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**THE MUNITIONS OF THE REPUBLIC.
PRODUCTION, COMMERCE,
AND MANAGEMENT OF MATERIEL
IN RENAISSANCE FLORENCE**

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*to the farewell of a Roman dawn,
to the kiss of a Paduan night*

*They will never die on that battlefield
nor the shade of wolves recruit their hoard like brides of
wheat on all horizons waiting there to consume battle's end
There will be no dead to tighten their loose bellies
no heap of starched horses to redsmash their bright eyes
or advance their eat of dead
They would rather hungersulk with mad tongues
than believe that on that field no man dies
They will never die who fight so embraced
breath to breath eye knowing eye impossible to die
or move no light seeping through no maced arm
nothing but horse outpanting horse shield brilliant upon
shield all made starry by the dot ray of a helmeted eye
ah how difficult to fall between those knitted lances
And those banners! Angry as to flush insignia across its
erasure of sky
You'd think he'd paint his armies by the coldest rivers
have rows of iron skulls flashing in the dark
You'd think it impossible for any man to die
each combatant's mouth is a castle of song
each iron fist a dreamy gong flail resounding flail
like cries of gold
How I dream to join such battle!
A silver man on a black horse with red standard and striped
lance never to die but to be endless
a golden prince of pictorial war*

(G. Corso, Paolo Uccello, 1958)

ABSTRACT

This doctoral dissertation presents a collection of eight articles, published on different scientific journals, and focused on the theme of the production of weapons in Renaissance Florence.

Developing from the problematic military issues of the Florentine Republic, the essays will try to outline the structures of the offices charged with the organization of the army, analyzing their expenses in particular.

The interest of the Dieci di Balìa and the Otto di Pratica in the manufacture of munitions will reveal the existence of a lively market in arms, characterized by the involvement of numerous craftsmen and important firms, the polycentrism of factories and arsenals, and the innovations in several goods, such as artillery.

From the first experimentations on bronze bombards to the adoption of the French style ordnance, in fact, firearms and gunmakers will be at the core of the whole research. Comparative papers will examine developments in practices and technological transfers, as well as their repercussions on actual warfare.

The case study of the conflict between Florence and Pisa, one of the most important campaign of the late fifteenth century, will lastly underline aspects and concerns of the procurement of arms, a “revolutionary challenge” in terms of administration, production, and credit.

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NOTICE TO READERS
AN ARTICLE THESIS

This Ph.D. thesis is intended to be a compilation of eight separate articles, connected by the theme of the production of weapons in Renaissance Florence. All of the essays have been published on, or have been accepted by, various scientific journals.

Each paper has been written following the guidelines of its periodical, and is now presented with the very same format. Thus, every chapter differs from the others in bibliography and footnotes.



INTRODUCTION
**BEHIND MACHIAVELLI, BEYOND THE MAGNIFICENT.
FOR AN HISTORY OF WARFARE IN RENAISSANCE FLORENCE**

The purpose of this thesis is dual. The first aspect concerns the reconstruction of the whole production process of weapons in the Republic of Florence during the Renaissance, from the trade of raw material to the equipment of the army. A particular attention will be directed at craftsmen, at their workshops, and at their contribution towards the diffusion of artifacts and techniques. The second strand deals with a reevaluation of the military organization of the “fifth power of Italy,” an administration so far considered as backward and ineffective. This analysis will focus on the awareness of technological developments in armaments developed by statesmen, their incentive to enhance the industry, and their improvement in the management of arsenals.

A similar scrutiny was never endeavored for this geographical area and for this period of time. Besides, this essay is intended to look at the military topics from a different, original perspective, combining the issues of manufacture with the political concerns about warfare, the actual usage of materiel during campaigns and the necessity of arming soldiers, the availability of skilled manpower and the control over the commerce of arms, the polycentrism of factories and the construction of centralized magazines. In the following pages, the role of the public demand in innovating weaponry and in circulating ideas will be assessed, as well as the experimentations and the adaptation of artisans to new forms and modern shapes.

The chronology of the dissertation will be defined by two unsuccessful sieges, two critical moments of the Florentine history. One of these is the failed conquest of Lucca, in 1430, a climax of the long conflict against Filippo Maria Visconti, which accentuated the disagreements between the rival city factions, leaded by Rinaldo degli Albizzi and Cosimo de’ Medici. The other defeat dates 1499, when the retreat from Pisa deteriorated the critical political situation of the Republic, strengthening the popular opposition to the government. In these seven decades, the Republic would have been involved in other, numerous military campaigns, from the battle of Anghiari to the defense of Piombino, from the reconquest of Vada to the sack of Volterra, from the Pazzi’s War to the conquest of Sarzana, spending about forty years in winning or losing against the armies of the whole Peninsula. In this time of near permanent war, moreover, several changes would have occurred in the “art of war,” with the

creation of permanent military offices and the enlistment of standing armies, with the early spread of firearms and the late appearance of the innovative French ordnance.

An accurate research into primary sources has underlain this work from its very outset. Data have been collected from the Florentine State Archive, from the Biblioteca Nazionale Centrale of Florence, and from the historical fonds of the Istituto degli Innocenti. The study has been based, above all, on the documentation written by the appointees of the two military institutions of the Commune, the Dieci di Balìa and the Otto di Pratica. Their registers of ammunitions have been useful in finding out the orders placed by the councils, the output of workshops, and the various specializations of practitioners. The variations in the expenses on salaries, ammunitions, and fortifications have been measured through the accountancy of treasurers. The resolutions of the officials and the correspondence of their commissioners have disclosed strategies and tactics, needs and impositions, commitments and achievements. Moreover, the tax statements, the books, and the notes of several artisans, as Maso di Bartolomeo and Bonaccorso Ghiberti, have revealed the formation of their knowledge, the destinations of their frequent travels, the links of their networks, and the characteristics of their goods. A significant examination has been conducted also on numerous diaries of contemporary Tuscan authors, such as the *storie* of Piero Parenti, Luca Landucci, Piero Vaglianti, Biagio Buonaccorsi, and Giovanni Portovenieri, which reported information on the political upheavals, on the progresses of campaigns, and on the reactions of Florentines to taxation. Lastly, the comparison with other Italian state commenced with the reading of local chronicles and published records of the Milanese, Roman, Neapolitan, and Venetian chanceries, like inventories, letters, and bookkeeping.

Historiographical approaches

Further readings in literature have modeled a “very elastic method of cross-examination, so that it may change its direction or improvise freely for any contingency”.¹ If the original project was centered around the economic themes of production, the very last observations were addressing the artistic status of gunmakers as one of the principal reasons behind their freedom of movement.

¹ Marc Bloch, *Apologia della storia, o mestiere di storico*, trans. from the 1993 French edition by Giuseppe Gouthier (Turin: Einaudi, 2007), 52.

Interesting suggestions have been given by numerous publications relative to the patterns and the developments of Renaissance technology. Scholars have affirmed, above all, the crucial role of the context in the assimilation of new products, emphasizing its social, political, and material roots. John Staudenmaier, for example, insisted on the inherent contingency of progress, on its dependency upon a large number of heterogeneous factors.² Analyzing the gradualism of technological evolution, Pamela Long has recognized the persistence of traditions as a background to innovations.³ Nathan Rosenberg has reflected, instead, upon the user redefinition of techniques, the communications, and the confrontations between communities and producers.⁴ The supportive services for maintaining fully operational technologies has been analyzed by David Edgerton.⁵ Luca Molà and Carlo Belfanti have discussed the policies of technological transfer and industrial growth, often realized through the migration of practitioners and the imitation of goods.⁶ Liliane Hilaire-Perez and Catherine Verna have recently published a general survey of these contributions, recapitulating the diversity of development paths, the necessity of primary sets of material and immaterial resources, and the outcomes of the multiple mediations in the various interests involved in the transmission of knowledge.⁷ Lastly, Bert Hall has invited to open the “black box” of technology through the analysis of wares, makers, and purchasers.⁸

² John Staudenmaier, “Rationality, agency, contingency. Recent trends in the history of technology,” *Reviews in American History* 30, no. 1 (2002), 168-181.

³ Pamela Long, “The craft of premodern European history of technology. Past and future practices,” *Technology and Culture* 52, no. 3 (2010), 698-714.

⁴ Nathan Rosenberg, “Economic development and the transfer of technology. Some historical perspectives,” in ID., *Perspectives on technology* (Cambridge: Cambridge University Press, 1976), 151-172; ID., *Exploring the black box. Technology, economics, and history* (Cambridge: Cambridge University Press, 1994).

⁵ David Edgerton, “Innovation, technology, or history. What is the historiography of technology about?,” *Technology and Culture* 51, no. 3 (2010), 680-697.

⁶ Luca Molà, “States and crafts. Relocating technical skills in Renaissance Italy,” in *The material Renaissance*, ed. Michelle O’Malley and Evelyn Welch (Manchester and New York: Manchester University Press, 2007), 133-153; Carlo Belfanti, “Guilds, patents, and the circulation of technical knowledge. Northern Italy during the early modern age,” *Technology and Culture* 45, no. 3 (2004), 569-589.

⁷ Liliane Hilaire-Perez and Catherine Verna, “Dissemination of technical knowledge in the Middle Ages and the early modern era. New approaches and methodological issues,” *Technology and Culture* 47, no. 3 (2006), 536-565.

⁸ Bert Hall, *Weapons and warfare in Renaissance Europe* (Baltimore and London: The Johns Hopkins University Press, 1997), 2.

These contextual theories seem to have influenced also the study of a “socially shaped” military technology,⁹ after years of heated debate about the “military revolution” in tactics, in strategies, and in state administration.¹⁰ In fact, the engaging and controversial thesis of Michael Roberts and Geoffrey Parker has been discussed and criticized multiple times. In general, historians questioned the accuracy of the technological determinism inferred in the transformation caused by gunpowder weapons and modern fortifications, both in terms of “technical change causing social change” and “technology shaping society.”¹¹ So, according to a paradigm of “punctuated equilibrium,” Clifford Rogers has proposed a centuries-long series of “incremental and revolutionary changes” which would have altered wars and societies. Jeremy Black and John Lynn have attributed the “revolution” to the political and economic development of a modern, absolutist state, more than the innovations in heavy artillery and portable guns. John Hale and Kelly DeVries refused to associate the political control of gunpowder weaponry with the rise of the modern state. David Parrott rather affirmed the “complete failure to meet the challenges posed by the administration and the deployment of contemporary armies,” and “to come to terms with the real determinants of warfare.”¹²

The multiple ties of military technology with war production, however, have been effectively demonstrated by other authors, including Kelly DeVries and Robert Douglas Smith. The two have analyzed the various typologies and utilizations of armaments, underlining the experimental development of new military machines, the formalization of technical treatises,

⁹ John Stone, “Technology, society, and the infantry revolution of the fourteenth century,” *The Journal of Military History* 68, no. 2 (2004), 361-380.

¹⁰ Michael Roberts, “The military revolution, 1560-1660,” in ID., *Essays in Swedish History* (London: Widenfeld & Nicolson, 1967), 195-225; Geoffrey Parker, *La rivoluzione militare. Le innovazioni militari e il sorgere dell'Occidente*, trans. from the 1988 English edition by Gianfranco Ceccarelli and Natalia Seri (Bologna: il Mulino, 2005).

¹¹ Edgerton, “Innovation, technology, or history,” 689; Kelly DeVries, “Catapults are not atomic bombs. Towards a redefinition of ‘effectiveness’ in premodern military technology,” *War in History* 4, no. 4 (1997), 454-470.

¹² Clifford J. Rogers, “The military revolutions of the Hundred Years’ War,” *The Journal of Military History* 57, no. 2 (1993), 241-278; Jeremy Black, *A military revolution? Military change and European society, 1550-1800* (London: Macmillan Education, 1991); John Lynn, “The *trace italienne* and the growth of armies. The French case,” *Journal of Military History* 55, no. 3 (1991), 297-330; David Parrott, “Strategy and tactics in the Thirty Years’ War. The military revolution,” *Militargeschichtliche Mitteilungen* 38 (1985), 7-25; Kelly DeVries, “Gunpowder weaponry and the rise of the early modern state,” *War in History* 5, no. 2 (1998), 127-145. For the scholarly discussion about the military revolution, see also: *The military revolution debate. Readings on the military transformation of Early Modern Europe*, ed. Clifford Rogers (Boulder: Westview Press, 1995).

and the promotion of practitioners.¹³ The complexity of the long-term “gunpowder revolution” has been examined by Bert Hall, along with the evolving tradition of fabrication of propellant, and the interdependence upon changes in gunnery.¹⁴ The study of behavior, development, and manufacture of propellant has been also developed in two collections of essays, both edited by Brenda Buchanan, which have dealt with “history of technology, of science, of economics and trade, and of politics.”¹⁵ Bertrand Gille and Pamela Long have described the careers, the cultures, and the meetings of engineers and practitioners, which contributed to the “rise of new sciences.”¹⁶ Carlo Maria Cipolla and John Guilmartin have reflected on the dynamics of cannon founding and the changes in battles, concentrating also upon social and financial questions.¹⁷ Other researches have been dedicated to the management of artillery in several European states. Philippe Contamine, Simon Pepper, and Emmanuel de Crouy-Chanel have evaluated the ordinary administration and extraordinary appointees of the French artillery at the eve of the Italian Wars, its presumed success during the campaign of Charles VIII, and its impact on royal finances.¹⁸ DeVries and Smith collaborated also for the examination of the guns of the dukes of Burgundy.¹⁹ Maria Dolores Herrero Fernandez-Quesada investigated the

¹³ Kelly DeVries and Robert Douglas Smith, *Medieval military technology* (Peterborough: Broadview Press, 1992); Kelly DeVries, “Sites of military science and technology,” in *The Cambridge History of Science*, III. *Early Modern Science*, ed. Katharine Park and Lorraine Daston (Cambridge: Cambridge University Press, 2008), 306-307.

¹⁴ Hall, *Weapons and warfare*, 67-200.

¹⁵ *Gunpowder. The history of an international technology*, ed. Brenda Buchanan (Bath: Bath University Press, 1996); *Gunpowder, explosives, and the state. A technological history*, ed. Brenda Buchanan (Burlington: Ashgate, 2006).

¹⁶ Bertrand Gille, *Leonardo e gli ingegneri del Rinascimento*, trans. from the 1964 French edition by Adriano Carugo (Milan: Feltrinelli, 1972); Pamela Long, *Artisans, practitioners and the rise of the new sciences* (Corvallis: Oregon State University Press, 2011).

¹⁷ John Guilmartin, *Gunpowder and galleys. Changing technology and Mediterranean warfare at sea in the sixteenth century* (London: Conway Maritime Press, 2003); Carlo Cipolla, *Vele e cannoni* (Bologna: Il Mulino, 2003).

¹⁸ Philippe Contamine, “L’artillerie royale française à la veille des guerres d’Italie,” *Annales de Bretagne* 71, no. 2 (1964); ID., “Les industries de guerre dans la France de la Renaissance. L’exemple de l’artillerie,” *Revue Historique* 550 (1984), 249-280; Simon Pepper, “Castles and cannon in the Naples campaign of 1494–95,” in *The French descent into Renaissance Italy, 1494-1495. Antecedents and effects*, ed. David Abulafia (Aldershot: Ashgate, 1995); Emmanuel de Crouy-Chanel, “Charroi de l’artillerie et construction de l’état moderne en France dans le dernier quart du quinzième siècle,” in *Contre-champs. Études offertes à Jean-Philippe Genet*, ed. Aude Mairey, Solal Abeles, and Fanny Madeline (Paris: Classiques Garnier, 2016), 159-176. See also David Potter, *Renaissance France at war. Armies, culture and society* (Woodbridge: Boydell and Brewer, 2008), 152-157.

¹⁹ Kelly DeVries and Robert Douglas Smith, *The artillery of the dukes of Burgundy* (Woodbridge: The Boydell Press, 2005).

ordnance of the Catholic Monarchs in the fifteenth century Spain.²⁰ Dan Spencer has recently studied the arsenals and the facilities of London under the Lancaster, York, and Tudor sovereigns.²¹

Unfortunately, the Italian literature has not achieved comparable advances in this field. On the contrary, Manlio Calegari has denounced a surprising disinterest in technological themes.²² The military expenditures were scarcely considered, too. In spite of its premises, even the recent article of Elisabetta Scarton on the “costs of wars” has turned into an analysis of diplomatic correspondence, more than of the real prices of equipment, supplies, and wages.²³ Therefore, it is not surprising that Richard Goldthwaite, William Caferro, and Enrico Stumpo have claimed the necessity of examining the impact of Renaissance conflicts on productive activities.²⁴

Compared to contemporary engineers and renowned architects, however, smiths, founders, and gunpowder makers continued to be ignored by economic and military historians. Only the renowned Milanese armorers seem to have attracted the attention of artistic scholarship, with their precious, luxurious cuirasses, acquired exclusively by noble customers.²⁵ As regards the mass market of weapons, Silvio Leydi has analyzed the supply and

²⁰ Maria Dolores Herrero Fernandez-Quesada, “Los Reyes Catolicos y la artilleria,” in *Isabel la Catolica. Homenaje en el quinto centenario de su muerte*, ed. Juan Carlos Dominguez Nafria and Carlos Perez Fernandez-Turegano (Madrid: Editorial Dykinson, 2005), 65-80; ID., “La artilleria de los Reyes Catolicos. Procedencia y sembianza,” in *Artilleria y fortificaciones en la Corona de Castilla durante el reinado de Isabel la Catolica*, ed. Aurelio Valdés Sanchez (Madrid: Secretaria General Tecnica del Ministerio de Defensa, 2004), 156-179.

²¹ Dan Spencer, “The provision of artillery for the 1428 expedition to France,” *Journal of Medieval Military History* 13 (2015); ID., “The tower of London and firearms in the reign of Edward IV,” *Arms and Armour* 13, no. 2 (2016), 98-110; ID., “The Lancastrian armament programme of the 1450s and the development of field guns,” *The Ricardian* 25 (2015), 61-70. For the preceding period, see David Bachrach, “The military administration of England. The royal artillery,” *The Journal of Military History* 68, no. 4 (2004), 1083-1104.

²² Manlio Calegari, “Nel mondo dei ‘pratici.’ Molte domande e qualche risposta,” in *Saper fare. Studi di storia delle tecniche in area mediterranea*, ed. Manlio Calegari (Pisa: ETS, 2004).

²³ Elisabetta Scarton, “Costi della guerra e forze in campo nel secolo XV, tra verità storiografiche e manipolazione dell’informazione,” *Revista Universitaria de Historia Militar* 6, no. 11 (2017), 23-42.

²⁴ William Caferro, “Warfare and economy in Renaissance Italy,” *The Journal of Interdisciplinary History* 39, no. 2 (2008); Richard Goldthwaite, *The economy of Renaissance Florence* (Baltimore: The Johns Hopkins University Press, 2009), 400-401; Enrico Stumpo, “La finanza di guerra negli antichi stati italiani,” in *Storia economica della guerra*, ed. Catia Eliana Gentilucci (Rome: Società Italiana di Storia Militare, 2008), 196.

²⁵ Stuart Pyhrr, José Godoy, and Silvio Leydi, *Heroic armor of the Italian Renaissance. Filippo Negroli and his contemporaries* (New York: The Metropolitan Museum of Art, 1998).

the demand of Lombard equipment during the early Spanish dominion, while Emilio Motta, Francesco Malaguzzi Valeri, and Luciana Frangioni have briefly examined the production of the late fifteenth century.²⁶ Contributions to the study of other Italian industries are rare. Mario Scalini and Silvia Bianchessi have respectively investigated the proper styles of Florentine armor and the arrival of foreign *corazzai* at the Neapolitan court.²⁷

Similarly, academics have neglected the technical advancements of artillery, the processes of its fabrication, the patterns of its diffusion, and its achievement in battlefields. The pioneering works of Angelo Angelucci, Cesare Quarenghi, and Carlo Montù on the history of the Italian ordnance were not deepened for decades.²⁸ Only at the beginning of the twenty-first century Walter Panciera has made interesting suggestions about the Venetian “government” of production of both cannons and powder, their use, and their storage.²⁹ In the following decades, several other works appeared. An excellent archival studies on the Siense documentation has led Giampaolo Ermini to delineate the career and the products of two founders, Agostino de’ Rossi from Piacenza and Giovanni from Zagreb.³⁰ Andrea Bernardoni focused exclusively on the theories of Leonardo da Vinci, Francesco di Giorgio Martini, and Niccolò Tartaglia, avoiding the actual practices and products of contemporary gunmakers.³¹

²⁶ Silvio Leydi, “Le armi,” in *Il rinascimento italiano e l’Europa*, IV. *Commercio e cultura mercantile*, ed. Franco Franceschi, Richard Goldthwaite, and Reinhold Mueller (Treviso: Angelo Colla Editore, 2007); Emilio Motta, “Armaioli milanesi nel periodo visconteo-sforzesco,” *Archivio Storico Lombardo* 41, no. 1 (1914), 187-232; Francesco Malaguzzi Valeri, *La corte di Ludovico il Moro*. IV. *Le arti industriali, la letteratura, la musica* (Milan: Hoepli, 1923), 29-41; Luciana Frangioni, “Aspetti della produzione delle armi milanesi nel XV secolo,” in *Milano nell’età di Ludovico il Moro* (Milan: Il comune, 1983).

²⁷ Mario Scalini, “L’armatura fiorentina del Quattrocento e la produzione d’armi in Toscana,” in *Guerra e guerrieri nella Toscana del Rinascimento*, ed. Franco Cardini and Marco Tangheroni (Florence: EDIFIR, 1990); Silvia Bianchessi, “Cavalli, armi e salnitro fra Milano e Napoli nel secondo Quattrocento,” *Nuova Rivista Storica* 52, n. 3 (1998).

²⁸ Angelo Angelucci, *Documenti inediti per la storia delle armi da fuoco italiane* (Turin: Tipografia Cassone, 1869); Cesare Quarenghi, “Tecno-cronografia delle armi da fuoco italiane,” in *Atti del regio istituto d’incoraggiamento alle scienze naturali, economiche e tecnologiche di Napoli* 17 (1880), 53-307; Carlo Montù, *Storia dell’artiglieria italiana* (Rome: Rivista d’Artiglieria e Genio, 1934).

²⁹ Walter Panciera, *Il governo delle artiglierie. Tecnologia bellica e istituzioni veneziane nel secondo Cinquecento* (Milan: Franco Angeli, 2005); ID., “La polvere da sparo,” in *Il rinascimento italiano e l’Europa*, III. *Produzione e tecniche*, ed. Philippe Braunstein and Luca Molà (Treviso: Angelo Colla Editore, 2007).

³⁰ Giampaolo Ermini, “Campane e cannoni. Agostino da Piacenza e Giovanni da Zagabria: un fonditore padano e uno schiavone nella Siena del Quattrocento,” in *L’industria artistica del bronzo del Rinascimento a Venezia e nell’Italia settentrionale*, ed. Matteo Ceriana and Victoria Avery (Verona: Scripta, 2008), 387-425.

³¹ Andrea Bernardoni, “La fusione delle artiglierie tra Medioevo e Rinascimento. ‘Cronaca’ di un rinnovamento tecnologico attraverso i manoscritti di Leonardo,” *Cromohs* 19 (2014), 106-116.

Renato Ridella dedicated many of his contributions to several dynasties of founders, like the Gioardis, the Merellos, and the Sommarivas from Genova.³² Moreover, the former serviceman has often teamed up with archaeologists for the analysis of shipwrecked guns.³³ A survey of all of these works has been lastly made by Jean-François Belhoste in his essay on late medieval European ordnance.³⁴

Raw metals, in general, received more attention. Marco Merlo and Mario Borracelli have written about the Sienese iron works, while Gabriella Piccinni reported the investment of the local entrepreneurs in the reopening of several mines.³⁵ The management of a Tuscan copper *cava* has been examined by Guido Pampaloni in his essay on the enterprise of the Marinai family.³⁶ Enzo Baraldi and Manlio Calegari, instead, documented the establishment of a new *ferriera* in the Apuan Alps, and the projects of his proprietor, the duke of Ferrara, as well as the circulation of metallurgic practices and the recruitment of skilled miners.³⁷ Baraldi has studied also the technical innovations in Alpine ironworking, such as new types of furnaces and more

³² Renato Ridella, "Fonditori italiani di artiglierie in trasferta nell'Europa del XVI secolo," In *Storie di armi*, ed. Nicola Labanca and Pier Paolo Poggio (Milan: Unicopli, 2009); ID., "Produzione di artiglierie nel sedicesimo secolo. I fonditori genovesi Battista Merello e Dorino II Gioardi," in *Pratiche e linguaggi. Contributi a una storia della cultura tecnica e scientifica* (Pisa: ETS, 2005).

³³ *Ships and guns. The sea ordnance in Venice and Europe between the 15th and 17th century*, ed. Carlo Beltrame and Renato Ridella (Oxford and Oakville: Oxbow Books, 2011); Renato Ridella and Francesco Laratta, "Un cannone veneziano fuso nel 1518 per gli Ospedalieri di San Giovanni di Rodi, dal mare della Calabria," *Archeologia postmedievale* 18 (2014), 63-81. See also *I cannoni di Venezia. Artiglierie della Serenissima da fortezze e relitti*, ed. Carlo Beltrame and Marco Morin (Florence: All'Insegna del Giglio, 2013).

³⁴ Jean-François Belhoste, "Nascita e sviluppo dell'artiglieria in Europa," in *Il rinascimento italiano e l'Europa*, III. *Produzione e tecniche*.

³⁵ Marco Merlo, "Armamenti e gestione dell'esercito a Siena nell'età dei Petrucci. Le armi," *Rivista di Studi Militari* 5 (2016); Mario Borracelli, "Siderurgia e imprenditori senesi nel Quattrocento fino all'epoca di Lorenzo il Magnifico," in *La Toscana al tempo di Lorenzo il Magnifico. Politica, economia, cultura, arte* (Pisa: Pacini, 1996); Gabriella Piccinni, "Le miniere del senese. Contributo alla messa a punto della cronologia dell'abbandono e della ripresa delle attività estrattive," in *La Toscane et les Toscans, autour de la Renaissance. Cadres de vie, société, croyances* (Aix-en-Provence: Université de Provence, 1999), 239-254. See also Aurora Meniconi, "Studi antichi e recenti sulle miniere medievali in Toscana. Alcune considerazioni," *Ricerche Storiche* 14, no. 1 (1984), 203-226, and Maria Elena Cortese, Riccardo Francovich, "La lavorazione del ferro in Toscana nel Medioevo," *Ricerche Storiche* 25, no. 2 (1995), 435-457.

³⁶ Guido Pampaloni, "La miniera del rame di Montecatini Val di Cecina. La legislazione mineraria di Firenze e i Marinai di Prato," *Archivio storico pratese* 51, no. 2 (1975).

³⁷ Enzo Baraldi and Manlio Calegari, "Pratica e diffusione della siderurgia 'indiretta' in area italiana," in *La siderurgia alpina en Italie*, ed. Philippe Braunstein (Rome: Ecole Française de Rome, 2001); Manlio Calegari, "La mano sul cannone," in *Pratiche e linguaggi. Contributi a una storia della cultura tecnica e scientifica*, ed. Luciana Gatti (Pisa: ETS, 2005).

effective bellows.³⁸ Philippe Braunstein has conducted several studies on the commerce of iron in Venice.³⁹

The military reforms of fifteenth-century Italy

This scarcity of literature could be explained by a certain fragmentation of the documentation. The Milanese fonds, for example, were dismembered and dispersed in the late eighteenth century by Austro-Hungarian archivists. The books of the Aragonese chancery were destroyed during the Second World War, a terrible loss for the studies in the history of the Neapolitan Kingdom. The fire did not spare also part of the registers written by the Venetian officers responsible for the management of ordnance, the *provveditori alle artiglierie*.

Indeed, this lack of primary sources for three of the most important states of Renaissance Italy has undoubtedly prevented scholars from undertaking further research into military topics.⁴⁰ Only in the last two decades scholars have dealt with the issues of the contemporary historiography on warfare, integrating them into more general researches on institutions, culture, and society. Different approaches have resulted in a better comprehension of the reciprocal influence between military reforms, civic transformations, financial innovations, and state consolidation.⁴¹ Military institutions have been seen as the expression of more complex political projects.⁴² The formation of standing armies was

³⁸ Enzo Baraldi, "La siderurgia In Italia dal XII al XVII secolo," in *La civiltà del ferro. Dalla preistoria al terzo millennio*, ed. Walter Nicodemi (Milan: Olivares, 2004); ID., "Una nuova età del ferro. Macchine e processi della siderurgia," in *Il rinascimento italiano e l'Europa*. III. *Produzioni e tecniche*, 199-216.

³⁹ Philippe Braunstein, "Le commerce du fer a Venise au quinzième siescle," *Studi Veneziani* 8 (1966), 267-302.

⁴⁰ Luciano Pezzolo, "La 'rivoluzione militare.' Una prospettiva italiana," in *Militari in Età Moderna. La centralità di un tema di confine*, ed. Alessandra Dattero and Stefano Levati (Milan: Cesalpino, 2006) 32-59.

⁴¹ Claudio Donati, "Strutture militari degli stati italiani nella prima età moderna: una rassegna degli studi recenti," in *Società Italiana di Storia Militare. Quaderno 2000*, ed. Piero Del Negro (Naples: Edizioni Scientifiche Italiane, 2003), 45-53; Alessandra Dattero and Stefano Levati, "La storia militare tra società, economia e territorio," in *Militari in Età Moderna*, 7-14; Bernhard Kroener, "Stato, società, 'militare.' Prospettive di una rinnovata storia militare della prima Età Moderna," in *Militari e società civile nell'Europa dell'Età Moderna*, ed. Claudio Donati and Bernhard Kroener (Bologna: Il Mulino, 2007), 11-21.

⁴² Giorgio Chittolini, "Il 'privato,' il 'pubblico,' lo stato," in *Origini dello stato. Processi di formazione statale in Italia fra Medioevo ed Età Moderna*, ed. Giorgio Chittolini, Anthony Molho, and Pierangelo Schiera (Bologna: Il Mulino, 1994), 573.

considered as an instrument of internal control and of centralization of the state authority.⁴³ The construction of modern fortifications, “iron belts” of a “territorial machine,” has been studied through the contrasts and the agreements between the regional governments and the local communities.⁴⁴ The recruitment of mercenaries has been intertwined with the “geography of famine” of the rural areas, and with the marginalization and the reintegration of soldiers and deserters into city contexts. The difficult coexistence between soldiers and civilians has been highlighted by the studies of garrisons and posts.⁴⁵ The analysis of the relationships between rulers and condottieri has been focused on patronage, loyalty, and justice. The companies of *venturieri*, moreover, have been investigated as structured firms, well organized by their leaders and their treasurers, according to economic and familiar ties.⁴⁶ The daily life of an encampment was reconstructed through the letters of noblemen, commissioners, captains, and simple combatants.⁴⁷ Historians have been interested also in the narrations of Renaissance battles in contemporary songs and diaries.⁴⁸ Moreover, they have analyzed the representation of violence, and the warlike performances of jousts and

⁴³ Maria Nadia Covini, “Guerra e ‘conservazione dello stato.’ Note sulle fanterie sforzesche,” *Cheiron* 23 (1995), 67-104.

⁴⁴ Ennio Concina, *La macchina territoriale. La progettazione della difesa nel Cinquecento veneto* (Rome and Bari: Laterza, 1983); Giorgio Chittolini, “Il ‘militare’ tra tardo Medioevo e prima Età Moderna,” in *Militari e società civile nell’Europa dell’Età Moderna*, 83-102.

⁴⁵ Luciano Pezzolo, “L’archibugio e l’aratro,” *Studi Veneziani* 7 (1983), 59-80; ID., “Professione militare e famiglia in Italia tra tardo Medioevo e prima Età Moderna,” in *La justice des familles. Autour de la transmission des biens, des savoirs et des pouvoirs*, ed. Anna Bellavitis and Isabelle Chabot (Rome: École Française de Rome, 2011), 341-366; Franco Cardini, *Quell’antica festa crudele* (Milan: Arnoldo Mondadori Editore, 1995), 78-123.

⁴⁶ Mario del Treppo, “Gli aspetti organizzativi, economici e sociali di una compagnia di ventura italiana,” *Rivista Storica Italiana* 85, no. 2 (1973), 253-75; William Bernardoni, “La compagnia del capitano Micheletto Attendolo nella contabilità quattrocentesca della Fraternita dei Laici di Arezzo,” *Annali aretini* 22 (2014), 115-44.

⁴⁷ Francesco Storti, “La *novellaja* mercenaria. Vita militare, esercito e stato nella corrispondenza di commissari, principi e soldati del secolo quindicesimo,” *Studi Storici* 54, no. 1 (2013), 5-39; Maria Nadia Covini, “La fortuna e i fatti dei condottieri ‘con veritate, ordine e bono inchiostro narrati’,” in *Medioevo dei poteri. Studi di storia per Giorgio Chittolini*, ed. Massimo della Misericordia, Andrea Gamberini, and Francesco Somani (Rome: Viella, 2012), 215-244; Enrica Guerra, *Soggetti a ribalda fortuna. Gli uomini dello stato estense nella guerre dell’Italia quattrocentesca* (Milan: Franco Angeli, 2005).

⁴⁸ Andrea Matucci, “‘E farai alcun fiume’. Il mito della battaglia di Fornovo fra Leonardo e Machiavelli,” in *Les guerres d’Italie. Histoire, pratiques, représentations*, ed. Danielle Boillet and Marie Françoise Piéjus (Paris: Université Paris 3 Sorbonne Nouvelle, 2002), 103-116; Massimo Rospocher, “Songs of war. Historical and literary narratives of the ‘horrendous Italian Wars,’” in *Narrating war. Early modern and contemporary perspectives*, ed. Marco Mondini and Massimo Rospocher (Bologna: Il Mulino, 2013), 79-97.

tournaments.⁴⁹ Military information has been gathered also from ambassadorial dispatches, which reported data and details about the strength and the intentions of rival and allied powers, all provided by spies, agents, clients, and merchants.⁵⁰ Scholars singled out the civilization of military customs and the rationalization of the “art” of war, the habits of a *bona guerra* expressed through treatises and biographies. Last but not least, even the condottieri were not portrayed as evil brigands anymore, but depicted as professional fighters, courtiers, and administrators.⁵¹

With regard to the “art of war,” the old, monumental book of Piero Pieri is still remaining unrivalled in the explanation of the evolutions in this period. Pieri, in fact, considered the transformations of strategies and tactics before and after the foreign invasions of Italy, and, through a punctilious examination of battles and campaigns, he successfully confronted the traditional prejudice in favor of the decadence of Italian armies during the fifteenth century.⁵²

An extraordinary synthesis of all of these subjects was proposed by Michael Mallett. His *Mercenaries and their masters*, appeared for the first time in 1974, still represents an impressive analysis of the history of war in Renaissance Italy, with a historical scope which extends from thirteenth-century companies to sixteenth century battles. Mallett explained not only tactics and strategies, but the whole cultural, financial, political context of conflicts, as well as their role in the contemporary society. Moreover, he held his attention in the military organization of Italian states, to the creation of permanent offices, to the founding of

⁴⁹ Paola Ventrone, “Cerimonialità e spettacolo nella festa cavalleresca fiorentina del Quattrocento,” in *La civiltà del torneo. Giostre e tornei tra Medioevo ed Età Moderna* (Narni: Centro Studi Storici di Narni, 1990), 35-53; Maria Nadia Covini, “Alcune note su scontri, duelli e giochi militari nella documentazione della Lombardia ducale del quindicesimo secolo,” in *Agon und Distinktion. Soziale Räume des Zweikampfs zwischen Mittelalter und Neuzeit*, ed. Uwe Israel and Christian Jaser (Berlin: Lit Verlag, 2016), 134-145.

⁵⁰ Francesco Senatore, “La battaglia nelle corrispondenze diplomatiche. Stereotipi lessicali e punto di vista degli scriventi,” in *La battaglia nel Rinascimento meridionale*, ed. Giancarlo Abbamonte, Joana Barreto, Teresa D’Urso, Alessandra Perriccioli Saggese, and Francesco Senatore (Rome: Viella, 2011), 223-240; Scarton, “Costi della guerra e forze in campo nel secolo XV”; Michael Mallett, “Diplomacy and war in later fifteenth-century Italy,” in *Lorenzo de’ Medici. Studi*, ed. Gian Carlo Garfagnini (Florence: Leo S. Olschki, 1992), 234-250.

⁵¹ Franco Cardini, “Condottieri e uomini d’arme nell’Italia del Rinascimento,” in *Condottieri e uomini d’arme nell’Italia del Rinascimento*, ed. Mario del Treppo (Naples: Liguori, 2001), 1-10; Maria Nadia Covini, “Guerra e relazioni diplomatiche in Italia. La diplomazia dei condottieri,” in *Guerra y diplomacia en la Europa occidental, 1280-1480* (Pamplona: Gobierno de Navarra, 2005), 163-198; Christine Shaw, *Barons and castellans. The military nobility of Renaissance Italy* (Leiden and Boston: Brill, 2015).

⁵² Piero Pieri, *Il Rinascimento e la crisi militare italiana* (Turin: Einaudi, 1952).

expeditions. Above all, Mallett highlighted the evolution of the relationships between rulers and condottieri, and their contrasts in the conduct of campaigns.⁵³

A decade later, John Hale would have attempted a broader survey of the subject, choosing to extend its geographical range to the entire continent. The highly important volume on *War and society in Renaissance Europe* focused mainly on the recruitment process of aristocrats, mercenaries, and militiamen, and their return to a civil life. Hale introduced also the problem of the direct and indirect economic effects of warfare on communities and governments, such as increases in taxation, incentives to production, extensions of the public authority. In the preceding years, Hale devoted several essays to the cultural influence of war during the sixteenth century, discussing also the intellectual controversy about the use of gunpowder.⁵⁴

In 1989, the translation of the Mallett's book on the military organization of Venice renewed the scholarly debate about the creation of standing armies and permanent magistracies in the fifteenth-century Peninsula. Mallett covered the issues of control, enlistment, supplying, and funding troops. He proposed again the themes of the relationships between the state and its captains. Furthermore, he overturned the traditional criticism of the Italian conservatism in military organization, examining the progresses made by the Most Serene Republic in the management and uses of its cavalry, infantry, and artillery.⁵⁵

So influential were this works that other volumes on the history of warlike institution began to appear. In 1998, Maria Nadia Covini reconstructed "the choices, the orientations, the decisions, and the practices" on which the Sforza of Milan based the military administration of their duchy and their standing armed force.⁵⁶ Deriving much of her analysis from vast archival sources, Covini discussed the bonds between the court and its soldiers, strengthened by salaries, donations, and vassalage. The condotta became an instrument of power, an efficient means of consolidating the state, an exchange of benefits and loyalty between the center and its peripheries. Covini pondered also on the impact of the war on Lombard society, especially

⁵³ Michael Mallett, *Signori e mercenari. La guerra nell'Italia del Rinascimento*, trans. from the 1974 English edition by Alghisi Princivalle (Bologna: Il Mulino, 2006). See also Michael Mallett and Christine Shaw, *The Italian Wars, 1494-1559* (London and New York: Routledge, 2012), 177-217.

⁵⁴ John Hale, *Guerra e società nell'Europa del Rinascimento*, trans. from the 1985 English edition by Franco Salvatorelli (Rome and Bari: Laterza, 1987); ID., *Renaissance War Studies* (London: The Hambledon Press, 1983).

⁵⁵ Michael Mallett, *L'organizzazione militare di Venezia nel Quattrocento*, trans. from the 1984 English edition by Enrico Basaglia (Rome: Jouvence, 1989).

⁵⁶ Maria Nadia Covini, *L'esercito del duca: organizzazione militare e istituzioni al tempo degli Sforza, 1450-1480* (Rome: Istituto storico italiano per il Medioevo, 1998).

on the cities, which negotiated the necessary taxation, and the rural villages, which housed soldiers.

In 2007, Francesco Storti investigated the creation of a “state army” in the Kingdom of Naples, during the reign of Ferrante I d’Aragona, and under the command of his son, Alfonso, the feared duke of Calabria. This “*demanio di gente d’arme*” would have been established through the incorporation and the confiscation of several cavalry companies of barons and vassals, and through the collaboration between the monarchy and the local communities. The reform would have allowed the sovereign to disarm temporarily his rebellious nobility, and to economize on the recruitment of foreign mercenaries. Storti has showed also the connections between the actual royal plans and the theoretical reflections expressed in the military treatise of two Neapolitan courtiers, Orso Orsini and Diomede Carafa. Unfortunately, the book did not offer a comprehensive analysis of the costs of this new centralized structure, but the expenditures on permanent contingents of infantry and light horsemen have been outlined in another article of the same author.⁵⁷

The Machiavellian “orthodoxy”

Only one Italian Renaissance state is still neglected by military historiography, that is, Florence. Too often, in fact, the prejudice of Niccolò Machiavelli against mercenaries has been assumed to be the reason and the consequence of a supposed decadence of the republican army during the fourteenth and the fifteenth century.⁵⁸ According to William Caferro, the dualism between citizen combatants and corrupt condottieri has insidiously turned into a serious prejudice, a self-evident explanation, a strict “orthodoxy” that has undoubtedly influenced the studies on the whole topic.⁵⁹ Thus, the relationships between the Commune and its captains have been purely analyzed from a perspective of reciprocal diffidence and sneaking suspicion. Statesmen

⁵⁷ Francesco Storti, *L’esercito napoletano nella seconda metà del Quattrocento* (Salerno: Laveglia, 2007); ID., “Il principe condottiero. Le campagne militari di Alfonso, duca di Calabria,” in *Condottieri e uomini d’arme nell’Italia del Rinascimento*, 327-346; ID., “Fanteria e cavalleria leggera nel Regno di Napoli,” *Archivio Storico per le Province Napoletane* 133 (2015), 1-47; Francesco Senatore and Francesco Storti, *Spazi e tempi della guerra nel Mezzogiorno aragonese* (Salerno: Carlone, 2002).

⁵⁸ An exhaustive bibliography on the *segretario fiorentino* can be found in one of the latest works of Andrea Guidi, *Un segretario militante. Politica, diplomazia e armi nel cancelliere Machiavelli* (Bologna: Il Mulino, 2009). A partially critical approach to the military, theoretical knowledge of Machiavelli is in Felix Gilbert, *Machiavelli e il suo tempo* (Bologna, Il Mulino, 1964), 253-289.

⁵⁹ William Caferro, “Continuity, long-term service and permanent forces. A reassessment of the Florentine army in the fourteenth century,” *Journal of Modern History* 80, no. 2 (2008), 219-251.

have often been blamed for their disinterest in military organization, and even for their “incomprehension” of the irrational, violent phenomenon of war. Florentines have been accused of avoiding personal, active involvement in conflicts, preferring instead to hire professional *venturieri*. The administration of troops has been assessed as haphazard and improvised, and the army has been judged as disorganized and inefficient.⁶⁰

It is always worth repeating and reminding, however, that “in history, as elsewhere, the causes cannot be assumed. They are to be looked for.”⁶¹ And the postulate of Florentine backwardness seems to have been merely based on the Machiavellian grievances and on the classic nostalgia for the *armi proprie*, rather than on a punctilious research into primary sources, into the abundant documentation of the local State Archive. Also the unique volume of Charles Bayley on war and society in Renaissance Florence reprised themes and complaints of the humanistic literature, reaffirming the distrust of condottieri, and their heavy burden on fiscal system.⁶²

The recent reassessment of the Florentine army in terms of continuity and rationalization proposed by Caferro has been a welcome, clever exception to this trend, but its problems and its suggestions were not deepened further. Therefore, a radical reconstruction of the war like preparations of the Republic is still missing, as a complete examination of its two military institutions, the extraordinary Dieci di Balla and the permanent Otto di Pratica. Suffice it to say that an article of Andrea Guidi completely ignored the archival practices of both these offices, overlooking bookkeeping and resolutions which date from the War of the Eight Saints to the exile of Piero di Lorenzo de’ Medici, and stressing, once again, the omnipresent, bulky figure of the Machiavelli.⁶³ The chapters dedicated by Guidubaldo Guidi to the Dieci, instead, were limited in summarizing roles and assignments of their appointees, and in engrossing the formal legislation relative to their posts.⁶⁴ Hints on these officers could be

⁶⁰ Mallett, *Signori e mercenari*, 134-136; Claudio Finzi, “La guerra nel pensiero politico del Rinascimento toscano,” in *Guerra e guerrieri nella Toscana del Rinascimento*, ed. Franco Cardini and Marco Tangheroni (Florence: EDIFIR, 1990), 127-153; Andrea Guidi, *Un segretario militante. Politica, diplomazia e armi nel cancelliere Machiavelli* (Bologna: Il Mulino, 2009).

⁶¹ Marc Bloch, *Apologia della storia, o mestiere di storico*, 143.

⁶² Charles Bayley, *War and society in Renaissance Florence. The De Militia of Leonardo Bruni* (Toronto: University of Toronto Press, 1961).

⁶³ Andrea Guidi, “The Florentine archives in transition. Government, warfare and communication,” *European History Quarterly*, 46, no. 3 (2016), 458-479.

⁶⁴ Guidubaldo Guidi, *Il governo della città-repubblica di Firenze del primo Quattrocento. II. Gli istituti ‘di dentro’ che componevano il governo di Firenze nel 1415* (Florence: Leo S. Olschki, 1981), 203-12; ID.

retrieved also in the edition of the letters of Lorenzo de' Medici, but their duties are not well profiled, relegated behind the will, the plans, and the personality of the same Magnificent.⁶⁵ Nevertheless, a distinction between the responsibility of the council and the behavior of Lorenzo has to be made, and Nicolai Rubinstein was aware of "a sort of division of labor" between the two, with the firsts "being in charge of the day-to-day conduct of military operations," and the latter "more concerned with long-term issues, and, in particular, with secret negotiations."⁶⁶

Little is known about the networks of rulers and soldiers. The famed negative attitude of the Republic towards its *capitani generali* has completely obscured the significant connections with other military leaders, such as heads of local factions, neighboring condottieri, and bellicose *accomandatari* of the Commune. Certainly, the works of Patrizia Meli have adequately highlighted the bonds between the Magnificent Lorenzo and two foreign condottieri, Gabriele Malaspina and Pierandrea di Brando, which revealed private and public interests in the region of Lunigiana and in the isle of Corsica. Christine Shaw has illustrated the difficult kinship between the Medici family and the Roman powerful clan of Orsini.⁶⁷ But the documentation points out further strong patronage links with the Vitelli of Città di Castello, with the counts of Montedoglio and Marsciano, with the marquises of Monte Santa Maria, with the lords of Sassetta and Faenza, and with the influential *connestabili* of Borgo San Sepolcro, Arezzo, and Castrocaro.

The Florentine campaigns, moreover, have been exclusively examined through their diplomatic implications and their repercussions on the precarious balance of power of the whole Peninsula.⁶⁸ It is the case, for instance, of the Barons' War.⁶⁹ As a matter of fact, the

Lotte, pensiero e istituzioni politiche nella Repubblica Fiorentina dal 1494 al 1512. II. Gli istituti sovrani e di governo (Florence: Leo S. Olschki, 1992), 787-97.

⁶⁵ See, for example, *Lorenzo de' Medici. Lettere*, III., ed. Nicolai Rubinstein (Florence: Giunti and Barbera, 1977).

⁶⁶ Nicolai Rubinstein, "Lorenzo de' Medici. The formation of his statecraft," in *Lorenzo de' Medici. Studi*, 62.

⁶⁷ Christine Shaw, "Lorenzo de' Medici and Niccolò Orsini," in *Lorenzo de' Medici. Studi*, 257-279; Patrizia Meli, *Gabriele Malaspina, marchese di Fosdinovo. Condotte, politica e diplomazia nella Lunigiana del Rinascimento* (Florence: Firenze University Press, 2008), 23-78; ID., "Un conestabile corso al servizio di Lorenzo il Magnifico. Pier Andrea Gentili di Brando," *Ricerche Storiche* 42 (2012), 39-56; Stephen Epstein, "Storia economica e storia istituzionale dello stato," in *Origini dello stato*, 108-109.

⁶⁸ Michael Mallett, "Diplomacy and war in later fifteenth-century Italy;" Riccardo Fubini, "Lega italica e politica dell'equilibrio all'avvento di Lorenzo de' Medici al potere," in ID., *Italia quattrocentesca. Politica e diplomazia nell'età di Lorenzo il Magnifico* (Milan: Franco Angeli, 1994), 185-219.

political premises of the Pazzi's conspiracy has attracted the attention of academics more than the resultant conflict.⁷⁰ The study of the rebellion of Volterra has not differed from this historiographical tradition, concentrating on the individual involvement of Lorenzo de' Medici in the repression, on the brutal bloodbath that ended the siege, and, above all, on the peculiar economic causes of the revolt, that is, the exploitation of the nearby alum mines.⁷¹

The publication of the correspondence of general commissioners has undoubtedly offered particulars of the tasks of officers and warriors, facts about the daily life in encampments, and details related to the ongoing operations, but without any systematic approach.⁷² With regard to these *commissari*, Mallett has openly criticized their "little direct experience of war" as well as their provisional appointments, emphasizing the contrast between the military unpreparedness and the diplomatic understanding of the ruling elite of the capital.⁷³

Despite the praises of Machiavelli, even the defensive strategies of the Magnificent have not been considered by historians, along with the project for securing the borders, the expenditures on strongholds, and the relationships between garrisons and civilians. The original castles planned by the *bottega* of Francesco di Giovanni and Francesco d'Angelo have rarely entered the debate on the early development of the bastioned fortification. Architects, at least, have analyzed the construction of new fortresses of Volterra, Monte Poggiolo, Sarzana, Sarzanello, Pietrasanta, Poggio Imperiale, and Firenzuola, built for the purpose of "keeping and fighting foes at distance" during the last quarter of the fifteenth century.⁷⁴

⁶⁹ Humfrey Butters, "Florence, Milan and the Barons' War," in *Lorenzo de' Medici. Studi*, 281-308; ID., "Lorenzo and Naples," in *Lorenzo il Magnifico e il suo mondo*, ed. Gian Carlo Garfagnini (Florence: Leo S. Olschki, 1994). In the same miscellany, see also Melissa Bullard, "In pursuit of *honore et utile*. Lorenzo de' Medici and Rome," 125-126.

⁷⁰ Lauro Martines, *April blood. Florence and the plot against the Medici* (Oxford: Oxford University Press, 2003); Riccardo Fubini, "La congiura dei Pazzi. Radici politico-sociali e ragioni di un fallimento," in ID., *Italia quattrocentesca*, 100-104; John Najemy, *A history of Florence* (Oxford: Blackwell, 2006), 352-361.

⁷¹ Enrico Fiumi, *L'impresa di Lorenzo de' Medici contro Volterra* (Florence: Leo S. Olschki, 1948).

⁷² Elisabetta Scarton, "Giannozzo Manetti, commissario in campo. Le istruzioni dei Dieci di Balìa," *Atti e memorie dell'Accademia Toscana di Scienze e Lettere* 76 (2011), 81-202; *Commissioni di Rinaldo degli Albizzi per il Comune di Firenze dal 1399 al 1433*, ed. by Cesare Guasti (Florence: Coi tipi di Mariano Cellini e Compagni, 1867).

⁷³ Mallett, "Diplomacy and war in later fifteenth-century Italy," 240; ID., *Signori e mercenari*, 134.

⁷⁴ Niccolò Machiavelli, *Storie fiorentine* (Florence: Per Bernardo di Giunta, 1532), 213r; Daniela Lamberini, "Architetti ed architettura militare per il Magnifico," in *Lorenzo il Magnifico e il suo mondo*, 407-425; John Hale, "The early development of the bastion. An Italian chronology," in ID., *Renaissance War Studies*, 1-29.

The “magnificent” administration

Besides, the historiography on Renaissance Florence has mainly focused on other topics, as politics and economy. Scholars have studied the establishment of a permanent diplomatic corps,⁷⁵ the formation of the *criptosignoria* of the Medici,⁷⁶ the consolidation of the regional state,⁷⁷ the rise of merchant bankers,⁷⁸ the development of textile industries,⁷⁹ and the general trends of production and trades in Tuscany.⁸⁰ However, all of these themes could not be entirely separated from the military fortunes of the Republic. As John Hale observed, conflicts “played a role which, if thought away, radically maims the understanding of the social experiences in those years.”⁸¹

⁷⁵ See the indispensable works of Riccardo Fubini, as *Quattrocento fiorentino. Politica, diplomazia, cultura* (Pisa: Pacini, 1996); ID., *Italia quattrocentesca*; ID., “Diplomacy and government in the Italian city-states of the fifteenth century,” in *Politics and diplomacy in early modern Italy. The structures of diplomatic practices*, ed. Daniela Frigo (Cambridge: Cambridge University Press, 2000); ID., “Classe dirigente ed esercizio della diplomazia nella Firenze quattrocentesca. Rappresentanza esterna e identità cittadina nella crisi della tradizione comunale,” in *I ceti dirigenti nella Toscana del Quattrocento* (Impruneta: Papafava, 1987).

⁷⁶ See, for example, Nicolai Rubinstein, *Il governo di Firenze sotto i Medici*, trans. from the 1966 English edition by Michele Luzzati (Florence: La Nuova Italia, 1971); Dale Kent, *The rise of the Medici faction in Florence* (Oxford: Oxford University Press, 1978); *The Medici. Citizens and masters*, ed. Robert Black and John Law (Florence: The Harvard University Center for Italian Renaissance Studies, 2015).

⁷⁷ *Lo stato territoriale fiorentino. Ricerche, linguaggi, confronti*, ed. Andrea Zorzi and William Connell (Pisa, Pacini, 2001); Marvin Becker, *Florence in transition, II. Studies in the rise of the territorial state* (Baltimore: The Johns Hopkins University Press, 1968).

⁷⁸ For a first approach to these themes, see Raymond de Roover, *The rise and decline of the Medici bank* (Cambridge: Harvard University Press, 1963); Sergio Tognetti, *Il banco Cambini. Affari e mercati di una compagnia mercantile-bancaria nella Firenze del quindicesimo secolo* (Florence: Leo S. Olschki, 1999).

⁷⁹ Two of the most important studies in the field are Franco Franceschi, *Oltre il tumulto. I lavoratori fiorentini dell’Arte della Lana fra Tre e Quattrocento* (Florence: Leo S. Olschki, 1993); Hidetoshi Hoshino, *L’arte della lana in Firenze nel Basso Medioevo. Il commercio della lana e il mercato dei panni fiorentini nei secoli tredicesimo e quattordicesimo* (Florence: Leo. S. Olschki, 1980).

⁸⁰ Among the others, see Goldthwaite, *The economy of Renaissance Florence*; ID., *La costruzione della Firenze rinascimentale. Una storia economica e sociale*, trans. from the 1980 English edition by Marina Romanello (Bologna: Il Mulino, 1984); Federigo Melis, *L’economia fiorentina del Rinascimento* (Florence: Le Monnier, 1984); ID., *Industria e commercio nella Toscana Medievale* (Florence: Le Monnier, 1989); Bruno Dini, *Manifattura, commercio e banca nella Firenze medievale* (Fiesole: Nardini, 2001).

⁸¹ Hale, *Guerra e società nell’Europa del Rinascimento*, 3.

This can be seen in the case of internal affairs, during the whole *Quattrocento*. The early crisis accentuated the “civic humanism” of Florentine intellectuals, their patriotic defense of republican liberty against “evil tyrants.”⁸² The long campaign against Milan, moreover, coincided with the affirmation of the Albizzi’s faction, which fell into decline soon after the failed capture of Lucca. The sudden, unconditional surrender to the French army of Charles VIII represented the trigger for the end of the Medici’s regime. The wearing war against the Pisan rebels exacerbated the city political turmoil in the last years of the century.⁸³

The diplomatic victory in the Pazzi’s War, above all, had significant consequence for the republican institutions, allowing the Magnificent to start a general oligarchic reform, concentrating several constitutional powers in his hands. Through the powerful, restricted Consiglio dei Settanta, Lorenzo could influence all the decisions on domestic politics. His membership in the Diciassette Riformatori guaranteed the control over public economy. Thanks to his patronal role, moreover, he could manipulate the new permanent magistracy of the Otto di Pratica, the council charged with managing the military organization and the foreign policy of the Commune.⁸⁴

The conflict, hence, not only tested the cohesion of the regime, but contributed to its strengthening. In the aftermath, the position of the inner circle of clients, the combination of public and private interests, and the personalistic statecraft of the Magnificent was significantly emphasized. The installation of the “tyrant” led also to a fierce rivalry between “Caesar” and part of the upper and middle classes of the capital. The excluded and marginalized members of important Florentine families expressed strong opposition to his “arrogance.”⁸⁵ His supporters, on the contrary, benefited also from the high rates of numerous short-term loans, consolidating their position inside the ruling “financial oligarchy.”⁸⁶ Loyal

⁸² Hans Baron, *La crisi del primo Rinascimento italiano. Umanesimo civile e libertà repubblicana in un’età di classicismo e di tirannide*, trans. from the 1966 English edition by Roberto Pecchioli (Florence: Sansoni, 1970).

⁸³ Giorgio Cadoni, *Lotte politiche e riforme istituzionali a Firenze tra il 1494 e il 1502* (Rome: Istituto storico italiano per il Medioevo, 1999).

⁸⁴ Nicolai Rubinstein, *Il governo di Firenze sotto i Medici*, 237-250; ID., “Lorenzo de’ Medici. The formation of his statecraft,” 54-66; Mallett, “Diplomacy and war in later fifteenth-century Italy,” 254-256; Vanna Arrighi and Francesca Klein, “Segretari e archivi segreti in età laurenziana,” in *La Toscana al tempo di Lorenzo il Magnifico*, 1386.

⁸⁵ Alison Brown, “Lorenzo and public opinion in Florence. The problem of opposition,” in *Lorenzo il Magnifico e il suo mondo*, 61-85. In the same miscellany is Francis Kent, “Lorenzo de’ Medici and oligarchy,” 53-55.

⁸⁶ Louis Marks, “The financial oligarchy in Florence under Lorenzo,” in *Italian Renaissance Studies*, ed. Ernest Jacob (New York: Barnes and Noble, 1960), 123-147.

bankers and devoted merchants conceded these *prestanze* especially in wartime, permitting the government to collect large sums of ready cash.⁸⁷ According to John Najemy, the early Milanese wars represented “the beginning of the commune’s dependence on its wealthiest citizens.”⁸⁸ After the Pazzi’s plot, more than three hundred thousand golden florins were annually borrowed from the citizenry. In 1495, four hundred thousand golden florins were accumulated “for preserving freedom.”⁸⁹

Although financiers made profits on their agreements with the Commune, the small investors often faced the insolvency of the public investment funds, that is, the *monte comune* and the *monte delle doti*.⁹⁰ The government, in fact, frequently failed to pay interest on their obligations, earmarking money for waging wars. The Republic did not returned the entire sum advanced for the campaigns against Filippo Maria Visconti, equal to one million golden florins. One hundred thousand golden florins were diverted from repayments to the salaries of troops, in 1472. In 1480, above all, the enemy invasion led to a major financial crisis, and the state was under the threat of bankruptcy.⁹¹

These “bad times” required determined efforts and drastic measures to raise the “inelastic” public revenues and to confront the “limitless” growth of military expenditures. The tax burden escalated sharply since the first decades of the century.⁹² The protracted conflict against the Milanese army compelled the Republic to promulgate a general survey on the business investments, the holding in public debt, and the real property of the inhabitants of the whole Dominio. Decreed for the first time in 1427, the *catasto* was revived in 1431 and in 1433, in an effort to defeat the Sienese and Lucchese resistance. The Neapolitan pressure on

⁸⁷ Lauro Martines, “Forced loans. Political and social strain in *Quattrocento* Florence,” *The Journal of Modern History*, 60, no. 2 (1988), 300-311.

⁸⁸ John Najemy, *A history of Florence*, 191.

⁸⁹ Benedetto Dei, *La cronica*, ed. Roberto Barducci (Pisa: Papafava, 1985), 103; Piero Parenti, *Storia fiorentina*, I., ed. Andrea Matucci (Florence: Leo S. Olschki, 1994), 92, 110, 114, and 168.

⁹⁰ Alison Brown, “Public and private interest. Lorenzo, the Monte and the Seventeen Reformers,” in *Lorenzo de’ Medici. Studi*, 103-138; Anthony Molho, “Debiti pubblici ed interessi privati nella Firenze tardomedievale,” in *La Toscana al tempo di Lorenzo il Magnifico*, 825-838 and 850-854.

⁹¹ Luciano Pezzolo, “Note sulla finanza dello stato fiorentino,” in *Studi in onore di Furio Bianco*, ed. Alessio Fornasin and Claudio Povolo (Udine: Forum, 2014), 293-297; Anthony Molho, “The state and public finance. A hypothesis based on the history of late medieval Florence,” *The Journal of Modern History* 67 (1995), 97-135; Louis Marks, “La crisi finanziaria a Firenze dal 1494 al 1502,” *Archivio Storico Italiano* 112 (1954), 40-72; Goldthwaite, *The economy of Renaissance Florence*, 495-502.

⁹² Elio Conti, *L’imposta diretta a Firenze nel Quattrocento* (Rome: Istituto storico italiano per il medioevo, 1984); Anthony Molho, *Florentine public finances in the Early Renaissance* (Cambridge: Harvard University Press, 1971); Gene Brucker, “The economic foundations of Laurentian Florence,” in *Lorenzo il Magnifico e il suo mondo*, 11-15.

the southern borders, in 1451, solicited the *tassa dei traffichi* on the capital of partnerships. A new *catasto* was levied in 1480, after the disastrous retreat from Poggio Imperiale and the loss of Colle Valdelsa. The reconquest of Pisa urged the imposition of the *decima*, an annual tithe on the incomes from immovable possessions, owed by citizens and peasants.⁹³

According to contemporary diarists, Florentines were “dismayed” and “displeased” for the heavy taxation, the major cause of the “decay of the city.”⁹⁴ But the price of warfare was actually overexpanding. The attempts to centralize its management, the necessity to maintain a large number of soldiers, and the prolonged duration of operations, affected its costs. From June 1452 to December 1453, the defense against the Neapolitan troops was subsidized with about six hundred thousand golden florins.⁹⁵ The four-week siege of Volterra required forty-four thousand golden florins.⁹⁶ For the conquest of Sarzana, in 1487, the Pisan officers paid ten thousand golden florins just for the provisions for ammunitions.⁹⁷ A decade later, the Dieci spent more than two hundred thousand golden florins on a six-month operations against the Pisan rebels.⁹⁸ From 1495 to 1499, the same war drained away one million golden florins.⁹⁹

Last but not least, these wars hindered local and interregional trades. The Milanese blockade on Pisa caused “much worry throughout the city, because if wool does not get here, there is no work in Florence, and the city is practically under siege.”¹⁰⁰ Chronicles reported the closing down of several *banchi* and *botteghe* during the Pazzi’s War, and the deep recession of the city economy. At the eve of his Italian campaign, Charles VIII posed menaces to Florentine merchants resident in France, trying to force Piero de’ Medici into breaking off his alliance with

⁹³ David Herlihy and Christiane Klapisch-Zuber, *I toscani e le loro famiglie. Uno studio sul catasto fiorentino del 1427*, trans. from the 1978 French edition by Mario Bensi (Bologna: Il Mulino, 1988); Otto Karmin, *La legge del catasto fiorentino del 1427. Testo, introduzione e note* (Florence: Bernardo Seeber, 1906); Anthony Molho, “The Florentine ‘tassa dei traffichi’ of 1451,” *Studies in the Renaissance* 17 (1970), 73-118.

⁹⁴ Luca Landucci, *Diario fiorentino*, ed. Iodoco del Badia (Florence: Studio Biblios, 1969).

⁹⁵ ASF, Dieci di balia, Entrata e uscita, 6, CIVv, 113v, and 236r.

⁹⁶ ASF, Dieci di balia, Debitori e creditori, 20, 94v.

⁹⁷ ASF, Ufficiali delle castella, 29, 56r.

⁹⁸ ASF, Dieci di balia, Debitori e creditori, 39, 292v.

⁹⁹ ASF, Dieci di balia, Debitori e creditori, 29, 255v; ASF, Dieci di balia, Debitori e creditori, 30, 293v; ASF, Dieci di balia, Debitori e creditori, 34, 238v; ASF, Dieci di balia, Debitori e creditori, 39, 292v; ASF, Dieci di balia, Debitori e creditori, 40, 202v; ASF, Dieci di balia, Debitori e creditori, 43, 272v; ASF, Dieci di balia, Debitori e creditori, 45, 329v; ASF, Dieci di balia, Entrata e uscita, 15, 178v and 315r.

¹⁰⁰ Najemy, *A history of Florence*, 190.

king Ferrante.¹⁰¹ The business of the various branches of the Medici bank declined or prospered following the disagreement with Venice, Naples, and Rome.¹⁰²

The ammunition of the Republic

Beyond the discussion over the prosperity or the hardship of Florentine markets during the Laurentian age, the concrete effect of military matters on the public finance is undeniable. Gene Brucker, Richard Goldthwaite, Bruno Dini, Anthony Molho, and many other historians affirmed that war contributed, directly or incidentally, to modify fiscal policies, to worsen the problem of the public debt, and to stabilize economic relationships based on political dependences. The condition of state incomes, and the solutions to fund army, have been deeply analyzed. Notwithstanding, several questions on expenditures proper to warfare are still unanswered, or not asked at all.

For example campaigns stimulated the demand for purveyance, with clear benefit to the economy. Many Florentines, from weavers to woodworkers, from stonemasons to bricklayers, from bakers to saddlers, had opportunities for gain. In general, the manufactures and the trades in arms thrived.¹⁰³ Mercenary companies had to equip their knights with a large variety of pieces of armor, such as armets, cuirasses, gauntlets. Usually, most of their captains sought the best steel from the prestigious Lombard workshops, which could have guaranteed tested, bolt-resistant wares. The lances and the clothes, instead, were sold by local makers. Infantrymen searched out their second-hand crossbows and their used helmets in the shops of small retailers, or purchased their new cuirasses from merchants and artisans directly in the encampment.

The most relevant customer of all was undoubtedly the Signoria, with its significant, massive requests for raw material and finished products. According to an appointee, besides, "our soldiers would be useless, if we did not supply them with arms."¹⁰⁴ The Dieci di Balìa and the Otto di Pratica were responsible for the provisions of regular garrisons and permanent armies. Two of their members were given the remit to negotiate with craftsmen about

¹⁰¹ Dei, *La cronica*, 103; Parenti, *Storia fiorentina*, 64, 80-81, and 103.

¹⁰² Bullard, "In pursuit of *honore et utile*," 135; Michael Mallett, "Lorenzo and Venice," in *Lorenzo il Magnifico e il suo mondo*, 113; de Roover, *The rise and decline of the Medici bank*, 365-366.

¹⁰³ Caferro, "Warfare and economy in Renaissance Italy," 198.

¹⁰⁴ ASF, Dieci di balìa, Missive, 60, 91r.

quantities and payments.¹⁰⁵ The overseer was in charge of the drafting of purchase agreements, and of the revision of the accountancy.¹⁰⁶ By the end of the century, one of his assistants, along with the two guardians of the arsenals, were registering and inventorying “all the ammunitions acquired and dispatched by order of our lordships.”¹⁰⁷

The officers commissioned portable firearms, heavy ordnance, and gunpowder, making the production of artillery a sort of state monopoly. They controlled imports and exports of “war stuff,” and fixed the prices of several items, and rented facilities and caves. The Otto spent considerable sums in public workshops, and signed many contracts with practitioners from all over the continent. The Dieci organized an efficient putting-out system for the fabrication of arrows, and as well amassed sizeable reserves of raw materials, such as saltpeter, copper, tin, and iron. But, if the Republic could not properly manage warfare, if its rulers could not even comprehend this “violent phenomenon,” why ever did the government cope with ammunitions? If the military institutions arranged conflicts carelessly and irrationally, why did they invest vast amounts of capital in these venture? And, if the troops were fraudulent and idle, why did they were armed with expensive, advanced, lethal instruments?

The original answers to these fundamental questions will be at the core of this dissertation, which will combine the economic and the political features of the Florentine military administration. Evaluating the impact of conflicts on commerce and production, and the involvement of the state in these affairs, this thesis will aim to reevaluate and reassess the choices, the orientations, and the decisions of the Commune, testing the current assumption about the backwardness of the armies of *Marzocco*. Moreover, this research wants to offer a first, valuable contribution to the study of the Italian Renaissance arms manufacture, presenting the state interest in warlike innovations, and highlighting the participation of artisans in the preparations of campaigns.

Thus, the first article, *Some notes on the archives of the military institution of Renaissance Florence*, will introduce the structure of the two military offices of the Republic, the Dieci di Balìa and the Otto di Pratica, reconstructed through a careful examination of their archival documentations. The daily registrations of treasurers, secretaries, and commissioners, will illustrate the practices and the organization of these two permanent, alternate

¹⁰⁵ ASF, Dieci di balìa, Munizioni, 6, 181v.

¹⁰⁶ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 31, 17v.

¹⁰⁷ ASF, Dieci di balìa, Munizioni, 8, 1r.

institutions, during the last quarter of the fifteenth century. These “heterodox” primary sources will demonstrate that the Republic could operate warfare efficiently and effectively, rationally and coherently, in spite of the “orthodox” backwardness preached by generations of scholars. The accounts, above all, will reveal facts and numbers of the contracts, of the relationships between rulers, soldiers, and artisans, highlighting the attempts to create a regular army through peculiar processes of enlistment and equipment.

The second paper, *Craftsmen, artillery, and war production in Renaissance Florence*, will approach the matter of production during the entire fifteenth century, from the early wars against Filippo Maria Visconti to the late hostilities with the rebel Pisans. The interest of the Signoria in the military will be confirmed by its management of war production. The public demand, in fact, would have played a leading role in the stimulation of the market and in the introduction of technical changes. As for them, the numerous artisans employed in fabricating munitions would have been able to imitate and to assimilate innovative tools and new weapons, reaching excellent qualitative standards and sufficient quantitative yields. Firearms, especially, would have received the most attention from politicians and craftsmen.

The third essay, *Geografie della Guerra nella Toscana del Rinascimento*, will focus on the private workshops of these practitioners, diffused throughout the whole territory, due to the diverse specializations of towns and the different accessibility to natural resources. The intervention of the central government will be visible also in the integration of this polycentric manufacture, a circulation of merchandise coordinated by the local officers through regulations and negotiations. Other orders would have concerned the construction of public facilities and new warehouses in Florence and in Pisa, so as to facilitate the concentration, and the distribution of ammunitions to armies and garrisons. For fulfilling these critical function, the Republic would have contacted and contracted smiths, carpenters, engineers, gunners, and founders.

The fourth chapter, *I “maestri dell’artiglieria” nell’Italia del Rinascimento*, will precisely discuss the institutional efforts to attract the skilled labor of gunmakers, comparing the policies of the principal Italian states. From Milan to Rome, from Florence to Naples, in fact, the authorities would have tried to enhance the production of the indispensable heavy artillery, gathering in their arsenals as many specialists as possible. The contribution of these master would have exceeded the simple fabrication of bombards. Confronting their practical experiences, enriching their empirical knowledge, these *maestri di getto* would have created innovative machines and original methodologies, often meeting the needs of captains and

commissioners. During long travels, by means of cultural exchanges, they would have disseminated several military “open techniques,” available for each of their employer.

The fifth part, *The life of a Renaissance gunmaker*, will deepen the understanding of the careers of these skillful, clever masters. The study will rely on the sound, thirty-year documentation left by a prominent Florentine artisan, Bonaccorso di Vettorico Ghiberti, the grandson of the illustrious Lorenzo di Cione. His notebooks will provide important details about the formation in the family foundry, and the collaborations with artists, engineers, and soldiers. His accounts will have data on the actual metal works, the bells, the statues, and the guns realized for several *signori*. His drawing, above all, will allow a survey of the casting techniques of both traditional Italian bombards and new French cannons.

The sixth section, “*This French artillery is very good and very effective*,” will return to comparative themes, analyzing the technological premises and the productive consequences of the assimilation of the infamous royal guns into Italian warfare, the “diabolical devices” which impressed chroniclers and captains. The shocks of the Neapolitan campaign would have produced many, main departures for the artillery manufacture and the procurement of ammunitions, based on the previous, widespread experimentations of gunmakers. The institutions of the whole Peninsula would have rapidly commenced to develop firearms similar in mobility, power, and effectiveness to the pieces of the foreign invaders. These replicas and these hybrids would have proved the aptitude for innovating of statesmen and founders, who could adopt and adapt immediately the new weapons, accelerating the gradual evolution of the customary gunnery, and fostering further, substantial improvements in the industries of ordnance, cannonballs, and carriages.

The seventh publication, *Supplying the army*, will examine a concrete case study, that is, the equipment of the Florentine troops during the war in the Pisan countryside, one of the first Italian campaigns to be radically influenced by the appearance of the Transalpine technology. The findings will illustrate the various, numerous necessity of the “mobile city” of a Renaissance army, underlining, once again, the direct, strong connections between tactic, strategy, and production. The innovations in weaponry, in fact, would have brought several, significant changes not only in poliorcetics. In the course of that single summer, the waging of the artillery warfare would have multiplied the requests for weapons and ammunitions. This impact on the supply chains would have compelled statesmen, soldiers, and artisans to cope adequately with a new, demanding logistics of conflicts.

Lastly, the concluding *The siege of Pisa* will summarize all of the preceding aspects. The attempts at seizing the rebel city will be indicative of the endeavor of the Commune to manage the fabrication and the commerce of materiel. During this operation, the Republic would have deployed all of its firepower, straining the capacity of its gunpowder makers, and mobilizing every single founder of the capital. On this occasion, the entire military organization would have effectively reacted to the solicitations of this impressive enterprise, keeping a force of about fifteen thousand men. The Signoria would have made every financial, bellicose, and productive effort to win the battle, and to end a wearing, long war.

The “revolutionary challenge”

Despite these struggles to supply its army, the Republic was incapable of establishing a self-sufficient arms manufacture. Its captains preferred to rely upon the imports from Lombardy of thousands steel products, as breastplates, helmets, and arrowheads. The Machiavellian militia was equipped with *petti* and *celate* purchased in Brescia.¹⁰⁸ Over the whole century, the *catasti* registered a drastic decrease in the workshops of makers of cuirasses and swords, that is, the *spadai* and the *corazzai*. The plans to develop an armor industry in Pisa failed, due to a lack of a strong political will.¹⁰⁹ At the end of the century, Florentine ironworks were technologically limited and quantitatively insignificant, even compared to the *ferriere* of the near Sienese state, promoted and managed by local rulers.¹¹⁰ This problem was particularly evident in the first years following the introduction of iron cannonballs, when the Dieci di Balìa were compelled to hire external practitioners for increasing the output, or to acquire forged and cast missiles from their allies.

The promulgation of several laws for regulating and promoting the opening of new mines would not have had any positive effect on the sector.¹¹¹ On the long term, this scarcity of iron probably prevented the expansion of several city businesses, hindering any entrepreneurial aptitude. Smiths did not sell portable firearms abroad, even if they could fabricate thousands *scoppietti* per month, in case of necessity. The most prominent masters,

¹⁰⁸ ASF, Dieci di balìa, Munizioni, 9, 181v.

¹⁰⁹ Scalini, “L’armatura fiorentina,” pp. 113-144; Maria Luisa Bianchi and Maria Letizia Grossi, “Botteghe, economia e spazio urbano,” in *Arti fiorentine. Il. Il Quattrocento*, ed. Franco Franceschi and Gloria Fossi (Florence: Giunti, 1999), pp. 60-61; Pampaloni, “La miniera del rame,” pp. 53-54.

¹¹⁰ Borracelli, “Siderurgia e imprenditori senesi nel Quattrocento,” pp. 1218-1220.

¹¹¹ ASF, Provvisioni, Carte di corredo, 26, 113r.

enriched by the state commissions, preferred to invest their profits in public debt or in real estates.¹¹²

The situation was worsened by the disinterest of Florentine *mercantanti* in weapons market. Their brokerage, on the contrary, was restricted to the most lucrative metals and minerals. The firms of Soderini, Strozzi, and Capponi sold the expensive copper to the Signoria, while the banks of Pitti, Berti, and Bardi dealt in the precious saltpeter. In both trades were involved also the Medici, as rulers and as merchants.

Hence, even in this market, *Marzocco* was completely dependent on its international commercial network for the necessity of raw materials. This characteristic was evident above all in the artificial manufacture of the primary component of gunpowder. The Commune was a latecomer to this industry, with the first public nitrary opened only at the beginning of the sixteenth century.¹¹³ And, considering the overall Italian progresses in the field, this delay was undoubtedly a major, severe fault.

Florence, moreover, was a modest, peripheral center of exportation of finished goods, which “consisted of those few thing the city could produce utilizing the natural and human resources at hand.”¹¹⁴ The Pistoiese spear producers could take advantage of the timber of the surrounding mountains for retailing their goods in Lucca, Siena, and Bologna. The leather workers of Borgo Sansepolcro could sell their saddles thanks to the local animal fairs. As for them, the Dieci and the Otto could only exploit, integrate, and favor the specializations of these minor towns, according to common policy of productive complementation adopted by the republican government.¹¹⁵

Although the constraints, the two military councils relentlessly pursuit excellence in the production of artillery. Experimentations on design, material, and propellant of guns were carried throughout the whole century, and especially in its first decades, with the tests of organ guns, cast iron pieces, and corned powder. The advancement of Florentine ordnance would have been strongly supported by the various *politiques techniques* of the government, which looked after the exemption from duties for materiel, the construction of public workshops and roomy arsenals, and the punctual, adequate, free supply of metals for their

¹¹² ASF, Decima repubblicana, 16, 204r-205r.

