

Simone Picchianti

University of Trieste



ORCID ID: 0000-0001-5211-1990

OBLICZA WOJNY

TOM 10 • NARZĘDZIA WOJNY

ŁÓDŹ 2023 • ISBN 978-83-8331-461-7 • s. 125-144

<https://doi.org/10.18778/8331-461-7.08>

# PRODUCTION AND LOGISTICS OF CROSSBOW BOLTS IN THE EARLY RENAISSANCE FLORENCE AND THE WAR AGAINST LUCCA (1429–1433)

**Summary.** In the autumn of 1429, Florence declared war on Lucca, to complete its domination over the north of Tuscany. The siege began in December and continued until the mercenary chief Niccolò Piccinino defeated the Florentine army outside the walls of Lucca, but the war continued until May 1433.

In this period, although firearms already existed, the use of crossbows was still very important. To satisfy the requests of Florence, the men of Montefioralle, a small town in Chianti, specialised in the production of crossbow bolt heads. In this village of about two hundred inhabitants, every man was a blacksmith and together they produced on average 100,000 metal elements every six months. The shafts for the crossbow bolts were, on the other hand, produced by other specialised craftsmen in the mountains of the Casentino, and were assembled in other places. The Florentine war office, the *Dieci di Balìa*, took care of the logistics both to connect the different artisans and to send the ammunition to the battlefields and fortresses.

Thanks to the documents kept in the State Archives of Florence, it has been possible to reconstruct the entire network of artisans, the management of shipments, and the quantity and expense for these ammunitions.

**Keywords:** renaissance Florence, Florentine guilds, renaissance warfare, arms and armour, war production

## Introduction: From Siege to Peace

From the mid-fourteenth century Florence began to significantly expand its borders. Initially the territories of the north Mugello region were conquered, and shortly thereafter other places of importance were annexed such as Pescia, Prato, Pistoia, and San Gimignano, to which were added Volterra and San Miniato. A second

important phase of increasing territorial possessions began through the subjugation of Arezzo and Montepulciano, and finally Pisa and Cortona in the last quarter of the century. At the beginning of the fifteenth century, the Florentine borders delimited a territory that covered more than two-thirds of present-day Tuscany, and a part of Romagna.<sup>1</sup>

Florence then went from being a *Comune* to becoming a 'territorial state', with specific offices for its government clearly codified within the city statutes of 1415.<sup>2</sup> In the following decades Florence continued its expansionist policy, and opened up new outlets in the Mediterranean Sea through the 1421 purchase from Genoa of Livorno and Porto Pisano.

The Florentine attitude aroused concerns not only in Siena – Florence's historical enemy – but also in Milan. As a consequence, between 1423 and 1453, central northern Italy was in a state of constant war where each city state wanted to limit the other's expansion by changing alliances rapidly and continuously.

Although a peace agreement had been signed between Milan and Venice and their allies in April 1428, by the autumn of the following year Florence was preparing to conquer Lucca. Among the reasons for the war against Lucca was the fact that the lord of the city, Paolo Guinigi, had sent his son and his army to support Milan and not Florence during the previous conflict. In any case, for Florence the conquest of Lucca meant acquiring the last important city in the

<sup>1</sup> As Pirillo has highlighted, from the end of the 13<sup>th</sup> century Florence started a process of transformation of the borders, aimed at changing them from a zonal to a linear dimension. This territorial classification and, consequently, of the population present there, responded to multiple needs of various kinds: administrative, judicial, fiscal, and, last but not least, military. P. PIRILLO, *Fines, termini et limites. I confini nella formazione dello Stato fiorentino*, „Reti Medievali Rivista” 2006, vol. 7, no. 1, pp. 1–12; P. PIRILLO, «Incerti fines». Il confine medievale tra norme e pratiche sociali, [in:] *Terre di confine tra Toscana, Romagna e Umbria. Dinamiche politiche, assetti amministrativi, società locali (secoli XII–XVI)*, Conference proceedings, Florence 17 May 2019, Perugia 8–9 November 2019, eds. P. PIRILLO, L. TANZINI, Florence 2020, pp. 3–12.

<sup>2</sup> On the formation of the Florentine territorial state we refer to the historiographical cornerstones on the subject: M.B. BECKER, *Florence in Transition*, vol. 1–2, *Studies in the Rise of the Territorial State*, Baltimore 1968; G.A. BRUCKER, *The Civic World of Early Renaissance Florence*, Princeton 1977; E.F. GUARINI, *Potere e società negli stati regionali italiani del '500 e '600*, Bologna 1978, pp. 7–47; G. GHITTOLINI, *La formazione dello Stato regionale e le istituzioni del contado. Secoli XIV e XV*, Torino 2021, pp. 225–265; S.K. COHN JR., *Creating the Florentine State, Peasants and Rebellion, 1348–1434*, Cambridge 1999; A. ZORZI, *The material constitution of the Florentine dominion*, [in:] *Florentine Tuscany, Structures and Practices of Power*, eds. W.J. CONNELL, A. ZORZI, Cambridge 2000, pp. 6–31.

north of Tuscany, thus unifying almost the entire region, with the sole exclusion of the Sienese territories.<sup>3</sup>

In December 1429 Florence besieged Lucca. In August of the following year the lord of the city was deposed in a coup, and the city returned to a collegial government.<sup>4</sup>

A few days later, the citizens of Lucca reached out for help to Filippo Maria Visconti, duke of Milan. Bound by the 1428 peace agreements with Florence, Visconti could not provide direct help – instead he released the famous mercenary commander Francesco Sforza from his contract and allowed his army to join Lucca's defence. At the beginning of October, however, Sforza – bought by the Florentines – left Lucca, and the city immediately sought an alliance with Genoa. In the first days of December, Genoa sent the mercenary chief Niccolò Piccinino, freed from a contract with Milan, who defeated the Florentine army on the banks of the Serchio river.<sup>5</sup>

Concerned that the Duke of Milan would take advantage of the situation to conquer the northern territories of Tuscany, Venice and Pope Eugene IV re-established the alliance with Florence. At the beginning of January 1431, hostilities also began in northern Italy.<sup>6</sup>

The first four months of 1431 were difficult for the Florentines and their allies: Piccinino conquered many localities throughout Lunigiana and subsequently in the counties of Volterra, San Miniato, and Arezzo; Francesco Sforza – on behalf of the Duke of Milan – defeated the Venetians in March; Lucca made further alliances with Genoa and Siena. After Niccolò Piccinino's return to the Po Valley, the Florentine army managed to regain the lost territories. The clashes also continued at sea, and at the end of August of that year the Venetians and Florentines defeated the Visconti-Genoese fleet in the battle of Rapallo.<sup>7</sup>

---

<sup>3</sup> D. BONINSEGNI, *Storie della città di Firenze. Dall'Anno 1410 al 1460*, ed. T. GUADAGNI, Firenze 1637, pp. 29–30.

<sup>4</sup> I. DEL PUNTA, *La signoria di Paolo Guinigi a Lucca (1400–1430): un modello paternalistico?*, [in:] *Le signorie cittadine in Toscana. Esperienze di potere e forme di governo personale (secoli XIII–XV)*, ed. A. ZORZI, Roma 2013, pp. 301–321;

<sup>5</sup> A. PELLEGRINI, *Tre anni di Guerre tra le Repubbliche di Firenze e di Lucca. 1430–1433*, [in:] *Studi e Documenti di Storia e Diritto*, Roma 1898, pp. 174–177.

