projectiles 340 kg in weight. To fire such a gun, or even a smaller one, elaborate preparations had to be made. First it had to be transported, then placed in position, loaded and fired. If the expansion of the gases did not burst the gun-

powder chamber, the projectile was sent from the wider opening. It produced a very deep sound, called by the Latin name of „bombus”. The air and the thickest walls vibrated with the sound a mile away. If the projectiles were fired every hour, the preparations took at least one hour, and all of them hit the same place, the wall crumbled. However, the military importance of artillery most frequently consisted in paralysing the will of the defenders and was purely psychological in character. It was only thanks to the fundamental reform of siege tactics and artillery introduced by Maximilian I Habsburg that guns started to play the right role both on the battlefield and during sieges.

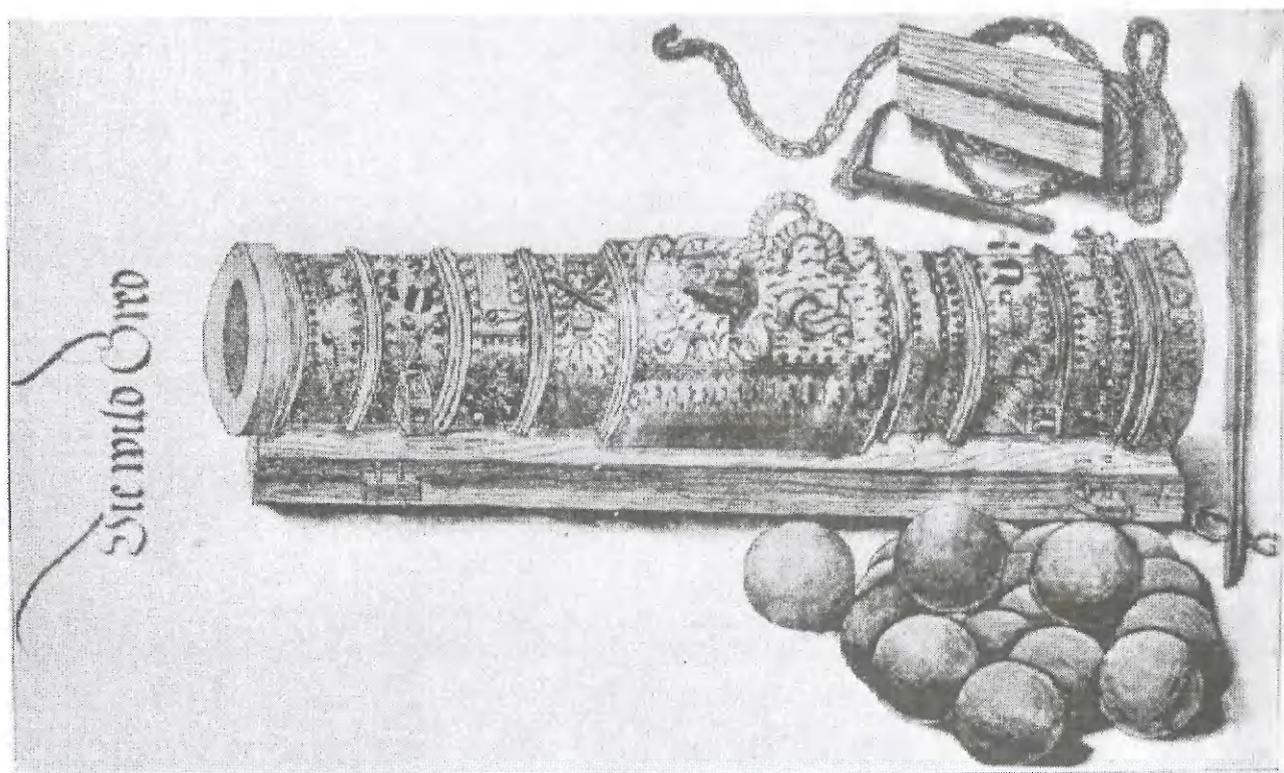


Fig. 1. *Dulle Griete of Ghent*. A drawing from the Emperor Maximilian's *Zeugbücher*.



Fig. 2. Maximilian Habsburg as King. A painting dating from 1502. After E. Heck.