¹¹³ ASF, Dieci di balia, Munizioni, 9, 168v.

¹¹⁴ Goldthwaite, *The economy of Renaissance Florence*, 114-120.

¹¹⁵ Stephen Epstein, “Stato territoriale ed economia regionale nella Toscana del Quattrocento,” in *La Toscana al tempo di Lorenzo il Magnifico*, 869-885; Sergio Tognetti, “Il governo delle manifatture nella Toscana del tardo Medioevo,” in *Il governo dell’economia. Italia e Penisola Iberica nel basso Medioevo*, ed. Lorenzo Tanzini and Sergio Tognetti (Rome: Viella, 2014), 310-330.

gunmakers. The state incentivized also the migration of several foreign founders, in order to foster innovation and introduce new armaments, according to the existing practices of technological transfer and industrial development.¹¹⁶ Similarly, they backed the formation of an informal, artistic, local school of gunnery, mostly composed by renowned bronze sculptors. Besides beautiful statues, in fact, Maso di Bartolomeo, Pasquino da Montepulciano, Andrea del Verrocchio, Leonardo da Vinci, and Bonaccorso Ghiberti would have realized massive, fine bombards, too.

The research will determine that the Republic actually “desired perfection” for its guns.¹¹⁷ The state actively pursued significant policies of support for crafts indispensable to defend the republican “freedom” and to increase the warlike “reputation.” The Dieci and the Otto sponsored technical changes, granted privileges to skilled labor, maintained infrastructures, controlled the traffic of various wares, and obtained the full cooperation of merchants and artisans. They imitated exactly the same initiatives reserved for the textile sector, the most important city industry.¹¹⁸ The influence of usual entrepreneurial schemes was apparent also from the general military accountancy, modeled on the bookkeeping of contemporary private businesses.¹¹⁹

All the Florentine attempts to improve the arms management are emblematic of the try of the other Italian Renaissance powers. Since the first half of the century, in fact, the diffusion of artillery would have imposed the creation of special offices, entrusted with the purchasing of gear and with the dispatching of ammunitions. Governments appeared to be very interested in tracking down useful products, as more durable powder, more resistant guns, and more mobile carriages. The trade of saltpeter would have involved diplomats, secretaries, and princes. Rulers had also to affirm their monopoly in the fabrication of firearms.¹²⁰ And the same courts would have promoted innumerable opportunities for the dissemination of

¹¹⁶ Molà, “*States and crafts*,” 133-137.

¹¹⁷ ASF, Dieci di balia, Missive, 57, 17r.

¹¹⁸ Franco Franceschi, “Medici economic policy,” in *The Medici. Citizens and masters*, 130-153; Franco Franceschi and Luca Molà, “Regional states and economic development,” in *The Italian Renaissance state*, ed. Andrea Gamberini and Isabella Lazzarini (Cambridge: Cambridge University Press, 2012), 453-463.

¹¹⁹ Federigo Melis, *Documenti per la storia economica dei secoli XIII-XVI* (Florence: Leo S. Olschki, 1972), 49-74.

¹²⁰ Fabio Bargigia and Fabio Romanoni, “La diffusione delle armi da fuoco nel dominio visconteo,” *Revista Universitaria de Historia Militar* 11, no. 6 (2017), 153.

technologies, creating the “trading zones” of arsenals and *uffici*, “where people from different backgrounds could communicate in substantive ways.”¹²¹

Besides, the state customers could attained new weaponry exclusively through a fruitful collaboration with their “engineers,” through the versatile ingenuity of their gunmakers, through the frequent gatherings of their able craftsmen, through the enterprising habits of their practitioners. Within warehouses and foundries, a technical Renaissance was steadily spreading, permitting the free circulation of original ideas, the slow transformation of empirical knowledge, the lively debates about errors and successes, machineries and variables, theories and practices.¹²²

All of these “cumulative interconnections,” the synergies between public institution and private individuals, and the creation of this “unified technological space”, would have made possible the immediate proliferation of the French ordnance in the receptive political, economic, and cultural context of the Italian *Quattrocento*.¹²³ According to the Sieneese master Vannoccio Biringuccio, “the moderns, today, proceed to fabricate artillery more intelligently and with greater reason, because many experiments have enlightened them.”¹²⁴ After these gradual trials, however, the burst of gunmaking activities would have had serious repercussions on the whole complex of Italian warfare, in the course of a sole decade.

Apart from the actual effectiveness of the new weapons,¹²⁵ the logistical system would have undergone extensive modifications, due to a systematic increase in the demand of guns, powder, missiles, and carts. Condottieri would have requested more and more cannons, culverins, and falcons. Authorities should have arranged timely provisions for their troops, reorganizing the whole commodity chain, from the exploitation of natural resources to the distribution of weapons. Officers could not have improvised haphazard solutions to maintain

¹²¹ Long, *Artisans, practitioners*, 94-96; Guido Guerzoni, “Novità, innovazione e imitazione. I sintomi della modernità,” in *Il Rinascimento italiano e l’Europa*. III. *Produzione e tecnica*, 67-72; Hilaire-Perez and Verna, “Dissemination of technical knowledge,” 550; Rosenberg, “Economic development,” 168.

¹²² Gille, *Leonardo e gli ingegneri del Rinascimento*, 8-9; Luca Molà, “Inventors, patents, and the market for innovations,” *History of technology* 32 (2014), 25.

¹²³ Stephan Epstein, “Labour mobility, journeyman organizations and markets in skilled labour in Europe, 14th-18th centuries,” in *Le techniciens dans la cité en Europe occidentale, 1250-1650*, ed. Mathieu Arnoux and Pierre Monnet (Rome: École Française de Rome, 2004), 251; Angus Buchanan, “The structure of technological revolution,” *History of technology* 16 (1994), 209.

¹²⁴ Vannoccio Biringuccio, *Pirrotechnia* (Venice: Per Comin da Trino di Monferrato, 1558), 79rv.

¹²⁵ Pepper, “Castles and cannon in the Naples campaign,” 289-291; George Raudzens, “War-winning weapons. The measurement of technological determinism in military history,” *The Journal of Military History* 54, no. 4 (1990), 407-408.

and to deploy the new technology in an adequate manner.¹²⁶ They rather had to combine appropriately the “government of artillery” with the “governance of production.”

Therefore, the problematic equipment of the armies would have imposed careful planning and preventive actions, and the states would have responded with the same resolute interventions already made in health regulations, fiscal reforms, and military organization. From this perspective, the questioned “military revolution” should perhaps be recast, for the late fifteenth century, in a more modest frame, that is, another “revolutionary challenge” in terms of administration, credit, and procurement, a process with connections with a broader sociopolitical change, during the long-lasting rise of the modern state.

¹²⁶ Frank Tallett and David Trim, “‘Then was then and now is now.’ An overview of change and continuity in late-medieval and early-modern warfare,” in *European Warfare, 1350-1750*, ed. Frank Tallett and David Trim (Cambridge: Cambridge University Press, 2010), 23-26; Baraldi, “Una nuova età del ferro,” 214-216.

ARTICLE I
MILITARY ARCHIVES OF RENAISSANCE FLORENCE.
RESOLUTIONS AND BOOKKEEPING OF THE DIECI DI BALIA AND THE OTTO DI PRATICA
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In the last decades, the analysis of the Florentine Renaissance military institutions has often been a simple restatement of the traditional Machiavellian juxtaposition of citizen militia and mercenary companies. Tuscan statesmen have been often blamed for the decadence of their militia, for their distrust of soldiers, and even for the 'incomprehension' of the 'violent' war phenomenon.¹ In one of his essay on Renaissance warfare, William Caferro has affirmed, with good reason, that 'this schema has achieved the status of orthodoxy', a genuine, unavoidable, and ineradicable prejudice.²

This conviction it is far more surprising, considering that the Dieci di Balìa and the Otto di Pratica have been always praised, instead, for their diplomatic achievements, for the networks of their ambassadors, for their crucial role in the preservation of the 'peace of Lodi'.³

¹ Michael Mallett, *Signori e mercenari. La guerra nell'Italia del Rinascimento*, Alghisi Princivalle, trans. (Bologna 2006), 120 and 134-36; id., *L'organizzazione militare di Venezia nel Quattrocento*, Enrico Basaglia, trans. (Rome 1989), 256-57; Piero Pieri, *Il Rinascimento e la crisi militare italiana* (Turin 1970), 262-63; John Hale, *Guerra e società nell'Europa del Rinascimento*, Franco Salvatorelli, trans. (Rome and Bari 1987), 6; Stephan Epstein, 'Storia economica e storia istituzionale dello stato', in Giorgio Chittolini, Anthony Molho, and Pierangelo Schiera, eds, *Origini dello stato. Processi di formazione statale in Italia fra medioevo ed età moderna* (Bologna 1994), 108-09; Claudio Finzi, 'La guerra nel pensiero politico del Rinascimento toscano', in Franco Cardini and Marco Tangheroni, eds, *Guerra e guerrieri nella Toscana del Rinascimento* (Florence 1990), 141.

² William Caferro, 'Continuity, long-term service, and permanent forces. A reassessment of the Florentine army in the fourteenth century', *The Journal of Modern History*, 80, 2 (2008), 219-223.

³ Riccardo Fubini, *Italia quattrocentesca. Politica e diplomazia nell'età di Lorenzo il Magnifico* (Milan 1994); id., *Quattrocento fiorentino. Politica, diplomazia, cultura* (Pisa, 1996); id., 'Diplomacy and government in the Italian city-states of the fifteenth century', in Daniela Frigo, ed, *Politics and diplomacy in early modern Italy. The structures of diplomatic practices* (Cambridge 2000); id. 'Classe dirigente ed esercizio della diplomazia nella Firenze quattrocentesca. Rappresentanza esterna e identità cittadina nella crisi della tradizione comunale', in *I ceti dirigenti nella Toscana del Quattrocento* (Impruneta 1987); Guido Pampaloni, 'Gli organi della repubblica fiorentina per le relazioni con l'estero', *Rivista di studi politici internazionali*, 20 (1953); Giuseppe Vedovato, *Note sul diritto diplomatico della repubblica*

Nevertheless, these two offices are still judged 'backward,' even in spite of the recent progresses of the Italian historiography in the study of the connections between politics and army, of the influence of conflicts upon the construction and the consolidation of territorial powers.

In the last two decades, in fact, several scholars have dealt with the issues of the Renaissance warfare of the Peninsula. Michael Mallett's book on the military organization of Venice, for example, overturned the traditional criticism of the Italian conservatism in military organization, examining the progresses made by the Most Serene Republic in the management and uses of its cavalry, infantry, and artillery.⁴ Francesco Storti investigated the creation of a 'state army' in the Neapolitan kingdom, established through the incorporation and the confiscation of several baronial companies, and through the collaboration with many local communities.⁵ Maria Nadia Covini has discussed the bonds between the Milanese court and its soldiers, strengthened by salaries, donations, and vassalage. In Lombardy, the *condotta* became an efficient means of consolidating the state, an exchange of benefits and loyalty between the center and its peripheries.⁶

In general, these different approaches have resulted in a better comprehension of the reciprocal influence between military reforms, civic transformations, financial innovations, and state consolidation.⁷ Military institutions have been seen as the expression of more complex political projects, and the formation of standing armies was considered as an instrument of internal control and of centralization of the state authority.⁸ The construction of modern fortifications, "iron belts" of a "territorial machine," has been studied through the contrasts and the agreements between the governments and their subjects.⁹ The recruitment of troops

fiorentina (Florence 1946); Elisabetta Scarton, *Giovanni Lanfredini. Uomo d'affari e diplomatico nell'Italia del Quattrocento* (Florence 2007).

⁴ Mallett, *L'organizzazione militare di Venezia nel Quattrocento*.

⁵ Francesco Storti, *L'esercito napoletano nella seconda metà del Quattrocento* (Salerno 2007).

⁶ Maria Nadia Covini, *L'esercito del duca. Organizzazione militare e istituzioni al tempo degli Sforza* (Rome 1998).

⁷ Claudio Donati, 'Strutture militari degli stati italiani nella prima età moderna: una rassegna degli studi recenti', in Piero Del Negro, ed, *Società Italiana di Storia Militare. Quaderno 2000* (Naples 2003), 45-53; Bernhard Kroener, "'Stato, società, militare. Prospettive di una rinnovata storia militare della prima Età Moderna', in Claudio Donati and Bernhard Kroener, eds, *Militari e società civile nell'Europa dell'Età Moderna* (Bologna 2007), 11-21.

⁸ Giorgio Chittolini, 'Il privato, il pubblico, lo stato', in *Origini dello stato*, 573; Maria Nadia Covini, 'Guerra e conservazione dello stato. Note sulle fanterie sforzesche', *Cheiron*, 23 (1995), 67-104.

⁹ Giorgio Chittolini, 'Il militare tra tardo Medioevo e prima Età Moderna', in *Militari e società civile nell'Europa dell'Età Moderna*, 83-102; Enrica Guerra, *Soggetti a ribalda fortuna. Gli uomini dello stato*

has been intertwined with the 'geography of famine' of rural areas.¹⁰ The analysis of the relationships between rulers and mercenaries, moreover, has been focused on patronage, and the companies of *venturieri* have been investigated as structured firms, well organized by their leaders and their treasurers. Even the *condottieri* were not portrayed as evil brigands anymore, but depicted as courtiers and administrators.¹¹ Lastly, military information has been gathered from ambassadorial dispatches, which reported details about the strength and the intentions of rival and allied powers, with data provided by spies, agents, and merchants.¹²

This increasing debate has undoubtedly benefited from the international, contemporary researches on warfare management. The impact of conflicts on European societies was valued through the rise of modern states and the affirmation of bureaucratic apparatuses, the transformations of army organizations, the imposition of enduring fiscal measures and the consequences for the economy, the modifications in political thought and in diplomatic policies, as well as the procurement of weapons and the technological advancement of the so-called 'military revolution'.¹³

Developing from these broader suggestions, this contribution aims to reconstruct the archives of the two Florentine military institutions, in order to examine their complex, wide

estense nelle guerre dell'Italia quattrocentesca (Milan 2005); Ennio Concina, *La macchina territoriale. La progettazione della difesa nel Cinquecento veneto* (Rome and Bari 1983);

¹⁰ Luciano Pezzolo, 'L'archibugio e l'aratro', *Studi Veneziani*, 7 (1983), 59-80; id., 'Professione militare e famiglia in Italia tra tardo Medioevo e prima Età Moderna', in Anna Bellavitis and Isabelle Chabot, eds, *La justice des familles. Autour de la transmission des biens, des savoirs et des pouvoirs* (Rome 2011), 341-366; Franco Cardini, *Quell'antica festa crudele* (Milan 1995), 78-123.

¹¹ Mario del Treppo, 'Gli aspetti organizzativi, economici e sociali di una compagnia di ventura italiana', *Rivista Storica Italiana*, 85, 2 (1973), 253-75; William Bernardoni, 'La compagnia del capitano Micheletto Attendolo nella contabilità quattrocentesca della Fraternita dei Laici di Arezzo', *Annali aretini*, 22 (2014), 115-44; Franco Cardini, 'Condottieri e uomini d'arme nell'Italia del Rinascimento', in Mario del Treppo, ed, *Condottieri e uomini d'arme nell'Italia del Rinascimento* (Naples 2001), 1-10; Christine Shaw, *Barons and castellans. The military nobility of Renaissance Italy* (Leiden and Boston 2015).

¹² Elisabetta Scarton, 'Costi della guerra e forze in campo nel secolo XV tra verità storiografiche e manipolazione dell'informazione', *Revista Universitaria de Historia Militar*, 6, 11 (2017), 23-42; Michael Mallett, 'Diplomacy and war in later fifteenth-century Italy', in Gian Carlo Garfagnini, ed, *Lorenzo de' Medici. Studi* (Florence 1992), 234-250.

¹³ See, for example, Hale, *Guerra e società nell'Europa del Rinascimento*; Frank Tallett and David Trim, eds, *European warfare, 1350-1750* (Cambridge 2010); Frank Tallett, *War and society in early-modern Europe* (London 1992); Philippe Contamine, ed, *War and competition between states* (Oxford 2000); Geoffrey Parker, *The military revolution. Military innovation and the rise of the West, 1500-1800* (Cambridge 1988); Jeremy Black, *A military revolution? Military change and European society, 1550-1800* (Atlantic Highlands 1991); Clifford Rogers, ed, *The military revolution debate. Readings on the military transformation of Early Modern Europe* (Boulder 1995).

range of activities during the second half of fifteenth century, before the admission of Niccolò Machiavelli to the republican chancery, and, above all, before the passing of the law that limited definitively the power of the Dieci di Balìa, in September 1500.¹⁴ These registers are all kept in the State Archive of Florence, and are extremely useful for understanding the structure of the offices, the management of the troops, the enlistment of soldiers, the relationships between condottieri and rulers, the construction of new fortifications, the manufacture of ammunitions, and the expenditures on the whole *res militaris*.

Resolutions, contracts, and allocations

The Dieci were the ten officials extraordinarily elected in times of war, chosen among the members of the Council of the Hundred, and approved by the Signoria.¹⁵ They had a specific authority, the *balìa*, over the foreign policy and the conduct of campaigns, '*pro defensione, securitate et conservatione statutis et libertatis civitatis Florentiae, et pro defensione et tutela subditorum, adherentium, sequacium ac federatorum ipsius populi et communis, et ad offesam inimicorum suorum vigore eorum potestatis, arbitrii et baliae*'.¹⁶ Their appointment lasted generically for six months, and cannot be declined.¹⁷ The Dieci di Balìa were in charge during the prolonged conflict against the Visconti, in the years of the Aragonese incursions into the Tuscan coast, for the battle of Riccardina, and after the Pazzi's conspiracy.

The oligarchic reforms of Lorenzo de' Medici, in 1480, led to the institution of another but permanent office, the Otto di Pratica. These eight men were chosen personally by the head of the Florentine regime among his inner circle, and formally voted in the Council of the Seventy. Every semester, the closest friends of the Magnificent alternated with his clients and relatives, among which were Tommaso Soderini, Jacopo and Luigi Guicciardini, Bongianni Gianfigliuzzi, Bernardo del Nero, Maso degli Albizi, Niccolò Capponi, Guidantonio Vespucci,

¹⁴ This *provvisione*, in fact, subordinated the autonomy of the Dieci to the approval of the Signori, depriving the officers of the possibility to declare war, to nominate new commissioners, and to increase the number of companies and soldiers. See Giorgio Cadoni, *Lotte politiche e riforme istituzionali a Firenze tra il 1494 e il 1502* (Rome 1999), 133-36; Francesco Guicciardini, *Storie fiorentine*, ed. by Piero and Luigi Guicciardini (Florence 1859), 235-36; Piero Parenti, *Storia fiorentina*, II., ed. by Andrea Matucci (Florence, 2005), 394.

¹⁵ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 21, llrv.

¹⁶ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 27, 10r.

¹⁷ Guidubaldo Guidi, *Il governo della città-repubblica di Firenze del primo Quattrocento*. II. *Gli istituti 'di dentro' che componevano il governo di Firenze nel 1415* (Florence 1981), 203-12.

Bernardo Rucellai, Francesco Valori, and Pierfilippo Pandolfini.¹⁸ At the outbreak of a war, however, a member of the *arti maggiori* and a representative of *arti minori* were added to the Otto, re-forming again the Dieci.¹⁹ During the following decade, the latter would have relieved the firsts in several occasions, such as the war of Ferrara, the siege of Pietrasanta, and retaliation against Rome for the papal support of the conspiracy of the barons.

With the fall of the Medici's *criptosignoria* and the republican restoration, in 1494, the Dieci became the guarantors of 'peace and freedom', the sole, powerful military institution of the Commune, capable of influencing both the foreign and the domestic policies of the city.²⁰ But this accumulation of responsibilities, and this unprecedented leverage, were also determined by several major alteration in the contemporary political situation. The passage of Charles VIII through Tuscany, in fact, would have had considerable effects on the military mobilization and the diplomatic strategies of the state. The revolt of Pisa against the 'evil tyranny' of its rulers, and the opening of a new front inside the same Florentine borders, would have compelled the Dieci to adopt and to develop new solutions to a permanent conflict, during the years of the first Italian Wars.

In any case, for accomplishing their numerous duties, the officials could rely on the solid experience of their chancellery. Giovanni della Valle, Filippo Redditi, Francesco di Barone, Alessandro Braccesi, Luca Ficini, Ottaviano from Ripa, Jacopo di Ruffino, Raffaello Fedini, and Agostino Vespucci secured a certain administrative continuity. In fact, they had already worked as notaries and secretaries for the former Otto di Pratica, often coordinated by the principal chancellors of the Signoria, as Bartolomeo Scala and Francesco Gaddi.²¹

During the last quarter of the century, this staff had to supervise the daily tasks of their superiors. The two archival series of *ricordanze* and *sommari* reveal the frenetic, hectic activities of Machiavelli's predecessors. On these daybooks, in fact, the secretaries wrote down the 'accounts of the pending facts', such as arrivals and consignments of ammunitions, purchases of raw materials, cash down payments to smiths and carpenters, notes of

¹⁸ Nicolai Rubinstein, *The government of Florence under the Medici* (Oxford 1997), 226-232.

¹⁹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 25, 9r-10v.

²⁰ Guidubaldo Guidi, *Lotte, pensiero e istituzioni politiche nella Repubblica Fiorentina dal 1494 al 1512. II. Gli istituti sovrani e di governo* (Florence 1992), 787-97; Cadoni, *Lotte politiche e riforme istituzionali a Firenze*, 101-75.

²¹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, 320r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 30, 84v-86r; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 3, 11r, 47v.

diplomatic dispatches, requests of condottieri, complaints of subjects, transfers of artisans and infantrymen, and reports of spies and envoys.²²

In September 1486, one of the chancellors reminded laconically to a commissioner that 'a vigorous war attains a better peace'. Other lines concerned a selling of nineteen tons of saltpeter from the Medici bank to the Otto di Pratica, or the supplies of firearms for the towns of the Florentine *Dominio*. A couple of years later, a colleague annotated stage by stage the construction of the citadel of Sarzana, from the carving of the wooden model to the excavation of the moats, from the measurements of walls to the salaries of bricklayers, sketching also the entire plan of the fortress.²³

The contracts between the officers and the architects for similar building site were also regularly transcribed in the books of resolutions. In 1479, several bricklayers labored in Montevarchi, in Pisa, in Colle Valdelsa, and on the hill of the Poggio Imperiale. Domenico di Francesco, nicknamed *Capitano*, received about three hundred florins for his works.²⁴ In April 1485, the Dieci commissioned Francesco di Giovanni and Francesco d'Angelo, better known as *Francione* and *Cecca*, to repair and widen the castle of Pietrasanta, 'in such a way that they can be praised by all the perfect masters'. The officers commissioned also the construction of 'round' or 'square' towers, parapets, and battlements, fixing moreover the date of completion, the penalty clauses, and the remuneration for the two associates.²⁵ The Florentine defensive policy, and the interest of Lorenzo de' Medici in the fortification of the state borders, led soon to other tenders.²⁶

The aforementioned Bernardo Corbinelli, Francesco di Giovanni, Domenico di Francesco, and Francesco d'Angelo, undertake to build the new walls of the fortress of Sarzana, with a remuneration of four *soldi* for every sixty square centimeters of construction. These master promise lay the

²² ASF, Dieci di balia, Ricordanze, 7, 3r, 27v; ASF, Dieci di balia, Ricordanze, 8, 59r, 62; ASF, Dieci di balia, Sommari di missive e responsive, ricordi, 1, 2v, 5v, 10v, 31r, 58r; ASF, Dieci di balia, Sommari di missive e responsive, ricordi, 2, 20v, 22r, 65r.

²³ ASF, Otto di pratica, Minutari di missive e ricordi, 1, 3r-145v. ASF, Otto di pratica, Ricordanze, 1, 6r, 23v.

²⁴ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, 190rv; ASF, Miscellanea repubblicana, 6, 195, 180r.

²⁵ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 24, 107v-109v.

²⁶ Daniela Lamberini, 'Architetti e architettura militare per il Magnifico', in Gian Carlo Garfagnini, ed, *Lorenzo il Magnifico e il suo mondo* (Florence 1994), 407-425. See also Niccolò Machiavelli, *Storie fiorentine* (Florence 1532), 213r.

foundations at their expenses, while the Otto di Pratica, or the Dieci di Balìa, have to supply them with mortar, ashlar, and tools.

The empty spaces between battlements and parapets will be calculated as if they were solid.

For digging moats, from four to five meters deep, the masters will receive one *soldo* and four *denari* for every sixty cube centimeters of excavation.

All the walls that are thirty centimeters thick will be measured as if they were sixty centimeters thick [...].

The empty spaces under the vaults will be calculated as if they were solid.

The masters can use, without any payment, all the stones that belong to the Republic, that is, the rubble of dismantled towers and collapsed walls, within or outside the city of Sarzana.

The empty spaces of doors, windows, arrowslits, and embrasures for bombards, will be considered as if they were solid.

The masters have to erect the walls using only good and serviceable gravel, collecting it from wherever they want, including the banks of the Magra river.

The masters are obliged to realize these walls usefully, like capable craftsmen, according to the heights and the widths of the model accepted by the Otto di Pratica.

The masters come to an agreement with the office to keep the ordered schedule for the construction.

The present Otto di Pratica and their successors, or the Dieci di Balìa, have to pay the masters regularly, so that time cannot be wasted.

Other arrangements were made with stonecutters for '*faciendas et fabricandas*' ashlar.²⁷

Besides, all the bargains with craftsmen are contained in these volumes. In January 1493, for example, the Otto agreed with Johannes from Augsburg on the fabrication of bronze guns in the foundry of the 'old citadel' of Pisa.²⁸

Master Giovanni should make and cast all the undermentioned guns, priced at seventy *lire* every three hundred and forty kilograms of molten metal. He would purchase tools at his expenses, and the Otto di Pratica would supply the raw material, according to custom. The weight loss of these castings should not exceed the seven percent.

Every time he was requisitioned, master Giovanni should manufacture full bombards in one, or two, or three pieces, with a shot weight of one hundred and thirty-five kilograms or more [...]. Giovanni promise to the Otto to realized all these firearms honestly and loyally, like a skillful and capable craftsman.

²⁷ ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 2, 10r-11v, 21r-22v, 43v-44v.

²⁸ ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 5, 96v-97r.

In December 1498, instead, three foreign masters were hired to realize weapons and projectiles in the town of Pistoia, trying to remedy the shortages of the preceding summer, and to foster this indispensable production.²⁹

Giovanni di Piero from Piedmont, Lancillotto di Voglino from Pistoia and Antonio di Giovanni from the Holy Roman Empire are engaged to fabricate cast iron shot, hand guns and harquebuses, and spingards, in Pistoia. The price for thirty-three kilograms of wrought iron are fixed, respectively, at thirteen, twenty, and eighteen *lire*.

We will to advance to them fifty golden florins.

A similar settlement was signed in 1499 by two of the most important gunpowder makers of the Republic, Piero di Zanobi, called *Zucca*, and Jacopo di Corso, also known as *Baia*, entrusted with the monthly manufacture of five tons of propellant in the public facilities of the capital. As for them, the Dieci provided their artisans with all the '*supellectilibus actis ad dictum exercitium pulveris fiende*'. In the following years, *Zucca* and *Baia* would have renewed this '*conducta pulveris*', with an obligation 'to go and to stay' where the Dieci ordered them, and with a salary of six florins per week.³⁰

The Florentine officers employed also masters of gunnery and engineering. The registers listed *bombardieri* coming from the whole European continent. Germans, Frenchmen, Greeks, Italians, boasted their abilities in aiming ordnance, in refining saltpeter, in repairing rotten firearms, and in constructing terrepleins and defenses for the batteries.³¹ Experience and skills belonged also to *ingegneri*. The aforementioned Cecca was capable of carving carts for heavy bombards, fabricating mobile shelters for walls and towers, and crafting incendiary missiles. For more than fifteen years, Filippo di Giovanni, called *Pippa*, was a gunner, a carpenter, and a gunpowder maker. The omnipresent Giovanni di Demetrio worked on several coastal fortifications in the last years of the century, along with Giuliano da San Gallo. Even an elderly

²⁹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 46, 12v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 47, 61r.

³⁰ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 35, 15v-16r, 64v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 46, 52v.

³¹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, ff. 33v-35r, 61r, 107v-108v, and 173v.

Francesco di Giorgio Martini offered his services to the Florentine Republic in 1498, during the victorious campaign in the Pisan countryside.³²

In 1479, also Leonardo da Vinci was sent in San Gimignano, in his capacity as military engineer.³³ With regard to Renaissance artists, Maso di Bartolomeo stored in Florentine arsenals five bronze heavy pieces, in 1452.³⁴ Thirty years later, the Commune commissioned the 'master of bombards' Andrea del Verrocchio to cast a 'beautiful and good' gun for the siege of Pietrasanta. It was a giant firearms of three pieces, and weighed seven tons and a half.³⁵ One of his disciples, Lorenzo di Credi, sold instead several tools for castings to the government, on the occasion of the opening of a new public foundry in the central city area of the Sapienza, in January 1495.³⁶

The series of *deliberazioni, condotte e stanziamenti* contains, above all, a large amount of data and information about the republican army. The registers of *condotte*, for example, consist specifically of clauses of contracts between the Dieci and the captains of infantry and cavalry companies, that is, *connestabili* and *condottieri*. These legal documents specified the duration of the service, the number of soldiers, the monthly or annual salary, always distinguishing periods of peace from times of war. For the drafting of these papers and for the collection of their money, the captains were obliged to nominate a secretary approved by the government. This right-hand man would have stayed in Florence, looking after the relationships between his master and the Commune.³⁷

In the second half of the century, an average *condotta* for a *connestabile* provided for a renewable monthly hiring, a personal remuneration according to the dimension of his troop, and a wage of fourteen *lire* and seventeen *soldi* for each infantryman.³⁸ Regarding the ranks of a company, they were generically subdivided into *connestabile*, double paid 'corporals', and

³² ASF, Dieci di Balìa, Deliberazioni, condotte e stanziamenti, 27, 231r, 275r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 42, 138r; ASF, Dieci di Balìa, Deliberazioni, condotte e stanziamenti, 43, 72v; ASF, Dieci di Balìa, Deliberazioni, condotte e stanziamenti, 44, 103r.

³³ ASF, Dieci di Balìa, Deliberazioni, condotte e stanziamenti, 22, 211r.

³⁴ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 20, 113v, 219r.

³⁵ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 23, 78v, 79r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 30, 249v.

³⁶ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 31, 149v.

³⁷ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 24, 76v-77r.

³⁸ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 46, 11rv.

simple soldiers. In 1498, the dense brigade of Vitellozzo Vitelli had also a 'captain of the flag', a 'lieutenant', a 'governor', a 'standard bearer' and a 'drummer'.³⁹

Some of the principal heads were Niccolò Vitelli from Città di Castello, *Scaramuccia* from Santa Croce d'Arno, Pasqua di Domenico from Arezzo, the marquis Gabriele Malaspina from Fosdinovo, Giovanni della Vecchia from Lodi, Antonello from Pontassieve, Borgo di Matteo Rinaldi from Florence, the count Cecco from Montedoglio, Riccio from Campogialli, and the count Piero from Monte Santa Maria. A contract after another, they served the Republic for ten, twelve, fifteen years, or even more.⁴⁰ Ciriaco di Matteo from Borgo San Sepolcro, for example, started his career in 1467, along with fifty companions. In 1499, he was the leader of six hundred men, and one of the most praised Italian *connestabili*.⁴¹ Many fighters pursued similar careers, such as Donato del Biondo from Arezzo, Gnagni di Piccone from Borgo San Sepolcro, Carlo from Cremona. Someone could also be nominated as '*capitaneum generalem et ducem peditum militiae florentinae*', like Andrea di Matteo from Borgo San Sepolcro, who was appointed to this title by the Otto di Pratica in February 1482, 'considering his admirable virtues, his mastery in the art of war, and his utmost and longtime fidelity'.⁴²

As in the fourteenth century, Florence employed its infantrymen on short term agreements, but the permanence of its 'battle-hardened veterans' lasted long, assuring a certain continuity of leadership in the management of the army.⁴³ Frequently, besides, the military units survived the replacement of individual members. The companies of dead captains were often split between their sons. It is the case of Gilio from Cortona, Vecchia from Lodi, Ugolino from Montedoglio, Pasqua from Arezzo, and many others.⁴⁴ Furthermore, corporals could create their own brigades in the encampment, leaving the ranks of their former masters.⁴⁵

³⁹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 14, 284r-287r.

⁴⁰ See, for example, ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, 31r-102r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 30, 142r-152v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 43, 2r-3r.

⁴¹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 46, 18r; ASF, Miscellanea repubblicana, 6, 195, 163r; Marino Sanudo, *Diari*, II., ed. by Guglielmo Berchet (Venice 1879), 942.

⁴² ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 1, 51r.

⁴³ Caferro, 'Continuity, long-term service, and permanent forces. A reassessment of the Florentine army in the fourteenth century', 229-37.

⁴⁴ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 33, 26r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 34, 48r, 57r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 36, 21r, 25r, 26r, 33r, 34r, 156r.

⁴⁵ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 28, 245v.

The majority of these soldiers came from the whole Tuscany, and especially from the regions of Borgo San Sepolcro, Arezzo, Anghiari, Cortona, and Pisa, and from the mountains of Casentino and Pistoia. Also Florentine citizens were recruited, or offered themselves as volunteers. Mario Vettori, Cornelio Peruzzi, Antonio Strozzi, Bernardo degli Albizi, Benedetto Altoviti, Francesco Tosinghi, Girolamo Guicciardini, all belonged to the cadet branches of some of the most important city families.⁴⁶ Due to the alliance with Giovanni Bentivoglio, numerous Bolognese infantrymen served in the Republican army too. From abroad, moreover, came several companies of Spaniards, Albanians, Sicilians, and Corsicans. Among their leaders were Alfonso and Leonardo Magnares, and Pier Andrea Gentili di Brando, a personal friend of the Magnificent Lorenzo.⁴⁷ Several German and French hand gunners, instead, were recruited in 1479.⁴⁸ Swiss pikemen appeared in rolls only in 1497, when three hundred mercenaries garrisoned Leghorn, causing numerous problems and costing too much money. Their heads, Ridolfo Groffo and Antonio Binder, were demobilized in a hurry. During the same years, the Dieci hired also four hundred Gascons, and another foreign troublemaker, Giovanni Guerrieri, also known as ‘captain fighter’.⁴⁹

Alongside trained infantry, the Florentine officers could rely also on conscript subjects, for their army, and long before the institution of Machiavellian militia. Already in 1450s, the local officers had to choose among the men ‘*magis apti meliusque armis sint muniti*’ of their district, searching them ‘door to door’ on the eves of sieges and assaults.⁵⁰ Usually, these hundreds men were sent in the encampments by the *podestà*, *vicari*, and *capitani* of Pistoia, Poppi, Scarperia, Prato, Castrocaro, and Arezzo.⁵¹

Furthermore, the resolutions underline the relationships between the Dieci, the Otto, and their *condottieri*. Michael Mallett has described this association as distrustful and suspicious.⁵²

⁴⁶ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 33, 24v-48r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, 117r; Luca Landucci, *Diario fiorentino*, ed. by Iodoco del Badia (Florence 1969), 98.

⁴⁷ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, 164r-165v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 28, 241r-245v; Patrizia Meli, ‘Un conestabile corso al servizio di Lorenzo il Magnifico’, *Ricerche storiche* 52, 1 (2012), 39-56.

⁴⁸ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, 38v.

⁴⁹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 42, 34v-35v, 55v, 57v, 69r, 70r; ASF, *Miscellanea repubblicana*, 3, 91, 1v-2r.

⁵⁰ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 20, 76r.

⁵¹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 34, 113v, 116r.

⁵² Mallett, *Signori e mercenari*, 69, 134; id., *L'organizzazione militare di Venezia nel Quattrocento*, 256-57.

Notwithstanding, the registers of *condotte* testify several long-lasting links between the government and its men-at-arms. In 1498, for example, the count Rinuccio from Marsciano could vaunt sixteen years of uninterrupted career in the army, resulted in an appointment as ‘general governor’, a contract for two hundred and five knights, and the patronage of several magnates of the capital. His father, Antonio, had also served the Dieci during the wars with Siena and Genoa.⁵³ The Vitelli family, instead, was helped by Lorenzo de’ Medici to reconquest its stronghold of Città di Castello, in 1482. Several of its members, as Niccolò, Camillo, Giovanni, Paolo, and Vitellozzo, fought for Florence in the course of two decades. Paolo, above all, became the general captain of the Republic, in May 1498, in praise of his ‘virtue and experience’, and with ‘honor, convenience, benefit, and reputation of our state’.⁵⁴

In 1485, instead, six years after his first *condotta*, was the turn of Nicola Orsini, count of Pitigliano, to be nominated *capitano generale*, thanks to his ties with the Magnificent and the Roman Curia.

In primis, the magnificent Nicola Orsini from Pitigliano, count of Sovana, is declared to be hired by the excellent Florentine Republic, under all the terms, pacts, and agreements of the present contract. Considering the virtue and the experience *in rebus militaribus* of the aforementioned count, he is declared to be appointed as the general captain of all the cavalymen and the infantrymen of the excellent Florentine Republic, which have to obey him as their real and legitimate captain, with no exceptions. Furthermore, is declared that the title of general captain implies all the honors, pre-eminences, dignities, and prerogatives of the other past general captains of the excellent Florentine Republic, as the insignia and the baton.

Item, the aforementioned count, along with his state, subjects, and vassals, is declared to be under the protection and the guardianship of the excellent Florentine Republic, throughout the whole term of the present *condotta*. The excellent Florentine Republic promises, *bona fide et toto posse*, to defend the aforementioned count, his state, his subjects, and his vassals, from all of his enemies.

Item, the *condotta* of the aforementioned, magnificent count is declared to last three years, starting from the first day of March 1485. Any possible annual prolongation had to be asked at least three months before the expiration of this contract.

⁵³ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 27, 110v-115v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, 2v-3r.

⁵⁴ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, 31r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 24, 58v-59r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 27, 250v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 43, 98v-99v, 111v.

The salary of the aforementioned count is declared to amount to thirty thousand florins, in time of war, under the express condition that he will serve the excellent Florentine Republic with one hundred and ninety lances and forty light horses among mounted crossbowmen and *stradiotti*. Every lance has to be composed of four men and four horses, including a good and strong animal for the man-at-arms. The knights have to be expert and experienced in the profession of arms, according to the customs of Italian companies.

However, in times of peace, the aforementioned, magnificent count is declared to be remunerated fifteen thousand florins, and has to maintain one hundred men-at-arms and twenty light horses among mounted crossbowmen and *stradiotti*.

Item, the aforementioned wages has to be paid in silver *grossoni*, with a deduction of six and a half percent [...].

Item, a *prestanza* of six monthly salaries has to be advanced to the aforementioned, magnificent count, in times of war. During campaigns, he has to receive the rest of his annual wage every two months. Once a year, within forty days after the receipt of the *prestanza*, the Signoria, or the Dieci di Balìa, or the Otto di Pratica, could request from him a roll of his company. The reviews of men, weapons, and horses, instead, have to be carried out whenever the officials ordered them [...].

Item, is declared that the aforementioned count, faithfully and *toto posse*, with his person and his company, has to serve the excellent Florentine Republic, going, staying, fighting, and riding wherever and whenever its officials ordered him, and against any king, prince, baron, and lord, city, castle, and company, and men, whatever their dignities, conditions, and pre-eminencies. The count swears to obey all the commands of the Signoria, of the Dieci di Balìa, of the Otto di Pratica, and of all their general commissioners.

Other terms of this long contract concerned immunities, exemptions, rewards, and prisoners. With similar pacts, in the same year, also Gentile, Virginio, Giulio, and Giampaolo Orsini followed their relative in Tuscany.⁵⁵

Other neighboring lords were involved in this politics of recruitment and alliance, in order to secure the borders of the Florentine territory.⁵⁶ Jacopo IV Appiano from Piombino, Annibale and Ercole Bentivoglio from Bologna, Giampaolo, Guido, Astorre, and Ridolfo Baglioni from Perugia, Ottaviano, Astorre, and Galeotto Manfredi from Faenza, Ottaviano Riario from Forlì, Costanzo Sforza from Pesaro, and the dukes of Urbino, Federico and Guidubaldo from Montefeltro, were repeatedly hired during the last quarter of the century.

⁵⁵ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 25, 71rv; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 30, 100v-106r, 114r-118r; Christine Shaw, 'Lorenzo de' Medici and Niccolò Orsini', in Gian Carlo Garfagnini, ed, *Lorenzo de' Medici. Studi* (Florence 1992), 257-79.

⁵⁶ Machiavelli, *Storie fiorentine*, 213r.

Their companies were organized into 'lances', or 'helmets', or 'cuirasses', each comprising 'one men-at-arms, one mounted squire, one light horseman, and a transporter for the luggage', according to the Italian practices.⁵⁷ Eighteen, twenty, twenty-five, or thirty heavy knight formed a squadron. These ranks were composed of veterans, relatives, sons, friends, clients, recommended soldiers, all coming from the whole Peninsula.⁵⁸ During campaigns, every man-at-arm was on a salary of one hundred florins per year, always according to contemporary customs. Their heads, instead, received a proper remuneration, a *piatto*, depending on their fame and their skills, and a *presta*, a payment in advance, for arming their brigade.

The duration of the *condotta* varied from one to five years, and the number of heavy knights between ten and two hundred and fifty. On the whole, Florence could have at its disposal several hundred lances. In the spring of 1479, they were one thousand and sixty-five, excluding the allied cavalry. In 1486, nine hundred and ninety-five. During the war against Pisan rebels, they amounted to eight hundred.⁵⁹ Along with men-at-arms, the Dieci and the Otto enlisted also several contingents of light cavalry, and especially numerous mounted crossbowmen, employed in explorations, escorts, and sacks. Each *balestriere a cavallo* earned five florins per month.⁶⁰ Two hundred florins, instead, was the wage for forty *stradiotti*, the frightening, ruthless Albanian mercenaries. The brigades of Michele Musacchio and Dimitri Progazononos remained on the Florentine rolls for more than a decade.⁶¹

The contracts of men-at-arms provided also for exemption from duties, for free hay and firewood, and, above all, for free quarters. Contrarily to other Italian states, the problem of barracks seemed to be not so nagging, for the Dieci and the Otto. Usually, the cavalry companies were ordered to stay in the plains nearby Arezzo and Pisa, that is, Valdiserchio,

⁵⁷ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, 92r, 102v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 43, 99v-100r.

⁵⁸ del Treppo, 'Gli aspetti organizzativi, economici e sociali di una compagnia di ventura italiana'; Pezzolo, 'Professione militare e famiglia in Italia tra tardo medioevo e prima età moderna', 352-61.

⁵⁹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, 80r-81v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 28, 184r-188r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, 2rv.

⁶⁰ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, 7rv. See also Pieri, *Il Rinascimento e la crisi militare italiana*, 371-72.

⁶¹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 30, 150r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 45, 169v.

Valdichiana, and Valdarno, where *'dictas gentes commodius possa morare'*.⁶² Officers examined 'diligently' the quantity of troops and horses that towns and cities could accommodate, while commissioners preceded marching brigades in order to prepare and assign the *stanze*. They tried to avoid disparity in distributions of brigades, complaints of the subjects, and dishonest and criminal behaviors of both inhabitants and soldiers, such as raising of prices on local markets, blackmails, and request for money. They rather encouraged 'friendly manners', but with scarce results.⁶³ The *compagnie* of the neighboring *condottieri* were often, astutely sent back in the territories of their leaders and lords, saving money and preventing protests.

The infantry companies, instead, were reduced to thirty, forty elements, during winters, and entrusted with the garrison of several castles and villages, from Fivizzano, in Lunigiana, to Valiano, on the Sienese border. In the zones behind the front, their number could be increased until one hundred and fifty men, according to the strategic relevance of the post. Florence and Pisa had a proper guard, as well as the principal citadels of Sarzana, Pietrasanta, Leghorn, Volterra, Arezzo, and Cortona.⁶⁴ All of these fortifications, *'secundum ordinamenta'*, were regularly inspected by two members of the Otto or the Dieci, *'pro muniendo et providendo de munitionibus et victualis'*. The officers consulted *rettori* and *connestabili*, compiled inventories of weapons and rations, noted the necessary repairing, and wrote down the ability of the defenders. In 1489, Niccolò Ridolfi and Lorenzo Carducci visited fifty-six fortresses on the frontiers with Romagna, Umbria, and Liguria. A similar task was accomplished in the following years by Pierantonio Soderini, nominated general commissioner on purpose.⁶⁵

As in encampments as in towns, knights and foot soldiers were also frequently reviewed by the 'ordinary' inspectors of the Republic. During the whole century, this *rassegna* was composed by an official of the Condotta, a notary, a blacksmith, and a servant, *'ad scribendum*

⁶² ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 45, 82v-83r, 168v.

⁶³ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 21, 107v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 24, 138v, 140rv, 143v-144r, 156rv, 182r.

⁶⁴ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 25, 40r-44r, 226v-227v; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 3, 20r, 22v; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 5, 71r-88r.

⁶⁵ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 21, 163v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 24, 73v-74r; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 1, 52v; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 3, 75rv; ASF, Miscellanea repubblicana, 6, 205, 1r-31v.

comitivas'.⁶⁶ This squad had to verify the presence of the entire brigade of a *condottiero* or a *connestabile*, checking the quality of its armaments, the brands of horses, and the state of men.⁶⁷

We have hired again Leonardo di Niccolò from Florence, along with thirty companions. Now, you have to write a list of these men, specifying their names, their patronymics, and their birthplaces, and describing their marks, their hair, and their beards. You must not accept local inhabitants nor boys. We desire to have at our disposal adequate men, who are worth their pay of two florins.

Also the regulations on the conduct of garrisons were strict, regulating the activities of the troops and the relationships between civilians and soldiers.

The brigade must not leave the castle without your permission, and only a man in ten can stay the night outdoors. The absentees must be punished with by fines, or even by removal.

When the reviewers arrive, you have to ring the bell of the fortress for a quarter of an hour. After this time, the missing soldiers will incur penalties.

These infantrymen must not work in the shops nor in the markets of the city.

The reports of the *rassegna* were then used for eliminating 'useless pay', and demobilizing several infantrymen '*de minus utilis et sufficientibus*'.⁶⁸

Lastly, the books of resolution permit to reconstruct the whole structure of the Florentine institutions, through the elections and the appointments of its employees, like the 'overseer', the *provveditore*. He was in charge of the relationships with the manufacturers of ammunitions, the drafting of purchase agreements, and the revision of the accountancy. At the end of the century, due to the increased war demand, he was helped by two

⁶⁶ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 20, 6v, 8v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 43, 49v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 50, 105v.

⁶⁷ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 25, 32r; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 5, 12r.

⁶⁸ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 25, 227rv; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 3, 3r, 18v, 22v,

sottoprovveditori, who were particularly responsible for acquiring and inventorying ammunitions.⁶⁹

In those years, in the capital worked also the keepers of the arsenals, that is, the gunpowder facility on the southeastern bank of the Arno, and the '*arce Notomiae*', the 'lookout tower' placed on the opposite side of the river. The Dieci assigned Michele di Jacopo di Baldino Compagni to reside in the turret, to test new guns, to weigh saltpeter and gunpowder, to review the artillery of the republican fortresses, to consign arms and armor to the army, and to buy materiel retail. His colleague, Gaspare di Antonio Pasquini, was elected in April 1485, and was still serving in June 1499.⁷⁰ Additional '*ministri supra munitionibus*' were temporarily nominated during the whole *Quattrocento*, in times of war.⁷¹

Many other 'ministers' were present in the encampments, in most cases entrusted with the equipment of the troop. These 'particular commissioners' were assigned '*ad levandum et conducendum in castra armorum ductores*', '*ad scribendum et rassignandum milites tam equestres quam pedestres*', '*ad providendum de victualis*', and '*ad dandum stationes*'.⁷² They provided for the distribution and the sale of ammunitions, the quarters of troops, the daily cash payments to soldiers and craftsmen, the satisfaction of *condottieri* and *connestabili*, the management of ordnance, the control over intractable pioneers and conscripts. Above all, they supervised the indispensable supplies of food and hay, arranging nourishment markets, the so-called *canove*, facilitating the influx of bread and wine from the surrounding villages, and coordinating transporters, bakers, and peasants.⁷³ The justice, instead, was abruptly administered by a 'jailer', an *aguzzino*, and his twenty or thirty companions, including an executioner.⁷⁴ For the 'mobile city' of their army, the Dieci paid also chaplains and doctors. The sources of 1498 register a priest and six 'barbers' and surgeons.⁷⁵

⁶⁹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 31, 17v; Guidi, *Lotte, pensiero e istituzioni politiche nella Repubblica Fiorentina dal 1494 al 1512*. II. *Gli istituti sovrani e di governo*, 787-97.

⁷⁰ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 25, 213r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 46, 77r. See also Fabrizio Ansani, 'Geografie della guerra nella Toscana del Rinascimento. Produzione di armi e circolazione dei pratici', *Archivio Storico Italiano*, 651 (2017), 81-83.

⁷¹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 20, 112r, 236v.

⁷² ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 45, 89v, 95v, 135v, 168v.

⁷³ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 30, 228r-286r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 35, 97r-98r.

⁷⁴ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, 103v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 41, 43v.

⁷⁵ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, 33v-34r.

The responsible for all of these appointees were the *commissari generali*, the ‘general commissioners’ of the Republic. The Dieci and the Otto conferred on them ‘the same absolute authority’ of the offices, a ‘*potestas in rebus tantum ad bellum, bonam custodiam et munitionem locorum et passuum spectantibus*’, as in the whole Florentine territory as abroad.⁷⁶ These plenipotentiary had full powers to take actions and make decisions, to order and solicit, to hire and negotiate on behalf of the state. They belonged to the most influential and eminent families of the capital, now linked with the regime, now associated with the various city factions. Mallett has expressed serious doubts about their preparation and the continuity of their duties, but the documentation highlights a recurrent selection of the most trained and experienced men as leaders of military enterprises.⁷⁷ It is the case, for example, of Piero Capponi, Piero Vettori, Pierfilippo Pandolfini, Bongianni Gianfigliuzzi, Piero Corsini, Antonio Giacomini, Luca degli Albizzi, Jacopo and Luigi Guicciardini, who were directly involved in the direction of the principal campaigns of the last three decades of the century, from the siege of Volterra to the Pisan war, from the conquest of Sarzana to the invasion of Lazio. They were acquainted with the first condottieri of their time, such as Gian Giacomo Trivulzio, the ‘duke of Calabria’ Alfonso of Aragon, Federico from Montefeltro, Nicola Orsini, Paolo Vitelli.⁷⁸ The republican general commissioner had undoubtedly a wide knowledge of conflicts and their issues, apart from the official duration of their task.

Allocations, incomes and expenditures, and debtors and creditors

If money were the proverbial ‘*nervus belli*’, one of the key figures of the Dieci di Balìa was certainly their treasurer, the *camerlengo*, or *camerario*, chosen from the city merchant bankers.⁷⁹ Among these magnates were Piero Mellini, Francesco Scarfi, Filippo Ginori, Alfonso Strozzi, Benedetto del Giocondo, and Carlo Gondi, all belonging to influent Tuscan companies. They administered the considerable military funds of the Florentine state, collected from public debt, tax farming, forced loans, voluntary offers, *catasti* and *decime*, fines and

⁷⁶ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 45, 155v.

⁷⁷ Mallett, *Signori e mercenari*, 134-35.

⁷⁸ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 22, 213r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 24, 89r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 30, 286r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 36, 193v, 196r, 197v; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 37, 1r-46v; ASF, Balie, 34, 3v, 5r;

⁷⁹ Guidi, *Lotte, pensiero e istituzioni politiche nella Repubblica Fiorentina dal 1494 al 1512*. II. *Gli istituti sovrani e di governo*, 796.

deductions from soldiers' wages. In urgent needs of money, they also had to personally advance hundreds of florins.⁸⁰

At the present, the scrupulous, quotidian work of *camerlenghi* is cataloged in various, numerous registers. The allocations, the *stanziamenti*, are included in the aforementioned *deliberazioni*. The records of incomes and expenditures and the books of debtors and creditors, instead, are part of two distinct archival series, that is, the *entrata e uscita* and the *debitori e creditori* of the Dieci. The Otto di Pratica, on the contrary, have not produced any significant volume of accountancy. Their office, in fact, did not comprise a treasurer, but only a simple 'depositor', a *depositario*. The 'cashier', the *cassiere* of the *Camera del Comune* managed their finances, along with expenses and revenues of the whole Republic.⁸¹

Written by chancellors, the *stanziamenti* were brief, concise notes of the payments made by the Dieci, divided in two major categories. The first group concerned the personnel, *condottieri*, *connestabili*, gunners, engineers, and guards, whose salaries had to be obligatory approved by the Signoria. The second one included the wages of secretaries, commissioners, envoys, craftsmen, transporters, reimbursement for extraordinary remittances, and the procurement of arms, equipment, and food.⁸²

The books of allocations itemized the price of services and products, declaring the figures of raw materials and ammunitions, the cost of the rent of mules and oxen, as well as the remunerations for the *ministri* and the length of their appointments. A *commissario generale*, for example, could earn sixteen *lire* and thirteen *soldi* per day. A *provveditore* received four florins every month, the *camarlingo* seven florins, the keepers of magazines two florins. In the encampments, a carpenter could earn six florins, a doctor ten florins, a stone cutters five florins, a baker thirty *lire*, a spy up to twenty-five florins. But the examples, in general, are innumerable. Goods had different prices, according to their material, their availability, their demand. A solid cart for cannons had an average value of three florins, a breastplate of six florins and a half, a bronze spingard of fifteen florins, thirty-three kilograms of refined saltpeter of fifty florins, a spear of sixteen *soldi*, and so on. The counts could include also nails, harquebuses, wooden grips, hoes, shovels, ramrods, horseshoes, harnesses,

⁸⁰ Anthony Molho, 'Lo stato e la finanza pubblica. Un'ipotesi basata sulla storia tardo medioevale di Firenze', in *Origini dello stato*, 235-44.

⁸¹ Lorenzo Tanzini, 'Il più antico ordinamento della Camera del Comune di Firenze. Le provvisioni canonizzate del 1289', in *Annali di Storia di Firenze* 1 (2006), 139-40.

⁸² ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 46, 1r.

saddles.⁸³ The spending was increased also by the gifts for foreign ambassadors and the celebrations for the arrivals of important guests, by the constant monetary requests of Florentine envoys, by the rewards for troops and luxury armor for captains, by the subventions for wounded soldiers, by the expensive textiles for flags and insignia, by the compensation for dead horses and captured beasts of burden, by the corruption of enemy officers, by the decryption of letters in cipher, by new projects for fortifications, by the widening of arsenals, by the continuous reconstruction of the port of Leghorn, by the countless, little, leather bags necessary for transporting money, by the exchanges rates of the different currencies, by the maintenance of artillery, by the postal services, by the recruitment of pioneers, by the purchases of new furnishing and new jotters for the chancery, and by the pay of both *capitano della piazza* and *capitano del contado*, that is, respectively, the guard of the capital and the 'police' of its whole dominion.⁸⁴

The costs of the daily management of an encampment were written by *commissari generali* and *camerlenghi di campo* on separate accounts, subsequently handed to the general treasurer.⁸⁵ The sole surviving volume of this kind listed the salaries of gunners, woodworkers, smiths, mule and ox drivers, stone cutters, bricklayers, boatmen, and postmen, all present in the camp of Pontedera during the summer of 1496. Moreover, it contains the *condotte* drawn up by the commissioners, and the monthly payments for the officials employed on food, guns, transportations, and pioneers.⁸⁶

In 1480s, accountants were present also in the zones behind the front, where the supplies were produced, stored, and dispatched. At the time of the siege of Pietrasanta, the customs officer of Pisa, Francesco Cambini, registered 'what I have bought and from who, who has paid, where I have send everything, and who has received it', compiling twelve notebooks,

⁸³ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 27, 220v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 41, 160v-161r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 46, 123v-124r, 128r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, 100v, 118v, 124v.

⁸⁴ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 27, 250rv, 251v, 257r, 258r, 263r, 265r, 268v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 30, 202v-203r, 206r-208r, 218v, 225v-226r, 233v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 33, 119v-120r, 133r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 34, 91r, 141r-143r, 260v-265r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 43, 40v, 52v, 84r, 90r

⁸⁵ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 34, 117r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 41, 83r.

⁸⁶ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 38, 1r-42v.

a ledger, and a résumé. In 1486, in Montepulciano, Bartolo Tedaldi noted all the consignments of wheat and bread ordered for the army stationed in Bracciano.⁸⁷

Like the balance sheets of contemporary business company, the accounting of the Florentine military institutions was precise and analytical. It consisted of several, different registrations, with numerous cross-references, in order to facilitate calculations and audits, payments and settlements. The allocations approved by the government, for example, were transcribed on the books of incomes and expenditures, now summarizing, now detailing the information. These *libri* were periodically examined by two state accountants, the *sindaci del Monte*, and were personally compiled by the *camerlenghi*.⁸⁸ The treasurers, moreover, could compare the data with the chronological entries of their general journals, the so-called *quaderni di cassa*.⁸⁹ Also the overseers had their proper *giornali*, which contained contracts, promises, memoirs, minor expenses, and inventories of the chancery of the Dieci.⁹⁰

In the last years of the century, the *provveditore* and the keepers of the arsenals archived also the accounts of several artisans, merchants, and commissioners. The subjects of these *libri dei conti* are obviously the most disparate. In July 1499, for example, Francesco Spina reported the costs of four hundred and sixty cast iron cannonballs and eight hundred and eighty wrought iron shot. In the same weeks, Ludovico di Niccolò wrote down the rent of an ironwork in Colle Val d'Elsa. Michele di Jacopo di Baldino Compagni noted all the transactions of tiles and beams for the roof of the tower of *Notomia*, and all the names of the bricklayers and carpenters and transporters that had collaborated with him on the construction. Other *conti* concerned the supplies of raw materials for the craftsmen of the public workshops, the procurement of steel bolts and bronze culverins, the wages of soldiers, technicians, and spies, and even the trades of hammers, nails, reams, wires.⁹¹

Furthermore, the earnings of practitioners are also testified by the books of debtors and creditors, compiled by the overseers using a double-entry bookkeeping system.⁹² Thanks to

⁸⁷ ASF, Dieci di balia, Entrata e uscita, 10, 1r; ASF, Dieci di balia, Entrata e uscita, 11, 6r.

⁸⁸ ASF, Dieci di balia, Entrata e uscita, 8; ASF, Dieci di balia, Entrata e uscita, 13; ASF, Dieci di balia, Entrata e uscita, 30.

⁸⁹ ASF, Dieci di balia, Entrata e uscita, 12; ASF, Dieci di balia, Debitori e creditori, 41, 1r.

⁹⁰ ASF, Dieci di balia, Entrata e uscita, 23, 1r, 192r, 382r.

⁹¹ ASF, Dieci di balia, Entrata e uscita, 13, 156v-160v, 179r-180r, 190v-191r, 237v-239r; ASF, Dieci di balia, Entrata e uscita, 26, 195r-204r, 208rv, 320r, 320v-321r, 321v-347v.

⁹² For the relations between business and warfare, see John Hale, *Guerra e società nell'Europa del Rinascimento*, 236-49; William Caferro, 'Warfare and economy in Renaissance Italy', *The Journal of*

these registers, above all, it is possible to analyze the global expenses of the Dieci di Balìa, their investments in single sectors, and the trends of their expenditures. At the end of every volume, in fact, a balance sheet states the amount of money disbursed by the officers during their semester. From June to December 1498, during the offensive against the Pisan rebels and their Venetian allies, the officials spent about two hundred thousand and forty-three thousand golden florins.⁹³

Postmen, 1600 golden florins
Minor expenses, 277 golden florins
Spies, 1166 golden florins
Ammunitions, 6056 golden florins
Transports, 2239 golden florins
Pioneers, 73 golden florins
Garrisons, 625 golden florins
Staff of the office, 740 golden florins
Condottieri and men-at-arms, 34311 golden florins
Mounted crossbowmen, 5306 golden florins
Interests, 258 golden florins
Connestabili and infantrymen, 66739 golden florins
Commissioners, 4916 golden florins
Gunners, 1425 golden florins
Artisans, 5133 golden florins
Extraordinary expenses, 2915 golden florins
Back debts, 109735 golden florins

In times of war, the salaries of cavalymen and foot soldiers multiplied the overall costs. The wages for the operation against Volterra, in 1472, amounted to thirty-two hundred golden florins. For resisting the assaults of the Imperial army, in 1496, the Dieci paid their troops more than one hundred thousand and thirty thousand golden florins. For the siege of Pisa, in 1499, the *connestabili* only came to fifty-eight thousand golden florins.⁹⁴ Regarding this campaign, the chronicler Piero Parenti calculated that the conflict had a daily cost of one thousand and six hundred florins.⁹⁵ According to the official accounting of the government, one million and a half golden florins were the price of five years of wearing fights.⁹⁶

Interdisciplinary History, 39, 2 (2008), 198-200; Enzo Baraldi, 'Una nuova età del ferro. Macchine e processi della siderurgia', in Philippe Braunstein and Luca Molà, eds, *Il rinascimento italiano e l'Europa*, III. *Produzione e tecniche* (Treviso 2007), 214-16.

⁹³ ASF, Dieci di balìa, Debitori e creditori, 39, 293r.

⁹⁴ ASF, Dieci di balìa, Debitori e creditori, 20, 94v; ASF, Dieci di balìa, Debitori e creditori, 29, 247r, 252r, 254r; ASF, Dieci di balìa, Debitori e creditori, 45, 329v.

⁹⁵ Parenti, *Storia fiorentina*, II., 186, 190, and 194.

These 'bad times' required determined efforts and drastic measures to raise the public revenues. The tax burden escalated sharply since the first decades of the century.⁹⁷ The Neapolitan pressure on the southern borders, in 1451, solicited the *tassa dei traffichi* on the capitals of partnerships. After the disastrous events of 1480, the Republic promulgated a new *catasto*, a general survey on the business investments, the holding in public debt, and the real property of the inhabitants of the whole Florentine dominion. The reconquest of Pisa, in 1495, urged the imposition of an annual tithe on the incomes from immovable possessions of citizens and peasants.⁹⁸

The expanding price of warfare, besides, was contributing to worsen the problem of the public debt, thus stabilizing economic relationships based on political dependences. In fact, during wartime, loyal bankers and devoted merchants could concede short-term loans, the so-called *prestanze*, consolidating their position inside the ruling 'financial oligarchy', and permitting the government to collect large sums of ready cash.⁹⁹ According to John Najemy, the early Milanese conflicts represented 'the beginning of the commune's dependence on its wealthiest citizens.'¹⁰⁰ After the Pazzi's plot, more than three hundred thousand golden florins were annually borrowed from the citizenry. In 1495, four hundred thousand golden florins were accumulated 'for preserving freedom.'¹⁰¹

Although financiers made profits on their agreements with the Commune, the small investors often faced the insolvency of the public investment funds, that is, the *monte comune* and the *monte delle doti*. The government, in fact, frequently failed to pay interest on their

⁹⁶ ASF, Dieci di balia, Entrata e uscita, 15, 178v, 315r; ASF, Dieci di balia, Debitori e creditori, 29, 255v; ASF, Dieci di balia, Debitori e creditori, 30, 293v; ASF, Dieci di balia, Debitori e creditori, 34, 238v; ASF, Dieci di balia, Debitori e creditori, 39, 292v; ASF, Dieci di balia, Debitori e creditori, 40, 202v; ASF, Dieci di balia, Debitori e creditori, 43, 272v; ASF, Dieci di balia, Debitori e creditori, 45, 329v; ASF, Dieci di balia, Entrata e uscita, 15, ff. 178v and 315r.

⁹⁷ Elio Conti, *L'imposta diretta a Firenze nel Quattrocento* (Rome 1984); Anthony Molho, *Florentine public finances in the Early Renaissance* (Cambridge 1971); Gene Brucker, 'The economic foundations of Laurentian Florence', in *Lorenzo il Magnifico e il suo mondo*, 11-15.

⁹⁸ Otto Karmin, *La legge del catasto fiorentino del 1427. Testo, introduzione e note* (Florence 1906); Anthony Molho, 'The Florentine *tassa dei traffichi* of 1451', *Studies in the Renaissance*, 17 (1970), 73-118.

⁹⁹ Louis Marks, 'The financial oligarchy in Florence under Lorenzo', in *Italian Renaissance Studies*, ed. Ernest Jacob (New York 1960), 123-147; Lauro Martines, 'Forced loans. Political and social strain in *Quattrocento* Florence', *The Journal of Modern History*, 60, 2 (1988), 300-311.

¹⁰⁰ John Najemy, *A history of Florence* (Oxford 2006), 191.

¹⁰¹ Benedetto Dei, *La cronica*, ed. Roberto Barducci (Pisa 1985), 103; Piero Parenti, *Storia fiorentina*, I., ed. Andrea Matucci (Florence 1994), 92, 110, 114, and 168.

obligations, earmarking money for waging wars. One hundred thousand golden florins, for example, were diverted from repayments to the salaries of troops, in 1472.¹⁰²

Ammunitions

In 1498, a general commissioner lamented that 'soldiers would be useless, if we did not supply them with arms'. In those months, the equipment of eight thousand men compelled the Dieci to buy thirty-two bronze pieces of heavy artillery, as well as dozens hand guns, hundreds shots of various forms, thousands darts, and several tons of saltpeter and gunpowder.¹⁰³

The purchases and the consignments of these weapons were annotated on two different records. The first, written by the keepers of the magazines or by one of the two *sottoproveditori*, was a 'book of incomes and expenditures for ordnance, ammunitions, food supplies, and transporters', a journal with chronological entries and detailed information about the quality of the armament. The second, instead, was compiled by the other *sottoproveditore*, and was a volume of debtors and creditors, intended exclusively for arms. It contained reports on the output levels of the Florentine workshops, the exact number of spears, cuirasses, carts, harquebuses, bobbins of bowstring, barrels of powder, sacks of nitrate, spingards, and cannons, traded with the Republic by dealers and craftsmen.

The inventories and data of the series of the *munizioni* document all the branches of this lively industry, and also their connections with the market of the Peninsula, through the negotiations of ambassadors and the commerce of local and foreign merchants.¹⁰⁴ Moreover, they underline the role of the state in introducing innovative tools, in fostering technical developments, and in encouraging the migrations of practitioners towards the capital. Already in 1430s, Florentine gunmakers experimented with cast iron guns, 'organ' firearms, bronze breeches, and corned powder.¹⁰⁵ Twenty years later, the tradition of artistic bronze sculpture was helping the fabrication of giant bronze bombard to progress. In 1484, the principal Florentine *bombarda* could fire an impressive stone missile weighing two hundred and thirty

¹⁰² Anthony Molho, 'Debiti pubblici ed interessi privati nella Firenze tardomedievale', in *La Toscana al tempo di Lorenzo il Magnifico. Politica, economia, cultura, arte* (Pisa 1996), 825-838 and 850-854; Id., 'The state and public finance. A hypothesis based on the history of late medieval Florence', *The Journal of Modern History* 67 (1995), 97-135.

¹⁰³ Fabrizio Ansani, 'Supplying the army. 1498. The Florentine campaign in the Pisan countryside', to be published in *The Journal of Medieval Military History*.

¹⁰⁴ ASF, Dieci di balia, Munizioni, 7, 355rv, 394v.

¹⁰⁵ ASF, Dieci di balia, Munizioni, 1, XLVIIIr, Lv, 144v, 161r.

kilograms. And when Charles VIII descended into Italy, in 1494, the Dieci immediately commissioned several new cannons, assimilating the patterns of the renowned French royal ordnance in the city production. Furthermore, the officers invited Transalpine and Lombard masters to collaborate with their artisans.¹⁰⁶

This public interests in arms procurement can be deduced also from the involvement of the principal Florentine banks in the supplies of raw material. The companies of Bardi, Capponi, and Berti frequently sold large amount of copper to the military offices. As a ruler, as a merchant, and as a member of the Otto di Pratica, Lorenzo de' Medici was aware of the necessity of making the sale of saltpeter a sort of monopoly of his firm and of his government.¹⁰⁷ He tried also to establish new armor industries in Pisa, a few months before his death, in collaboration with Tommaso Marinai, the owner of several mines in the region of Montecatini.¹⁰⁸ In 1485, instead, the Magnificent effectively ordered the construction of a foundry in the centre of Florence, entrusting it to one of the most famous Italian gunmaker of the late fifteenth century, Alberghetto Alberghetti from Ferrara.¹⁰⁹

This furnace of the *Sapienza* was not the only public facility of the Republic. For the whole century, on the contrary, the manufacture of arms and armor was polycentric, complementary, and integrated. Weapons factories were opened in Pisa in 1480s. Smiths labored in the vicinity of the capital, in Grassina, in Villore, in Ricorboli, and in Figline, producing arrowheads and *scoppietti*. Woodworkers cut the shafts of uncountable arrows in the forest of Pratomagno, nearby Arezzo. The ironworks of Colle Val d'Elsa realized metal projectiles. Mills for the powder were present in Leghorn. Pistoiese spears were bought also in Lucca and in Siena. Aragonese companies purchased pavises, shields, and leather articles in Borgo Sansepolcro.

By the end of *Quattrocento*, figures leave the impression of an high, improved productivity. At the eve of the French invasion, in 1494, the mills of Florence and Pisa could fabricate more than thirty thousand kilograms of powder. One year later, the most important smith of the capital, Baldassarre di Giovanni, could made three hundred and fifty harquebuses, thirty *scoppietti*, and fifty spingards in his *bottega*. During the summer of 1498, the Republican gunmakers manufactured about thirty cannons. The Florentine arsenals, besides, were kept up to date. In 1472, Volterra was attacked with eight, giant bronze guns. In 1479, during the

¹⁰⁶ ASF, Dieci di balia, Munizioni, 5, 32r.

¹⁰⁷ ASF, Otto di pratica, Munizioni, 1, 15v.

¹⁰⁸ ASF, Carte Riccardi, 816, 98.

¹⁰⁹ ASF, Dieci di balia, Entrata e uscita, 8, 129v; ASF, Dieci di balia, Debitori e creditori, 24, 91v.

Neapolitan invasion of the southern borders, the Dieci could dispatch two thousand hand guns and seven hundred spingards, securing three hundred and twenty-nine towns. In 1499, the Florentine camp was provided with more than thirty tons of gunpowder and about eighty firearms, between customary bombards and recent culverins.¹¹⁰

Conclusions

The analysis of the numerous tomes of the correspondence of the Dieci and the Otto highlights, once again, all the activities and all the interests of both the institutions. The series of *missive* contain the commands, suggestions, and complaints sent from the Palazzo dei Priori to captains, commissioners, and servants. The notorious books of *legazioni and commissarie*, instead, include the instruction for ambassadors and envoys. Last but not least, the *responsive* give voice to the daily duties of *commissari* and *rettori*, *connestabili* and *condottieri*, comprising news from the encampments, agreements with merchants, descriptions of battles and sieges, plans for campaigns, requests of money, orders of ammunitions, failures and defeats, and all the various issues of Renaissance wars.

Therefore, at the beginning of the sixteenth century, the administration of the newer and the older military institutions, the Nove Conservatori di Ordinanza e Milizia and the Dieci di Balìa, could rely on firm practices. Since 1494, in fact, the restoration of the Republic, the necessity of more transparency in the governance of military affairs, the long war against Pisa, and the continuous dangers to the same existence of the Florentine state, had compelled the officers to enhance their former archival management and to accelerate the creation of a larger communication network.¹¹¹ As described on the previous pages, however, the production of documentation had already been increased by the formation of permanent offices, in 1480. Besides, the concepts and the formulas of the registers of *munizioni*, *deliberazioni*, *entrata* and *debitori* were not an unusual novelty, at that time. On the contrary, their structure dated back to the first decades of the *Quattrocento*. In the fonds of the '*decem commissaris et officialibus guerre communis Florentiae*' it is possible to find accounts and

¹¹⁰ For the production and the procurement of arms in fifteenth-century Florence, see Fabrizio Ansani, 'Craftsmen, artillery, and war production in Renaissance Florence', *Vulcan*, 4 (2016), 1-22; id., 'The life of a Renaissance gunmaker. Bonaccorso Ghiberti and the development of Florentine artillery in the late fifteenth century', *Technology and Culture*, 58, 3 (2017), 749-80; id., 'Geografie dalla guerra', 73-117.

¹¹¹ Guidi, *The Florentine archives in transition*, 470.

resolution for the siege of Lucca in 1430, for the battle of Anghiari in 1440, and even letters from 1384, the year of the purchase of the city of Arezzo.

The abundance, the continuity, and the content of these sources refute the biases of the traditional, historiographical 'orthodoxy'. They indicate that Florentine statesmen did not treat with thoughtlessness and improvisation wars which could have hindered the commerce of their banks, or menaced the sacred freedom of the Republic. They managed attentively not only the hostilities, but also their social, economic, and political dynamics. Thus, the periodical crisis of the public debt bolstered the unity of the oligarchy.¹¹² In the same way, the condotte strengthened existing patronage links, permitting an indirect control over the ruling factions of the peripheral towns of the Dominion, and securing the hold on the surrounding minor lords.¹¹³

The policies of officers were not backward, nor inefficient, considering, above all, their consciousness of 'being the fifth power of Italy' and the modesty of their military purposes.¹¹⁴ On the contrary, the large sums invested on warfare, the precision of the accounting, confirm their regard for conflicts. The whole administration became more systematic and more professional, in order to collect larger revenues and cover the heavy costs of campaigns.¹¹⁵ And numerous contracts revealed the willingness to support a permanent army and the intention to innovate the technology of its weapons.¹¹⁶

This efficiency in procurement and recruitment, however, did not always result in success. Victories and defeats, in fact, were determined by different factors. During the Pazzi's War, the Venetian aid of the was inconsistent with the pressing requests of the Commune. This scarcity of troops, along with the lack of a strong military guide, allowed the enemy to seize numerous border towns.¹¹⁷ The precarious situation was worsened also by the outbreak of the plague. And the invasion, above all, led to a major financial crisis, with the state under the threat of bankruptcy.¹¹⁸

¹¹² Alison Brown, 'Public and private interest. Lorenzo, the Monte and the Seventeen Reformers', in Gian Carlo Garfagnini, ed, *Lorenzo de' Medici. Studi* (Florence 1992), 103-138.

¹¹³ William Connell, 'Changing patterns of Medicean patronage. The Florentine Dominion during the fifteenth century', in *Lorenzo il Magnifico e il suo mondo*, 87-107.

¹¹⁴ Parenti, *Storia fiorentina*, II., 263.

¹¹⁵ Gene Brucker, *Renaissance Florence* (New York 1969), 161.

¹¹⁶ Ansani, 'Geografie della guerra', 116-117.

¹¹⁷ Machiavelli, *Storie fiorentine*, 205r-206r; Guicciardini, *Storie fiorentine*, 44; Landucci, *Diario fiorentino*, 24-29.

¹¹⁸ Gene Brucker, 'The economic foundations of Laurentian Florence', 11; Goldthwaite, *The economy of Renaissance Florence* (Baltimore 2009), 495-502.

But this interdependency between politics, diplomacy, and economy could be illustrated by numerous examples. In 1484, the delay in capturing Pietrasanta was caused by the hesitation of the Neapolitan ally in sending the fleet in the Genoese waters, thus preventing the arrival of hostile reinforcements.¹¹⁹ In 1494, the French menace to Florentine merchants influenced Piero de' Medici to surrender to Charles VIII.¹²⁰ After the revolt of Pisa, the conflict against the insurgents was conditioned by internal upheavals and external isolation.¹²¹ In 1499, the siege of the rebel city failed due to the alleged treason of the general captain, aroused by the meddling of Venice and Milan.¹²² In 1500, another attempt went wrong, when the Swiss and the Gascon mercenaries mutinied, capturing the Florentine commissioner. The soldiers were bemoaning the shortage of food and the deferment of payment. However, chroniclers accused commanders and warriors of behaving cheerfully towards the foes, reporting their 'malice' towards their masters.¹²³

Therefore, more than their achievements, the inevitable faults of Florentine officers should be judged without preconceptions, contextualizing errors and avoiding postulates. Hypotheses and explanations have to be proved. And, as Marc Bloch said, 'in history, as elsewhere, the causes cannot be assumed. They are to be looked for'.¹²⁴

¹¹⁹ Humfrey Butters, 'Lorenzo and Naples', in *Lorenzo il Magnifico e il suo mondo*, 148.

¹²⁰ Piero Parenti, *Storia fiorentina*, I., 80-81; id., *Storia fiorentina*, II., 283.

¹²¹ Bartolomeo Cerretani, *Storia fiorentina*, ed. by Giuliana Berti (Florence 1994), 233-255. See also Cadoni, *Lotte politiche e riforme istituzionali a Firenze*.