<sup>6</sup> *Storia di Milano. Il ducato visconteo e la Repubblica Ambrosiana (1392–1450)*, vol. 6, ed. F. COGNASSO, Milano 1955, p. 266.

<sup>7</sup> *Ibidem*, p. 278. Further information on the organisation of the Florentine fleet can be found in: M. MALLETT, *The Florentine Galleys in the Fifteenth century with Diary of Luca di Maso degli Albizzi Captain of the Galleys 1429–1430*, Oxford 1967.

The fighting continued throughout the first part of 1432. At the beginning of June, the Florentines defeated the army of Lucca, Siena, and part of the Milanese in the battle of San Romano. From this moment Florence maintained a defensive position, without instigating any new important clashes. In northern Italy the battles continued until November, when the Visconti army defeated the Venetians in the battle of Delebio.

In December the parties began to look for an acceptable agreement, signing a peace treaty in Ferrara on 26 April 1433.<sup>8</sup>

### Production and Logistic

Crossbows were used almost continuously in Europe from the Classical Age to Modern times, but the period of greatest use was from the 11<sup>th</sup> to the 16<sup>th</sup> century<sup>9</sup>. Besides the longbow, a crossbow was the most powerful (and the easiest to use) among all portable weapons, to the point that it remained appreciated in hunting fields centuries after it had been supplanted on battlefields by flintlock firearms. For these reasons, the production of crossbow bolts was very important for the states of the period and required a very well-developed production organisation to meet the high demand.

The best way to reconstruct the overall purchases of crossbow bolts made by the Republic of Florence during the war against Lucca is to study the actions of the *Dieci di Balìa*, the Florentine office of war. After its establishment in 1384 the *Dieci* was only summoned in case of war. It was composed of ten members (hence the name), who were the most important political figures in the city; normally, their office lasted six months. Their duties ranged from the creation of the army and the hiring of mercenary troops, to the purchase of armaments for the army and fortifications, as well as performing foreign policy tasks.<sup>10</sup>

<sup>8</sup> *Storia di Milano...*, p. 293.

<sup>9</sup> On the evolution of the crossbow over the centuries *vide*: M. LOADS, *The Crossbow*, Oxford 2018, pp. 7–28.

<sup>10</sup> G. PAMPALONI, *Gli organi della Repubblica fiorentina per le relazioni con l'estero*, „Studi politici internazionali” 1953, vol. 20, pp. 270–276; G. GUIDUBALDO, *Il governo della città-repubblica di Firenze nel primo Quattrocento. Gli istituti «di dentro» che componevano il governo di Firenze nel 1415*, vol. 2, Firenze 1981, pp. 203–112.

In times of peace, defence organisation depended on multiple offices with specific tasks.<sup>11</sup>

Much information is collected in the registers of the purchases of the *Dieci di Balìa*. First of all, the producers are listed with the relative goods they sell to the Republic, reporting the quantity and selling price. There are also other lists that show where such goods are sent to, such as fortresses or to mercenary chiefs; in this second case, there are the quantities of the goods in addition to any transport costs. Sometimes specific lists show the dispatch of *biscotto*, food supplies for the army, or the purchase of food for some cities. Listed among the ammunition there are also the artisans who were hired to work at specific fortresses, in order to fortify or repair them, or those who were sent to the siege camps for the construction of siege machines or other works that required specific skills of carpenters or stone workers.<sup>12</sup>

The making of crossbow bolts allowed for the division of the work into three production phases: the making of the heads, the manufacture of the rods, and their assembly and completion. Obviously, the great use of crossbows in the war field reflected on the need for a large quantity of ammunition, differing by various characteristics.



Fig. 1. Crossbow Bolt, 15<sup>th</sup> or 16<sup>th</sup> century, Western Europe, MET, New York, A. N. 14.25.1591a-l (Source: Author's own elaboration)

<sup>11</sup> S. PICCHIANTI, *Per la difesa dei confini della Repubblica di Firenze Le fortificazioni e la loro gestione secondo gli Statuti del 1415*, [in:] *Confini e sconfinamenti*, eds. I. CANDELIERI, C. DAFFONCHIO, Trieste 2022, pp. 4–6.

<sup>12</sup> In order to reconstruct the total number of crossbow bolts purchased, the locations where they were built and where they were sent, the following records were analysed: Archivio di Stato di Firenze (hereinafter: ASFi), *Dieci di Balìa, Munizioni*, 1–2 and 4. Since the register corresponding to the semester June 1430–December 1430 is missing, another source of a fiscal nature was used. This register was compiled by the *Camera del Comune* of Florence, the office that dealt with the income and expenditure of the state: ASFi, *Camera del Comune, Specchi di Entrata e di Uscita*, 42.

All types of crossbow bolts consist of three elements: the head, the shaft, and the feathers (fig. 1).<sup>13</sup> Five types were produced during the war of Lucca: *verrettoni da gamba*, small compared to the others and used on hand-loaded crossbows; *verrettoni da cianfogna*, of medium size and used on reel crossbows; *passatoi*, with particularly sharp heads with a circular section; *quadrelli* (quarrel), with a square section and high penetrating power; *cianfognoni* for galley, similar to *cianfogna* but larger in size and with a specific use in naval battles.<sup>14</sup>

Crossbow bolt heads are classified mainly on the basis of three aspects: use, method of attachment to the shaft, and bolt head shape. They could be used for military or for hunting; the fixing could take place by means of a socket or a tang; the bolt heads came in many forms.<sup>15</sup>

Hunting bolt heads are easily recognisable as they have particular shapes based on the type of prey. Military bolt heads tended to favour characteristics that increased their penetrating power in armour, such as a very sharp shape. Obviously, war crossbow bolts could also have been used for hunting. Most bolt heads, especially the war ones, had a socket fixing, probably because it was easier to assemble than those with a tang.<sup>16</sup>

Florentine production was mainly concentrated in five localities:<sup>17</sup> Montefioralle; Greve; Florence, San Miniato al Tedesco, and Vico (fig. 2).

The largest number of these products were created in Montefioralle, which exceeded 700,000 items, as well as being the only place to produce *quadrelli* and

<sup>13</sup> For the types of crossbows and ammunition used in Tuscany in 13<sup>th</sup> and 14<sup>th</sup> centuries, *vide*: D. DE LUCA, R. FARINELLI, *Archi e balestre. Un approccio storico-archeologico alle armi da tiro nella Toscana meridionale (secc. XIII–XIV)*, „Archeologia Medievale” 2002, vol. 29, pp. 455–487.

<sup>14</sup> ASFi, *Dieci di Balìa, Munizioni*, 2, cc. 34v; 37v; 38r.

<sup>15</sup> C. RAU, *European Arrowheads and Crossbow Bolts. From the Bronze Age to the Late Middle Ages*, Berlin 2018, pp. 187–191.

<sup>16</sup> *Ibidem*, pp. 185–187.