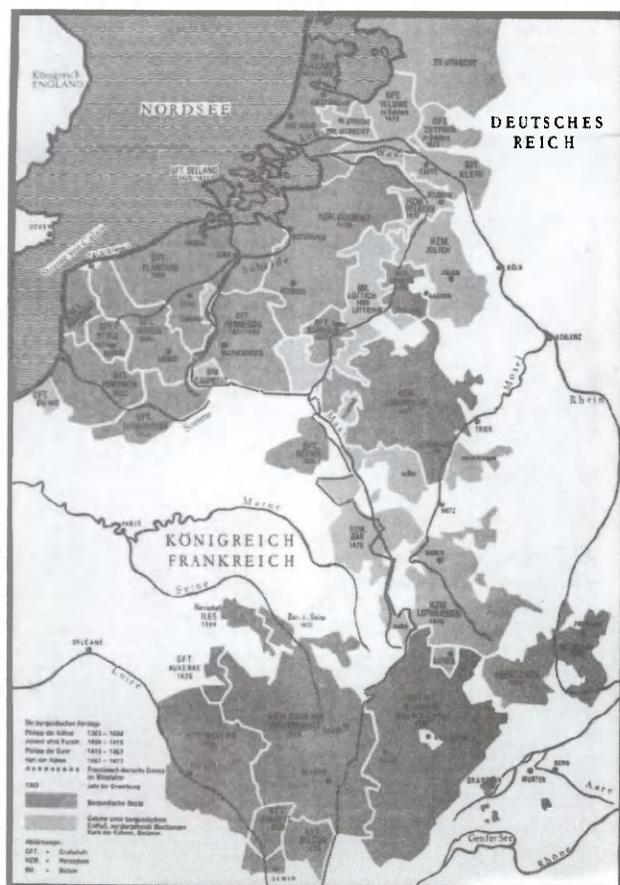


Fig. 3. The Burgundy of 1363-1477.

Polish literature provides a lot of information about this interesting man¹. Maximilian Habsburg (1459-1519), the first Roman emperor of the German people (from 1493 onwards) who bore this name, the son of Frederick III, married Mary of Burgundy (1477), heiress of Charles the Brave, who in the same year was killed in the Battle of Nancy². The fiancée and the fiancé got married for love, but this dynastic marriage was accompanied by numerous misfortunes. France had claimed Burgundy for many years. Her influence weakened shortly after Maximilian's victory in the Battle of Guinegate in 1479. Mary died prematurely in 1482. Her husband became Regent on behalf of his son, Philip, later called Philip the Fair. During long and fierce fights Maximilian was taken

captive. He was so disgusted with the fight for the Netherlands that he handed over the authority over the Burgundian part of the country to his son (1494). Two years later he married Joan of Aragon, heiress to the Spanish monarchy. This was the way, so typical of the Habsburg dynasty, Spain, the Kingdom of Naples and a few colonies became part of the empire.

The Netherlands, however, as the richest land of the contemporary Christian world, were worth fighting. In the 15th century, the counts of Flanders and Holland possessed Gelderland, Kleve and Brabant, besides Hagenau, Artois and Limburg. Brugge was the centre of commerce of northern Europe. Ghent, Löwen, Tournai as well as Antwerpen and Brussels, which were beginning to flourish at the beginning of the 16th century, became important cultural centres. The dominant role of the patronage of the dukes of Burgundy began to give way to middle-class patronage.

The inclination of the Burgundian aristocracy to ally themselves with France resulted from the fact that there were close ties between many Burgundian families and the Valois Kings. The same families were periodically feudally dependent on the French Crown or on the Empire. The divisions were aggravated in the period of Maximilian's fight for the Netherlands.

¹ W. Czaplinski, A. Galos, W. Korta, *Historia Niemiec (A History of Germany)*, Wrocław-Gdańsk 1981, pp. 226 seqq.

² The biographical notes on Maximilian Habsburg mainly from: E. Heyck, *Kaiser Maximilian I*, Bielefeld and Leipzig 1898. The information about the Burgundian and Dutch episodes of the second half of the 15th century and the beginning of the 16th century from: O. Carfelli, *Am Hofe der Herzöge von Burgund*, Basel 1926; J. Calmette, *Les Grands Ducs de Bourgogne*, Paris 1949 (German edition München 1963); H. Pirrenne, *Histoire de Belgique*, vol. II: *Du commencement du XVI^e siècle à la mort de Charles le Téméraire*, Brussels 1947.



Fig. 4. Maximilian Habsburg accepts the capitulation of the French. A fragment of *The Gate of Honours* by Albrecht Dürer. After E. Heck.

The third power, which was gradually gaining importance, was the separatist trend: attempts to become independent of both the powers.

2. About Myself for Future Generations

Maximilian is frequently mentioned in literature and biographical works. The allegorical and chivalric poem *Der Theuerdank*, with 118 handcoloured woodcuts, was published in Nurnberg in 1517³. The poem contains a description of Maximilian's expedition and adventures as a suitor of Mary of Burgundy's. On the way the knight is frequently exposed to dan-

³ M. P f i n z i g, *Der Theuerdank*, Nürberg 1519. I used both the copy from Herzog August Bibliothek in Wolfenbüttel and the copy from the Library of the Polish Academy of Sciences in Gdańsk (call number Uph. f. 905). The full title given by M. P f i n z i g is *Die Geferlicheite und geschichten des löblichen Streytbaren und Hochberiemnten Hhelds und Eitters Theuerdankts*. See also: J. Benring, *Die Buchdrucker des 16 und 17 Jahrhunderts im deutschen Schprachegebiet*, Wiesbaden 1963, p. 333; H. Th. M u s p e r (and others), *Kaiser Maximilians „Theuerdank“*, Stuttgart 1968; *Ausstellungskataloge Burgkmair und die graphische Kunst der deutschen Renaissance*, Braunschweig 1973, p. 14.