¹²² ASF, Signori e collegi, Deliberazioni in forza di ordinaria autorità, 101, 89rv; *Consulte e pratiche della Repubblica Fiorentina, 1498-1505*, I., ed. by Denis Fachard (Geneva 1993), 228.

¹²³ Biagio Buonaccorsi, 'Delle cose fatte da Luca di Antonio degli Albizzi e dell'assalto dato a Pisa dai fiorentini con le genti francesi', *Archivio Storico Italiano*, 4, 2 (1853), 407-417; Parenti, *Storia fiorentina*, II., 367-374; Piero Vaglianti, *Storia dei suoi tempi*, ed. by Giuliana Berti, Michele Luzzati, and Ezio Tongiorgi (Pisa 1982), 110-113; Niccolò Machiavelli, *Legazioni. Commissarie. Scritti di governo*, I., ed. by Fredi Chiappelli and Jean-Jacques Marchand (Rome: 1971), 379-384.

¹²⁴ Marc Bloch, *Apologia della storia, o mestiere di storico* (Turin 1998), 143.

Appendix 1. Members of the military offices of the Florentine Republic, 1480-1499

Otto di Pratica, April 1480

Tommaso di Lorenzo Soderini
Jacopo di Piero Guicciardini
Giovanni d'Antonio Serristori
Girolamo Morelli
Bongianni di Bongianni Gianfigliuzzi
Piero di Nicolò Malegonnelle
Angelo di Lorenzo della Stufa
Bernardo di Giovanni Buongirolami

Otto di Pratica, April 1481

Niccolò di Giovanni Capponi
Bernardo di Tommaso Corbinelli
Giovanni di Antonio Serristori
Giovanni di Taddeo dell'Antella
Bongianni di Bongianni Gianfigliuzzi
Pietro di Giovanni Minerbetti
Bernardo di Giovanni Buongirolami
Lorenzo di Piero de' Medici

Dieci di Balìa, September 1482

Tommaso di Lorenzo Soderini
Antonio di Lorenzo Ridolfi
Bernardo di Giovanni Buongirolami
Piero di Francesco Mellini
Niccolò di Giovanni Capponi
Piero di Lutozzo Nasi
Jacopo di Piero Guicciardini
Pierfilippo di Giannozzo Pandolfini
Antonio di Bernardo Dini
Michele di Corso delle Colombe

Dieci di Balìa, April 1484

Tommaso di Lorenzo Soderini
Antonio di Lorenzo Ridolfi
Bongianni di Bongianni Gianfigliuzzi
Pietro di Francesco Mellini
Antonio di Bernardo Dini
Niccolò di Giovanni Capponi
Antonio di Puccio Pucci
Jacopo di Piero Guicciardini
Pierfilippo di Giannozzo Pandolfini
Michele di Corso delle Colombe

Otto di Pratica, October 1480

Luigi di Piero Guicciardini
Piero di Francesco Mellini
Antonio di Taddeo Taddei
Antonio di Puccio Pucci
Roberto di Francesco Leoni
Antonio di Leonardo de' Nobili
Bernardo di Neri del Nero
Maso di Luca degli Albizi

Otto di Pratica, October 1481

Luigi Guicciardini
Antonio di Lorenzo Ridolfi
Francesco di Giovanni Dini
Antonio di Puccio Pucci
Roberto di Francesco Leoni
Antonio di Leonardo de' Nobili
Ugolino di Niccolò Martelli
Maso di Luca degli Albizi

Dieci di Balìa, May 1483

Tommaso di Lorenzo Soderini
Antonio di Lorenzo Ridolfi
Bernardo di Giovanni Buongirolami
Piero di Francesco Mellini
Niccolò di Giovanni Capponi
Piero di Lutozzo Nasi
Jacopo di Piero Guicciardini
Pierfilippo di Giannozzo Pandolfini
Antonio di Bernardo Dini
Michele di Corso delle Colombe

Dieci di Balìa, November 1484

Tommaso di Lorenzo Soderini
Antonio di Lorenzo Ridolfi
Antonio di Taddeo Taddei
Niccolò di Giovanni Capponi
Antonio di Leonardo de' Nobili
Jacopo di Piero Guicciardini
Pierfilippo di Giannozzo Pandolfini
Antonio di Bernardo Dini
Michele di Corso delle Colombe
Pietro di Francesco Mellini

Dieci di Balìa, April 1485

Tommaso di Lorenzo Soderini
Antonio di Lorenzo Ridolfi
Antonio di Taddeo Taddei
Niccolò di Giovanni Capponi
Antonio di Leonardo de' Nobili
Jacopo di Piero Guicciardini
Pierfilippo di Giannozzo Pandolfini
Antonio di Bernardo Dini
Michele di Corso delle Colombe
Piero di Francesco Mellini

Dieci di Balìa, March 1486

Antonio di Lorenzo Ridolfi
Bernardo di Filippo del Nero
Michele di Corso delle Colombe
Francesco di Piero Dini
Giovanni di Antonio Serristori
Antonio di Bernardo Dini
Antonio di Leonardo de' Nobili
Bernardo di Giovanni Rucellai
Antonio di Taddeo Taddei
Pierfilippo di Giannozzo Pandolfini

Otto di Pratica, January 1488

Francesco di Piero Dini
Antonio di Leonardo de' Nobili
Giovanni di Antonio Serristori
Maso di Niccolò degli Alessandri
Bernardo di Neri del Nero
Pierfilippo di Giannozzo Pandolfini
Niccolò di Luigi Ridolfi
Antonio di Bernardo Dini

Otto di Pratica, January 1489

Francesco di Piero Dini
Maso di Niccolò degli Alessandri
Giovanni di Antonio Serristori
Piero di Lutozzo Nasi
Ridolfo di Pagnozzo Ridolfi
Francesco di Filippo Valori
Antonio di Bernardo Dini
Piero di Giovanni Scodellari

Dieci di Balìa, October 1485

Antonio di Lorenzo Ridolfi
Bernardo di Filippo del Nero
Michele di Corso delle Colombe
Francesco di Piero Dini
Giovanni di Antonio Serristori
Antonio di Bernardo Dini
Antonio di Leonardo de' Nobili
Jacopo di Piero Guicciardini
Antonio di Taddeo Taddei
Pierfilippo di Giannozzo Pandolfini

Otto di Pratica, July 1487

Guidantonio di Giovanni Vespucci
Angelo di Ottone Niccolini
Niccolò di Giovanni Capponi
Jacopo di Pietro Guicciardini
Maso di Luca degli Albizi
Ruggero di Niccolò Corbinelli
Francesco di Filippo Valori
Niccolò di Michele Dini

Otto di Pratica, July 1488

Guidantonio di Giovanni Vespucci
Angelo di Ottone Niccolini
Niccolò di Giovanni Capponi
Antonio di Taddeo Taddei
Jacopo di Piero Guicciardini
Maso di Luca degli Albizi
Bernardo di Giovanni Rucellai
Michele di Corso delle Colombe

Otto di Pratica, July 1489

Angelo di Ottone Niccolini
Antonio di Taddeo Taddei
Niccolò di Giovanni Capponi
Bernardo di Neri del Nero
Lorenzo di Angelo Carducci
Pierfilippo di Giannozzo Pandolfini
Niccolò di Luigi Ridolfi
Michele di Corso delle Colombe

Otto di Pratica, January 1490

Pietro di Boccaccino Alamanni
Francesco di Piero Dini
Giovanni di Antonio Serristori
Jacopo di Piero Guicciardini
Maso di Luca degli Albizi
Francesco di Filippo Valori
Bernardo di Giovanni Rucellai
Antonio di Bernardo Dini

Otto di Pratica, January 1491

Guidantonio di Giovanni Vespucci
Giovanni di Antonio Serristori
Piero di Lutozzo Nasi
Maso di Luca degli Albizi
Niccolò di Andrea Sacchetti
Bernardo di Giovanni Rucellai
Paolantonio di Tommaso Soderini
Antonio di Bernardo Dini

Otto di Pratica, January 1492

Antonio di Piero Malegonnelle
Giovanni di Antonio Serristori
Maso di Niccolò degli Alessandri
Domenico di Carlo Pandolfini
Bernardo di Giovanni Rucellai
Giuliano di Francesco Salviati
Paolantonio di Tommaso Soderini
Antonio di Bernardo Dini

Otto di Pratica, January 1493

Antonio di Piero Malegonnelle
Giovanni di Antonio Serristori
Maso di Niccolò degli Alessandri
Francesco di Filippo Valori
Bernardo di Giovanni Rucellai
Giuliano di Francesco Salviati
Paolantonio di Tommaso Soderini
Antonio di Bernardo Dini

Otto di Pratica, January 1494

Antonio di Piero Malegonnelle
Giovanni di Antonio Serristori
Maso di Niccolò degli Alessandri
Lorenzo di Piero Davanzati
Niccolò di Andrea Sacchetti
Francesco di Filippo Valori
Paolantonio di Tommaso Soderini
Antonio di Bernardo Dini

Otto di Pratica, July 1490

Angelo di Ottone Niccolini
Antonio di Piero Malegonnelle
Antonio di Taddeo Taddei
Niccolò di Giovanni Capponi
Maso di Niccolò degli Alessandri
Bernardo di Neri del Nero
Niccolò di Luigi Ridolfi
Michele di Corso delle Colombe

Otto di Pratica, July 1491

Angelo di Ottone Niccolini
Francesco di Piero Dini
Bernardo di Neri del Nero
Ruggero di Niccolò Corbinelli
Pierfilippo di Giannozzo Pandolfini
Niccolò di Luigi Ridolfi
Lorenzo di Piero de' Medici
Michele di Corso delle Colombe

Otto di Pratica, July 1492

Francesco di Piero Dini
Bernardo di Neri del Nero
Lorenzo di Piero Davanzati
Lorenzo di Angelo Carducci
Pierfilippo di Giannozzo Pandolfini
Niccolò di Luigi Ridolfi
Piero di Lorenzo de' Medici
Michele di Corso delle Colombe

Otto di Pratica, July 1493

Pietro di Boccaccino Alamanni
Tommaso di Andrea Minerbetti
Angelo di Ottone Niccolini
Francesco di Pietro Dini
Bernardo di Neri del Nero
Domenico di Carlo Pandolfini
Niccolò di Luigi Ridolfi
Piero di Giovanni Pieri

Otto di Pratica, July 1494

Bernardo di Neri del Nero
Matteo di Giovanni Canigiani
Niccolò di Carlo Federighi
Mariotto di Piero Rucellai
Pietro di Bertoldo Corsini
Niccolò di Luigi Ridolfi
Piero di Jacopo Guicciardini
Michele di Corso delle Colombe

Dieci di Balìa, December 1494

Francesco di Luca degli Albizi
Pietro di Bertoldo Corsini
Jacopo di Giovanni Pandolfini
Pietro di Francesco Vettori
Lorenzo d'Anfrione Lenzi
Lorenzo di Matteo Morelli
Paolantonio di Tommaso Soderini
Pietro di Jacopo Guicciardini
Pietro di Giovanni Pieri
Lorenzo di Niccolò Benintendi

Dieci di Balìa, December 1495

Bernardo di Lutozzo Nasi
Baldassarre di Bernardo Brunetti
Paolantonio di Tommaso Soderini
Alamanno di Filippo Rinuccini
Lorenzo di Matteo Morelli
Pietro di Niccolò Popoleschi
Piergiovanni di Andrea Ricasoli
Francesco di Filippo Valori
Pierfilippo di Giannozzo Pandolfini
Francesco di Andrea Romoli

Dieci di Balìa, December 1496

Antonio di Simone Canigiani
Piero di Bertoldo Corsini
Battista di Giovanni Serristori
Francesco di Martino Scarsi
Lorenzo di Anfrione Lenzi
Pierfilippo di Giannozzo Pandolfini
Taddeo di Agnolo di Zanobi Gaddi
Tommaso di Paolo Morelli
Antonio di Sasso Sassi
Jacopo di Bongiani Mini

Dieci di Balìa, December 1497

Giovanbattista di Luigi di Lorenzo Ridolfi
Paolantonio di Tommaso Soderini
Antonio di Giovanni Giugni
Giuliano di Francesco Salviati
Domenico di Giovanni Bartoli
Domenico di Bernardo Mazzinghi
Pierfrancesco di Francesco Tosinghi
Luigi di Angelo della Stufa
Giovanni di Francesco Puccini
Pietro di Giovanni di Pietro Pieri

Dieci di Balìa, June 1495

Pietro di Niccolò Del Benino
Matteo di Giovanni Canigiani
Francesco di Ciriaco Pepi
Andrea di Niccolò Giugni
Jacopo di Angelo Acciaiuoli
Filippo di Lorenzo Buondelmonti
Francesco di Santi Ambrogi
Gino di Giuliano Ginori
Vieri di Cambio di Vieri de' Medici
Mazzeo di Giovanni Mazzi

Dieci di Balìa, June 1496

Domenico di Baldassarre Bonsi
Bernardo di Filippo del Nero
Piero di Giovanni Pieri
Matteo di Onofrio del Caccia
Giuliano di Francesco Salviati
Guidantonio di Giovanni Vespucci
Domenico di Bernardo Mazzinghi
Ludovico di Antonio Masi
Francesco di Antonio Taddei
Giuliano di Giovanni Marucelli

Dieci di Balìa, June 1497

Francesco di Lorenzo Gualterotti
Tanai di Francesco de' Nerli
Matteo di Onofrio del Caccia
Michele di Bernardo Nicolini
Clemente di Cipriano Sernigi
Bernardo di Giovanni Rucellai
Gino di Giuliano Ginori
Francesco di Filippo Valori
Mauro di Antonio Fantoni
Marco di Giovanni Baroncini

Dieci di Balìa, June 1498

Benedetto di Tanai di Francesco de' Nerli
Bernardo di Carlo di Zanobi da Diacceto
Clemente di Francesco Cerpelloni
Francesco di Andrea di Nofri Romoli
Giovanni di Antonio di Dino Canacci
Jacopo di Giannozzo Pandolfini
Piero di Daniele degli Alberti
Piero di Niccolò Popoleschi
Ridolfo di Pagnozzo Ridolfi
Vieri di Cambio de' Medici

Dieci di Balìa, December 1498

Antonio di Sasso Sassi

Battista di Giovanni Serristori

Clemente di Cipriano Sernigi

Domenico di Baldassarre Bonsi

Giovanni di Giannozzo Manetti

Giuliano di Leonardo Gondi

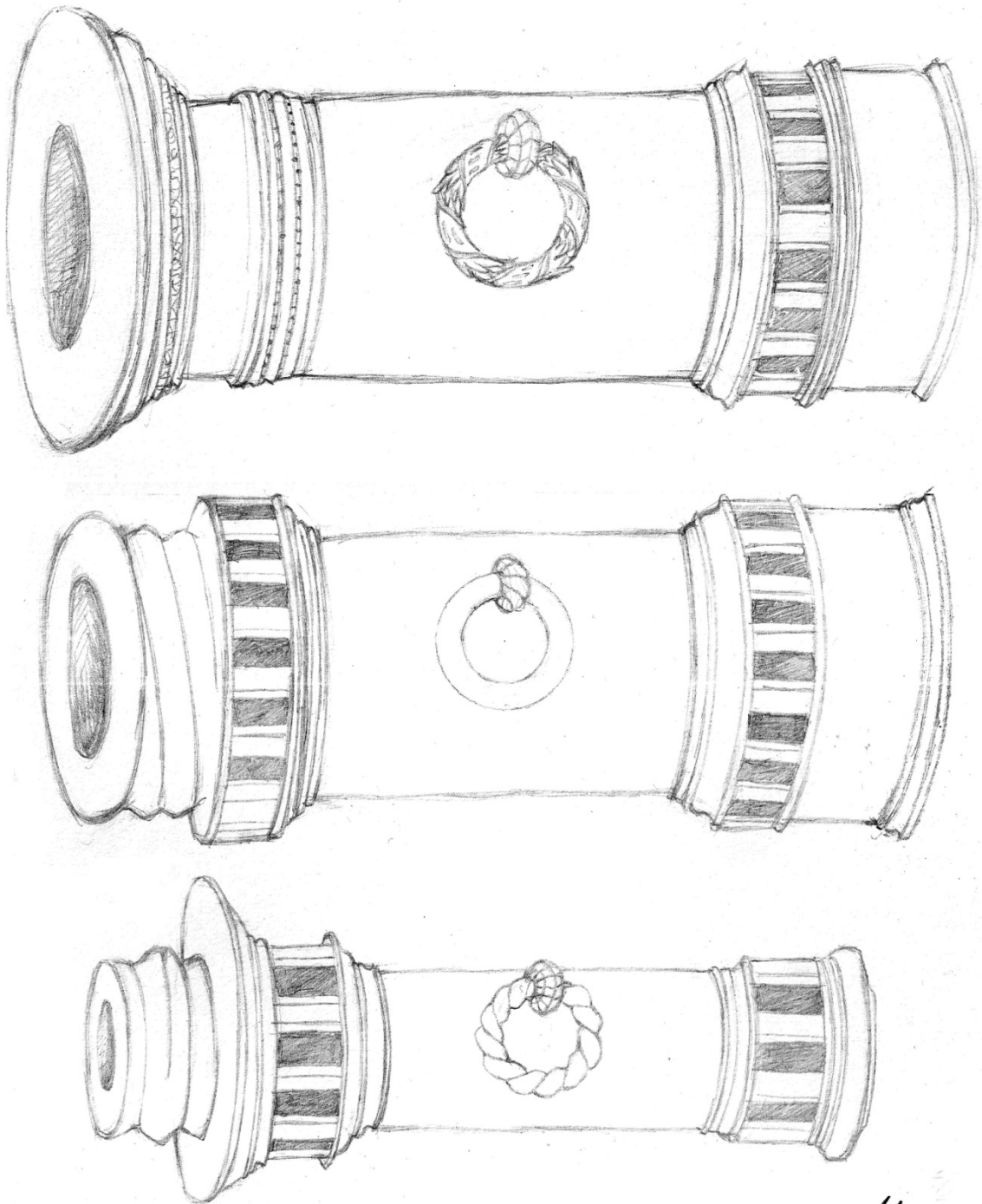
Guidantonio di Giovanni Vespucci

Luca di Antonio degli Albizi

Paolo di Francesco Falconieri

Zenobi di Bartolomeo del Zaccaria

Sources: ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 25, ff. 11r, 171v, 197r, 214r, 225v and 232r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 33, f. 1r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 36, f. 226vr; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 41, f. 165v; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 42, f. 1r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 43, f. 1r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 46, f. 1r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 48, f. 1r; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 1, ff. 1r, 15r, 31r, and 38r; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 2, ff. 1r, 17r, 40r, and 66r; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 3, ff. 1r, 30r, 53r, and 67r; ASF, Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti, 5, ff. 1r, 33r, 60r, 99r, 119r, 150r, and 170r.



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Figure 1. A dismantled bombard, sketched by Bonaccorso Ghiberti in 1480s
Firenze, Biblioteca Nazionale Centrale, Banco rari, 228
Drawing by Angela Marino

ARTICLE II
CRAFTSMEN, ARTILLERY, AND WAR PRODUCTION IN RENAISSANCE FLORENCE
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A supposed Florentine backwardness in military organization during the fifteenth century has been a historiographical paradigm for centuries (Mallett 2006, 134–36; Mallett 1989, 256–57; Hale 1987, 64; Epstein 1994, 108–109). According to William Caferro (2008a, 219–23), this proposition “has achieved the status of orthodoxy.” Niccolò Machiavelli’s condemnation of mercenaries and his nostalgia for citizen armies have conditioned generations of scholars: cowardly captains and corrupt soldiers rather than foreign invaders are seen as responsible for the irreversible decline of the early modern Italian peninsula (Puddu 1975, 61–67). Florentine politicians have been repeatedly blamed for their lack of interest in warfare and for their “incomprehension” of the “irrational, violent phenomenon” of war (Finzi 1990, 141). Only in recent decades have a few important studies attempted to reevaluate the military institutions of the Italian Renaissance states (Mallett 1989; Covini 1998; Storti 2007). After Milan, Naples, and Venice, however, is a similar analysis possible for Florence, the birthplace of Machiavelli, the author of *Il Principe*?

A review of the evidence from Florentine sources concerning military production during the fifteenth century can help to answer the question. The need for specific studies of the economic implications of Renaissance wars has been asserted by several scholars (Caferro 2010, 165; Goldthwaite 2009, 400–402), though the negative economic effects of these conflicts have already been well documented in medieval and early modern chronicles. The *Storia fiorentina* of Piero Parenti (1450–1519) and the *Diario* of Luca Landucci (1437–1516) highlight the major problems caused to agriculture and commerce by soldiers. Landucci (1969, 97–98) also underlined the heavy taxation imposed by Florentine government for the financing of the Pisan campaign in 1495. Another consequence of war in the late Middle Ages was the improvement of fiscal systems (Hale 1987, 257–80) since the maintenance of armies was the most expensive endeavor of the Italian states (Caferro 2008b, 169).

Paid troops, however, could not fight without weapons. Alongside the tax system, war production can be actually considered a useful sign of military organization and its

management – its “governance” – can reveal campaign planning in terms of credit, enlistment, supplies, and armaments (Panciera 2005). Firearms will be the particular focus of this article, stressing more their economic dimension as manufactured goods than their use in battles and sieges. Undoubtedly, from their appearance in the fourteenth century, guns were becoming more prominent in warfare, in spite of their high costs, low mobility, and lack of precision (Hale 1987, 41–47). By the second half of the fifteenth century, cannon and arquebuses were probably stored in every arsenal of the continent, especially in France and Burgundy (Contamine 2011, 197–213). But were those guns the same as a hundred years before? The spread of artillery certainly brought about continuous experimentation in their production (Belhoste 2007, 325–42). Innovations were made in the materials, dimensions, safety, and mobility of the pieces. Lead and iron cast shot replaced stone projectiles. Black powder was made granular (“corned”) and it became more powerful and more resistant to moisture than the past (Hall 1997, 87–95).

Historians of the military revolution have affirmed for years that this progress was constant and linear, with clear repercussions on infantry tactics and fortifications (Parker 2005, 23–70). In reality, despite the vast mobilization of scientific and technical resources, the process was slow, full of interdependent changes, attempts, failures, and second thoughts (Belhoste 2007, 327). But how, and when, were those improvements adopted in Tuscany?

Sources

Even if economic and military historians have largely ignored them, the sources for examining the development of Florentine factories are numerous. The well-known *catasto* of 1427 (Herlihy and Klapish-Zuber 1985), alongside the *decima repubblicana* of 1495 and other fiscal records, provide information on the wealth of craftsmen and the tools of their *botteghe*. The documentation of the guilds of smiths (*fabbri*), armorers (*corazzai*), and apothecaries (*speziali*) is useful for understanding the regulations of production and market, the membership and the working relationships of the artisans (Degrassi 1998, 95–152). The registers of two Florentine military institutions, the Dieci di Balìa and the Otto di Pratica, played a predominant role in this research: the Dieci di Balìa was the council of ten officials elected in time of war during the first half of the century and the Otto di Pratica was a permanent office responsible for warfare and diplomacy created in 1480 by Lorenzo de’ Medici after the Pazzi conspiracy. In the following years, the Dieci occasionally took over the tasks of the Otto at the outbreak of a war

(Rubinstein 1971, 238–45). Only after the Medici regime collapsed, was the “republican” Dieci totally restored in December 1494 (Cerretani 1994, 221). Despite those political upheavals, their documentation is still plentiful. Their registers of munitions (*munizioni*), resolutions (*deliberazioni*), and letters (*missive* and *responsive*) offer an opportunity to underline not only the real use of weapons in encampments and fortresses, but, above all, the leading role of public demand in the introduction of technical changes and innovative instruments.

Gunpowder

One of the most important changes in Renaissance war production concerned the indispensable propellant of artillery: gunpowder (*polvere*). “Far and away this invention surpassed other harmful devices,” affirmed Vannoccio Biringuccio in his *Pirotechnia* (1558, 152r). When it was used, however, the powder went literally up in smoke. From an economic point of view, this was its best aspect: continuous replacement and constant production were necessary for supplying armies and garrisons. In Renaissance Florence, mixing sulfur, charcoal, and saltpeter was entrusted to some members of the guild of *speziali* (Dieci, *Munizioni*, 4, 90r; for further information on this guild, see Ciasca 1927), apothecaries, and spices dealers (*Arte dei Medici e Speziali*, 4, 20v–21r).

Almost two generations of the Formiconi family contributed to the charges of Florentine firearms, and, for more than 70 years, several members of the Barducci family were masters of powder fabrication (*maestri di polvere*). The sons of Stagio Barducci, Lorenzo and Giovanni, were the major manufacturers at the outbreak of the war with Lucca, in 1429. They produced more than 20,000 *libbre* of powder at the beginning of 1431 (Dieci, *Munizioni*, 1, 133r; a Florentine *libbra* was approximately equal to 340 grams, so this was 6,800 kg of powder). In spite of all their efforts, it was not enough to meet the state demand. The prolonged conflict with the Filippo Maria Visconti, Duke of Milan, opened the market to other competitors, such as Vannuccio di Andrea di Berto and Giano Biurg, the latter probably a German artisan (Dieci, *Munizioni*, 1, 115v). The earnings opportunity could be quite attractive for newcomers: 6 florins was the value set by the Dieci for every 100 *libbre* of powder (Dieci, *Munizioni*, 1, 81v). Considering their account for 17,000 *libbre* [5,780 kg], in just six months Vannuccio and Giano earned a great amount, more than a thousand florins (Dieci, *Munizioni*, 1, 144v).

Moreover, military officers contributed more than merely money, periodically providing *maestri* with saltpeter, sulfur, and charcoal, and then subtracting the cost of those raw

materials from the price of the end product (Dieci, Munizioni, 1, 127v). From December 1498, Bonarrigo di Matteo from Artimino and Nonni di Giovanni supplied Florentine arsenal with several thousand *libbre* of willow and hazel charcoal (Dieci, Entrata, 30, 67v–188r; Dieci, Munizioni, 9, 177r). The price was fixed at 3 *lire* per 100 *libbre* (Dieci, Entrata, 30, 160v; a Florentine *lira* equaled 20 *soldi*, and 9 *soldi* corresponded approximately to the daily rate for unskilled workers during all the century. See Goldthwaite 2009, 364). Sulfur cost 4 *lire* per 100 *libbre* (Dieci, Entrata, 15, 71r) and was usually purchased from small retailers, such as merciai (Dieci, Debitori, 25, 75v) and vetturali (Dieci, Entrata, 30, 105v). The charcoal and the sulfur were sent to mills for grinding (Dieci, Entrata, 23, 398r) and officials gave the ground materials (*charboni macinati* and *zolfo macinato*) to gunpowder makers, along with rough (*soro*, *rossellino*) or refined (*rafinato*) saltpeter. Masters had only to provide the vats, ladles, and brooms, and then buy firewood, vinegar, soap, oil, and other commodities necessary for the production of the powder and the functioning of their workshops (Dieci, Munizioni, 9, 121r–v).

This provision continued for the entire century. In 1490, the son of Lorenzo Barducci, Stagio, and another apothecary, Giovanni Formiconi, received a payment from the Otto for “powder credits,” with a deduction for “saltpeter debits” (Otto, Munizioni, 1, 11v; *polvere data* and *salnitro auto*). A decade of wars with Naples (1478–1480), Venice (1482–1484), Rome (1485–1486), and Genoa (1486–1487) greatly increased Florentine requirements for gunpowder, forcing the state to build a new, public workshop (Dieci, Entrata, 8, 74v) and to entrust production to five or six other masters. The consumption grew to such massive amounts that it exceeded the skill base and the productive facilities of apothecaries, even though on the eve of French invasion, in the autumn of 1494, Giovanni Formiconi was still producing tons of corned powder, dispatched to Pisa, Barga, Firenzuola, and other border towns (Otto, Munizioni, 1, 53r–68v). In August 1495, Jacopo di Corso, called *Baia*, and Piero di Zanobi, called *Zucca*, signed a contract for the supply of gunpowder (*conducta pulveris*) with the Dieci di Balia, becoming the most prominent masters of the Republic (Dieci, Deliberazioni, 35, 16r). Five years later, their workshop had 7 millstones for the powder, 4 copper boilers, and 22 tubs for the saltpeter (Signori, Condotte, 18, 124v). Moreover, carpenters made their appearance in the registers of military officers, as when Bartolomeo Banchini started to mix powder and to refine saltpeter in 1498 (Dieci, Entrata, 23, 324r). In the previous years, he seems to have crafted only carts, boxes for darts, and wooden beams (Dieci, Entrata, 14, 240v). Filippo di Giovanni, called *la Pippa*, was a carpenter, a military engineer (Dieci, Deliberazioni, 33, 49r), and a gunner (Dieci, Deliberazioni, 39, 111r), before starting to work

with Jacopo di Corso in 1499 (Dieci, Entrata, 30, 41v). Giovanni di Corso (called *Baino*), the brother of Jacopo, served in Livorno as a gunner and gunpowder maker in 1500 (Signori, Condotte, 17, 207r).

The production itself was becoming polycentric. Baia worked in Romagna in 1494 (Otto, Munizioni, 1, 60r). In July 1499 he was sent into the Florentine encampment during the siege of Pisa (Signori, Missive, 21, 51r). Two years before, Jacopo and his workmate went to Livorno to increase the local supplies (Dieci, Deliberazioni, 44, 122r). Zucca returned twice in the coastal town during 1498 (Dieci, Entrata, 25, 1v; Dieci, Entrata, 27, 25v). A contract of 1499 specified the obligation for Jacopo and Piero “to go and to stay” where the Dieci ordered them, with a monthly salary of 12 florins and a monthly commission for 14,000 *libbre* [4,760 kg] of powder (Dieci, Deliberazioni, 46, 12r). At that time, gunpowder was also produced in Castrocaro (Dieci, Entrata, 30, 71r and 187r).

By the end of the century, therefore, production figures leave the impression of high levels of output. In the first six months of 1495, Stagio Barducci and his son Giovanni, Jacopo di Corso, Piero di Zanobi, and Giovanni Formiconi fabricated 104,261 *libbre* [nearly 35,500 kg] of powder (Dieci, Munizioni, 5, 1r–65r). The Florentine camp was provided with more than 25,000 *libbre* [8,500 kg] during May 1499 alone (Dieci, Entrata, 30, 147v–148r). In the summer of the same year, Piero di Zanobi produced 65,160 *libbre* [22,150 kg] of the precious propellant (Dieci, Entrata, 30, 246r), often working through the night (Dieci, Entrata, 30, 188v–189r and 194v). Gunpowder makers were active in Florence, in encampments, and in strategically important cities. Qualitatively, they could reach the contemporary standards of northern European masters. The 1431 register of munitions reports the existence of the *polvere mezzana* (Dieci, Munizioni, 1, 144v), a particular type of powder which may have been that “new” granular, “corned” powder which was affirmed at that time in Germany and the Low Countries as more explosive and more durable (Howard, 1996, 4). It was obtained by stamping the raw ingredients to reduce particles to roughly uniform size and mix them thoroughly, then adding a liquid and shaping the resulting paste into lumps. Those lumps were subsequently dried and crushed in grains: a method described forty years later by Francesco di Giorgio Martini (1439–1501) for preserving powder on long campaigns (1841, 248). The archival records of the 1490s increasingly point out the differences between the types of powder. The corned powder was the *polvere fina* “for portable firearms” produced by Jacopo di Corso and Piero di Zanobi, and the *polvere sottile* of Giovanni Formiconi was probably corned too (Dieci,

Deliberazioni, 35, 16r; Otto, Munizioni, 1, 53v). However, to avoid the explosion of guns, less powerful, “mealed” *polvere grossa* was still in use for bombards (Tartaglia 1554, 41v–42v).

Iron firearms

Small firearms and giant bombards were fabricated by smiths. In the 1430s, Florentine masters had already produced dozens of cannons for the Dieci. Even while trebuchets were still employed during the siege of Lucca (Dieci, Munizioni, 1, XVIIIr), the rate of spread of artillery was increasing rapidly. Hundreds of hand cannons (*scoppietti*) were sent to Tuscan towns in those years and the purchase of these portable firearms outnumbered the sale of crossbows in the first months of 1431 (Dieci, Munizioni, 1, 321v–322r). The powder of Lorenzo and Stagio Barducci was used for charging several new cannons. Thirty hand cannons and eleven bombards were bought from Antonio di Domenico in Grassina, a village in the vicinity of the capital (Dieci, Munizioni, 1, 103v). Tinaccio di Piero’s workshop, at the city gate of San Niccolò, made 113 hand cannons, 41 bombards, and 257 *libbre* of bullets, for which the Dieci owed him 2,468 *lire* in May 1431 (Dieci, Munizioni, 1, 158v and 3, 209v). Until 1432 he received orders for guns and ramrods (*paletti di ferro da scoppietti cioè da carichargli*), and for repairing damaged cannons (Dieci, Munizioni, 2, 238r). He also collaborated with another smith, Michele di Jacopo delle Volte, on the fabrication of a giant bombard of approximately 4,000 *libbre* [1,360 kg] (Dieci, Munizioni, 1, XLVIII). The workshop of Michele di Jacopo and his son, Simone, situated in the district of San Donato de’ Vecchietti, was probably the most active center for the production of Florentine artillery. In his catasto statement, Michele declared a taxable income of 5,209 florins. Four years later, in 1431 his credit account amounted to 4,349 *lire*, the price of 231 hand guns and 60 *bombarde* of various weights, materials, and dimensions, such as *bombardelle*, *bombarde mezane*, and *bombardine pichole* (Catasto, 77, 18; Dieci, Munizioni, 1, 161r).

Alongside those principal workshops, other smiths made deals with the Dieci. Some of them were specifically gunmakers, *bombardieri*, or *maestri di bombarde*, like Bindo di Nanni from Castelfranco, Piero di Bartolo from Casoli, Mariotto di Bartolomeo from Arezzo, or Michele di Bartolomeo from Barga (Dieci, Munizioni, 4, 9v and 3, 12r). The variety of their birthplaces was not an exception: Santi di Domenico came from “the valley of the river Garza” (Valdigarza) near Brescia, and Maso di Matteo from Perugia. Many other craftsmen were born in small Tuscan villages before moving to Florence (Dieci, Munizioni, 1).

Obviously, this market thrived in the course of a few decades. In the 1430s production was already variegated. Small cannons of fifteen *libbre* were put beside guns of hundreds or thousands *libbre*. Michele di Jacopo tested cast iron (*ferro colato*) for the making of three single-piece bombards (Dieci, Munizioni, 1, XLVIIIr). Michele and Piero di Tinaccio used the expensive, resistant cast bronze for the posterior barrel (*cannone*) of their gun, while the anterior (*tromba*) was made in forged iron (Dieci, Munizioni, 1, XLVIIIr). Bronze and iron were employed in the making of hand cannons (Dieci, Munizioni, 1, 116v). Piero di Tinaccio manufactured a four-barrel bombard, a so-called “organ cannon,” with a thousand *libbre* of iron (Dieci, Munizioni, 1, Lv; *una bonbarda di ferro colla tronba lungha a modo di cerbottana et con quattro cannoni*). Taken together, these results suggest that experimentations and innovations were the norm in Florence. The use of cast iron also suggests the existence of a “Genoese” furnace in the vicinity of the city, suggesting a general improvement in Tuscan ferrous metallurgy (Nesti and Tognarini 2003, 70–80; Baraldi 2004, 158–84). Only the prices did not change: between 5 and 7 *soldi* for every *libbra* of ironwork, 8 *soldi* for every *libbra* of iron hand cannons, 8 *lire* for every bronze hand cannon, 9 *soldi* for every *libbra* of cast bronze.

Several new models were soon introduced to the battlefield. The improvements in gunpowder permitted a differentiation of pieces, shapes, and uses for obtaining better results and greater mobility. The ordnance listed by Francesco di Giorgio Martini (1841, 245–47) in his treatise were actually produced in Florence in the 1480s and 1490s. From the longer to the shorter, they were:

basilisks, with a length of 25 feet and a shot weight of 20 *libbre*
 bombards, 20 feet and 300 *libbre*
passavolanti, 18 feet and 16 *libbre*
cortane, cortali, cortaldi, 12 feet and 100 *libbre*
mezzane, 10 feet and 50 *libbre*
cerbottane, 9 feet and 3 *libbre*
spingarde, 8 feet and 15 *libbre*
 mortars, 6 feet and 300 *libbre*

Handguns of the day were known as harquebuses or hand cannons (Ridella 2005, 77–92; for an English nomenclature of late fifteenth-century Italian artillery, see Pepper 1995, 292–293). The word *archibugi* seems to have appeared in Florentine documentation for the first time in April 1484, when 12 portable firearms were sent to Sarzanello (Dieci, Deliberazioni, 27, 234r). The sources for the preceding decade are extremely scarce, but there is evidence of an increasing use of portable firearms during the campaign of 1478 (Dieci, Deliberazioni, 22, 38v).

Hand cannons and harquebuses were still produced in 1495 by the Florentine smith Baldassarre di Giovanni: 30 of the older type, and 300 of the newer (Dieci, Munizioni, 5, 3r–65r). A single iron hand cannon cost 52 *soldi* (Dieci, Munizioni, 5, 3r) while iron harquebuses were priced at 400 *soldi* for every 100 *libbre* of wrought iron (Dieci, Munizioni, 5, 39r). Considering the weight of a single harquebuse (typically 25 to 35 *libbre*, and therefore 100–140 *soldi*, not including the wooden grip [*manico*], that was separately itemized at 15 *soldi*; Dieci, Entrata, 15, 67v–86r), they would seem to have cost more than a hand cannon. Indeed, in May 1495, the Dieci even purchased one presumably high-grade harquebuse for 160 *soldi* (Dieci, Munizioni, 5, 4r). In the workshop of Zanobi and Giovambattista di Francesco, however, harquebuses were definitely replacing hand cannons in 1495 (Dieci, Deliberazioni, 33, 171r). In 1496 the Dieci acquired 300 new harquebuses (Dieci, Munizioni, 6, lv–llr) and only 60 new hand cannons (Dieci, Munizioni, 6, 142v).

In any case, the most important partner of Dieci for the supplying of iron, munitions, and portable firearms was undoubtedly Baldassarre di Giovanni (Dieci, Deliberazioni, 42, 129r–132r; Dieci, Munizioni, 5, 3r–65r; Dieci, Debitori, 28, 76v–77r), who manufactured numerous small guns, the *spingarde*, and a pair of iron bombards (Otto, Munizioni, 1, 61v; Dieci, Entrata, 15, 262v). Moreover, he was entrusted with building the gallows for the execution of the “prophetic” Dominican friar and preacher, Girolamo Savonarola (Dieci, Entrata, 26, 56r). These collaborations would have been fruitful, for Baldassarre: according to his statement of income, he owned six houses and three pieces of land by the end of 1490s (Decima, 16, 204r–205r).

Bronze firearms

Forged iron gradually came to be used only for the fabrication of smaller firearms such as harquebuses, hand cannons, and *spingarde* (Hall 1997, 93). In the second half of the *Quattrocento*, several new craftsmen were working in Florentine arsenals: the *maestri di getto*, experts in bronze fusion and makers of cannons and, often, statues and bells. Compared with wrought iron bombards, their cannons were undoubtedly stronger and safer. A single-piece cast bronze gun could better contain the explosions generated by larger powder charges, increasing the range of shot and diminishing the risks for gunners (Biringuccio 1558, 79r; Panciera 2005, 120). Furthermore, their pieces were more easily transported (Calegari 2005, 71–72).

Alberghetto Alberghetti from Ferrara, one of the most important Italian gunmakers (Pancierà 2005, 163), made several bronze *spingarde* in 1485 (Dieci, Deliberazioni, 30, 260v). The German artisan Giovanni from “Auspurch” (i.e., Augsburg) started his career in Lunigiana as a gunner. In 1485 he repaired a bombard in Pietrasanta (Dieci, Deliberazioni, 24, 105v). Here, one year later, he cast a gun of 14,000 *libbre* [4,760 kg], called *la Felice* (Dieci, Deliberazioni, 30, 259v). Giovanni manufactured the Marzocchina during the siege of Sarzana in 1487 (Dieci, Deliberazioni, 28, 293r). In 1489 in Pisa he made a giant basilisk (*basilisco*) of two pieces from 16,000 *libbre* [5,440 kg] of bronze and 2 single-piece heavy guns (*cortaldi*), earning for those three guns 1,692 *lire* (Otto, Munizioni, 1, 9v). He was still in Pisa in 1492, and there he was paid by the Otto for 2 bells, 2 bombards, and 90 bronze harquebuses (Otto, Munizioni, 1, 33r). Bronze handguns seems to have been relatively unusual pieces, though eleven bronze harquebuses (*archibugi di bronzo*) were listed along with other iron ones in a 1496 inventory of ammunition of Livorno (Dieci, Entrata, 16, 298r). In 1502, some still remained in Florentine arsenals (Dieci, Munizioni, 8, 22r). Francesco from Asti even fabricated two brass harquebuses (*archibusi di ottone*) in 1500 (Dieci, Entrata, 30, 106v).

In any case, portable firearms were not specified in the contract that *magister Iohannes de Uspurch teuthonicus* signed with the Otto di Pratica in January 1493. Instead, he offered the following to officials:

bombards, with a shot weight of 400 *libbre* or more
 half-bombards, 200 *libbre* or more
 quarter-bombards, 100 *libbre* or more
 eighth-bombards, 40 *libbre* or more
 bombards *da ripari* for castles and city walls, from 15 to 25 *libbre*
passavolanti, *cortaldi*, or *basilischi*, 100 *libbre*
 half-*passavolanti*, *cortaldi*, or *basilischi*, from 50 to 100 *libbre*
 quarter-*passavolanti*, from 25 to 50 *libbre*
serpentine, from 5 to 25 *libbre*
spingarde, from 5 to 6 *libbre*

The price of those cannons was 70 *lire* for every 1,000 *libbre* of cast bronze (Otto, Deliberazioni, 5, 96v–97r). In 1499 Giovanni moved from Pisa to Florence, hired again by Dieci. He received a monthly salary of 12 florins, with the same clauses of the previous contract (*condotta*): both the 70 *lire* and the free provisions of metal raw materials (Dieci, Deliberazioni, 46, 20r).

At that time, Florentine production of bronze cannons was increasing. Lorenzo di Giovanni Cavaloro, another *magister gettuum*, sold *spingarde* and bombards to military officers (Dieci, *Deliberazioni*, 33, 171v). Bonaccorso di Vettorino di Bartoluccio, better known as Bonaccorso Ghiberti, cast 1 bombard and 2 *passavolanti* in 1496 (Dieci, *Deliberazioni*, 34, 212r). In 1498, the Dieci ordered him to build a new furnace in his workshop for “easier and better melting” (Dieci, *Deliberazioni*, 48, 145r; *perché possi fare i getti migliori et più comodamente*). Bonaccorso, who also served the army as an engineer (Scaglia 1976, 486), produced a book of assorted drawings and texts, the *zibaldone* (Codex Banco Rari 228). The sketches of this book almost certainly reflected the guns that Bonaccorso produced in his foundry: single-piece, bronze, small cannons, mounted on carriages and equipped with trunnions (Gille 1972, 116). Significantly, his notes included a reference to French methods of manufacturing artillery, related to the diameter of the shot: small guns were cast with the rear part of the barrel thick as their bore, while the same part of heavy cannons had a thickness of twice the measure of their caliber (Banco Rari 228, 88r).

The lethal modern cannon, made infamous in the French artillery of Charles VIII, were in fact the new standard of excellence (Santi Mazzini 2006, 251–52). To reassert his claim on the Kingdom of Naples, Charles made his way down the Italian peninsula in 1495, destroying enemy fortresses along the way (Parenti 1994, 177). The “impregnable” castle of Montefortino was crushed in just one day, causing astonishment and fear among contemporaries (Dieci, *Missive*, 31, 173r). According to Francesco Guicciardini (1971, 79), those guns were devices more “diabolic than human” (*più tosto diabolico che umano instrumento*). For these reasons, French cannons became immediately famous. “This French ordnance is very good and very effective,” wrote the Dieci in March 1495 (Dieci, *Missive*, 32, 79r–v; *queste artiglierie francesi sono molte buone et fanno grandi effecti*). For these reasons, above all, the military officers of the Republic decided to manufacture those weapons in Florence.

In January 1495, the Dieci started construction in the city’s center of a new foundry “for casting bombards and other pieces” (Dieci, *Munizioni*, 5, 17r). The furnace was located in the semi-abandoned area of the Sapienza, the college projected 70 years earlier by Niccolò da Uzzano for the Florentine university (Ferretti 2009, 93–96). Bricklayers and carpenters built the workshop in three weeks. Before mid-February the casting pit was dug, and the furnace “walled up” (Dieci, *Munizioni*, 5, 25r). A few days later, 8,000 *libbre* [2,720 kg] of copper and 700 *libbre* [238 kg] of tin arrived in Sapienza (Dieci, *Munizioni*, 5, 32r). Baldassarre di Giovanni provided iron (Dieci, *Munizioni*, 5, 28v). On 17 March, the first ever French-style cannon

produced in Florence was sent to the Pisan encampment (Dieci, Missive, 32, 79v): a bronze *cortaldo a la francese* (Dieci, Munizioni, 5, 38r), put on a small cart “according to French custom” (Dieci, Deliberazioni, 33, 245r; *in curribus more gallico*).

The designers of the cannon were master Francesco di Bartolomeo Telli and Simone di Bronzi (Dieci, Munizioni, 5, 15v). In January, before the opening of the foundry, the Dieci ordered Francesco to reach Castrocaro and join the French gunners and gunmakers that garrisoned the town for observing, measuring, and drawing their cannons (Dieci, Missive, 31, 81r). Considering the results, the apprenticeship of Francesco was extremely successful. His drawings could have been a sort of guidebook for the following casting processes and for the reproduction of French guns (Degrassi 2005, 82–83). Based on a solid and reliable tradition, the assimilation of new techniques in Florentine production was about to start, as testified by Ghiberti’s *zibaldone*. The bronze *cortaldo* demonstrate that the Republic in the 1490s had the men, the knowledge, and the tools for acquiring innovations and reaching excellent qualitative levels in gun production.

Bronze cannon as art

The significance of the Florentine tradition was not exclusively a heritage of smiths and maestri di getto during those years. In the capital of the Renaissance, alongside the professional gunmakers artists were involved in the casting of fine-looking, yet still lethal, ordnance. After his collaboration with Brunelleschi and Michelozzo, Maso di Bartolomeo, also known as *Masaccio*, became a military engineer and a gunmaker, a *magister bombardarum*, in the 1450s (Pardo 2001, 230–31; Dieci, Deliberazioni, 20, 219r). According to his account book, ordnance pieces were the most expensive objects that he produced (Codex Baldovinetti 70; Maso di Bartolomeo 1894). Pasquino di Matteo from Montepulciano was one of his disciples. During his career as bronze sculptor, he also knew the artists Filarete, Desiderio from Settignano, and Andrea del Verrocchio. He cast two *spingarde* in his hometown during 1479 (Dieci, Deliberazioni, 23, 79r). In 1482 he served as a gunner in Città di Castello and Citerna. Two years later he worked as gunmaker (*bombardiere*) in Pisa and Sarzanello (Dieci, Deliberazioni, 27, 257v and 276r). Even Andrea del Verrocchio manufactured a *bombarda grossa* for Lorenzo de’ Medici in 1484. It was a giant bronze gun of three pieces, and weighed more than 20,000 *libbre* [6,800 kg] (Dieci, Deliberazioni, 30, 240v). In 1480 Andrea was even cited as a master in casting cannons (Dieci, Deliberazioni, 23, 79r) and years later, one of his most talented

apprentices, Leonardo da Vinci, offered his works to the Duke of Milan, boasting his ability to make beautiful and useful cannons (Gille 1972, 152–53).

Verrocchio's bombard might appear obsolete when measured against contemporary French ordnance, but it demonstrates the considerable skills in bronze casting of the Florentine master, even while its giant dimensions obviously contrast with the European tendency towards lighter and more mobile pieces. But was this technical marvel so unrelated to the Italian context? A more massive bombard called *Galeozesca Vittoriosa* was fabricated for the Milanese army in 1472: it weighed 2 tons more than the bronze cannon of Verrocchio (Belhoste 2007, 331). A 1478 Sienese bombard weighed more than 8 tons, the Aragonese army used a giant bombard in Naples in 1495, and even Venetian gunmakers cast giant pieces during the second half of the century (Angelucci 1869, 85; Ferraiolo 1987, 78; Mallett 1989, 110–14).

Raw materials

Artists and craftsmen needed raw materials for their creations. Yellow sulfur (*zolfo giallo*) used for manufacturing gunpowder was mined in quarries near Volterra, in the volcanically active area of Larderello (Otto, *Deliberazioni*, 5, 50r; Giovannelli 1613, 62). It was also acquired in Sicily, in Pozzuoli, or in the neighboring state of Siena (Biringuccio 1558, 25v–26r). Saltpeter, in contrast, was not so abundant in nature. Its artificial production probably began in the first quarter of the fifteenth century (Hall 1997, 74–79). In Italy the richest organic deposits were found in the southern region of Puglia, where several sources of nitrates were still exploited during the eighteenth and the nineteenth century (Bianchessi 1998, 572–73; De Sanctis, 2010). In the spring of 1481, the gunpowder maker Giovanni Formiconi was in Puglia with an export license (*licenza di tratta*) for saltpeter, granted by the king of Naples (Otto, *Deliberazioni*, 1, 33r). It is likely that, after the peace and the alliance of 1480, Florence and Naples began commerce in the precious nitrate, as we know they did for raw silk and other agricultural products (Goldthwaite, 2009, 140). In any case, during the 1480s, the Medici bank was the sole agent for saltpeter. As a ruler and as a merchant, Lorenzo the Magnificent had several interests in making its sale a sort of public monopoly. The records of the Otto listed dozen of trades of the indispensable compound between 1488 and 1494. The price was fixed at 35 florins per 1,000 *libbre* of raw saltpeter, and at 50 florins for the same quantity of refined substance (Otto, *Munizioni*, 1, 53v). In the first months of 1491, the credit of Medici bankers amounted to 2,645 florins for 59,916 *libbre* [20,370 kg] of saltpeter (Otto, *Munizioni*, 1, 15v).

The French invasion changed the situation: the banishment of Piero de' Medici and the crisis of the Aragonese kingdom compelled the Republic to buy saltpeter in Liguria, Romagna, and Marche (Dieci, Deliberazioni, 33, 105r; Debitori, 28, 40v; and Munizioni, 9, 186r). The Genoese merchant David Lomellino sold 26,802 *libbre* [9,100 kg] of saltpeter to Dieci di Balìa in 1503 (Dieci, Munizioni, 8, 167r). Benedetto Buonvisi, a Lucchese banker, dispatched to Florence 14,979 *libbre* [5,100 kg] in July 1499. One month later, Leonardo Strozzi sent to the Signoria 18,540 *libbre* [6,300 kg] from Rimini (Dieci, Entrata, 30, 180v). From 1498 to 1502, another Florentine merchant, Piero di Matteo Berti, provided republican *maestri di polvere* with several thousand *libbre* of saltpeter (Dieci, Deliberazioni, 48, 124v; Dieci, Signori, Condotte, 17, 248v; Dieci, Munizioni, 8, 12v). In January 1498, 98 florins were paid to Angelo Bardi for 2,000 *libbre* [680 kg] (Dieci, Debitori, 30, 16v). In August of the same year, the Florentine ambassador in Rome, Francesco Gualterotti, signed a deal with the Sienese banker Giulio Spannochi for a supply of 25,000 *libbre* [8,500 kg] of refined material (Dieci, Entrata, 23, 351v). Contemporaneously, the Dieci tried to enhance the production of artificial saltpeter inside the borders of the Republic. In 1496 Florentine officials made a business agreement (*merchato di salnitro*) with Antonio di Jacopo from Faenza, lending him 40 florins for establishing a saltpeter factory (*nitriera*) in Castrocaro (Dieci, Debitori, 28, 40v). In 1502 Salvatore from Fermo and Giovanni from Incisa were saltpeter makers (*maestri di salnitro*) in Arezzo (Dieci, Munizioni, 9, 168v).

The provenance of metals is uncertain. In the fifteenth century, iron mines were active in Piombino (Meli and Tognetti 2006, 89–104) and in the mountains of Casentino (Melis 1989, 192–97). Recent research has suggested that Tuscany had the resources to be self-sufficient in iron (Goldthwaite 2009, 17). According to Ciasca (1927, 438–40), tin, copper, and lead were imported from northern Europe, in particular from England and Poland. In the 1480s the Republic promulgated several laws for regulating and promoting the opening of new mines (Provvisioni, Carte di corredo, 26, 113r). Tons of copper arrived in Florence during the last years of the Medici regime (Otto, Munizioni, 1). The enterprise of Montecatini, managed by some of the most prominent Florentine oligarchic families, was successful in copper mining (Pampaloni 1975; the complaints that Paolantonio Soderini wrote about this quarry in his statement of income are not very believable: see Decima, 9, 1155r). Recycling used metals is also testified in the sources through the entire century (Dieci, Munizioni, 1; Deliberazioni, 27, 231v and 30, 252v). Bronze, however, remained one of the most expensive materials: 24 *lire* for every 100 *libbre*, while iron cost only 7 *lire* for the same quantity and lead 8 *lire per cento*

(Dieci, *Deliberazioni*, 31, 124r). Tin at about 40 *lire per cento* and copper for as much as, in 1492, 45 florins per 1,000 *libbre* (Dieci, *Deliberazioni*, 30, 240r; Otto, *Munizioni*, 1, 21r) drove the cost of bronze to much higher.

Finally, timber was needed in all steps of munitions' manufacture and use. Trees were cut everywhere and forests were exploited indiscriminately due to the increase of the production of artillery (Morelli 2007, 468–69). The charcoal derived from softwoods (pine, elder, hazel, or willow) was one of the three major component of gunpowder, with sulfur and saltpeter (Biringuccio 1558, 153v). Beech and chestnut were required for stoking furnaces and for casting metals (Dieci, *Deliberazioni*, 30, 209v; Baraldi 2007, 205–208). Gun-laying systems, the so-called “ladders” (*scale*) and “stumps” (*ceppi*), were made of elm (Dieci, *Deliberazioni*, 34, 211v). Gun carriages were entrusted to carpenters (Dieci, *Munizioni*, 5, 45r), and thousands of barrels were used for transporting saltpeter and gunpowder (Dieci, *Deliberazioni*, 33, 246v).

Other war materiel

Florentine war production, however, was obviously not limited to firearms. The Dieci and the Otto, in fact, continuously bought materiel of various sorts for supplying castles, fortresses, cities, armies, and, sometimes, fleets. Pavises (*targoni*) were mainly commissioned to artisans of San Sepolcro (Dieci, *Deliberazioni*, 33, 180r). Purchases of spears are often noted down in officers' registers. In the 1430s Matteo di Benedetto sold more than 5,000 lances for knights (*da chavallo*) and infantrymen (*da piè*) to the commune (Dieci, *Munizioni*, 2, 58r). The high number of soldiers maintained by Republic at the time of Pisan wars increased the demand of those weapons. Pistoia, at that time, was the center of production. Pace di Pippo and Donato di Giuliano were the suppliers for several companies (Dieci, *Deliberazioni*, 48).

Firearms, moreover, were useless without shot. Lead was adopted for small bullets, mainly for *scoppietti* and *spingarde* (Dieci, *Deliberazioni*, 27, 226v; *Deliberazioni*, 24, 103r). In 1502 Francesco Telli was entrusted with casting lead shots (*palle di piombo*) for bronze cannons (Signori, *Condotte*, 18, 134r). Stone was used for the shot of bombards. Stone-cutters worked incessantly in encampments from the beginning to the end of the century. They were under the walls of Lucca, in the zone behind the front in 1478, in Lunigiana, and with the army during the Pisan campaign (Dieci, *Munizioni*, 1, 125v; *Deliberazioni*, 22, 195r; *Deliberazioni*, 30, 214r; and *Deliberazioni*, 34, 209r, respectively). The major quarry was sited near the gorge of Golfolina (Dieci, *Missive*, 31, 123v). In 1499, “two stone balls covered with lead” (*due pallottole*

di sasso choperte di piombo) were sent to the Florentine encampment (Dieci, Entrata, 30, 135v). During the 1483 siege of Sarzana, the Dieci experimented with 12 shells of “fire” for burning the town. Those *pallottole di fuochi lavorati* were cast as hollow spheres filled with “black” and “Greek” pitch, oil, sulfur, paint, turpentine, saltpeter, verdigris, cotton wool, tow, twine, and wax (Dieci, Deliberazioni, 27, 266v). The maker of these projectiles was Francesco d’Agnolo, called *la Cecca*, one of the most brilliant military engineers of the Florentine Republic (Vasari 1568, I, 440–47). Eleven years later, the innovations of French cast-bronze artillery was accompanied by the introduction of more efficient cast-iron shot (Calegari 2005, 64–65). Iron shot was cheap and easily reproducible, with better aerodynamic and ballistic performances than stone ammunition (Hall 1997, 93–94). According to contemporary chroniclers, those cannonballs were unknown to Italian warfare (Guicciardini 1971, 78; Ferraiolo 1987, 81), but Florentine masters could readily assimilate the new technology. Giuliano d’Andrea, a stone-cutter, was commissioned to sculpt a mold for shot in June 1495 (Dieci, Entrata, 14, 10v). Other molds were made by Tommaso Marinai (Dieci, Munizioni, 5, 37r), one of the owners of the Montecatini copper mine and of the iron mine of Volterra (Dieci, Deliberazioni, 34, 213v). Production, managed by Tommaso himself, started in March in the ironworks of Colle Val d’Elsa (Dieci, Missive, 32, 96r). In 1498 the Dieci hired two masters, Giovanni di Piero from Piemonte and Antonio di Giovanni from Germany, for casting iron shot in Pistoia (Dieci, Deliberazioni, 46, 12v). Every gunmaker and every bell founder of Florence was mobilized (Dieci, Entrata, 30, 170v–174v), while the Signoria tried to foster production of iron cannonballs (Signoria, Condotte, 17, 27r). According to Piero Parenti (1994, 280) and to the anonymous chronicler of *La guerra del Millecinquecento* (1845, 367), in the summer of 1499 the army was even provided with cast-bronze cannonballs during the siege of Pisa, due to the lack of iron shot (Signori, Missive, 21, 52v).

Replacing military technology

In the 1490s, however, other sectors were slowly declining. The sale of crossbows seems to diminish in step with the affirmation of hand cannons and arquebuses. If the books of 1431 mentioned several makers and five or six shapes of *balestre* (Dieci, Munizioni, 1), later sources cite no significant trade in new crossbows. The purchases of a large quantity of cords for crossbows – thousands and thousands of *ghavette di filo fiandresco per balestre* – reveals, instead, a vast use of private weapons (Dieci, Deliberazioni, 48, 126r). Even Florentine

armourers did not benefit from public orders. The promising industry of the first half of *Quattrocento* did not last long. The *catasto* of 1427 listed 20 armorers (Caferro 2008b, 199), who were capable of competing with the well-known Lombard masters. Many stylistic improvements distinguished a very lively market in armor, helmets, and luxury arms. Florentine weapons merchants (*armaiuoli*) exported those products to France, Spain, and England (Scalini 1990, 113–17). However, by the third quarter of the century, Tuscan wares conformed to Lombard trends. Lorenzo de' Medici preferred to buy cuirasses for the garrison of Pisa directly in Brescia, and Milanese armor was still arriving in Florence in 1487 and 1496 (Dieci, *Deliberazioni*, 30; 42, 120v; and 36, 234v). The captain Paolo Vitelli and his brother Vitellozzo wore Lombard steel, as probably did almost all *condottieri* of those decades (Canestrini 1851, 246; Del Treppo 1973, 253–56). Infantrymen often equipped themselves with second-hand armor. Old and well-worn pieces were as durable as new ones (Leydi 2007, 173). Soldiers could purchase cuirasses in camp (Otto, *Missive*, 6, 4r) or in the shops of Florentine *merciai*, retailers of helmets (*bacinetti*, *crestate*, *cervelliere*), gauntlets, mail, swords, spears, and daggers as well as things of everyday usage, such as hats, bags, guitars, keys, gloves, lanterns, hoes, and pots (Arte dei Medici e Speziali, 4, 66r–67r).

Furthermore, these retailers traded in arrows. Domenico di Niccolò sold more than 40,000 “small” and “medium” crossbow quarrels in 1494 (Otto, *Munizioni*, 1, 49r–70r). Those bolts offer a particularly interesting case study. During the Milanese war, several craftsmen were employed in the fabrication of quarrels (*passatoi*) for goats-foot lever (*da ghanba*) and for windlass (*cianfogna*) crossbows (Dieci, *Munizioni*, 4, 40v–77r; for the different typologies of loading systems, see Gelli 1900, 111). Even if the commune did not commission new crossbows, the volume of this production remained impressive in the last quarter of the century. In 1489, 116,000 steel darts (*verrettoni*) moved in and out of Florentine warehouses (Otto, *Munizioni*, 1, 5r–9r). Eight years later, the Dieci purchased 40,000 medium, 2,000 thick, and 7,000 “olive leaf” darts (Dieci, *Deliberazioni*, 42, 128v). The capacity to produce such large numbers of projectiles may be explained by their complex production cycle. It was a sort of putting-out system (Malanima 1997, 273–77), where military officers played the role of central agents (Dieci, *Munizioni*, 1, 196r). The early sources highlight every step of the process, with many artisans acting as subcontractors that fabricated the final products in their workshops or houses. Woodcutters produced the shafts (*asticciuole*) in the forest of Pratomagno (Dieci, *Munizioni*, 4, 22r). Smiths forged arrowheads (*ferrì*) in Florence and in the town of Montefioralle, in the Chianti region. Donato di Iacopo gave to the Dieci 14,000 *ferrì* between

June and October 1432 (Dieci, Munizioni, 4, 5r). Frosino di Stefano sold 34,000 pieces (Dieci, Munizioni, 1, 138v). Even the gunmaker Michele di Jacopo delle Volte was involved in this business (Dieci, Munizioni, 4, 2r). Lastly, shafts and arrowheads were fixed by assembly workers (*inastatori*), while fletchers (*impennatori*) bound the feathers (Dieci, Munizioni, 2, 228r). Parchment (*charta pechora*) was used for the production of darts for mounted crossbowmen (Dieci, Entrata, 30, 97v and 185r). For assembly workers and fletchers, making bolts was often an alternative source of income, as it seems to have been for Piero di Giovanni, whose trade was that of a *cembolaio*, a manufacturer of musical instruments (Dieci, Deliberazioni, 31, 140v). Marietta di Jacopo made arrows in her own home (Dieci, Deliberazioni, 34, 213v). Antonio, Giovanni, and Santi dei Nonni were miniaturists and goldsmiths, but they turned into “professional” *inastatori* and *impennatori* by the end of the century (Dieci, Deliberazioni, 48, 174r; Decima, 33, 163r and 374r).

In the last 20 years of the fourteenth century, one of the most important stakeholders in the business of materiel, including arrows, was Baldo di Giovanni from Careggi. His first trade was registered in January 1486, when he received 180 florins for 18,000 bolts (Dieci, Deliberazioni, 30, 259r). After that, his affairs multiplied. In August 1492, he was creditor with the Otto for about 125,000 *libbre* [42,500 kg] of copper. Two years later, Baldo sold to officers tin, brass, copper, quarrels, harquebuses, steel crossbows, and even four *spingarde* and 1,000 Brescian cuirasses (Otto, Munizioni, 1, 32r and 1, 45v–68v). Similar deals were made with the Dieci in the late 1490s. Between June and December 1495, more than 60,000 *passatoi* and about 50,000 arrowheads went through Florentine customs (Dieci, Deliberazioni, 33). He received another allocation in 1496 for 139,625 *ferri*, 12 *spingardoni*, and 70 Brescian breastplates (Dieci, Deliberazioni, 36, 234v). In this city of Venetian state, Baldo also collaborated with the master Agnolo di Filippo for the production of many munitions, negotiating moreover several copper deals with Antonio and Gervaso Battelli (Dieci, Deliberazioni, 48, 125v and 34, 112r).

But who was Baldo di Giovanni? The sources do not help to reconstruct perfectly his role in the market. In 1472 he matriculated in the guild of smiths (Arte dei fabbri, 5, 10r), but in the records of the Dieci and the Otto he is often cited as a transporter. In 1496, for example, he was entrusted for delivering two lions given as a present to the king of France (Dieci, Deliberazioni, 34, 116v). His omnipresence excludes the possibility that he was simply a driver of carts. At the same time, the volume of his transactions suggests that he could not manufacture all those wares alone. Was he a merchant? A passage from the record of the Otto

seems to negate this hypothesis. The copper delivered in February 1492 did not belong to Baldo, but rather to Bartolomeo Bartolini and other bankers (Otto, *Munizioni*, 1, 43r). This findings indicates that Baldo was not the owner of the arms that he handled—or at least not the only one. Nevertheless, Baldo was probably a business agent between increasing public demand and foreign supply.

In any case, the Lombard commerce of Baldo di Giovanni offers the opportunity to tackle another set of problems. The trade of materiel was a “difficult” kind of commerce. Weapons were “strategic” goods for states, and foreign policy, conflicts, and alliances, could undoubtedly condition the market (Leydi 2007, 171–72). At the beginning of the century, the imports of Milanese armor were stopped by the war against the Visconti (Scalini 1990, 82). The statute of the armorers forbade commerce with enemies (Camerani Marri 1957, 32–33). In 1495 Florentine officers bought goods for 607 florins and 1,686 *lire* in Brescia (Dieci, *Deliberazioni*, 31, 129r), but, when tensions with Venice led to open war in late 1498, the frontier was closed. In the register of the first half of 1499 there are no payments for Baldo and his suppliers (Dieci, *Deliberazioni*, 46). According to Giovanni Portovenieri (1845, 294–95), in 1495 the Genoese government allowed only Pisans to buy weapons in its possessions. The Florentine Republic forbade the export of lances from Pistoia to Lucca and Siena in January and April of the same year (Dieci, *Missive*, 31, 173v–174r and 32, 132v–133r).

Florence and military technological knowledge

Florence, therefore, imported arms and armor. Was the Republic importing also knowledge? During the Renaissance, innovations were mainly spread by means of the migration of skilled labor, the so-called *pratici* (Schulz 2007, 89–94). Without theory and manuals, their technical culture derived only from the experiences in the field (Calegari 2004, 18–19). Their competence was exclusively empirical, learned during apprenticeships (Camerani Marri 1957, 159–63) and travels (Degrassi 2005, 55). Lombard masters moved through various Italian regions constructing blast furnaces (Baraldi 2007, 211). The Duke of Ferrara hired one of these *maestri da forno*, Jacopo Tacchetto, for his ironwork in Fornovolasco, in the mountains of Garfagnana (Calegari 2005, 74). Genoese craftsmen built their ironworks from Liguria to Corsica, France, and Sicily (Baraldi 2005, 177–78). It was a continuous movement. French masters probably cast bronze cannons for Pisan rebels in May 1495 (Portovenieri 1845, 307). Iron shot was cast in Naples in November, after the arrival of Milanese gunners (Ferraiolo

1987, 81). And British, Dutch, Greek, French, German, Italian, and Portuguese gunners served Florentine during the Pisan war (Dieci, *Deliberazioni*, 48). As described earlier, Francesco Telli worked with French gunmakers in Castrocaro, before casting his *cortaldo* in Florence. In his foundry he met Lorenzo di Credi, the heir of the Verrocchio's workshop, and Piero di Duai, a Picard gunner and gunmaker (Dieci, *Munizioni*, 5, 22r and 48r). He followed the army in 1495 (Dieci, *Missive*, 32, 95r). With an order of the Dieci, he then moved to Volterra to manufacture new cannons (Dieci, *Deliberazioni*, 42, 126v). Francesco di Giuliano from Asti was a gunner in Livorno (Dieci, *Deliberazioni*, 39, 106r) and a gunmaker in Sarzana (Otto, *Munizioni*, 1, 15r). Even Giuliano di Goro was a smith and a gunner (Dieci, *Deliberazioni*, 39, 100r). It is not easy, in the records, to distinguish gunners from carpenters, smiths, engineers, or soldiers. But, if artillery created new crafts (Belhoste 2007, 333), a significant, reciprocal exchange of their knowledge, techniques, and *pratiche* undoubtedly occurred in Tuscany during those years.

Storage and transportation

Public notices about Pistoiese spears, new foundries inside city borders, and mining legislation are only three examples of state control of this industry. A careful examination of archival documentation demonstrates, in fact, that the Florentine commune actually enhanced its management of war production, from mining grounds to battlefields.

This is also evident in the storage of weapons. Alongside the medieval warehouse *a' Lioni*, in the vicinity of Palazzo dei Priori (Dieci, *Munizioni*, 1, XXIIIv), new munitions dumps were opened in the towers of *Notomia* and *Giustizia*, in the eastern section of the city walls on the north bank of the Arno (Dieci, *Deliberazioni*, 33, 172v). The tower of *Notomia* was expanded in 1495 and 1496 (Dieci, *Deliberazioni*, 34, 212r; Dieci, *Deliberazioni*, 36, 237v). It was probably that old citadel (*citadella vecchia*) cited by Hale (1983, 36–37) in his study on early modern Florentine fortifications. A foundry was built in the vicinity of *Notomia* in 1496 (Dieci, *Entrata*, 26, 56v–57r; Dieci, *Entrata*, 23, 23v). The workshop of gunpowder makers, the *fuscina della polvere*, was placed on the opposite bank of the river, near the city gate of San Niccolò (Dieci, *Debitori*, 27, 183v; Dieci, *Entrata*, 30, 64v). Four boilers for refining saltpeter were walled up here before 1498 (Dieci, *Entrata*, 30, 199v). The location was not merely fortuitous, as a large amount of water was necessary to refine saltpeter (Biringuccio 1558, 150r). Another depot was sited in the palace of the Capitani di Parte Guelfa, the institution responsible for building and repairing state fortresses (Dieci, *Deliberazioni*, 34, 210r). During

the last decades of the century, Gaspare di Antonio Pasquini was the custodian of all materiel (Otto, *Deliberazioni*, 2, 21r). In April 1485 he was elected by the Dieci as responsible for munitions (*ministerium ad monitiones*) (Dieci, *Deliberazioni*, 25, 213r), and he was still in charge in June 1499 (Dieci, *Deliberazioni*, 46, 77r). In 1495 Michele di Jacopo di Baldino was chosen for watchman of the tower of Notomia (*pro guardia pulveris qui in munitione est apud portam Iustitiae*) (Dieci, *Deliberazioni*, 35, 3v). The care, purchase, and consignment of arms and armor were also entrusted to *provveditori*, officers specifically appointed by the Dieci, the Otto and the Capitani (Dieci, *Deliberazioni*, 31, 17v). Numerous officials were responsible for artillery in the main Tuscan towns (Dieci, *Deliberazioni*, 23, 78) and in encampment (Dieci, *Deliberazioni*, 33, 93v).

Whatever was the aim of these officials, transporters – *vetturali* and *carradori* – were indispensable in planning every military operation. The transport of heavy guns was a risky undertaking (Covini 2000, 228–30). In September 1482, 13 men, 26 oxen, and 4 carts were necessary for transporting a bombard from Arezzo to Anghiari (Dieci, *Deliberazioni*, 27, 222v). Oxen were commonly employed for transporting artillery in fifteenth-century Italy (Mallett 2006, 166). Horses and small carts seems to have appeared only after the French invasion. In 1498 the Dieci di Balìa hired 25 men, 25 horses and 25 “small carts” (*carrette*) to transport “small guns” (*artiglierie minute*) (Dieci, *Deliberazioni*, 47, 13r). In those years, moreover, the officials purchased and rented many carts “with two wheels” (*a due ruote*) (Dieci, *Entrata e uscita*, 30, 69r–82v). Two of the most important producers of these “new” carts were the Pratese Lorenzo di Giovanni Bifolchi and Domenico di Pacino (Dieci, *Debitori*, 32, 52v and *Entrata*, 23, 207r and 210r). The river Arno, on the contrary, was an easier means of transportation, and many of the cannons produced in Florence for the Pisan campaign were transported by boatmen (*scafaioli*) on their rafts (Dieci, *Entrata*, 30, 86v–88r; Landucci, 1969, 197).

Rope makers, also, provided cords for packing weapons (Dieci, *Deliberazioni*, 34, 214v). And many other Florentines were involved in this market. If several masters manufactured munitions, many other craftsmen were employed in supplying soldiers. Bakers, innkeepers, and wine merchants, for example, sold the basic foodstuffs, while porters were daily recruited to transport saltpeter, guns, and metals (Dieci, *Deliberazioni*, 46, 50v; 43, 54r; and 30, 209v). Carpenters – *legnaioli* and *maestri d'ascia* – were always present in camp, as were masons and bricklayers. Weavers, moreover, manufactured flags and pavilions for captains, and tents for troops (Dieci, *Deliberazioni*, 38, 1r; Dieci, *Munizioni*, 1, XLIIr).

Conclusions

Even a mere quantitative study, therefore, could reveal a significant growth in the commerce of war-related products. Hale (1987, 232–33) correctly observed that these public expenditures were not unprofitable. A multitude of artisans could occasionally make profits from the sale of countless goods: it could be an alternative source of income and an opportunity for gain. Merchants and bankers often made money from conflict with trade and loan (Caferro 2008b, 200). What Machiavelli (1521, 224) called the populous “mobile city” of an army, besides, would have consumed more food, clothes, and money than most “standing” towns, and soldiers’ wages were often recycled into the economy, intensifying market exchange (McNeill 1982, 74). When French soldiers entered Florence in November 1494, for example, the Signoria authorized the opening of several new taverns (Landucci 1969, 73). But the state, above all, purchased weapons.

During the entire Quattrocento, as described in the previous pages, the Republic contributed to increase this market. Craftsmen were employed in producing munitions and in supplying soldiers and fortresses with guns, arms, and armor. Above all, the government fostered technological improvements in the fabrication of firearms. Iron bombards and hand cannons were gradually replaced by bronze artillery and arquebuses. New foundries were built in the city, while the introduction of iron shot stimulated the construction of new ironworks. Merchants traded in saltpeter and metals. Even in this field Florentine society confirmed the receptive and enterprising habits (Cipolla 2009, 221–225) that distinguish its artistic and “technical” Renaissance (Gille 1972, 8–12). Clearly, improved fiscal policies (Molho 1994, 225–64) and increasing taxes impoverished lower classes, reduced capital, and limited investments (McLean 2005, 645–46). In 1497 the Pisan conflict coincided with unemployment, epidemics, and famine (Landucci 1969, 132–46). Armies disrupted fundamental trade routes, and blockades, as explained earlier, denied access to raw materials. Political crisis also influenced the economy of war (Cadoni 1999, 101–75). From a production-related perspective, however, the sources makes fairly clear that the received historiographical wisdom of a military “backwardness” of the Republic is not accurate at all.



Figure 2. A bombard, sketched by an anonymous Sienese chancellor in 1470s
Siena, Archivio di Stato, Concistoro, 2557
Drawing by Angela Marino

ARTICLE III
**GEOGRAFIE DELLA GUERRA NELLA TOSCANA DEL RINASCIMENTO.
PRODUZIONE DI ARMI E CIRCOLAZIONE DEI «PRATICI»**

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Se manieri e fortezze sono stati finora ampiamente indagati dalla storiografia, militare e non, per la loro valenza politica, la loro funzione economica ed il loro impatto sociale, non altrettanto interesse hanno suscitato, negli studiosi, altri spazi della guerra medievale, come quelle fonderie e quelle fucine dove le armi venivano prodotte e vendute.¹ D'altronde, ancor meno attenzione hanno ricevuto, almeno in Italia, i processi ed i progressi tecnologici dettati dai conflitti, la loro diffusione e la loro concreta realizzazione per mano di esperti «pratici», al di là di una generica consapevolezza teorica delle loro relazioni con le evoluzioni di tattiche e strategie, del ruolo degli armamenti nelle scelte operative di governi e generali, del loro quotidiano utilizzo in miniere, botteghe ed accampamenti.² Non sorprende, quindi, che ai lavori pionieristici di Angelo Angelucci e di Carlo Montù sulla storia delle artiglierie italiane siano seguiti soltanto pochi altri contributi, apparsi perlopiù nell'ultimo ventennio, e solitamente circoscritti all'area veneta ed all'indagine archeologica di alcuni relitti navali.³

¹ W. CAFERRO, *Contesting the Renaissance*, Oxford, Wiley-Blackwell, 2010, p. 165; M. CALEGARI, *Nel mondo dei pratici. Molte domande e qualche risposta*, in *Saper fare. Studi di storia delle tecniche in area mediterranea*, Pisa, ETS, 2004, pp. 9-33; R. GOLDTHWAITE, *The economy of Renaissance Florence*, Baltimore, The Johns Hopkins University Press, 2009, pp. 400-402; E. STUMPO, *La finanza di guerra negli antichi stati italiani*, in *Storia economica della guerra. Quaderno 2007-2008*, a cura di Catia Eliana Gentilucci, Roma, Società Italiana di Storia Militare, 2008, p. 196. Da segnalare è, però, la recentissima pubblicazione di M. MERLO, *Armamenti e gestione dell'esercito a Siena nell'età dei Petrucci. Le armi*, «Rivista di Studi Militari», V, 2016.