<sup>17</sup> Any information concerning the quantities of crossbow darts purchased by the *Dieci di Balìa* is contained in the following documents: ASFi, *Dieci di Balìa, Munizioni*, 1, cc. 32r–59r (12/1429–06/1430); ASFi, *Camera del Comune, Specchi di Entrata e di Uscita*, 42, cc. 344r–357v (06/1430–12/1430); ASFi, *Dieci di Balìa, Munizioni*, 1, cc. 82r–180r (12/1430–06/1431); ASFi, *Dieci di Balìa, Munizioni*, 2, cc. 228r–349r (06/1431–12/1431); ASFi, *Dieci di Balìa, Munizioni*, 2, cc. 34r–126r (12/1431–06/1432); ASFi, *Dieci di Balìa, Munizioni*, 4, cc. 2r–15r and 20r–30v and 34r–61v and 80r–84v and 90r–92v (06/1432–12/1432); ASFi, *Dieci di Balìa, Munizioni*, 4, cc. 16r–19r and 31v–33v and 64v–77r and 84v–89r and 93v–105r (12/1432–06/1433).

*cianfognoni* for galley. In second place was the town of Greve, not far from Montefioralle, with a total production of over 188,000 bolt heads. In addition to these places, the *famigli* are also present in the graph. The *famigli* were trusted men of the members of some Florentine offices, to whom large amounts of money could be delivered in order to carry out certain tasks, such as hiring mercenaries, buying supplies, paying spies or, as in this case, buying armaments. These ‘assistants’ were given this specific task only during the period December 1430–June 1431. It is likely that the producers could not satisfy the requests of the Republic, which is why the *famigli* were instructed to purchase all the bolt heads available in the domains.

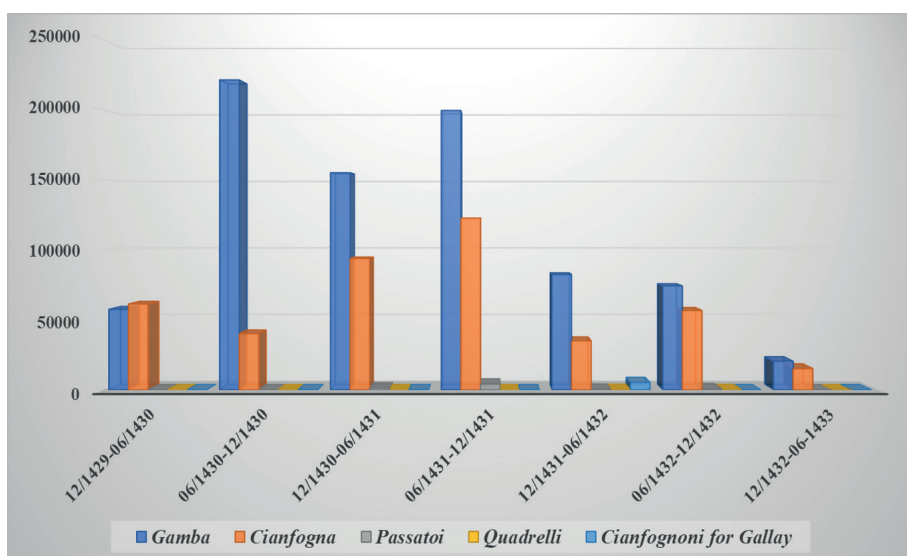


Fig. 2. Production of Crossbow Bolt Heads (Types), December 1429–June 1433  
(Source: Author’s own elaboration)

More than 1,200,000 bolt heads were created over the course of the conflict. The maximum production was reached in the second half of 1431, with over 325,000 items (fig. 3). The request at this specific moment by the Republic of Florence was due to a change of course in the conflict after the reconquest of the villages and fortresses that the Piccinino had conquered. Ammunition and troops were sent to these locations to increase their defenses.<sup>18</sup> The fewest bolt heads were purchased in the last six months of the war, but levels had

<sup>18</sup> A. PELLEGRINI, *op. cit.*, p. 182.



already dropped significantly by the preceding semester. As mentioned, in the last year of the war the clashes between the opposing armies were considerably reduced and, consequently, the purchases of ammunition followed the same downward trend.

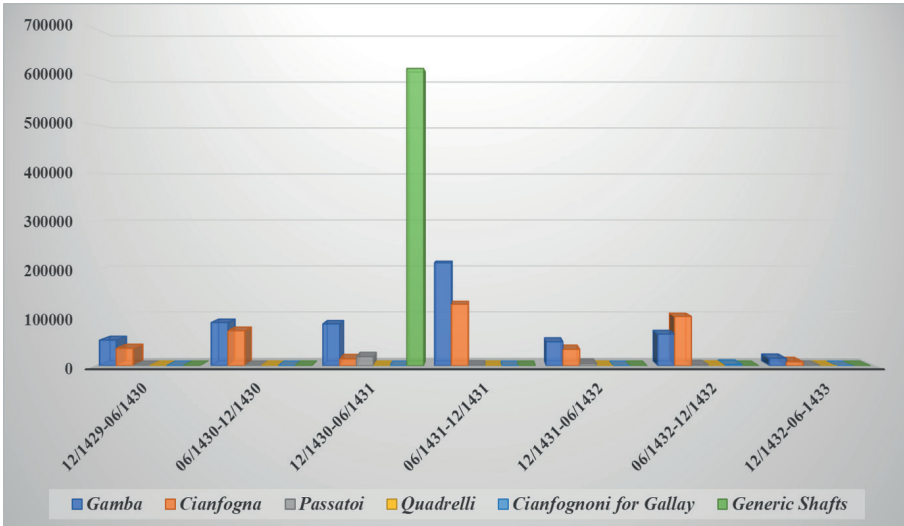


Fig. 3. Production of Crossbow Bolt Shafts (Types), December 1429–June 1433  
(Source: Author's own elaboration)

The most produced crossbow bolt heads were those for *verrettoni da gamba*, about 64%, followed by the *verrettoni da cianfogna*, about 34%. The prices for bolt heads varied according to the type of steel, quantity of steel used in production, and the time needed to make them. The most expensive were the *passatoi* and the *quadrelli*, made with a steel rich in carbon in order to increase their penetrating power. Their value was six times that of the less expensive *verrettoni da gamba* heads. After the *quadrelli* follow the *cianfognoni* for galley, created with the same metal as the *gamba* and *cianfogna* ones but larger in size.<sup>19</sup>

<sup>19</sup> The value corresponds to the purchase price of 500 pieces, the standard quantity of a case of complete crossbow bolts. The unit of measurement that will be used is the *Lira* (L): *Gamba* 10 L; *Cianfogna* 16 L; *Passatoi* 66.67 L; *Quadrelli* 65.03 L; *Cianfognoni* for galley 20 L. ASFi, *Dieci di Balia, Munizioni*, 2, cc. 34v, 37v; 38r. To understand how much similar figures corresponded at the time, a crossbowman hired to defend the city of Pisa, the highest paid of the flourishing domains, received monthly 16 L, equal to the cost of 500 *cianfogna* crossbow bolt heads. ASFi, *Camera del Comune, Scrivano di Camera, Uscita, Duplicato*, 218, c. 16r.