Fig. 5. Illustration from *Der Weisskunig*. A woodcut by Hans Burgkmair.

ger but fortunately defeats his rivals. Special italic types used for printing the poem were made by Hans Rockner. The woodcuts were prepared by Hans Burgkmair, Leonhard Beck and Hans Schuffelein. *Der Theuerdank* was very popular at knights' castles and at ducal courts. The first edition could only be acquired as a gift.

Der Weisskunig is a biographical work *par excellence*. The story was taken down by Marx Treitzsauerwein. It was available only as a handwritten copy for many years⁴. The fair copy was ready in 1514. It contained over a hundred woodcuts made by Burgkmair and 125 woodcuts by Beck. The rest were made by Hans Springginkle and Schuffelein. The *Weisskunig*, the wise or learned king, was probably Maximilian himself. The Grey King, the Black King, the Green King, the Red King etc. were contemporary rulers. The book provides interesting information about numerous knightly skills, which a young man of noble birth had to acquire. It describes the ways of ruling a country, the structure of authority, the art of war, ruses used to seize towns. The role of artillery and the functions of siege guns are stressed. The woodcuts vividly depict artillery guns of different

⁴ M. T r e i t z s a u e r w e i n, *Der Weisskunig*, Vienna 1775 (First edition). See also: H. R u p p r i c h, *Das literarische Werk Kaiser Maximilians I, [in:] Maximilian I*, Innsbruck 1969 (the exhibition catalogue). The full title given by the editor of *Der Weisskunig* is *Der Weiss Kunig. Eine Erzählung von den Thaten Kaiser Maximilian des Ersten. Von Marx Treitzsauerwein aus dessen zusammengetragen (...). Herausgegeben aus dem Manuscripte der kaiserl. königl. Hofbibliothek*, Vienna 1775.



Fig. 6. Wagon laager with artillery in position. An illustration from *Der Weisskunig*. A woodcut by Hans Burgmair.

sizes, the means of transport, the ways of aiming and loading, the scenes of firing the guns. At the same time, they are rich in decorative detail.

Maximilian inherited the romanticism of the medieval knight errant and combined this romanticism with the Renaissance quest for a general knowledge of the universe. Therefore one should not be surprised at his decisions taken during long sieges and experiments with larger and larger guns.

Maximilian wanted to uncover the secret of casting red bronze barrels. As a ruler he was of the opinion that wars could be more easily conducted if the armouries, located in different parts of a country, were full of modern equipment. According to the *Weisskunig*, large guns firing stone or iron projectiles had to be founded first. There should be a hundred of them (!)⁵. The ruler should also have at his disposal special, equally large artillery guns with drilled barrel openings and guns called *szarfen mätzen* (some of them could fire stone projectiles which were able to knock down every wall)⁶. After his arrival at a place, he should be able to start storming the town or the castle within a few hours. He must not run out of new, medium-size

guns firing iron projectiles called nightingales or singers. He should store them in his armoury in case of a rebellion and carry them off in battles. Their cruel „song” should spread panic among his enemies.

The following pages deal with the presentation of the artillery and technological innovations with which every young king should be familiar. He must know the secrets and ways of gun-founding, the working of all types of guns, the qualities of the material and the technology. This knowledge will allow him to combine theory with practice and invent new and new forms in his imagination. The so-called small-calibre iron sticks and red bronze *puxen* (handboxes with hooks) are also mentioned. Those small-calibre guns appear to be very useful on the battlefield. Wagons used for transporting cannons and other artillery accessories should be formed into wagon laagers and joined together in the Hussite way.

Iconographic sources, particularly the two most important documents of the epoch, namely *The Books of the Emperor's Armouries* dating from the years 1504-1509 and 1515-1519 and *The Triumphant Parade* of the Emperor Maximilian's artillery painted by the artist from Innsbruck Jörg Kölderer in the period 1507-1512, provide interesting information about Maximilian I's artillery. The sources are the only representation of the Emperor's artillery potential, which was remelted by his grandson, Charles V (the guns must have been obsolete).

The first encounters of the young Maximilian with King Louis XI during which cannons were used were the battles of Terouanne in Artois in 1479. Maximilian's expeditions to the Netherlands sometimes ended in victory and sometimes in failure. As I have mentioned before, in 1488 he was taken captive and was held a prisoner by the people of Ghent and Brussels. In the wet land of Flanders Maximilian's army, with cannons, crossed the Ternois near Hesdin. It was thus that Maximilian gained experience in building pontoon bridges. This experience proved useful many years later, namely in the Emperor Maximilian's wars on the Plain of Campania in Italy.

One of the woodcuts by Burgmair in *Der Weisskunig* represents the siege of Ghent, the attack from the suburbs on the walls, in 1488. The barrels of the large guns are placed between the baskets. The guns have supporting logs at the bottoms. Further away are the positions of the culverins on gun-carriages. The large sacks of gunpowder, the interchangeable chambers increasing the rate of shooting, the ramrods, the cleaning rods, the hammers are scattered all around. All those indispensable accessories are depicted in the right order in the above mentioned *Triumphant Parade* by Jörg Kölderer. It should be stressed that both the illustrators of *Der Weisskunig* and Jörg Kölderer knew the realities of artillery equipment.