² K. DEVRIES, *Medieval military technology*, Toronto, University of Toronto Press, 2012; B. HALL, *Weapons and warfare in Renaissance Europe*, Baltimore e London, The Johns Hopkins University Press, 1997; J. GUILMARTIN, *Gunpowder and galleys. Changing technology and Meditterrean warfare at sea in the sixteenth century*, London, Conway Maritime Press, 2003; E. BARALDI, *Una nuova età del ferro. Macchine e processi della siderurgia*, in *Il Rinascimento italiano e l'Europa*, III. *Produzione e tecniche*, a cura di Philippe Braunstein e Luca Molà, Treviso, Angelo Colla Editore, 2007, pp. 214-216.

³ A. ANGELUCCI, *Documenti inediti per la storia delle armi da fuoco italiane*, Torino, Tipografia Cassone, 1869; C. MONTÙ, *Storia dell'artiglieria italiana*, Roma, Rivista d'Artiglieria e Genio, 1934; W. PANCIERA, *Il governo delle artiglierie. Tecnologia bellica e istituzioni veneziane nel secondo Cinquecento*, Milano,

Un caso a parte è forse rappresentato dagli arsenali, luoghi privilegiati di interazione e di scambio tra la cultura tecnica di artigiani e militari e la riflessione teorica di ingegneri e uomini di scienza.⁴ Inoltre, anche i famosi corazzai milanesi, come i Missaglia ed i Negroli, sembrano avere attratto l'attenzione degli storici dell'arte per le loro armi di lusso, elmi e «rotelle» di splendida fattura che costituivano, però, soltanto una minima parte di quel vastissimo mercato di spade, corazze, archibugi, anche di seconda mano, che animava le piazze di accampamenti e città.⁵

L'obiettivo di questo saggio è, pertanto, un tentativo di ricostruzione della geografia della produzione bellica, dello sfruttamento delle risorse energetiche, della circolazione delle merci e della migrazione dei «pratici»,⁶ all'interno di un contesto, come quello della Firenze rinascimentale, economicamente molto reattivo e vivace, ma sul quale pesano, ormai da troppi anni, il pregiudizio machiavelliano sulle milizie mercenarie e l'«ortodossia dell'arretratezza» in ambito militare.⁷ A questo scopo, sono state vagliate fonti fiscali, come quelle del catasto e della decima repubblicana, e documenti prodotti dalle corporazioni dei fabbri, dei corazzai e degli speciali, che hanno fornito non solo informazioni sulle relazioni sociali e lavorative degli artigiani, ma anche, e soprattutto, sulla loro ricchezza e sugli strumenti

Franco Angeli, 2005; C. BELTRAME, M. MORIN, *I cannoni di Venezia. Artiglierie della Serenissima da fortezze e relitti*, Firenze, All'insegna del Giglio, 2013; *Ships and guns. The sea ordnance in Venice and Europe between the fifteenth and the seventeenth century*, a cura di Carlo Beltrame e Renato Ridella, Oxford, Oxbow Books, 2001.

⁴ P. LONG, *Artisans, practitioners and the rise of the new sciences*, Corvallis, Oregon State University Press, 2011; B. GILLE, *Leonardo e gli ingegneri del Rinascimento*, Milano, Feltrinelli, 1972.

⁵ S. PYHRR, J. GODOY, S. LEYDI, *Heroic armor of the Italian Renaissance. Filippo Negroli and his contemporaries*, New York, The Metropolitan Museum of Art, 1998; M. SCALINI, *L'armatura fiorentina del Quattrocento*, in *Guerra e guerrieri nella Toscana del Rinascimento*, a cura di Franco Cardini e Marco Tangheroni, Firenze, EDIFIR, 1990; S. LEYDI, *Le armi*, in *Il Rinascimento italiano e l'Europa*, IV. *Commercio e cultura mercantile*, a cura di Franco Franceschi, Richard Goldthwaite e Reinhold Mueller, Treviso, Angelo Colla Editore, 2007; S. BIANCHESSI, *Cavalli, armi e salnitro fra Milano e Napoli nel secondo Quattrocento*, «Nuova rivista storica», LXXXII, 1998.

⁶ P. BRAUNSTEIN, *La geografia della produzione*, in *Il Rinascimento italiano e l'Europa*, III. *Produzione e tecniche*, cit., pp. 3-31.

⁷ Sulla presunta decadenza degli eserciti fiorentini, v. M. MALLETT, *Signori e mercenari. La guerra nell'Italia del Quattrocento*, Bologna, Il Mulino, 2006, pp. 134-136; ID., *L'organizzazione militare di Venezia nel Quattrocento*, Roma, Jouvence, 1989, pp. 256-257; C. FINZI, *La guerra nel pensiero politico del Rinascimento toscano*, in *Guerra e guerrieri nella Toscana del Rinascimento*, cit., pp. 127-153; J. R. HALE, *Guerra e società nell'Europa del Rinascimento*, Roma – Bari, Laterza, 1987, p. 64. Basandosi su fonti primarie, un tentativo di ribaltamento di questa visione è stato offerto recentemente da W. CAFERRO, *Continuity, long-term service and permanent forces. A reassessment of the Florentine army in the fourteenth century*, «Journal of Modern History», LXXX, 2008, 2, pp. 219-251.

delle loro botteghe. Ampio uso è stato fatto, inoltre, dei registri delle due istituzioni militari fiorentine, i Dieci di Balìa e gli Otto di Pratica, avvicendatesi nel corso di tutto il Quattrocento. I loro libri di «munizione», di «deliberazioni» e «condotte», di «missive» e «responsive», infatti, hanno permesso di investigare approfonditamente il ruolo avuto dallo stato nell'introduzione dei cambiamenti tecnologici, nell'adozione di strumenti innovativi, nell'apertura di nuovi impianti e nello stimolare, complessivamente, la produzione di «piombo, polvere e saettume». A questa documentazione, conservata nell'Archivio di Stato di Firenze, vanno senz'altro aggiunti, infine, i libri di conto, le «ricordanze» ed i quaderni di appunti di due dei principali fonditori della Repubblica, Maso di Bartolomeo e Bonaccorso Ghiberti, conservati rispettivamente nella Biblioteca Nazionale Centrale di Firenze e nell'archivio storico dell'Istituto degli Innocenti.

Nella Firenze rinascimentale, il più antico arsenale risulta essere stato quello «a' Lioni», posto sul retro del palazzo dei Priori, complementare ai magazzini trecenteschi della Camera dell'Arme, collocati, a loro volta, al pian terreno dell'edificio arnofiano. Fin dagli anni Venti, ai «Lioni» venivano riposte le munizioni della Repubblica, comprese le artiglierie e la polvere da sparo, nonché centinaia di casse contenenti decine di migliaia di verrettoni, fabbricati durante la guerra coi Visconti e destinati all'esercito ed alle guarnigioni di frontiera.⁸ Una simile funzione era svolta anche dalla «chasa del chomune», dove, nel 1472, era stata collocata la bombarda «Victoriosa», di ritorno dall'assedio di Volterra.⁹ I depositi del palazzo, tuttavia, sembrano essere stati dismessi già prima dell'esilio di Piero de' Medici, nel novembre del 1494, scacciato dalla capitale al grido di «popolo e libertà».¹⁰ L'ultima esplicita menzione dei «Lioni», infatti, risale al 1491, quando vi venivano collocati centotrentadue archibugi di ferro provenienti da Sarzana, dalla bottega di maestro Francesco d'Asti, fabbro e bombardiere.¹¹ Soltanto con la riforma della milizia machiavelliana, nel 1506, tornavano ad essere depositate sotto le volte e gli anditi del «palagio» delle armi, fra cui spiccavano, numericamente, seicentonovanta archibugi di bronzo fusi a Firenze, diecimiladuecento lance pistoiesi e più di

⁸ ARCHIVIO DI STATO DI FIRENZE [da ora in avanti ASF], *Dieci di balìa, Munizioni*, 1, c. XXIVv; ASF, *Dieci di balìa, Munizioni*, 4, cc. 40v-77r; ASF, *Dieci di balìa, Ricordanze*, 7, c. 4r; ASF, *Dieci di balìa, Debitori e creditori*, 20, c. 76r.

⁹ ASF, *Dieci di balìa, Debitori e creditori*, 20, cc. 73v e 92r.

¹⁰ P. PARENTI, *Storia fiorentina*, I., a cura di Andrea Matucci, Firenze, Leo S. Olschki, 1994, pp. 112-129.

¹¹ ASF, *Otto di pratica, Munizioni*, 1, c. 15r.

seimila «petti d'acciaio» acquistati a Brescia, affidati alla custodia del massaiolo della Camera dell'Arme, e riservati alle «bande».¹²

Fra il luglio del 1511 e l'agosto del 1512, anche la loggia della piazza dei Signori veniva adibita, «cavata et acconcia», ad arsenale delle artiglierie. Sei «finestre di filo d'ottone fatte co' telai di ferro» furono montate alla «volta», a protezione di dodici cannoni, otto passavolanti, un cortaldo, undici mezzani, venticinque falconetti, due bombarde «all'antica» ed un mortaio, coi loro carri e «fornimenti».¹³ I pezzi, tutti di bronzo, erano stati in parte trasferiti dalle «stalle del papa», altro deposito di artiglierie dei primi anni del Cinquecento, posto nei pressi della chiesa di Santa Maria Novella.¹⁴ Non era, in ogni caso, la prima volta che i cannoni facevano bella mostra di sé, sotto l'alta torre di Arnolfo. Già nel 1505, infatti, in occasione del quarto assedio tentato contro la ribelle Pisa, il cronista Piero Vaglianti scriveva che i cannoni erano sfilati tra il popolo festante.

Questo dì XXVII d'agosto andonno giù l'artiglierie, che funno pezzi quaranta, cioè quattordici grosse di getto di libbre centocinquanta di pallottole di ferro, e pezzi quattordici di getto di libbre cento, e pezzi dodici d'archibugi per trarre a' merli. E passonno di piazza de' Signori, a cagione che tutto 'l popolo la vedesse, con gran trionfo e gran solennità.¹⁵

Poste accanto al cuore della Repubblica, le artiglierie assurgevano dunque a simbolo di forza e di potere, vero e proprio «*cliché of statecraft*», necessarie alla difesa, garanzia di ordine,¹⁶ soprattutto in un periodo di forte crisi politica, come quello vissuto a Firenze dopo la battaglia di Ravenna e prima del sanguinoso saccheggio di Prato.¹⁷ La «piazza», del resto, era, e sarebbe ancora stata, palcoscenico del «militare». Le compagnie d'arme vi facevano spesso la

¹² ASF, *Dieci di balia, Munizioni*, 9, cc. 165r, 181v e 189r; ASF, *Dieci di balia, Munizioni*, 10, cc. 99rv, 158v e 172r. Dell'acquisto dei «petti per le fanterie» parla anche P. VAGLIANTI, *Storia dei suoi tempi*, a cura di Giuliana Berti, Michele Luzzati ed Ezio Tongiorgi, Pisa, Pacini, 1982, p. 195.

¹³ ASF, *Dieci di balia, Munizioni*, 10, cc. 201r e 202v.

¹⁴ ASF, *Dieci di balia, Munizioni*, 9, c. 100v; ASF, *Dieci di balia, Munizioni*, 10, cc. 11r e 112v. La localizzazione esatta delle «stalle» è offerta, più che dalle fonti archivistiche, da L. LANDUCCI, *Diario fiorentino*, a cura di Iodoco del Badia, Firenze, Studio Biblos, 1969, p. 310.

¹⁵ VAGLIANTI, *Storia dei suoi tempi*, cit., p. 201.

¹⁶ HALE, *Gunpowder and the Renaissance*, cit., pp. 393 e 408; M. CALEGARI, *La mano sul cannone. Alfonso I d'Este e le pratiche di fusione dell'artiglieria*, in *Pratiche e linguaggi. Contributi a una storia della cultura tecnica e scientifica*, Pisa, ETS, 2005, p. 76; MALLETT, *Signori e mercenari*, cit., p. 168.

¹⁷ F. RINUCCINI, *Ricordi storici*, Firenze, Dalla Stamperia Piatti, 1840, pp. 171-178; LANDUCCI, *Diario fiorentino*, cit., pp. 315-325; VAGLIANTI, *Storia dei suoi tempi*, cit., pp. 233-237.

mostra, rassegnate dagli ufficiali della Condotta.¹⁸ Qui, «su la ringhiera de' Signori», veniva consegnato il «bastone» al capitano generale.¹⁹ E la guerra e la violenza pubblica potevano spesso diventare efficaci strumenti di consenso, quando espresse, o represses, dalla «bella» giustizia, o se incanalate nelle forme spettacolari e propagandistiche delle giostre e dei tornei.²⁰

E a dì venticinque di giugno 1513, feciono in su la Piazza de' Signori uno castello di legniamè, e fecionlo combattere con diverse lance e arme e con mattoni crudi e bastoni, tutti senza ferro. Era dentro circa cento uomini e di fuori furono circa trecento; e fu in modo bestiale la guerra che di quegli di fuori ebbono di quei mattoni in modo che ne andò assai allo Spedale, e anche ne morì.²¹

Rientrati i Medici nella capitale, nel settembre del 1512, i tamburi, le armi e le corazze dei vecchi battaglioni di fanteria erano rientrati, a poco a poco, nei magazzini del palazzo dei Capitani di Parte Guelfa,²² gli ufficiali incaricati della guardia e della manutenzione delle fortezze del Dominio, nonché della nomina dei loro castellani, provvigionati, artiglieri e tecnici.²³ Le prime attestazioni della «munizione della Parte», il secondo arsenale della Repubblica per importanza e grandezza, risalgono al 1472.²⁴ All'interno dell'edificio venivano custodite armi delle più svariate ragioni, ma anche attrezzi per i guastatori, e, soprattutto, ingenti quantitativi di metallo.²⁵ Gli inventari del 1496, ad esempio, registravano quarantuno corazze, sessantaquattro balestre d'acciaio, dodicimila gavette di filo di Fiandra, cinquantanovemila punte di freccia e cinquantasettemila «passatoi», millesettecento «ferri da lance», cinquecento «manichi da scure e pale e marre e bechastrini», duecento «targoni»,

¹⁸ LANDUCCI, *Diario fiorentino*, cit., p. 255.

¹⁹ BIBLIOTECA MEDICEA LAURENZIANA, *Plut.61.41*, c. 82v.

²⁰ LANDUCCI, *Diario fiorentino*, cit., pp. 176-178 P. VENTRONE, *Cerimonialità e spettacolo nella festa cavalleresca fiorentina del Quattrocento*, in *La civiltà del torneo. Giostre e tornei tra Medioevo ed Età Moderna*, atti del settimo convegno di studio, Narni, 14-16 ottobre 1988, Narni, Centro di Studi Storici, 1990, pp. 35-53.

²¹ LANDUCCI, *Diario fiorentino*, cit., p. 340.

²² Sulla consegna degli armamenti ai battaglioni, v. ASF, *Nove conservatori di ordinanza e milizia, Distribuzioni di armi*, 1, c. 1v; N. MACHIAVELLI, *Provisione della ordinanza*, in ID., *L'arte della guerra. Scritti politici minori*, a cura di Jean-Jacques Marchand, Denis Fachand e Giorgio Masi, Roma, Salerno, 2001, pp. 482-483; VAGLIANTI, *Storia dei suoi tempi*, cit., p. 214; LANDUCCI, *Diario fiorentino*, cit., p. 273.

²³ G. GUIDI, *Lotte, pensiero e istituzioni politiche nella repubblica fiorentina dal 1494 al 1512*, Firenze, Leo S. Olschki, 1992, pp. 823-841.

²⁴ ASF, *Dieci di balìa, Debitori e creditori*, 20, c. 23r.

²⁵ ASF, *Dieci di balìa, Entrata e uscita*, 11, cc. IIr-IVr.

trecento fra archibugi e «schopietti», sedicimila libbre di ottone, ottomila di piombo «sodo et d'ogni sorta», centosettantasettemila di rame «in fasci et piastre» e mille di stagno. Casette, «involture» e barili erano state tutte «consegnate» ai Dieci di Balìa dal provveditore dei Capitani, Bernardo Ciai,²⁶ il cui predecessore, Bernardo Bartolini, era stato nominato, alla metà degli anni Ottanta, «provveditore generale delle munizioni del nostro comune».²⁷ Al loro «donzello» spettava, invece, il «racconciare passatoi vecchi», il «rassettare la polvere», la «legatura delle some mandate in campo» ed anche, occasionalmente, la fusione di pallottole di piombo.²⁸

Sempre nel 1496, si procedeva ad ottimizzare gli spazi del deposito con «rastrelli chon picciuoli et arpioni per apichare l'artiglieria intorno al maghazino», «uncini da apicchare choraze», «arpioni per apicare i targoni» e «piane per lance»,²⁹ mentre, a poche centinaia di metri di distanza, in riva all'Arno, i Dieci di Balìa iniziavano l'ampliamento dell'arsenale della «Notomia».

Completate, come il resto della seconda cerchia muraria, nel 1284, le due torri della «Giustizia» e della «Notomia» svettavano sul lato orientale della città, sulla banchina settentrionale del fiume. La prima prendeva il nome dalla porta che proteggeva, posta al termine della via dei «malcontenti», dei condannati a morte che di lì transitavano, diretti verso le forche antistanti. La seconda, la torre dell'«osservazione», era posta invece «*super Arnum*». Chiamata talvolta anche «torre di San Francesco» per la vicinanza all'omonimo convento, è oggi identificabile con il torrione «della zecca vecchia» che sorge in piazza Piave. L'intero complesso, compreso in uno spazio di cinquanta metri lineari, andava a formare, ai primi del Cinquecento, quella «citadella vecchia» citata da John Hale nei suoi studi sulle fortificazioni fiorentine della prima Età Moderna, indicata anche, in un registro del 1495, come l'«*arce Notomiae*».³⁰ Di questo tratto di mura scriveva anche il Machiavelli in una sua «relazione di

²⁶ ASF, *Dieci di balìa, Munizioni*, 6, cc. 2r, 8v, 19v, 49v, 51v, 83v, 97v, 113v, 115r, 126v, 139v, 142v, 163v e 181rv.

²⁷ ASF, *Dieci di balìa, Missive*, 25, c. 160v; ASF, *Dieci di balìa, Missive*, 29, c. 83v; ASF, *Otto di pratica, Missive*, 6, c. 48v.

²⁸ ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 31, c. 148rv.

²⁹ ASF, *Dieci di balìa, Munizioni*, 7, cc. 112r, 181v, 274r e 276v.

³⁰ ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 33, c. 246r; J. HALE, *The end of Florentine liberty. The Fortezza da Basso*, in ID., *Renaissance war studies*, London, The Hambledon Press, 1983, pp. 36-37.

una visita fatta per fortificare Firenze», sopralluogo compiuto con il noto ingegnere militare spagnolo Pietro Navarro nell'aprile del 1526.

Venimo dipoi alla porta alla Croce, la quale si debbe affortificare come le altre, e di quivi, partiti per lungo le mura, si trova una torre che è dirimpetto all'Agnolo Raffaello, la quale vorrebbe si ingrossasse bene, per fare più difese al luogo propinquo ad Arno. Venimo alla porta alla Giustizia, dove gli pare da abbattere il Tempio e tutti quegli imbratti che sono intorno a quella parte, et fare quivi un grossissimo baluardo, acciocché possa difendere gagliardamente quella entrata d'Arno. Vorrebbe ancora che la torre della munizione, che è propinqua alla porta, si abbassasse et ingrossasse, acciocché fosse ancora più gagliarda quella parte.³¹

Il primo riferimento alla «porta alla Giustizia» come deposito di «*pulvis et salnitru pro publico munimento*» risale, comunque, al 1484. In quell'anno, difatti, vi venivano immagazzinati diversi barili di polvere da sparo, posti probabilmente «in luoghi alti, dove poco si pratici, per molti rispetti, e, se non per altro, perché la stia all'asciutto».³² Nei sotterranei, invece, erano stivate le centinaia di migliaia di libbre di salnitro acquistate a Napoli dal banco Medici e rivendute al Comune.³³ Con la fine della «criptosignoria» e, soprattutto, con l'aumento delle minacce interne e dei pericoli esterni, i Dieci decisero di fortificare ulteriormente la «cittadella», affidando l'opera al capomastro del palazzo dei Priori, Simone del Pollaiuolo, detto «il Cronaca», a Jacopo Rosselli, «maestro di murare», ed al «Riccio muratore».³⁴

La ristrutturazione della «Notomia», iniziata nel giugno del 1495, prevedeva l'allargamento degli spazi di deposito, lo scavo di alcune «buche per sanitro» nel seminterrato, il posizionamento di «chorridori» e «parapetti» lignei tra la «porta alla Giustizia» e la torre, il rifacimento di «schala e palchetto» ed il collocamento di una spingarda a guardia della pescaia dell'Arno. In particolar modo, venivano risistemate le «burbere» per «tirare suso e mandare giuso munizione», sostituite le chiavi e le toppe, ed acquistato il mobilio necessario

³¹ N. MACHIAVELLI, *Relazione di una visita fatta per fortificare Firenze*, in ID., *L'arte della guerra. Scritti politici minori*, cit., p. 670. Su tali progetti e lavori, v. ASF, *Procuratori delle mura*, 1, cc. 1v-2r.

³² ASF, *Dieci di balia, Entrata e uscita*, 8, cc. 91v e 161v; V. BIRINGUCCIO, *Pirotechnia*, Venezia, Per Comin da Trino di Monferrato, 1559, c. 154v.

³³ ASF, *Otto di pratica, Munizioni*, 1, cc. 3v, 12rv, 15v, 25r e 54r; ASF, *Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti*, 1, c. 33rv.

³⁴ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 34, c. 212r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 36, c. 237v; ASF, *Dieci di balia, Entrata e uscita*, 14, cc. 170v-171r e 273v.

all'abitazione del guardiano, una «lettiera salvatica», cassapanche, un «descho per ischirivere» ed un «chalamaio e una ampolla d'inchiostro et sanopia et penello per segnare e' barili». Sul nuovo tetto, infine, veniva anche posto «el segnio de' Dieci», una «bandera» di ferro a forma di colomba,³⁵ realizzata «di suo disegno» dal fabbro Filippo di Leonardo, detto «Chiavaccio».³⁶

L'opera di ampliamento dell'arsenale continuava ancora nel 1496, rompendo «el muro dell'orto della porta alla Giustizia», asportando «sassi e terra e spianare per mettere e' charri» ed «impianellando el tetto fatto alla torre per choprire l'artiglierie». A giugno, la «Notomia» poteva essere considerata, a tutti gli effetti, il nuovo deposito delle bombarde della Repubblica. Oltre a ciò, nel mese precedente, si era proceduto al «muramento della stanza per il fornello della porta», ovvero alla costruzione di una fonderia pubblica, destinata esclusivamente alla produzione di armi da fuoco. All'innalzamento del fabbricato e del «magazzino del rame» parteciparono diverse decine di artigiani, «fornaciaci», «fondatori», «legnaioli», fabbri, manovali, scalpellini, «carrettai» e «renaioli», tutti coinvolti a vario titolo in quella vivace industria edile della Firenze quattrocentesca, che, sul finire del secolo, vedeva fra i suoi maggiori committenti anche i Dieci di Balìa.³⁷ Sul finire del 1498, infine, la «Notomia» venne dotata anche di una fucina.³⁸

Tutte le spese di «acchoncimo et muratura» erano minuziosamente annotate da Michele di Jacopo di Baldino Compagni, eletto dai magistrati, nel giugno del 1495, «*pro guardia pulveris quis in munitione est apud portam Crucis seu Iustitiae*», con condizione che risiedesse permanentemente nella torre. Il suo salario ammontava a quattro fiorini al mese.³⁹ La vita del Compagni, tuttavia, non sembrava essere stata, fino ad allora, particolarmente legata al mondo delle armi. Figlio di un rigattiere, immatricolato nell'arte dei fabbri, Michele era stato imprigionato per debiti e costretto a prestare servizio «in sulle ghalee de' Medici», per essere poi catturato «in sulle ghalee del re Ferrando da Cholombo, chorsale francioso», alla metà degli anni Ottanta. Dieci anni più tardi, nella sua portata della «decima», affermava di non fare

³⁵ ASF, *Dieci di balia, Entrata e uscita*, 8, c. 60v.

³⁶ ASF, *Dieci di balia, Entrata e uscita*, 13, cc. 156v-160v e 174v-176r; ASF, *Dieci di balia, Entrata e uscita*, 14, cc. 170v-171r e 273v; ASF, *Dieci di balia, Entrata e uscita*, 15, cc. 60v e 61v; ASF, *Dieci di balia, Debitori e creditori*, 25, cc. 62v-63r.

³⁷ ASF, *Dieci di balia, Entrata e uscita*, 26, cc. 56v-57r; ASF, *Dieci di balia, Munizioni*, 7, cc. 304v e 308v. Sull'economia legata all'edilizia, v. R. GOLDTHWAITE, *La costruzione della Firenze rinascimentale*, Bologna, Il Mulino, 1984.

³⁸ ASF, *Dieci di balia, Entrata e uscita*, 30, c. 64v.

³⁹ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 35, 3v; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 42, cc. 115r e 169v.

«arte né botteggha nessuna».⁴⁰ Nonostante i suoi trascorsi burrascosi, o forse proprio in virtù del suo passato rocambolesco, a lui erano comunque affidate le chiavi del più importante arsenale fiorentino, così come la scrittura del «libro dei conti» dei Dieci, la tenuta degli inventari, i rapporti con gli artefici, le complesse operazioni di pesatura delle armi da fuoco e della polvere, la sistemazione dei «fornimenti» delle bombarde, e persino la «rasegnia» delle «artiglierie per le fortezze et chastella della Republica».⁴¹ A ciò si aggiungeva anche il collaudo dei nuovi pezzi, eseguito proprio sul «prato della Giustizia».

Si portò una bonbarda alla Porta alla Giustizia, fatta di nuovo; e provandola, trasse e rovinò una casa alla Capannaccia.⁴²

Gaspare di Antonio Pasquini affiancava il Compagni nella gestione e nella guardia dei depositi, nelle spedizioni di armi, nei rapporti con gli artigiani e negli acquisti al minuto delle più svariate attrezzature. Scelto come «*ministrum ad monitiones*» nell'aprile del 1485, dopo avere gestito una «boteggha di pizichagnolo» insieme al fratello, Gaspare era ancora in carica nel giugno del 1499, a quasi sessant'anni di età.⁴³ Contrariamente al suo collega, il Pasquini aveva maggiore dimestichezza col mercato delle armi, avendo venduto ai Dieci, durante le campagne contro volterrani, senesi e napoletani, diversi barili di polvere e numerosi archibugi.⁴⁴ A lui spettava il compito di redigere i «libri di munitione» dei Dieci di Balìa e degli Otto di Pratica, annotando quotidianamente le spese relative alla manutenzione dei magazzini, delle polveriere e delle fonderie, nonché i rifornimenti delle materie prime, i costi delle attrezzature ed i pagamenti a fabbri, falegnami, fonditori, fornai, carradori e muratori.⁴⁵

⁴⁰ ASF, *Catasto*, 1021, cc. 293r-294r; ASF, *Arte dei fabbri*, 5, c. 52r; ASF, *Decima repubblicana*, 31, c. 274v.

⁴¹ ASF, *Dieci di balìa, Entrata e uscita*, 13, c. 156v; ASF, *Dieci di balìa, Munizioni*, 5, cc. 136r e 358r; ASF, *Dieci di balìa, Munizioni*, 6, cc. 181r-182r; ASF, *Dieci di balìa, Munizioni*, 7, c. 15v; ASF, *Dieci di balìa, Entrata e uscita*, 16, c. 1r; ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 34, c. 197r; ASF, *Dieci di balìa, Debitori e creditori*, 28, c. 64v.

⁴² LANDUCCI, *Diario fiorentino*, cit., p. 128; ASF, *Dieci di balìa, Entrata e uscita*, 30, c. 112r. Nel 1510, «alla porta a San Francesco», venivano «provati» anche i nuovi bombardieri. In ASF, *Dieci di balìa, Munizioni*, 10, c. 209v.

⁴³ ASF, *Catasto*, 994, c. 340r; ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 25, 213r; ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 46, 77r; ASF, *Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti*, 2, 21r.

⁴⁴ ASF, *Dieci di balìa, Debitori e creditori*, 20, c. 41; ASF, *Dieci di balìa, Debitori e creditori*, 22, c. 14v.

⁴⁵ ASF, *Otto di pratica, Munizioni*, 1, c. 1r; ASF, *Dieci di balìa, Munizioni*, 5, cc. 1r, 77r e 221r.

Sull'operato del Pasquini e del Compagni sovrintendevano, a loro volta, i due sottoprovvettori dei Dieci. Istituiti al tempo della guerra di Pisa, il loro incarico consisteva nel rivedere e «raghualgliare» i conti dell'ufficio, nel compilare le partite doppie dei debitori e creditori «per conto di munizione», e, a partire dal dicembre 1496, nel «tenere» il «libro d'entrata e uscita di artiglieria e vettovaglia e charradori e vetture».⁴⁶ Ed è proprio di mano del sottoprovvettore Francesco di Bernardo Quaratesi l'inventario del giugno 1503 in cui si ritrovano «tutta la munizione et artiglieria et altra masserizia» presente nella «cittadella vecchia», distribuita in diversi ambienti.

Nel palcho di sopra della torre della Giustizia cioè nella cima: una ruota da tirare suso polvere e altro chol suo chanapo vecchio in cima della torre.

Allo scendere al sechondo palcho: undici balestre d'acciaio sformite; tredici balestre di legno tra chorde e sanze chorde, quattro rotte; due ribalde, cioè celate.

Allo scendere nel terzo palcho: un lettuccio vecchio; una chassetta di braccia tre in circha.

Nell'ultima stanza di sotto cioè in terreno: trecentosessanta palle e dadi grossi di ferro da channoni; sessantasette palle di ferro e piombo da passavolanti; duecento dadi di ferro mezzani e piccholi; uno spinghardone inceppato cho' l'arme de' Medici; sette chode tra di ferro e bronzo da falconetti; una secchia di rame; una chazza da charichare; due asse d'abeto; tre schure cho' manichi; uno archobuso di ferro senza chassa; dua paletti di ferro; tre saccha; dua strisce di ferro lombardo; dua bande di ferro lombardo; quaranta manichi di pale; ottanta aste di braccia tre e mezo l'una; uno falchonetto inceppato chol segno della croce senza choda; sessanta palle di pietra in circha da passavolante; uno fascio di legnami da trabacche; una bombarda grossa chol segno di cholombe in due pezzi; una bombarda in due pezzi chol segno della Parte Ghuelfa; uno pezzo d'artiglieria grossa a uso di bombarda senza choda; uno channone di braccia cinque et mezo in circha inceppato in sul suo charro; cinque channoni, cioè quattro mezzani e uno grosso, senza ceppi e carri; uno channone grosso inceppato in sul suo charro; tre chortaldi grossi.

Nella stanza tiene la Parte Ghuelfa: uno channone grosso chon sua schala e charro; tre passavolante chon schale e charri; uno falchonetto fornito sul suo charro.⁴⁷

La polvere ed il salnitro erano stati trasferiti, in quegli anni, sull'altra sponda del fiume, nel cosiddetto «antiporto» di San Niccolò, lì dove sorgeva la «fabbrica della polvere», costruita dal

⁴⁶ ASF, *Dieci di balia, Debitori e creditori*, 27, c. 1r; ASF, *Dieci di balia, Debitori e creditori*, 31, c. 1r; ASF, *Dieci di balia, Debitori e creditori*, 35, c. 1r; ASF, *Dieci di balia, Munizioni*, 6, c. 1r; ASF, *Dieci di balia, Munizioni*, 7, c. 1r.

⁴⁷ ASF, *Dieci di balia, Munizioni*, 9, cc. 3v-4v.

Comune attorno al 1483, ai tempi della guerra di Ferrara e della prima, infruttuosa spedizione contro Sarzana.⁴⁸ La posizione di quest'altra «muraglia per le munizioni» era tutt'altro che casuale. Ingenti quantitativi d'acqua, infatti, erano necessari sia per il processo di raffinatura del salnitro «soro» o «rossellino», sia per garantire il movimento costante di macine verticali in pietra e di magli in legno, indispensabili all'incorporazione della polvere «grossa» ed alla produzione della polvere «granita».⁴⁹ Altri mulini, posti sempre sulle rive meridionali dell'Arno, venivano utilizzati anche per la pressatura dello zolfo «giallo» e per la triturazione dei carboni di salice e di nocciolo, concentrando così la lavorazione delle materie prime nel raggio di poche decine di metri. Inoltre, la posizione periferica assicurava una certa protezione contro i rischi di incendio e di esplosione.⁵⁰ Gli imprevisti e gli incidenti, tuttavia, non mancavano, e non sfuggivano all'attenzione degli osservatori più accorti.

E a dì ventiquattro di novembre 1498, intervenne ch'a Ricorboli, essendo alloggiati vetturali con dieci muli carichi di polvere da bombarda e artiglierie, alcuni giovani volendo provare uno scoppietto, s'appicco el fuoco a quella polvere e arse la casa e mula; e' vetturali ne fu guasti dal fuoco cinque in modo che furono portati allo spedale.⁵¹

In mancanza di altre fonti, è lecito supporre che, fino agli anni Ottanta del Quattrocento, il prezioso propellente per le artiglierie fosse lavorato nella botteghe di quegli «speciali», farmacisti e venditori di spezie, cui i Dieci affidavano il compito di comporre il materiale esplosivo.⁵² In questo particolare settore merceologico, si distinguevano in particolar modo due famiglie. Tre generazioni di Formiconi, dalla metà del secolo in poi, avevano servito «Marzocco», lavorando nel quartiere di Santo Spirito, in Oltrarno.⁵³ E già nel 1429, durante

⁴⁸ ASF, *Dieci di balia, Entrata e uscita*, 8, 74v.

⁴⁹ BIRINGUCCIO, *Pirotechnia*, cit., cc. 151r-153v; PANCIERA, *Il governo delle artiglierie*, cit., pp. 95-96 e 135-136. Sulla maggiore forza esplosiva della polvere granulare e sulla sua maggiore conservabilità, v. HALL, *Weapons and warfare in Renaissance Europe*, cit., pp. 67-74; W. PANCIERA, *La polvere da sparo*, in *Il Rinascimento italiano e l'Europa*, III. *Produzione e tecniche*, cit., pp. 307-315.

⁵⁰ ASF, *Signori e collegi, Condotte e stanziamenti*, 18, c. 129r; ASF, *Dieci di balia, Entrata e uscita*, 30, cc. 94r e 103v. Sul posizionamento in città di manifatture potenzialmente pericolose, v. D. DEGRASSI, *L'economia artigiana nell'Italia medievale*, Roma, Carocci, 1998, p. 173.

⁵¹ LANDUCCI, *Diario fiorentino*, cit., pp. 188-189.

⁵² ASF, *Dieci di balia, Munizioni*, 4, 90r; ASF, *Arte dei medici e speciali*, 4, cc. 20v-21r. Sulle attività della corporazione, v. anche R. CIASCA, *L'arte dei medici e speciali nella storia e nel commercio fiorentino dal secolo XII al XV*, Firenze, Leo S. Olschki, 1927.

⁵³ ASF, *Catasto*, 997, c. 297r; ASF, *Decima repubblicana*, 6, c. 119r; ASF, *Dieci di balia, Debitori e creditori*, 16, c. 46r; ASF, *Otto di pratica, Munizioni*, 1, c. 53v; ASF, *Dieci di balia, Munizioni*, 9, c. 8v.

l'assedio di Lucca, Lorenzo e Giovanni Barducci potevano fabbricare più di diecimila libbre di polvere, nel loro fondaco posto nella centrale via di «san Brocholo». L'opificio era poi stato ereditato dai loro discendenti, Stagio e Giovanni, entrambi «maestri di polvere» della Repubblica.⁵⁴

Ma la polvere, usata, andava letteralmente in fumo. E se questo, economicamente, era il suo aspetto migliore, dal punto di vista strategico il consumo eccessivo poteva rivelarsi un problema. Bisognava produrla incessantemente, rimpiazzarla negli accampamenti e nelle fortezze, e persino nelle fiaschette dei singoli archibugieri.⁵⁵ Nel 1487, le sette bombarde «piantate» contro Sarzana consumavano quasi cinquantamila libbre di propellente alla settimana, ed i commissari generali richiedevano costantemente agli Otto di provvedere ad «strumenti et maestri in modo che se ne possa fare ogni dì quanta ne logora il campo».⁵⁶ Fabbricare polvere in bottega, con mortai e crivelli, non poteva certo soddisfare la crescente domanda statale, aumentata a dismisura fin dal 1478, quando si era dovuto rifornire, da Firenze, più di trecento fra città, castelli e borghi.⁵⁷ L'officina pubblica dell'«antiporto», dunque, nasceva per meccanizzare e velocizzare la preparazione del composto, evitando di «pestarlo» come «anticamente si soleva, con certi mulinetti et macine, come le farine», che «era via molto pericolosa, oltre la fadiga».⁵⁸ Dai pochi libri contabili superstiti, risulta che i primi a lavorare nell'impianto siano stati Piero di Zanobi, soprannominato «il Zucca», ed il «vaiaio» Vittorio di Domenico Sini.⁵⁹ Negli anni successivi, Piero avrebbe continuato a gestire l'arsenale insieme ad un suo altro socio, Jacopo di Corso, detto «Baia». Nel 1499, i due stipulavano una «*conducta pulveris*» con i Dieci, obbligandosi a produrre ogni mese quattordicimila libbre di polvere, a fronte di un salario annuale di centoventi fiorini d'oro.⁶⁰ L'anno successivo, nel «munitione di San Niccholò» si contavano quattro «chaldaie» di rame per la bollitura del nitrato, ventidue «tinelle d'afinar salnitro» ed un «edifizio da far polvere chon sei macine», nonché diversi attrezzi di metallo, madie, imbuti, bilance, botti, sacchi,

⁵⁴ ASF, *Catasto*, 80, c. 99r; ASF, *Catasto*, 1022, c. 315r; ASF, *Decima repubblicana*, 33, c. 405r; ASF, *Dieci di balia, Munizioni*, 1, c. XVIIv; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 23, c. 78v; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 48, c. 130r.

⁵⁵ HALE, *Guerra e società nell'Europa del Rinascimento*, cit., p. 242.

⁵⁶ ASF, *Otto di pratica, Missive*, 7, c. 209rv.

⁵⁷ ASF, *Dieci di balia, Debitori e creditori*, 22, cc. 30r-187r.

⁵⁸ BIRINGUCCIO, *Pirotechnia*, cit., c. 154r.

⁵⁹ ASF, *Dieci di balia, Entrata e uscita*, 8, cc. 130r e 165r.

⁶⁰ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 35, c. 16r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 46, c. 12r.

scope in abbondanza, svariate cataste di legna, aceto per impastare i cosiddetti «gnocchi» di propellente, e calcina, olio e sapone per le mole.⁶¹

La necessità di utilizzare considerevoli quantità di polvere, tuttavia, costringeva le magistrature militari fiorentine ad affidarsi anche a «pratici» che non fossero «maestri» o speciali. Nel 1472, Papino di Cerbino «legnaiolo» aveva ricevuto un compenso di centosettantatre fiorini «per la monta di libre tremiladugento di polvere da bombarda auta da lui». ⁶² Altri falegnami avrebbero fatto la loro apparizione nei registri delle «munizioni» negli anni seguenti. Bartolomeo di Ventura Banchini, ad esempio, produceva soltanto carri, cassette per il trasporto di verrettoni e «inceppature d'archibusi», prima di iniziare a «raffinare salnitri e fare polvere nella munizione dell'antiporto della porta a San Nicholò» nel 1498. ⁶³ Filippo di Giovanni, conosciuto anche come «la Pippa», aveva invece servito per più di quindici anni come carpentiere, riparatore di balestre, artigliere ed ingegnere militare nei campi fiorentini, prima di collaborare con Jacopo di Corso e divenire uno dei «maestri d'afinare salnitro» di un nuovo impianto, costruito presso il ponte alle Grazie, nel 1499. Qui, sempre insieme al «Baia», operò per qualche mese anche il «Nuziato dipintore». ⁶⁴

Alla fine del secolo, il reclutamento di nuova manodopera e la meccanizzazione dei processi di incorporazione sembravano poter garantire soddisfacenti livelli di produzione. Nei primi sei mesi del 1495, i maestri avevano fabbricato più di centomila libbre di polvere. ⁶⁵ Durante il maggio del 1499, l'esercito era stato rifornito con venticinquemila libbre di «grossa» e di «granita», e, nell'estate di quello stesso anno, ai tempi del fallito assedio di Pisa, il solo «Zucca» aveva prodotto sessantacinquemila libbre di propellente, lavorando «tutte le feste e di molte notti». ⁶⁶

⁶¹ ASF, *Signori e collegi, Condotte e stanziamenti*, 18, c. 124rv; ASF, *Dieci di balia, Munizioni*, 9, c. 121rv; ASF, *Dieci di balia, Entrata e uscita*, 30, c. 199v. Sulla lavorazione della polvere nera, v. HALL, *Weapons and warfare in Renaissance Europe*, cit., pp. 67-90.

⁶² ASF, *Dieci di balia, Debitori e creditori*, 20, c. 88r.

⁶³ ASF, *Dieci di balia, Munizioni*, 7, cc. 345v, 446v-447 e 495v; ASF, *Dieci di balia, Entrata e uscita*, 14, c. 240v; ASF, *Dieci di balia, Entrata e uscita*, 23, c. 324r.

⁶⁴ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 43, c. 72v; ASF, *Dieci di balia, Entrata e uscita*, 30, c. 79v; ASF, *Dieci di balia, Entrata e uscita*, 13, c. 49r; ASF, *Dieci di balia, Munizioni*, 7, cc. 428r e 451r-452v; ASF, *Signori e collegi, Condotte e stanziamenti*, 17, c. 45v; ASF, *Dieci di balia, Debitori e creditori*, 24, c. 63v.

⁶⁵ ASF, *Dieci di balia, Responsive*, 58, cc. 45r e 86r.

⁶⁶ ASF, *Dieci di balia, Munizioni*, 5, cc. 1v-65r; ASF, *Dieci di balia, Entrata e uscita*, 30, cc. 147v-148r, 188v-189r, 194v e 246r.

Condussevisi alsì, benché con difficoltà, perché non si trovavano salnitri, quantità di polvere e pallottole di ferro, per le quali si mandò fino a Brescia, e, non se ne potendo avere la quantità necessaria, si prese per partito di farle di bronzo, e così si sopplì. Costava l'una circa fiorini tre. Vollene alquante el capitano, dorate, per trarle dentro a' pisani, e' quali diceano che a' fiorentini mancavano danari, e che non sarebbero d'accordo a fare la 'mpresa.⁶⁷

La fusione di queste pallottole di bronzo aveva mobilitato, in quel concitato luglio del 1499, tutte le fonderie di Firenze. Vi era concorso, ad esempio, l'«affinatore» Jacopo Pintegli, che aveva imparato il mestiere dal padre Piero, impiegato nella zecca e proprietario della bottega di via della Gora, confinante con le mura cittadine.⁶⁸ La Signoria aveva richiesto anche i servizi dell'orafo Giovanni Antonio Moro, di Giuliano di Andrea, di Jacopo del Mazza e di Damiano «campanaio alla porta a San Ghallo», fornendo loro rame, carbone, legname e mattoni per il forno.⁶⁹

Non era la prima che il Comune si rivolgeva ad officine private per la fusione di munizioni ed artiglierie.⁷⁰ Già nel 1452, Maso di Bartolomeo, chiamato comunemente «Masaccio»,⁷¹ collaboratore di Donatello ed amico del Brunelleschi, aveva prodotto, nel suo «fornello» di via della Porta Rossa, diverse bombarde di bronzo, come la «Disperata», la «Lionessa», la

⁶⁷ P. PARENTI, *Storia fiorentina*, II., a cura di Andrea Matucci, Firenze, Leo S. Olschki, 2005, p. 280.

⁶⁸ ASF, *Catasto*, 998, c. 190r; ASF, *Decima repubblicana*, 6, c. 253rv.

⁶⁹ ASF, *Entrata e uscita*, 30, cc. 168v, 169v, 170v-174r, 195v-197v e 212v; ASF, *Signori e collegi, Condotte e stanziamenti*, 17, c. 86r.

⁷⁰ Sulla produzione delle artiglierie in bronzo nel tardo medioevo e nella prima età moderna, v. BIRINGUCCIO, *Pirotechnia*, cit., cc. 78v-89r e 92r-93v; GUILMARTIN, *Gunpowder and galleys*, cit., pp. 305-312; PANCIERA, *Il governo delle artiglierie*, cit., pp. 161-196; J. BELHOSTE, *Nascita e sviluppo dell'artiglieria in Europa*, in *Il Rinascimento italiano e l'Europa*, III. *Produzione e tecniche*, cit., pp. 325-343; R. RIDELLA, *Produzione di artiglierie nel XVI secolo. I fonditori genovesi Battista Merello e Dorino Il Gioardi*, in *Pratiche e linguaggi. Contributi a una storia della cultura tecnica e scientifica*, cit., pp. 78-89. Sulla riflessione scientifica legata alle stesse, v. A. BERNARDONI, *La fusione delle artiglierie tra Medioevo e Rinascimento. 'Cronaca' di un rinnovamento tecnologico attraverso i manoscritti di Leonardo*, «Cromohs», XIX, 2014, pp. 106-116; ID. *Le artiglierie, da manufatto tecnico alla riflessione scientifica degli ingegneri del Rinascimento*, «Quaderni storici», CXXX, 2008, 1, pp. 3-33; GILLE, *Leonardo e gli ingegneri del Rinascimento*, cit., pp. 119-122 e 243-247; LONG, *Artisans, practitioners and the rise of the new sciences*, cit., pp. 94-110.

⁷¹ M. GRASSO, *Maso di Bartolomeo*, in *Dizionario Biografico degli Italiani*, LXXI, Roma, Istituto della Enciclopedia Italiana, 2008; M. PARDO, *On the identity of 'Masaccio' in Leon Battista Alberti's dedication of Della pittura*, in *Perspectives on early modern and modern intellectual history*, a cura di Joseph Marino e Melinda Schlitt, Rochester, University of Rochester Press, 2001, pp. 230-231; C. YRIARTE, *Journal d'un sculpteur florentin au XVe siècle. Livre de souvenirs de Maso di Bartolommeo dit Masaccio*, Paris, Rothschild, 1894.

«Tribolata», la «Luchese» e la «Perla», cui sarebbero seguite la «Chaccia Pazia» e la «Né patti né chonchordia». ⁷² Allievo dello stesso «Masaccio» e del Filarete, ⁷³ anche Pasquino di Matteo aveva modellato alcune armi da fuoco nella sua bottega di borgo alla Noce ed in diverse altre località del Dominio, tanto da meritarsi l'appellativo di «Pasquino delle bombarde». ⁷⁴ Andrea del Verrocchio, suo discepolo, aveva utilizzato i locali della sua «chasa», in via dell'Oriuolo, per la realizzazione di una bombarda da ventitremila libbre, «bella et buona», inviata a Pietrasanta nel 1484. ⁷⁵ Ed in pieno centro città, sotto «la volta del vescovato», Giuliano di Mariotto della Nave, «fa mistero di champane», aveva fabbricato un passavolante nell'ottobre del 1494, poche settimane prima della cacciata dei Medici. ⁷⁶

Sotto il nuovo regime repubblicano, due altri impianti privati assunsero a ruoli di primaria importanza. Il primo era quello di Lorenzo di Giovanni, detto «Cavaloro», gestito insieme al fratello Pacino ed al socio Ludovico di Guglielmo del Buono «orafo», posto sulla via Nuova degli Innocenti. ⁷⁷ Il secondo, una «chorte chon terreno dinanzi, in mezo el muro de la città del sechondo cierchio, e dentro portici intorno», sorgeva nel medesimo quartiere di San Giovanni, a pochi metri di distanza, all'incrocio tra la via della Pergola e la via di Sant'Egidio. ⁷⁸ Confinante con l'ospedale di Santa Maria Nuova, era di proprietà di Bonaccorso di Vettorino Ghiberti, ingegnere militare, orafo, «maestro di getto» di campane e di cannoni, e nipote dell'assai più famoso Lorenzo di Cione. ⁷⁹

Si che per l'una chosa e per l'altre mi danno detta bottegha, la quale è stata già un tempo a uso di schultura overo a uso di gietto, imperò in quella si gittorono le porte di bronzo di San Giovanni Battista di Firenze [...]. E a me agiudichorono tutti i tagli di stagni, pietre fini intagliate e non intagliate,

⁷² BIBLIOTECA NAZIONALE CENTRALE DI FIRENZE [da ora in avanti BNCF], *Baldovinetti*, 70, cc. 92v, 104v e 111v; ASF, *Dieci di balia, Debitori e creditori*, 17, cc. 21r e 143v-144r.

⁷³ F. CAGLIOTI, P. PARMIGGIANI, *Pasquino da Montepulciano*, in *Dizionario Biografico degli Italiani*, LXXXI, Roma, Istituto della Enciclopedia Italiana, 2014.

⁷⁴ ASF, *Catasto*, 1017, c. 389r; ASF, *Arte dei maestri di pietra e legname*, 2, c. 140v; ASF, *Dieci di balia, Entrata e uscita*, 8, c. 89v; ASF, *Dieci di balia, Debitori e creditori*, 22, c. 17v.

⁷⁵ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 30, c. 249v; ASF, *Dieci di balia, Missive*, 20, c. 156v; ASF, *Dieci di balia, Missive*, 21, cc. 122v e 146v.

⁷⁶ ASF, *Decima repubblicana*, 32, c. 247r; ASF, *Otto di pratica, Munizioni*, 1, c. 59r.

⁷⁷ ASF, *Decima repubblicana*, 35, c. 283r; ASF, *Decima repubblicana*, 25, c. 52rv.

⁷⁸ ASF, *Catasto*, 1022, c. 394r; ASF, *Decima repubblicana*, 33, c. 483v.

⁷⁹ F. ANSANI, *The life of a Renaissance gunmaker. Bonaccorso Ghiberti and the development of Florentine artillery in the late fifteenth century*, di prossima pubblicazione su «Technology and Culture»; G. SCAGLIA, *A miscellany of bronze works and texts in the Zibaldone of Buonaccorso Ghiberti*, «Proceedings of the American Philosophical Society», CXX, 1976, 6, pp. 485-513.

dovunque ve fussino, e ongni altra maserizia atta a l'arte di schultura o di pittore o d'orafo o di gietti, e in gienero tutte chosse non usabili alla chasa, cioè tutte chosse appartenenti a schrittoio o che si possa chomprendere essere a simili chosse, perché el vero è che per testamento di Lorenzo di Cione Ghiberti erano mie tutte masserizie.⁸⁰

A partire dal 1498, in queste due fonderie, per ordine dei Dieci, erano state sperimentate le fusioni di nuove artiglierie di bronzo, basate su modelli francesi,⁸¹ ed assai differenti dalle tradizionali, «intrattabili» bombarde italiane, che richiedevano innumerevoli guastatori ed intere settimane di lavoro per essere trasportate e posizionate.⁸² Arrivati al seguito di Carlo VIII, i nuovi pezzi transalpini erano apparsi agli occhi dei contemporanei come terribilmente veloci, straordinariamente compatti ed incredibilmente manovrabili. Posti su piccole «carrette», trainati da cavalli, i *canons*, i *faulcons* e le *couleuvrines* erano inoltre caricati con pallottole di ferro, munizioni mai viste prima, che ne facevano «più tosto diabolici che umani instrumenti».⁸³

Su espressa richiesta del capitano generale Paolo Vitelli, in quello stesso 1498, i magistrati avevano anche tentato di velocizzare ed incrementare la fabbricazione di «falconetti» e «cortaldi»,⁸⁴ facendo erigere nello «scrittoio» ghibertiano un nuovo «fornello, perché possi

⁸⁰ ARCHIVIO STORICO DELL'ISTITUTO DEGLI INNOCENTI [da ora in avanti AOI], *Ricordanze di Bonaccorso di Vettorio di Lorenzo Ghiberti*, 13230, cc. 7v-8r.

⁸¹ ASF, *Dieci di balia, Munizioni*, 5, cc. 134r, 259r, 324v e 343v; ASF, *Dieci di balia, Munizioni*, 7, cc. 246r, 257r, 265r, 313v, 318r, 367v, 370v, 387v, 390r, 427v, 478v e 488r; AOI, *Debitori e creditori di Bonaccorso di Vettorio di Lorenzo Ghiberti*, 13229, cc. 24v-26r; BNCF, *Banco rari*, 28, c. 88r.

⁸² Nel 1484, ad esempio, i commissari generali in campo avevano più volte lamentato la mancanza di manodopera necessaria al posizionamento delle artiglierie, che «non si piantono dal dire al fare». ASF, *Dieci di balia, Missive*, 20, cc. 157r e 225v; ASF, *Dieci di balia, Missive*, 21, cc. 106r e 108r; ASF, *Dieci di balia, Responsive*, 32, cc. 161r, 171v, 177r, 356v, 362r e 363r.

⁸³ S. PEPPER, *Castles and cannon in the Naples campaign of 1494-95*, in *The French descent into Renaissance Italy*, a cura di David Abulafia, Aldershot, Variorum, 1995, pp. 263-265 e 286-291; G. SANTI MAZZINI, *La macchina da guerra*, Milano, Mondadori, 2006, pp. 251-252; D. POTTER, *Renaissance France at war. Armies, culture and society*, Woodbridge, The Boydell Press, 2008, pp. 152-153; HALL, *Weapons and warfare in Renaissance Europe*, cit., pp. 90-95; BIRINGUCCIO, *Pirotechnia*, cit., c. 79rv; B. CERRETANI, *Storia fiorentina*, a cura di Giuliana Berti, Firenze, Leo S. Olschki, 1994, p. 203; P. GIOVIO, *Historie del suo tempo*, Venezia, Appresso Domenico de' Farri, 1555, c. 59rv; F. GUICCIARDINI, *Storia d'Italia*, a cura di Silvana Seidel Menchi, Torino, Einaudi, 1971, p. 79.

⁸⁴ G. NICASI, *La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504*, «Bollettino della Regia Deputazione di Storia patria per l'Umbria», XVII, 1911, p. 366.

fare i getti migliori et più comodamente». ⁸⁵ Nel mentre, dopo varie tribolazioni, la Repubblica poteva finalmente tornare in possesso della sua fonderia della «Sapienza».

Officine di proprietà statale erano attive un po' dappertutto, in Italia. Il grande complesso industriale dell'arsenale di Venezia era all'avanguardia negli sviluppi della tecnologia bellica fin dal tardo Trecento, ed accoglieva maestri provenienti da tutta Italia. ⁸⁶ Una «chasa delle bombarde» era funzionante ad Urbino già nel 1450. ⁸⁷ A Napoli erano all'opera, nel Castel Nuovo e nel «tarcinale» navale, diversi «pratici» genovesi, francesi e siciliani, tra cui spiccava il «mestre maior della artelleria», Guglielmo dello Monaco. ⁸⁸ In delle rimesse pubbliche operava, probabilmente, la maggior parte dei «*bombardarii*» tedeschi al servizio del papa nella seconda metà del Quattrocento. ⁸⁹ Il duca di Milano ed il signore di Piombino, allo stesso modo, avevano fornito i loro impianti agli artigiani stranieri che avevano ingaggiato. ⁹⁰ E nei suoi possedimenti in Garfagnana, Ercole I d'Este, duca di Ferrara, aveva fatto costruire, fra gli anni Settanta e gli anni Novanta, il «forno di Volastro», con annessi magazzini, stalle, carbonili ed una «fabricha» per la riduzione della ghisa, assoldando maestri bresciani e bergamaschi. ⁹¹

A Firenze, il «fornello del comune» sembra essere stato inaugurato con un certo ritardo rispetto alle altre capitali italiane. Al 1485, infatti, risale la fusione delle prime artiglierie nel complesso della «Sapienza», e cioè quattro passavolanti, diverse spingarde e due bombarde,

⁸⁵ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 48, c. 145r; ASF, *Dieci di balia, Munizioni*, 7, c. 390r.

⁸⁶ MALLETT, *L'organizzazione militare di Venezia nel Quattrocento*, cit., pp. 109-114; PANCIERA, *Il governo delle artiglierie*, cit., pp. 163-166; E. CONCINA, *L'arsenale della Repubblica di Venezia. Tecniche e istituzioni dal Medioevo all'Età Moderna*, Milano, Electa, 1984.

⁸⁷ BNCF, *Baldovinetti*, 70, c. 7r.

⁸⁸ R. RIDELLA, *Fonditori italiani di artiglierie in trasferta nell'Europa del XVI secolo*, in *Storie di armi*, a cura di Nicola Labanca e Pier Paolo Poggio, Milano, UNICOPLI, 2009, pp. 19-20; FERRAILOLO, *Cronaca*, a cura di Rosario Coluccia, Firenze, Accademia della Crusca, 1987, p. 81; F. DE NEGRI, *dello Monaco, Guglielmo*, in *Dizionario Biografico degli Italiani*, XXXVIII, Roma, Istituto della Enciclopedia Italiana, 1990.

⁸⁹ K. SCHULTZ, *La migrazione di tecnici, artigiani e artisti*, in *Il Rinascimento italiano e l'Europa*, III. *Produzione e tecniche*, cit., pp. 108-109.

⁹⁰ L. BELTRAMI, *La Galeazesa Vittoriosa*, Milano, Tipografia Allegretti, 1916, pp. 13-14; C. VISCONTI, *L'ordine dell'esercito ducale sforzesco*, «Archivio storico lombardo», III, 1876, 3, p. 475; AOI, *Ricordanze di Bonaccorso di Vettorio di Lorenzo Ghiberti*, 13230, cc. 16rv e 52v-59r; AOI, *Debitori e creditori di Bonaccorso di Vettorio di Lorenzo Ghiberti*, 13229, cc. 3r-4v

⁹¹ CALEGARI, *La mano sul cannone. Alfonso I d'Este e le pratiche di fusione dell'artiglieria*, cit., pp. 63-67.

fabbricate dal ferrarese Alberghetto Alberghetti, uno dei più conosciuti artefici del tempo.⁹² Le fonti, purtroppo, non chiariscono dove «maestro Alberghetto» abbia realizzato le ventiquattro «spinghardelle» fornite ai Dieci di Balìa sei anni prima, o dove abbia lavorato su una statua di Traiano commissionatagli dalla famiglia Niccolini,⁹³ ma è comunque ipotizzabile che la sua bottega fosse stata approntata in uno spazio pubblico, o quasi, proprio come quello della «Sapienza»,⁹⁴ edificata su di un vasto terreno di proprietà dell'Arte di Calimala, sito tra la chiesa della Santissima Annunziata ed il convento di San Marco, lì dove Niccolò da Uzzano aveva progettato di costruire una monumentale «casa della Sapienza» per gli allievi indigeni dello «studio fiorentino».⁹⁵

Il cantiere del collegio, avviato nel 1429, non era mai stato portato a termine, ostacolato dall'ostruzionismo dei Medici, fortemente interessati al controllo dell'area, sita nel cuore stesso della città, ed assai vicina al loro palazzo di via Larga. Così, accanto alla chiesa servita, fra i «chiostri» della «casa», gli orti ed i tiratoi sorti negli anni Settanta, apriva i suoi battenti la «Sapienza» di Alberghetto, destinata però ad essere serrata nel giro di pochi mesi, in seguito al trasferimento del maestro a Venezia, ed a causa della sempre maggiore rilevanza assunta, nel contempo, dalle officine di Pisa.⁹⁶ Soltanto nel gennaio del 1495, dopo la ribellione dell'antica repubblica marinara, venne giudicato necessario il ripristino dell'impianto e la costruzione di una nuova «muraglia per gittare artiglierie».⁹⁷ D'altronde, in quegli stessi giorni, i Dieci sembravano essere rimasti alquanto impressionati dalle relazioni fatte loro sui nuovi pezzi francesi, che «sono molto buoni et fanno grandi effecti».⁹⁸ Muratori e falegnami avevano completato la bottega nel giro di qualche settimana, scavando il «pozzo» ed edificando il «fornello» con migliaia di mattoni,⁹⁹ mentre il «maestro di getto» del Comune, Francesco di Bartolomeo Telli, veniva inviato a Castrocaro «per pigliare le misure delle bombarde del re di

⁹² ASF, *Dieci di balìa, Missive*, 23, cc. 18v e 48r; ASF, *Dieci di balìa, Responsive*, 30, c. 115r; ASF, *Dieci di balìa, Entrata e uscita*, 8, c. 129v; ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 30, c. 260v; ASF, *Otto di pratica, Responsive*, 3, c. 422r; ASF, *Dieci di balìa, Debitori e creditori*, 24, c. 91v.

⁹³ ARCHIVIO NICCOLINI DI FIRENZE, *Fondo antico*, 106, i. 4.

⁹⁴ ASF, *Dieci di balìa, Debitori e creditori*, 22, c. 17v.

⁹⁵ E. FERRETTI, *La Sapienza di Niccolò da Uzzano. L'istituzione e le sue tracce architettoniche nella Firenze rinascimentale*, «Annali di storia di Firenze», IV, 2009, pp. 89-112.

⁹⁶ PANCIERA, *Il governo delle artiglierie*, cit., p. 163.

⁹⁷ ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 31 c. 149v; ASF, *Dieci di balìa, Entrata e uscita*, 13, c. 45v.

⁹⁸ ASF, *Dieci di balìa, Missive*, 32, c. 79rv.

⁹⁹ ASF, *Dieci di balìa, Munizioni*, 5, cc. 15v-31v.

Francia» e disegnarle.¹⁰⁰ Al suo ritorno, con ottomila libbre di rame e settecento di stagno, il Telli realizzava, insieme al suo socio, Simone «di Bronzi», un «cortaldo a la francese», posto «*in curribus more gallico*», collaudato il diciassette di marzo, e subito inviato in campo.¹⁰¹

I lavori nell'officina erano continuati, incessantemente, nella primavera e nell'autunno del 1495. A maggio, gli ufficiali avevano invitato un bombardiere piccardo, Piero da Douai, a lavorare nell'officina, congedandolo poco dopo a causa della cattiva riuscita di un «cortaldo».¹⁰² In agosto, la bottega veniva ricostruita ed ampliata, permettendo al Telli di fondere, nei mesi successivi, più di sedicimila libbre di bronzo.¹⁰³ Tuttavia, nonostante gli sforzi profusi dai Dieci e dai loro esperti, la fonderia era destinata a chiudere di nuovo, «per chagione», stavolta, «che el fornello di detta Sapienza si disse pe' frati di San Marcho».¹⁰⁴

Ampliandosi la dottrina di frate Ieronimo, e tirando alla sua religione molti di cui l'ingegno vedeva pronto e bene disposto a fare negli Studi il frutto, volontà li venne di preparare studio o libreria oltre che là di San Marco. Però, parendoli vicina la Sapienza, istituita dal nobile uomo Niccolò da Uzzano, e raccomandato all'Arte de Mercatanti e per invidia della Casa Medici suto fatto lasciare per molti anni imperfetto, lui finalmente impetrò di potervi spendere ducati cinquemila e tirarlo alla perfezione, non mutando però del disegno dell'autore niente e mettendovi la sua arme, con condizione che quando resi fussero e' decti denari, allora li frati di San Marco iurisdictione alcuna non vi avessero.¹⁰⁵

Nel luglio del 1496, venivano così consegnati «in mano di Michele di Baldino, alla torre di San Francescho » tutti gli attrezzi provenienti dalla «Sapienza», molle, pali, rastrelli «da chavare rame», «vagli di ferro da buttare terra», «finestre di ferro della fornace», «ferri per le armadure» e «fusi di legno da fare l'anima degli stormenti», canapi, scale, casse ed argani

¹⁰⁰ ASF, *Dieci di balia, Entrata e uscita*, 12, c. 17v; ASF, *Dieci di balia, Missive*, 31, c. 81r. Dodici «falconi», cinque «cortaldi» ed altrettante «colovrine» erano state infatti lasciate da Carlo VIII a Castrocaro, durante la sua marcia in Romagna, come annotato in M. SANUDO, *La spedizione di Carlo VIII in Italia raccontata da Marino Sanuto il Giovane*, a cura di Rinaldo Fulin, Venezia, Tipografia del Commercio, 1883, p. 127. Sulla valenza e sull'utilità del disegno nella trasmissione delle tecnologie, v. D. DEGRASSI, *La trasmissione dei saperi. Le botteghe artigiane*, in *La trasmissione dei saperi nel Medioevo (secoli XII-XV)*, atti del diciannovesimo convegno internazionale di studi, Pistoia, 16-19 maggio 2003, Pistoia, Centro Italiano di Studi di Storia e d'Arte, 2005, pp. 82-83.

¹⁰¹ ASF, *Dieci di balia, Munizioni*, 5, cc. 32r e 38r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 33, c. 245r.

¹⁰² ASF, *Dieci di balia, Munizioni*, 5, cc. 48r e 57v; ASF, *Dieci di balia, Debitori e creditori*, 26, c. 82v.

¹⁰³ ASF, *Dieci di balia, Munizioni*, 5, c. 358r; ASF, *Dieci di balia, Entrata e uscita*, 13, cc. 190v-191r.

¹⁰⁴ ASF, *Dieci di balia, Munizioni*, 7, c. 130r.

¹⁰⁵ PARENTI, *Storia fiorentina*, II., cit., p. 28.

destinati all'allora erigenda officina della «Notomia», insieme ad un «fornello armato di ferro chon due bocche».¹⁰⁶ Soltanto nel 1498, dopo il rogo del Savonarola e la momentanea sconfitta dei «frateschi»,¹⁰⁷ l'Arte aveva richiesto l'intervento della Signoria per ottenere la restituzione del complesso. Il ventuno luglio del 1498, il provveditore della «Sapienza» affidava ancora «le chiavi al provveditore dei Dieci di Balìa, perché quivi si possa fare spingarde e artiglierie per il tempo che i presenti Dieci staranno in officio».¹⁰⁸ Il due agosto, il «forno» era nuovamente in attività, dopo aver «messo tutti e' mattoni et ferramenti di quello dalla porta alla Giustizia in quello alla Sapienza».¹⁰⁹

Nell'estate del 1503, il Telli affidava tutte le «masserizie» della bottega, compresi alcuni «fusi» di pezzi non terminati, a due dei nuovi «pratici» del Comune, Giovannantonio da Novara e Giovanni Piffero, autori, nelle settimane successive, di una «colobrina» e di un «mezzano».¹¹⁰ L'anno dopo, il «maestro di getti alla Sapienza» era Bernardino di Antonio, originario di Milano, assoldato con una provvisione mensile di sette fiorini d'oro al mese.¹¹¹ Durante la sua condotta, la produzione dell'impianto si era moltiplicata, come testimoniato dagli undici «mezzani» fusi nel 1507, dai diciannove «falconetti» fabbricati nel 1511 e, soprattutto, dai seicentonovanta scoppietti di bronzo consegnati al Comune nel solo 1510.¹¹² Qualche tempo prima, il complesso della «Sapienza» era stato ampliato con un'altra fonderia, destinata però alla realizzazione di statue, come quelle del gruppo della «Predica del Battista», modellate da Giovan Francesco Rustici per il battistero fiorentino, e «gettate» dallo stesso Bernardino in cambio di centoventi fiorini.¹¹³

Inoltre, nel 1505, i Dieci avevano investito più di cinquecento lire in una ferriera della «Sapienza», gestita da Jacopo di Francesco delle Opere e da Andrea di Jacopo Manzini da Colle

¹⁰⁶ ASF, *Dieci di balìa, Munizioni*, 7, c. 129v.

¹⁰⁷ LANDUCCI, *Diario fiorentino*, cit., pp. 169-178; VAGLIENTI, *Storia dei suoi tempi*, cit., pp. 46-51; PARENTI, *Storia fiorentina*, II., cit., pp. 162-175; CERRETANI, *Storia fiorentina*, cit., pp. 245-251.

¹⁰⁸ ASF, *Carte strozziane*, s. II, 51, t. II, c. 267r.

¹⁰⁹ ASF, *Dieci di balìa, Munizioni*, 7, c. 362v.

¹¹⁰ ASF, *Dieci di balìa, Munizioni*, 8, cc. 127v e 161v; ASF, *Dieci di balìa, Munizioni*, 9, c. 14v. Fra il 1514 ed il 1519, un Giovanni Piffero viene indicato, nelle fonti senesi, come il fonditore delle canne dell'organo della cappella del palazzo comunale, e come il realizzatore di un analogo strumento per la chiesa della Santissima Annunziata. È piuttosto verisimile che si tratti dello stesso «pratico», padre, fra l'altro, di Benvenuto Cellini. V. *L'organo di Giovanni Piffero del Palazzo Pubblico di Siena. Relazione di restauro, saggi, prelievi, rilievi*, a cura di Pier Paolo Donati, Siena, Tipolitografia Periccioli, 1983.

¹¹¹ ASF, *Dieci di balìa, Munizioni*, 9, c. 52v.

¹¹² ASF, *Dieci di balìa, Munizioni*, 10, cc. 9v, 31v, 172r e 225r.

¹¹³ FERRETTI, *La Sapienza di Niccolò da Uzzano. L'istituzione e le sue tracce architettoniche nella Firenze rinascimentale*, cit. pp. 115-116.

Val d'Elsa. Il «fornello», in particolar modo, era destinato alla produzione di pallottole di ferro, cave, «da trarre fochi lavorati»,¹¹⁴ e di «forme di palle di ferro cholato», ma anche, probabilmente, di veri e propri proiettili di ghisa, realizzati grazie all'ausilio di potenti mantici, mossi da un particolare «ingenio».¹¹⁵

Altre fonderie, più o meno occasionali, si ritrovavano sparse su tutto il territorio della Repubblica. Nella stessa Firenze, nel 1484, uno o più pezzi della gigantesca bombarda del Verrocchio erano stati fabbricati nelle circostanze del succitato palazzo di Parte Guelfa.¹¹⁶ Nell'agosto del 1478, durante la campagna contro l'esercito napoletano sui confini senesi, a Colle Val d'Elsa erano state fuse «bombardelle et spingardelle», dando disposizione che «cotesta comunità concorra et col bronzo delle campane et con altro».¹¹⁷ Un simile provvedimento era stato adottato, nel novembre dello stesso anno, a Montepulciano. Qui, il commissario Jacopo Dini scriveva «che v'è bisogno di tre bombarde grosse per defendere la terra», ma i Dieci, «non le potendo di quaggiù mandare comodamente» inviavano direttamente «costi Brancatio bombardiere, che le facci con ogni prestezza possibile».¹¹⁸

In occasione degli assedi di Citerna e di Città di Castello, nel 1482, Pasquino di Matteo riparava il «channone» e la «tromba» di un pezzo a Sansepolcro, a poche miglia dai due centri umbri. Qualche mese più tardi, Pasquino avrebbe inoltre colato, nel suo «fornello» di Firenze, una campana per il castello di Monte Poggiolo.¹¹⁹ Fra il 1485 ed il 1486, anche il maestro tedesco Giovanni di Jacopo da Augusta «rigitava tre maschi di bombarda et uno da

¹¹⁴ ASF, *Dieci di balia, Munizioni*, 9, c. 124rv. Questi proiettili incendiari erano solitamente riempiti con pece «greca», olio «petroio», acqua «arza», canfora, bambagia, zolfo, vernice, salnitro, verderame, trementina e limatura d'acciaio, a seconda della personale ricetta dell'ingegnere. In ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 27, c. 266v; ASF, *Dieci di balia, Entrata e uscita*, 30, c. 191rv.

¹¹⁵ ASF, *Dieci di balia, Munizioni*, 10, cc. 41r e 66v.

¹¹⁶ ASF, *Dieci di balia, Entrata e uscita*, 8, cc. 129v e 161v; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 30, 240v.

¹¹⁷ ASF, *Dieci di balia, Missive*, 5, cc. 4r, 63v, 69v, 81v, 129v-130r; ASF, *Dieci di balia, Debitori e creditori*, 22, c. 17v.

¹¹⁸ ASF, *Dieci di balia, Missive*, 6, cc. 29r e 32v; ASF, *Dieci di balia, Missive*, 7, cc. 46r, 83r, 122v e 179r. Se gli «imbasciatori» poliziani offrivano volentieri il metallo dei loro campanili ai fiorentini, ben altra situazione si sarebbe vissuta nell'Aquila cinquecentesca. Per punire i ribelli, infatti, il governo spagnolo avrebbe sequestrato le diciotto maggiori campane cittadine «per ordine dello illustrissimo signor viceré et consegnatole allo signor castellano per la artiglieria se fa per lo stesso castello». In S. MANTINI, *L'Aquila spagnola*, Roma, Aracne, 2008, pp. 49 e 58-60.

¹¹⁹ ASF, *Dieci di balia, Entrata e uscita*, 8, cc. 31v, 44r, 89v e 101r.

pasavolante a Pietrasanta», dopo aver servito in quel di Livorno come bombardiere.¹²⁰ Una nuova officina venne anche approntata a Firenzuola, al tempo della calata di Carlo VIII, affidandola al «Cavaloro», che, nella fortezza, realizzò due passavolanti, quattro spingarde e sei code «da bombardelle».¹²¹ A Volterra, poi, nel 1496, il capitano della città, Lorenzo Morelli, faceva costruire un «fornello in ciptadella per li getti del bronzo», usato da Francesco Telli per la manifattura dapprima di una italica bombarda di due pezzi e di cinque cortaldi «alla francese».¹²²

Agli inizi del nuovo secolo, il provveditore di Livorno riceveva da Bernardino da Milano due «cholovrine over chanoni», sei mezzani, quattordici falconetti, «una bombarda per la fusta» ed un «passavolante pel rivellino della nuova di mare», artiglierie «che sono una chosa bella e buona». Il maestro lombardo si era successivamente spostato a Cascina per riparare «quattro chanoni de' vostri vecchi», ma, prima di stabilirsi definitivamente nella «Sapienza», avrebbe lavorato anche a Castrocaro, nella fortezza di Librafratta ed a Volterra.¹²³

La presenza di diverse fonderie sul territorio è indice di una produzione decentralizzata e policentrica, confermata anche dalla specializzazione raggiunta da altri centri del Dominio nella fabbricazione di diverse tipologie di armi. Alla Trappola, nel territorio di Loro Ciuffenna, venivano realizzate decine di migliaia di «asticciuole» da frecce, assemblate poi in Firenze con le punte metalliche provenienti da Montefioralle.¹²⁴ Al Borgo a Sansepolcro, Vico di Schiatta ed i suoi figli producevano i cosiddetti «targoni», grossi scudi di legno per la fanteria, ricoperti di cuoio bollito, venduti nella capitale e, spesso, alle truppe napoletane di passaggio per il centro

¹²⁰ ASF, *Dieci di balia, Entrata e uscita*, 9, c. 127v; ASF, *Dieci di balia, Missive*, 24, cc. 69r, 124v e 128v; ASF, *Dieci di balia, Missive*, 28, c. 102r; ASF, *Dieci di balia, Responsive*, 33, cc. 584r, 592r e 598r.

¹²¹ ASF, *Dieci di balia, Munizioni*, 5, c. 361r; ASF, *Dieci di balia, Munizioni*, 7, c. 163r; ASF *Dieci di balia, Debitori e creditor*, 25, c. 71r; ASF, *Dieci di balia, Debitori e creditor*, 26, c. 43v.

¹²² ASF *Dieci di balia, Debitori e creditor*, 28, cc. 73v-74r; ASF, *Dieci di balia, Debitori e creditor*, 29, cc. 159r e 199v; ASF, *Dieci di balia, Munizioni*, 7, c. 244r.

¹²³ ASF, *Dieci di balia, Munizioni*, 8, c. 191v; ASF, *Dieci di balia, Munizioni*, 9, c. 159v; ASF, *Dieci di balia, Munizioni*, 10, cc. 23v, 60r e 243rv.

¹²⁴ ASF, *Dieci di balia, Munizioni*, 1, cc. 138v e 196r; ASF, *Dieci di balia, Munizioni*, 2, c. 228r; ASF, *Dieci di balia, Munizioni*, 4, cc. 2r, 5r, 22r e 40v-77r. Il ciclo produttivo dei verrettoni «da ghanba» e da «cianfogna» seguiva gli schemi tipici del *putting-out system* dell'industria tessile, caratterizzato da una forte divisione del lavoro. In questo sistema, le magistrature militari fiorentine rappresentavano l'anello di congiunzione di una catena di attività coordinate, tutte svolte a domicilio da diversi artigiani, controllandone e dirigendone lo svolgimento. Sul *domestic system*, v. P. MALANIMA, *Economia preindustriale*, Milano, Bruno Mondadori, 1995, pp. 273-277.