Returning to the analysis of the locations where crossbow bolt heads were produced, according to the sources, the production organisation at Montefioralle appears as the early proto-industrial system. Fortunately, the registry of those enrolled in the *Arte dei Fabbri* (Guild of Blacksmiths) in Florence and its countryside still exists.<sup>20</sup> Through this register it was possible to identify thirty-three blacksmith masters from Montefioralle enrolled during the war of Lucca.<sup>21</sup> Most of these were able to join the guild thanks to the fact that their fathers were already members; only five were new members. Their names also testify

<sup>20</sup> From the statute of the *Arte* we learn the internal subdivision based on the types of products they created: *Statuti delle Arti dei Corazzai, dei Chiavaioli, Ferraioli e Calderai e dei Fabbri di Firenze (1321–1344)*, ed. G. CAMERANI MARRI, Florence 1957, pp. 128–129: «Et primo quod ars fabrorum dividatur et distinguatur per membra hoc modo videlicet: Quod omnes et singuli exercentes in civitate et districtus Florentie infrascripta fabrilia opera et fabricantes et facientes de infrascriptis misteriiis vel operibus vel aliquo eorum sint, appellantur et habeantur fabri et de arte fabrorum predictae civitatis et districtus Florentie, videlicet quod omnes et singuli facientes bumeros, marras, vangas, secures, mannarias, segas, stateras, succhiellos, martellinos, quadrellos, moschectas, palectas, catenas, et similia sit unum membrum, quod nominetur membrum artis grosse. Et ferratores, marischalchi et facientes ferros et chiovos equorum, mulorum, asinorum et bovis sit aliud membrum et censeatur membrum ferratorum. Et facientes frenos, calcaria, fibulas, bullas, acus, sprangas, puntales et ferra pro correggiis, pro spatibus et cultellis et ferramentis et pro forcerinis et catenellas et stagnatores sit aliud membrum et nominetur frenariorum et fibiariorum. Et facientes cultellos cuiuscumque conditionis et generis, forcines, rasorios, cultellinos et facientes manicas pro gladiis vel cultellinis et arotatores et tenentes ruotas pro arotando ferros, incisoria vel alia feramenta et similia sit aliud membrum et nominetur membrum cultellariorum. Et facientes enses, quadrellos et spuntones, pomes, elsas, doratores cultellorum et spuntorum cultellinorum et similia sit aliud membrum et censeatur membrum spadariorum. Et facientes elmos, cappellos, crestutas, baccinectos, cervellaria et similia sit aliud membrum et censeatur membrum cervellariorum. Et subesse debeant, teneantur et cogi possint sub consulibus dicte artis fabrorum. Et quod dicta membra omnia sint unum corpus dicte artis et facientium et fabricantium de misteriiis fabrilibus suprascriptis vel aliquo eorum.»

<sup>21</sup> ASFi, *Arte dei Fabbri*, 5: Carlone di Piero, c. 18r; Biagio di Piero, c. 12r; Donato di Iacopo, c. 23r; Agnolo di Cristofano Santi, c. 4r; Cristofano di Iacopo, c. 18r; Cerbone di Piero, c. 18r; Piero d'Andrea, c. 65r; Lorenzo di Marco, c. 48v; Marco di Arrigo, c. 53r; Fruosino di Stefano, c. 29r; Giovanni di Ghirigoro, c. 37r; Ambruogio di Fruosino di Benvenuto, c. 4v; Fruosino di Lorenzo, c. 29v; Simone di Lodovico, c. 72r; Sandro di Bartolo, c. 72r; Michele di Domenico, c. 54r; Simone di Bartolo, c. 72r; Antonio di Fruosino, c. 5r; Bartolomeo di Lodovico, c. 13r; Papino di Fruosino, c. 65v; Bartolomeo d'Agostino, c. 13r; Fruosino di Iacopo, c. 29v; Giuliano di Bartolo di Stefano, c. 38r; Filippo di Bartolo di Stefano, c. 29v; Francesco di Nanni di Marco, c. 29v; Fruosino di Giovanni di Mico, c. 30r; Bastiano di Michele, c. 13r; Mariano di Giovanni, c. 54v; Matteo d'Andrea, c. 54v; Chimenti di Cristofano, c. 18v; Gerino di Iacopo, c. 38r; Stefano di Giovanni di Ghirigoro, c. 72v; Zanobi di Stefano di Marco, c. 79r.

that most of them were brothers or cousins, further demonstrating the strong family tradition of the blacksmith's trade in Montefioralle. Comparing their number with that of all those enrolled in the *Arte dei Fabbri* of the Florentine countryside, this locality had the largest number of members throughout the fifteenth century.<sup>22</sup>

Based on the tax documentation, we know that seventy men of working age lived in Montefioralle in 1427.<sup>23</sup> Counting that thirty-three of these were masters, we can easily hypothesise that the remaining men worked in the workshops and that the children were apprentices. Consequently, almost all men produced crossbow bolt heads, thus showing us how it was possible to produce on average over 100,000 items every six months, also reaching maximum production levels of over 196,000 items per month. The purchase of such huge quantities of bolt heads from Montefioralle entailed for the Republic of Florence an expense of over 18,600 L during the war period.<sup>24</sup>

The production of the shafts was mainly divided into six locations: Trappola, Poggio, Cocollo, Maggiona, Loro Ciuffenna, and Camaldoli (fig. 4).<sup>25</sup>

Most of the shafts were produced in the town of Trappola, in the Arezzo Mountains. This town appears similar to the case of Montefioralle. With a population of about fifty inhabitants, it managed to produce about 983,000 shafts during the war, reaching the maximum six-monthly production of 454,000 items in the first part of 1431. Those who fabricated the shafts for the crossbow bolts were called *legnaiuoli* and in Florence and its countryside the guild they joined was the *Arte dei Legnaiuoli* (Guild of Woodworkers).<sup>26</sup> Unlike Montefio-

<sup>22</sup> The main localities of the Florentine countryside for the presence of blacksmiths enrolled in the guild were: Castel Fiorentino; Figline Valdarno; Empoli; Poggibonsi, San Giovanni Valdarno; Montevarchi. S. Picchianti, *L'Arte dei Fabbri a Firenze e nel suo contado attraverso gli statuti e le matricole (1344–1481)*, "Ricerche Storiche" 2018, p. 142.

<sup>23</sup> E. CONTI, *La formazione della struttura agraria moderna nel contado fiorentino*, 2<sup>nd</sup> part, Rome 1965, p. 294.

<sup>24</sup> The total expense for the crossbow bolt heads was 30,904.14 L.

<sup>25</sup> Other locations indicated: San Chimento, Cascia, Chiassaia, Montemarciano, Raggiolo, Rocca Ricciarda, and Castel Focognano.

<sup>26</sup> ASFi, *Arte dei Legnaiuoli*, 4, c. 6r. «Questi sono li Statuti dell'Arte e università de legnaioli grossi, Cassetai, Chofanai, Bottai e barlettai della città e distretto di Firenze e di qualunque altro s'aspettasse e partenesse a detta arte, ovvero per vighore delli infrascritti statuti o d'alchuno di quelli sotto detta arte e suoi consoli tenuti di giurare e di promettere, cioè venditori di legname e acconciatori di legname con ferro e venditori di lastre e facitori o venditori di chofani, forzieri, forzerini, casse, scrigni,

ralle, due to the lack of registers of those enrolled in the guild it was not possible to identify all the names of the masters who lived in Trappola.