As has already been said, Mary of Burgundy died in 1482. A few years later, in 1493, Maximilian, in accordance with the political interests of the fami-

⁵ *Der Weisskunig*, op. cit.: „Wie der Jung Weyss kunstlich was, mit der Artalery”, p. 98, Fig. 43.

⁶ *Szarfen mätze* – a great siege demolition gun, the so-called wall-breaker (German Mauerbrechen, Matzkanone). See Z. S t e f a Ń s k a, *Próba ustalenia typów i nazw dział artylerii polskiej XVI i XVII wieku (An Attempt to Establish the Types and Names of the Guns of the Polish Artillery of the 16th and the 17th Centuries)*, „Muzealnictwo Wojskowe”, vol. I, 1959, pp. 207 seqq.

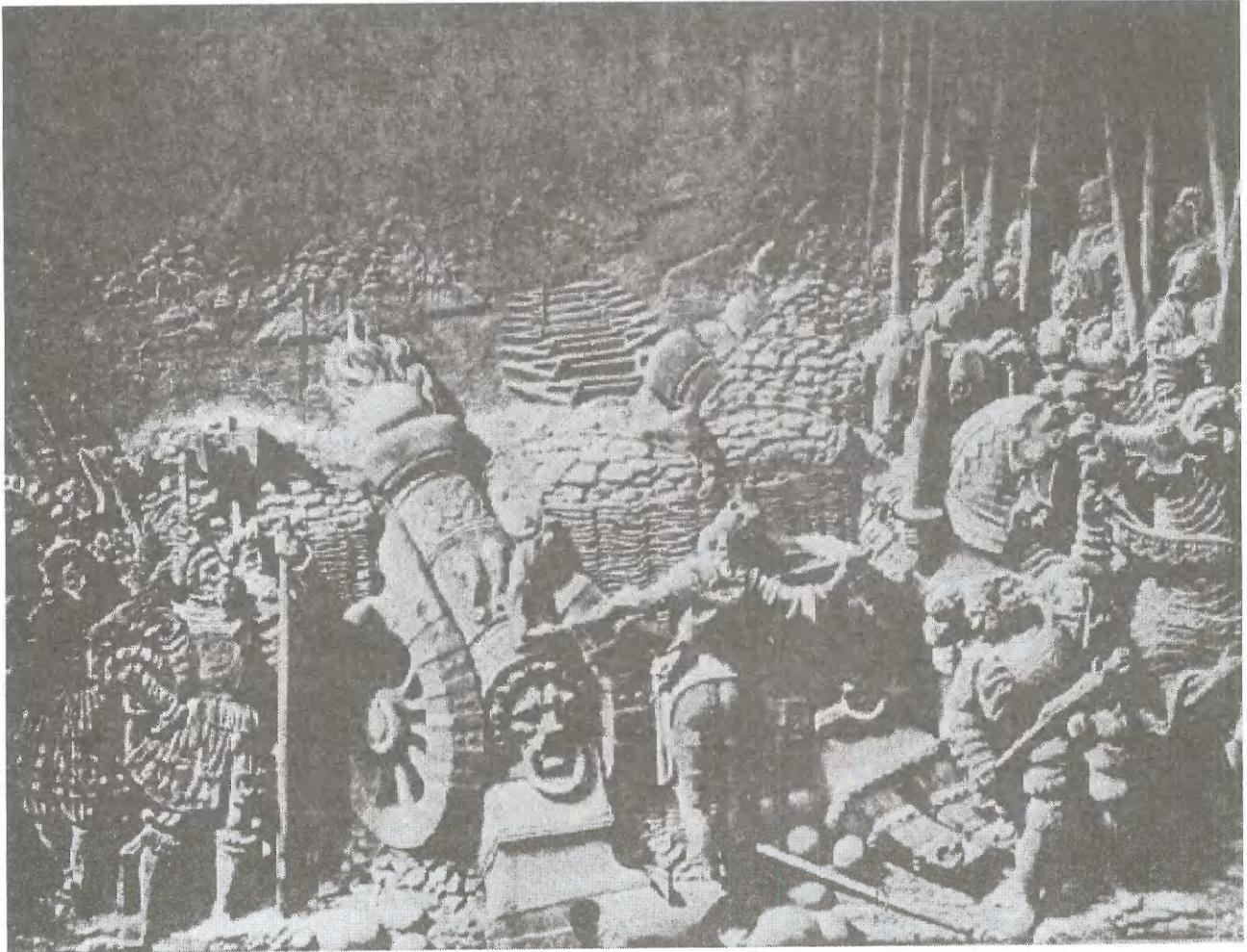


Fig. 7. Siege of Kufstein. A fragment of the monument in Innsbruck. After E. Heck.