Italia.¹²⁵ Maestri «di carra» per le artiglierie repubblicane erano invece i fratelli Lorenzo e Francesco Bifolchi da Rignano, coadiuvati, almeno negli anni Ottanta, da uno dei principali ingegneri militari del Comune, Francesco d'Angelo, meglio conosciuto come «la Cecca».¹²⁶ A Livorno, dopo la ribellione di Pisa, era stato costruito un «edificio» della polvere, gestito, durante le campagne estive, dal «Zucca» e dai suoi garzoni.¹²⁷ Il carbone necessario al propellente veniva lavorato ad Artimino,¹²⁸ mentre lo zolfo era estratto dalle cave della regione vulcanica di Pomarance, nei dintorni di Volterra.¹²⁹ Per quanto riguarda il salnitro, la prima nitriera repubblicana sembra essere stata aperta a Castrocaro soltanto nel 1496, su iniziativa di Antonio di Jacopo da Faenza.¹³⁰ Nel 1507, Antonio di Salvatore da Fermo e Giovanni di Domenico da Incisa aprivano un secondo impianto ad Arezzo.¹³¹

Richordo chome questo dì XXX di gennaio di chomessione di messer Piero ghonfaloniere facciamo merchato chon Giovanni di Domenicho della Ancisa maestro di fare salnitro ad Arezzo, presente Francesco Davanzati, di tutta quella quantità di salnitro lavorassi in detto luogho, di quella qualità e bontà d'uno saggio appresso di Francesco Quaratesi o meglio, el quale ci ha a porre in doana di Firenze a ogni sua spesa, per pregio e prezzo di fiorini trentacinque d'oro in oro, de' quali n'ha auto al presente da Taddeo Taddei depositario fiorini venti, di che ne sta mallevadore Francesco Quaratesi, el quale salnitro ha a mandare di quello ha lavorato, e di poi quello farà di per di.¹³²

¹²⁵ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 33, c. 180r; ASF, *Dieci di balia, Missive*, 20, cc. 133r e 200rv; ASF, *Dieci di balia, Missive*, 27, cc. 37r e 45v; ASF, *Dieci di balia, Debitori e creditori*, 31, c. 17r.

¹²⁶ ASF, *Dieci di balia, Debitori e creditori*, 24, c. 96v; ASF, *Dieci di balia, Debitori e creditori*, 32, cc. 52v, 159r, 207r e 263v; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 46, c. 43v; ASF, *Dieci di balia, Entrata e uscita*, 30, c. 127r; ASF, *Otto di pratica, Missive*, 5, c. 184r; ASF, *Otto di pratica, Missive*, 7, cc. 26r e 38v.

¹²⁷ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 44, c. 122r; ASF, *Dieci di balia, Entrata e uscita*, 25, c. 1v; ASF, *Dieci di balia, Entrata e uscita*, 27, c. 25v.

¹²⁸ ASF, *Dieci di balia, Entrata e uscita*, 30, cc. 67v-188r.

¹²⁹ ASF, *Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti*, 5, c. 50r. Sulle attività estrattive dello zolfo sulle Colline Metallifere, v. F. FRANCESCHI, *Vicende della regione boracifera volterrana nel Basso Medioevo*, in *Il calore della terra. Contributo alla storia della geotermia in Italia*, a cura di Marco Ciardi e Raffaele Cataldi, Pisa, ETS, 2005, pp. 143-153. Il contratto di una «societate et compagnia sulfuris» operante «nella serra di Fontebagni o vero Allidora, corte di Libbiano, et in parte dele Pomarancie», è in ASF, *Carte Riccardi*, 816, i. 118.

¹³⁰ ASF, *Dieci di balia, Debitori e creditori*, 28, c. 40v; ASF, *Dieci di balia, Responsive*, 58, c. 219v.

¹³¹ ASF, *Dieci di balia, Munizioni*, 9, c. 168v.

¹³² ASF, *Dieci di balia, Munizioni*, 10, c. 20v.

A Pistoia, invece, erano attive diverse officine di lanciai, come quella di Pace di Pippo o quella di Donato di Giuliano, capaci di rifornire condottieri e connestabili fiorentini con decine di migliaia di armi da «fanti a piè» o da «chavallo», da «sacchomanni» e da «giostra», con i ferri battuti secondo la tradizione italiana o la nuova moda transalpina. La compravendita di grossi quantitativi di lance era affidata talvolta a mercanti locali, come i Partini ed i Panciatichi, o alle grandi compagnie commerciali della Dominante, come gli Strozzi, che, spesso, riuscivano ad esportare i manufatti anche a Siena ed a Lucca.¹³³

Sempre a Pistoia venivano colate anche le pallottole di ferro per le nuove artiglierie «alla francese», totalmente sconosciute al *warfare* italiano prima del 1494.¹³⁴ Se i proiettili di pietra potevano essere scolpiti nelle cave sparse un po' dappertutto sul territorio toscano,¹³⁵ la fusione delle munizioni per i «cortaldi», i «falchonetti» e le «cholovrine» richiedeva invece impianti complessi e «pratici» capaci di adoperarli. I «fornelli», inoltre, necessitavano della disponibilità di acqua corrente per il movimento dei mantici, nonché di grandi quantità di combustibile ligneo.¹³⁶ Gli impianti siderurgici sulle rive dell'Ombrone erano stati messi in funzione sul finire del 1498, assoldando maestri stranieri e «nostrali».¹³⁷

Maestro Giovanni di Piero di Piamonte, Lancilotto di Voglino da Pistoia e maestro Antonio di Giovanni tedesco, conducti a piacimento dell'ufficio loro per fare pallottole di ferro colato in Pistoia a lire tredici il cento et schoppietti et archibusi a lire venti il cento et spingarde colle chode a lire diciotto il cento, tutto a prouva et a loro spese, et con conditione debino di

¹³³ ASF, *Dieci di balia, Debitori e creditori*, 19, c. 148v; ASF, *Dieci di balia, Entrata e uscita*, 13, cc. 171r-172v; ASF, *Dieci di balia, Munizioni*, 7, cc. 103v, 109r e 150v; ASF, *Dieci di balia, Missive*, 31, cc. 173v-174r; ASF, *Dieci di balia, Responsive*, 32, c. 316r; ASF, *Otto di pratica, Responsive*, 5, cc. 102v, 107r-108r, 149r e 174r.

¹³⁴ GUICCIARDINI, *Storia d'Italia*, cit., p. 78; FERRAILOLO, *Cronaca*, cit., p. 81; BIRINGUCCIO, *Pirotechnia*, cit., c. 117v.

¹³⁵ Decine e decine di scalpellini, infatti, lavorarono incessantemente, per tutto il secolo, negli accampamenti dell'esercito, sotto le città assediate, o nelle zone vicine al fronte, come in Lunigiana, o sul confine senese. Sul finire del Quattrocento, la principale cava delle «pallottole di sasso» era sita nella gola della Golfolina, in Valdarno di Sotto, nei pressi del porto di Signa. ASF, *Dieci di balia, Munizioni*, 1, c. 125v; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 22, c. 195r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 30, c. 214r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 34, c. 209r; ASF, *Dieci di balia, Missive*, 31, c. 123v.

¹³⁶ BIRINGUCCIO, *Pirotechnia*, cit., c. 118r; E. BARALDI, *La siderurgia in Italia dal XII al XVII secolo*, in *La civiltà del ferro. Dalla preistoria al terzo millennio*, a cura di Walter Nicodemi, Milano, Olivares, 2004, pp. 147-186; ID., *Una nuova età del ferro. Macchine e processi della siderurgia*, in *Il Rinascimento italiano e l'Europa*, III. *Produzione e tecniche*, cit., pp. 325-243; A. NESTI, I. TOGNARINI, *Archeologia industriale*, Roma, Carocci, 2003, pp. 70-90.

¹³⁷ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 46, cc. 12v-13r.

presente essere serviti di fiorini cinquanta larghi di oro in oro, et loro hanno a dare mallevadori sufficienti di francharli in fare le sopradecte artiglierie et inoltre di osservare il merchato.¹³⁸

L'«edificio del ferro» pistoiese sembra aver lavorato con «qualche difficoltà» nei suoi primi anni, per poi stabilizzarsi agli inizi del Cinquecento.¹³⁹ A Colle Val d'Elsa, invece, i proiettili di ghisa venivano «gettati» fin dal 1495, sotto la supervisione di Tommaso Marinai, uno dei maggiori imprenditori minerari della Toscana quattrocentesca.¹⁴⁰ Nel 1497, alle «fabriche» colligiane veniva inviato anche uno «maestro Giovanni», per cercare di migliorare ed aumentare la produzione.

Noi desiderremo, quando fussi possibile, che d'ogni sorta di munizioni si facessero in sul nostro di quella perfectione che si fanno a Brescia o in altro luogo. Et essendoci venuto ad mano uno maestro Giovanni maestro di getti, che ha qualche opinione di potere fare palle di ferro colato et in quella qualità le hanno e' francesi, viene con questa per provarne tale opera alle fabbriche di costì. Et noi desiderremo che, quando non ne risultasse danno a' padroni della fabbriche, li fusse prestato favore, accioché potesse sperimentare el suo disegno. Et pertanto ti diciamo che tu conforti quelli maestri sieno contenti, per nostro amore, a sopportare un pocho di disagio senza loro danno, accioché questa cosa si sperimenti¹⁴¹.

In occasione dell'assedio del 1499, la Signoria aveva persino affittato e ristrutturato una ferriera di Colle, rifornendola di diciannovemila libbre di «rottami di ferro» ed affidandola al maestro Simone di Andrea da Romena ed ai suoi carbonai.¹⁴² L'anno successivo, l'officina ospitava anche un «pratico» bresciano, Giovanni di Comino dei Fusti.¹⁴³

¹³⁸ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 47, c. 61r.

¹³⁹ ASF, *Signori, Missive seconda cancelleria*, 21, 47v; ASF, *Dieci di balia, Entrata e uscita*, 30, cc. 169r e 199r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 50, c. 196r.

¹⁴⁰ ASF, *Dieci di balia, Munizioni*, 5, c. 37r; ASF, *Dieci di balia, Entrata e uscita*, 14, c. 10v; ASF, *Dieci di balia, Missive*, 32, c. 96r. La carriera di Tommaso è stata presa in esame da G. PAMPALONI, *La miniera del rame di Montecatini Val di Cecina. La legislazione mineraria di Firenze e i Marinai di Prato*, Prato, A cura della Cassa Risparmi e Depositi, 1976.

¹⁴¹ ASF, *Dieci di balia, Missive*, 57, c. 17r.

¹⁴² ASF, *Consulte e pratiche*, 65, c. 61r; ASF, *Dieci di balia, Entrata e uscita*, 26, cc. 320v-321r; ASF, *Dieci di balia, Entrata e uscita*, 30, c. 161v; ASF, *Signori e collegi, Condotte e stanziamenti*, 17, cc. 32r, 34v e 37v.

¹⁴³ ASF, *Signori e collegi, Condotte e stanziamenti*, 17, c. 237v; ASF, *Signori e collegi, Condotte e stanziamenti*, 18, c. 125r.

Per tutto il Quattrocento, nelle vicinanze della capitale, ed in particolar modo a Grassina, a Villore, a Figline ed a Ricorboli,¹⁴⁴ diversi fabbri aveva prodotto scoppietti, archibugi, spingarde, e persino bombarde. Le loro fucine integravano la produzione di manufatti ferrei delle più importanti botteghe cittadine, come quella della famiglia Tinacci,¹⁴⁵ di Michele e Simone delle Volte,¹⁴⁶ di Francesco di Geremia¹⁴⁷ e di Baldassarre di Giovanni.¹⁴⁸ Quest'ultimo, in particolar modo, si era arricchito, nell'ultimo ventennio del secolo, grazie alla vendita di migliaia di armi da fuoco portatili, come testimoniato dalle sue dichiarazioni al fisco fiorentino. Per la portata del catasto del 1480, infatti, «el detto Baldassarre non ha beni, salvo i ferri atti all'exercitio del fabro», mentre, per la «decima» del 1498, l'artefice dichiarava di possedere sei case, diversi terreni, e di tenere appigionate due botteghe, poste in prossimità di palazzo Strozzi, nella via «de' ferravecchi», ed uno «maghazino per tenere charboni».¹⁴⁹

¹⁴⁴ ASF, *Dieci di balia, Debitori e creditori*, 16, c. 240r; ASF, *Dieci di balia, Debitori e creditori*, 19, cc. 45v, 46r e 192r; ASF, *Dieci di balia, Debitori e creditori*, 20, cc. 50v, 53v e 81v; ASF, *Dieci di balia, Debitori e creditori*, 27, cc. 24r-25r; ASF, *Dieci di balia, Munizioni*, 2, c. 236v; ASF, *Dieci di balia, Munizioni*, 7, c. 245r; ASF, *Dieci di balia, Entrata e uscita*, 8, c. 46v; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 33, c. 171r.

¹⁴⁵ Trasferitisi a Firenze da Castel San Niccolò, i Tinacci avevano lavorato per i Dieci di Balia fin dagli anni Venti del Quattrocento, tramandandosi il mestiere per almeno tre generazioni. La loro officina era posta «fuori dalla porta a San Niccholò». ASF, *Arte dei fabbri*, 5, cc. 21r, 33v, 34v, 63r, 65v, 75v; ASF, *Catasto*, 67, c. 460r; ASF, *Catasto*, 1015, c. 361r; ASF, *Dieci di balia, Munizioni*, 1, c. Lv; ASF, *Dieci di balia, Munizioni*, 7, cc. 5v, 19v, 28r e 39r; ASF, *Dieci di balia, Debitori e creditori*, 16, c. 169r; ASF, *Dieci di balia, Debitori e creditori*, 20, c. 53v.

¹⁴⁶ I due delle Volte, padre e figlio, erano stati, al tempo delle guerre contro Milano, i principali fornitori della Repubblica, arrivando ad accumulare un discreto patrimonio immobiliare e ad investire più di settecento fiorini nel «monte chomune». I registri delle magistrature militari riportano diverse loro sperimentazioni nella fabbricazione delle artiglierie, come la realizzazione di pezzi in «ferro colato» o l'impiego del bronzo per il «cannone» delle bombarde. ASF, *Arte dei fabbri*, 5, c. 70r; ASF, *Catasto*, 77, c. 118v-121r; ASF, *Dieci di balia, Munizioni*, 1, cc. XLVIIIr e 161r.

¹⁴⁷ Fin dal 1467, nella sua bottega «nel borgho fuori della porta alla Croce», Francesco era capace di fucinare centinaia di «scoppietti» per l'esercito fiorentino. ASF, *Arte dei fabbri*, 5, c. 30v; ASF, *Catasto*, 1018, c. 412rv; ASF, *Dieci di balia, Debitori e creditori*, 17, c. 126r; ASF, *Dieci di balia, Debitori e creditori*, 19, 44v; ASF, *Dieci di balia, Debitori e creditori*, 22, c. 14v.

¹⁴⁸ ASF, *Arte dei fabbri*, 5, c. 10r; ASF, *Dieci di balia, Munizioni*, 5, cc. 2v-65r; ASF, *Dieci di balia, Munizioni*, 7, cc. 20v, 46v, 53r, 56r e 60rv; ASF, *Dieci di balia, Debitori e creditori*, 22, cc. 14v, 17v e 21v; ASF, *Dieci di balia, Debitori e creditori*, 27, cc. 8v-9r e 179v-180r; ASF, *Dieci di balia, Debitori e creditori*, 31, cc. 20r, 22v, 120v e 147r; ASF, *Dieci di balia, Debitori e creditori*, 35, cc. 31r e 57v.

¹⁴⁹ ASF, *Catasto*, 1005, c. 78r; ASF, *Decima repubblicana*, 16, cc. 204r-205r. La vendita, da parte di Baldassarre, di un suo «pezo di terra», è annotata anche dal cronista e calderaio Bartolomeo Masi. Il podere, confinante con le proprietà dello «spedale de' Nocienti», fu pagato dal padre dello scrittore cinquanta fiorini d'oro. In B. MASI, *Ricordanze*, a cura di Giuseppe Corazzini, Firenze, Sansoni, 1906, p. 36.

La fabbricazione di altri prodotti metallici, invece, si era decisamente contratta, nel corso del quindicesimo secolo. La fiorente manifattura di elmi e di armature, contraddistinta da svariate migliorie stilistiche e da nuove tipologie di protezione, aveva resistito alla concorrenza milanese e bresciana per tutti gli anni Venti e Trenta, riuscendo ad esportare celate e «petti» in Francia, in Spagna ed in Inghilterra, anche grazie all'operosità dei mercanti di armi fiorentini, i cosiddetti «armaiuoli».¹⁵⁰ Delle venti botteghe di corazzai elencate nel catasto del 1427, tuttavia, ben poche sopravvissero all'affermazione degli acciai e delle fogge lombarde,¹⁵¹ in mancanza soprattutto di grossi ordinativi statali, essendo l'acquisto delle armature demandato alle singole compagnie d'arme.¹⁵² Nel 1478, Pierfilippo Pandolfini, oratore a Venezia, otteneva dal Senato della Serenissima la «licentia di trarre mille corazze da Brescia».¹⁵³ Preparando l'assedio di Sarzana, nel 1487, gli Otto di Pratica avevano incaricato Filippo Redditi, uno dei loro cancellieri, di acquistarne a Bologna da maestri milanesi e da mercanti emiliani.¹⁵⁴

Noi haremo bisogno di cinquecento in secento corazze da fanti a piè. Però voliamo, senza dimonstrazione, sappi et intenda se costi n'è, et ad che pregio si harebbono, et quante, et avisacene subito. Et quando tu potessi persuadere et operare che quelli che n'hanno le portassino da loro a Pisa o a Pietrasancta, te ne ingegnerai, certificandogli che ne venderanno là, subito et presto, ogni gran somma. Ingegnerati farne opera et effecto con dextro modo.¹⁵⁵

Negli anni Ottanta e Novanta, a guadagnare dalle importazioni da Brescia, Mantova e Bologna era stato soprattutto il «vetturale» Baldo di Giovanni da Careggi, uno dei principali commercianti di materiale bellico del tardo Medioevo fiorentino, che in Lombardia ed in Emilia intratteneva diversi rapporti di affari con alcuni armaioli e mercanti, come «maestro Agnolo di

¹⁵⁰ SCALINI, *L'armatura fiorentina del Quattrocento e la produzione d'armi in Toscana*, cit., pp. 83-126.

¹⁵¹ W. CAFERRO, *Warfare and economy in Renaissance Italy*, «The Journal of Intedisciplinary History», XXXIX, 2008, 2, p. 199.

¹⁵² ASF, *Dieci di balia, Missive*, 60, c. 101v; G. CANESTRINI, *Documenti per servire alla storia della milizia italiana dal XIII secolo al XV*, «Archivio Storico Italiano», XV, 1851, pp. 246-247. Sulla gestione economica delle compagnie, v. M. DEL TREPPO, *Gli aspetti organizzativi, economici e sociali di una compagnia di ventura italiana*, «Rivista Storica Italiana», LXXXV, 1973, 2, pp. 253-275; W. BERNARDONI, *La compagnia del capitano Micheletto Attendolo nella contabilità quattrocentesca della Fraternita dei Laici di Arezzo*, «Annali Aretini», XXII, 2014, pp. 115-144.

¹⁵³ ASF, *Dieci di balia, Missive*, 4, c. 173r; ASF, *Dieci di balia, Missive*, 5, c. 35r.

¹⁵⁴ ASF, *Otto di pratica, Missive*, 6, c. 4r; ASF, *Dieci di balia, Munizioni*, 7, c. 415r.

¹⁵⁵ ASF, *Otto di pratica, Missive*, 5, c. 103r.

Filippo», Antonio e Gottardo «dei Battelli», e gli eredi di Guido e Ridolfo Zanchini.¹⁵⁶ Fra le «munizioni» da lui vendute ai Dieci ed agli Otto, figuravano, oltre alle «coraze», anche «rami ed ottoni», «passatoi», punte di freccia, spingarde, pallottole di ferro, archibugi, «scoppietti», marre, beccastrini e balestre d'acciaio, tutto solitamente «passo in doana a gabella dello officio».¹⁵⁷

Nell'ultimo decennio del Quattrocento, proprio per sottrarsi al monopolio mercantile di ferri di qualità e di acciai lavorati dei «lombardi», il «maestro di cave» Tommaso Marinai si era rivolto a Lorenzo de' Medici con un progetto piuttosto ambizioso, che avrebbe potuto fruttare diversi utili anche alle casse dello stato. L'intento dell'imprenditore pratese, difatti, era quello di impiantare in Pisa l'intera filiera produttiva delle armi bianche, assoldando «pratici» siderurgici e facendo affidamento sugli approvvigionamenti di metallo della «magona» medicea di Pietrasanta, delle miniere dell'Elba e della ferriera di Suvereto, gestita dalla sua famiglia in compartecipazione col banco Capponi di Firenze.¹⁵⁸

Richordo questo dì XVI di novembre 1493 che, havendo più fa il nostro Tommaso hauto ragionamento cholla felice memoria del magnifico Lorenzo de' Medici di chondurre l'arte dell'arme et altri exercizi di Milano in Pisa, et dicendo detto Tommaso che bisognava prima chondurre in questa parte l'arte delli acciai per avere ferri acciariti et altro migliore merchato et a suo proposito, rimase in chomposizione che detto Tommaso ci chonducessi tale arte et a sua magnificenzia farebbe fare gli acciai et ferrereccie si facessino in questa parte, et chosì fe'. Et stimando noi, chome ci dise, che tale opera havessi a essere chomune, ci mettemo mano, et havendo speso parechi centinaia di fiorini, bisognò havere speso del nostro, et fussi per noi chondotto l'arte delli acciai. Detto magnifico Lorenzo, volendo mettere

¹⁵⁶ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 34, c. 112r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 36, c. 236r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 48, c. 125v.

¹⁵⁷ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 34, c. 209v;; ASF, *Dieci di balia, Munizioni*, 7, c. 269v; ASF, *Dieci di balia, Debitori e creditori*, 27, cc. 81v-82r; ASF, *Dieci di balia, Debitori e creditori*, 35, c. 115r; ASF, *Dieci di balia, Missive*, 59, cc. 47v-48r; ASF, *Dieci di balia, Missive*, 60, c. 74r; ASF, *Otto di pratica, Munizioni*, 1, c. 24r;

¹⁵⁸ PAMPALONI, *La miniera del rame di Montecatini Val di Cecina*, cit., pp. 53-54; P. GINORI CONTI, *Le magone della vena del ferro di Pisa e di Pietrasanta sotto la gestione di Piero de' Medici e compagni*, Firenze, Leo S. Olschki, 1939; P. MELI, S. TOGNETTI, *Il principe ed il mercante nella Toscana del Quattrocento. Il Magnifico Signore di Piombino Jacopo III Appiani e le aziende Maschiani di Pisa*, Firenze, Leo S. Olschki, 2006, pp. 105-168; F. FRANCESCHI, *Medici economic policy*, in *The Medici. Citizens and masters*, a cura di Robert Black e John Law, Firenze, The Harvard University Center for Italian Renaissance Studies, 2015, pp. 151-152.

avanti l'arte dell'armi in Pisa, promettendoci in questo ristorarci et farci denari assai, gli sopravvenne il male del quale si morì. Et intendendo dipoi il magnifico Piero de' Medici suo figliuolo di tali ragionamenti, volle intendere tutto, et inteso il ragionamento seguito cholla felice memoria di Lorenzo suo padre, dicendo 'io volgio vadi avanti', et a sua richiesta li demo per nota, et più d'una, quello bisognava per tale exercizio. Et doppo molte dispute, rimanemo in questa chomposizione, che noi facessimo di questa arte dell'arme et altro una chompagnia insieme, ma segreta, et facessimo questa arte dell'arme in Pisa et l'altre chose intorno a ciò si potessino, et che lui ci farebbe dare dal chomune di Firenze ducati tremila larghi d'oro in oro chome li chiedemo, con questo, che passati tre anni dovessimo dare tante arme per ammunizione o arme schoperte per huomini d'arme ciaschuno anno dipoi il terzo, cioè per fiorini mille larghi in oro insino allo intero paghamento, per quello pregio che lui farebe d'achordo cho' signori Otto della Pratica che pe' tempi fussino o con chi l'avessi a fare. Et dell'utile o del danno che seguissi, del quale danno ci guardi Iddio, il detto magnifico Piero ne havessi avere tre quarti, cioè soldi quindici per lira, et noi un quarto, cioè soldi cinque per lira, et di questo ci facessi una scripta, chome si chostuma fare nelle chompagnie, ma chon questo lo dovessimo tenere segreto, che tutto voleva si facessi sotto nome nostro.¹⁵⁹

Più che i tentennamenti di Piero, a far naufragare irrimediabilmente la proposta del Marinai sarebbero stati i rovesci politici che di lì a poco avrebbero travolto la Repubblica ed il suo ceto dirigente.¹⁶⁰ Ma è comunque da notare come la scelta di Pisa non fosse assolutamente casuale, sia per il fondamentale ruolo svolto dalla città, «bocca della Toscana», nei traffici di tutta la regione,¹⁶¹ sia per la preesistenza di una manifattura di «munitioni» che le campagne militari in Lunigiana avevano contribuito a vivacizzare per tutti gli anni Ottanta.

Fin dalla metà del Quattrocento, al tempo del conflitto contro Alfonso d'Aragona, il «*magister bombardarum*» Maso di Bartolomeo, aveva procurato, all'ombra della torre pendente, il «bronzo vecchio» necessario «*pro novis bombardis conficiendis*».¹⁶² Nelle fonderie della «cittadella nuova» operò, in seguito, anche il suo vecchio apprendista, Pasquino di Matteo, che vi fuse una bombarda «di getto di libbre quattrocento» di palla di pietra.¹⁶³ Nel

¹⁵⁹ ASF, *Carte Riccardi*, 816, i. 98.

¹⁶⁰ PARENTI, *Storia fiorentina*, I., cit., pp. 63-129.

¹⁶¹ G. PINTO, *Cultura mercantile ed espansione economica di Firenze*, in *Vespucci, Firenze e le Americhe*, atti del convegno di studi, Firenze, 22-24 novembre 2012, a cura di Giuliano Pinto, Leonardo Rombai e Claudio Tripodi, Firenze, Leo S. Olschki, 2014, pp. 9-10; GOLDHTWAITE, *The economy of Renaissance Florence*, cit., pp. 149-158.

¹⁶² ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, c. 113v.

¹⁶³ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 27, c. 276r; ASF, *Dieci di balia, Entrata e uscita*, 8, c. 101r; ASF, *Dieci di balia, Missive*, 10, c. 145v.

1480, anche Andrea del Verrocchio riceveva un pagamento per «resto di fattura et gittatura del cannone d'una bombarda di bronzo fatta in Pisa».¹⁶⁴ Nel quindicennio successivo, il maestro Giovanni di Jacopo da Augusta divenne responsabile del «fornello», realizzandovi, nel 1489, un «bavalischo» di bronzo, lungo sei metri e mezzo e pesante più di cinque tonnellate. La produzione dell'artigiano tedesco non si limitava comunque soltanto ai pezzi da campagna. Nella sua condotta con gli Otto di Pratica, siglata nel 1493, vi si trovano elencate diverse altre bocche da fuoco, come passavolanti, «cortali», serpentine e spingarde, categorizzate secondo il peso del proiettile e la lunghezza della canna.¹⁶⁵ Ribellatasi Pisa, fu sempre Giovanni a realizzare, per conto dei rivoltosi, dei nuovi falconetti, «li quali si portavano sulle carette all'usanza di Franza», che «sono molto belle cosse, e furiosse».¹⁶⁶

Nella cittadella nuova, posta in riva all'Arno, erano presenti anche due «edifici da fare polvere», entrambi affidati al maestro Giovanni di Martino Zoppo da Modigliana, nei quali venivano lavorati i cospicui quantitativi di salnitro acquistati a Livorno da mercanti pisani e fiorentini, raffinati con le caldaie «murate» nei locali della stessa fortezza.¹⁶⁷ Le «cotte» dei carboni, invece, venivano approntate, in caso di necessità, nella «vecchia», coi legni di salice forniti da tutti i centri del contado.¹⁶⁸ Così come a Firenze, le «fabriche» erano state costruite col preciso scopo di incrementare i livelli di produzione. Fra il 1484 ed il 1485, i garzoni dell'officina erano capaci di fabbricare fino a cinquecento libbre al giorno di propellente, definito dai commissari come «vantaggiatissimo». In quel biennio, in totale, ne erano state realizzate quarantamila libbre. Nel solo 1487, nel campo di Sarzana, se ne erano inviate più del doppio.¹⁶⁹

Della gestione degli arsenali e delle botteghe era incaricato Francesco di Lorenzo Cambini, «doaniere di Pisa», che esercitava, pur senza averne esplicita nomina, la funzione di

¹⁶⁴ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 23, cc. 78v-79r.

¹⁶⁵ ASF, *Otto di pratica, Munizioni*, 1, c. 9v; ASF, *Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti*, 5, cc. 96v-97r; ASF, *Dieci di balia, Debitori e creditori*, 24, c. 12v; ASF, *Ufficiali delle castella*, 29, cc. 20r, 25v, 29v, 31v e 33v. Su nomenclatura e tipologia delle armi da fuoco prodotte a Firenze, v. F. Ansani, *Craftsmen, artillery and war production in Renaissance Florence*, «Vulcan. The International journal of the social history of military technology», IV, 2016, pp. 6-12.

¹⁶⁶ G. PORTOVENERI, *Memoriale*, «Archivio Storico Italiano», VI, 1845, 2, p. 307.

¹⁶⁷ ASF, *Dieci di balia, Missive*, 20, c. 125r; ASF, *Miscellanea repubblicana*, b. 6, i. 205, c. 31v; ASF, *Dieci di balia, Missive*, 20, cc. 171r e 234v; ASF, *Dieci di balia, Missive*, 22, c. 21r; ASF, *Otto di pratica, Missive*, 5, c. 91r; ASF, *Dieci di balia, Entrata e uscita*, 10, c. 8v; ASF, *Ufficiali delle castella*, 29, c. 43r.

¹⁶⁸ ASF, *Entrata e uscita*, 10, c. 15r; ASF, *Dieci di balia, Responsive*, 30, c. 46r.

¹⁶⁹ ASF, *Dieci di balia, Responsive*, 30, c. 46r; ASF, *Dieci di balia, Entrata e uscita*, c. 23v; ASF, *Ufficiali delle castella*, 29, c. 28r.

provveditore della città. A lui toccava tenere i conti delle «ispese» fatte per conto dei Dieci, «di quello si comprava et da chi, et chi pagava, et dove et a chi si mandavano tali cose», ed inoltre redigere i «libri grandi» della «canova» di campo, «comandare biade et bestie» e carri, rapportarsi con commissari, soldati ed artigiani, «fare ongni dì a chalci et a morsi» con gli ottusi ed astiosi rettori del contado, talvolta senza trarsi «mai calze di piè né farsetto di dosso».¹⁷⁰

Alla metà degli anni Ottanta, nella due cittadelle lavoravano anche dei fabbri, fra i cui «ferramenti lavorati et comperati» si annoveravano artiglierie di ferro, dadi per le pallottole, chiodi, mazze, arpioni, martelli, «bossoli da carro», «alari grossi da strugiere piombo», «caricatoï» e «cingnie d'archibusi», marre, beccastrini, zappe e «pestoni della polvere».¹⁷¹ Non mancavano nemmeno i «maestri di balestre».¹⁷² Tutti gli artigiani ricevevano una paga mensile ed erano provvisti della propria «habitatione et botteggha» all'interno dei forti, ma a loro era fatto assoluto divieto di vendere i propri prodotti all'esterno. In città, inoltre, si ritrovavano anche corazzai e lanciai, ed «una casa dove si pulisce arme».¹⁷³ Alla sola costruzione delle navi sembra invece essere stato destinato, nell'ultimo quarto del secolo, l'arsenale dell'antica repubblica marinara.¹⁷⁴

Nel vecchio «arzanà», nel 1485, i commissari generali Jacopo Guicciardini e Pierfilippo Pandolfini avevano tentato di «accozzare insieme» l'ingegnere Giovanni di Novellino ed il maestro Vergaro di Navarra, da poco fuggito da Genova quando «s'achorse essere pagato di parole». Dal loro lavoro comune, dai loro scambi di opinioni, erano scaturiti, in breve tempo, i progetti di una «palandrea», una nave pesantemente armata, e di una «travata» per la difesa di Livorno, una sorta di piattaforma galleggiante per le artiglierie.¹⁷⁵

¹⁷⁰ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 27, c. 230r; ASF, *Dieci di balia, Responsive*, 30, c. 521rv; ASF, *Ufficiali delle castella*, 29, c. IIIr; ASF, *Dieci di balia, Entrata e uscita*, 10, cc. 1r e 15v-16r.

¹⁷¹ ASF, *Dieci di balia, Entrata e uscita*, 8, c. 199r; ASF, *Dieci di balia, Entrata e uscita*, 10, cc. 19r-22r; ASF, *Dieci di balia, Missive*, 23, c. 90r; ASF, *Dieci di balia, Missive*, 25, c. 68r; ASF, *Otto di pratica, Responsive*, 3, c. 442r; ASF, *Dieci di balia, Responsive*, 30, c. 425r.

¹⁷² ASF, *Dieci di balia, Missive*, 24, cc. 139v-140r; ASF, *Otto di pratica, Missive*, 7, c. 33v.

¹⁷³ ASF, *Balie*, 34, c. 21v; ASF, *Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti*, 5, c. 50r; ASF, *Otto di pratica, Responsive*, 10, c. 182r.

¹⁷⁴ ASF, *Dieci di balia, Responsive*, 30, c. 270r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 25, c. 43r.

¹⁷⁵ ASF, *Dieci di balia, Responsive*, 30, c. 261r; G. VIVOLI, *Annali di Livorno*, Livorno, Tipografia Sardi, 1843, p. 243.

Havendo stamani accozzato insieme maestro Vergaro, che è quello di che vi scrivemo hiersera, con maestro Giovanni Novellino per vedere di fare una travata anchora noi, et havendo parlato insieme decti maestri tornò poi a noi maestro Giovanni solo, et ha offerto fare uno certo legno a modo di fusta, che vogherà con ottanta remi, et sarà forte in modo che dice vi si pianterà su una bombarda di gietto di libre cento in centocinquanta, et più dua passavolanti grossi, et disegna la bombarda piantarla a prua et i passavolanti a poppa, et armarlo in forma che potrà ire appresso alla ghalee senza essere offeso, et, se riesce nel modo che disegna, sarà cosa di grandissima utilità. Il perché hoggi vi habbiamo dato principio, et solleciterassi con ogni prestezza. Questo maestro Vergaro tegnamo in parole per vedere di chavarne qualche fructo, et farasegli fare uno modello della travata, perché, se sarà giudicato che sia utile poi farla, si possi fare.¹⁷⁶

Colloqui simili erano avvenuti durante tutto il secolo, fra le professionalità più disparate. Nella bottega di Francesco di Giovanni, «vocato il Francione» lavoravano architetti, come «il Capitano muratore» e Giuliano da Sangallo, ed ingegneri a tutto tondo, come la Cecca, autore, nel corso degli anni, di «fuochi lavorati», di di «ceppi» per le artiglierie, di terrapieni, e persino di una fantasiosa «nugola» mobile, piena di «sacca di lana», atta a proteggere le torri dai colpi delle artiglierie.¹⁷⁷ Negli accampamenti fiorentini della fine del secolo era possibile ritrovare muratori, legnaioli, «maestri d'ascia», scalpellini, fabbri, corazzai, o personalità dal multiforme ingegno, quali «la Pippa» e «Masaccio», Francesco del Caprina, «maestro Giannettino grecho», capo dei bombardieri del campo, o l'albanese Giovanni di Demetrio, costruttore delle difese di diverse città costiere.¹⁷⁸

Richiesti dai condottieri, offerti dai comandanti, fonditori ed artiglieri di tutta Europa seguivano gli eserciti in marcia, acciò che «omne bombarda habia el suo bombardiere, et sieno boni, et un maestro d'asse per una». Nel 1472, «el danese bombardiere del ducha di Milano» giungeva in campo a Volterra, insieme a «Bonagiunta da Trento con un suo figliuolo, mandati da Bologna da messer Giovanni Bentivogli», a «Sirro e Monchetto, ingegneri del signor conte d'Urbino», a «Godino francioso» ed a «Simone di Nicholò di Nantes», ed ancora «Arigo tedesco» e «Gerardo della Magna», «Giovanni di Bartolomeo del Bronzo maestro di

¹⁷⁶ ASF, *Dieci di balia, Responsive*, 30, c. 270v.

¹⁷⁷ ASF, *Dieci di balia, Debitori e creditor*, 24, c. 137r. La fama della «Cecca» era ben nota anche al temuto duca di Calabria, Alfonso d'Aragona, che nel marzo del 1486 lo richiese «con disegni et instrumenti et ordini da fare ponti, perché sua excellentia fa conto, se Idio gli dessi gratia di potersi unire con gli Orsini, d'havere a fare un ponte in sul Tevere». In ASF, *Dieci di balia, Responsive*, 33, c. 462r.

¹⁷⁸ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 38, cc. 1r, 2r e 13r; ASF, *Dieci di balia, Entrata e uscita*, 22, cc. 100v-101r; ASF, *Dieci di balia, Responsive*, 53, c. 2v.

bombarde» e «Vangelista da Monte Lupone maestro d'achonciare polvere da bombarda», il «Francione» ed il «Capitano».¹⁷⁹

In vista della campagna contro Pietrasanta, nel 1484, l'ambasciatore fiorentino a Milano, Pierfilippo Pandolfini, chiedeva ed otteneva da Ludovico Sforza «dua bombardieri». Alfonso d'Aragona, duca di Calabria, concedeva, da parte sua, «un ingegniero, chiamato Achactabrigha, il quale molto loda», un figlio di «Cyro ingegnere», che sua «excellentia dice molto pratico et simile al padre in simile exercitio», così come Mariotto di Lionello da Gubbio, che il condottiere Rinuccio da Farnese «molto commendava», ed «uno Agnolo da Castello Durante, huomo molto pratico ad expugnare terre et a fare cave».¹⁸⁰

Durante la «guerra di Roma» del 1486, Bonaccorso Ghiberti veniva inviato dai Dieci a Bracciano per fondere una nuova bocca da fuoco, perché «senza artiglierie ogni piccola bicocca fa difesa» e, «quando uno capitano ha le bombarde in ordine, spesse volte fa de' molte cose con li spaventachi, che non l'avendo gli omini se ne fanno beffe».¹⁸¹ Il fonditore sarebbe rimasto nel Lazio, al servizio di Gentile Virginio Orsini, per altri due anni, come «maestro ingegnere», esperto di «munitiones» e «fabricationes».¹⁸² Nel 1490, era invece a Piombino, assoldato da Jacopo IV Appiano. Nel porto tirrenico, poi, conosceva Tommaso Marinai, entrando dunque in contatto con altri «pratici», con i loro strumenti, con la loro cultura empirica, con le loro esperienze.¹⁸³ Il *network* di Bonaccorso, ricostruibile attraverso le sue «ricordanze», è d'altronde costellato di incontri con maestri «di getto» e «da forno», carpentieri, soldati, fabbri, artisti, conosciuti in Toscana ed altrove.¹⁸⁴

Come lui, altri artigiani viaggiavano ed operavano in località diverse, accrescendo il loro sapere tecnico, affrontando una somma sempre crescente di casi, migliorando la capacità di governare le variabili dei processi produttivi. Basilio della Scola, ad esempio, aveva lavorato per Carlo VIII, prima di trasferirsi a Venezia,¹⁸⁵ dove da anni ormai operava Sigismondo Alberghetti, figlio di Alberghetto.¹⁸⁶ Nel 1498, i Dieci assoldavano a Barga maestro Giovanni,

¹⁷⁹ ASF, *Dieci di balia, Debitori e creditor*, 20, cc. 41v, 76r e 85v.

¹⁸⁰ ASF, *Dieci di balia, Responsive*, 32, cc. 34r, 47r e 52rv.

¹⁸¹ ASF, *Dieci di balia, Entrata e uscita*, 9, c. 171v; ASF, *Dieci di balia, Responsive*, 33, cc. 385v e 493r; ASF, *Dieci di balia, Responsive*, 36, cc. 354r e 374v.

¹⁸² C. VON FABRICZY, *Adriano Fiorentino*, «Jahrbuch der königlich preussischen Junstsammlungen», XXIV, 1903, p. 76.

¹⁸³ AOI, *Debitori e creditor di Bonaccorso di Vettorino di Lorenzo Ghiberti*, 13229, cc. 3r-4v.

¹⁸⁴ AOI, *Ricordanze di Bonaccorso di Vettorino Ghiberti*, 13230, cc. 12r-145r.

¹⁸⁵ M. SANUDO, *I diari*, I., a cura di Federico Stefani, Venezia, 1879, p. 146; D. MALPIERO, *Annali veneti*, «Archivio Storico Italiano», VII, 1843, p. 562.

¹⁸⁶ PANCIERA, *Il governo delle artiglierie*, cit., p. 163.

«uomo ingegnioso et da bene, maestro *non solum* di trarre, ma *etiam* di fare artiglieria», proveniente, probabilmente, dalla ferriera estense di Fornovolasco.¹⁸⁷ Pochi mesi dopo, i magistrati ricevevano da Napoli una lunga, appassionata lettera da parte del loro concittadino Barone d'Angelo, «della maestà dell signor re Federigho ingegniero», che offriva loro conoscenze e competenze «da fare uno nuovo mondo».

Excellentissimi signori Dieci di Ghuerra e Balìa della excellentissima città di Fiorenza, rachomandazione.

Le excellentie vostre sapino che questa solo sarà per far notizia a vostre signorie chome, esendo istato all servizio di chasa di Raghona cinque anni fa in atto d'ingenyniero, ho a questa ora fatto tanto per detta chasa che s'io l'avesi fato per servizio di Dio saria beato.

Per lla maestà del signor re Allfonso fu diputato all suo tempo alla fortifichazione di Polichastro, e lì per me si fe' sette bastioni e perfetti in la provinzia del principato di Salerno a la marina.

E di poi, per ordinazione di messer Tibaldo Vischonti, fu traferito alla fortifichazione della Ischalea, e li fe' dua bastioni. E fu traferito all Celento e ad Aghruopoli, e li fortifichai quele terre.

E dipoi per ordinazione del signor re Allfonso fu mandato alla fortifichazione del Gharigliano in Terra di Lavoro.

E si fe' quanto per lo ingegnio e industria mia si poteva d'uno fosso di quarantadua pallmi fondo e quarantadua largho, e detegli pallmi quindici d'aqua.

E fornito [...] fu tuto de' franzesi in la venuta del signore re di Francia.

Dipoi, seghuendo lo esilio loro, me ne partì da la lor divozione e lor servizi, e in quanto per me si fe' per loro onore e utile posuto per me fare l'ho fato, di maniera tengho da loro bona e sincera ghrazia ma utile pocho per la impossibilità e sapientia paucha.

Chonsiderando gli afanni delle mie illustrissime et excellentissime signorie et trovandomi in ordine chon quatro homini da fare uno nuovo mondo, e in fatto di ghuerra potreste cerchare da lo levante a lo ponente per tale misterio di trovare quatro piue al proposito di vostre signorie quanto sarò io chon quelli che a vostre signorie se chondurò, quando a quelle si piacia, e in prima, cioè in far bastioni in difensione d'uno istremo luogho, in piantar bonbarde, in chondurle, in far ponti, in far tagliate, in fare riparazione d'andare a dare bataglia a una terra et in difensalla, in fuochi lavorati di più maniere.

Ayo el primo maestro d'Itaglia di far chanoni, falchonetti e girifalchi e cholonbrine, in gitalle e in armarle e sì in fabbrichando, o in qualsivoglia chosa di ghuerra, che quando le excellentissime signorie vostre non avesino tali persone, e sapiendo fusino a Santa Maria Finisterre, le signorie vostre dovere mandare là per avelli, e di questo istate di bona volontà che forse

¹⁸⁷ ASF, *Dieci di balìa, Responsive*, 53, c. 287r; ASF, *Dieci di balìa, Responsive*, 55, c. 9r; ASF, *Dieci di balìa, Missive*, 57, c. 69v.

per aventura le signorie vostre non n'ebono cinquanta anni fa tali sufizienti servitori.

Da nesuno di noi vi sarà dimandato prezo né solldo per fino a tanto non sono chonosciute le virtù di ciaschuno, e tuti saremo patrioti e non forestieri.

E volendo le illustrissime signorie vostre vederne lo efetto si dengnino di mandarci quatro versi che noi possiamo venire liberi e sichuri senza alchuna excezione per avere mortto uno nell 1474 a XVI d'aprile, et ayo auto la pace sedici anni pasati fa. Et eci uno alltro mio simile chonpangnio che ha morto uno alltro è du' ani asai, e deci la pace e non c'è la rimisione, e volendo venire fateci lettere che vinimo sichuri tanto parliamo cholle signorie vostre.

E troverete che per aventura sarà meglio avere quatro nostri pari che avere sedici isquadre di chavagli.

Saremo chontenti per la liberazione di nostra patria metere la vita, se mille volte si posesi.

El primo si è Barone d'Angniolo ingegniero del signore re. El secondo si è mastro Jacopo da Chortona, e terzo mastro Rosso suo fratello, e quarto sarà suo fratello e quinto maestro bonbardiero e gitatore di chanoni, falchoneti e cholonbrine e girifalchi per sufiziente e primo homo d'Itaglia, ma è genovese, ed è l'ochio e 'Il quore mio, ed è disposto a morire per amore mio, e di questo tuto aviso.

E 'Il proverbio dice ch'uno bello morire tuta la vita honora, e masime morendo per la patria sua.

Ch'altro disiderio per me non si tiene se non di far qualche fazione in onore, in utile di mia patria, si ché, parendo alle signorie vostre che siamo all proposito, subito per llo primo aviso di quelle saremo mossi.

E volendo altra natura d'omini per chonto allchuno, abbiamo modo e chredito menarne quela quantità per illustrissime signorie vostre ci fussi ordinato, intendosi tuti homini atti a ghuerra.

Altro non mi ochorre di dire, se non che pregharò Idio mantenga la nostra excelsa città e in filicissimo istato la inalzi, e chrescha e chonservi sani tuti quelli che amono el suo utile e 'Il suo honore.¹⁸⁸

Una simile missiva era stata spedita, tempo prima, da Leonardo da Vinci, che si era proposto al duca di Milano come «maestro de compositore de instrumenti bellici» e «varie e infinite cose da offendere e difendere», come «bombarde comodissime e facili a portare» e «mortari e passavolanti di bellissime e utili forme, fora del comune uso».¹⁸⁹ Nell'estate del 1498, invece, era stato un anziano «capo maestro ingegnieri et architectore», Francesco di Giorgio Martini a proporsi al mandatario dei Dieci a Siena, offrendosi «di fare ingegni mirabili per la offesa di Pisa».¹⁹⁰

¹⁸⁸ ASF, *Dieci di balia, Responsive*, 57, cc. 259r-260v.

¹⁸⁹ GILLE, *Leonardo e gli ingegneri del Rinascimento*, cit., pp. 152-154.

¹⁹⁰ ASF, *Dieci di balia, Responsive*, 58, c. 317v.

Negli accampamenti, nei palazzi, nelle officine, negli arsenali, i «pratici» confrontavano dunque le loro tradizioni, le loro esperienze, le loro metodologie, i loro prodotti, aprendo la via a sperimentazioni ed innovazioni. Accanto a Leonardo, Francesco di Giorgio Martini, Giovanni da Augusta, Bernardino da Milano, Francesco d'Asti e Piero da Douai, molti altri «bombardieri» e «spingardieri», dall'Inghilterra al Portogallo, dall'Ungheria alla Francia, dalla Grecia alla Germania,¹⁹¹ concorrevano alla creazione di uno «spazio tecnologico unificato», promosso, finanziato e controllato dallo stato.¹⁹² E la guerra, come l'architettura e l'arte, come l'industria tessile e la stampa, mobilitava uomini, denaro, informazioni, risorse, merci.

Accanto al flusso migratorio degli artigiani, infatti, lo stato incoraggiava il commercio di materie prime e di prodotti finiti. Le lance di Pistoia venivano esentate dal pagamento delle imposte su tutto il Dominio fiorentino, che «non fu mai usanza che nostre cose di commune, maxime di munitione et da guerra, pagassino alcuna gabella».¹⁹³ Altra mercanzia «franca» era, soprattutto, il salnitro, importato in grandi quantità dalla Puglia, con «licenza di tratta» reale, dalle Marche e dalla Liguria, attraverso i porti di Livorno e di Pesaro.¹⁹⁴ Ad esserne agevolati erano mercanti come i Lomellini di Genova, i Buonvisi di Lucca, nonché i Cambi di Pisa e gli Strozzi, i Bardi, i Medici, i Capponi, i Berti ed i Biliotti di Firenze.¹⁹⁵

Richordo chome questo dì XX di dicembre 1497 abbiamo fatto merchato chon Giovanni di Lorenzo Agnolo Biliotti di miglia trenta di libre di salnitro del Reame a fiorini quarantotto larghi d'oro il migliaio, posto in Firenze a tutte sue spese di

¹⁹¹ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 48 cc. 33v-35r e 107v-108v.

¹⁹² BARALDI, *Una nuova età del ferro. Macchine e processi della siderurgia*, cit., pp. 214-216; SCHULZ, *La migrazione di tecnici, artigiani e artisti*, cit., pp. 89-110; PANCIERA, *Il governo delle artiglierie*, cit., pp. 213-216; C. M. CIPOLLA, *Tecnica, società e cultura. Alle origini della supremazia tecnologia dell'Europa*, Bologna, Il Mulino, 1989, p. 10; G. GUERZONI, *Novità, innovazione e imitazione. I sintomi della modernità*, in *Il Rinascimento italiano e l'Europa*, III. *Produzione e tecniche*, cit., pp. 67-72; S. EPSTEIN, *Labour mobility, journeyman organizations and markets in skilled labour in Europe, 14th-18th centuries*, in *Le techniciens dans la cité en Europe occidentale, 1250-1650*, a cura di Mathieu Arnoux e Pierre Monnet, Roma, École Française de Rome, 2004, p. 251; L. MOLÀ, *Il mercato delle innovazioni*, in *Le techniciens dans la cité en Europe occidentale, 1250-1650*, in *ivi*, pp. 215-222;

¹⁹³ ASF, *Otto di pratica, Missive*, 5, c. 149v; ASF, *Dieci di balia, Munizioni*, 7, cc. 355rv e 457v.

¹⁹⁴ ASF, *Otto di pratica, Deliberazioni, partiti, condotte e stanziamenti*, 1, c. 33r; ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 33, c. 105r; ASF, *Dieci di balia, Munizioni*, 9, c. 186r. Sui permessi di esportazione concessi dai sovrani napoletani e sui giacimenti di Altamura, Trani e Manfredonia, v. BIANCHESSI, *Cavalli, armi e salnitro fra Milano e Napoli nel secondo Quattrocento*, cit., pp. 573-575.

¹⁹⁵ ASF, *Dieci di balia, Munizioni*, 7, cc. 9r, 19r, 25v e 409r; ASF, *Dieci di balia, Munizioni*, 8, c. 167r; ASF, *Dieci di balia, Entrata e uscita*, 30, c. 180v; ASF, *Signori e collegi, Condotte e stanziamenti*, 17, c. 248v; ASF, *Dieci di balia, Missive*, 7, c. 149r.

vettura, posto in dogana di Firenze a gabella del comune. El quale detto Giovanni s'obriga mettere in detta dogana per tutto gennaio prossimo a venire libre diecimila e di poi ogni mese libre diecimila sino a detta somma di libre trentamila, chome è detto, e noi gli dobbiamo dare e' denari chome ce l'avrà consegnato e pesato, a detto pregio di fiorini quarantotto larghi d'oro il migliaio, el quale salnitro debba essere de la bontà è d'uno saggio ci è lasciato, el quale è nelle mani del proveditore, o migliore d'esso, e per ciò osservare obrigha sé e suo rede e beni presenti e futuri.¹⁹⁶

Nell'estate del 1498, anche l'ambasciatore a Roma, Francesco Gualterotti, aveva stipulato un contratto analogo con il banco senese degli Spannochì, operante in «chorte di Roma». Stando alla «schritta», le venticinquemila libbre di materiale «rafinato» dovevano essere condotte a Firenze «sanza far loro pagare datii, passi o gabbelle di alcuna qualità».¹⁹⁷

Persino i modelli delle artiglierie francesi erano divenuti, a pochi mesi dal passaggio dell'esercito di Carlo VIII in Toscana, un prodotto ambito. Nel febbraio del 1495, un mercante pistoiese ne offriva ai Dieci diversi pezzi, ed prezzi, pare, piuttosto convenienti.

Qui ci è uno che ha modelli bellissimi da fare artiglierie di più ragioni, che dice haverli havuti da certi franciosi. Sono ingegni perfectissimi da bombarde, passavolanti, mortai et altre artiglierie, circa quattordici o quindici capi. Harebonsi con picholo prezzo, che stimo stare bene. Conforto vostre signorie, parendo nondimeno a quelle et non altrimenti, mandare per costui che le ha, et vostre signorie le potranno vedere et intendere se sono il bisogno, che stimo di sì, et, quando così sia, usarli qualche gentilezza et torli da lui.¹⁹⁸

I traffici di merci «difficili» come le armi, tuttavia, richiedevano anche una certa regolamentazione.¹⁹⁹ Per ottenere l'acquisto di «balote di fero» sul mercato bresciano, nel 1498, gli ufficiali fiorentini avevano dovuto richiedere il beneplacito dell'ostile Senato della Serenissima,²⁰⁰ finendo poi per rivolgersi a chi le facessi «venire contro a bando».²⁰¹ In quello stesso anno, anche i genovesi avevano posto diverse «prohibitioni in Riviera» per la vendita di nitrato, costringendo il commerciante a condurlo a Livorno in «segreto, et pocho per volta», ed

¹⁹⁶ ASF, *Dieci di balia, Munizioni*, 7, c. 274v.

¹⁹⁷ ASF, *Dieci di balia, Entrata e uscita*, 23, c. 351v; ASF, *Dieci di balia, Missive*, 59, c. 127v.

¹⁹⁸ ASF, *Dieci di balia, Responsive*, 38, c. 244r.

¹⁹⁹ LEYDI, *Le armi*, cit., pp. 174-179.

²⁰⁰ M. SANUDO, *I diari*, II., a cura di Guglielmo Berchet, Venezia, 1879, p. 896.

²⁰¹ ASF, *Dieci di balia, Responsive*, 57, c. 283rv.

obbligando il commissario a contattare altri «huomini da bene et amici nostri».²⁰² Dal canto loro, i Dieci avevano dato un perentorio ordine ai magistrati pistoiesi.

Preteera noi siamo advisati che lucchesi et altri a stanza de' pisani hanno tracto di costì lance et altre cose da offendere et difendere, le quali sono portate a Luccha, et di qui a Pisa. Per rimediare a questo senza che lucchesi o altri se ne possino dolere, voliamo facci mettere bando che niuno possa trarre di costì lance di niuna sorte né artiglierie da offendere et difendere per fuora della iurisdizione nostra, né medesimamente possa vendere ad altri che trahessi, sotto pena di perdere le robe, le bestie, venti cinque ducati et quatro tracti di fune, et se ne truovi alcuno che contrafacessi puniscilo in quello modo occorrerà alla prudentia tua.²⁰³

Le istituzioni degli stati territoriali, dunque, tendevano a creare la domanda ed a sostenere l'offerta già dal tardo Quattrocento, combattendo fra di esse, e permettendo la circolazione di uomini, prodotti ed idee. L'esame della «geografia della guerra» nella Toscana rinascimentale ha dunque cercato di mettere in luce la politica economica fiorentina nell'ambito della produzione bellica, il suo «governo delle manifatture» e quello «delle artiglierie», il livello di integrazione e complementarità raggiunto dalle officine della capitale con gli impianti periferici, i numerosi investimenti dello stato in attività industriali fondamentali per la sua stessa sopravvivenza, la concessione di numerose licenze minerarie, l'adattamento degli artigiani alle nuove tecnologie belliche continentali, ed anche l'iniziativa privata nelle importazioni di materie prime, o il sostanziale monopolio medico del salnitro negli anni culminanti del regime.²⁰⁴ Ed è proprio in questa loro dimensione economica, sociale, politica, culturale, più che in quella strettamente militare, che i conflitti del Rinascimento costituivano «una dimensione quasi quotidiana di vita, uno degli elementi dominanti dell'esistenza» per cittadini e contadini, guerrieri e «pratici», a Firenze, la città degli artisti, dove «ciò che ha esser, convien sia. Chi vuol esser lieto, sia, di doman non c'è certezza».

²⁰² ASF, *Dieci di balia, Responsive*, 55, cc. 45v, 101v e 126r.

²⁰³ ASF, *Dieci di balia, Missive*, 31, cc. 173v-174r.

²⁰⁴ Per un approfondimento di queste tematiche, v. GOLDTHWAITE, *The economy of Renaissance Florence*, cit., pp. 400-402 e 511-545; S. TOGNETTI, *Il governo delle manifatture nella Toscana del tardo Medioevo*, in *Il governo dell'economia. Italia e Penisola Iberica nel basso Medioevo*, a cura di Lorenzo Tanzini e Sergio Tognetti, Roma, Viella, 2014, pp. 310-330; F. FRANCESCHI, L. MOLÀ, *Regional states and economic development*, in *The Italian Renaissance state*, a cura di Andrea Gamberini e Isabella Lazzarini, Cambridge, Cambridge University Press, 2012, pp. 453-463; F. FRANCESCHI, *Istituzioni ed attività economica a Firenze. Considerazioni sul governo del settore industriale*, in *Istituzioni e società in Toscana nell'Età Moderna*, atti delle giornate di studio, Firenze, 4-5 dicembre 1992, Roma, Ufficio Centrale per i Beni Archivistici, 1994, pp. 114-117; ID., *Medici economic policy*, cit., pp. 130-153.

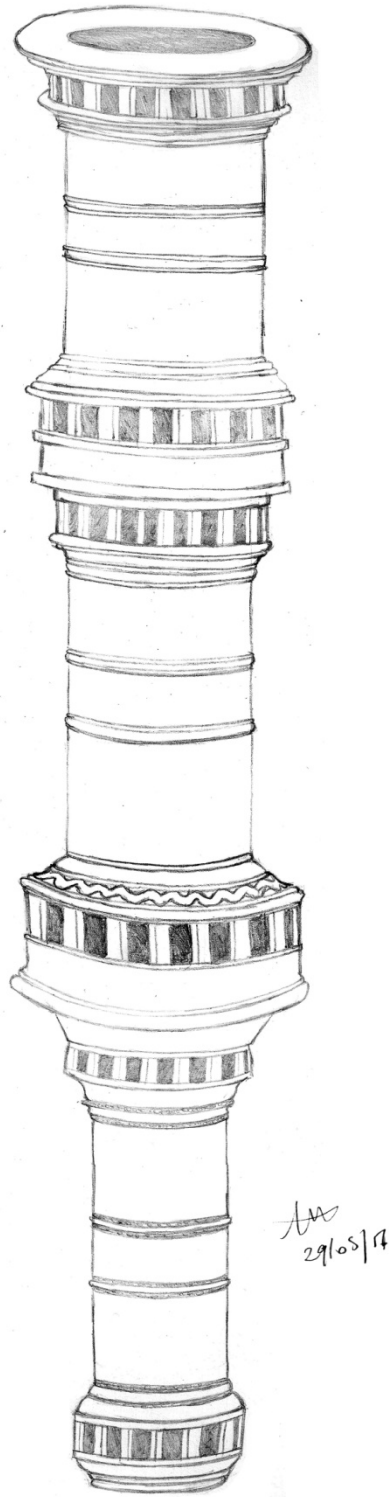


Figure 3. A bombard, sketched by Bonaccorso Ghiberti in 1480s
Firenze, Biblioteca Nazionale Centrale, Banco rari, 228
Drawing by Angela Marino

ARTICLE IV

“PER INFINITE SPERIENTIE.”

I “MAESTRI DELL’ARTIGLIERIA” NELL’ITALIA DEL QUATTROCENTO

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Se la diffusione della tecnologia militare medievale è ormai pienamente riconosciuta come un fattore di cambiamento socialmente condiviso, non altrettanta fortuna storiografica pare abbiano avuto alcuni fra i suoi protagonisti più determinanti e significativi, come i fonditori dell’Italia del Rinascimento, spesso ignorati dagli studiosi interessati alle trasformazioni dell’arte della guerra quattrocentesca e alle sue molteplici declinazioni¹. Ad esempio, poco è stato scritto dagli economisti sulla compravendita delle bocche da fuoco, o sull’espansione del mercato degli armamenti in seguito all’affermazione della polvere da sparo, già suggerita da alcuni mercuriali genovesi e veneziani sul finire del Trecento². Nemmeno il decennale dibattito sulla cosiddetta rivoluzione militare ha distolto l’attenzione degli storici dai soggetti tradizionali di ricerca: i brillanti architetti e i multiformi ingegneri coinvolti, a vario titolo, nella riflessione sulle problematiche fortificatorie e sui relativi riflessi ossidionali³.

Leonardo da Vinci e Francesco di Giorgio Martini, soprattutto, sono stati celebrati come mediatori fra una cultura teorica e un sapere empirico, raffrontando le loro opere

Abbreviazioni

ASF = Archivio di Stato di Firenze

BNCF = Biblioteca Nazionale Centrale di Firenze

¹ DeVries, *Early modern military technology*, p. 81; Rogers, *The military revolutions*, pp. 275-278; Stone, *Technology, society, and the infantry revolution* pp. 364-367.

² Tali listini sono riportati in Melis, *Documenti per la storia economica* pp. 302, 304 e 316. Riguardo ai successivi sviluppi del mercato degli armamenti e alle sue ramificazioni in Italia, i contributi, purtroppo, non abbondano. Si vedano, a titolo meramente esemplificativo, Bianchessi, *Cavalli, armi e salnitro*, pp. 572-582; Merlo, *Armamenti e gestione dell’esercito*, pp. 71-85; Ansani, *Craftsmen, artillery, and war production*, pp. 2-22; Esch, *Armi per Roma*, pp. 176-178. Un contributo di recentissima pubblicazione è Mocarrelli e Ongaro, *Weapons production*, pp. 3-10.

³ Parker, *The military revolution*. Sulla discussione storiografica in merito, si veda *The military devolution debate*.

razionalizzanti e innovative con una realtà tecnica impietosamente definita come deludente⁴. Alcune recenti pubblicazioni hanno poi ribadito gli apporti dell'umanesimo ai vari settori artigianali, nonché la corrispettiva integrazione delle tecniche nella tradizione colta, concentrandosi, ancora una volta, sulle macchine leonardesche e sulle due differenti versioni del trattato del maestro senese⁵. L'insistenza su casi già noti, tuttavia, ha colpevolmente perpetuato la dimenticanza in cui versano, attualmente, una moltitudine di artigiani operanti nel settore bellico, nonostante bilanci e carteggi, ricordanze e cronache conservino numerose testimonianze di una loro specifica conoscenza pratica.

La carenza di studi sui maestri dell'artiglieria⁶ quattrocenteschi è d'altronde imputabile anche ai ritardi della storiografia militare italiana, profondamente segnata, per quel che riguarda il tardo medioevo e la prima età moderna, dal pregiudizio machiavelliano contro le compagnie di venturieri, e, inevitabilmente, dal dualismo fra "corrotti" eserciti mercenari e "integerrime" milizie cittadine⁷. Solo nell'ultimo ventennio le tesi del segretario fiorentino sono state efficacemente ribaltate dalle analisi di Maria Nadia Covini, di Francesco Storti, di Enrica Guerra e di William Caferro, che hanno acutamente approfondito le indicazioni di Piero Pieri, di John Hale e di Michael Mallett riguardo all'organizzazione militare degli stati italiani⁸. Anche in queste fondamentali opere, però, le tematiche relative alla produzione delle armi sembrano avere trovato poco spazio, al di là di una generica consapevolezza teorica delle loro connessioni con le evoluzioni di tattiche e strategie, del loro ruolo nelle scelte operative di governi e generali, e del loro sempre più frequente utilizzo in assedi e battaglie.

Non molti paiono nemmeno i lavori specificamente dedicati ai maestri di getto rinascimentali, se si escludono alcune recenti indagini archeologiche, i contributi dedicati ad alcune dinastie di fonditori cinquecenteschi, o gli studi incentrati perlopiù sulla produzione

⁴ Bernardoni, *La fusione*, pp. 106-116; Gille, *Leonardo e gli ingegneri*, pp. 125-228; Fiore, *Città e macchine del Quattrocento*, pp. 40-56.

⁵ Long, *Artisans, practitioners*, pp. 30-50.

⁶ Tale definizione è attestata in Archivio di Stato di Pisa, *Comune di Pisa, Divisione C, Camarlingo della massa*, 83, c. 130v.

⁷ Caferro, *Continuity, long-term service and permanent forces*, pp. 219-220.

⁸ All'ultimo ventennio risalgono infatti le pubblicazioni di Covini, *L'esercito del duca*; Storti, *L'esercito napoletano*; Guerra, *Soggetti a ribalda fortuna*. Imprescindibile, insuperata opera sulle evoluzioni dell'arte della guerra nell'Italia medievale è quella di Pieri, *Il Rinascimento e la crisi militare italiana*. Sul rapporto tra stati e compagnie di ventura è incentrato il testo del Mallett, *Signori e mercenari*. Di più ampio respiro è invece la sintesi di Hale, *Guerra e società*, che analizza l'impatto quotidiano della guerra in termini di reclutamento e di reinserimento dei soldati, nonché le conseguenze economiche dei conflitti sulla fiscalità e sulla produzione.

veneta coeva⁹. Certo, le pionieristiche pubblicazioni di Angelo Angelucci, di Cesare Quarenghi, di Luigi Cibrario e di Carlo Montù, apparse a cavallo fra Ottocento e Novecento, sono ancora da considerarsi come validissime fonti secondarie¹⁰. Ma l'indolenza della ricerca italiana, in questo settore, è particolarmente evidenziata dal confronto, non solo quantitativo, con le più recenti pubblicazioni internazionali sull'evoluzione tecnica e sulla gestione delle artiglierie, saggi riguardanti piccole e grandi realtà statali europee, in un arco cronologico compreso tra la fine della guerra dei Cent'anni e lo scoppio dei grandi conflitti di religione¹¹. Questo articolo, dunque, si propone di colmare, almeno parzialmente, tali lacune, esaminando l'apporto degli artigiani alla diffusione della tecnologia bellica quattrocentesca, ricostruendone sia le esperienze e la formazione, sia, soprattutto, il rapporto con la committenza statale, interessata clientela delle loro macchine d'assedio, promotrice di numerose appropriazioni e di vari riadattamenti tecnici¹². Si tenterà quindi di delineare, complessivamente, il quadro degli scambi di pratici e di pratiche fra gli stati della Penisola¹³.

Sullo sfondo, più che la guerra, vi sarà quindi il profondo legame fra società e tecnologia, tra politica ed economia, all'interno di un contesto culturale, quale quello rinascimentale, che avrebbe indubbiamente incentivato e garantito la continuità del trasferimento dei saperi, la pacifica circolazione di uomini, anche in ambito militare¹⁴, perché «la vita, come la scienza, ha tutto da guadagnare dal fatto che questo incontro sia fraterno»¹⁵.

⁹ Si vedano, fra gli altri, Panciera, *Il governo delle artiglierie*; Ridella, *L'evoluzione strutturale nelle artiglierie di bronzo*; Ridella, *Produzione di artiglierie nel sedicesimo secolo*; Ridella, *Fonditori italiani di artiglierie*; Beltrame, *Venetian ordnance*.

¹⁰ Cibrario, *Delle artiglierie*; Angelucci, *Documenti inediti*; Quarenghi, *Tecno-cronografia*; Montù, *Storia dell'artiglieria italiana*.

¹¹ Dei famigerati cannoni di Carlo il Temerario, ad esempio, hanno trattato Garnier, *L'artillerie des ducs de Bourgogne*, DeVries e Douglas Smith, *The artillery of the dukes of Burgundy*, e da ultimo Depreter, *De Gavre à Nancy*. Sempre in ambito francese, si segnalano le opere di Contamine, *Les industries de guerre*, e di de Crouy-Chanel, *Charroi de l'artillerie*. Brioist, *L'artillerie à la Renaissance*, e Walton, *The art of gunnery*, si sono occupati di teoria e pratica balistica nell'Inghilterra dei Tudor e degli Stuart. Gli arsenali spagnoli sono stati invece analizzati da Herrero Fernández-Quesada, *La artilleria de los reyes catolicos*, e da Cossart, *Le artilleurs*. Per l'area tedesca, ancora valido è il volume di von Essenwein, *Quellen zur Geschichte der Feuerwaffen*. Anche l'industria ottomana è stata esaminata da Agoston, *Guns for the sultan*. Un'ampia rassegna del dibattito estero, passato e presente, è in DeVries, *Early modern military technology*, pp. 73-80. Indispensabile alla comprensione del problema tecnologico è infine Hall, *Weapons and warfare*.

¹² Staudenmaier, *Rationality, agency, contingency*, pp. 168-171.

¹³ Hilaire-Perez e Verna, *Dissemination of technical knowledge*, pp. 545-546.

¹⁴ Buchanan, *Technology and history*, p. 496; Edgerton, *Innovation, technology, or history*, pp. 686-687 e 694.

¹⁵ Bloch, *Apologia della storia*, p. 108.

In taluni casi, lo scarso interesse per le problematiche tecniche è stato acuito dalla mancanza di fonti specifiche, dovuta alla distruzione dei registri della cancelleria aragonese durante l'ultimo conflitto mondiale, al rogo di alcuni fondi veneziani nel Cinquecento e al disordine degli archivi sforzeschi. Altrettanto difficili da rintracciare sono i libri di conto e gli appunti degli artigiani, rari persino nell'abbondante documentazione aziendale toscana.

Le sparse tracce della storiografia esistente verranno integrate dallo spoglio del carteggio e della contabilità delle magistrature militari fiorentine, da alcune cronache quattrocentesche, e da varie edizioni ottocentesche di documenti lombardi e campani, necessarie a comprendere il fondamentale ruolo delle autorità pubbliche nella gestione del munizionamento. Di particolare importanza saranno poi gli appunti e le ricordanze di Bonaccorso Ghiberti e Maso di Bartolomeo, che metteranno in luce le attività, il sapere e le relazioni lavorative e sociali di due fra i principali fonditori del tempo. Non mancheranno, infine, i riferimenti alla trattatistica quattro e cinquecentesca, relativa sia alle manifatture metallurgiche sia alla quotidianità guerresca.

2. *Affermazione, diffusione e sviluppo delle bombarde grosse*

Dopo la pace di Lodi, nel 1454, la valenza strategica delle artiglierie era ormai comunemente accettata da principi e condottieri. Il veterano napoletano Diomede Carafa, ad esempio, lodava, nei suoi *Memoriali*, le artiglierie, che «sono quelle fanno honore».

Et quilli se delectano in epse artelglyarie sono prudente et haviranno honore. Et quello fa talvolta in una bocta una zarbactana, non che una bombarda, non li haveria bastato milglyara de homini. Cossi dico in uno facto d'arme, como in una battalglya campale o combacto de terra le artelglyarie sono quelle che fanno le fazune de simile cose (...). Sì che se nde volino havere assai, et havere de quilli boni le adoprano, et anco hagianò habundancia de cose, perché se possano essere bene adoperate¹⁶.

Negli stessi anni, il suo capitano generale, Alfonso d'Aragona, il temuto duca di Calabria, affermava perentoriamente che «quando uno capitano ha le bombarde in ordine, spesse volte fa de' molte cose con li spaventachi, che non l'avendo gli omini se ne fanno beffe». Se il condottiero milanese Gian Giacomo Trivulzio concordava nel dire che «uno campo senza

¹⁶ Carafa, *Memoriali*, p. 343.

artiglierie non vale cosa alcuna»¹⁷, i Dieci di Balìa, da Firenze, ricordavano ai loro commissari che «consiste, in epse bombarde, gran parte della victoria»¹⁸.

D'altronde, rispetto a qualche anno prima, le bombarde grosse avevano ormai definitivamente soppiantato i trabucchi e gli arieti della tradizione medievale, iniziando a rivestire un ruolo sempre più importante durante gli assedi. Durante le fasi preliminari delle operazioni, alle bocche da fuoco era demandato non solo l'abbattimento del morale dei difensori per il «frachasso, pericolo e grande danno»¹⁹, ma anche la distruzione delle fortificazioni nemiche, in vista dello scavo delle trincee e dell'assalto frontale.

Gli evidenti difetti delle bombarde, come le dimensioni ingombranti, la lentezza del puntamento, le difficoltà di trasporto e lo scarso rateo di tiro, non ne avrebbero ostacolato l'affermazione, né ne avrebbero diminuito la popolarità²⁰. Già nel 1452, il governo fiorentino mandava in campo, contro le forze aragonesi, nove bombarde, di cui una, la *Leonessa*, «grossissima»²¹. Per l'assedio di Volterra, Federico da Montefeltro, «ha voluto, oltre alle tre bombarde mandate di qui e le due eravi da Pisa, tutte le altre v'erano rimaste, e oggi si sono chariche e ite via»²². I piani per il dispiegamento dell'esercito milanese, nel 1472, prevedevano l'impiego in campo di almeno quattro bombarde grosse e di «due *Ferline* e due *Ruffianelle*», nonostante ciò comportasse una spesa di diverse migliaia di lire imperiali²³. Qualche anno dopo, le forze napoletane, papali e senesi espugnavano Colle Val d'Elsa grazie all'ausilio di sette bombarde, fra cui la *Indiavolata*, che «facieva gran fragella di case, le due e tre per volta»²⁴. Durante la riconquista di Otranto, l'ambasciatore fiorentino, Pietro Nasi, testimoniava che «l'artiglieria che tirava alla terra era cosa stupenda, pareva che fiocchasse»²⁵. Per gli attacchi contro Ficarolo, nel 1482, le truppe veneziane, comandate da Roberto da Sanseverino, avevano impiegato nove pezzi²⁶. Otto grosse furono utilizzate anche Sarzana, nel 1487, tutte

¹⁷ ASF, *Dieci di balìa, Responsive*, 33, cc. 493r e 545r.

¹⁸ ASF, *Dieci di balìa, Missive*, 20, c. 157r.

¹⁹ Settia, *Rapine, assedi, battaglie*, pp. 133-138; Storti, *Note e riflessioni sulle tecniche ossidionali*, pp. 243-244.

²⁰ Contamine, *La guerra nel Medioevo*, pp. 278-279; Mallett, *Signori e mercenari*, pp. 166-167.

²¹ Dei, *La cronica*, p. 64.

²² ASF, *Carte strozziane, Prima serie*, 113, c. 121v.

²³ Visconti, *L'ordine dell'esercito ducale sforzesco*, p. 469.

²⁴ Allegretti, *Diario senese*, p. 795; Fecini, *Cronaca senese*, p. 874.

²⁵ ASF, *Otto di pratica, Responsive*, 1, c. 276r.

²⁶ Mantovani, *L'assedio di Ficarolo*, p. 43.

«piantate in buono luogho, et da fare buono fructo», ché i nemici «non potranno resistere ad tante percosse»²⁷.

Stando a quanto riportato dagli ufficiali fiorentini, in Lunigiana le bombarde consumavano quasi cinquantamila libbre di propellente alla settimana²⁸. L'elevato consumo di polvere e la necessità di un ingente quantitativo di proiettili, così come il ricorso a un crescente numero di armi da fuoco, non avrebbero tardato ad avere effetti concreti anche sull'organizzazione delle truppe, costringendo gli stati territoriali a investire somme considerevoli non solo sul mantenimento di eserciti permanenti, ma anche sul loro equipaggiamento e sulla loro logistica. Uffici addetti alla fabbricazione delle armi erano sorti un po' ovunque nella Penisola, favorendo nuove opportunità di investimento a mercanti e oligarchi, e arricchendo maestri di polvere e falegnami, e lanciai, scalpellini e «targonai». Non era un caso che il duca Francesco Sforza nominasse un «officialis» e un «contrascriptor municionum» poco dopo il suo insediamento, che i primi «libri delle munizioni» fossero compilati a Firenze già al tempo del fallito assedio di Lucca, che la Camera del Comune di Siena avocasse a sé la funzione di acquisto dei vari armamenti, e che Alfonso il Magnanimo disponesse di vari capitani e maestri addetti al reperimento delle materie prime indispensabili alla fabbricazione e al funzionamento di spingarde e bombarde²⁹.

Con l'istituzione di simili cariche, gli stati italiani tentavano di imporre il proprio diritto esclusivo nella produzione e nell'uso delle artiglierie, sia nelle capitali sia nei centri secondari, riservandosi il compito di rifornire con diligenza e costanza le fortezze di frontiera, le varie città, gli arsenali principali e gli eserciti in marcia. Un simile monopolio era stato efficacemente ottenuto dalle principali realtà della Penisola, come Venezia e Firenze. A Milano, già nel 1393, Gian Galeazzo Visconti imponeva il divieto di far realizzare bombarde senza una sua specifica licenza³⁰. Eccezioni in tal senso erano rappresentate solo dall'ambigua situazione genovese e dai bellicosi feudatari papali, come gli Orsini, i Colonna, i Vitelli e i Montefeltro. Per quanto riguarda Napoli, è probabile che le riforme di Ferrante d'Aragona tendessero a creare anche un "demanio" delle artiglierie, all'interno di un più ampio progetto di disarmo della feudalità

²⁷ ASF, *Dieci di balia, Responsive*, 37, cc. 261r-262r; ASF, *Otto di pratica, Responsive*, 3, c. 241r.