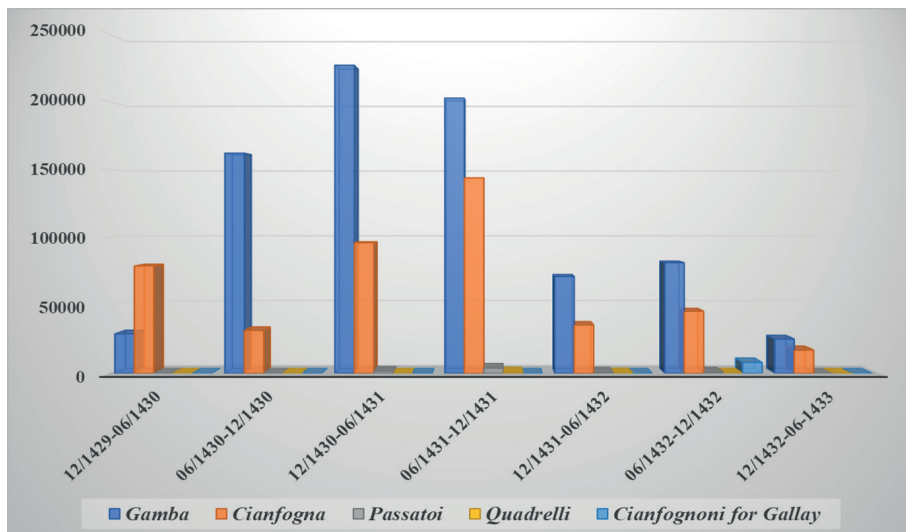


Fig. 4. Assembly of Crossbow Bolts (Types), December 1429–June 1433  
(Source: Author's own elaboration)

The peak of production occurred in the first half of 1431, with the exorbitant construction of over 735,000 bolt shafts (fig. 5).

Although the shafts were usually specific to the single types of bolt heads, in the first half of 1431, 'generic' ones were created in the number of over 616,000 pieces, equal to one third of all those produced during the war. At that time, the *Dieci di Balìa* had asked their *famigli* to procure all the shafts on the market. This need for ammunition stockpiling perhaps led to the request for generic shafts, which could probably be used both for the *gamba* bolt heads and for the *cianfogna* ones. By analysing the sale prices of the shafts, we learn that the generic ones cost the same as the *cianfogna*.<sup>27</sup> The most expensive shafts were those of

---

lettiere, tavole, deschi, banche, arche, madie, selle da bestie, pale di legno, rastrelli damondar grano, archi da battere, telai, gramole, asserelli, vanghini, botte, tini, bighonce, barili, cerchi, pavere e simile chose d'alchuna di dette cose e chi segha detti legnami chon seghe grosse a telaio echi tira detti legnami chon buoi e chi di dette chose o d'alchuna di quelle facesse compra o venditaaacconcime o facitura havendo e tenendo bottegha o luogho in città borgi o sottoborghi ocontado di Firenze».

<sup>27</sup> In this case the value refers to 500 pieces, and the unit of measurement present here is the *Lira* (L): *Gamba* 1.75 L; *Cianfogna* 2 L; *Passatoi* 3.50 L; *Quadrelli* 3.50 L; *Cianfognoni* for galley 12.26;

the *cianfognoni* for galley, given their clearly superior dimensions to those of the other types, exceeding the price of the most expensive seconds by more than three times, the *passatoi*. Although the quantities of shafts are huge, the final cost for their purchase at the expense of the Republic turns out to be of little impact, equal to 6,288 L. Although the making of good shafts for this ammunition was absolutely necessary, perhaps the low cost of the material and the speed of realisation led to a much lower price than the bolt heads, which were made of steel and individually forged by blacksmiths.

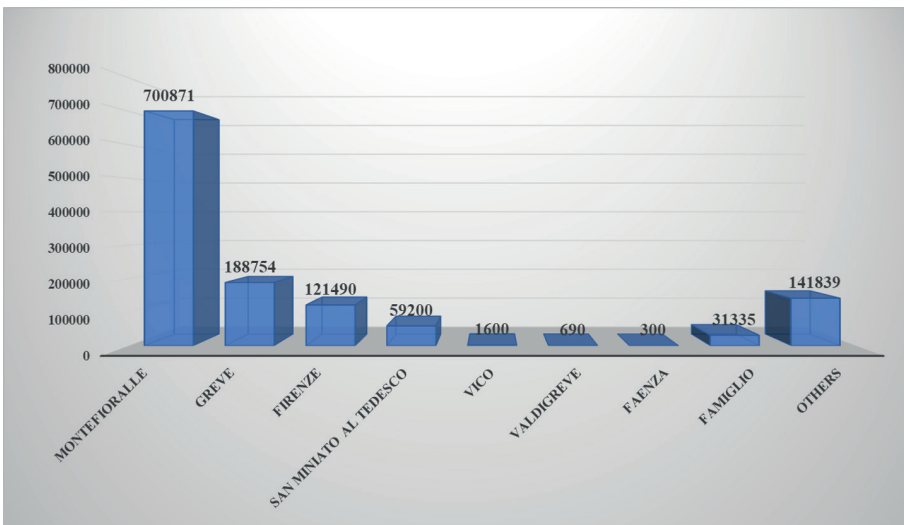


Fig. 5. Production of Crossbow Bolt Heads (Place), December 1429–June 1433  
(Source: Author's own elaboration)

The main locations where bolt heads and shafts were sent to be assembled were Florence, Ricasoli, and Camaldoli (fig. 6).<sup>28</sup> *Inastatori* combined the shafts with the bolt heads and completed the ammunition by adding feathers. Unfortunately, in most cases the place where they worked is not indicated in the documentation. In many cases this means that they were Florentine citizens, but without further investigation one cannot be certain.<sup>29</sup> A notable detail occurs in the first half of

*Generic Shafts* 2 L. ASFi, *Dieci di Balìa, Munizioni*, 1, c. 92v; ASFi, *Dieci di Balìa, Munizioni*, 2, c. 61v; ASFi, *Dieci di Balìa, Munizioni*, 4, c. 60r.

<sup>28</sup> In small and sporadic numbers at Dovadola and Pietra Santa.

<sup>29</sup> Even the *inastatori* were members of the *Arte dei Legnaiuoli*. As for those who produced the shafts, it was not possible to identify the names in the registers of the guild.

1431. At that time, as we have just seen, the *Dieci di Balìa* tried to find all the bolt heads and shafts on the market and simultaneously hired all those who could assemble and complete the ammunition. Given the contingent needs, they also resorted to those who were serving a sentence in the city prison, the *Stinche*.<sup>30</sup> However, their work was paid on par with that done by their colleagues in freedom.