ly, switched his attention to the south, namely to Lombardy and married Bianka Maria Sforza, the sister of Giangaleazzo, Duke of Milan. The old Emperor died in the same year and Maximilian's brother-in law in October 1494. France started to claim Lombardy. The young Emperor accepted the challenge and prepared the tactical plans himself. On 17th of May, 1496 he became the commander-in-chief of the League's forces and undertook to maintain the army on 60000 ducats for three months (he had borrowed the sum from Venice and Milan). The army consisted of 2000 horsemen and 4000 infantrymen. He set off with his cannons through Alpine passes and took the old road to Rome. Besieging Livorno, he cut off the port, in which the fleet of Charles VIII was anchored. During the next expedition, in the winter of 1508/9, Maximilian seized Verona, Vicenza, Trieste and besieged Padua. Maximilian's artillery played a major role in the fights of 1503. After the death of George, Duke of Landshut, the Emperor was engaged in the territorial conflict as *tertius gaudens*, i. e. the third pretender. Maximilian besieged and seized Kuffstein-on-Inn in Tyrol, near the Bavarian border. The famous *szarfen mätze* played a cardinal role in the battle. In Innsbruck a monument was built to commemorate the event.

In April 1513, Maximilian set out for Flanders as the Regent on behalf of his six-year-old grandson (his son Philip died in 1506). While assuming the Regency of the Burgundian heritage for the second time (until 1515), he allied himself with the English against the French and bombarded Terouanne.

3. Maximilian's Foundries

The art of gun-founding had had a long tradition on the banks of the rushing rivers of Tyrol, especially the Inn and in Innsbruck. The town was famous for its artillery industry and armourers' workshops. The blacksmiths, the founders, the carvers and the craftsmen who pickled metal, the designers, the painters and the goldsmiths co-operated in the production of most glorious guns. The Maximilian period created an atmosphere extremely favourable to the development of this art.

In 1504, Maximilian ordered an inspection of the strongholds and armouries of the Empire. The inventory (*Zeugbüchern*) contains the list and drawings of the most important guns of the strongholds of Swabia, Alsace and Carinthia (those were under the personal supervision of Hauszeugmeister and



Fig. 8. The young Maximilian in a founder's workshop. An illustration from *Der Weisskunig*. A woodcut by Hans Burgkmair.

Privy Councillor Michael Otto von Achterdingen). The guns were singled out by Bartholomus Freysleben, General Inspector of the Habsburg Armoury, during a previous inspection (1493). The first part of the picture inventory, prepared by Kölderer, was completed in 1509. After a short break, it was continued by Wolfgang Reisacher in the period 1515-1519 (i. e. after the Emperor's death).

There were 17 types of guns. The main gun (Hauptstück), called *Lion*, was a bombard firing stone projectiles⁷. In the drawings of the inventory the balls, the accessories and the way of seating the gun at a particular angle with the supporting blocks at the bottom part are clearly visible. The drawings depict also a *szarfen mätze*, 100 hundredweights in weight. It is made of iron, laid on a guncarriage and equipped with crates for the projectiles. The *szarfen mätze* could bombard walls with balls weighing from 55-70 to 100 lbs.⁸ On the following pages there are long iron *kartauna* on guncarriages (dating from 1502) firing iron projectiles 48 pounds in weight⁹. Short *kartauna* were shorter by one-third. They were a lighter variety of the long *kartauna* and could fire iron projectiles weighing 44 lbs.¹⁰ Two *kartauna* are placed on trestle gun mounts. These are demolition demicannons (Notbüchse). The upper gun is equipped with side-tenons, the lower gun placed directly on the



Fig. 9. Maximilian Habsburg as King. A painting by B. Striegel. After E. Heck.

logs¹¹. A demolition quartergun (Viertelbüchse) with a short barrel firing stone projectiles 25 pounds in weight is placed on a guncarriage¹². The next demolition gun, called the basilisk, over 100 hundredweights in weight, has got a multimember long, thin barrel. The chamber part is multilateral¹³. The culverines (Schlange) have got long barrels and weigh over 25 hundredweights¹⁴. They could fire projectiles 16 pounds in weight¹⁵. The following drawings depict two baststard culverines (lange Schlange) with long, thin barrels placed on guncarriages with tumbrels

¹¹ Ibidem, Figs. LXXVIII-LXXIX.

¹² Ibidem, Fig. LXXIX.

¹³ Ibidem, Figs. LXXX-LXXXI - „In meyl ich woll Meins herren veind wan ich tun soll Darumb Schnurchindurch nennt mann mich Vir, mir mues es als trennen sich Dhern haroff vor mir beleybet gantz Mann ich daruor wrffe ein Schantz“.

¹⁴ Ibidem, Figs. LXXXII-LXXXIII.

¹⁵ Ibidem, Figs. LXXXIV-LXXXV.

⁷ A. Essenwein, *Quellen zur Geschichte der Feuerwaffen*, Graz 1969, Figs. LXX-LXXI.

⁸ Ibidem, Figs. LXXII-LXXIII.

⁹ Ibidem, Figs. LXXIV-LXXV.

¹⁰ Ibidem, Figs. LXXVI-LXXVII.