²⁸ ASF, *Otto di pratica, Missive*, 7, c. 209rv.

²⁹ Archivio di Stato di Milano, *Registri ducali*, 150, cc. 68r-69r; ASF, *Dieci di balia, Munizioni*, 1, c. 1r; Minieri Riccio, *Alcuni fatti di Alfonso I d'Aragona*, pp. 14-16; Farinelli e Merlo, *La Camera del Comune*, pp. 205-206.

³⁰ Bargigia e Romanoni, *La diffusione delle armi*, p. 153.

ribelle³¹. In ogni caso, le armi da fuoco, per la loro valenza strategica, e a causa dei loro elevati costi, si avviavano in quegli anni a divenire una indispensabile *state-run, state-used and state-restricted technology*³², nonché un simbolo stesso dell'arte di governo³³. Ma, per potersene avvalere, lo stato avrebbe avuto bisogno della piena disponibilità di un significativo numero di pratici³⁴.

Accanto ai provveditori toscani, ai «superiori del carezzo e delle munition» milanesi e agli ufficiali napoletani, operavano infatti i maestri di bombarde veri e propri. Nella prima metà del Quattrocento, con la realizzazione di pezzi in ferro fucinato e cerchiato, i principali realizzatori di armi da fuoco erano stati i fabbri, con i loro «secreti ingenuosi» e il loro «esercizio da molto esaltare, perché, quando considero che li maestri di tal arte fanno li loro lavori senza forma, o disegno, ma col bastargli solo veder con l'occhio, o col giudicio, e che poi col batter li fanno giusti, e gareggiati, mi par gran cosa»³⁵.

Le necessità di una guerra endemica avrebbero però portato, in breve, a diverse rielaborazioni tecnologiche. La polvere «granita», ad esempio, si stava rivelando non solo più esplosiva rispetto alla «serpentina» trecentesca, ma anche più resistente all'umidità, caratteristica che la rendeva maggiormente durevole e facilmente conservabile³⁶. Allo stesso tempo, le maggiori capacità delle cariche determinavano modifiche delle forme delle armi, permettendo di ottenere diversi risultati balistici a seconda della lunghezza della canna e del calibro del proiettile³⁷. Attorno agli anni Trenta, numerosi artigiani avevano anche sperimentato la possibilità di costruire delle armi con bocche multiple, degli «organi» capaci di sparare contemporaneamente più proiettili³⁸.

Le macchine tradizionali si erano però rivelate estremamente fragili, di fronte alla potenza del propellente granulare. Le frequenti rotture e le difficoltà nella riparazione delle armi favorirono così l'adozione di bombarde in bronzo, il cui sviluppo era agevolato anche dalla riscoperta della scultura di grandi opere artistiche di metallo, portata avanti, proprio in quegli anni, da Andrea Pisano, da Lorenzo Ghiberti e da Donatello³⁹.

³¹ Storti, *L'esercito napoletano*, pp. 119-121.

³² Hale, *Guerra e società*, pp. 275-276; DeVries, *Gunpowder weaponry*, p. 129.

³³ Hale, *Gunpowder and the Renaissance*, pp. 407-410.

³⁴ Baraldi, *Una nuova età del ferro*, pp. 214 e 216.

³⁵ Biringuccio, *Pirrotechnia*, cc. 136v -138r.

³⁶ Ansani, *Craftsmen, artillery, and war production*, pp. 3-6; Panciera, *La polvere da sparo*, p. 307.

³⁷ Hall, *Weapons and warfare*, pp. 87-95.

³⁸ Quarenghi, *Tecno-cronografia*, pp. 112 e 117.

³⁹ Paoletti e Radke, *Art in Renaissance Italy*, pp. 31-32, 204-217 e 253-270.

Sebbene il rame e lo stagno fossero più dispendiosi rispetto al semplice ferro, la loro lega garantiva indubbi vantaggi. La maggiore resistenza alle detonazioni e alla corrosione, ad esempio, permetteva la costruzione di armi più sicure per i serventi e più costanti nell'impiego durante le operazioni di assedio. Anche il sistema a retrocarica delle bronzine era stato nettamente migliorato rispetto a quello delle vecchie bombarde, grazie all'adozione di un ingegnoso raccordo a vite tra il «cannone», ovverosia la camera di scoppio, e la «tromba», cioè la volata. Il nuovo sistema dava la possibilità di assemblare i due, o tre, o quattro pezzi della bombarda attraverso un sistema a incastro semplice e solido, evitando il ricorso a funi e cunei. L'avvitamento, inoltre, consentiva un rapido smontaggio, facilitando il trasporto delle diverse parti su carri «matti», progettati appositamente per lo spostamento di pesi elevati⁴⁰.

Su di un piano meramente economico, infine, le armi composite in bronzo garantivano un certo risparmio, grazie alla loro estrema durevolezza. Un componente usurato o danneggiato poteva infatti essere agevolmente rifuso, rimodellato, e rimesso in opera. Questo processo di «ispezatura» e di «rifacimento» poteva essere facilmente attuato da qualunque esperto, anche su pezzi realizzati da altri maestri. Non a caso le grosse prodotte agli inizi degli anni Cinquanta erano ancora in uso dopo decenni, come la *Neapolitana* aragonese, la *Vittoriosa* fiorentina e le *Ferline* milanesi, tutte sopravvissute ai loro stessi creatori⁴¹.

L'innovazione nasceva dunque come risoluzione di problemi strategici e pratici, e le pressanti richieste di ufficiali, politici e condottieri influenzavano indubbiamente le scelte e i metodi dei produttori di armi⁴². La domanda pubblica, lamentando difetti e suggerendo modifiche, non cessava di stimolare lo sviluppo, combinando il controllo sulle manifatture con il governo delle artiglierie⁴³. Ma per la definitiva affermazione delle nuove soluzioni tecniche si sarebbero seguiti diversi percorsi di adattamento⁴⁴. Alcuni artefici avevano tentato, ad esempio, di combinare una «tromba» in lamine di ferro con dei «cannoni» in bronzo. Ferrante d'Aragona aveva proposto la creazione di una bombarda grossa che «serà de tanti pezi che uno asino ne porterà uno pezo, per potere expugnare ogni forteza et terra posta in monte». Altre

⁴⁰ Bernardoni, *La fusione*, p. 109; Belhoste, *Nascita e sviluppo dell'artiglieria*, pp. 328-335; Ridella, *Produzione di artiglierie nel sedicesimo secolo*, pp. 81-82.

⁴¹ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 27, c. 222r; ASF, *Dieci di balia, Responsive*, 33, c. 598r; BNCF, *Baldovinetti* 70, c. 104v e 111v. Sul riciclo dei pezzi in bronzo, si veda Belhoste, *Nascita e sviluppo dell'artiglieria*, pp. 333-335.

⁴² Calegari, *Nel mondo dei pratici*, pp. 28-29; Edgerton, *Innovation, technology, or history*, p. 688; Long, *The craft*, p. 698; Rosenberg, *Economic development*, pp. 152, 158 e 165; Staudenmaier, *Rationality, agency, contingency*, pp. 173-174.

⁴³ Panciera, *Il governo delle artiglierie*; Tognetti, *Il governo delle manifatture*, pp. 310-330.

⁴⁴ Long, *The craft*, pp. 698-699; Rosenberg, *Economic development*, p. 152.

artiglierie erano state interamente fabbricate col «ferro colato», in un unico pezzo: tentativi tuttavia destinati a fallire, data l'estrema pesantezza e l'intrinseca debolezza della ghisa⁴⁵. Immutato restava però il gigantismo dei proiettili in pietra, che, a causa del loro basso peso specifico, rendevano indispensabile l'uso di massi di grosso diametro per ottenere sufficienti effetti distruttivi⁴⁶.

Sperimentazioni col bronzo erano comunque state fatte in tutta la Penisola fin dall'ultimo quarto del Trecento, con delle «bombardae aeneae» già presenti a Roma, a Ivrea, e a Mantova. Del rame era stato acquistato e immagazzinato anche a Como e a Pavia, e qualche fonditore era stato attivo a Perugia e a Genova nei decenni successivi⁴⁷. Nel Mezzogiorno, Alfonso d'Aragona e i suoi maestri catalani potevano disporre fin dagli anni Trenta di «tormenta aenea, quae multa, ac varia mirae magnitudinis habebat»⁴⁸.

Intorno alla metà del secolo, in ogni caso, la forgiatura sarebbe stata utilizzata esclusivamente per la manifattura di calibri minori, come passavolanti, spingarde e cerbottane. I fabbri, da parte loro, avrebbero continuato ad accumulare discrete fortune grazie alla vendita di armi da fuoco portatili, come scoppietti e archibugi⁴⁹. Ma le bombarde grosse dei principali stati italiani non sarebbero comunque più state «de ferro, alla antiqua»⁵⁰. Il rame e lo stagno le avrebbero rese migliori, secondo l'umanista ligure Bartolomeo Facio, consigliere del Magnanimo e storiografo ufficiale della corte partenopea.

Di queste artiglierie, alcune se ne fanno di bronzo, alcun'altre di ferro, ma le prime sono migliori, e più nobili. Fannosi con due bocche, o due canne (...), l'una delle quali, cioè quella di fuori, è più larga, e sono quasi uguali in lunghezza. Gettansi le più volte insieme, e talhor separatamente. Ma quelle che separatamente si gettano, si commettono poi insieme, e le sottili si pongono nelle grosse, e si congiungono insieme strettissimamente, perché non rifiatino in alcun luogo. Si acconciano dipoi sopra un tronco di quercia cavato, che chiamano il ceppo, acciocché la palla ne vada più alta, e più lontana. E questa è la forma, e l'uso di questa machina. La forza poi, con la quale è mandata la palla di pietra con tanto impeto fuori, nasce dalla polve, che si fa di salnitro, di zolfo, e di carbone di salcio (...). Questa polve si mette

⁴⁵ ASF, *Dieci di balìa, Munizioni*, 1, cc. XVIIIr, XLVIIIr e Lv; Belhoste, *Nascita e sviluppo dell'artiglieria*, pp. 333-334; Ermini, *Campane e cannoni*, p. 394; Hall, *Weapons and warfare*, p. 93; Ridella, *L'evoluzione strutturale nelle artiglierie di bronzo*, pp. 15-16; Storti, *Note e riflessioni sulle tecniche ossidionali*, p. 252.

⁴⁶ Ridella, *Produzione di artiglierie nel sedicesimo secolo*, p. 82.

⁴⁷ Quarenghi, *Tecno-cronografia*, pp. 90, 107-108, 115, 121 e 127.

⁴⁸ Minieri Riccio, *Alcuni fatti di Alfonso I d'Aragona*, pp. 12-14.

⁴⁹ Ansani, *Geografie della guerra*, pp. 102-103.

⁵⁰ Ermini, *Campane e cannoni*, p. 393.

nella più stretta canna, e calcasi dentro con uno cagno di ferro fatto a questo fine. E poi vi s'aggiunge una palla di pietra, ridotta con ugual misura della canna più grande. Finalmente si dà fuoco per un picciolo pertugio, ch'è nella canna men grande, lavorato sottilmente. Et a questa guisa, combattendo egli con molto impeto dentro, procacciando d'uscire, getta la palla da lontano, a guisa di fulmine. Né fin qui s'è trovato machina che tiri con maggior violenza, né più discosto, i sassi, di quello che fa l'artiglieria. E con questa si fendono le forti muraglie, le gagliardissime torri si gettano a terra, e ne vanno le palle più di due miglia discosto. Ma l'artiglieria del re Alfonso, chiamata la *Generale*, le mena più lontano di qualunque altra⁵¹.

Il procedimento tecnico della fusione delle bombarde di bronzo era però tutt'altro che codificato⁵². Ogni maestro seguiva il proprio modo di fare, influenzato da precedenti esperienze ed esperimenti, nonché dal confronto con altri maestri, come significativamente riportato negli appunti del fonditore fiorentino Bonaccorso Ghiberti.

La tromba de le bombarde vole essere lungha senza el chanone sette palottole e mezza. Altri dichono otto, et è meglio. E la grosseza del bronzo vole essere il sesto del mezo diametro de la palottola. El vano del chanone vole essere uno pocho più che la metà del vano de la tromba. La grosseza del bronzo del chanone vole essere la metà del voto. Vole avere grosso el fondo un terzo⁵³.

Procedimenti e proporzioni potevano così variare in ogni singola località, anche a poche miglia di distanza. Le norme suggerite da Francesco di Giorgio Martini, ad esempio, differiscono, in tutto o in parte, dai canoni del suo corregionale.

Sia la gola della ovvero coda della bombarda lunga due diametri della pietra, e la vita che congiunge la gola con la tromba sia la metà del diametro, e la tromba sia cinque in sette diametri. E, posposta la comodità del trattare e maneggiare la bombarda, per la quale si fa di due o di più parti, quanto la tromba più lunga, e l'istrumento di manco parti fusse, di tanto maggiore efficacia saria⁵⁴.

Ulteriori regole, teoriche e pratiche, venivano poi stabilite dall'ingegnere senese per la progettazione delle artiglierie in funzione del calibro.

⁵¹ Facio, *Fatti d'Alfonso d'Aragona*, pp. 222-223.

⁵² Bernardoni, *La fusione*, pp. 112-113; Guilmartin, *Gunpowder and galleys*, pp. 305-312; La Salvia, *Organizzazione della produzione*, p. 116.

⁵³ BNCF, *Banco rari* 228, 82v.

⁵⁴ Martini, *Trattato di architettura*, p. 246.

È da sapere che a tutte si ricerca tre condizioni, senza le quali non può essere perfetto l'istrumento. La prima, che la tromba sia per tutto di eguale vacuità, sicché i circoli del vacuo suo per tutto siano eguali, e le linee tratte dal primo all'ultimo fine siano dirette parallele, ovvero equidistanti, toccando per tutto i circoli intermedi, perocché, quando fussero i circoli della estremità maggiori degli altri, la palla, quando da una parte, quando dall'altra, declinerai. La seconda condizione è che il foro d'onde entra il fuoco sia piccolo e sopra l'ultima estremità del vacuo della gola, acciò in dietro non rimanga alcuna vacuità. La terza e ultima, che il vacuo della gola ovvero coda sia sempre più angusto uniformemente verso il foro del fuoco e parte posteriore dell'istrumento, il modo che il diametro dell'ultimo circolo del vacuo della gola sia la quinta parte minore del primo⁵⁵.

La differenziazione della lunghezza e del diametro, l'utilizzo di due diversi metalli, le dimensioni variabili delle pallottole, si riflettevano non solo nella diversità dei pezzi, ma anche nella varietà dei loro utilizzi. I più piccoli servivano, ad esempio per la difesa di terre murate, per la protezione degli accampamenti, o per il supporto delle grosse durante le manovre di puntamento. Gli attaccanti dispiegavano, inoltre, anche bombarde e mortai, ché «in piccolo tempo ogni fortezza di muro, ogni grossa torre si ruina e getta per terra». Fra gli anni Settanta e Ottanta, sempre il Martini, nel suo *Trattato*, elencava tutte le tipologie di armi da fuoco, e i «modi di procedere a varie offese».

In prima la bombarda di lunghezza comunemente di piedi quindici in venti. La pietra sua di pondo di libbre trecento in circa. La seconda è chiamala mortaro, diritto o campanuto, lungo piedi cinque in sei, il quale non debba essere di più parti. La pietra sua di pondo di libbre ducento in trecento. La terza è nominata comune ovvero mezzana, lunga piedi dieci. La pietra di libbre cinquanta in circa. La quarta è appellata cortana, lunga la tromba sua piedi otto e la coda piedi quattro. La pietra sua di libbre settanta in cento. La quinta è detta passavolante, lunga piedi diciotto in circa. La pietra sua si è plumbea, con un quadro di ferro in mezzo, di libbre sedici in circa. La sesta è chiamata basalisco, lunga piedi ventidue in venticinque. La pietra sua, di qualunque metallo, di libbre venti in circa. La settima è chiamata cerbottana, lunga piedi otto in dieci. La pietra, di piombo, libbre due in tre. L'ottava è nominata spingarda, lunga piedi otto. La palla, di pietra, di libbre dieci in quindici⁵⁶.

⁵⁵ *Ibidem*, p. 247.

⁵⁶ Martini, *Trattato di architettura*, pp. 245-246.

Simili classificazioni tendevano verso una razionalizzazione dei pezzi e, presumibilmente, riflettevano anche le richieste della committenza in tal senso⁵⁷. Proprio in quegli anni, il condottiero Orso Orsini, nei suoi scritti sul *Governo et exercitio della militia*, aveva proposto una normalizzazione delle artiglierie di piccolo calibro, come le cerbottane, per migliorare e ottimizzare le prestazioni degli addetti ai pezzi.

Siano tucte d'una misura, d'uno peso, et che vogliano tucte la ballocta ad un modo, et ogniuna tanta polvere, acciò che l'uno zarbactaneri possa subvenire l'altro et che omne uno le sappia operare tucte⁵⁸.

Anche a Venezia, nel 1487, i «patroni all'arsenal» Luca Pisani, Francesco Foscarini, Piero Soranzo, Girolamo Duodo e Pietro Lion avevano cercato di regolamentare le misure delle bombarde e il peso della palla, perlomeno nelle fucine del bresciano.

Con volontà dela illustrissima Signoria, hano concluso et fato margado con maistro Venturin, maistro Piero, Tonin et Mignol de Valtropia maistri de far bombarde, con sit che loro se proferiscano a far dite bombarde con i modi subscripti.

Che tute le bombarde che loro farà secondo le sue forse siano de uno pezo de piera e portada de polvere, et peso, et longeza de tromba egualmente, et siano de bono et optimo fero, ben boiide et salde, secondo l'uso de boni maistri (...). Che tutti i canoni, secondo sue sorte, siano fatti non mazori né minori uno de l'altro, ma tuti se servano et possino adaptar in ogni tromba, juxta la sorta. Che tute bombarde siano bolade de tre punte de ponzon nela cana dentro, sì davante come da driedo (...), et questo sia el segno dela illustrissima Signoria. Et cussì etiam ogni maestro che farà dite bombarde dieba metter el suo segno super li contraforti, sì suso le trombe come suso i canoni, et questo azoché se cognosa quello maistro haverà fatto la bombarda, per potter laudar over biazemar. Che tute bombarde che loro farà debino darle conducte a Breza, et lì siano per sua chiarezza pesade, et se loro vorano farle provar quali siano in sua libertà. Ma, dapoi conducte de qui all'arsenal, siano repesade un'altra volta, et cussì provate, al qual peso et prova loro debino star suzeti. Dichiarando che 'l peso se intenda al peso de Bressa, el qual, dapoi veduto dal peso venitian a quello de Breza, per quello siano pagati a soldi ventotto il peso. E il suo pagamento li sia fato de tempo in tempo, come li anderà consegnando, dandoli de presente (...) ducati cento, il qual se dié partir fra loro maistri, zoé ducati venticinque per uno de sovenzion, la quale se dié scontar come parerà a essi magnifici priori et patroni nele sue manifature⁵⁹.

⁵⁷ Bernardoni, *La fusione*, p. 115.

⁵⁸ Bibliothèque Nationale de France, *Département des manuscrits*, Italien 958, c. 18r.

⁵⁹ Quarenghi, *Tecno-cronografia*, pp. 171-172.

Tuttavia standardizzazioni definitive delle armi erano ancora di là da venire. Nello stesso documento, alle sole spingarde vengono assegnati tre calibri, da cinque, tre e una libbra, e tre lunghezze della canna, fra i sei e i quattro piedi, nonché tre diversi pesi, cioè seicento, quattrocentocinquanta e centosettanta libbre. Anche a Firenze le bombarde potevano avere i calibri più disparati, dalle trecento libbre in su, e i basilischi non erano esattamente pezzi minuti, come quelli martiniani, potendo pesare più di sedicimila libbre, distribuite su ben undici braccia⁶⁰.

Tra monopolio e openess. Le politiques techniques degli stati italiani in ambito militare

Più che la trattatistica, a propagare la diffusione delle nuove artiglierie erano stati proprio i fonditori, attraverso il loro lavoro, la loro flessibilità nell'apprendimento, il loro bagaglio culturale, le loro diverse esperienze e specifiche competenze⁶¹. Come in altri settori produttivi, la migrazione di manodopera specializzata era infatti essenziale alla disseminazione delle innovazioni, allo scambio dei prodotti e alla trasmissione del sapere tecnico, nonché alla mediazione fra le più recenti tecnologie e i più disparati interessi politici, economici e militari dei capitani e dei signori italiani⁶².

I metodi legati alla fabbricazione delle grosse di bronzo iniziavano rapidamente a circolare nelle corti e negli arsenali di tutta la Penisola, veicolati dai loro stessi creatori, maestri del «ridurre» i metalli «alle lor ultime perfettioni», dotati di «molto buono ingegno e gran iudicio». Il fonditore Vannoccio Biringuccio, autore del celebre trattato sulla *Pirotechnia*, descriveva la sua arte come faticosa «sì d'animo che di corpo», soggetta «più alla fortuna che all'ingegno», ma, «per contenere in sé certa espettatione di novità, prodotta da grandezza d'arte, aspettata con desiderio, le fa supportare con piacere», tanto più «quando l'artefice vede che per fino a gli huomini ignoranti è arte grata et dilettevole». Il fonditore senese non mancava di sottolineare quanto, per i fonditori, fosse «importantissima cosa d'essere buon disegnatore, et che quanto più può habbi l'arte della scoltura», e «bisognali poi sapere ben lavorar di legname et di ferro, et non esser ignorante di saper lavorare al torno». Inoltre,

⁶⁰ Ansani, *Craftsmen, artillery, and war production*, p. 9.

⁶¹ Ridella, *Fonditori italiani di artiglierie*, p. 19; Rosenberg, *Economic development*, pp. 154-157.

⁶² Calegari, *Nel mondo dei pratici*, pp. 22-25; Degrassi, *La trasmissione dei saperi*, pp. 65-69; Hilaire-Perez e Verna, *Dissemination of technical knowledge*, pp. 537-541; Long, *The craft*, p. 708; Molà, *States and crafts*, p. 133.

«ricercasegli ancora il sapere murare per far forni et canali al suo proposito». Ancora più importanti, veri e propri rudimenti del mestiere, erano «tre attioni principali, che è l'una il far ben le forme et ben disporle, l'altra il ben fondere et liquefar le materie de' metalli, la terza è in far le composition delle compagnie loro, secondo gli effetti che volete fare, alle quali cose è di bisogno usare ogni possibile advertentia, perché l'una senza l'altra non perfettamente fatta sarebbe, che tutte le vostre fadighe si convertirebbero in nulla». All'invito alla perfezione seguiva però un ammonimento, perché, se «con tanti colpi et tante advertentie è bisogno di schermire con lei, per defendere l'utile et l'honore tuo», allora «a me pare un'arte da fuggire più che si può»⁶³.

Al di là del modellare le forme di argilla e del padroneggiare il processo di fusione a cera persa, altri «gran secreti» riguardavano direttamente la produzione delle artiglierie, come la correlazione tra lo spessore della camera di scoppio e la carica di propellente, il collegamento tra la lunghezza della volata e la gittata del pezzo, il rapporto tra le dimensioni della canna e quelle del proiettile, l'alesatura dell'anima, i sistemi d'incastro tra la «tromba» e il «cannone», e le decorazioni della culatta⁶⁴. Ovviamente, «son li modi molti, tanto per causa dell'opere, come anco per l'ingegno et pratica o parere de' maestri, de' quali a un piace un cammino et a un altro un altro»⁶⁵. Intorno agli anni Cinquanta, a parecchi fonditori veniva poi richiesto di mettere in opera le loro grosse durante gli assedi, occupandosi del posizionamento e del tiro delle stesse. Anche in qualità di ingegneri e di bombardieri, gli artefici meritavano le lodi di cronisti, oratori e sovrani, tanto per la precisione nel tiro, quanto per la cura dei pezzi⁶⁶.

Eppure, quasi nessuno di loro aveva iniziato la propria carriera come fabbricante di armi, o come soldato. Nel periodo dell'apprendistato, le procedure di base delle varie arti del fuoco potevano essere assimilate in numerose botteghe, copiando fedelmente i manufatti dei maestri, collaborando attivamente all'esecuzione delle loro opere, o realizzando autonomamente alcuni modelli. Molti artigiani erano stati garzoni di scultori, di campanai, di orafi, e persino di padellai e di calderai, prima di diventare dei maestri di bombarde a tutti gli effetti⁶⁷. Nel corso degli anni, una formazione così diversificata avrebbe aiutato gli apprendisti

⁶³ Biringuccio, *Pirotechnia*, cc. 74v-76v e 100v. Un riassunto delle osservazioni del maestro toscano è in Garzoni, *La piazza universale*, cc. 248r-249r.

⁶⁴ Bernardoni, *La fusione*, pp. 112-114.

⁶⁵ Biringuccio, *Pirotechnia*, c. 83r.

⁶⁶ Simonetta, *Historie*, c. 329r; Storti, *Note e riflessioni sulle tecniche ossidionali*, pp. 253-254.

⁶⁷ Belhoste, *Nascita e sviluppo dell'artiglieria*, p. 331; Ermini, *Campane e cannoni*, pp. 388 e 390; La Salvia, *Organizzazione della produzione*, 112-121; Wackernagel, *Il mondo degli artisti*, pp. 369-370 e 380-386.

a dominare le difficoltà delle tecniche di fusione, rendendoli pronti ad un «magisterio di gran fatica, pericolo et travaglio, sì del corpo etiandio della mente», simili «a uno spazza camino tento di carboni et dispiacevoli et fuliginosi fumi, con veste polverose et dal fuoco mezze bruciate, et anco di molle fangosa terra le mani et il viso tutto imbrattato».

Così, maturati nei grandi e nei piccoli centri di tutto il continente, attratti dalla curiosità e dal desiderio di prestigio, i fonditori quattrocenteschi sarebbero stati costantemente in cerca di esperienze professionali⁶⁸. Alcuni artigiani sceglievano di presentarsi ai loro futuri datori di lavoro vantando le più disparate competenze. Nel 1482, Leonardo da Vinci offriva a Ludovico il Moro i suoi «modi de bombarde comodissime e facili a portare», e, «occurrento di bisogno, farò bombarde, mortari e passavolanti di bellissime e utili forme, fora del comune uso»⁶⁹. Sul finire del secolo, Bernardo da Novara prometteva agli ufficiali fiorentini di «essere maestro di getti molto sufficiente et etiam di essere bombardiere perfecto». Allo stesso modo, «Cristofano di Arrigo dal Faxy della Magna Alta et Giovanni di Lupo da Binrine dello Reno bombardieri», definiti come «due homini singolari nel loro exercitio», affermavano di «sapere et di getto et di trarre et di fare fuochi lavorati quanto se ne possa sapere per alchun altro, et che sono contenti sperimentarsi et stare uno mese gratis per mostrare le virtù loro»⁷⁰.

Anche l'ingegnere Barone d'Angelo, nella sua esuberante lettera di presentazione ai Dieci di Balìa di Firenze, lodava, fra i membri della sua squadra, «el primo maestro d'Itaglia di far chanoni, falchonetti e girifalchi e cholonbrine, in gitalle e in armarle», che «è l'ochio e 'l quore mio», e che è identificabile, probabilmente, con il genovese Antonio Gioardi, al tempo attivo presso le fonderie partenopee⁷¹.

Non ci sarebbe stato comunque troppo bisogno di presentazioni o di favoritismi. Gli stati italiani, al contrario, incoraggiavano i trasferimenti dei maestri di getto, contattando i vari artefici attraverso ambasciatori, mercanti e ufficiali, e ampliando e stabilizzando i circuiti dei pratici. In generale, simili *politiques techniques* per attrarre artigiani forestieri e regolamentare l'apertura di nuove manifatture erano state attivate fin dai primi decenni del Quattrocento,

⁶⁸ Calegari, *Nel mondo dei 'pratici'*, pp. 18-19; Epstein, *Labour mobility*, p. 251; Schulz, *La migrazione di tecnici, artigiani e artisti*, pp. 89-94.

⁶⁹ Gille, *Leonardo e gli ingegneri*, pp. 152-154.

⁷⁰ ASF, *Dieci di balia, Missive*, 59, cc. 9r e 122v.

⁷¹ ASF, *Dieci di balia, Responsive*, 57, cc. 259r-260v. La missiva è pubblicata integralmente in Ansani, *Geografie della guerra*, pp. 111-113. Per gli incarichi del Gioardi durante il regno di Federico d'Aragona, si veda Volpicella, *Le artiglierie di Castel Nuovo*, p. 347.

talvolta affidate ad istituzioni specificatamente votate alla ricerca di tecnologie innovative e di migliori opportunità commerciali⁷².

Leggi «pro arte introducenda», soprattutto nel settore tessile, erano state varate un po' dappertutto, e con ottimi risultati, grazie alla lungimiranza delle autorità, le uniche capaci di garantire e di gestire in maniera adeguata i privilegi e le concessioni riservate ai maestri stranieri, così come le corti, che allo stesso tempo, promuovano processi di invenzione, specializzazione e perfezionamento⁷³. La capacità di impiantare nuovi opifici e la possibilità di disporre di un sufficiente numero di fonditori, tuttavia, non costituivano soltanto un problema economico, o un'occasione produttiva. Il possesso delle artiglierie rappresentava anche una questione di prestigio e di magnificenza, di autosufficienza e di reputazione nelle operazioni militari, di difesa dai nemici esterni e interni. L'acquisizione di nuove tecnologie belliche era indubbiamente una priorità dell'azione di governo, tanto quanto l'organizzazione degli eserciti⁷⁴.

Per allettare i pratici forestieri, principi e repubbliche assicuravano loro la fornitura gratuita di materie prime, sia di prima che di seconda mano. Considerata la bassa produttività dei giacimenti della Penisola, pur di garantirsi sufficienti quantità di minerale, i governi erano spesso costretti a rivolgersi ai mercati e agli esperti dell'Europa settentrionale⁷⁵. Alcuni stati avevano anche tentato di sottrarsi all'egemonia dei maestri tedeschi introducendo apposite legislazioni minerarie, agevolando l'apertura di cave private nei loro territori, e tutelando la crescita dei distretti già presenti⁷⁶. Tuttavia, almeno nel corso del Quattrocento la fabbricazione delle bombarde avrebbe inciso relativamente poco sulla richiesta di rame e di stagno, dal momento che il bronzo poteva essere recuperato attraverso la rifusione degli «strumenti rotti». Inoltre, la produzione di armi di grosso calibro era piuttosto discontinua, tale da rendere necessario l'accumulo di una discreta riserva di materie prime, ma non un loro incessante acquisto⁷⁷.

⁷² Franceschi, *Istituzioni e attività economica*, pp. 114-116; Hilaire-Perez e Verna, *Dissemination of technical knowledge*, pp. 548-550; Molà, *States and crafts*, pp. 134-137.

⁷³ Guerzoni, *Novità, innovazione e imitazione*, pp. 67-72.

⁷⁴ Molà, *States and crafts*, p. 146.

⁷⁵ Vergani, *L'attività mineraria e metallurgica*, pp. 221-223.

⁷⁶ Pampaloni, *La miniera del rame*, pp. 3-33; Braunstein, *Le entreprises minières*, pp. 560-569; Calegari, *La mano sul cannone*, pp. 63-67.

⁷⁷ Ansani, *Craftsmen, artillery, and war production*, p. 14.

Alfonso il Magnanimo consegnava puntualmente quintali di bronzo ai suoi maestri di getto⁷⁸. Nel 1459, a Siena, Agostino da Piacenza era creditore, nei confronti del Comune, di più di tredicimila libbre di metallo, utilizzato per la fusione della *Balzana*⁷⁹. Qualche decennio dopo, i camerlenghi fiorentini annotavano l'acquisto di «bronzi, ottoni et stangnio», comprati da calderai, mercanti, banchieri, merciai e ferravecchi, tutti consegnati ad Andrea del Verrocchio «per fare la bombardata grossa»⁸⁰. Sul finire del secolo, sempre a Firenze, i Dieci di Balìa rendicontavano il «rame e stagno hanno auto da noi e quanti vasi hanno gitato» il maestro Francesco Telli ed i suoi aiutanti. Un altro consuntivo riguardava, invece, Lorenzo di Giovanni, detto *Cavaloro*.

Monta in tutto quanto ebbe da noi balle centosettantotto di rame, netto libbre trentamila e cinquecentoundici (...).

Monta lo stagno auto chome di sopra libbre tremilacinquecento e settantatre.

A di ventidue di luglio 1495 (...) abbiamo auto dal sopraschritto una pasavolante, pesò netta libbre cinquemila e centoventi.

A di sette d'ottobre (...) una pasavolante, pesò netta libbre cinquemila e ottocento.

A di trentuno detto (...) un chortale, pesò netto libbre semila e quattrocento.

In tutto, montano e' sopraschitti getti, chome si vede, libbre diciassettemila e trecento venti.

Che monta in tutto, a fiorini dieci di larghi di grossi el migliaio, fiorini centosettantatre e soldi otto larghi di grossi⁸¹.

Alle consegne di materiale veniva solitamente aggiunto lo sconto del calo di lavorazione del bronzo, ovvero la fisiologica perdita di parte del metallo durante e dopo la fusione. A carico del maestro erano invece la cera e il combustibile della fornace, carboni e «legna, stagionate e secche, perché in queste consiste il vigor del fuoco et la forza del tutto»⁸².

Nell'ambito delle trattative tra artefici e ufficiali, ancora più importante era la concessione gratuita di un'officina pubblica, spesso emblematicamente collocata accanto ai centri del potere. Il castello estense, ad esempio, ospitava la fonderia dei duchi ferraresi. Alcuni spazi sottostanti la torre del Mangia erano adibiti alla lavorazione delle bombarde

⁷⁸ Minieri Riccio, *Alcuni fatti di Alfonso I d'Aragona*, pp. 253, 424 e 429.

⁷⁹ Ermini, *Campane e cannoni*, p. 396.

⁸⁰ ASF, *Dieci di balìa, Entrata e uscita*, 8, cc. 130r e 161v.

⁸¹ *Ibidem*, 13, cc. 190v-191r e 197rv.

⁸² Biringuccio, *Pirotechnia*, c. 93r. Sul finire del secolo, il valore di una catasta di «legne d'ontano per fondere», a Firenze, si aggirava intorno alle cinquanta lire: Archivio Storico dell'Istituto degli Innocenti di Firenze, 13230, c. 16v.

senesi. In laguna, la Serenissima offriva ai suoi maestri non solo gli spazi del suo arsenale, ma anche un'abitazione per le loro famiglie. In quel di Napoli, invece, le botteghe erano poste nelle sale del Castel Nuovo, sulle banchine del porto, e persino in alcune abitazioni fuori dalle mura, «ubi fiebant bombardae curiae». Nell'inventario compilato nel 1501 da Luise Setaro, governatore della regia artiglieria napoletana, venivano descritti diversi strumenti delle officine dei fonditori del castello, come una «verga de ferro soctile da annectare la terra da dentro la artegliaria», «cerchie» e «bande de ferro per forme» di diverse misure, dei mantici, parecchie tavole di olmo per gli affusti, e numerosi altri strumenti per la fornace⁸³. Pochi anni prima, nei depositi della fortezza aragonese, erano immagazzinate anche cinquantanove tonnellate di rame⁸⁴.

Impianti di proprietà dei singoli maestri erano invece presenti a Firenze, dove «il fornello del comune» era stato inaugurato solamente agli inizi degli anni Ottanta, nel pieno centro della città, durante le fasi più intense della guerra in Lunigiana⁸⁵. Fra gli strumenti forniti al maestro di getto per l'opificio della *Sapienza*, un nota del 1496 elencava un «fornello armato di ferro chon due bocche», due «finestre di ferro della fornace», una «forchetta di ferro da chavare le finestre», due «rastrelli di ferro da nettare la fornace», due «mandriani di ferro da chavare rame», due «vaghi di ferro da buttare terra», tre «treppiedi di ferro da fucina», nove «fusi di legno da fare l'anima degli stromenti», venti «cerchi grossi e sottili di ferro per le forme», un «chanapo chon due taglie e charuchola di bronzo da trar fuori», un «ferro da nettare drento» le canne, e tenaglie, scale, beccastrini, verghe, paranchi e argani⁸⁶.

Dato il monopolio statale nella fabbricazione dei pezzi, agli artefici non veniva conferita alcuna privativa contro la concorrenza di altri fonditori. I magistrati, anzi, avrebbero sempre arruolato un maggior numero di maestri, stranieri e non, assicurandosi un rifornimento continuo di artiglierie, sia in tempo di pace, sia in caso di impellente necessità⁸⁷. Tra i benefici per i maestri di getto poteva però rientrare la concessione della cittadinanza, come avvenuto talvolta a Napoli, e non solo. A Vercelli, Giovanni della Mola da Casale e Antonino di Cozola sarebbero diventati parte integrante della comunità se avessero consegnato al comune tre

⁸³ Volpicella, *Le artiglierie di Castel Nuovo*, pp. 333-337.

⁸⁴ Quarenghi, *Tecno-cronografia*, p. 178.

⁸⁵ Ansani, *Geografie della guerra*, pp. 92-94. Per la storia del complesso della *Sapienza*, si veda Ferretti, *La Sapienza di Niccolò da Uzzano*.

⁸⁶ ASF, *Dieci di balia, Munizioni*, 7, cc. 129v-130r.

⁸⁷ Sulla concessione di monopoli, si veda Molà, *Inventors, patents, and the market for innovations*, pp. 7-10; Belfanti, *Guilds, patents*, p. 571.

cerbottane entro due mesi⁸⁸. In Sicilia, i maestri della famiglia Arena, nel 1488, venivano riconosciuti come cittadini di Palermo, dopo il loro trasferimento da Catania⁸⁹.

Non mancavano, infine, un salario mensile o una paga a cottimo, quest'ultima genericamente calcolata sulla quantità di metallo fusa. A Venezia il compenso era annuale, e ammontava a diverse decine di ducati, quando non centinaia⁹⁰. I maestri senesi potevano anche essere remunerati con beni immobiliari incamerati dalla Repubblica⁹¹. Il Magnanimo era in grado di promettere addirittura venticinque ducati per ogni mille libbre di materia lavorata⁹². Per tutta la seconda metà del secolo, i Dieci di Balìa offrivano una paga compresa fra le sessanta e le settantacinque lire per lo stesso peso, ad indicare probabilmente una certa, consolidata prassi italiana in merito⁹³.

Una condotta del 1493, conclusa sempre a Firenze tra il Comune e «magister Johannes de Uspurch teuthonicus», stabiliva il prezzo e la tipologia delle artiglierie, la percentuale del calo dei getti, le spese a carico dell'artigiano e gli obblighi della Signoria, «come si costuma di fare in simili cose».

In prima che il decto maestro Giovanni debba fare et gittare tucte le infrascripte artiglierie qui ad apresso notate et scripte per prezo et pregio di lire settanta piccioli et di quattrini neri il migliaio, a sua spese delle cose che vi si haranno adoperare chome si costuma di fare in simili cose et getti, havendo però la materia del getto dagli Octo decti. Et con pacto che il chalo di decti getti non possa passare libbre sette per cento, et per infino a tanta somma di calo gli sia admissa et facta buona. Passando più l'habbi ad fare il decto maestro Giovanni buono di suo a decti Octo.

I decti getti che egli è obligato fare ad ogni requisitione di decti Octo agli infrascripti pregi sono questi, cioè: bombarde grosse intere di uno pezo o di dua o di tre chome a decti Octo paressi, di getto di libbre quatrocento di pietra o più; meze bombarde di getto da libbre ducento in su, di uno o più pezi; quarte bombarde da libbre cento in su di getto, di uno o più pezi; octave bombarde da libbre quaranta in su di getto, di uno o più pezi; bombarde da ripari da quindici in venticinque libbre di getto, di uno pezo o più; passavolanti, cortaldi o basilischi di uno pezo o di dua o più chome vorranno i decti Octo, di getto da libbre cento di piombo o di ferro in su; mezi passavolanti, cortaldi et basilischi di getto di piombo o ferro da libbre cinquanta a cento; quarti passavolanti di getto chome di sopra da libbre

⁸⁸ Quarenghi, *Tecno-cronografia*, pp. 131-132.

⁸⁹ Palazzolo, *Cannoni e fonditori in Sicilia*, p. 68.

⁹⁰ Panciera, *Il governo delle artiglierie*, pp. 163-164.

⁹¹ Ermini, *Campane e cannoni*, p. 394.

⁹² Minieri Riccio, *Alcuni fatti di Alfonso I d'Aragona*, p. 444.

⁹³ BNCF, *Baldovinetti 70, 92v e 111v*; ASF, *Dieci di balia, Munizioni, 7*, cc. 244r, 246r e 265r.

venticinque in cinquanta; item serpentine sino da cinque a venticinque libbre di getto in circa; item spingharde da libbre cinque in sei di getto. Le quali tucte cose il decto maestro Giovanni si obliha et promette a decti Octo di fare bene et lealmente a uso di buono et leale maestro⁹⁴.

Allo stesso modo, nel 1472, i Nove della Custodia della Repubblica di Siena commissionavano al loro maestro Giovanni da Zagabria la realizzazione di una bombarda di bronzo, da modellarsi su una forma preesistente, concedendogli la fornitura dei metalli e l'usufrutto della fonderia comunale.

Supradicti officiales decreverunt quod magister Johannes de Sclavonia, magister bombardarum, colet trombam super forma facta olim per magistrum Augustinum (...), et similiter cannonem. Et si aliqua ex dictis formis non esset bona, illam reficiat suis sumptibus, et dictam bombardam cum cannone suis sumptibus det ad perfectionem, et factam consegnet (...). Habeat a Comuni Senarum ramen et stagnum opportunum, et locum subtus voltas planas sale consiliorum ubi fuerunt facte alie. Et pro suo labore et mercede, seu salario, libre novem pro singulo centonario (...). Item pro calo in conflatura deficiendo, admittatur decem pro centonario⁹⁵.

Sempre connessa alla produzione di artiglierie era la licenza concessa dagli Anziani di Lucca a Paolo Nicolini per l'apertura di un «edificio da trapanare spingarde, a aqua, in quel comune di San Quirico a Petroio, piviere di Sergromignio, in sul terreno suo», nel 1470⁹⁶.

Negli stessi anni, contratti simili venivano siglati anche con altri fabbricanti di munizioni, quali maestri di polvere e lavoratori del ferro, cui venivano ugualmente concessi laboratori pubblici, retribuzioni mensili, minerali e metalli, e, talvolta, anticipi e aiuti finanziari per avviare le attività⁹⁷. Significativo sarebbe stato, in tal senso, il tentativo dell'azienda Marinai e del banco Medici di «chondurre l'arte dell'arme et altri exercizi di Milano» in quel in Pisa⁹⁸. Ma, negli stessi anni, simili sforzi per attirare i rinomati corazzai lombardi erano stati compiuti anche a Napoli e a Ferrara⁹⁹. Nel 1464, i patti conclusi fra il maestro Ottolino e gli emissari di Borso d'Este prevedevano un premio di cento fiorini d'oro per «conducere se cum familia sua

⁹⁴ ASF, *Otto di Pratica, Deliberazioni, partiti, condotte e stanziamenti*, 5, cc. 96v-97r.

⁹⁵ Angelucci, *Documenti inediti*, pp. 556-557. Patti fra municipalità e artefici pare fossero in uso anche Oltralpe, come riportato da Contamine, *La guerra nel Medioevo*, p. 205.

⁹⁶ Quarenghi, *Tecno-cronografia*, pp. 146-147.

⁹⁷ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 46, cc. 12v-13r e 52v; 47, cc. 60r e 61r.

⁹⁸ ASF, *Carte Riccardi*, 816, i. 98.

⁹⁹ Bianchessi, *Cavalli, armi e salnitro*, pp. 560-572; Motta, *Armaioli milanesi*, pp. 201 e 219; Venturi, *Relazioni artistiche*, pp. 230-237.

usque ad duos menses proximos futuros ad habitandum in civitate Ferrarie», e qui, con tre aiutanti, lavorare «continue et toto ejus vite tempore de arte et magisterio armorum»¹⁰⁰.

Signori, condottieri e capitani non mancavano inoltre di richiedere o di offrire dei fonditori ai propri alleati, così come avveniva normalmente per gli ingegneri civili e per gli architetti militari. Già nel 1417, il governo senese pregava il signore di Lucca, Paolo Guinigi, di inviare un «magister bombardarum» ai suoi confederati¹⁰¹. Nel 1454, il marchese di Ferrara metteva a disposizione di Ludovico Gonzaga il maestro Giovanni da Lodi, affinché portasse a termine la fusione di una bombarda¹⁰². L'anno dopo, il senato di Ragusa si informava presso la Signoria di Firenze sulla disponibilità di due suoi tecnici, offrendo loro il metallo, un'officina e delle sostanziose ricompense in denaro¹⁰³. Da parte sua, Lorenzo de' Medici promuoveva Leonardo da Vinci alla corte di Ludovico Sforza, e assumeva, per l'officina comunale di «Marzocco», l'artigiano ferrarese Alberghetto Alberghetti, concessogli probabilmente da Ercole d'Este, allora capitano generale della lega che aveva sostenuto il Magnifico durante la guerra dei Pazzi¹⁰⁴. Lo stesso Alberghetti sarebbe stato richiesto anche dal signore di Faenza, Galeotto Manfredi, «per octo zorni, tanto che io facia vedere queste mie artiglierie»¹⁰⁵. Sul finire del secolo, gli emissari fiorentini in Francia domandavano a Carlo VIII un maestro delle artiglierie, mentre i commissari generali repubblicani inviavano ai Dieci di Balìa un «Antonio Chiariti da Lucca, maestro di getti, quale altra volta vostre signorie ci hanno chiesto», ben raggugiati della sua opera e delle sue qualità¹⁰⁶.

Non mancavano nemmeno i prestiti delle armi stesse. Nel 1459, Giovanni d'Angiò stipulava un «mutuo» semestrale, in Genova, per due grosse¹⁰⁷. Nel 1464, i fiorentini spedivano al duca di Milano, via mare, una bombarda, destinata all'assedio dello stesso capoluogo ligure¹⁰⁸. Qualche tempo prima, Filippo di Savoia aveva sollecitato al signore di Gruyères l'invio di due pezzi a canna molto corta, detti vugleri¹⁰⁹. Nel 1482, i senesi

¹⁰⁰ Cittadella, *Notizie relative a Ferrara*, p. 490.

¹⁰¹ Angelucci, *Documenti inediti*, pp. 580-581.

¹⁰² Cittadella, *Notizie relative a Ferrara*, p. 494.

¹⁰³ Fabriczy, *Fonditori fiorentini*, p. 316.

¹⁰⁴ ASF, *Dieci di balìa, Entrata e uscita*, 8, c. 129v; ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 30, c. 260v.

¹⁰⁵ Angelucci, *Documenti inediti*, pp. 277-278.

¹⁰⁶ ASF, *Dieci di balìa, Responsive*, 40, c. 356r; *Négociations diplomatiques de la France avec la Toscane*, p. 659.

¹⁰⁷ Storti, *Note e riflessioni sulle tecniche ossidionali*, p. 252.

¹⁰⁸ Beltrami, *Le bombarde milanesi*, p. 803.

¹⁰⁹ Quarenghi, *Tecno-cronografia*, p. 145.

dichiaravano al papa «parati facere de dictis nostris bombardis que placita sint sue sanctitati»¹¹⁰. Per la campagna dell'agro romano, nel 1486, Alfonso d'Aragona aveva richiesto, ai suoi alleati toscani, l'invio di due pezzi da Montepulciano, perché «non si può fare senza una bombarda grossa et qualche mezana artiglieria», e, senza, «ogni piccola bicocca fa difesa»¹¹¹. Da Napoli e da Roma provenivano rispettivamente la «bombarda del re di tre pezzi» e la «bombarda grossa del papa di due pezzi» utilizzate contro le fortificazioni di Colle Val d'Elsa nel 1479¹¹².

Prestiti e offerte smentirebbero, quindi, qualsiasi parvenza di “segreto militare” attorno alla produzione delle grosse, almeno per il Quattrocento¹¹³. Pur trattandosi di un sapere fondamentale per la sicurezza, il getto delle artiglierie non era coperto da nessuna riservatezza, configurandosi piuttosto come una *open technique*, disponibile e replicabile da qualsiasi stato, purché inserito nel tessuto delle leghe, generali o particolari che fossero¹¹⁴. Contrariamente a quanto avveniva per altre manifatture, le autorità italiane non ponevano controlli o restrizioni sui trasferimenti dei loro fonditori, non dovendo proteggere alcun primato economico o alcuna supremazia manifatturiera delle città capitali¹¹⁵. Allo stesso modo, neanche le corporazioni potevano porre vincoli alla circolazione della manodopera, non afferendo i pratici ad alcuna specifica arte. Nel caso fiorentino, nonostante qualche maestro fosse immatricolato nell'«arte dei maestri di pietra e legname», i pratici non erano costretti da nessuno statuto a mantenere il riserbo sulle tecniche impiegate, o a rimanere nella comunità di origine¹¹⁶.

Del resto, rispetto ad altre armi, come corazze, scoppietti e lance, le artiglierie pesanti erano un merce assai meno “difficile”¹¹⁷. In quanto di proprietà governativa, le grosse non erano assolutamente immettibili sul mercato. Solo i piccoli calibri potevano essere commerciati al dettaglio da maestri forestieri, senza però mai costituire una serie concorrenza per i prodotti locali. I fiorentini acquistavano un paio di spingarde l'anno sul mercato

¹¹⁰ Angelucci, *Documenti inediti*, p. 563.

¹¹¹ ASF, *Dieci di balia, Responsive*, 33, cc. 354r, 385v e 519r; ASF, *Dieci di balia, Responsive*, 36, c. 362r.

¹¹² Allegretti, *Diario senese*, pp. 793-794.

¹¹³ Bernardoni, *La fusione delle artiglierie*, p. 107.

¹¹⁴ Hilaire-Perez e Verna, *Dissemination of technical knowledge*, p. 540.

¹¹⁵ Molà, *Inventors, patents, and the market for innovations*, pp. 137-138.

¹¹⁶ Belfanti, *Guilds, patents*, pp. 574-576. Sul ruolo delle arti nella diffusione del sapere tecnico, si veda anche Epstein, *Craft guilds*, pp. 693-705.

¹¹⁷ Ansani, *Geografie della guerra*, pp. 115-116; Ashtor, *Aspetti dell'espansione italiana*, pp. 24-25; Bianchessi, *Cavalli, armi e salnitro*, pp. 573-575; Leydi, *Le armi*, pp. 171-175.

bresciano, un nonnulla, rispetto alla manifattura dei fabbri del Dominio, capaci di produrre centinaia in un solo semestre¹¹⁸. Nel 1492, Ferrante d'Aragona comprava a Milano, oltre a diecimila lame di spada e tremila partigiane, ben mille spingarde. Durante la conquista del regno, anche suo padre, Alfonso, aveva acquistato delle artiglierie in Catalogna, ma, in entrambe i casi, le forniture straordinarie erano state dettate unicamente dall'impellenza dei combattimenti e dalle minacce avversarie¹¹⁹.

Storie di pratici

Durante l'intero Quattrocento, interazioni e scambi fra le più disparate culture tecniche, artistiche e politiche sembravano avvenire quotidianamente, in tutta la Penisola. La reputazione e le sperimentazioni delle maestranze veneziane, ad esempio, attiravano indubbiamente l'attenzione di molti pratici, che spesso richiedevano al Senato l'autorizzazione a recarsi in laguna per studiare le tecnologie marciante, finendo talvolta per stabilirsi definitivamente in città. Fra i magazzini dell'arsenale si potevano quindi incontrare fabbricanti francesi, croati e germanici, o esperti provenienti dalla Terraferma, dalla Lombardia, dalle Marche, dal Piemonte, dalla Puglia. Originario di Cremona era invece maestro Bartolomeo, affermatosi come un personaggio chiave nella gestione, nel munizionamento e nella organizzazione dell'artiglieria¹²⁰. Nel 1487, come suo successore, sarebbe stato designato il figlio di Alberghetto Alberghetti, Sigismondo, «peritissimus et excellentissimus artifex conficiendorum tormentorum, passavolantium et aliorum huiusmodi instrumentorum bellicorum», promettendogli la concessione di un'abitazione, uno stipendio annuo di duecento ducati, e il pagamento di tutti i pezzi portati a termine¹²¹.

A Napoli, nel solo Castel Nuovo, intorno agli anni Cinquanta operavano maestri provenienti da Genova e dalla Sicilia, dalla Savoia e dall'Umbria, dalla Germania e dalla Catalogna, tutti agli ordini del «mestre maior de la artilleria», il parigino Guglielmo dello Monaco, incaricato dal Magnanimo della produzione di bombarde e dell'approvvigionamento

¹¹⁸ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 33, c. 171r; ASF, *Dieci di balia, Debitori e creditor*, 22, cc. 14v e 22r; ASF, *Dieci di balia, Responsive*, 30, c. 109v.

¹¹⁹ Barone, *Le cedole di tesoreria*, pp. 235-236; Minieri Riccio, *Alcuni fatti di Alfonso I d'Aragona*, p. 7; Quarenghi, *Tecno-cronografia*, p. 177.

¹²⁰ Mallett, *L'organizzazione militare di Venezia*, pp. 109-116; Ashtor, *Aspetti dell'espansione italiana*, pp. 21-26.

¹²¹ Angelucci, *Documenti inediti*, pp. 282-283.

di polvere e di salnitro¹²². Attivo a Milano già nel 1443, il fonditore francese si era trasferito presso la corte di Alfonso in qualità di realizzatore di «multiplices machinae», «egregie instructus arte horologiorum et quarundam pulchrarum rerum». Per incoraggiarlo a dedicarsi al suo lavoro «bene, alacri, libero et toto animo», il sovrano aragonese gli aveva garantito la cittadinanza regnicola e un salario annuo di quattrocento ducati d'oro, incrementati dal suo successore con la concessione della gabella della piazza Maggiore di Napoli.

A partire dal 1453, il dello Monaco aveva progettato e fuso campane e fontane. Ma il suo capolavoro tecnico, a detta di molti, era rappresentato dall'imponente *Neapolitana*, una grossa di quattro pezzi, realizzata con nove tonnellate di bronzo, finemente incisa, e decorata con «lo stemma reale di Aragona e del reame di Napoli, tenendo da una parte il castello e dall'altra la divisa delle spighe del miglio»¹²³. Nella reggia partenopea, l'artefice avrebbe poi fuso numerose altre bombarde e spingarde, alternando il suo lavoro in officina con quello sul campo di battaglia.

Parmi dovere fare intendere la forza de la bombarda che ha tracto, la quale se chiama la *Neapolitana*, et porta quatrocento libre de petra, et cosi la virtù del bombardero, che è magistro Gulielmo. Dicta bombarda non se poté, per l'aspreza del monte, piantare più presso alla torre (...), et bisognava trare a l'insuso. El muro de la torre, dove era più debile, era grosso quatordecim palmi, che quando el conte de Sarno et l'altri de la terra videro mectere dicta bombarda in quello loco (...) se ne ridevano, parendoli cosa impossibile che dicta bombarda ce dovesse fare alcuna offesa. La virtù del bombardero è stata questa, che mai ha gitato una sola petra in fallo, che ad tutti è parso cosa assai meravigliosa¹²⁴.

Le capacità e l'ingegno avrebbero permesso a Guglielmo di godere di un immenso prestigio, a corte, e di accumulare, nei decenni successivi, una discreta fortuna personale. Negli anni Sessanta, gli sarebbe infatti stato accordato l'acquisto della baliva di Cosenza, così come il possesso dei feudi di Monasterace, Perricello e Campolongo, nella provincia di Calabria Ultra, e l'usufrutto di tutte le miniere di allume del Regno, a eccezione di quelle regie di Ischia e Lipari¹²⁵.

Sempre in quel di Napoli operava un altro francese, Patris de la Motte, che aveva precedentemente prestato servizio presso Riccardo III ed Enrico VII d'Inghilterra. Dall'Impero

¹²² Barone, *Le cedole di tesoreria*, p. 13.

¹²³ Minieri Riccio, *Alcuni fatti di Alfonso I d'Aragona*, p. 444.

¹²⁴ Storti, *Note e riflessioni sulle tecniche ossidionali*, p. 254.

¹²⁵ Barreto, *Artisan ou artiste*, pp. 301-307.

proveniva poi un maestro Giovanni, che aveva realizzato a Gaeta una bombarda. Prima dell'arrivo di Guglielmo dello Monaco, Alfonso aveva commissionato altre bronzine a Bartolomeo da Milano. Ma altri fonditori, in genere, erano attivi anche nell'arsenale navale partenopeo¹²⁶.

La disponibilità di numerosi specialisti garantì ai sovrani aragonesi una produzione incessante di armi da fuoco, stimolata anche dalle guerre, dalle rivolte e dalle congiure che travagliarono il regno per tutto il secondo Quattrocento. Nel 1474, i pezzi della «regia munitione» assommavano a ben centotrentasette unità, fra bombarde e cerbottane di metallo¹²⁷. Alla fine del secolo, nel Castel Nuovo erano presenti una «casa grande dell'artiglieria», un deposito di polvere e una raffineria di salnitro, e almeno due distinte fonderie, gestite da Giovanni da Catania, Federico da Bergamo, Antonio Gioardi da Genova e Pietro «de Coria, spagniolo», insieme a cinque loro garzoni¹²⁸. In quegli anni, l'armeria della reggia, stando al cronista veneziano Marino Sanudo, rappresentava una vera e propria delizia per i contemporanei¹²⁹.

Seguendo le strade aperte da mercenari, fabbri, meccanici e stampatori loro connazionali, Guglielmo di Norimberga, Corrado di Stoccarda e altri artigiani tedeschi erano giunti a Roma negli anni Sessanta, su invito della Camera Apostolica. A loro spettavano gli incarichi di bombardieri e di maestri dell'artiglieria, mentre al pontefice in persona era spesso demandata la benedizione delle bocche da fuoco. D'altronde, come notava uno sconosciuto notaio della curia, «dove che per altro tempo li santi apostoli intendevano a conquistare li popoli alla fede et devotione christiana colli miracoli, orationi et segno della santa croce, adesso si acquistano colli colpi delle bombarde»¹³⁰. Nel 1462, tre bombarde erano state addirittura ribattezzate coi nomi più cari a Pio II.

Quarum primam, ex nomine patris Pii pontificis, Silviam appellavit. Alteram, ex nomine matris, Victoriam (...). Tertiam (...), Aeneam, quod id fuerit ante praesulatum pontificis nomen. Et haec reliquis maior, quae trecentorum

¹²⁶ Minieri Riccio, *Alcuni fatti di Alfonso I d'Aragona*, pp. 253, 255 e 257; Ridella, *Fonditori italiani di artiglierie*, pp. 19-20.

¹²⁷ Barone, *Le cedole di tesoreria*, p. 400.

¹²⁸ Volpicella, *Le artiglierie di Castel Nuovo*, pp. 336-337.

¹²⁹ Sanudo, *La spedizione di Carlo VIII*, p. 238.

¹³⁰ Infessura, *Diario della città di Roma*, p. 134.

pondo emisit, ille ducentorum, in qui tant vis reperta est, ut nulla murorum moles resistere valeret¹³¹.

La *Silvia*, la *Vittoria* e l'*Enea* erano state realizzate dal maestro Agostino de' Rossi da Piacenza, arrivato nella Città Eterna l'anno precedente, per espressa volontà di sua santità. Gli accordi con il «frabricator bombardarum» prevedevano l'affitto di una casa, la consueta fornitura del bronzo, la concessione degli strumenti e una paga di venti fiorini per ogni mille libbre di peso delle artiglierie¹³².

Dal punto di vista della committenza, la decennale carriera di Agostino appare senz'altro come una delle più notevoli. L'artefice era stato infatti attivo non solo a Roma, ma anche a Milano, a Mantova e ad Urbino. A Siena, soprattutto, aveva realizzato due bombarde, «magnas et ornatas», numerose serpentine e svariati «cannoni» per dei pezzi preesistenti. Inoltre, aveva preso parte, in qualità di bombardiere, alle operazioni contro Aldobrandino Orsini e Niccolò Piccinino¹³³. Le sue capacità avevano finito per attirare le attenzioni di numerosi governanti, e, nel 1457, anche Federico da Montefeltro ne aveva domandato insistentemente i servigi.

El me ocurre al presente el bisogno de uno maestro da gittare bombarde, et, perché sono informato che li in Siena è uno bono et sufficiente maestro, quale me satisferia assai, che 'l conobbi fin d'alora quando stetti li amalato, prego istantemente le signorie vostre che, ad mia singulare complacentia, li dia licentia, anzi, li commetta che vegna via subito, che cusì rechede el bisogno mio (...). Et io li farò fare el debito del suo pagamento, per modo che se chiamarà ben contento. Io debbio sperare che le signorie vostre me compiacciano del dicto maestro, perché in omne cosa che tendesse al bene et stato de la vostra Republica io seria affectionatissimo quanto niun altro possesse havere al mondo, et maxime attento che queste bombarde io le voglio per operarle contro el signor Sigismundo, inimico de la vostra signoria, a la quale me raccomando¹³⁴.

La Repubblica, solitamente, non tardava a concedere, al proprio artigiano, la licenza di lavorare presso gli alleati. La crescente stima dei contemporanei, e i suoi viaggi, permisero ad Agostino di entrare personalmente in contatto con Cicco Simonetta e con papa Piccolomini, arrivando a

¹³¹ Schulz, *La migrazione*, pp. 108-109; Esch, *Economia, cultura materiale ed arte*, pp. 140-142. Si vedano anche le testimonianze coeve di Piccolomini, *Commentarii rerum memorabilium*, p. 135.

¹³² Ermini, *Campane e cannoni*, p. 397.

¹³³ *Ibidem*, pp. 388-401.

¹³⁴ Angelucci, *Documenti inediti*, pp. 544-545.

ottenere, da quest'ultimo, il titolo di «palacii apostolici architectus ac exercitus Sanctae Romane Ecclesiae bombarderius»¹³⁵.

Come il maestro piacentino, anche l'«ottimo ingegnere» Ferlino da Chieri operò sui campi di battaglia e in bottega, servendo la Serenissima, e riuscendo persino ad aprire una propria officina sull'isola della Giudecca¹³⁶. Il fonditore piemontese era giunto a Venezia dopo aver fabbricato numerose bombarde in Savoia e in Lombardia. Qui, in particolar modo, aveva realizzato due omonime *Ferline*, di due pezzi ciascuna, entrambe caricabili con duecento libbre di palla di pietra¹³⁷.

Negli stessi anni, il genovese Francesco Bianco fondeva a Milano la *Corona*, di quattrocento libbre di calibro, e la *Bissona*, di trecento. Delle medesime pallottole di quest'ultima era munita la *Liona*, eccezionalmente realizzata in ghisa dallo specialista ligure¹³⁸. Maffeo da Como e Dainese Maineri, invece, sovrintesero alla fusione di una bombarda di otto tonnellate, la *Galezesca Victoriosa*, la cui «tromba» poteva ospitare un gigantesco proiettile di cinquecentosettanta libbre, e la cui «coda» doveva contenere l'esplosione di ben cento libbre di polvere¹³⁹. Ma tra i «ducali ingeniari et bombarderi» sforzeschi figuravano anche altri esperti locali, oltre a pratici stranieri, fra cui Cristoforo da Gandino, Francesco da Pavia, Francesco da Mantova, Giovanni da Lodi e «magistro Nardivo de Franza»¹⁴⁰.

Il tema della difesa, ovviamente, riguardava anche gli stati minori. Nel 1458, il marchese Borso d'Este aveva a sua disposizione due maestri francesi, Simone e Nicolò da Nancy¹⁴¹. Nel 1471, per finanziare i lavori di Giovanni di Zagabria, il governo senese era arrivato persino a imporre una specifica tassa sulle concessioni di grazia, «considerato che non sia molto honore che le vostre signorie, essendo di stima asai, habi solamente due bombarde, che quando ce ne fusseno dieci non sarebero troppe, et darebero a la vostra Republica grande reputatione»¹⁴². Per il conflitto contro Firenze, nel 1479, una grossa di due pezzi, pesante più di otto tonnellate, era stata fusa da Pietro di Niccolò Campana, e «passava mura, ripari, e ogni cosa, e non era niente che la tenesse». Durante quello stesso anno, la cattura di diverse artiglierie nemiche

¹³⁵ Ermini, *Campane e cannoni*, pp. 396-398.

¹³⁶ Panciera, *Il governo delle artiglierie*, p. 163.

¹³⁷ Simonetta, *Historie*, c. 329r; Visconti, *L'ordine dell'esercito ducale sforzesco*, p. 471.

¹³⁸ Beltrami, *Le bombarde milanesi*, pp. 798-799; Quarenghi, *Tecno-cronografia*, pp. 142-143.

¹³⁹ Visconti, *L'ordine dell'esercito ducale sforzesco*, p. 471.

¹⁴⁰ Motta, *Architetti ed ingegneri militari sforzeschi*, pp. 139-140.

¹⁴¹ Cittadella, *Notizie relative a Ferrara*, p. 495.

¹⁴² Archivio di Stato di Siena, *Concistoro*, 2557, c. 1r.

rese possibile la vista di una luccicante «montagna di bronzo» davanti al Palazzo Pubblico, con ventidue bombarde trionfalmente esibite in Piazza del Campo¹⁴³.

Firenze, del resto, pareva essere all'avanguardia, nel campo della produzione di armi da fuoco. Fin dalla metà del secolo, infatti, il Comune si era affidato esclusivamente a dei maestri di getto per la realizzazione delle sue armi d'assedio, forte anche della tradizione di suoi scultori e dei suoi orafi, come Donatello e Michelozzo. Collaboratore di entrambe era stato Maso di Bartolomeo, che, a partire dal 1449, si era occupato della produzione di armi nella «chasa delle bombarde» di Urbino, pagato «a ragione di fiorini venticinque del migliaio» di libbre di bronzo. Per Federico da Montefeltro, Maso avrebbe realizzato una «cierbottana di quattro pezi a vite», una grossa di tre pezzi, «di portata di libre trecento, che pesò la bombarda libre dodicimila e cinquecento», e una «bombarda di portata di libre ducento e quattro», fusa con undicimila libbre di metallo¹⁴⁴.

Tornato a Firenze nel 1451, nella sua bottega di via Porta Rossa, Maso provvide, nel giro di pochi mesi, ad immatricolarsi all'«arte de' maestri di pietra e legname»¹⁴⁵. Nell'inverno del 1453, i Dieci di Balìa lo incaricavano di reperire, nelle fortificazioni di Pisa, del bronzo usato, affinché lo conducesse a Firenze, «pro novis bombardis conficiendis»¹⁴⁶. La contabilità dei magistrati ne enumerava quattro, e cioè la *Disperata*, la *Lionessa*, la *Tribolata*, e la *Lucchese*, pagate più di millecinquecento lire, «in somma di più bronzo avuto».

Quattro bombarde, le quale abiamo fatto fare di bronzo vecchio che avevamo, ch'era libre ottomila e centosessanta, il quel venne da Pisa da Chonsoli del Mare (...) in più pezi, e libre quindicimila e quattrocentoventuno chomperamo da più persone (...).

E' nomi di dette bombarde sono qui da piè. Pesono in tutto libre ventimila e trecentocinquanta, che il resto di detto bronzo chalò per farlo due volte fondere, che chalò libre quattordici per cento. Una bombarda che si chiama la *Disperata*, che ha il chanone a vite, pesò libre novemila e secentotrenta, e una bombarda che si chiama la *Leonessa* che pesò libre semila e novecentoquindici, e una bombarda che si chiama la *Tribolata* che le faciamo la tromba e il chanone venne da Pisa, fu detta tromba libre dumila e ottocentonovanta e il chanone fu dumila e cinquanta, e una che si chiama la *Lucchese*, che avavamo la tromba e faciamo fare il chanone, che pesò libre

¹⁴³ Allegretti, *Diario senese*, p. 794; Angelucci, *Documenti inediti*, pp. 561-562.

¹⁴⁴ BNCF, *Baldovinetti* 70, cc. 7r e 22r.

¹⁴⁵ *Ibidem*, c. 37r.

¹⁴⁶ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 20, c. 113v.

cinquecento e ottanta, sì che in tutto pesò detto bronzo, chome di sopra, libre ventimila e trecentocinquanta¹⁴⁷.

Nel suo «conto di dare e d'avere e di opere», Maso riportava i calibri e le cariche delle bombarde, specificando che la «tromba di detta Disperata porta libre trecento di pietra, el channone porta libre ottanta di polvere», che la «tromba de la Leonessa porta libre ducentocinquanta di pietra e il channone porta libre cinquanta di polvere», e che «la tromba detta la Tribolata è di portata di libre centocinquanta di pietra»¹⁴⁸. Nei mesi seguenti, il maestro fiorentino avrebbe provveduto a riparare e rifondere più volte il «cannone» di alcune grosse, rotti durante le operazioni contro gli invasori aragonesi sul litorale toscano. Sempre per la stessa campagna, *Masaccio* avrebbe curato la «fattura d'una bombarda di portata di libre quattrocento di pietra, la quale bombarda pesò libre tredicimila circha», e di altre tre macchine, la *Caccia pazzia*, la *Né patti né concordia* e la *Vittoriosa*.

E deono dare a dì due d'aprile, per manifattura d'una bombarda detta *Chaccia Pazia*, di portata di libre ducento e cinquanta di pietra, pesa detta bombarda libre ottomila e cinquecento, per prezzo di lire settantacinque el migliaio, lire secentotrentasette e soldi dieci.

E deono dare a dì tre di luglio, per manifattura del channone della *Vittoriosa*, pesò libre cinquemila e novecento, per lire settantacinque el migliaio, lire trecentosettantacinque.

E deono dare a dì tre di luglio, per manifattura del channone che io rifeci alla tromba di *Né patti né chonchordia*, che l'ho rendere detto dì, che pesò libre cinquemila e ducentosettanta, per lire settantacinque el migliaio, monta lire trecentosettanta e soldi cinque¹⁴⁹.

Grazie ai suoi incarichi negli accampamenti di Rencine, Vada e Rosignano, Maso conosceva anche Astorre II Manfredi, allora condottiero dell'esercito glielato. Per il signore di Faenza avrebbe fuso diverse cerbottane, «cholla divisa dell'agnello», nonché «un paio di forme di bronzo che gittavano due pallottole di piombo, l'una di libre due e l'altra di libre una oncie sei»¹⁵⁰.

Fra gli assistenti di *Masaccio*, oltre al fratello Giovanni, figurava anche un suo discepolo montepulcianese, che, fra gli anni Settanta e Ottanta, si sarebbe guadagnato la stima del

¹⁴⁷ ASF, *Dieci di balia, Debitori e creditori*, 17, cc. 143v-144r.

¹⁴⁸ BNCF, *Baldovinetti* 70, c. 92v.

¹⁴⁹ *Ibidem*, cc. 101v e 111v.

¹⁵⁰ *Ibidem*, cc. 88v, 150v e 153v.

Magnifico e il soprannome di *Pasquino delle Bombarde*¹⁵¹. Dopo aver lavorato in Romagna e in Toscana sotto la guida del maestro, Pasquino aveva modellato autonomamente svariate bocche da fuoco nella sua officina fiorentina e nella cittadella nuova di Pisa, partecipando anche a qualche assedio, come quelli di Citerna e di Città di Castello nel 1482¹⁵². Durante la sua carriera, era riuscito a entrare nella cerchia dello scultore Desiderio da Settignano, finendo per trasmettere le sue conoscenze e le sue competenze a un allievo di quest'ultimo, Andrea del Verrocchio. Nel 1484, su commissione dei Dieci di Balìa, anche il famoso artista avrebbe realizzato, con ventitremila libbre di bronzo, una grossa di tre pezzi, «bella et buona», destinata all'assedio di Pietrasanta, ricevendo in cambio ben millequattrocento lire¹⁵³.

Nel giro di trent'anni, dunque, attraverso un'accorta politica di mecenatismo, la Repubblica sembrava aver favorito la creazione e la maturazione di una vera e propria scuola di maestri di getto locali, di scultori votati anche alla fusione di armi, arrivando a possedere almeno venti pezzi di artiglieria campale, tra cui una bombarda capace di lanciare più di settecento libbre di palla di pietra, il maggior calibro dell'intera Penisola¹⁵⁴. Soltanto le sollecitazioni dell'estenuante conflitto contro i genovesi richiesero l'apporto di pratici forestieri, come l'Alberghetti, e come, soprattutto, Giovanni da Augusta, arrivato a Livorno, col fratello Matteo, in qualità di semplice bombardiere.

Quel maestro bombardiere si vuole intendere cum esso noi. Se noi il vogliamo adoperare per bombardiere, el pregio suo è facto, cioè ducati dieci a tempo di guerra et il famiglio, et ducati sei a tempo di pacie. Ma se lo vogliamo adoperare a gittare, vuole essere pagato di getti, et è contento che, nel tempo si pagha di getti, il soldo non gli corra, et fare le cose gli commetteranno le signorie vostre per due o tre ducati meno che non fa maestro Alberghetto. Et però non l'ho mandato ancora a Pietrasancta, perché se l'uomo non si compone cum esso lui e' serve malvolentieri, et pena mille anni et hassene cattivo servizio, benché lavori bene a ogni modo. El pacto mi pare si facci per noi, perché, oltre il piacere ci fa salvandoci il bombardiere, ci levamo da dosso la spexa del bombardiere (...). A Livorno ha facto quattro archibusi che sono vantaggiatissimi, ma sono un pocho troppo gravi, che pesano dalle trentasei alle quarantatre libre l'uno. Ho lasciato sieno inceppati et messi nella roccha nuova. Avanza a Livorno di cose

¹⁵¹ ASF, *Arte dei maestri di pietra e legname*, 2, c. 140v; BNCF, *Baldovinetti* 70, c. 62v.

¹⁵² ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 27, cc. 257v e 276r; ASF, *Dieci di balìa, Entrata e uscita*, 8, cc. 44r e 89v.

¹⁵³ ASF, *Dieci di balìa, Deliberazioni, condotte e stanziamenti*, 30, c. 209v; ASF, *Dieci di balìa, Entrata e uscita*, c. 129v.

¹⁵⁴ ASF, *Dieci di balìa, Missive*, 22, c. 14r. Per le politiche fiorentine, si veda Ansani, *Geografie della guerra*, pp. 88-98, 106-107 e 116-117.

vecchie et triste dugentocinquanta libre di bronzo, che se non havessimo a mandare costui in Lunigiana l'arei messo in cittadella et fattogli fare dieci o dodici archibusi di venti libre l'uno, che sono buona monitione per queste cittadelle et costeranno piccola cosa più che di ferro¹⁵⁵.

A partire dal 1485, l'artigiano tedesco divenne il responsabile della fornace di Pietrasanta. Grazie al suo incessante impegno, sarebbe ben presto arrivato a coordinare i lavori della fonderia pubblica pisana, introducendo i propri metodi nella fusione tanto di «bavalischi» quanto di passavolanti, «cortali», serpentine e spingarde¹⁵⁶. Nel 1488, Giovanni realizzava anche delle campane, destinate al duomo di Pisa ed alla rocca di Sarzana¹⁵⁷. Il doganiere di Pisa, Francesco Cambini, non poteva che lodarne l'opera, perché «e' dura assai fatica et serve bene»¹⁵⁸.

Il Comune di Firenze, comunque, non tardò ad incentivare l'arrivo di nuovi pratici stranieri. Tra la fine del Quattro e l'inizio del Cinquecento, furono infatti invitati a lavorare nella *Sapienza* un maestro piccardo, Piero da Douai, e Giovannantonio da Novara¹⁵⁹, quest'ultimo aiutato dal fiorentino Giovanni Piffero, il padre di Benvenuto Cellini¹⁶⁰. Dal 1504 al 1511, l'officina pubblica fu gestita in esclusiva da Bernardino da Milano, che avrebbe contribuito ad armare la milizia machiavelliana con decine di pezzi di artiglieria pesante e con centinaia di armi da fuoco portatili¹⁶¹.

Il network dei maestri di getto

Parallelamente alla scuola di Maso e di Pasquino, la tradizione fusoria dei Ghiberti si era andata tramandando ed evolvendo nel corso di almeno tre generazioni. Ben prima di aderire formalmente all'«arte dei maestri di pietra e legname», il giovane Bonaccorso era cresciuto lavorando a fianco del padre Vettorino, ammirando da vicino le monumentali «porte del Paradiso» realizzate da suo nonno Lorenzo per il battistero fiorentino. Erede degli strumenti,

¹⁵⁵ ASF, *Dieci di balia, Responsive*, 30, c. 519r.

¹⁵⁶ ASF, *Otto di pratica, Munizioni*, 1, c. 9v; ASF, *Ufficiali delle castella*, 29, cc. 20r, 25v, 29v, 31v e 33v; ASF, *Signori e collegi, Condotte e stanziamenti*, 14, c. 197r; 16, c. 157r.

¹⁵⁷ Böninger, *Gli artigiani stranieri*, p. 111.

¹⁵⁸ ASF, *Dieci di balia, Responsive*, 37, c. 267v.