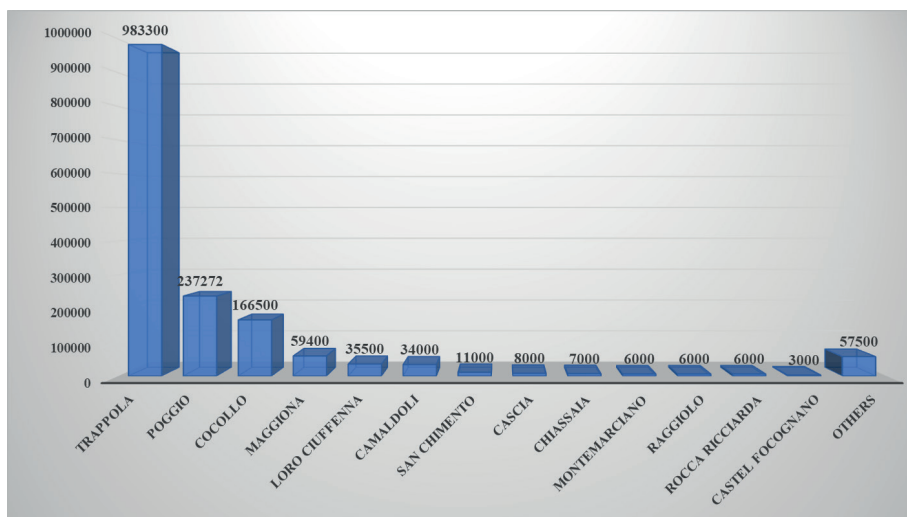


Fig. 6. Production of Crossbow Bolt Shafts (Place), December 1429–June 1433  
(Source: Author's own elaboration)

As in the case of the bolt heads, the production peak was reached in the second half of 1431, with over 351,000 pieces completed, a figure slightly higher than the previous half which had 324,000 (fig. 7).

This production phase also had different prices based on the type of crossbow bolts: the most expensive were the *quadrelli* and *passatoi*, followed by *cianfogna* and lastly the remaining models.<sup>31</sup> As appears from the figures, the importance of the assembly and completion of the ammunition had to be considerable, given that this task was paid more than the creation of the shafts.

<sup>30</sup> ASFi, *Dieci di Balìa, Munizioni*, 1: Antonio di Domenico *inastatore*, c. 99v; Carlo de Lanzimanni, c. 102r; Piero di ser Bartolomeo detto Quore, c. 103r, Bartolo di Zeppi *inastatore*, c. 165v; Pietro d'Agnolo, c. 178r; Quore di Bartolomeo c. 179r.

<sup>31</sup> Also, in this case the value refers to 500 pieces, and the unit of measurement present here is the *Lira* (L): *Gamba* 3.00 L; *Cianfogna* 4.50 L; *Passatoi* 10 L; *Quadrelli* 10 L; *Cianfognoni* for galley 3.75; ASFi, *Dieci di Balìa, Munizioni*, 1, c. 48v; ASFi, *Dieci di Balìa, Munizioni*, 2, cc. 254r and 273r; ASFi, *Dieci di Balìa, Munizioni*, 4, c. 42r.

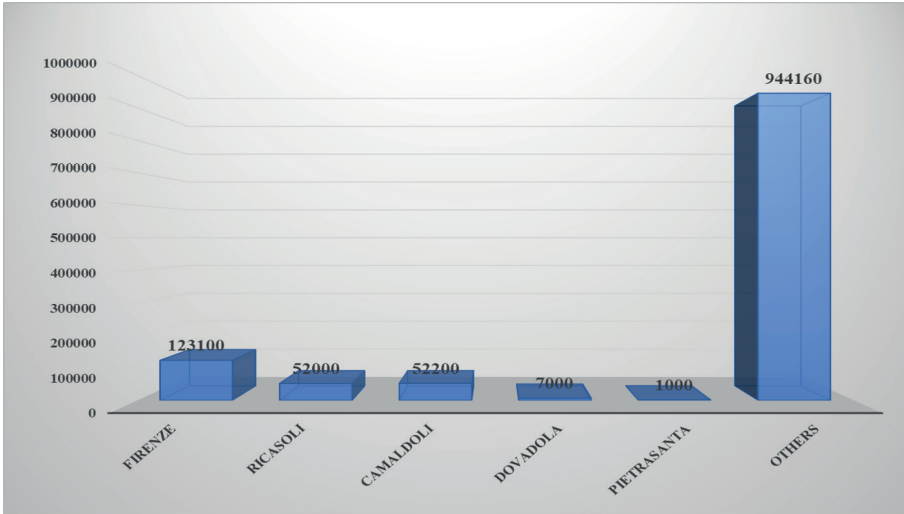


Fig. 7. Assembly of Crossbow Bolts (Place), December 1429–June 1433  
(Source: Author's own elaboration)

Logistics management concerning the movement of ammunition was a task entrusted to the *Dieci di Balìa*.<sup>32</sup> This management primarily concerned the delivery of the components of the crossbow bolts (heads and shafts) to the assemblers.<sup>33</sup> When the assemblers had fulfilled their duties, the ammunition was moved to Florence to the *Camera dell'Arme* (the Florentine Armory) located on the ground floor of *Palazzo Vecchio*. We know that the *Camera dell'Arme* was established at the beginning of the fourteenth century and continued to be operational until the end of the Medici government in Tuscany. According to the citizen statutes of the early fifteenth century, it was managed by lay and religious *camarlinghi*, a treasurer, a notary, a *massaio* (accountant), and numerous scribes.

<sup>32</sup> Any information concerning the logistic of crossbow darts sent by the *Dieci di Balìa* is contained in the following documents: ASFi, *Dieci di Balìa, Munizioni*, 1, cc. 3r–55r (12/1429–06/1430); ASFi, *Dieci di Balìa, Munizioni*, 1, cc. 226r–319v (12/1430–06/1431); ASFi, *Dieci di Balìa, Munizioni*, 2, cc. 228r–349r (06/1431–12/1431); ASFi, *Dieci di Balìa, Munizioni*, 2, cc. 376r–443r (12/1431–06/1432); ASFi, *Dieci di Balìa, Munizioni*, 4, cc. 110r–145v (06/1432–12/1432); ASFi, *Dieci di Balìa, Munizioni*, 4, cc. 145v–169v (12/1432–06/1433).

<sup>33</sup> An interesting comparison on the management of the logistics of crossbows and ammunition coeval with the period in question is possible thanks to the studies on the government of Count Guidantonio da Montefeltro: P. BISCARINI, *Balestre e verrettoni per luoghi fortificati e castelli durante il governo del Conte Guidantonio*, [in:] *Balestrando per Gubbio. Storie e documenti tra età comunale e signorile*, ed. P. BISCARINI, F. CECE, A. MENICETTI, Gubbio 2018, pp. 93–102.



The custody and maintenance of armaments stored in the *Camera* was the primary task of these state officials.<sup>34</sup>