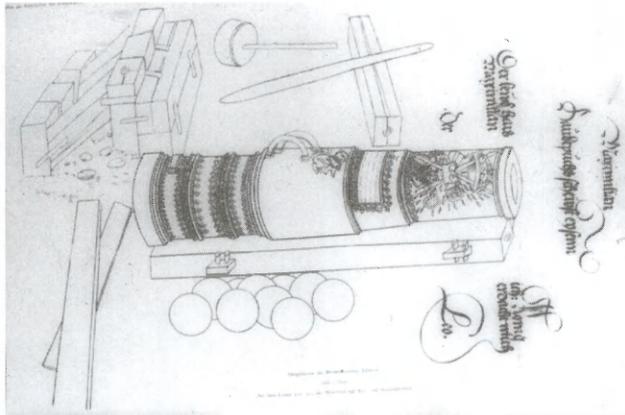


Fig. 10. The bombard *Lion* firing stone projectiles. A drawing from the Emperor Maximilian's *Zeugbücher*. After A. Essenwein.

(they will be further discussed below)¹⁶. The number 54 placed next to the demiculverines (Mittlere- or Halbeschlange) denotes the number of the cannons. The cannons are equipped with crates for the projectiles and two guncarriages with shafts. The barrels could fire balls weighing from 11 to 12.5 lbs.

The next six pictures depict iron chamber guns (schmede eisserne Kammerschlange), a type of culverine¹⁷; a falconet on a guncarriage¹⁸, a light gun firing projectiles 1.5 lbs. and from 2.5 ounces to 1.25 pounds in weight; and a terrace gun (one of the most common guns firing small-size iron and lead projectiles. Such guns were used for defending walls and placed in the foreground of an encampment until the Late Middle Ages)¹⁹. On one of the battle carriages there are six quarter-culverines with a screw mechanism for adjusting the firing angle²⁰. Another drawing represents a small field gun which could fire projectiles weighing over 5 lbs.. The improved form visible in the next picture is a field gun with 40 barrels placed on a cart (Hagelbüchse). The projectiles are iron buckshots or small shots 0.5-3 ounces in weight²¹. The main mortar (Der „Hummel“) was a large-sized demolition gun firing large stone balls²². The last gun was Der „Jochvogel“²³. Both the guns were equipped with mechanisms for adjusting the firing angle.

To sum up: it should be remembered that over a score of years later, the above-discussed types of Maximilian artillery gave rise to several intermediate species, or rather types of guns, especially in Germany. In the middle of the 16th century, there appe-

¹⁶ Ibidem, Figs. LXXXVI-LXXXVII.

¹⁷ Ibidem, Figs. LXXXVIII-LXXXIX.

¹⁸ Ibidem, Fig. XC.

¹⁹ Ibidem, Fig. XCI.

²⁰ Ibidem, Figs. XCII-XCIII.

²¹ Ibidem, Fig. XCIV.

²² Ibidem, Fig. XCV.

²³ Ibidem, Fig. XCVI.



Fig. 11. Basilisk - a demolition demicannon. A drawing from the Emperor's Maximilian's *Zeugbücher*. After A. Essenwein.

ared 9 types of *szarfen mätzen*, 3 types of *kartauna*, 3 types of basilisks, 3 types of nightingales, 2 types of singers, and 13 types of culverines. The light field guns developed into 10 types of falcons, falconets and serpentines. The confusion resulting from the consequent great variety of projectiles can only be imagined (a lot of barrels were imported from remote foundries and armouries). Maximilian's artillery was not yet affected by this „chaos“, where the number of guns did not correspond with real needs. But the guns were not grouped into categories. This is especially visible in the case of the ordinal guns, which were not subdivided into proper (legitimate) guns and improper (bastard) guns. The above basilisk, which can be a short or long gun, is a bastard variety of the legitimate culverine. Thus, it may be assumed that the division of guns into short and long guns (measured in calibres, e. g. a long gun was from 48 to 26 calibres long and a short gun from 27 to 17 calibres long) emerged in a later period. The *szarfen mätze* is a short demolition gun. The projectiles fired from the classical *szarfen mätze* of the old type weighed over 100 lbs. and the projectiles fired from the smaller variety from 55 to 85 lbs. The term „lange *kartauna*“ may mean a double *kartauna* 128 hundredweights in mass which could fire projectiles 96 pounds in weight. The „kurze *kartauna*“ is a legitimate gun from 70 to 80 hundredweights in mass firing projectiles 45-70 pounds in weight. The *Notbüchse* and *Viertelbüchse* are probably quarterguns corresponding to the category of singers which can fire projectiles 20-28 pounds in weight. The falconet and culverines were large siege guns, which will not be discussed here²⁴.

The second source providing information about Maximilian's artillery is the above discussed *The Triumphant Parade of the Emperor Maximilian* by Jörg Kölderer, painted in the years 1507-1512

²⁴ See Z. S t e f a ŋ s k a, *op. cit.*

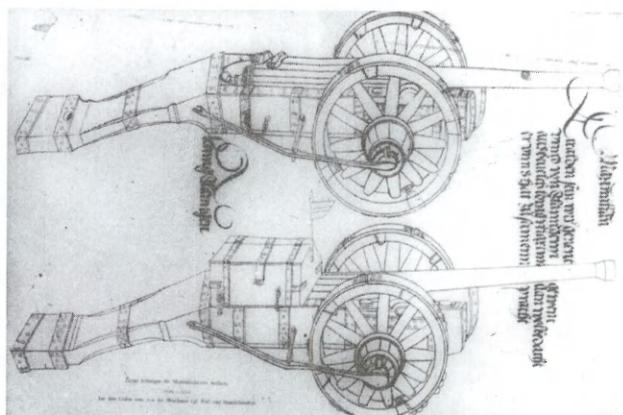


Fig. 12. Bastard culverine. A drawing from the Emperor Maximilian's *Zeugbücher*. After A. Essenwein.