¹⁵⁹ ASF, *Dieci di balia, Munizioni*, 5, cc. 48r e 57v; ASF, *Dieci di balia, Munizioni*, 8, cc. 127v e 161v.

¹⁶⁰ Gaye, *Carteggio inedito*, p. 455; Cellini, *Vita*, pp. 3-7.

¹⁶¹ ASF, *Dieci di balia, Munizioni*, 10, cc. 9v, 31v, 172r e 225r.

dei libri e della bottega di famiglia, anche lui aveva scelto l'avito mestiere, rivendicandolo sempre con orgoglio nei suoi scritti.

La prima metà di detta bottega ovvero istanza mi si dà per testamento di Lorenzo benché io l'avessi avere tutta per il detto testamento, e l'altra metà per li danari ho ispeso in chasa, sì che per l'una chosa e per l'altre mi danno detta bottega, la quale è stata già un tempo a uso di schultura ovvero a uso di gietto, imperò in quella si gittorono le porte di bronzo di San Giovanni Battista di Firenze (...). E a me agiudichorono tutti i tagli di stagni, pietre fini intagliate e non intagliate, dovunque ve fussino, e ongni altre maserizie atte a l'arte di schultura o di pittore o d'orafo o di gietti e in gienero tutte chosse non usabili alla chasa, cioè tutte chosse appartenenti a schrittoio o che si possa chomprendere essere a simili chosse¹⁶².

Proprio grazie alle sue ricordanze, al suo «libro di debitori e creditori» e al suo «zibaldone» di appunti, è possibile ricostruire, più che per molti altri suoi contemporanei, la sua attività di pratico¹⁶³, una carriera iniziata nel 1479, quando realizzava, per il Comune, le sue prime armi da fuoco. Non è improbabile che avesse conosciuto, in quell'occasione, Pasquino di Matteo e Alberghetto Alberghetti, entrambe impegnati a fondere delle spingarde da impiegare contro le truppe napoletane, romane e senesi, allora schierate intorno al Poggio Imperiale¹⁶⁴.

Agli anni precedenti risalgono, probabilmente, le letture di Vitruvio, gli studi sui macchinari di Mariano Taccola, gli approcci all'architettura militare e la ricopiatura del trattato del nonno, così come le note sull'oreficeria contenute nello «zibaldone», riguardanti i materiali necessari «per fare bronzo nero» o per «arientare senza fuocho», o la composizione dell'«acqua da dorare fero». Nel 1484, nello «scrittoio» all'incrocio fra la via di San Gilio e via della Pergola, Bonaccorso era alle prese con la realizzazione di alcune campane per l'ospedale di Santa Maria Nuova, come testimoniato anche dalle sue numerose annotazioni su scale e proporzioni di questi manufatti, e sui «modi di fare champane grose nela fosa»¹⁶⁵.

Su commissione dei Dieci di Balìa, richiesto a più riprese dagli alleati romani, il maestro si recava a Bracciano nel 1486, fondendovi una grossa, e rimanendovi in qualità di ingegnere del condottiero Gentile Virginio Orsini, responsabile di «munitiones et fabricationes». Nel 1490, il

¹⁶² Archivio Storico dell'Istituto degli Innocenti di Firenze, 13230, cc. 7v-8r.

¹⁶³ Si tratta, rispettivamente, dei manoscritti 13230 e 13229, conservati presso l'archivio storico dell'Istituto degli Innocenti, e del quaderno, segnato 228, appartenente al fondo *Banco rari* della Biblioteca Nazionale Centrale di Firenze.

¹⁶⁴ ASF, *Dieci di balia, Debitori e creditori*, 22, c. 17v.

¹⁶⁵ Immagini e testi del libro di appunti ghibertiano sono analizzati in Scaglia, *A miscellany of bronze works and texts*; Scaglia, *A translation of Vitruvius*.

Ghiberti si trasferiva ancora una volta, mettendosi al servizio del signore di Piombino, Jacopo IV Appiano, con un salario di otto fiorini d'oro al mese. Nel porto tirrenico, avrebbe collaborato con due dei più importanti imprenditori minerari toscani, i fratelli pratesi Zanobi e Tommaso Marinai, attivi nell'estrazione e nella vendita di rame e di ferro¹⁶⁶. Nel 1493, Franceschetto Cybo, il figlio di Innocenzo VIII, lo incaricava di «pore pregio delle munizioni e artiglierie e armadure e molte chose ne le chastela che lui dette overo vendé al singniore Vergilio Orsino»¹⁶⁷.

Tornato finalmente a Firenze, nel 1491, il Ghiberti sarebbe rientrato in contatto con molti dei suoi vecchi conoscenti, come il campanaio Giuliano di Mariotto e il muratore Antonio dal Pino, insieme al quale avrebbe costruito una fornace di riverbero, forse simile, nelle proporzioni, a quella rappresentata nello «zibaldone»¹⁶⁸. Altro «bono compare» era il pittore Pietro Vannucci, il famoso Perugino, al quale già il padre aveva affittato parte della bottega ghibertiana, riservandosi però «l'uso de l'entrare e de l'avere del porticho dove sono e' fornegli». Negli anni successivi, avrebbe incontrato esperti nella lavorazione della ghisa e maestri di getto di diverse nazionalità, condottieri e ufficiali, quei «molti» e quegli «altri» di cui avrebbe scrupolosamente annotato i consigli. Durante la sua trentennale carriera, avrebbe viaggiato e visto «asai istorie», sviluppando il suo «buono ingegno», coltivando una discreta pluralità di interessi, e arricchendo il suo sapere di pratico¹⁶⁹.

L'intraprendenza e la ricettività dei maestri di getto erano d'altronde testimoniate da molteplici opere d'arte e da altrettanti lavori d'artigianato, impieghi alternativi durante il «tempo di pace»¹⁷⁰. Guglielmo dello Monaco, ad esempio, aveva realizzato le maestose porte del Castel Nuovo, che immortalavano nel bronzo la vittoria di Ferrante d'Aragona contro Giovanni d'Angiò. Perito di meccanica, il maestro francese era stato capace di realizzare un orologio monumentale per la reggia napoletana. La campana della Torre del Mangia, a Siena, recava in rilievo la firma, il «lovanes de Saghabria me fecit». Maso di Bartolomeo dirigeva i lavori in diversi cantieri urbinati. A Firenze, egli avrebbe realizzato un «cimiero d'ariento del segno di Volterra, cioè un grifone adosso a un dragho», una stemma di marmo per la famiglia Vettori, alcune statue per Cosimo de' Medici, e un «uscio d'ottone con stipiti di bronzo» per

¹⁶⁶ Pampaloni, *La miniera del rame*, pp. 34-56.

¹⁶⁷ La carriera e le opere di Bonaccorso sono ampiamente discusse in Ansani, *The life of a Renaissance gunmaker*, cui si rimanda per più dettagliate indicazioni archivistiche.

¹⁶⁸ BNCF, *Banco rari* 228, c. 82v.

¹⁶⁹ Gille, *Leonardo e gli ingegneri*, pp. 8-12.

¹⁷⁰ Caferro, *Warfare and economy*, p. 200.

l'erigendo Tempio Malatestiano di Rimini. Lui, *Masaccio*, avrebbe anche coordinato il restauro del palazzo della Parte Guelfa, e fuso la «champana dell'oriuolo di palagio, che fu migliaia undici vel circha»¹⁷¹. Le fonti toscane menzionano il fonditore genovese Francesco Bianco come «maestro di fare polvere da bombarda», abile a piazzare i suoi prodotti in patria e all'estero. Giovanni Piffero, da parte sua, avrebbe alternato la manifattura di artiglierie a quella di canne d'organo e di altri strumenti musicali. Bernardino da Milano, invece, avrebbe realizzato alcune statue, come quelle del gruppo della *Predica del Battista*, create da Giovan Francesco Rustici per il battistero fiorentino. Pasquino da Montepulciano aveva collaborato con Filarete, Michelozzo, e Luca della Robbia, rivelandosi versato non solo nella produzione di artiglierie, ma anche nella scultura in pietra e in marmo. Era persino divenuto un cantore, e maestro dei chierici della cattedrale di Santa Maria del Fiore.

Come gli altri fonditori, Dainese Maineri aveva conosciuto e frequentato architetti, militi, bombardieri, meccanici e salnitrai, dentro e fuori il castello Sforzesco. Nelle corti signorili, nelle rimesse pubbliche, negli accampamenti e nelle piazze, gli artigiani intessevano importanti reti sociali, suggerendosi differenti opinioni, perfezionando le proprie metodologie, e ascoltando i frequenti suggerimenti della committenza¹⁷². Gli arsenali sarebbero diventati così delle vere e proprie *trading zones*, siti di sperimentazione e di innovazione, in cui persone con competenze diverse potevano comunicare in maniera proficua¹⁷³. Persino le tristi necessità della guerra avrebbero creato interazioni fondamentali al progresso tecnico.

Successful technological change seems to involve a kind of interaction that can best be provided by direct, personal contact. Successful instances of technological change in the past have involved a subtle and complex network of contacts and communication between people, a sharing of interests in similar problems, and a direct confrontation between the user of a machine, who appreciates problems in connection with its use, and the producer of machinery, who is thoroughly versed in problems of machinery production¹⁷⁴.

Le darsene veneziane, la fonderia del Castel Nuovo, la scuola fiorentina, l'«ufficio dei lavoreri ducali» milanese potevano dunque essere considerati come dei veri e propri collettivi di

¹⁷¹ BNCF, *Baldovinetti* 70, cc. 26r, 27v, 28r, 47v-48r, 57v e 71v. Si veda anche Yriarte, *Le livre de souvenirs*.

¹⁷² Hilaire-Perez e Verna, *Dissemination of technical knowledge*, p. 560.

¹⁷³ Long, *Artisans, practitioners*, pp. 94-107.

¹⁷⁴ Rosenberg, *Economic development*, p. 168.

pratici, in cui le più disparate capacità venivano coinvolte e sollecitate, coordinando la «scientia, sufficientia, experientia, industria, diligentia et sollicitudine» degli artefici¹⁷⁵. Non a caso il duca di Ferrara riuniva, nelle sue ferriere in Garfagnana, una folta schiera di fabbri, minatori, cavaatori, carbonai, muratori, maestri «da forno» e «da fabbriche», appositamente scelti nelle valli alpine, per avviare la produzione di materiale bellico¹⁷⁶. Un'iniziativa, quella estense, che, negli stessi anni, sarebbe stata imitata anche da Ludovico il Moro, nelle sue fonderie in Val d'Ossola¹⁷⁷.

Gli stati mettevano così in contatto diverse capacità, rendendo l'apprendimento di tecniche maggiormente rapido, e il trasferimento dello *know-how* più sistematico¹⁷⁸. Il supporto e l'interesse delle autorità, insomma, si rivelavano indispensabili ad un fruttuoso scambio tecnico, sociale ed economico¹⁷⁹. Le politiche di incentivo alla produzione, di sviluppo della manifattura, determinavano infatti la creazione di un contesto reattivo e dinamico. E le scelte e i progetti dei governanti favorivano il prosperare di una ambientazione materiale ed immateriale ideale al processo di rinnovamento tecnologico, mettendo a disposizione un insieme di risorse, e creando una stabile connessione tra numerosi saperi¹⁸⁰.

Conclusioni. Le artiglierie francesi, tra rivoluzione militare ed evoluzione tecnica

Negli anni successivi al fatidico 1494, nel vivace ambiente culturale del Rinascimento italiano, gli incontri tra artigiani, politici e militari si sarebbero rivelati necessari all'acquisizione di una tecnologia bellica che, di lì a poco, avrebbe radicalmente cambiato il modo di concepire e di combattere la guerra. Dopo aver attirato l'attenzione di diversi commentatori e cronisti, infatti, la «diabolica» artiglieria francese era stata immediatamente adottata dalle principali potenze della Penisola¹⁸¹. I condottieri assoldati da Carlo VIII, come i Vitelli, i Colonna, gli Orsini, consigliarono l'uso di *canons*, *coulevrines* e *faucons* ai loro signori, raccomandando

¹⁷⁵ Repishti, *Architetti e ingegneri*, pp. 44-58.

¹⁷⁶ Baraldi e Calegari, *Pratica e diffusione della siderurgia*, pp. 93-119; Calegari, *La mano sul cannone*, pp. 63-76.

¹⁷⁷ Motta, *Armaioli milanesi*, p. 223.

¹⁷⁸ Epstein, *Labour mobility*, p. 251.

¹⁷⁹ Franceschi e Molà, *Regional states*, pp. 458-466; Heilbroner, *Do machines make history?*, p. 343.

¹⁸⁰ Cipolla, *Storia economica dell'Europa pre-industriale*, pp. 223-224; Hilaire-Perez e Verna, *Dissemination of technical knowledge*, p. 544; Rosenberg, *Economic development*, p. 167.

¹⁸¹ Sulla rapida affermazione dei pezzi transalpini nella Penisola, si veda Ansani, «*This French artillery is very good and very effective*». *Hypotheses on the diffusion of a new military technology in Renaissance Italy*, di prossima pubblicazione in «*Journal of Military History*».

tanto l'assunzione di nuovi esperti quanto la costruzione di ulteriori fonderie. Dal canto loro, i maestri di getto si era adattati piuttosto facilmente alle nuove forme, diffondendo la novità attraverso i loro spostamenti, come nel caso di Basilio della Scola e Sigismondo Alberghetti, stabilitisi a Venezia e a Ferrara, dopo aver servito a Lione e a Milano.

A Firenze, avendo apprezzato i «grandi effecti» di cannoni e colubrine, i Dieci di Balìa incaricarono due dei loro artigiani di «pigliare le misure e disegnare pezzo per pezzo» tutte le artiglierie del «cristianissimo re» allora depositate a Castrocaro, in modo da poterle «fare per i bisogni del nostro Comune, perché le faccino più a proposito et commode al servirsene»¹⁸². Per favorirne la produzione, gli ufficiali avevano anche provveduto all'erezione di una nuova «muraglia» pubblica «per gittare artiglierie», nonché alla costruzione, a spese del Comune, di «fornelli», nelle botteghe private, «perché si possino fare i getti migliori et più comodamente»¹⁸³. Nel marzo del 1495, un primo «cortaldo alla francese» veniva inviato nel campo gigliato¹⁸⁴. Il disegno e l'imitazione dei manufatti erano stati indubbiamente validi mezzi di trasmissione della conoscenza¹⁸⁵, ma la riuscita dell'arma aveva dimostrato che la Repubblica disponeva di fonditori, pratiche e strumenti per acquisirla in maniera efficace e consapevole¹⁸⁶.

I bozzetti di Francesco Telli e di Lorenzo *Cavaloro* servirono anche a Bonaccorso Ghiberti, che di lì a poco li avrebbe ricopiati nel suo «zibaldone», aggiungendovi però la descrizione dei metodi di fusione adottati dai pratici transalpini, incentrati sul rapporto tra il volume del proiettile e lo spessore della camera di scoppio, appresi probabilmente dai *fondeurs* e dai *canonniers* dell'*artillerie royale*.

E' francesi usano fare grosse le loro passavolanti dirieto el netto, cioè el sodo, senza le chornici, tre palottole, cioè una al voto e due al bronzo, cioè tanto grosso el bronzo da ongni lato quanto el vano. E questo fano a quello che giettano insino in dieci libre di piombo. E quele che giettano da trenta a quaranta o a cinquanta libre di piombo fano grosse dirieto tuto el netto di fuori due palottole e mezo o pocho più.

¹⁸² ASF, *Dieci di balia, Missive*, 31, c. 81r.

¹⁸³ ASF, *Dieci di balia, Deliberazioni, condotte e stanziamenti*, 48, c. 145.

¹⁸⁴ ASF, *Dieci di balia, Munizioni*, 5, c. 38r.

¹⁸⁵ Calegari, *Nel mondo dei pratici*, p. 29; Degrossi, *La trasmissione dei saperi*, pp. 82-83; Hilaire-Perez e Verna, *Dissemination of technical knowledge*, pp. 538, 544 e 547; Staudenmaier, *Rationality, agency, contingency*, p. 175.

¹⁸⁶ Ansani, *Craftsmen, artillery, and war production*, p. 11; Ansani, *The life of a Renaissance gunmaker*, pp. 759-765.

E ancora:

Uno chortaldo overo passavolante che el vano sia tra uno terzo et uno quarto, et lungha braccia sei e uno terzo, peserà circa di libre cinquemila tutta, quando sarà netta, faciendola grossa dirieto dua palottole el di fuori o pocho più. Un altro cortaldo o vero passavolante che sia lungho braccia sei e che gietta ottanta libre di piombo peserà circha a libre semila¹⁸⁷.

A partire dal 1497, Bonaccorso stesso realizzò diversi «cortaldi alla francese», fusi in un unico pezzo di bronzo, dotati di orecchioni, e dalle dimensioni e dal peso assai più contenuti rispetto alle tradizionali grosse utilizzate fino ad allora¹⁸⁸.

La velocità di trasmissione delle tecniche ebbe, all'apparenza, un che di sorprendente. Non si trattava di imitare solamente l'arma, ma di replicare tutto un complesso di congegni, di azioni, di strategie atte a farla funzionare a dovere. Le nuove artiglierie, infatti, erano montate su complicati affusti mobili, muniti di pesanti ruote ferrate e di sospensioni più che resistenti. Inoltre, dovevano essere caricate non con i macigni tradizionali, ma con pallottole di ferro, difficilmente realizzabili senza l'ausilio di fornaci adeguate, ma assolutamente necessarie alla buona riuscita dei bombardamenti di saturazione adottati dai *maîtres* francesi¹⁸⁹.

Tuttavia, non si sarebbe potuta acquisire così rapidamente una simile, complessa senza una conoscenza pregressa, da parte dei vari maestri, delle pratiche di fusione dei pezzi, dei metodi di lavorazione della ghisa, e dei sistemi di costruzione dei carri «matti» delle bombarde¹⁹⁰. E difficilmente, soprattutto, l'*artillerie royale* avrebbe trovato spazio nella tattica guerresca italiana, se la committenza statale non avesse sviluppato delle forti esigenze in fatto di mobilità e di alleggerimento dei pezzi. Ben prima degli anni Novanta, ad esempio, gli eserciti di Firenze e di Venezia avevano utilizzato delle spingarde montate su carri a due ruote, molti simili ai falconetti¹⁹¹. La necessità di pezzi più manovrabili, d'altronde, era stata ben espressa, nella seconda metà degli anni Settanta, da Orso Orsini.

Quale bombarde vorriano essere facte tucte due ciascuno d'un peczo, et la una pesasse trenta cantara in un peczo, et l'altra vinti, et porrianose fare sufficiente ad abactere omne muro come quelle de tre peczi, che pesano

¹⁸⁷ BNCF, *Banco rari* 228, cc. 87v-88r.

¹⁸⁸ Ansani, *The life of a Renaissance gunmaker*, pp. 766-771.

¹⁸⁹ Contamine, *L'artillerie royale française*, pp. 246-249.

¹⁹⁰ Heilbroner, *Do machines make history?*, pp. 338-340.

¹⁹¹ Mallett, *L'organizzazione militare di Venezia*, p. 113.

sexanta cantara. El modo da farse dicte bombarde vorria essere de farle buctare de cola de brunzo in uno peczo, che la tromba fosse grossa due degeta, el cannone dove sta la polvere quattro (...), et poi fortificarle, et farle coperire tucte due de cerchie de ferro ben saldate et ben facte (...). Et le bombarde antescrite fanno para fazone, et portanose meglio, piantanose più presto, et possonose subito levare a li bisogni. Dicte bombarde se vogliono portare quando li campi sono equali a lo nemico, et anche alquanto inferiore. Quando li campi sono avvantagiusi o superiori al nemico, se possono portare bombarde de omne sorte, et in quello caso le bombarde de tre peczi so' bone ad usarele, et ogni altra grossa et impacciosa bombarda. Ma in omne muodo, per li campi, quanto de manco peczi so' le bombarde, meglio so', perché so' de manco impaccio ad invitare et svitare, legare et piantare, et cossì ad levarle¹⁹².

In questo senso, l'adozione delle artiglierie di Carlo VIII, delle tecnologie «oltramontane», era stata una soluzione contingente a problemi peculiari della comunità politica, militare e tecnica italiana, configurandosi come una evoluzione delle precedenti, ingombranti armi da fuoco¹⁹³. Un adattamento, questo, evidenziato anche dalla fabbricazione di "ibridi" tra la tradizione straniera e quella italiana, come colubrine dotate di camere di scoppio separate, imitazioni creative da cui sarebbe derivato un flusso continuo di aggiustamenti e di piccole modifiche da parte della manodopera specializzata¹⁹⁴.

L'importazione della tecnologia non comportò, quindi, un processo di mera replica. L'invasione francese, anzi, diede il via ad un percorso di cambiamento e di sviluppo intrapreso attivamente dai fonditori e dai loro signori, con una gradualità dettata da numerosi fattori, geografici e politici, culturali ed economici¹⁹⁵. Certo, non erano mancati fallimenti e rallentamenti, errori e ripensamenti. Le vecchie grosse continuarono ad essere prodotte e utilizzate. Gli stessi cannoni, sebbene rapidamente assimilati nella prassi guerresca, non incisero eccessivamente sugli esiti di assedi e battaglie, di fatto costituendo più una rivoluzione in termini di munizionamento e finanziamento, che non tattica o strategica¹⁹⁶.

Nondimeno, agli inizi del Cinquecento, la *tradition of innovation* rinascimentale¹⁹⁷ avrebbe portato «li moderni, più ingenuamente et con miglior ragioni procedendo, perché le sperienze così gli hanno dimostrato», a sostituire le «sconcie et intrattabili bombarde» con

¹⁹² Bibliothèque Nationale de France, *Département des manuscrits*, Italien 958, cc. 15v-17r.

¹⁹³ Bijker e Law, *Shaping technology*, p. 11.

¹⁹⁴ Hilaire-Perez e Verna, *Dissemination of technical knowledge*, p. 537

¹⁹⁵ Rosenberg, *Economic development*, pp. 152 e 166; Long, *The craft*, pp. 703-704.

¹⁹⁶ DeVries, *Catapults are not atomic bombs*, pp. 464-470; Raudzens, *War-winning weapons*, pp. 407-410.

¹⁹⁷ Molà, *States and crafts*, p. 146.

armi di «assai maggior effetto»¹⁹⁸. E anche se, «nel farle, è gran differenza da maestro a maestro, perché ogniuno vuol dimostrare d'havervi sopra gran pareri e gran segreti», la «regola» e la «moderatione» degli artefici sarebbero state fondamentali per i successivi sviluppi della scienza militare, dettati dai «maladetti, abominosi ordigni» e dalla polvere da sparo.

In un'Europa in fermento, in cui guerra moderna e produzione manifatturiera sarebbero andate di pari passo, anche i maestri di getto italiani sarebbero stati capaci di «fare uno mondo nuovo», disseminando il loro sapere in tutto il continente, e fabbricando macchine sempre più potenti, sempre più resistenti, e sempre più numerose¹⁹⁹. D'altronde, «in fatto di guerra potreste cercare da lo levante a lo ponente per tale misterio di trovare homini al proposito di vostre signorie», e «troverete che per aventura sarà meglio avere quatro nostri pari che avere sedici isquadre di chavagli»²⁰⁰.

¹⁹⁸ Biringuccio, *Pirotechnia*, c. 79rv.

¹⁹⁹ Baraldi, *Una nuova età del ferro*, p. 216; Cipolla, *Tecnica, società e cultura*, p. 10; Hale, *Guerra e società*, pp. 41-74; Hall, *Weapons and warfare*, pp. 201-235; Ridella, *Fonditori italiani di artiglierie*, pp. 20-42.

²⁰⁰ ASF, *Dieci di balia, Responsive*, 57, c. 259v-260r.

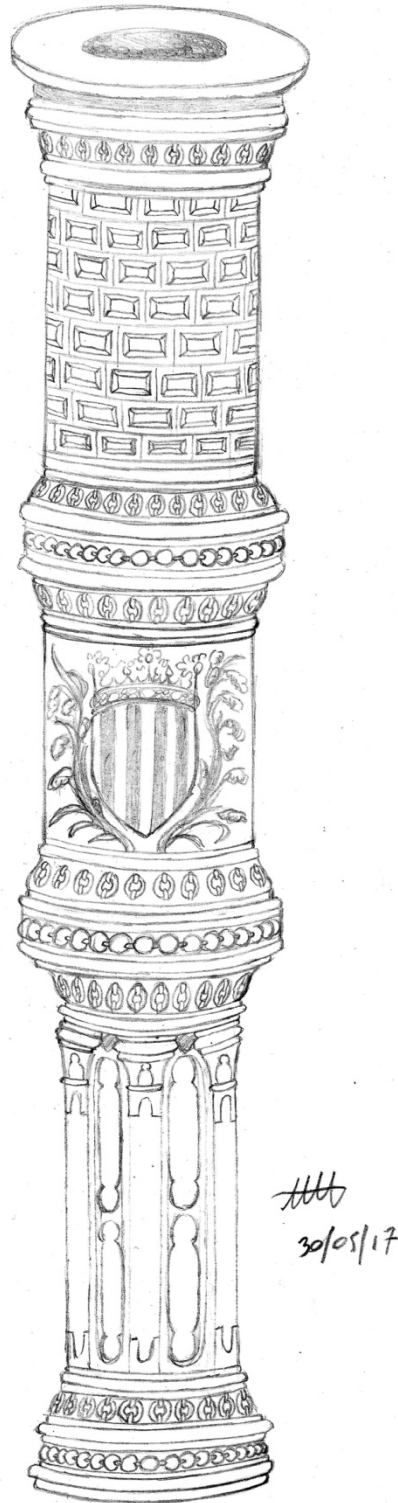


Figure 4. A bombard, sketched by Antonio Pisanello in Naples, during 1450s
Paris, Musée du Louvre, Département des Arts graphiques, INV 2294
Drawing by Angela Marino

ARTICLE V
THE LIFE OF A RENAISSANCE GUNMAKER.
BONACCORSO GIBERTI AND THE DEVELOPMENT OF FLORENTINE ARTILLERY
IN THE LATE FIFTEENTH CENTURY
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This article explores the technological development of artillery production in “backward” Florence during the last two decades of the fifteenth century. It demonstrates, contrary to extant historiography, the existence of a lively and reactive war-related industry in Renaissance Italy, aware of new ideas and new techniques, and examines the assimilation of the most efficient French ordnance into Italian warfare and into the practices of artisans. Through the life of a single Renaissance gunmaker, Bonaccorso Ghiberti (1451–1516), the grandson of the illustrious Lorenzo Ghiberti (1378–1455), this article studies the culture, the knowledge, the variety of methods and the movements of the community of Renaissance Tuscan craftsmen.

A major problem in the historiography of warfare and military technology in fifteenth-century Florence is entrenched assumptions. From Niccolò Machiavelli in the early sixteenth century to the present, the historiography has only restated old assertions of a division between corrupt mercenaries and reliable citizen armies, ignoring the traditions and innovations, changes and adaptations, and culture and methods of both soldiers and artisans. The Renaissance is furthermore portrayed as a time of Florentine military decadence. Tuscan statesmen have been repeatedly blamed for their disinterest in warfare, and even for their “incomprehension” of the irrational, violent phenomenon of war. According to William Caferro, the schema of Florentine backwardness has by now achieved the status of orthodoxy.¹

¹ This portrait of the Florentine army has been based more on humanist literature than on archival research: Charles Calvert Bayley, *War and Society in Renaissance Florence*; Claudio Finzi, “La guerra nel pensiero politico del Rinascimento toscano,” 141; William McNeill, *The Pursuit of Power*, 74; Michael Mallett, *L’organizzazione militare di Venezia*, 256–57. Other statements on the alleged Florentine backwardness have been made in: Daniela De Rosa, “Il controllo politico di un esercito”; Mallett, *Signori e mercenari*, 134–36; John Hale, *Guerra e società nell’Europa del Rinascimento*, 64; Stephan Epstein,

The military institutions of other Italian Renaissance states have been reevaluated in recent decades by a few important studies. Scholars have underlined the political role of these offices, their impact on the fiscal system, their attempts to construct an efficient chain of command, and the tactical innovations proposed by captains.² Even in the most well-known cases, however, the productive activities tied to war have generated a little attention from historians. The manufacture of firearms during Italian *Quattrocento*, for example, has been rarely analyzed. The literature on the early developments of artillery in the Peninsula is surprisingly scarce. The pioneering works of Angelo Angelucci and Carlo Montù were published in 1869 and 1934, respectively. Manlio Calegari and Francesco Storti in 2000 called attention to the lack of work in Italian historiography on technological and specifically military themes. Articles on Renaissance Italian military technology have only started to appear in Italy in the last decades.³

Walter Panciera, for example, has focused on Venetian institutions and their influence on the manufacture of guns and gunpowder in the second half of the sixteenth century. Renato Ridella, Marco Morin, and Carlo Beltrame have studied archeological finds, especially shipwrecked sea ordnance, for the same period. Calegari has investigated the fifteenth-century foundries and ironworks of Ercole I and Alfonso I d'Este in the Apennines. Jean-François Belhoste has made a comprehensive survey of these works in his own essay on late medieval European ordnance.⁴

"Storia economica e storia istituzionale dello stato," 108–109. William Caferro, "Continuity, Long-Term Service and Permanent Forces," offers, along with a relevant archival analysis, an extensive bibliography of works on the Florentine military historiography.

² For Venice, Milan and Naples, see, respectively: Mallett, *L'organizzazione militare di Venezia*; Maria Nadia Covini, *L'esercito del duca*; Francesco Storti, *L'esercito napoletano*. A survey of recent Italian studies has been proposed by Luciano Pezzolo, "La 'rivoluzione militare'," 32–59, and Claudio Donati, "Strutture militari," 45–62.

³ For international literature, see, for example: Kelly DeVries, *Medieval Military Technology*; Bert Hall, *Weapons and Warfare*; John Francis Guilmarin, *Gunpowder and Galleys*. Geoffrey Parker, *The Military Revolution*, linked innovations in military technology with several, radical changes in warfare and government, opening an intense

⁴ Early works on Italian ordnance are: Angelo Angelucci, *Documenti inediti*; Carlo Montù, *Storia dell'artiglieria italiana*. The complaints of Manlio Calegari are expressed in Calegari, "Nel mondo dei 'pratici'," 9–14. For the opinions of Storti on the uncertain identity of Italian military historiography, see Storti, "Istituzioni militari in Italia tra Medioevo ed Età Moderna." Recent works on the topic of production and management of artillery are: Walter Panciera, *Il governo delle artiglierie*; Panciera, "La polvere da sparo"; Renato Ridella, "Produzione di artiglierie"; Ridella and Francesco Laratta, "Un cannone veneziano"; Carlo Beltrame and Marco Morin, *I cannoni di Venezia*; Beltrame and Ridella, *Ships*

Scholars have explored weapons and their connection with the evolution of tactics, their role in the operational choices of governments, and their daily use. Nevertheless, the importance of smiths, gunmakers, and other masters, along with their practices and products, have been often ignored by economic and military historians.⁵ Only the renowned Milanese armorers, along with other Italian *corazzai*, with their luxurious and fascinating goods, seem to have attracted the attention of art historians.⁶ Gilded helmets and precious bucklers, however, were only a small part of the vast market of swords, armor, gauntlets, and shields. Little is known about the production of other Italian states, or about the commerce of weapons in the Late Middle Ages, or about the important second-hand market in equipment.⁷ The same applies to raw materials. Enzo Baraldi has studied the technical innovations in Alpine ironworking, such as new types of furnaces and more effective bellows. A Tuscan mining enterprise was examined by Guido Pampaloni. Moreover, early modern treatises explained casting methods and illustrated the tools of craftsmen, but the buyers of materials frequently remained unknown.⁸ Last but not least, also the manufacture and the trade of saltpeter in Renaissance Italy are scarcely considered by historians, in spite of the significant suggestions on its artificial production made by Bert Hall in 1997.⁹

This article, obviously, cannot fill in all the blanks in this historiography, yet by drawing attention to the Florentine master Bonaccorso Ghiberti this article offers a new perspective on Renaissance gunmaking in Tuscany. Ghiberti is a valuable and, with respect particularly to *and Guns*; Calegari, “La mano sul cannone”; Jean François Belhoste, “Nascita e sviluppo dell’artiglieria in Europa.”

⁵ The economic aspects of the problem have been analyzed by: Caferro, “Warfare and Economy in Renaissance Italy;” Richard Goldthwaite, *The Economy of Renaissance Florence*, 400–401; Enrico Stumpo, “La finanza di guerra,” 196.

⁶ For an exhaustive examination of the Milanese trends during the sixteenth century, see: Stuart Pyhrr, José Godoy, and Silvio Leydi, *Heroic Armor of the Italian Renaissance*. The Tuscan production has been examined in Mario Scalini, “L’armatura fiorentina del Quattrocento.”

⁷ Silvio Leydi, “Le armi”; Silvia Bianchessi, “Cavalli, armi e salnitro,” 560–72; Luciana Frangioni, “Armi e mercerie fiorentine per Avignone”; Frangioni, “Aspetti della produzione”; Brian Sandberg, “The Magazine of All Their Pillaging.”

⁸ The books of Vannoccio Biringuccio, *Pirotechnia*, and Georg Agricola, *De re metallica*, appeared in the mid-sixteenth century. A significant contribution to the studies on medieval iron working is: Enzo Baraldi, “La siderurgia In Italia dal XII al XVII secolo.”

⁹ Hall, *Weapons and Warfare*, 67–91; Bianchessi, “Cavalli, armi e salnitro,” 572–82; Brenda Buchanan, ed., *Gunpowder*. Florentine archival documentation abounds with notes on exchanges of the precious propellant, purchased in Naples, Genoa, Milan, and Rome. See, for example: Otto di Pratica, Munizioni, in ASF, 1, 15v; Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 33, 105r; Dieci di Balìa, Debitori e creditori, in ASF, 28, 40v; Dieci di Balìa, Munizioni, in ASF, 9, 186r; Dieci di Balìa, Munizioni, in ASF, 8, 167r; Dieci di Balìa, Entrata e uscita, in ASF, 23, 351v.

actual production, a somewhat understudied figure. Other aspects of his life have received more attention. Art historians have studied his writings, examining the theoretical and practical connections with the heritage of his family, and underlining the relationships between Bonaccorso and other Renaissance artists. Gustina Scaglia, for example, has discussed the studies of Bonaccorso on Vitruvius, and his interest in the architectural machines designed by Filippo Brunelleschi for the construction of the dome of the Florentine cathedral. Scaglia has also published part of Bonaccorso's notebook, the *zibaldone*. A decade before, Trude Krautheimer-Hess wrote on the estates that Bonaccorso inherited from his father Vettorino (1418–1496) and his grandfather Lorenzo Ghiberti. Lastly, the recent research of Victor Coonin briefly analyzes a rental agreement between the Florentine master and the painter Pietro di Cristofaro Vannucci, better known as Perugino.¹⁰

Generally, these scholars have not dealt with Bonaccorso's actual bronze works. Scaglia has commented on his drawings of firearms and his notes on furnaces, but she did not cite the numerous cannons that Bonaccorso produced in the last two decades of the fifteenth century. Nevertheless, contemporary sources mentioned him as a *maestro di getto*, a master in bronze founding, specializing in the casting of bells and, above all, artillery pieces. Various archival documents often remind us of the craft of Bonaccorso: his account books repeatedly hint at the gunmaking career of their writer. But his *libro di ricordanze* and his *libro di debitori e creditor* have never been analyzed from a military, technological, or economic perspective.

Today, these sources are kept in the historical archive of the Istituto degli Innocenti in Florence, along with hundreds of other memoirs, written by merchants, artisans, and bankers. The *zibaldone*, instead, is part of the *banco rari* collection of the Biblioteca Nazionale Centrale of Florence. But further data are found in the Florentine State Archive. The fiscal records of the *catasto* and the *decima repubblicana* provided information on the wealth of the craftsman and his bottega, the so-called *scrittoio*. The documentation of the guild of stonemasons and carpenters (*maestri di pietra e legname*) was useful for understanding the working relationships of Bonaccorso and his membership in the arte. The registers of the military institutions, moreover, were fundamental for this research. The books of ammunitions (*munizioni*) of the two Florentine military institutions, the Dieci di Balìa (the council of ten officials elected in time of war during the whole century) and the Otto di Pratica (a permanent

¹⁰ For further readings on the life of Bonaccorso Ghiberti, see: Gustina Scaglia, "Drawings of Machines"; Scaglia, "A Miscellany of Bronze Works"; Scaglia, "A Translation of Vitruvius"; Trude Krautheimer-Hess, "More Ghibertiana"; Victor Coonin, "New Documents."

office responsible for warfare and diplomacy created in 1480), their resolutions (*deliberazioni*), as well as their bookkeeping (*entrata e uscita, debitori e creditori*), offer the opportunity to highlight the leading role of public demand in the production of weapons and in the introduction of technical innovations. The correspondence of the Signoria, after the political upheavals of 1499, completed this documentation.¹¹ The analysis of such varied sources was necessary to understand the roles, uses, and developments of technology in its actual context – in this case, in the lively economic, social, cultural, military, and political life of Renaissance Florence.¹²

The formation of a gunmaker

Little is known about the early career of Bonaccorso. He probably completed his apprenticeship in the workshop of his family. Here, he could have studied the notes of his grandfather on Vitruvius and Brunelleschi, learning at the same time the rudiments of architecture and the practices of metal casting. His first notes in the Zibaldone concerned the art of the goldsmith.¹³ During his adolescence, Bonaccorso helped his father Vettorino to complete the monumental bronze doors of the Florentine Baptistery of Saint John. Vettorino was in fact a goldsmith, a founder, and an architect. Bonaccorso was the fourth member of the Ghiberti family to work on the “Gates of Paradise” from 1425, after his grandfather Lorenzo, his uncle Tommaso, and his father.¹⁴ At the age of twenty-three, in December 1474, Bonaccorso finally enrolled in the guild of stonemasons and carpenters with one of his brothers, Lorenzo. Other gunmakers and bronze workers, like the *magister bombardarum* Pasquino di Matteo from Montepulciano, had joined this same *corporazione* during the previous years.¹⁵ The onerous tasks and the virtues of these *maestri di getto* were described by Vannoccio Biringuccio in the sixth book of his *Pirotechnia* in 1540. According to the Siense master, these craftsmen were used to withstanding the heat of furnaces, and strong enough to

¹¹ The Dieci di Balìa, in fact, were not elected until October 1500. For the conflict over the electoral legislation and the complex reform of this office, see: Giorgio Cadoni, *Lotte politiche e riforme istituzionali*, 101–175. For the coexistence and the alternation of the Dieci and the Otto, see: Nicolai Rubinstein, *Il governo di Firenze*, 238–45.

¹² Pamela Long, *The Craft*, 702–707.

¹³ Giuseppe Marchini, *Vittorio Ghiberti architetto*; Maria Grazia Ciardi Dupré dal Poggetto, “Proposte per Vittore Ghiberti.” For Bonaccorso’s interest in the works of Brunelleschi and Vitruvius, see: Scaglia, “Drawing of Machines,” 96–97. His notes on jewelry are in Banco rari 228, in BNF, 1r-2r.

¹⁴ Scaglia, “A Translation of Vitruvius,” 3; Giovanni Gaye, Carteggio inedito, 109.

¹⁵ *Arte dei maestri di pietra e legname*, in ASF, 2, 143r and 140v.

handle the weight of timber, bricks, stones, and metals. Above all, craftsmen had to be diligent, careful, and experienced in drawing, carving wood, and walling up.¹⁶

Bonaccorso would have resembled a chimney sweep, stained with smoke and coal, with a dusty, singed dress, when he crafted his first small, bronze guns – nine *spingarde* – for the Florentine commune in 1479.¹⁷ In those years, along with his father Vettorino, he also produced and repaired bells for the church and the hospital of Santa Maria Nuova.¹⁸ Reported in 1484, it could have been the first commission for the Ghiberti's workshop since 1480, when the foundry "was empty because no work is being done."¹⁹ Bonaccorso wrote down several notes about these castings in the Zibaldone. He illustrated bell scales, molds, furnaces, and various practical methods of achieving different proportions in height, thickness, and width for the production of "beautiful" *buone campane*. Another drawing even showed the technique for welding a cracked bell.²⁰

According to Scaglia, Bonaccorso was also commissioned to produce new firearms for the Florentine army during the campaign in the border region of Lunigiana in 1487. The account books of the Otto di Pratica, however, do not testify his presence in the siege of Sarzana, or his works in the zone behind the front.²¹ Nevertheless, it is likely that Bonaccorso was in the encampment, as at that time he was, in fact, serving the condottiere Gentile Virginio Orsini, who actually fought the Genoese troops that spring. Bonaccorso was the *maestro ingegnere*, the military engineer of this mercenary captain. From 1486 to 1488, he was employed in *munitiones* and *fabricationes*, building new fortifications and casting new bombards.²² Nothing is known of his fortresses, but probably, as well as other contemporary

¹⁶ Biringuccio, *Pirotechnia*, 74v–76v.

¹⁷ Dieci di Balìa, *Debitori e creditori*, in ASF, 22, 17v.

¹⁸ Santa Maria Nuova, in ASF, 40, 154v and 179r.

¹⁹ Catasto, in ASF, 1022, 394r–395r.

²⁰ Banco rari 228, in BNF, 51v, 57rv, 74v, and 75v.

²¹ Scaglia, "A Miscellany of Bronze Works," 485; Dieci di Balìa, *Debitori e creditori*, in ASF, 24; *Ufficiali delle Castella*, in ASF, 29. Even though this last register is now part of the archive of the *Ufficiali delle Castella*, it was originally written for the Otto di Pratica, as clearly stated in its heading.

²² Cornelius Von Fabriczy, *Adriano Fiorentino*, 76. Gentile Virginio Orsini was hired by the Florentine Republic and the Duchy of Milan in 1485 along with three other members of his family, Giulio, Vicinio, and Giampaolo. Their *condotta* is reported in: Dieci di Balìa, *Deliberazioni, condotte e stanziamenti*, in ASF, 30, 114r–118r. For their involvement in the conquest of Sarzana, see: Dieci di Balìa, *Debitori e creditori*, in ASF, 24, 101v–102r. For the Florentine campaign in Lunigiana and the conquest of Pietrasanta and Sarzana, see, instead: Francesco Guicciardini, *Storie fiorentine*, 76–78; Niccolò Machiavelli, *Historie fiorentine*, 218v–221v.

engineers, he was entrusted to construct only temporary defenses, such as terrepleins and *bastioni*, along with carpenters, smiths, and *maestri d'ascia*.

The interest of Bonaccorso in military architecture is also testified by a detailed drawing of the *Torre del Marzocco* in Livorno, probably copied from the original project of the tower. In this sketch, Ghiberti wrote down the thickness of the wall and the position of ammunition dumps, cisterns, and ovens for the garrison. In those years, Bonaccorso may have met three of the most brilliant Tuscan military architects of the late Quattrocento: Francesco di Giovanni, called *Francione*, Giuliano da Sangallo, and Francesco d'Agnolo, also known as *la Cecca*.²³ This variety of works and activities was typical of contemporary engineers. For example, Filippo di Giovanni, called *la Pippa*, was a gunner, a carpenter, and a gunpowder maker. He served the Florentine Republic for more than fifteen years, building bastions, repairing crossbows, manufacturing wooden parts of firearms, following the army in several campaigns, firing guns, and even estimating the saltpeter bought by the Signoria from foreign merchants.²⁴

Also the migration of gunmakers is testified by several contemporary sources. German masters, for example, were hired in Rome during the second half of the century. In 1492, French, Genoese, and Sicilian skilled labor worked together in the Neapolitan foundry of Castel Nuovo.²⁵ And two years before, in Tuscany, even Bonaccorso moved to Piombino. He was hired by the local lord, Jacopo IV Appiano, with a salary of eight golden florins per month. In his *libro di debitori*, Bonaccorso did not specify his duties, but twice noted a trade of copper, the indispensable component of bronze alloy.²⁶ His metal works allowed Bonaccorso to meet the Pratese brothers Zanobi and Tommaso Marinai, two of the most important prospectors of the time. Along with some members of prominent Florentine oligarchic families, Tommaso Marinai was also the owner of the Montecatini copper mine and the iron mine of Volterra.²⁷ Bonaccorso seems to have concluded deals with these brothers during his stay in Piombino: in fact, he lent to Zanobi ten golden florins for two unspecified trades in Corsica and Sardinia.

²³ Banco rari 228, in BNF, 96v; Scaglia, "La «Torre del Marzocco» a Livorno." The contemporary presence of the three architects under the walls of Sarzana is testified in: Dieci di Balìa, *Debitori e creditori*, in ASF, 24, 186v; *Ufficiali delle Castella*, in ASF, 29, 15v.

²⁴ Dieci di Balìa, *Deliberazioni, condotte e stanziamenti*, in ASF, 43, 72v; Dieci di Balìa, *Entrata e uscita*, in ASF, 30, 79v; Dieci di Balìa, *Entrata e uscita*, in ASF, 13, 49r; *Signori e collegi, Condotte e stanziamenti*, in ASF, 17, 45v; Dieci di Balìa, *Debitori e creditori*, in ASF, 24, 63v.

²⁵ Ridella, "Fonditori italiani," 19–20; Knut Schulz, "La migrazione di tecnici," 108–109; Montù, *Storia dell'artiglieria italiana*, 347.

²⁶ *Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti*, in ASII, 13229, 3r–4v

²⁷ For the business of Marinai, see: Guido Pampaloni, "La miniera del rame di Montecatini"; Goldthwaite, *The Economy of Renaissance Florence*, 529.

Although Bonaccorso left the coastal town in August 1491, the contract with Jacopo IV enhanced his reputation as a reliable, expert gunmaker.²⁸ In January 1493, Francesco Cybo, count of Anguillara and Cerveteri, sent Bonaccorso in his castles for inventorying and estimating artillery, ammunitions, and armor. On this occasion, Bonaccorso encountered his former master, Gentile Virginio Orsini, who was in the process of acquiring the counties of Franceschetto.²⁹

Demand and supply of artillery

But, what type of artillery could Bonaccorso have produced, or inventoried, for his masters? In those years, in Pisa, Giovanni *da Auspurch* or *da Uspurghi*, a probable native of the city of Augsburg in Germany, cast one *basilisco* in two pieces, eleven *braccia* long and weighing more than 16,000 *libbre* (a Florentine *libbra* was approximately equal to 340 grams, while a Florentine *braccio* measured 58 centimeters). He also crafted two single-piece, bronze *cortali*, in the foundry of one of the city fortresses, the so-called *cittadella nuova*. In his contract, signed in January 1493, the Otto di Pratica specified each type of his artillery production: *bombarde* (with a shot weight of 400 *libbre* or more), half bombards (200 *libbre* or more), quarter bombards (100 *libbre* or more), eighth bombards (40 *libbre* or more), bombards *da ripari* for castles and city walls (from 15 to 25 *libbre*), *passavolanti*, *cortali*, *basilischi* (100 *libbre*), half *passavolanti*, *cortali*, *basilischi* (from 50 to 100 *libbre*), quarter *passavolanti* (from 25 to 50 *libbre*), *serpentine* (from 5 to 25 *libbre*), and *spingarde* (from 5 to 6 *libbre*).³⁰

Giovanni used exclusively bronze in his workshop, characteristic of ordnance manufacture in the late fifteenth century. Pasquino di Matteo, Damiano di Giovanni, and Brancazio di Guido also realized their guns exclusively with copper and tin in 1478, during the war against Naples, Siena, and Rome. Alberghetto Alberghetti from Ferrara was one of the most important Italian gunmakers, when he made several bronze *spingarde* for Lorenzo de' Medici in 1478 and 1485. Similar firearms were fabricated by Maso di Piero d'Antonio during

²⁸ Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13229, 3v and 4v. In 1490, a Florentine golden florin equaled one hundred and thirty *soldi*, while a Florentine *lira* was worth twenty *soldi*. Nine *soldi* corresponded approximately to the daily rate for unskilled workers during the century. See: Goldthwaite, *La costruzione*, 598; Goldthwaite, *The Economy of Renaissance Florence*, 364.

²⁹ Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13229, 13v.

³⁰ Otto di Pratica, Munizioni, in ASF, 1, 9v; Otto di Pratica, Deliberazioni, partiti, condotte e stanziamenti, in ASF, 96v–97r; Dieci di Ballia, Debitori e creditori, in ASF, 24, 12v; Ufficiali delle Castella, in ASF, 29, 20r, 25v, 29v, 31v, and 33v.

the siege of Pietrasanta in 1484. Another maestro di getto was Giuliano di Mariotto della Nave, who realized a bronze *passavolante*. Even Andrea del Verrocchio was quoted in the sources as a “master” in casting cannons, manufacturing a *bombarda grossa* for Lorenzo de’ Medici in 1484. It was a giant bronze gun of three pieces, weighing more than twenty thousand libbre, and was still in service in 1488. (See appendix 1.) In the last decades of the century, other Florentine masters were also active in the Dalmatian republic of Ragusa.³¹

The fabrication of Florentine artillery was also entrusted to smiths. By the 1430s, Tuscan craftsmen produced dozens of forged iron bombards for the Dieci, and even in this early technological stage the production was diversified. Small firearms of fifteen pounds were put beside guns of hundreds or thousands of libbre. Michele di Jacopo tested cast iron (*ferro colato*) for the making of three single-piece bombards in 1429, while Piero di Tinaccio manufactured a four-barrel bombard, a so-called “organ cannon,” with a thousand libbre of iron.³² During the second half of the century, improvements in gunpowder production permitted several kinds of differentiation of shapes and uses to obtain better results. The pieces listed by Francesco di Giorgio Martini in his treatise of 1478 were actually produced in Florence in the 1480s and 1490s. From the longer to the shorter, they were *basilischi*, *bombarde*, *passavolanti*, *cortane*, *mezzane*, *cerbottane*, *spingarde*, and *mortari*.³³ A particular variety of these guns were the *spingarde* and the *passavolanti a cartoccio*, loaded with both the powder and the shot contained in a sheet of paper, a *foglio reale*.³⁴ Nevertheless, compared with the ordnance of maestri di getto, smiths’ bombards were undoubtedly less strong and less safe. A single-piece cast bronze gun could better contain the explosions generated by larger powder charges, increasing the range of shot and diminishing the risks for gunners.³⁵

³¹ Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 23, 79r; Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 24, 102v, and 175v; Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 30, 240v and 260v; Dieci di balìa, Entrata e uscita, in ASF, 8, cc. 129v e 161v; Dieci di Balìa, Debitori e creditori, in ASF, 22, 17v; Dieci di Balìa, Munizioni, in ASF, 5, 26r. For the travels of Florentine gunmakers, see: Ridella, “Fonditori italiani,” 19.

³² Dieci di Balìa, Munizioni, in ASF, 1, XLr, XLVIIIrv, and 161r.

³³ Francesco di Giorgio Martini, Trattato di architettura, 245–46; Ridella, “Produzione di artiglierie,” 77–92.

³⁴ Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 24, 98v. Biringuccio later described this cartridge in: Biringuccio, *Pirotechnia*, 156r. For a further explanation, see: Angelucci, *Documenti inediti*, 90–91.

³⁵ Panciera, *Il governo delle artiglierie*, 120; Calegari, “La mano sul cannone,” 71–72; Ridella, “La produzione di artiglierie,” 80–85; Biringuccio, *Pirotechnia*, 79r.

The ordnance produced by Florentine masters, therefore, might seem obsolete, considering the contemporary European tendency towards safer, more agile, bronze ordnance. But the Florentine style of artillery was typical of other ordnance in the Italian context. A Sienese bombard in 1478 weighed more than eight tons. Other massive iron and bronze bombards were fabricated in Milan during those decades. One of them, the Galeozesca Vittoriosa, weighed eight tons, three more than Verrocchio's *bombarda grossa* of 1484. The three other Milanese grosse – the *Corona*, the *Bissona*, and the cast iron *Liona* – required nearly 80 carts and 200 pair of oxen for their transportation. According to Mallett, even Venetian gunmakers cast giant pieces during the second half of the century. The Aragonese army was still using a *bombarda grossa* during the recapture of Naples in 1495.³⁶

The assimilation of the French ordnance

Before the French army crossed the Alps in autumn 1494, bronze use was already increasing in Tuscany. By 1452, Maso di Bartolomeo had crafted four heavy bombards with more than 23,000 libbre of copper.³⁷ In 1472, Volterra was besieged with eight bronze pieces.³⁸ And twenty years later, between 1492 and 1493, more than 540,000 libbre of copper were stored in Florentine and Pisan arsenals.³⁹ According to Ciasca, tin and copper were imported from northern Europe, in particular from England and Poland. In the 1480s, the Republic promulgated several laws for increasing the local production and promoting the opening of new mines. Sources throughout the century testify to a reutilization of second-hand metals. Nevertheless, bronze remained one of the most expensive materials. It cost twenty-four *lire* for every hundred *libbre*, while iron cost only seven *lire* for the same quantity. Tin cost forty *lire* every *cento*, and the Otto bought copper for about twenty-nine *lire* and five *soldi* for every hundred *libbre*.⁴⁰

³⁶ See: Angelucci, *Documenti inediti*, 85; Belhoste, "Nascita e sviluppo dell'artiglieria in Europa," 331; Mallett, *L'organizzazione militare di Venezia*, 110–114; Ferraiolo, *Cronaca*, 78. The Milanese ordnance is listed in Carlo Visconti, "Ordine dell'esercito ducale," 470–86.

³⁷ Dieci di Balìa, Debitori e creditori, in ASF, 17, 143v.

³⁸ Balie, in ASF, 34, 28r.

³⁹ Otto di Pratica, Munizioni, in ASF, 1, 21r–40r.

⁴⁰ Importations were suggested by Raffaele Ciasca, *L'arte dei medici e speziali*, 438–440. For the regulation of new mining enterprises, see: Provvisioni, Carte di corredo, in ASF, 26, 113r. The market for second-hand copper is testified in: Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 27, 231v; Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 30, 252v. The prices of these metals

In 1494, however, with the appearance of the infamous artillery of Charles VIII, these materials became indispensable for reaching new standards of excellence in gunnery. The introduction of trunnions and the small size of *canons*, *coulevrines*, and *faulcons* enabled French gunners to fire rapidly. The mobility and the maneuverability of these pieces, along with the use of iron cannonballs, offered many improvements over the heavy, traditional bombards and their stone ammunition.⁴¹ Even if the king did not make his way to Naples thanks to his bronze ordnance, his guns undoubtedly caused fear and astonishment among Italian chroniclers, ambassadors, soldiers, and statesmen.⁴² The great number of pieces, the speed of horses and carriages, and the menacing spectacle of several small, heavy cannons probably impressed witnesses accustomed to the difficult shift of a single, “intractable” bombard. According to Francesco Guicciardini, these firearms were more “diabolic” than “human” devices.⁴³ For these reasons, Charles’s cannons provoked interest and attention: “this French artillery is very good and very effective,” wrote the Dieci di Balìa laconically in March 1495.⁴⁴ For these reasons above all, the military officers of the Republic decided to produce those weapons directly in Florence.

In January 1495, in the center of the city, the Dieci started the construction of a new foundry in the semi-abandoned area of the *Sapienza*, the college projected seventy years earlier by Niccolò da Uzzano for the Florentine university.⁴⁵ Before mid-February, bricklayers and carpenters completed the workshop, digging the casting pit and “walling up” the furnace. The masters of the *Sapienza* received 8,000 *libbre* of copper and 700 *libbre* of tin few days later. In March, the first ever French style cannon produced in Florence was sent to the Pisan encampment.⁴⁶

are repeatedly noted in the bookkeeping of the military offices. See, for example, Dieci di Balìa, *Deliberazioni, condotte e stanziamenti*, in ASF, 30, 240r; Otto di Pratica, *Munizioni*, in ASF, 1, 21r.

⁴¹ Giovanni Santi Mazzini, *La macchina da guerra*, 251–52; David Potter, *Renaissance France at War*, 152–53; Hall, *Weapons and Warfare*, 90–95.

⁴² Simon Pepper, “Castles and Cannon.”

⁴³ Paolo Giovio, *Historie*, 59rv; Bartolomeo Cerretani, *Storia fiorentina*, 203; Biringuccio, *Pirotechnia*, 79rv; Guicciardini, *Storia d’Italia*, 79.

⁴⁴ Dieci di Balìa, *Missive*, in ASF, 32, 79rv: “*Queste artiglierie franzesi sono molte buone et fanno grandi effecti.*”

⁴⁵ Dieci di Balìa, *Munizioni*, in ASF, 5, 17r; Dieci di Balìa, *Deliberazioni, condotte e stanziamenti*, in ASF, 31, 149v. For the history of the college and the events that followed its construction, see: Emanuela Ferretti, “La Sapienza di Niccolò da Uzzano.”

⁴⁶ Dieci di Balìa, *Missive*, in ASF, 32, 79r; Dieci di Balìa, *Munizioni*, in ASF, 5, 15v, 25r, 32r, and 38r; Dieci di Balìa, *Deliberazioni, condotte e stanziamenti*, in ASF, 33, 245r. It is difficult to establish the actual ratio of tin and copper used in those castings. The *maestri* often fabricated their guns with metals

The designers of this bronze *cortaldo a la francese* were maestro Francesco di Bartolomeo Telli and his assistant, maestro Simone di Bronzi. In January, before the opening of the foundry, the Dieci ordered Francesco to reach Castrocaro and join the French gunners and gunmakers that garrisoned the town for observing, measuring, and drawing their cannons. Here, he examined twelve *falconi*, five *cortaldi*, and five *colovrine*. The same task was entrusted to another artisan, Lorenzo di Giovanni, called *Cavaloro*, in April.⁴⁷ The alliance with Charles VIII permitted and encouraged this circulation of ideas and men.⁴⁸ The apprenticeship of Francesco and Lorenzo was extremely successful. Their drawings could have been a sort of guidebook for subsequent casting processes and for the reproduction of French guns.⁴⁹ Basing their efforts on a solid and reliable tradition of bronze working, the assimilation of new techniques and new patterns in Florentine production was about to start. The bronze *cortaldo* demonstrated that the Republic in the 1490s had the makers, the knowledge, and the tools for acquiring innovations and reaching excellent qualitative levels in gun production.

The market for the new French cannons thrived immediately. In February 1495 a Pistoiese merchant offered several models of these guns to the Dieci.⁵⁰

Here is a man who has beautiful models for making various kind of guns. He has acquired them from some Frenchmen. These models are perfect for crafting bombards, passavolanti, mortars and other pieces. They are fourteen or fifteen pieces. We could buy them for a reasonable price. I exhort your lordships to search for this man, and your lordships could see these models and grasp if they are just what you need. I think so.

that they already had in the workshop, and these libbre were not computed by officials. Moreover, and very often, they did not cast all the material that they received from the Commune.

⁴⁷ Dieci di Balla, Missive, in ASF, 31, 81r; Dieci di Balla, Responsive, in ASF, 38, 45r; Dieci di Balla, Entrata e uscita, in ASF, 12, 17v, and 103v. For the number of the French cannons, see: Marino Sanuto, *La spedizione*, 127.

⁴⁸ A treaty between the Florentine Republic and the king of France was signed in November 1494: Piero Parenti, *Storia fiorentina*, 141–44; Luca Landucci, *Diario fiorentino*, 86; Cerretani, *Storia fiorentina*, 219.

⁴⁹ For the importance of drawings in the transmission of knowledge, see: Donata Degrassi, “La trasmissione dei saperi,” 82–83; Biringuccio, *Pirotechnia*, 76r; Wolfgang Lefèvre, *Picturing Machines*.

⁵⁰ Dieci di Balla, Responsive, in ASF, 38, 244r: “*qui ci è uno che ha modelli bellissimi da fare artiglierie di più ragioni, che dice haverli havuti da certi franciosi. Sono ingegni perfectissimi da bombarde, passavolanti, mortai et altre artiglierie, circa quattordici o quindici capi. Harebonsi con picholo prezzo, che stimo stare bene. Conforto vostre signorie, parendo nondimeno a quelle et non altrimenti, mandare per costui che le ha, et vostre signorie le potranno vedere et intendere se sono il bisogno, che stimo di sì, et quando così sia usarli qualche gentilezza et torli da lui.*”

In May, even the Pisan rebels could manufacture five *passavolanti all'usanza di Franza*, “beautiful and furious things.”⁵¹ French technology spread rapidly across the whole of Italy. In November 1495, iron cannonballs were made in the Neapolitan arsenal “for the first time ever,” probably by Milanese masters. In Venice, an engineer who served with Charles VIII, Basilio della Scola, started the production of new ordnance in May 1496. The duke of Ferrara, Ercole d’Este, built ironworks, furnaces, and warehouses in Fornovolasco between 1496 and 1497, hiring Lombard artisans for fabricating shot and artillery.⁵² In Florence, the casting work in the *Sapienza* continued incessantly during the spring and the autumn of 1495. In May, a Picard gunner, Pierre from Douai, was invited to work in the foundry, but he failed in casting a *cortaldo*. Francesco Telli, instead, supplied the army with several *spingarde* and *passavolanti ala francese*, that is, falcons and culverins. In August, his first furnace was rebuilt, and, a few weeks later, a second foundry was fully operational in the same area. In the following months, the Dieci decided also to open new workshops in two of their most important border fortresses, both entrusted to their Florentine masters. *Cavaloro* was sent in Firenzuola to complete several unfinished *passavolanti*, while Francesco Telli reached the citadel of Volterra, where a new *fornello* was made for *li getti del bronzo*.⁵³

Initially, however, the manufacture of the new single-piece bronze cannons coexisted with the production of the traditional ordnance. In July 1496, Baldassarre di Giovanni, a smith, still fabricated an iron *bombarda*, two iron *passavolanti*, and several iron *spingarde*. He was undoubtedly the most important partner of the Dieci di Balìa for supplying iron, ammunitions, and portable guns such as *scoppietti* and *archibugi*.⁵⁴ But, alongside Baldassarre, the *maestri di getto* also continued to craft artillery with old methods and old shapes. In May 1496 Lorenzo di Giovanni and his workmate, Ludovico di Guglielmo, created a giant bombard of three pieces with nearly 17,000 *libbre* of cast bronze. Francesco Telli was still casting many breech sections

⁵¹ Giovanni Portoveneri, “Memoriale,” 307.

⁵² Ferraiolo, Cronaca, 81; Sanudo, *I diarii*, vol. 1, 146; Domenico Malipiero, “Annali veneti,” 562. For the development of the Ferrarese ordnance, see Calegari, “La mano sul cannone.”

⁵³ For the works and the movements of Francesco Telli, see: Dieci di Balìa, Munizioni, in ASF, 5, 48r, 57v, 295r, and 307r; Dieci di Balìa, Entrata e uscita, in ASF, 14, 134v, 168v, and 304v; Dieci di Balìa, Entrata e uscita, in ASF, 15, 288v; Dieci di Balìa, Entrata e uscita, in ASF, 17, 238r; Dieci di Balìa, Debitori e creditori, in ASF, 26, 82v; Dieci di Balìa, Debitori e creditori, in ASF, 34, 19v.

⁵⁴ Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 42, 129r–132r; Dieci di Balìa, Munizioni, in ASF, 5, 3r–65r; Dieci di Balìa, Munizioni, in ASF, 6, 107v and 141v; Dieci di Balìa, Entrata e uscita, in ASF, 15, 262v; Dieci di Balìa, Debitori e creditori, in ASF, 28, 76v–77r. These collaborations would have been fruitful for Baldassarre: according to his statement of income, he owned six houses and three pieces of land by the end of the century. Decima repubblicana, in ASF, 16, 204r–205r.

for his *passavolanti*, along with new single-piece *cortaldi*. In March 1496 he produced a *bombarda di dua pezi* decorated with the coat of arms of the Commune. A similar gun was cast one year later in Volterra.⁵⁵

Only in the first half of 1498 did the Florentine masters seem to fully abandon the *artillerie italiane* for the French style. The change was probably due to the wartime increase in demand. In this year, the Republic took the offensive against Pisan rebels, with the help of the Duke of Milan. Ludovico Sforza supplied his Florentine allies with 10,000 golden florins and about 30,000 *libbre* of raw saltpeter.⁵⁶ Moreover, the new captain, Paolo Vitelli, had experience with the French ordnance at the time of his service with the French army in the kingdom of Naples between 1495 and 1496. During his command, he frequently requested new bronze cannons, tons of powder, and iron cannonballs, and he personally owned twelve bronze *falconetti* in his stronghold of Città di Castello, which he would have used for seizing Buti and Vico Pisano.⁵⁷

Meanwhile in Florence, the Dieci began to repair several furnaces under the supervision of one of the captain's secretaries. The *fornello* of the Sapienza was rebuilt. A new foundry for maestro Telli was also previously constructed near the arsenal of the tower of *Notomia*, in the eastern section of city walls, on the north side of the Arno. The officers also hired new gunpowder makers and widened their workshop, sited on the opposite bank of the river, in the vicinity of the city gate of San Niccolò. Between July and September Francesco Telli cast 12,000 *libbre* of bronze, manufacturing ten *falconetti* and three *cannoni* of different forms. The same number of cannons was crafted by Lorenzo di Giovanni and his workmate.⁵⁸ (See appendix 2.)

When the Venetian army invaded the Tuscan region of Casentino in the autumn of 1498, the Florentine artillery was very different compared to the past. New portable firearms, the *archibugi*, were replacing the old *scoppietti*, and the encampment was supplied only with the

⁵⁵ The *bombarda di tre pezzi* is reported in Dieci di Balìa, *Deliberazioni, condotte e stanziamenti*, in ASF, 34, 212r; Dieci di Balìa, *Munizioni*, in ASF, 5, 173r. For the cannons of maestro Telli, see: Dieci di Balìa, *Entrata e uscita*, in ASF, 17, 221v; Dieci di Balìa, *Munizioni*, in ASF, 5, 136v, and 178r.

⁵⁶ Dieci di Balìa, *Entrata e uscita*, in ASF, 30, 1r; Dieci di Balìa, *Munizioni*, in ASF, 7, 511v.

⁵⁷ Dieci di Balìa, *Deliberazioni, condotte e stanziamenti*, in ASF, 33, 117r; Dieci di Balìa, *Missive*, in ASF, 59, 90v; Dieci di Balìa, *Missive*, in ASF, 60, 101r. For the career of Paolo Vitelli, see: Claudio Rendina, *I capitani*, 450; Giuliano Passero, *Giornali*, 104; Giuseppe Nicasi, "La famiglia Vitelli," 366.

⁵⁸ Dieci di Balìa, *Munizioni*, in ASF, 7, 390r; Dieci di Balìa, *Entrata e uscita*, in ASF, 23, 23v, and 241v. The accounts of both masters were kept in Dieci di Balìa, *Munizioni*, in ASF, 7, 367v, 387v, 427v, and 508v. For the tower of Notomia and its foundry, see: Dieci di Balìa, *Entrata e uscita*, in ASF, 13, 156v–160v; Dieci di Balìa, *Debitori e creditori*, in ASF, 32, 173v–207v; Dieci di Balìa, *Munizioni*, in ASF, 7, 352r, and 362v.

new ordnance: four *cannoni grossi alla francese* and *their carri grossi nuovi a dua ruote fornite*, two *cortaldi* and two *passavolanti*, one *falconetto grosso a facce di bronzo d'un pezzo*, another *falconetto tondo di bronzo a camera*, and the other eight *falconetti*.⁵⁹ Even the terminology changed: according to the French custom, the word "*cannone*" no longer indicated only the breech chamber of the gun, but the whole artillery piece.⁶⁰

According to the Pisan chronicler Giovanni Portoveneri, in 1499 the Florentine army besieged his city with eighty guns.⁶¹

The Florentine army numbered about fifteen thousand men between infantry and cavalry. They carried also eighty guns. There were fifty pieces between *passavolanti* and *cortaldi*, mounted on carts, and seven heavy bombards. Florentine gunners fired about two hundred shot per hour on the wall and in the city. The entire world seemed to be getting destroyed.

This source, as well as many others, shows that the demands of actual combat compelled soldiers and rulers to use both "old" and "new" models. Even if the Florentine masters had produced only French cannons, in fact, all manner of weapons were pressed into service, irrespective of their quality, metal, or mobility. Technical innovations were also combined with traditional machines. Several falcons were equipped with a separate breech like old *spingarde*. And in the same way, in those months Louis XII seized Lombard castles with three bombards of his Piedmontese allies, along with thirty-six pieces of the royal artillery.⁶²

For the campaign of 1498 the Dieci also rented and purchased many new carts, *carrette alla francese*. These were equipped with a box for powder and cannonballs, and were extraordinary useful for moving light pieces, the *artiglierie minute*, such as *falconetti*. Their two wheels, above all, were moved by fast horses, instead of the slow oxen traditionally used in the transportation of heavy guns. The reduction in weight and size in bronze artillery, in any case, permitted additional improvements. A *cannone* could reach the impervious mountain of Casentino from Florence in ten days only, accompanied by only eight carters (*carradori*) and

⁵⁹ Dieci di Ballia, Munizioni, in ASF, 5, 3r–65r; Dieci di Ballia, Munizioni, in ASF, 6, 1v–4r, 142v, and 224r.

⁶⁰ Santi Mazzini, *La macchina da guerra*, 252.

⁶¹ Portoveneri, "Memoriale," 341–42: "*erano circa persone quindicimila tra piè e a cavallo, e avevano recato per anco ottanta boche d'artiglierie, che ve n'era tra passavolanti e cortali boche cinquanta in carete, e bombarde grosse sulle culatte, boche sette, in modo che tiravano circa colpi dugento per ora tra nelle mura e per la tera, che pareva che el mondo si disfacesse.*"

⁶² Sanuto, *I diarii*, vol. 2, 1104.

eight pairs of oxen. In the preceding decades thirteen men, twenty-six oxen, and four carts were necessary to the ground transit of a giant, iron bombard from Arezzo to Anghiari.⁶³

The “beautiful cannons” of Bonaccorso Ghiberti

In the first decade of the sixteenth century, besides, the Dieci decided to foster the production by hiring masters from the Alpine regions of Piedmont and Lombardy. Giovanni Antonio from Novara, for example, arrived in Florence in 1502. Bernardino from Milan, instead, worked in Castrocaro before moving to the foundry of the Sapienza, to Volterra, to Libbrafratta, and to Livorno. In the workshop of this port in 1506, the Milanese master crafted six *mezzani*, two *colovrine*, fourteen *falconetti*, a *passavolante* for the ravelin of the *fortezza nuova di mare*, and a *bombarda* for a small galley. Moreover, he cast 692 *scoppietti* for the Florentine, Machiavellian militia in 1510.⁶⁴

Alongside Bernardino, Giovanni Antonio, and the other maestri di getto, Bonaccorso Ghiberti also contributed to the development of Florentine artillery. When he began to write his *libro di ricordanze* in 1496, he had already returned in Florence. After the death of his father Vettorino in November of the same year, Bonaccorso inherited a third of a farm in Settimo and, in the capital, a third of the family house in the street of *borgo Allegri*, and an apothecary workshop in the *canto alle paglie*. Above all, Bonaccorso took full ownership of the foundry of his father and his grandfather, which included the tools for casting and engineering, blacksmith’s instruments, and also the drawings and the books of Lorenzo Ghiberti.

Bonaccorso notes proudly (and repeatedly) that it was the bottega “in which the bronze gates of San Giovanni of Florence were made.”⁶⁵ In March 1497 he began to live in his workshop, in the rooms near the facilities for bronze casting. The foundry – “the *portico* where the furnace is” – was next to the church of Santa Maria Nuova, in the old street of San Gilio.

In January 1497 Bonaccorso walled up a new reverberatory furnace with the help of three bricklayers. The bricks, baked or mud, cost fourteen lire. According to Biringuccio, this

⁶³ Dieci di Balìa, Entrata e uscita, in ASF, 30, 69r–90r; Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 27, 222rv; Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 47, 13r; Dieci di Balìa, Munizioni, in ASF, 7, 356r, 364v, and 366r; Dieci di Balìa, Entrata e uscita, in ASF, 30, 72r.

⁶⁴ Dieci di Balìa, Munizioni, in ASF, 8, 127v, 161v–162r; Dieci di Balìa, Munizioni, in ASF, 9, 180rv; Dieci di Balìa, Munizioni, in ASF, 10, 172r, and 174r.

⁶⁵ Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 6v–14v. For the inheritance of Lorenzo and Vettorino Ghiberti, and for the property disputes between Bonaccorso and his half-brothers Francesco and Cione, see: Krautheimer-Hess, “More Ghibertiana,” 307–311.

fornello di riverberazione was “powerful” and necessary for the principal castings, the *gran getti* of statues, bells, and artillery pieces.⁶⁶ In the Zibaldone, Bonaccorso illustrated several different *fornelli*. For example, he depicted a furnace with a water wheel used for smelting soft ores in the vicinity of mines or for assaying the metals. Another one was used by glassmakers. Above all, Bonaccorso showed two *fornelli* used in casting and in remelting bronze: the first had an oval hearth and the second was round, with two fire boxes.⁶⁷ It is likely that similar types of furnaces were placed in the *scrittoio*.

A new furnace was necessary, as in the preceding months the Dieci di Balìa commissioned Bonaccorso to cast new cannons for the Republic. In April he made two small, bronze *passavolanti ala francese* of nearly 3,000 *libbre*. But, like Telli and Cavaloro, he also crafted an old-style *bombarda grossa* in two pieces, weighing more than 12,000 *libbre*, following his casting method. The muzzle of a bombard had to be seven and a half shots in length, and a sixth of the diameter of its projectile in thickness. The side of the breech, instead, had to measure a quarter of the bore; its bottom, a third. The empty space of the chamber, a little bit more than a half. The expense for the fuel and the alder wood for casting amounted to 50 lire. The four wheels of the *carro della bombarda*, besides, cost almost 200 lire, and 76 lire were spent on the laying and aiming systems and the shaft of the carriage. The Dieci owed Bonaccorso 182 florins *di grossi* for these three firearms: the price was fixed, as usual, at 10 florins *di grossi* every hundred *libbre* of cast bronze. The cost of pieces weighing less than 1,000 *libbre*, such as *falconetti* and *spingarde*, was set at 80 *lire* for the same quantity of metal. These were the typical salaries of a Florentine *maestro di getto*, the earnings from his work, his *magistero*.⁶⁸

One year later the *sottoprovveditore*, Manno degli Albizi, was still providing Bonaccorso with 8,000 *libbre* of copper and 800 *libbre* of tin. The contribution of military officers, in fact, was not merely monetary. They periodically provided *maestri* with these metals and other raw

⁶⁶ Biringuccio, *Pirotechnia*, 101v–104r.

⁶⁷ Banco rari 228, in BNF, 75r, 82r, and 83r. These and other furnaces are described in Biringuccio, *Pirotechnia*, 101v–106v.

⁶⁸ Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 16v; Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13229, 24v; Dieci di Balìa, Entrata e uscita, in ASF, 15, 301v; Dieci di Balìa, Debitori e creditori, in ASF, 28, 20r; Dieci di Balìa, Debitori e creditori, in ASF, 32, 52v. The payments for the masters' *manifattura* are reported in Dieci di Balìa, Munizioni, in ASF, 5, 181rv; Dieci di Balìa, Munizioni, in ASF, 7, 318r, and 508v; Banco rari 228, in BNF, 91v: “*La tromba de le bombarde vole essere lungha senza el chanone sette palottole e mezza [...]. El vano del chanone vole essere uno pocho più che la metà del vano de la tromba. La grosseza del bronzo del chanone vole essere la metà del voto. Vole avere grosso el fondo un terzo.*”

materials, subtracting their cost from the price of the end product. And, with these *stagno* and *rame*, Bonaccorso produced two single-piece *passavolanti* in July 1497.⁶⁹ In August he left his hometown and moved again to Piombino. He remained here until December, along with Raffaello di Monna Venere, a carpenter who helped him “with the bombards.”⁷⁰

As for the other masters, 1498 was the most “revolutionary” year in the gunmaking career of Bonaccorso. His ordnance, too, seems to have adapted to the French design. In April he received a new commission by the military officers “to cast artillery and complete some molds.” Three months later the Dieci delivered to their maestro 8,000 *libbre* of copper and 1,000 *libbre* of tin. With this raw material, Bonaccorso produced three French-style bronze guns: a *cortaldo overo bombardella*, a *cannone overo passavolante* with a shot weight of fifty *libbre* of iron, and a small *cannone a uso di candeliere*. This undefined terminology revealed the coexistence of new (*cortaldo*, *cannone*) and traditional (*bombardella*, *passavolante*) names during the process of adaptation and innovation. In any case, significantly, Bonaccorso’s notes in the Zibaldone included a reference to French methods of casting artillery, related to the diameter of the shot.⁷¹

A chortaldo or passavolante will weigh about five thousand libbre, if it has a bore diameter of a third or a quarter of braccio, a length of six and a third braccia [...], and a rear part thick as two shot. Another chortaldo or passavolante will weigh about six thousand libbre, if it has a length of six braccia, and if it fires eighty libbre of lead [...]. French gunmakers are accustomed to cast the breech of their passavolanti three shot thick, that is, one for empty space and two for bronze, that is, every side of the chamber as much thick as the gap. This is their own way to craft guns with a shot weight of ten libbre of lead, or less. And for the pieces with a shot weight of thirty, or forty, or fifty libbre of lead, they made these sides two and half shot thick.

⁶⁹ Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 15r; Dieci di Balìa, Debitori e creditori, in ASF, 32, 207v.