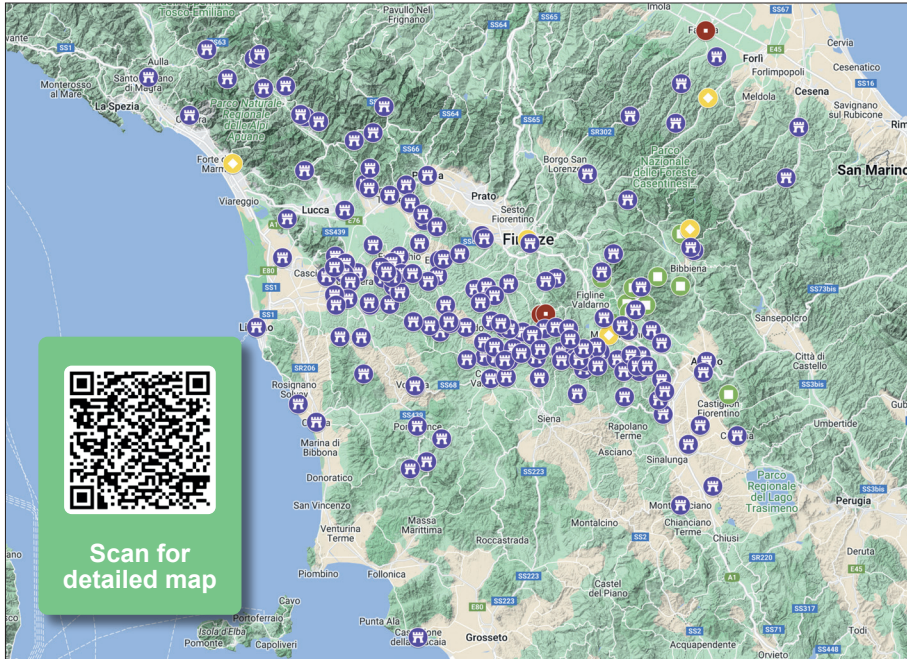


Fig. 8. Production centers of crossbow bolts and location that received ammunition, December 1429–June 1433. By scanning this QR code with a mobile device, the map created via Google-MyMaps will be displayed. The map indicates and subdivides the locations according to the place of production of crossbow bolt heads and shafts, where these ammunitions were assembled, and where they were sent (Source: Author's own elaboration)

The ammunition and various armaments were sent throughout the Florentine territory, from the various fortresses to the main cities of the domain such as Pisa, Arezzo, San Miniato, and Volterra, or to mercenary chiefs for their armies (fig. 8). The transport took place by means of *vetturali*, transporters of goods, which mainly used mules, or *carradori* (carters). All shipments were managed from Florence but the expense could be borne either by the capital or by the local communities who sent their own transporters to receive the necessary goods. The sending

<sup>34</sup> *Statuta populi et communis Florentiae publica auctoritate collecta castigata et praeposita anno salutis MCCCCXV*, ed. M. KLUCH, vol. III, Freiburg 1783, V, II, pp. 283–284; G. GUIDUBALDO, *op. cit.*, vol. 2, Firenze 1981, pp. 280–281. Further information on the previous period: L. TANZINI, *Statuti e legislazione a Firenze dal 1355 al 1415. Lo Statuto cittadino del 1409*, Firenze 2004, p. 65.



of transporters from the places that were to receive ammunition was a very widespread practice and probably favoured by the fact that in this case the Republic would not have to bear the transport costs. Unfortunately, this procedure doesn't allow us to know the actual number of mules sent to the Florentine territory, since it didn't incur an expense. During the conflict more than 1,000 mules were sent by Florence to the fortifications, cities, or mercenary camps present in the territory.

The sending of materials by the Republic was in fact managed by a single transport company, that of Checcho del Grasso, nickname of Francesco di Zanobi, enrolled in a Florentine guild as an *albergatore* (host).<sup>35</sup> Unfortunately, no trace of this important entrepreneur has yet been found. His absence from the *Catasto* of 1427 suggests that he wasn't a Florentine citizen; a single mention of him is made in the archive of the cathedral of *Santa Maria del Fiore*, as he had to be paid for a transport he had arranged.<sup>36</sup>

Transport rates varied based on the distance that mules would have to travel: among the most expensive places to reach there was Camporignano (12 L by mule), Castiglione (10.10 L by mule), Barga (10 L by mule); while the least expensive were Pisa, Librafatta, and Caprona (Vicopisano) (3 L by mule).<sup>37</sup> By calculating the average price of the journeys and the total number sent by Checcho del Grasso, his company obtained for its services during the war a remuneration exceeding 6,000 L.

## Conclusion

As we have seen, the well-organized production of crossbow bolts was fundamental for a state of the early fifteenth century. The infantry of that time was still divided equally between palvesari, lancers, and crossbowmen, and in this context crossbow bolts were undoubtedly the most important ammunition.<sup>38</sup>

<sup>35</sup> There is a second company, that of Arrigo and Angelo Castellani, but during the conflict they sent just over forty mules.

<sup>36</sup> AOSMFi, II.1.72, c. 47v.

<sup>37</sup> There is an interesting price list with many other locations within one of the ammunition registers. ASFi, *Dieci di Balìa, Munizioni*, 1, c. 36r.

<sup>38</sup> On the organisation of foot soldiers on the battlefields: A.A. SETTIA, *De re militari. Pratica e teoria nella guerra medievale*, Roma 2008, pp. 207–238. On the armies defending the Florentine fortifications: P. PIRILLO, *Castellani e guarnigioni nei castelli del contado e del distretto fiorentino (secolo XIV)*, [in:] *Connestabili. Eserciti e guerra nell'Italia del primo Trecento*, ed. P. GRILLO, Soveria Mannelli 2018, pp. 159–173. S. PICCHIANTI, *Per la difesa...*, pp. 11–12.

To fulfill this demand, Florentine artisans created specialized production centers that we can define as proto-industrial, as in the case of Montefioralle for the crossbow bolt heads and Trappola for the shafts, reaching a maximum production over 196,000 and 454,000 items respectively in six months. The specialization of work was therefore fundamental, as the case of Montefioralle clearly testifies. The total population of that town was 200 inhabitants, and all the men were probably dedicated to the manufacture of bolt heads, not only during the war of Lucca but probably throughout the entire fifteenth century.

The creation of the crossbow heads, shafts, and assembly significantly affected the expenses for ammunition.<sup>39</sup> During the war, spending on ammunition – which in addition to crossbow bolts mainly included defensive armaments, gunpowder crossbows, artillery, and spears – totaled 183,437.88 L. The expense for crossbow bolts was just over 25%, equal to 46,241.36 L. To this figure must then be added the cost of transport and that of the crates in which the crossbow bolts were shipped and then stored in the arsenals or on the battlefields.

The organisation of logistics was of equal importance. Managing the dispatch of over 1,000 mules loaded with goods every six months demonstrates how the war office was particularly capable in this task. Obviously, the creation of a monopoly on transport had an impact on facilitating this duty.

Further investigations on the production of arms and armour in the medieval period, and more generally on war spending, will certainly increase our knowledge in this field of study and also on the economic history and on the organisation and specialisation of work in that period.

## BIBLIOGRAFIA • BIBLIOGRAPHY • БИБЛИОГРАФИЯ

### Źródła archiwalne • Archival sources • Архивные источники

Archivio dell'Opera di Santa Maria del Fiore

AOSMFi, II.1.72

---

<sup>39</sup> The prices refer to 500 complete and assembled crossbow bolts: *Gamba* 14,75 L; *Cianfogna* 22,50 L; *Passatoi* 80,17 L; *Quadrelli* 78,53 L; *Cianfognoni* for galley 36,01 L.

**Archivio di Stato di Firenze**

- ASFi, *Arte dei Legnaiuoli*, 4  
 ASFi, *Arte dei Fabbri*, 5  
 ASFi, *Camera del Comune, Specchi di Entrata e di Uscita*, 42  
 ASFi, *Dieci di Balìa, Munizioni*, 1, 2, 4  
 ASFi, *Camera del Comune, Scrivano di Camera, Uscita, Duplicato*, 218

**Źródła drukowane • Printed sources • Печатные источники**

- BONINSEGGNI D., *Storie della città di Firenze. Dall'Anno 1410 al 1460*, ed. T. GUADAGNI, Firenze 1637.  
*Statuta populi et communis Florentiae publica auctoritate collecta castigata et praeposita anno salutis MCCCCXV*, ed. M. KLUCH, vol. III, Freiburg 1783, V, II.  
*Statuti delle Arti dei Corazzai, dei Chiavaiooli, Ferraioli e Calderai e dei Fabbri di Firenze (1321–1344)*, ed. G. CAMERANI MARRI, Florence 1957.