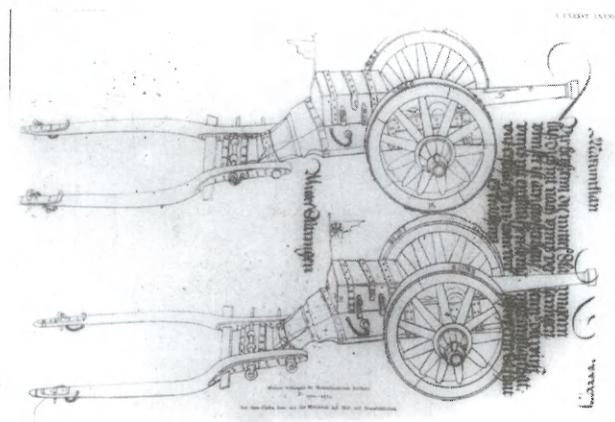


Fig. 13. Demiculverine. A drawing from the Emperor Maximilian's *Zeugbücher*. After Essenwein.

(nowadays kept in the Vienna Albertine). Just before the outbreak of the Second World War, the painting was examined by Bruno Thomas, which releases me from a detailed analysis²⁵. However, it is tempting to draw a comparison between teams transporting different kinds of guns in the picture and those enumerated in a Mainz inventory dating from the beginning of the 16th century. The inventory, kept in Germanisches Museum Bibliothek in Nurnberg, contains a list of guns, wagons, horses, tools, artillery instruments, carters and the gunner's helpers²⁶.

Kölderer's painting shows the above-mentioned *Lion* placed on a cart (the weight is evenly spread on the axles). The cart is drawn by 15 horses harnessed in pairs. The bottom and muzzle part of the bombard are fastened to the cart with ropes. The cannon, with chains passed through the dolphin-shaped ears, was 5 m long and could fire stone projectiles 500 pounds in weight²⁷. The *szarfen mätze* as shown in *The Parade* is placed on a block guncarriage and drawn by 8 horses. According to the handwritten Mainz inventory, larger *szarfen mätzen* transported on wagons with iron fittings were drawn by 18 horses and the guncarriages of smaller *szarfen mätzen* were pulled by 6 such animals. The guns were accompanied by 400 balls loaded onto 20 carts. Each cart was drawn by 4 horses. To fire the balls, 2 hundredweights of gunpowder had to be used.

In the middle row of the parade there is a basilisk with a long barrel, whose muzzle protrudes from a lion's mouth. The outer surface of the bottom part with clearly spiral flutes resembles the numerous similarly ornamented siege guns which are depicted in the woodcuts of *Der Weisskunig*. The guns might be basilisks which fire projectiles weighing about 75 lbs. However, the bore of the muzzle in Kölderer's painting seems to be exceptionally small. In the Innsbruck armoury there was a basilisk called *Crocodile*. Unfortunately, we do not know whether this is the same gun.

In the first and the second rows on the right side there are 60-70(mm)-bore falconets equipped with barrels up to 2.5 m in length on average. The projectiles weigh from 1 to about 1.5 lbs. Their surfaces are fluted vertically and divided into segments by rings (that is also the case with other barrel surfaces in *The Parade*. We shall not, however, analyse the decorative elements of the barrels). Each falconet is drawn by a horse, which is harnessed to a forked guncarriage (the so-called wheelbarrow). Behind the bottom part there is a tumbrel with metal fittings, used for carrying the projectiles. The gunpowder was transported in sacks or barrels. The ridge-roofed crates with pennons with eagles are repeatedly depicted in *The Books of the Emperor's Armouries*. Meanwhile the falconets and legitimate culverines of the Mainz inventory are placed on wagons pulled by two horses.

The main mortar is placed on a reinforced ladder undercarriage and fastened to it with chains and ropes. The front and the back of the wagon are additionally loaded with balls. It is drawn by 6 horses. Mortars were used mainly for bombarding encampments surrounded by ramparts and strongholds surrounded by walls. In order to place a mortar in position, it was unloaded from the wagon. If it was transported on a guncarriage, the wheels were removed

²⁵ B. Thomas, *Die Artillerie im Triumphzug Kaiser Maximilians I*, „Zeitschrift für Historische Waffen-und Kostümkunde“, Bd. 6, H. 1, Berlin 1937-1939, pp. 229-235.

²⁶ The Mainz Inventory: „Wie viel geschütz zu eynem dapffern Veldzug gehort vnd was dem unhengig ist (...)“ dating from 1514, published in: A. Essenwein, op. cit., pp. 61-64.

²⁷ If we assume that an Austrian pound was equivalent to 0.56 kg, the balls for *Lion* must have weighed about 185 kg.

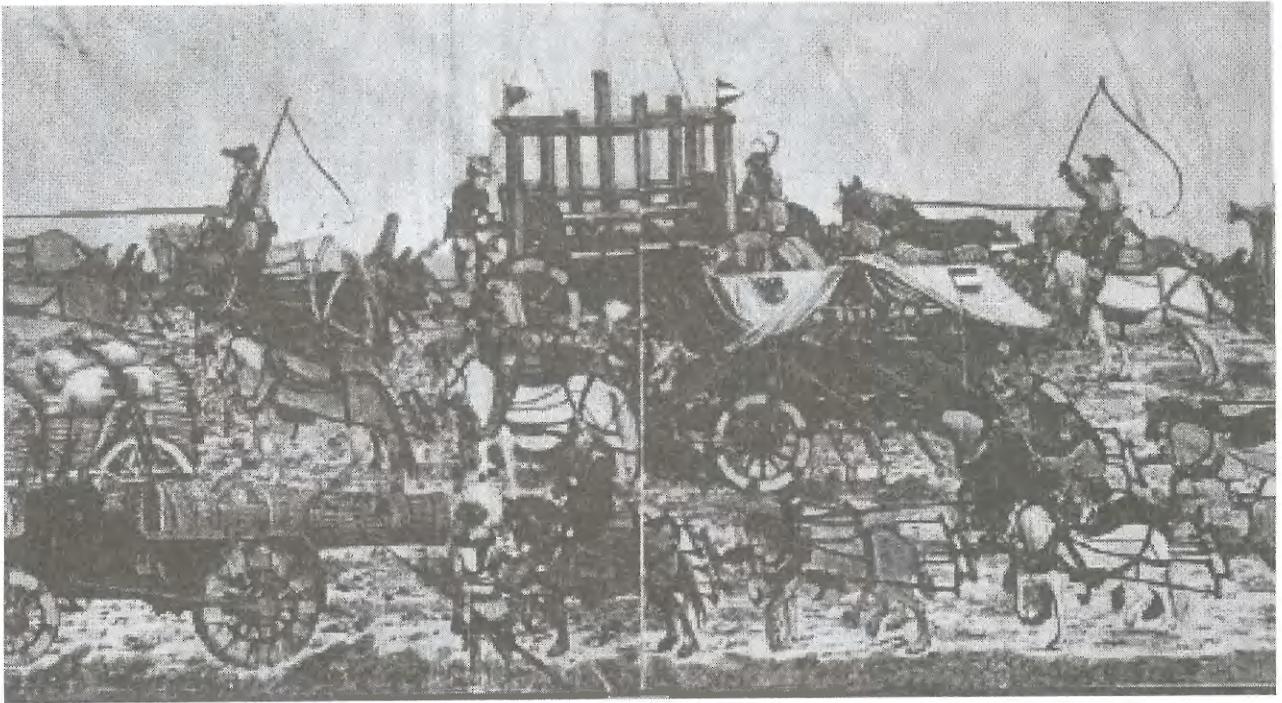


Fig. 14. Guns of Maximilian Habsburg in *The Triumphant Parade* by Jörg Kölderer.

from the axles, the gun leaned against the ground and the construction strengthened.

Besides the wagons and guncarriages in the parade there is also a cart with a battery of eight small-calibre chamber barrels. Two of the eight are placed on the front and at the back of the cart. Six barrels are situated on the sides. The barrels are passed over the sides so that they can be lifted by looped ropes and thus hooked to the upper hangers. The gunpowder chambers are laid beside the barrels.

Behind the battery, in the back row, there is a vehicle carrying four ramrods for ramming down the charge of muzzle loading guns. The ramrods are turned by cogs. The gunner's helpers are standing by the cranks.

This artillery equipment was supplemented with wagons loaded with fuses, pikes, sacks of gunpowder, auxiliary pulley blocks, hoists and levers, spare wagon wheels and all kinds of *gezeug*, namely tools, accessories, cooking utensils, troughs, bellows and fire hooks, which were indispensable in the field and during sieges. According to the Mainz inventory, 300 hundredweights of gunpowder had to be transported by 13 wagons. Such a wagon was pulled by 4 horses. Wagons loaded with ropes, the carpenter's and the blacksmith's tools were drawn by 4 horses. Combat enginery used to be loaded on to two carts, the guard of the armoury had at his disposal one cart and one wagon was assigned to the gunsmith. 12 large guns would be serviced by 24 gunners etc.. Besides, the guard of the armoury could have two horses, the master of the teams three horses, the blacksmith, the metalworker and the wheelwright two horses. Each

orderly had at his disposal 24 chargers. In addition, there were also heavy wagons laden with projectiles for different types of cannons. Thus, an army needed an amazing number of horses, as well as carters and grooms, not to mention the sacks of forage. The above list gives us an idea of the immensity of artillery transport during the military campaigns of the Emperor Maximilian.

Translated by Zuzanna Poklewska-Parra