**Opracowania • Secondary sources • Литература**

- BECKER M.B., *Florence in Transition*, vol. 1–2, *Studies in the Rise of the Territorial State*, Baltimore 1968.  
 BISCARINI P., *Balestre e verrettoni per luoghi fortificati e castelli durante il governo del Conte Guidantonio*, [in:] *Balestrando per Gubbio. Storie e documenti tra età comunale e signorile*, ed. P. BISCARINI, F. CECE, A. MENICETTI, Gubbio 2018, pp. 93–102.  
 BRUCKER G.A., *The Civic World of Early Renaissance Florence*, Princeton 1977.  
 COHN JR. S.K., *Creating the Florentine State, Peasants and Rebellion, 1348–1434*, Cambridge 1999.  
 CONTI E., *La formazione della struttura agraria moderna nel contado fiorentino*, 2<sup>nd</sup> part, Rome 1965.  
 DE LUCA D., FARINELLI R., *Archi e balestre. Un approccio storico-archeologico alle armi da tiro nella Toscana meridionale (secc. XIII–XIV)*, „Archeologia Medievale” 2002, vol. 29, pp. 455–487.  
 GHITTOLINI G., *La formazione dello Stato regionale e le istituzioni del contado. Secoli XIV e XV*, Torino 2021.  
 GUARINI E.F., *Potere e società negli stati regionali italiani del '500 e '600*, Bologna 1978.  
 GUIDUBALDO G., *Il governo della città-repubblica di Firenze nel primo Quattrocento. Gli istituti «di dentro» che componevano il governo di Firenze nel 1415*, vol. 2, Firenze 1981.

- LOADS M., *The Crossbow*, Oxford 2018.
- MALLET M., *The Florentine Galleys in the Fifteenth century with Diary of Luca di Maso degli Albizzi Captain of the Galleys 1429–1430*, Oxford 1967.
- PAMPALONI G., *Gli organi della Repubblica fiorentina per le relazioni con l'estero*, „Studi politici internazionali” 1953, vol. 20, pp. 261–296.
- PELLEGRINI A., *Tre anni di Guerre tra le Repubbliche di Firenze e di Lucca. 1430–1433* [in:] *Studi e Documenti di Storia e Diritto*, Roma 1898, pp. 171–189.
- PICCHIANTI S., *L'Arte dei Fabbri a Firenze e nel suo contado attraverso gli statuti e le matricole (1344–1481)*, „Ricerche Storiche” 2018, pp. 123–146.
- PICCHIANTI S., *Per la difesa dei confini della Repubblica di Firenze Le fortificazioni e la loro gestione secondo gli Statuti del 1415*, [in:] *Confini e sconfinamenti*, ed I. CANDELIERI, C. DAFFONCHIO, Trieste 2022, pp. 3–21.
- PIRILLO P., *Castellani e guarnigioni nei castelli del contado e del distretto fiorentino (secolo XIV)*, [in:] *Connestabili. Eserciti e guerra nell'Italia del primo Trecento*, ed. P. GRILLO, Soveria Mannelli 2018.
- PIRILLO P., *Fines, termini et limites. I confini nella formazione dello Stato fiorentino*, „Reti Medievali Rivista” 2006, vol. 7, no. 1, pp. 1–12.
- PIRILLO P., «*Incerti fines*». *Il confine medievale tra norme e pratiche sociali*, [in:] *Terre di confine tra Toscana, Romagna e Umbria. Dinamiche politiche, assetti amministrativi, società locali (secoli XII–XVI)*, Conference proceedings, Florence 17 May 2019, Perugia 8–9 November 2019, ed. P. PIRILLO, L. TANZINI, Florence 2020, pp. 3–12.
- DEL PUNTA I., *La signoria di Paolo Guinigi a Lucca (1400–1430): un modello paternalistico?*, [in:] *Le signorie cittadine in Toscana. Esperienze di potere e forme di governo personale (secoli XIII–XV)*, ed. A. ZORZI, Roma 2013, pp. 301–321.
- RAU C., *European Arrowheads and Crossbow Bolts. From the Bronze Age to the Late Middle Ages*, Berlin 2018.
- SETTIA A.A., *De re militari. Pratica e teoria nella guerra medievale*, Roma 2008.
- Storia di Milano. Il ducato visconteo e la Repubblica Ambrosiana (1392–1450)*, vol. 6, ed. F. COGNASSO, Milano 1955.
- Storia di Venezia. Dalle origini alla caduta della Serenissima. Il Rinascimento, politica e cultura*, vol. 4, eds. A. TENETI, U. TUCCI, Roma 1996.
- TANZINI L., *Statuti e legislazione a Firenze dal 1355 al 1415. Lo Statuto cittadino del 1409*, Firenze 2004.
- ZORZI A., *The material constitution of the Florentine dominion*, [in:] *Florentine Tuscany, Structures and Practices of Power*, eds. W.J. CONNELL, A. ZORZI, Cambridge 2000, pp. 6–31.

Simone Picchianti

## **PRODUKCJA I LOGISTYKA DOSTAW BEŁTÓW DO KUSZ WE WCZESNYM RENESANSIE. FLORENCJA I WOJNA Z LUKKĄ (1429-1433)**

**Streszczenie.** Jesienią 1429 r. Florencja wypowiedziała wojnę Lukce, pragnąc zakończyć walkę o swoją dominację nad północną Toskanią. Oblężenie rozpoczęło się w grudniu i trwało do momentu pokonania florenckiej armii pod murami Lukki przez dowódcę oddziałów najemnych Niccolò Piccinino – choć sama wojna trwała jeszcze do maja 1433 r.

W tym okresie, mimo że broń palna już istniała, nadal bardzo ważne było wykorzystanie kusz. Aby zaspokoić potrzeby Florencji, mieszkańcy Montefioralle, małego miasteczka w regionie Chianti, wyspecjalizowali się w produkcji bełtów. W tej liczącej około dwustu mieszkańców miejscowości każdy mężczyzna był kowalem i wszyscy przez sześć miesięcy łącznie produkowali średnio 100 000 metalowych elementów kusz. Trzony bełtów były z kolei wytwarzane przez innych wyspecjalizowanych rzemieślników zamieszkujących góry Casentino oraz montowane w innych miejscach. Florenckie biuro do spraw wojny, *Dieci di Balìa*, zajmowało się logistyką zaopatrzenia koordynując i łącząc pracę różnych rzemieślników oraz wysyłając amunicję na pola bitew i do fortec.

Dzięki dokumentom przechowywanym w Archiwum Państwowym we Florencji udało się zrekonstruować całą sieć rzemieślników, system zarządzania dostawami oraz ustalić ilość i koszty produkowanej amunicji.

**Słowa kluczowe:** renesansowa Florencja, florenckie gildie, renesansowe działania wojenne, broń i uzbrojenie, produkcja wojenna