⁷⁰ Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 16rv.

⁷¹ Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 19r. The reference is in Banco rari 228, in BNF, 87v–88r: “Uno chortaldo overo passavolante che el vano sia tra un terzo e un quarto, e lungho braccia sei e un terzo, pesserà circha di libre cinquemila tutta [...], faciendola grossa drieto dua palottole [...]. Un altro cortaldo overo passavolante che sia lungho braccia sei e che gietti ottanta libre di piombo pesserà circha a semila libbre [...]. E’ franzesi usano fare grosse le loro passavolanti drieto el netto, cioè ‘l sodo senza la chornice tre palottole, cioè una al vuoto e dua al bronzo, cioè tanto grosso el bronzo da ongni lato quanto el vano. E quello fano a quele che gettano insino in dieci libbre di piombo. E quelle che gettano da trenta a quaranta o a cinquanta libbre di piombo fanno grosse drieto tutto el netto di fuori dua palottole e mezo o pocho più.”

Several sketches of his notebook almost certainly depict the guns that Bonaccorso produced in that summer: single-piece, bronze, light cannoni, mounted on carts equipped with two spoke wheels, tailpieces, and different gun laying systems. Various notes were about the proportions and the measurements of cannons, or the calculation of the weight of a piece according to length, or the earth used on the molds of ordnance. Bonaccorso wrote down even some tricks to break a cannon with molten metal, or to disengage the nut and screw of an overheated bombard. A couple of figures were also dedicated to handguns and mortars. But these drawings, above all, illustrate Bonaccorso's curiosity about the innovation. They showed the development of his artillery, from the giant bombards to the bronze cortaldi, from the copy of Valturio's obsolete firearms to the assimilation of French technology.⁷²

Between August and September the Dieci gave another thousand libbre of metal to Bonaccorso. Moreover, they ordered him to build a new furnace in his workshop for "an easier and better melting," *perché possi fare i getti migliori et più comodamente*. This *fornace* in via della Pergola cost thirty-two *lire* and eight *soldi*. It was a useful improvement for Bonaccorso, who rapidly manufactured a falconetto and another beautiful cannon, decorated with heads of lions and "old-fashioned" ornaments: "on September 22, 1498, I have tried and I have handed to the Dieci a French-fashioned, bronze cannon with lion heads on the trunnions and classical ornaments on the muzzle." A third gun, six and half *braccia* long and with a shot weight of fifty *libbre* of iron, was produced in November. At this time, the credit of Bonaccorso with the Dieci amounted to 293 florins *di grossi*. With 30,000 *libbre* of bronze, he had made one *cortaldo*, four *cannoni*, and a *falconetto*⁷³.

⁷² Banco rari 228, in BNF, 55v, and 82r–94v; Scaglia, "A Miscellany of Bronze Works," 492–93 and 498–513; Bertrand Gille, *Leonardo e gli ingegneri del Rinascimento*, 116. Even Leonardo da Vinci, in two plates of his Codex Atlanticus, illustrated this development, sketching *cannoni vecchi* next to *cannoni francesi* and *colovrine*. Ridella, "L'evoluzione strutturale," 20–22.

⁷³ Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13229, 25v; Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 23r–26r; Dieci di Balìa, Munizioni, in ASF, 7, 390r, 427v, 478r, and 488r; Dieci di Balìa, Entrata e uscita, in ASF, 23, 242r. Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 25r: "*ricordo come a dì 22 di settembre 1498 io detti e provai a' X un chanone di bronzo a la francese chon teste di lioni ne' piloni overo ne' manichi chon fregi a l'anticha. E a dì 23 lo pesorono e dissono ch'è pessato netto libre seimila ducento.*"

Casting guns, casting shot

However, cannons and harquebuses were useless without shot. Stone was still in use for the iron bombards. The major quarry was sited near the gorge of Golfolina. Here, in 1499, Simone di Tommaso del Pollaiuolo, also known as *il Cronaca*, crafted 1,005 stone shot for supplying the army during the siege of Pisa. Lead was adopted in large quantities for the making of little bullets, mainly for the small calibers of *scoppietti*, *archibugi*, *spingarde*, and *passavolanti*. The metal was “cut,” melted, and cast into *pallottole*. In 1495 more than 15,000 *pallottole di piombo da passavolanti* were stored in the arsenal of Parte Guelfa. During the spring of 1498 the *provveditore* of the Florentine encampment counted about 500 lead shot for *archibugi* and *spingarde*, and more than 1,000 for *passavolanti*, *falconetti*, and *cortaldi*. In 1499 cast lead was even used for “covering” two stone shot.⁷⁴ The practice was unusual in Florentine warfare, but at that time metal shot was becoming the new standard. The innovation of the French cast bronze ordnance was in fact accompanied by the introduction of cast iron shot. They were cheap and easily reproducible, with better performances than the traditional stone ammunition.⁷⁵

According to contemporary chroniclers, those cannonballs were totally unknown to Italian warfare. However, as with the guns, Florentine masters assimilated the new technology immediately. Tommaso Marinai was commissioned to cast bronze molds for the shot in March 1495. Other molds were made by Giuliano d’Andrea, a stonecutter. The production, managed by Tommaso himself, started in the ironwork of Colle Val d’Elsa in the first months of 1495. In May more than one hundred *pallottole di ferro colate* were sent to the Florentine encampment at a cost of 135 lire. Three years later, Florentine gunners had approximately available the same quantity of projectiles. However, the necessities of the campaigns in Pisan contado and in Casentino, and the increasing number of bronze cannons, compelled the Dieci

⁷⁴ Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 27, 226r; Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 31, 148v; Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 34, 209r; Dieci di Balìa, Munizioni, in ASF, 6, 229r–233r; Dieci di Balìa, Entrata e uscita, in ASF, 30, 135v, and 192r; Dieci di Balìa, Missive, in ASF, 31, 123v.

⁷⁵ This innovation has been analyzed by: Calegari, “La mano sul cannone,” 64–65; Hall, *Weapons and Warfare*, 93–94; Ridella, “Produzione di artiglierie,” 85. For contemporary descriptions and impressions, see: Guicciardini, *Storia d’Italia*, 78; Ferraiuolo, *Cronaca*, 81; Biringuccio, *Pirotechnia*, 117v.

to accelerate the production. In July 1498 the Dieci signed a contract with a Lombard master and a Florentine merchant for a furniture of a thousand projectiles.⁷⁶

I remember that today, on July 21, 1498, we have made a bargain with Agniolo di Filippo from Brescia and Baldo di Giovanni from Careggi for cast iron shot, weighing up to fifty *libbre* each, according to the model. We will pay 13 *lire* for every hundred *libbre* of metal, and Agniolo and Baldo have to hand two hundred cannonballs by the fifth of August and three hundred by the tenth of the same month. They have to bring the shot in Signa at their expense, except the custom duties of our territory.

Agniolo and Baldo delivered about 400 shot between August and October, earning more than 2,000 *lire*. At the same time, the military officers received hundreds of iron cannonballs from Castrocaro. They also hired three masters, Giovanni di Piero from Piedmont, Antonio di Giovanni from Germany, and Lancillotto di Voglino for casting iron shot in Pistoia. The price was fixed at thirteen *lire* for every hundred *libbre* of shot. Their *condotta* made provision also for the manufacture of *scoppietti*, *archibusi*, and *spingarde*. In February Giovanni, Antonio, and Lancillotto received 244 *lire* for forty-five *palle grosse da cannoni* and four *palle piccole da passavolante*.⁷⁷ But despite these efforts, and despite the growth of the market in cannonballs, the army still had insufficient ammunition.

In the summer of 1499 the Signoria tried its best to solve the problem of the “necessary and indispensable” shot. New *pallottole* were made with stone and lead, but after the taking of Cascina, captain Paolo Vitelli expressly requested iron cannonballs for knocking down the walls of Pisa. In July the ambassador in Venice requested *balote* from the Most Serene Republic. The officials sent also an intermediary in Brescia, Mantova, and Bologna for acquiring 300 projectiles. The marquis of Ferrara, Ercole d’Este, was asked to lend 200 shot. The Florentine agent in Lucca, Francesco Spina, bought 465 cast *palle di ferro* and many forged

⁷⁶ Dieci di Balìa, Munizioni, in ASF, 5, 37r; Dieci di Balìa, Munizioni, in ASF, 6, 231v–233r; Dieci, Entrata e uscita, in ASF, 14, 10v; Dieci di Balìa, Missive, in ASF, 32, 96r. Dieci di Balìa, Munizioni, in ASF, 7, 355rv, and 457v: “*richordo oggi questo dì XXI di luglio 1498 chome abbiamo fatto merchato chon Angniolo di messer Filippo da Brescia e chon Baldo di Giovanni da Chareggi di palle di ferro cholato di libre 50 in circha l’una, sechondo il modello, e di nostro a L. 13 per il cento di libre, portate al porto a Signa a ongni loro spesa salvo le gabelle del nostro territorio, i quali ci debbono dare in detto porto palle 200 per tutto dì V d’agosto prossimo a venire e palle 300 per tutto dì X detto, e volendone noi di poi insino alla somma di 1000 sia a nostro piacimento.*”

⁷⁷ Dieci di Balìa, Entrata e uscita, in ASF, 23, 542r; Dieci di Balìa, Entrata e uscita, in ASF, 30, 110r; Dieci di Balìa, Munizioni, in ASF, 7, 353r–386v.

palle fatte a maglio, for about 400 golden florins.⁷⁸ Moreover, the captains of Arezzo and Cortona were ordered to send *ferramenti vecchi* and other scrap iron towards the capital. Nineteen thousand libbre of those *rottami di ferro* were collected and dispatched to an ironwork in Colle Val d'Elsa. The conversion and the rent of this foundry – an *edificio del ferro* – cost 127 lire, and the price of the fifty wooden *palle* for the molds was 8 lire. The production was entrusted to two charcoal-burners and to maestro Simone d'Andrea from Romena, a mountain village sited in the vicinity of several ironworks in Casentino. From July to September, Simone cast 394 shot of various sorts, weighing a total of 14,000 libbre.⁷⁹

At the same time, Lancillotto di Voglino and his workmates were given more than 21,000 libbre of scrap iron, but they could manufacture only 163 *palle*. By the end of July, in fact, their furnace did not work perfectly but with, they reported, *qualche difficoltà*.⁸⁰ The Signori sent maestro Francesco Telli to repair the malfunctioning *fornello*, and a few days later Bonaccorso Ghiberti also moved to Pistoia.⁸¹

On July 20, 1499, the Signoria of Florence sent me to Pistoia to craft iron cannonballs for the siege of Pisa. On July, 24, the Signoria sent to my workshop Giovanni d'Aspurgo, and commissioned him to cast bronze shot for the cannons, because they could not have the iron ones.

This confirms the report of Piero Parenti, who wrote that the army was provided with “expensive” cast bronze cannonballs for lack of iron ones. Their hurried production mobilized every gunmaker and every bellfounder of Florence. The masters were Giovanni of Augsburg, Francesco Telli, Lorenzo Cavaloro, Ludovico orafo, and Bonaccorso Ghiberti, along with three *campanai*, Jacopo Pintegli, Giovanni Antonio *orafo*, and Damiano. Some of these craftsmen

⁷⁸ Signori, Missive seconda cancelleria, in ASF, 21, 29v, 41r, 52r, and 55v; Signori e collegi, Condotte e stanziamenti, in ASF, 17, 21v; Dieci di Balìa, Missive, in ASF, 60, 74r; Dieci di Balìa, Entrata e uscita, in ASF, 26, 320r; Dieci di Balìa, Entrata e uscita, in ASF, 30, 146v, 164r, 175r, and 192r. The Venetian negotiation is reported also in Sanuto, *I diarii*, vol. 2, 896.

⁷⁹ Consulte e pratiche, in ASF, 65, 61r; Dieci di Balìa, Entrata e uscita, in ASF, 26, 320v–321r; Dieci di Balìa, Entrata e uscita, in ASF, 30, 161v; Signori e collegi, Condotte e stanziamenti, in ASF, 17, 32r, 34v, and 37v. For the *ferriere* of Casentino, see: Andrea Barlucchi, “La lavorazione del ferro,” 175–78.

⁸⁰ Dieci di Balìa, Entrata e uscita, in ASF, 30, 169r and 199r; Signori, Missive seconda cancelleria, in ASF, 21, 47v; Signori e collegi, Condotte e stanziamenti, in ASF, 18, 4v.

⁸¹ Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13229, 26r: “a dì venti di luglio 1499 la Signoria di Firenze mi mandò a Pistoia per fare fare palottole di ferro per tirare chon chanoni in Pisa, e a dì ventiquattro mi mandorono in bottegha mia da Santa Maria Nuova uno maestro Giovanni d'Aspurgho maestro di gietti perché lui gittassi loro palottole di bronzo per chanoni perché non vedevano modo di poterle avere di fero.”

were ordered to build new furnaces. Officials paid in advance for bricks, charcoal, and timber. As usual, the maestri were provided with copper collected from the two Florentine arsenals of Giustizia and Parte Guelfa, and with 5,000 *libbre* of old, used copper arrived from the castle of Firenzuola. The Signori also acquired 15,000 *libbre* of copper, 3,000 *libbre* of tin and 11,000 *libbre* of brass from Matteo Strozzi. Bonaccorso, moreover, received several “rotten” cannons.⁸²

Bonaccorso, in his account books, complained about the whole situation. According to his notes, the military officers “expropriated” his foundry during his stay in Pistoia and ordered Giovanni of Augsburg to use the furnace for casting bronze shot. However, the German master left the *scrittoio* for the encampment after only two days. By the end of July, Bonaccorso was recalled in Florence and was required to finish the work. Considering the poor quality of the metals and the large quantity of *materia triste* and burnt bronze, Bonaccorso initially refused, but his attitude was soon mitigated by the promise of a large payment. In the first twelve days of August, Bonaccorso manufactured 364 *palottole di bronzo* weighing 19,000 *libbre*. His credit account amounted to 191 florins *di grossi*. Four of these projectiles were handed to two goldsmiths, Andrea di Pasquino and Paolo Soglianni, that the Signori had commissioned to engrave an inscription, *per tirarle in Pisa dorate e con uno motto*, for the purpose of deriding the besieged Pisans.⁸³

Within two weeks, Florentine maestri crafted 689 bronze shot, earning more than 300 florins *di grossi*. Nevertheless, despite the expensive efforts of officials and artisans, the siege of Pisa ended with a resounding, disastrous failure. The Florentine artillery knocked down about fifty *braccia* – nearly thirty meters – of the Pisan walls, but the captain Paolo Vitelli refused to assault the breach. In October the condottiere was captured, charged with treason and rebellion, and then beheaded on the roof of the Palazzo dei Priori.⁸⁴ In any case, in autumn 1499 only 100 *palle di bronzo da cannone* remained in Florentine warehouses, but

⁸² Parenti, *Storia fiorentina*, 280; Signori, Missive seconda cancelleria, in ASF, 21, 52v; Dieci di Balìa, Entrata e uscita, in ASF, 30, 168v, 169v, 170v–174r, 195v–197v, and 212v; Signori e collegi, Condotte e stanziamenti, in ASF, 17, 86r.

⁸³ Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13229, 50v and 51r; Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 33v–35r; Dieci di Balìa, Entrata e uscita, in ASF, 30, 170v–173r, and 179v; see also Anonymous, “La guerra del Millecinquecento,” 367.

⁸⁴ The Pisan campaign of 1499 has been described by: Landucci, *Diario fiorentino*, 198–203; Portovenieri, “Memoriale,” 341–49; Parenti, *Storia fiorentina*, 281–306; Bartolomeo Masi, *Ricordanze*, 43–45.

these cannonballs were not used for a second time. In 1503, they were handed to maestro Giovannantonio da Novara as “raw material” for manufacturing a new cannon.⁸⁵

In the following years, the Signori hired new experts in casting iron shot. In May 1500 Giovanni di Comino dei Fusti, native of Brescia, was at work in his *ferriera* in the territory of the Sienese Republic. Through the podestà of Barga, they also contacted a master of the Estense ironwork of Fornovolasco. In Florence, Francesco Telli continued to craft lead shot for bronze firearms.⁸⁶ By 1507 the Republic no longer suffered a cannonball shortage. According to a contemporary register of munizioni, thousands and thousands of iron shot were fabricated in Florentine Tuscany at that time.⁸⁷

The Dieci di Balìa also encouraged the production of hollow iron spheres, necessary for the production of incendiary missiles, the so-called *fuochi lavorati*. In 1505 the officials invested more than 500 lire in a new foundry in the area of the Sapienza, managed by Jacopo di Francesco dell’Opera and Andrea di Jacopo from Colle Val d’Elsa. The shells of *fuochi lavorati* were usually filled with “black” and “Greek” pitch, oil, sulfur, paint, turpentine, saltpeter, verdigris, cotton wool, tow, twine, and wax, and they were usually made by engineers and gunpowder makers. In 1499 the Florentine *maestri di polvere* Jacopo di Corso and Piero di Zanobi fabricated about 400 *palle di fuochi lavorati* for the Pisan siege with paint, pitch, turpentine, and camphor. In the Zibaldone, Bonaccorso Ghiberti wrote down his personal recipe for making rockets, fire arrows, and fire balls to be dropped in water.⁸⁸

Fire balls to be dropped in water. Tow covered with powder, tied with string and soaked in vinegar. Then, another covert of tow wrapped in powder and bound with rope and dipped in vinegar. Then, make a hole and put a wooden peg in it. Melt sulfur, Greek pitch and sheep fat, and dip the ball in this mixture for protecting it from water. Then, set fire to the peg, and drop the shot in water.

⁸⁵ Signori e collegi, Condotte e stanziamenti, in ASF, 18, 82v; Dieci di Balìa, Munizioni, in ASF, 8, 188v.

⁸⁶ Signori e collegi, Condotte e stanziamenti, in ASF, 17, 237v, and 249r; Signori, Missive seconda cancelleria, in ASF, 22, 71r; Signori e collegi, Condotte e stanziamenti, in ASF, 18, 134r.

⁸⁷ Munizioni, in ASF, 10, 67v, 76v–77r, 87v, 93r, 166r, 174v, and 187rv. The source does not clarify if these projectiles were produced in Florence or in Colle Val d’Elsa.

⁸⁸ Dieci di Balìa, Munizioni, in ASF, 9, 124rv; Dieci di Balìa, Entrata e uscita, in ASF, 30, 191rv; Dieci di Balìa, Deliberazioni, condotte e stanziamenti, in ASF, 27, 266v. Banco rari 228, in BNF, 88v–92r: “*fuochi lavorati per aqua. Istopa involta in polvere e leghata chon ispago e poi tuffata in acieto. E dipoi un altra choverta di stoppa rivolta in polvere e leghata chon ispago e tuffata in acieto. Chossi fa tantte volte quanto la voi fare grossa. E dipoi farvi uno foro e mettervi uno piolo di lengnio. E poi abi zolfo, pecie grecha e un po’ di sevo di pechora e ongni chosa fonduto. E tuffavi quella palla e favi intor-no una grosseza per difendere dal aqua. E apichavi fuocho e giettala in aqua.*”

The manufacture of these *fuochi lavorati* was common among Italian contemporary engineers. Basilio della Scola crafted *fuogi artificziadi* and “poisoned spears” for the Venetian army in 1498. And forty years before, even Maso di Bartolomeo listed the ingredients for the “Greek fire” in his account book.⁸⁹

A man of his time

The casting of bronze cannonballs was the last commission of Signoria for Ghiberti. In fact, he did not produce any artillery for the second siege of Pisa in June 1500. During this year, the *scrittoio* functioned only in March. For a few weeks, Bonaccorso helped Giovanni of Augburg cast three bells for the church of San Miniato al Monte. In November, he was newly hired by Jacopo IV Appiano as a gunmaker. He returned to Piombino in February 1501, along with several assistants. Here, he crafted his last bronze cannon. When Bonaccorso returned to Florence, he ceased casting. Neither the *libro di ricordanze* nor the *libro di debitori* cite new metal works after March 1501. In July he sold part of his copper to the commune of Castelfranco.⁹⁰ He was fifty years old, and it is likely that he was actually too elderly to withstand the toil of the foundry. According to Biringuccio, in fact, the *arte del getto* was suitable only for strong, young, and vigorous craftsmen.⁹¹

In 1502 Bonaccorso was elected as bookkeeper (*provveditore*) of his guild, as evidenced by a *quadernuccio* kept in the archive of the Istituto degli Innocenti.⁹² He also continued to keep up to date the account of his estates, including the rentals of the Perugino’s bottega and of the apothecary workshop in the *canto alle paglie*. Meanwhile, he slowly emptied his foundry of unused metal. In 1503 he handed 1,000 *libbre* of copper and bronze to *maestro* Giovannantonio from Novara. In 1505 he gave to Baccio from Montelupo, a sculptor, several *libbre* of tin. In November 1508 and April 1509, Bonaccorso was ordered to deliver about 6,000 *libbre* of bronze to the principal Florentine gunmaker, Bernardino from Milano. The Dieci di Balìa requested this metal because Bonaccorso was in debt of more than 18,000 *libbre* of

⁸⁹ Sanuto, *I diarii*, vol. 2, 362–63; Baldovinetti 70, in BNF, 1r.

⁹⁰ Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 52v–59r, and 69v; Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13229, 4v–5r and 56r.

⁹¹ Biringuccio, *Pirotechnia*, 75r.

⁹² Debitori e creditori dell’arte dei maestri di pietra e legname, in ASII, 13231.

copper, tin, and brass. Bonaccorso, in fact, seems to have received, from 1496, a large quantity of *materia* that he did not cast.⁹³

In July 1509 Bonaccorso moved to the border town of Firenzuola, to work in the local customs as *doganiere*. He was given another public office in April 1511, becoming the new podestà of Monte Spertoli, in the vicinity of Florence. When he came back to Florence, Bonaccorso stopped writing his *ricordanze*. At present, there are no known sources for reconstructing the last five years of his life. Probably he again visited his estates in Suvereto, in the Maremma region.⁹⁴

Journeys were an important part of his life. Like many other *pratici* he travelled frequently, meeting gunners and soldiers, learning new techniques, listening to different opinions and various advices. Reading his grandfather's notes, he knew the thinking of Vitruvius and the devices of Mariano Taccola. He was familiar with the works of Francesco di Giorgio Martini and Giuliano da Sangallo. He collaborated with famous condottieri, and was a good friend of Pietro Vannucci, one of the most important painters of the late Italian Quattrocento.⁹⁵ His network included also bellfounders, soldiers, politicians, prospectors, gunmakers. He improved his method by meetings and experience, and the rich heritage of his family undoubtedly helped him to develop his practical knowledge. He was always proud of the achievements of the Ghiberti's foundry. During his life, moreover, Bonaccorso showed interest in several fields, such as architecture and engineering. Above all, he actually practiced the bronze casting of statues, bells, and cannons. Bonaccorso, with his receptive and enterprising habits, was certainly a man of his time, a craftsman of the Florentine artistic and technical Renaissance.⁹⁶

⁹³ Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 101r, 119r, 144r, and 147r; Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13229, 50v.

⁹⁴ Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 149v, 158r–163v, and 165.

⁹⁵ Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, in ASII, 13230, 147r. See also: Coonin, "New Documents," 100–101. Pietro rented a part of the *scrittoio* for twelve florins per year: his agreement with Vettorino Ghiberti dated back to 1487, and ended only in 1511.

⁹⁶ Methods and knowledge of Renaissance engineers and craftsmen are analyzed in Gille, *Leonardo e gli ingegneri del Rinascimento*, 8–12; Schulz, "La migrazione di tecnici," 89–94; Calegari, "Nel mondo dei 'pratici'," 14–33; Ridella, "Produzione di artiglierie," 92–119.

Conclusion

According to Stephan Epstein, during the fifteenth century the transfer of technical knowledge became faster and more systematic in Europe. As described on the previous pages, public demand played a leading role in the creation of this “unified technological space” and in the introduction of technical improvement and innovative tools. States promoted inventions, specialization, changes, promoted new opportunity for inventiveness and production, and needed a vast number of artisans for achieving its aims. The Florentine Republic, like Venice and France, reacted to security threats investing also in technology. And war, like architecture, art, printing, mechanics, and weaving, mobilized men, money, and scientific and technical resources. A variety of people from diverse backgrounds offered opinions, suggested alternatives, and produced writings, drawings, and, above all, objects. It was not only a relationship between patrons and clients. Like Bonaccorso, many other *pratici* met among themselves, or with military experts, statesmen, or engineers, confronting their traditions, their skills, and their own methodologies. This web of contacts was created in encampments, palaces, squares, and factories. Arsenals, for example, became sites for experimentations and innovations. But the Florentine example suggests that technical improvements could mature also inside a single workshop, an apothecary’s store, a forge, or a renowned *bottega* such as Verrocchio’s.⁹⁷

Here, information and ideas circulated freely. Craftsmen carried on their empirical process, repeating and gradually improving established procedures. Their practical culture was the result of different experiences, developed during travel, work, and apprenticeship. They learned from other masters, copying items, imitating advances, improving and adapting their own technique, and developing a unique, concrete, logical knowledge. Often, developments took place without any articulated theory. Neither Ghiberti nor Telli were aware of the numerous, complex, critical variables involved in the casting of their guns. Sometimes, failures followed successes. The production of a French cannon, like the casting of a statue or the fabrication of any machinery, required multiple attempts, observation, intuition, and reflection. And when rationality entered the various, vast world of empiricism, practical knowledge met the interest of learned culture. Francesco di Giorgio Martini tried to classify

⁹⁷ Epstein, “Labour Mobility,” 251; Baraldi, “Una nuova età del ferro,” 214–16; Guido Guerzoni, “Novità, innovazione e imitazione,” 67–72; Schulz, “La migrazione di tecnici,” 89–110; Luca Molà, “Il mercato delle innovazioni,” 215–22; Carlo Maria Cipolla, *Tecnica, società e cultura*, 10; Filippo De Vivo, “La farmacia,” 141–42; Jean-Louis Fournel, “I luoghi,” 637–39.

guns according to their length and to the weight of their shot, exalting, moreover, in their superiority over ancient weapons. Leonardo da Vinci studied the casting methods, the recoil of cannons, the motion of projectiles, the nature of gunpowder. Niccolò Tartaglia combined mathematics and ballistics, working on theoretical and actual problems. In the meantime, corned powder and the blast furnaces permitted changes in the production of guns and new departures in their design. In turn, the fabrication of artillery stimulated other researches. Machiavelli, for example, reflected on the tactical use of firearms, and the Most Serene Republic finalized its “government” of ordnance. In the first decades of the sixteenth century, moreover, Vannoccio Biringuccio and Georgius Agricola wrote their treatise on mines, ores, metals, and castings.⁹⁸

Social demand inspired and encouraged several technical transformations, and information and culture continued to spread, through handbooks, craft mobility, migrations, and encounters during the early modern technological efflorescence.⁹⁹ In this lively, stimulating context, the Dieci di Balìa encouraged their masters to introduce French technology in foundries and encampments. Enhancing their artillery, the Florentine officials were to promote a new, modern art of war. Bronze cannons, in fact, would have played an important part in the sixteenth-century “military revolution,” with serious consequences on tactics and fortifications.¹⁰⁰ Nevertheless, at the end of the Italian *Quattrocento*, these changes were not completely carried out. As described in the previous pages, technological progresses were neither constant nor linear. Sometimes, they were not effective at all. Iron firearms and stone shot were still used on battlefields. Craftsmen produced giant bombards and separate breeches. Casting new projectiles was often problematic, due to the scarcity of adequate furnaces. The construction of bastion forts, moreover, was far from being widespread. Traditional warfare, therefore, would have coexisted with the assimilation of new weapons for decades.

⁹⁸ Calegari, “Nel mondo dei ‘pratici’,” 18–19; Gille, *Leonardo e gli ingegneri del Rinascimento*, 254–81; Degrassi, “La trasmissione dei saperi,” 53–87; Guilmartin, *Gunpowder and Galleys*, 305–312; Belhoste, “Nascita e sviluppo dell’artiglieria in Europa,” 327–28; Andrea Bernardoni, “Le artiglierie,” 8–25; Bernardoni, “La fusione,” 108–114; Long, *Artisans/Practitioners*, 94–110; Hall, *Weapons and Warfare*, 67–133; Allan Gilbert, “Machiavelli on Fire Weapons,” 275–82; Panciera, *Il governo delle artiglierie*, 213–16; Baraldi, “Una nuova età del ferro,” 208–213.

⁹⁹ Guerzoni, “Novità, innovazione e imitazione,” 63–87.

¹⁰⁰ Michael Roberts, *The Military Revolution*; Parker, *The Military Revolution*; Jeremy Black, *A Military Revolution?*; Hale, *Guerra e società nell’Europa del Rinascimento*, 41–74.

Appendix 1. The production of bronze bombardars in Florentine Tuscany, 1450-1500

Gunmaker	Date	Location	Name	Type	Pieces	Shot Weight	Overall Weight	Breech Weight	Muzzle Weight
Maso di Bartolomeo	1452	Florence	<i>Disperata</i>	<i>Bombarda</i>	2	300	9.630	4.150	5.480
Maso di Bartolomeo	1452	Florence	<i>Lionessa</i>	<i>Bombarda</i>	2	250	6.915	2.900	4.015
Maso di Bartolomeo	1452	Florence	<i>Tribolata</i>	<i>Bombarda</i>	2	150	6.690	2.700	3.990
Maso di Bartolomeo	1452	Florence	<i>Lucchese</i>	<i>Bombarda</i>	1	-	-	580	-
Maso di Bartolomeo	1452	Florence	-	<i>Bombarda</i>	-	400	13.000	-	-
Maso di Bartolomeo	1452	Florence	<i>Perla</i>	<i>Bombarda</i>	2	25	1.110	444	656
Maso di Bartolomeo	1454	Florence	<i>Caccia pazzia</i>	<i>Bombarda</i>	-	250	8.500	-	-
Maso di Bartolomeo	1454	Florence	<i>Vittoriosa</i>	<i>Bombarda</i>	-	-	-	5.900	-
Maso di Bartolomeo	1454	Florence	<i>Né patti né concordia</i>	<i>Bombarda</i>	-	-	-	-	5.270
-	-	-	<i>Spazza campagna</i>	<i>Bombarda</i>	-	-	-	-	-
-	-	-	<i>Accatta patti</i>	<i>Bombarda</i>	-	-	-	-	-
-	-	-	<i>Cemolina</i>	<i>Bombarda</i>	-	-	-	-	-
Pasquino di Matteo	1484	Pisa	-	<i>Bombarda</i>	-	400	-	-	-
Andrea del Verrocchio	1484	Florence	-	<i>Bombarda</i>	3	-	23.502	-	-
-	-	-	-	<i>Bombarda</i>	4	700	-	-	-
-	-	-	<i>Colombina</i>	<i>Bombarda</i>	-	-	-	-	-
-	-	-	<i>Marzocchina</i>	<i>Bombarda</i>	-	450	-	-	-
-	-	-	<i>Rinfranca</i>	<i>Bombarda</i>	-	-	-	-	-
-	-	-	-	<i>Bombarda</i>	3	-	25.000	-	-
-	-	-	<i>Sfrenata</i>	<i>Bombarda</i>	3	-	-	-	-
Alberghetto Alberghetti	1485	Florence	-	<i>Bombarda</i>	-	-	-	-	-
Alberghetto Alberghetti	1485	Florence	-	<i>Bombarda</i>	3	-	-	-	-

Gunmaker	Date	Location	Name	Type	Pieces	Shot Weight	Overall Weight	Breech Weight	Muzzle Weight
Giovanni from Augsburg	1486	Pietrasanta	<i>Felice</i>	<i>Bombarda</i>	-	310	14.794	-	-
Giovanni from Augsburg	1489	Pisa	-	<i>Basilisco</i>	2	-	16.685	7.805	8.880
Giovanni from Augsburg	1489	Pisa	-	<i>Cortale</i>	1	-	3925	-	-
Giovanni from Augsburg	1489	Pisa	-	<i>Cortale</i>	1	-	3925	-	-
Bonaccorso Ghiberti	1496	Florence	-	<i>Bombarda</i>	2	-	12.700	4.300	8.400
Francesco Telli	1496	Florence	-	<i>Bombarda</i>	2	-	17.770	8.200	9.500
Lorenzo Cavaloro	1496	Florence	-	<i>Bombarda</i>	3	-	16.850	5.780	11.070

Notes: all weights are expressed in Florentine *libbre*; a *libbra* equaled 333 grams. All lengths are expressed in Florentine *braccia*; a *braccio* measured 58 centimeters.

Appendix 2. The manufacture of French style guns in Florence, 1495-1498

Gunmaker	Date	Type	Translation	Shape	Separate breech	Length	Weight	Shot Weight
Francesco Telli	March 1495	<i>Cortaldo</i>	Cannon	-	No	-	4870	74
Lorenzo Cavaloro	July 1495	<i>Passavolante</i>	Culverin	-	No	5 ½	5120	-
Francesco Telli	August 1495	<i>Passavolante</i>	Culverin	-	No	-	1690	-
Francesco Telli	August 1495	<i>Passavolante</i>	Culverin	-	No	-	1660	-
Francesco Telli	September 1495	<i>Passavolante</i>	Culverin	-	No	-	1680	-
Francesco Telli	September 1495	<i>Passavolante</i>	Culverin	-	No	-	1660	-
Francesco Telli	September 1495	<i>Cortaldo</i>	Cannon	-	No	5 ½	5260	-
Francesco Telli	September 1495	<i>Passavolante</i>	Culverin	-	No	-	2240	-
Francesco Telli	September 1495	<i>Passavolante</i>	Culverin	-	No	-	2130	-
Lorenzo Cavaloro	October 1495	<i>Cortaldo</i>	Cannon	-	No	6 ½	5800	-
Lorenzo Cavaloro	October 1495	<i>Cortaldo</i>	Cannon	-	No	6 ¾	6400	-
Bonaccorso Ghiberti	March 1496	<i>Passavolante</i>	Culverin	-	No	-	2850	-
Bonaccorso Ghiberti	March 1496	<i>Passavolante</i>	Culverin	-	No	-	2700	-
Francesco Telli	April 1497	<i>Cortaldo</i>	Cannon	-	No	5 ½	4124	-
Francesco Telli	April 1497	<i>Cortaldo</i>	Cannon	-	No	5 ⅛	3856	-
Francesco Telli	April 1497	<i>Cortaldo</i>	Cannon	<i>Aperto</i>	No	4 ⅓	3229	-
Francesco Telli	May 1496	<i>Cortaldo</i>	Cannon	-	No	5 ¾	2550	25
Francesco Telli	June 1497	<i>Cortaldo</i>	Cannon	-	No	5	-	-
Francesco Telli	June 1497	<i>Cortaldo</i>	Cannon	-	No	5	-	-
Bonaccorso Ghiberti	July 1497	<i>Passavolante</i>	Culverin	<i>A rochetta</i>	No	-	5970	-
Bonaccorso Ghiberti	July 1497	<i>Passavolante</i>	Culverin	<i>A rochetta</i>	No	-	4920	-
Lorenzo Cavaloro	October 1497	<i>Falconetto</i>	Falcon	Round	No	2 ⅔	182	-
Lorenzo Cavaloro	October 1497	<i>Falconetto</i>	Falcon	Round	No	2 ⅔	196	-

Gunmaker	Date	Type	Translation	Shape	Separate breech	Lenght	Weight	Shot Weight
Lorenzo Cavaloro	October 1497	Falconetto	Falcon	Round	No	2 ³ / ₄	310	-
Lorenzo Cavaloro	October 1497	Falconetto	Falcon	Round	No	2 ³ / ₄	333	-
Lorenzo Cavaloro	October 1497	Falconetto	Falcon	Round	No	3	319	-
Lorenzo Cavaloro	October 1497	Falconetto	Falcon	Facet	Yes	-	226	-
Lorenzo Cavaloro	October 1497	Falconetto	Falcon	Facet	Yes	-	247	-
Lorenzo Cavaloro	October 1497	Falconetto	Falcon	Facet	No	-	830	-
Lorenzo Cavaloro	October 1497	Falconetto	Falcon	Facet	No	-	800	-
Lorenzo Cavaloro	October 1497	Falconetto	Falcon	Facet	No	-	840	-
Lorenzo Cavaloro	October 1497	Falconetto	Falcon	Facet	No	-	810	-
Lorenzo Cavaloro	November 1497	Passavolante	Culverin	-	No	-	3330	-
Lorenzo Cavaloro	February 1498	Falconetto	Falcon	Facet	No	3	231	-
Lorenzo Cavaloro	February 1498	Falconetto	Falcon	Facet	No	3	225	-
Lorenzo Cavaloro	February 1498	Falconetto	Falcon	Facet	No	3	229	-
Lorenzo Cavaloro	February 1498	Falconetto	Falcon	Facet	Yes	3	238	-
Lorenzo Cavaloro	February 1498	Falconetto	Falcon	Facet	Yes	3	240	-
Lorenzo Cavaloro	June 1498	Falconetto	Falcon	Round	No	-	930	-
Lorenzo Cavaloro	June 1498	Falconetto	Falcon	Facet	No	-	820	-
Lorenzo Cavaloro	June 1498	Falconetto	Falcon	Facet	No	-	840	-
Lorenzo Cavaloro	June 1498	Falconetto	Falcon	Facet	No	-	810	-
Lorenzo Cavaloro	June 1498	Falconetto	Falcon	Facet	No	-	760	-
Lorenzo Cavaloro	June 1498	Falconetto	Falcon	Facet	No	-	243	-
Lorenzo Cavaloro	June 1498	Falconetto	Falcon	Round	Yes	-	231	-
Francesco Telli	June 1498	Falconetto	Falcon	Round	No	-	600	-
Francesco Telli	June 1498	Falconetto	Falcon	Round	No	-	600	-
Francesco Telli	June 1498	Falconetto	Falcon	Facet	No	-	500	-
Francesco Telli	June 1498	Falconetto	Falcon	Round	Yes	-	309	-

Gunmaker	Date	Type	Translation	Shape	Separate breech	Length	Weight	Shot Weight
Francesco Telli	July 1498	Falconetto	Falcon	Facet	No	-	500	-
Bonaccorso Ghiberti	August 1498	Falconetto	Falcon	A <i>boccia</i>	No	4 ½	900	4-6
Francesco Telli	August 1498	Falconetto	Falcon	-	Yes	-	-	-
Francesco Telli	August 1498	Falconetto	Falcon	-	Yes	-	-	-
Francesco Telli	August 1498	Falconetto	Falcon	-	Yes	-	-	-
Francesco Telli	August 1498	Falconetto	Falcon	-	Yes	-	-	-
Bonaccorso Ghiberti	August 1498	<i>Cortaldo</i>	Cannon	-	No	-	4560	-
Lorenzo Cavaloro	August 1498	<i>Cannone</i>	Cannon	Round	No	6	4800	50
Bonaccorso Ghiberti	August 1498	<i>Cannone</i>	Cannon	Round	No	6 ½	6300	50
Francesco Telli	August 1498	<i>Cannone</i>	Cannon	Round	No	8	4300	50
Lorenzo Cavaloro	August 1498	<i>Cannone</i>	Cannon	Round	No	7	5940	50
Bonaccorso Ghiberti	August 1498	<i>Cannone</i>	Cannon	Round	No	6 ½	5420	50
Francesco Telli	August 1498	<i>Cannone</i>	Cannon	Round	No	7 ½	-	50
Francesco Telli	August 1498	<i>Cannone</i>	Cannon	-	No	5	-	22
Francesco Telli	August 1498	Falconetto	Falcon	-	Yes	-	-	-
Francesco Telli	August 1498	Falconetto	Falcon	-	Yes	-	-	-
Francesco Telli	August 1498	Falconetto	Falcon	-	Yes	-	-	-
Francesco Telli	August 1498	Falconetto	Falcon	-	Yes	-	-	-
Francesco Telli	August 1498	Falconetto	Falcon	-	Yes	-	-	-
Lorenzo Cavaloro	September 1498	<i>Cannone</i>	Cannon	Round	No	7	2612	22
Bonaccorso Ghiberti	September 1498	<i>Cannone</i>	Cannon	Round	No	7	6200	50
Bonaccorso Ghiberti	November 1498	<i>Cannone</i>	Cannon	Round	No	6 ½	6000	50

Notes: all weights are expressed in Florentine *libbre*; a *libbra* equaled 333 grams. All lengths are expressed in Florentine *braccia*; a *braccio* measured 58 centimeters.



Figure 5. A bombard, sketched by Antonio Pisanello in Naples, during 1450s
Paris, Musée du Louvre, Département des Arts graphiques, INV 2293
Drawing by Angela Marino

ARTICLE VI

“THIS FRENCH ARTILLERY IS VERY GOOD AND VERY EFFECTIVE.”

HYPOTHESES ON THE DIFFUSION OF A NEW MILITARY TECHNOLOGY IN RENAISSANCE ITALY

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The performances of the French cannons during the Neapolitan campaign of 1494 has been discussed several times, and with divergent, contrasting outcomes.¹ Geoffrey Parker, for example, affirmed that the entire invasion marked an important, durable change in European warfare.² In his analysis of the impact of royal artillery on Italian fortifications, instead, Simon Pepper claimed the necessity to retain a “healthy skepticism” for its presumed accomplishments, effectively demonstrating that Charles VIII did not make his way through the Peninsula thanks to his ordnance.³ Kelly deVries and Robert Douglas Smith have agreed with this opinion, highlighting, moreover, that king’s guns were very, very far from being “revolutionary.”⁴

Beyond the considerations about the effects of French weapons on the developments of bastioned fortifications, however, a study on the assimilation of the new technology in Italy is

¹ Bert Hall, *Weapons and warfare in Renaissance Europe* (Baltimore and London: The Johns Hopkins University Press, 1997), 158; Jean-François Belhoste, “Nascita e sviluppo dell’artiglieria in Europa,” in *Il rinascimento italiano e l’Europa*, III. *Produzione e tecniche*, ed. Philippe Braunstein and Luca Molà (Treviso: Angelo Colla Editore, 2007), 326-327; Raffaele Puddu, *Eserciti e monarchie nazionali nei secoli quindicesimo e sedicesimo* (Florence: La Nuova Italia, 1975), 47-49; Manlio Calegari, “La mano sul cannone,” in *Pratiche e linguaggi. Contributi a una storia della cultura tecnica e scientifica*, ed. Luciana Gatti (Pisa: ETS, 2005), 61-62; Bertrand Gille, *Leonardo e gli ingegneri del Rinascimento*, trans. from the 1964 French edition by Adriano Carugo (Milan: Feltrinelli, 1972), 40-41 and 243-244; John Hale, *Guerra e società nell’Europa del Rinascimento*, trans. from the 1984 English edition by Franco Salvatorelli (Rome and Bari: Laterza, 1987), 43.

² Geoffrey Parker, *La rivoluzione militare. Le innovazioni militari e il sorgere dell’Occidente*, trans. from the 1996 English edition by Gianfranco Ceccarelli and Natalia Seri (Bologna: il Mulino, 2005), 27-28.

³ Simon Pepper, “Castles and cannon in the Naples campaign of 1494–95,” in *The French descent into Renaissance Italy, 1494-1495. Antecedents and effects*, ed. David Abulafia (Aldershot: Ashgate, 1995), 265.

⁴ Kelly deVries and Robert Douglas Smith, *The artillery of the dukes of Burgundy* (Woodbridge: The Boydell Press, 2005), 42-44.

still missing, as well as a comparison between the French royal artillery and the actual, traditional, Italian bombards of the late fifteenth century. Besides, a comprehensive survey of Italian Renaissance artillery has not been undertaken since the beginnings of the last century.⁵ The early works of Angelo Angelucci and Cesare Quarenghi date back even to the second half of the nineteenth century.⁶ Only in the last decades historians and archaeologists have focused on the production and the management of firearms. Walter Panciera, for example, has studied the influence of Venetian institutions on the manufacture of ordnance and gunpowder during the sixteenth century. Carlo Beltrame, Renato Ridella, and Marco Morin have analyzed shipwrecked sea ordnance for the same century. Manlio Calegari examined how the Ferrarese dukes tried to foster the fabrication of ammunitions in their ironworks over the Apennines.⁷

In any case, a general disinterest has affected the investigation of Italian war production in the Late Middle Ages. The workshops of smiths, the practices of gunmakers, have been frequently ignored by economic and military historians.⁸ Almost nothing is known about the trades of metals.⁹ Also the commerce of saltpeter have been scarcely considered by scholars, along with a noteworthy second-hand market in materiel.¹⁰ Only the luxurious and fascinating masterpieces of the renowned Lombard armorers seem to have attracted the attention of art historians. The various articulations and regulations of this manufacture were partially explored by Silvio Leydi, analyzing the exports of Milanese arms during the sixteenth century.

⁵ Carlo Montù, *Storia dell'artiglieria italiana* (Rome: Rivista d'Artiglieria e Genio, 1934).

⁶ Angelo Angelucci, *Documenti inediti per la storia delle armi da fuoco italiane* (Turin: Tipografia Cassone, 1869); Cesare Quarenghi, "Tecno-cronografia delle armi da fuoco italiane", *Atti del regio istituto d'incoraggiamento alle scienze naturali, economiche e tecnologiche di Napoli* 17 (1880): 53-295.

⁷ Walter Panciera, *Il governo delle artiglierie. Tecnologia bellica e istituzioni veneziane nel secondo Cinquecento* (Milan: Franco Angeli, 2005); Renato Ridella, *Fonditori italiani di artiglierie in trasferta nell'Europa del XVI secolo*. In *Storie di armi*, ed. Nicola Labanca and Pier Paolo Poggio (Milan: Unicopli, 2009); Renato Ridella, "Produzione di artiglierie nel sedicesimo secolo. I fonditori genovesi Battista Merello e Dorino Il Gioardi," in *Pratiche e linguaggi. Contributi a una storia della cultura tecnica e scientifica* (Pisa: ETS, 2005); Carlo Beltrame and Renato Ridella, *Ships and guns. The sea ordnance in Venice and Europe between the 15th and 17th century* (Oxford and Oakville: Oxbow books, 2011); Carlo Beltrame and Marco Morin, *I cannoni di Venezia. Artiglierie della Serenissima da fortezze e relitti* (Florence: All'Insegna del Giglio, 2013).

⁸ William Caferro, "Warfare and economy in Renaissance Italy," *The Journal of Interdisciplinary History* 39, no. 2 (2008); Richard Goldthwaite, *The Economy of Renaissance Florence*, 400-401; Enrico Stumpo, "La finanza di guerra negli antichi stati italiani," in *Storia economica della guerra*, ed. Catia Eliana Gentilucci (Rome: Società Italiana di Storia Militare, 2008), 196.

⁹ Enzo Baraldi, "La siderurgia In Italia dal XII al XVII secolo," in *La civiltà del ferro. Dalla preistoria al terzo millennio*, ed. Walter Nicodemi (Milan: Olivares, 2004).

¹⁰ Silvia Bianchessi, "Cavalli, armi e salnitro fra Milano e Napoli nel secondo Quattrocento," *Nuova Rivista Storica* 52, n. 3 (1998).

Mario Scalini, moreover, has dedicated several essays to Tuscan artifacts, as sword, cuirasses, and helmets.¹¹

Military technology, instead, has been seen as “the key driving force behind the nature of Medieval warfare.” Innovation has been considered a cause, or a consequence, of political and social transformations. Deterministic and interdependent changes in technique have become the engines of several, so-called “revolutions.”¹² The purpose of this article, however, it is not an investigation of similar, undefined, questionable repercussions in the long term. It aims to examine the premises of a rapid technological assimilation, the immediate introduction of French pattern into Italian warfare, the coexistence of older and latest heavy weapons, as well as the actuality of a lively and reactive war-related industry in Renaissance Italy, aware of new ideas and new practices. Above all, this paper wants to suggest new archival researches, indispensable for comprehending the structure and the dimensions of this business, and for knowing its political connections, its commercial links, and its protagonists.

The primary and secondary sources used for this research are numerous. The analysis of such different, variegated documents was necessary to understand roles, uses and developments of technology in its actual context. The various, contemporary description of French cannons, the first impressions of Italian writers and statesmen, and the following diffusion of cannons in the whole Peninsula, for example, have been analyzed through more than thirty Roman, Genoese, Sienese, Venetian, and Neapolitan chronicles. These diaries were mostly published in the anthologies of the *Rerum Italicarum Scriptores* between the eighteenth and the twentieth century. Several critical editions of documents, in addition, have been useful for the study of the circulation of ideas, products, and craftsmen, and the production of firearms in the Italian fifteenth century.

Florentine case has been examined in depth, thanks to the abundant handwritten material kept in the local state archive, in the National Central Library and in the Innocenti

¹¹ Stuart Pyhrr, José Godoy, and Silvio Leydi, *Heroic armor of the Italian Renaissance. Filippo Negroli and his contemporaries* (New York: The Metropolitan Museum of Art, 1998); Luciana Frangioni, “Aspetti della produzione delle armi milanesi nel XV secolo,” in *Milano nell’età di Ludovico il Moro* (Milan: Il comune, 1983); Mario Scalini, “L’armatura fiorentina del Quattrocento e la produzione d’armi in Toscana,” in *Guerra e guerrieri nella Toscana del Rinascimento*, ed. Franco Cardini and Marco Tangheroni (Florence: EDIFIR, 1990).

¹² Kelly DeVries, *Medieval military technology* (Peterborough: Broadview Press, 1992), 95-122; Hall, *Weapons and warfare in Renaissance Europe*, 201-235; Parker, *La rivoluzione militare*, 11-16; John Stone, “Technology, society, and the infantry revolution of the fourteenth century,” *The Journal of Military History* 68, no. 2 (2004): 361-367.

Institute. Despite the “orthodoxy” of a warlike decadence,¹³ the registers of the Florentine military institutions, the *Dieci di Balìa* and the *Otto di Pratica*, have offered the opportunity to highlight the leading role of the public demand in the production of weapons and in the introduction of technical innovations. The bookkeeping of the most important Florentine gunmakers, moreover, permitted to deal with their actual bronze works and to analyze the developments of Tuscan artillery in the second half of the fifteenth century.

The production of Italian bombards

By the mid of the fifteenth century, Italian regional states seemed to have enhanced their management of artillery, often pursuing a policy of general reform of their military institutions.¹⁴ While dukes, kings, and popes entrusted their fates to permanent forces, guns, in fact, were becoming more prominent in warfare, and especially in sieges.¹⁵ Traditional, medieval machinery, as catapults and trebuchets, was slowly disappearing from battlefields, even though they were still assembled and positioned under the walls of Lucca, Manfredonia, Genoa, and Volterra.¹⁶ Gunpowder, instead, was influencing tactics and logistics, radically

¹³ Claudio Finzi, “La guerra nel pensiero politico del Rinascimento toscano,” in *Guerra e guerrieri nella Toscana del Rinascimento*, ed. Franco Cardini and Marco Tangheroni (Florence: EDIFIR, 1990), 141; Michael Mallett, *Signori e mercenari. La guerra nell’Italia del Rinascimento*, trans. from the 1974 English edition by Alghisi Princivalle (Bologna: Il Mulino, 2006), 134-136; Stephen Epstein, “Storia economica e storia istituzionale dello stato,” in *Origini dello stato. Processi di formazione statale in Italia fra medioevo ed età moderna*, ed. Giorgio Chittolini, Anthony Molho, and Pierangelo Schiera (Bologna: il Mulino, 1994), 108-109; William Caferro, “Continuity, long-term service and permanent forces: a reassessment of the Florentine army in the fourteenth century,” *The Journal of Modern History* 80, no. 2 (June 2008): 219-251.

¹⁴ Francesco Storti, *L’esercito napoletano nella seconda metà del Quattrocento* (Salerno: Laveglia, 2007); Maria Nadia Covini, *L’esercito del duca: organizzazione militare e istituzioni al tempo degli Sforza, 1450-1480* (Rome: Istituto storico italiano per il Medioevo, 1998); Michael Mallett, *L’organizzazione militare di Venezia nel Quattrocento*, trans. from the 1984 English edition by Enrico Basaglia (Rome: Jouvence, 1989). A survey of Italian recent studies has been proposed by Claudio Donati, “Strutture militari degli Stati Italiani nella prima età moderna: una rassegna degli studi recenti,” in *Società Italiana di Storia Militare. Quaderno 2000*, ed. Piero Del Negro (Rome: Edizione Scientifiche Italiane, 2003), 45-62, and Luciano Pezzolo, “La ‘rivoluzione militare’. Una prospettiva italiana,” in *Militari in Età Moderna. La centralità di un tema di confine*, ed. Alessandra Dattero and Stefano Levati (Milan: Cesalpino, 2006), 32-59.

¹⁵ Mallett, *Signori e mercenari*, 94-120 and 164-168; Luciano Pezzolo, “La ‘rivoluzione militare,’” 24.

¹⁶ Aldo Settia, *Rapine, assedi, battaglie. La guerra nel Medioevo* (Rome and Bari: Laterza, 2009), 130.

changing the conduct and the character of campaigns.¹⁷ Above all, in the medium term and in the long run, firearms were affecting the costs of warfare, increasing the expenditures on soldiers, personnel, training, equipment, ammunitions, and fortifications.¹⁸

Military institutions invested considerable sums in the defense of their borders and in the supplying of their troops.¹⁹ The constant purchases of ordnance, hand cannons, powder, metals, arms and armor, crossbows and arrows, as well as the construction of arsenals and furnaces, stimulated a lively and reactive war related industry, connecting the “control over manufacture” with the “government of artillery”.²⁰ In this market, the public demand played an important, leading role. States fostered technological improvements, promoted the introduction and the diffusion of innovative tools, and created opportunities for commerce and production. At the same time, war mobilized money, scientific and technical resources, engineers and artisans. Officials and condottieri needed a vast number of craftsmen for achieving their aims, a “small army” of practitioners, as blacksmiths, experts in bronze casting, gunpowder makers, producers of saltpeter, carpenters, stone-cutters, transporters, and many others.²¹

¹⁷ John Hale, “Gunpowder and the Renaissance,” in ID., *Renaissance War Studies* (London: The Hambledon Press, 1983), 390-391.

¹⁸ Caferro, “Warfare and economy in Renaissance Italy:” 177; Hale, *Guerra e società nell’Europa del Rinascimento*, 41-47.

¹⁹ Silvio Leydi, “Le armi,” in *Il rinascimento italiano e l’Europa*, IV. *Commercio e cultura mercantile*, ed. Franco Franceschi, Richard Goldthwaite, and Reinhold Mueller (Treviso: Angelo Colla Editore, 2007); Fabrizio Ansani “Craftsmen, artillery, and war production in Renaissance Florence,” *Vulcan. The international journal for the social history of military technology* 4 (2016); Bianchessi, “Cavalli, armi e salnitro fra Milano e Napoli nel secondo Quattrocento;” Marco Merlo, “Armamenti e gestione dell’esercito a Siena nell’età dei Petrucci. Le armi,” *Rivista di Studi Militari* 5 (2016); Pamela Long, *Artisans, practitioners and the rise of the new sciences* (Corvallis: Oregon State University Press, 2011), 96-100.

²⁰ Panciera, *Il governo delle artiglierie. Tecnologia bellica e istituzioni veneziane nel secondo Cinquecento*; Sergio Tognetti, “Il governo delle manifatture nella Toscana del tardo Medioevo,” in *Il governo dell’economia. Italia e penisola iberica nel basso Medioevo*, ed. Lorenzo Tanzini and Sergio Tognetti (Rome: Viella, 2014), 310-330; Fabrizio Ansani, “Geografie della guerra nella Toscana del Rinascimento. Produzione di armi e circolazione dei pratici,” *Archivio Storico Italiano* 651 (2017): 116-117.

²¹ Enzo Baraldi, “Una nuova età del ferro,” in *Il rinascimento italiano e l’Europa*, III. *Produzione e tecniche*, 214-216; Luca Molà, “Il mercato delle innovazioni,” in *Le techniciens dans la cité en Europe occidentale, 1250-1650*, ed. Mathieu Arnoux and Pierre Monnet (Rome: École française de Rome, 2004), 215-222; Cipolla, *Tecnica, società e cultura. Alle origini della supremazia tecnologia dell’Europa* (Bologna: Il Mulino, 1989), 10.

The diffusion and the affirmation of artillery, moreover, triggered off a continuous experimentation in their production. Established procedures and accustomed methods underwent several modifications since the second quarter of the century.²² Gunmakers improved their pieces by a long series of empirical attempts that required observations, intuitions, and trials, and errors.²³ Several military engineers reflected upon the correlation between the length and the thickness of guns and the weight of their ammunitions and of their charge.²⁴

Gradual, interdependent innovations concerned several features of the pieces. Their propellant, for example, the black powder, was made granular, “corned”, and it was more powerful and more durable than the traditional, “mealed” one.²⁵ Stone shot, also, was substituted by lead projectiles in the usage of small firearms and hand cannons. At the same time, craftsmen tried new designs and new materials for their guns. Barrels became longer, in order to increase the range of shot. Cast iron was tested for fabricating heavy ordnance. The outcomes, however, were scarce.²⁶ In the course of a decade, gunmakers preferred bronze to the cast iron. This was due to a number of reasons. First of all, the casting of bronze could rely on the solid, secular tradition of bell makers and artists. Moreover, bronze allowed the production of single piece guns, or the introduction of a nut and screw system for connecting the two, or three, or four barrels of heavy artillery. Thanks to these innovations, ordnance could better contain the explosion of larger powder charges, diminishing the risks for gunners, servants, and sappers. Finally, a bronze broken gun could be remelted, and the metal reused for the substitution of damage sections, or even the manufacture of new firearms.²⁷

²² Belhoste, “Nascita e sviluppo dell’artiglieria in Europa,” 325-342.

²³ Gille, *Leonardo e gli ingegneri del Rinascimento*, 243-246.

²⁴ Andrea Bernardoni, “Le artiglierie nella riflessione scientifica degli ingegneri del Rinascimento,” *Quaderni Storici* 130, no. 1 (2008): 9-10.

²⁵ Hall, *Weapons and warfare in Renaissance Europe*, 67-95; Walter Panciera, “La polvere da sparo,” in *Il rinascimento italiano e l’Europa*, III. *Produzione e tecniche*, 307-315.

²⁶ An unique cast iron bombard was tested in Florence in 1430s. Milanese gunmakers tried to realize a similar gun in 1470s. See: Ansani “Craftsmen, artillery, and war production in Renaissance Florence,” 7; Luca Beltrami, “Le bombarde milanesi a Genova nel 1464,” *Archivio Storico Lombardo* 4, no. 4 (1887): 798-799; Ridella, “Produzione di artiglierie nel sedicesimo secolo,” 81-82.

²⁷ John Guilmartin, *Gunpowder and galleys. Changing technology and Mediterranean warfare at sea in the 16th century*. (London: Conway Maritime Press, 2003), 305-313; Belhoste, “Nascita e sviluppo dell’artiglieria in Europa,” 330-333; Renato Ridella, “L’evoluzione strutturale nelle artiglierie di bronzo in Italia fra XV e XVII secolo,” in *I cannoni di Venezia*, 15-16.

In the second half of fifteenth century, these technical progresses had already emerged in Italy. Forging gradually came to be used only for light pieces. Giant bronze bombards were rapidly replacing older, smithy ones, while thousand tons of copper and tin were now stored in arsenals and warehouses.²⁸ In the South, already in 1430s, during the war with Angevines, Alfonso the Magnanimous tried to improve the fabrication, the administration and the use of ordnance. According to the records of the Aragonese chancery, the king acquired bombards from Spanish merchants, hired Catalan gunners and Italian gunmakers, and started the production of the new corned powder in his territories of Campania and Puglia.²⁹ Before and after the conquest of Naples, in 1442, Alfonso appointed Pietro dell'Ortigna, Dalmao Delentorn and Alessandro Moragnes as captains of artillery, giving them the responsibility to buy saltpeter, sulfur, coal, lead, copper, tin, and other raw materials.³⁰ Along with these officials, several foreign gunmakers worked in Neapolitan foundries, as Giovanni from Germany, Bartolomeo from Milan, Pietro from Perugia, Giordano from Savoy, and other Genoese and Sicilian artisans.³¹ In the arsenal of the Castel Nuovo and in the shipyard, this labor realized dozens of bronze guns. According to the contemporary chronicler Bartolomeo Facio, Alfonso had at his disposal "lots of admirable bronze firearms of various size."³² The army and the fleet were also supplied with iron pieces.³³

In 1465, king Ferrante ordered the construction of a new arsenal in the capital.³⁴ Nine years later, he commissioned Giosuè Cantelmo, a painter, to depict the ordnances stored in the royal armory. The result was a book containing the drawings of one hundred and thirty-seven pieces, among bombards and *cerbottane*.³⁵ The importance of artillery for the warlike

²⁸ Fabrizio Ansani, "The life of a Renaissance gunmaker. Bonaccorso Ghiberti and the development of Florentine artillery in the late fifteenth century," *Technology and Culture* 58, no. 3 (2017): 756-759.

²⁹ Anonymous, "Diario napoletano," in *Rerum Italicarum Scriptores*, XXI., ed. Ludovico Antonio Muratori (Milan: Tipografia della Società Palatina, 1732), 1113.

³⁰ Camillo Minieri Riccio, "Alcuni fatti di Alfonso I d'Aragona dal quindici aprile 1437 al trentuno di maggio 1458," *Archivio Storico per le Province Napoletane* 6, no. 2 (1881): 242 and 245.

³¹ Renato Ridella, "Fonditori italiani di artiglierie in trasferta nell'Europa del XVI secolo," in *Storie di armi*, ed. Nicola Labanca and Pier Paolo Poggio (Milan: UNICOPLI, 2009), 19-20.

³² Bartolomeo Facio, *De rebus gestis ab Alphonso primo Neapolitanorum rege commentariorum libri decem* (Lyon: Apud haeredes Sebastianii Gryphii, 1560), 296.

³³ Minieri Riccio, "Alcuni fatti di Alfonso I d'Aragona," 424.

³⁴ Nicola Barone, "Le cedole di tesoreria dell'Archivio di Stato di Napoli dall'anno 1460 al 1504," *Archivio Storico per le Province Napoletane* 9, no. 1 (1884): 32

³⁵ Nicola Barone, "Le cedole di tesoreria dell'Archivio di Stato di Napoli dall'anno 1460 al 1504," *Archivio Storico per le Province Napoletane* 9, no. 3 (1884): 400. The current English translation for

ruler of the Neapolitan kingdom was underlined also by Diomede Carafa in his *Memoriale*, a memoir written for Alfonso, duke of Calabria and captain of the Neapolitan army.³⁶

As it can be seen, guns bring honor, and those who delight in artillery are wise and distinguished. Sometimes, a *cerbottana*, or a bombard, complete tasks that a thousand men cannot undertake. In a battle, or during a siege, ordnance accomplishes very much. Just four *cerbottane* can put a squadron to flight, or kill sheltered defenders, or destroy battlements. Therefore, it would be good to have numerous pieces and skilled gunners.

Another courtier, Orso Orsini, in his treatise on the command and the drill of the *militia*, advised his prince to supply the troops with, at least, two hundred *cerbottane* and two bombards.³⁷ Years later, even the Venetian chronicler Marino Sanudo was impressed by the Neapolitan arsenal.³⁸

The royal arsenal was divided in three warehouses. Beautiful armor for mounted knights were stored in the first depot. Another one contained cuirasses and crossbows. In the third armory there were eight heavy bronze bombards and two large *cerbottane*, and a lot of breastplates for infantrymen, and numerous iron bombards for fortresses and galleys. Those weapons were kept inside the Castel Nuovo.

It is likely that, among those bombards, laid also the *Neapolitana*. It was a masterpiece of engineering, a giant bombard of four pieces, realized with nine thousand and two hundred kilograms of bronze, loaded with a stone shot of one hundred and thirty kilograms,³⁹ finely inlaid with heraldic symbols.⁴⁰ His creator was the French master Guglielmo dello Monaco, the foreman of the Neapolitan arsenals and the most important bronze worker of the Aragonese

cerbottana is “blowgun.” During Renaissance, the term indicated a gun with a long barrel and a small caliber.

³⁶ Diomede Carafa, *Memoriali*, ed. Franca Petrucci Nardelli (Rome: Bonacci, 1988), 343.

³⁷ BNF, Département des manuscrits, Italien 958, 4v and 15v.

³⁸ Marin Sanudo, *La spedizione di Carlo VIII in Italia*, ed. Rinaldo Fulin (Venice: Tipografia del Commercio, 1883), 238.

³⁹ All the medieval measures of mass and length, as the Neapolitan *libbra*, the Florentine *braccio*, the Milanese *rubbo*, the Ferrarese *piede*, and so on, have been converted into standard units of the international metric system.

⁴⁰ Francesco Storti, “Note e riflessioni sulle tecniche ossidionali del secolo quindicesimo,” in *Diano e l’assedio del 1497*, ed. Carmine Carlone (Battipaglia: Laveglia, 2010), 253; Alan Ryder, *The Kingdom of Naples under Alfonso the Magnanimous. The making of a modern state* (Oxford: Clarendon Press, 1976), 280.

period. From 1452 to 1470, he was entrusted by sovereigns with casting firearms, clocks, bells, medals, and even with the planning and the realization of the beautiful, imposing gates of Castel Nuovo.⁴¹

Also in Milan engineers collaborated with the dukes on the management of artillery. Bartolomeo Gadio, for example, was the “overseer of the ammunitions,” the responsible for the purchase and the transport of weapons. In 1472, he supervised, along with two other gunmakers, Dainese Maineri and Maffeo from Como, the casting of the *Galeozesca Vittoriosa*. This enormous bronze bombard weighed more than eight tons, and could fire more than two hundred kilograms of stone.⁴² It was not the only heavy gun stored in the state warehouses of Pavia and Milan. For the campaign in Liguria, in 1464, Francesco Sforza sent two other bronze bombards, the *Corona* and the *Bissona*, and the cast iron *Liona*. These firearms were fabricated by Francesco Bianco, a Genoese master, and had a shot weight from ninety to one hundred and thirty kilograms.⁴³ In 1470s, the ducal ordnance was composed, moreover, of two small bombards, called *rofianelle*, and two medium sized *ferline*, the latter named after their manufacturer, the “excellent engineer” Ferlino from Chieri.⁴⁴

Ferlino acquired this reputation at the courts of Savoy and Milan. In 1452, he was also in Venice. Here, he cast a couple of firearms in the renowned city Arsenal, before opening his personal workshop in the district of Castello. Around 1460, also Antonio di Conti started to work in Calle della Tana.⁴⁵ Among shipyards and armories, Italian and German masters experimented new techniques and innovated instruments and products. Under the supervision of the “heads of gunners,” Venetian artisans experimented new shots, different carts, and original shapes for small pieces. The workshop of the Most Serene Republic, therefore, became attractive as to apprentices as to skilled and famous engineers, like Bartolomeo from Cremona and Sigismondo Alberghetti.⁴⁶

⁴¹ Felicita de Negri, “Dello Monaco, Guglielmo,” in *Dizionario Biografico degli Italiani*, XXXVIII. (Rome: Istituto della Enciclopedia Italiana, 1990); Joana Barreto, “Artisan ou artiste entre France et Italie? Le cas de Guglielmo Monaco à la cour de Naples au XVe siècle,” *Laboratoire italien. Politique et société* 11 (2011).

⁴² Belhoste, “Nascita e sviluppo dell’artiglieria in Europa,” 331.

⁴³ Beltrami, “Le bombarde milanesi a Genova nel 1464,” 798-799; Carlo Visconti, “L’ordine dell’esercito ducale sforzesco,” *Archivio Storico Lombardo* 3, no. 3 (1876): 469-472.

⁴⁴ Giovanni Simonetta, *Historie delle memorabili et magnanime imprese fatto dallo invittissimo Francesco Sforza* (Venice: Al segno dil Pozzo, 1544), 329r.

⁴⁵ Panciera, *Il governo delle artiglierie*, 163.

⁴⁶ Mallett, *L’organizzazione militare di Venezia nel Quattrocento*, 110-114

Other minor states provided to secure their future with the fusion of copper and tin. In 1450, in Urbino, Federico from Montefeltro engaged Maso di Bartolomeo and other Florentine gunmakers for his “house of bombards.” The famous condottiere spent more than five hundred florins on two heavy pieces, weighed respectively three hundred and thirty kilograms and four tons.⁴⁷ Ludovico II Gonzaga, marquis of Mantua, contacted various Italian chancery in order to find labor for the casting of new heavy bombards.⁴⁸ Ercole d’Este, instead, raised a metallic wall for protecting Ferrarese borders against Venetian troops.⁴⁹ During the Salt War, in 1482, the duke confiscated even one hundred and fifty bells for the making of *passavolanti*, harquebuses, and other small bronze firearms.⁵⁰

In Tuscany, the Sienese commune hired master Agostino from Piacenza in 1453. In the workshop of the town hall, the Lombard artisan fabricated several heavy bronze bombards, immediately used against the count Aldobrandino Orsini. In that campaign, however, Sienese officers complained about the delay of the supplies and the excessive number of “old” and “useless” iron bombards.⁵¹ During the following decades, the Tuscan republic attempted to increase the production of pieces. In 1468, the city council put a tax for financing the purchase of metals and the cast of two new guns, entrusted to the master Giovanni from Zagreb.⁵²

It would be dishonorable, for your lordships, to own only two bombards, considering that even ten would not be too many, and that the Republic could gain a reputation for them [...]. It would be useful, then, if citizens could pay at least one ducat for every public pardon, entrusting the collection to the treasurer of the *Concistoro* [...], and earmarking this sum to fabricate bombards [...]. These firearms would be exclusively commissioned by the *Nove della Guardia* [...], and it would be forbidden to spend this income for everything else.

⁴⁷ BNCF, Baldovinetti, 70, 7r and 22r.

⁴⁸ Giampaolo Ermini, “Campane e cannoni. Agostino da Piacenza e Giovanni da Zagabria: un fonditore padano e uno schiavone nella Siena del Quattrocento,” in *L’industria artistica del bronzo del Rinascimento a Venezia e nell’Italia settentrionale*, ed. Matteo Ceriana and Victoria Avery (Verona: Scripta, 2008), 397.

⁴⁹ Calegari, “La mano sul cannone,” 63.

⁵⁰ Marin Sanudo, *Commentarii della guerra di Ferrara tra li Viniziani e il duca Ercole d’Este*, ed. Leonardo Manin (Venice: Co’ tipi di Giuseppe Picotti, 1829), 46. The word *passavolante* derived from the combination of the past participles of the two Italian verbs *passare* and *volare*, that is, “to pass” and “to fly.” In the fifteenth century, the term indicated a gun with a long barrel and a small bore.

⁵¹ Ermini, “Campane e cannoni,” 391-401.

⁵² ASSI, Concistoro, 2556; ASSI, Concistoro, 2557, 1r.

In spite of this efforts, the Sienese army was still using an iron bombard for the sieges of the Florentine border towns of Castellina, Radda, Brolio, Cacchiano, and Monte San Savino, in 1478. The next year, however, after the unexpected and decisive victory of Poggio Imperiale, many bronze firearms were plundered from enemy encampment.⁵³ Moreover, Pietro di Niccolò Campana cast a giant weapon of two pieces, three and a half meters long, weighed eight and a half tons, loaded with one hundred kilograms of stone.⁵⁴ At the end of the Pazzi's war, Piazza del Campo seemed a "bronze mountain, with twenty-two bombards displayed in front of the palace."⁵⁵

In 1479, even a "papal bombard" arrived in this main square, dismantled in two pieces, and followed by several stones of one hundred and fifteen kilograms.⁵⁶ In those years, pontiffs were extremely attentive to the development of their ordnance, and the increase of their number. In 1462, Agostino from Piacenza, "distinguished artisan," cast three heavy guns for Pius II, the *Silvia*, the *Vittoria* and the *Enea*,⁵⁷ in which "there is such strength that no wall, whatever its thickness, can resist."⁵⁸ Paul II invited many German gunmakers in the Roman foundries. From 1464 to 1471, Conrad from Stuttgart and William from Nuremberg were employed by the Apostolic Camera as gunners and keepers of arsenals and fortresses.⁵⁹ Also Sixtus IV ordered the production of several guns, decorated with the oak of his family, the Della Rovere. In 1482, the bronze *Sistina Papale* was named after the pope.⁶⁰ Two years later, his holiness himself blessed the new ordnance, praying, wherever it went, for the rout of enemies.⁶¹

⁵³ Cristoforo Cantoni, "Cronaca senese," ed. Alessandro Lisini and Fabio Iacometti, in *Rerum Italicarum Scriptores*, XV., 6., ed. Pietro Fedele (Bologna: Nicola Zanichelli, 1939), 880

⁵⁴ Allegretto Allegretti, "Diario senese," in *Rerum Italicarum Scriptores*, XXIII., ed. Ludovico Antonio Muratori (Milan: Tipografia della Società Palatina, 1733), 794.

⁵⁵ Angelucci, *Documenti inediti per la storia delle armi da fuoco italiane*, 561-562.

⁵⁶ Allegretti, "Diario," 794.

⁵⁷ Ermini, "Campane e cannoni," 397-398.

⁵⁸ Enea Silvio Piccolomini, *Commentarii rerum memorabilium, quae temporibus suis contigerunt* (Frankfurt: Officina Aubriana, 1614), 135

⁵⁹ Knut Schulz, "La migrazione di tecnici, artigiani e artisti," in *Il rinascimento italiano e l'Europa*, III. *Produzione e tecniche*, 108-109.

⁶⁰ Gaspare Pontani, "Diario romano," ed. Diomede Toni, in *Rerum Italicarum Scriptores*, III., 2., ed. Giosuè Carducci and Vittorio Fiorini (Città di Castello: Lapi, 1908), 9 and 16.

⁶¹ Stefano Infessura, *Diario della città di Roma*, ed. Oreste Tommasini (Rome: Tipografia del Senato, 1890), 134.

Once upon a time, saint apostles converted towns to faith and devotion with miracles, speeches, and the sign of the holy cross. Nowadays, cities were conquered with the shot of bombards and *cerbottane*, and with other machinery fitted for the battle.

According to Antonio da Vasco, among these firearms were two “really heavy” bronze guns, two *passavolanti*, two *cerbottane*, and several iron “small bombards.”⁶² In his *Diario*, the chronicler mentioned also the private artillery of two of the most important Roman families, the Orsini and the Colonna.⁶³

In 1486, during the conflict with Sixtus, Nicola and Virginio Orsini requested a gunmaker from their Florentine allies. The *Dieci di Balìa* granted one of their principal gunmaker, Bonaccorso di Vettorino Ghiberti, the nephew of the illustrious Lorenzo di Cione.⁶⁴ At that time, the Republic of Florence was undoubtedly in the vanguard of bronze castings. A decade of wars against Siena, Naples, Rome, and Genoa, in fact, was compelling military officers to accelerate the production of ordnance.⁶⁵ The Medici bank multiplied the purchases of metal and saltpeter.⁶⁶ The foundry of the Sapienza was opened in the capital, while other workshops were built in Pisa and in the border towns of Colle Val d’Elsa, Montepulciano, Sansepolcro, Pietrasanta, and Firenzuola.⁶⁷

Several craftsmen contributed to these developments. Already in 1452, Maso di Bartolomeo, better known as Masaccio, stored in Florentine arsenals five bronze heavy pieces. They were the *Disperata*, the *Lionessa*, the *Tribolata*, the small *Perla*, and the little *Lucchese*. Some months later, the “master of bombards” made also the *Caccia Pazzia*, the *Vittoriosa* and the *Né patti né concordia*. These firearms weighed from three kilograms to four tons, while their stone shot ranged in size from eight to one hundred kilograms.⁶⁸ One of Masaccio’s apprentices, Pasquino di Matteo from Montepulciano, realized fifty-one spingards and several bombards in 1478, along with Alberghetto Alberghetti from Ferrara, Bonaccorso Ghiberti, Damiano di Giovanni and Brancazio di Guido. In the same year, after the Pazzi’s conspiracy, Lorenzo the Magnificent dispatched two of his personal bronze “small bombards” in Volterra.

⁶² Antonio da Vasco, “Diario della città di Roma,” ed. Giuseppe Chiesa, in *Rerum Italicarum Scriptores*, XXIII., 3., ed. Giosuè Carducci and Vittorio Fiorini (Città di Castello: Lapi, 1908), 511.

⁶³ *Ibid.*, 525 and 534. See also: Pontani, “Diario,” 30-31.

⁶⁴ ASF, Dieci di balìa, Entrata e uscita, 9, 171v.

⁶⁵ Ansani, “Craftsmen, artillery, and war production,” 9-10.

⁶⁶ ASF, Otto di pratica, Munizioni, 1, 1v-59v.

⁶⁷ Ansani, “Geografie della guerra,” 88-98.

⁶⁸ BNCF, Baldovinetti, 70, 77v-112r.

Smiths, moreover, fabricated hundreds of hand cannons.⁶⁹ The necessity of the war compelled Florentine masters to experiment also on mobile firearms, as several, innovative spingards “mounted on carts.”⁷⁰

In 1484, Pasquino crafted a bombard with a caliber of one hundred and thirty-five kilograms of stone.⁷¹ His former disciple, Andrea del Verrocchio, contemporaneously realized an enormous, beautiful gun of three pieces with seven thousand and eight hundred kilograms of bronze.⁷² Both firearms were used in the victorious siege of Pietrasanta. Alongside them, the army carried in Lunigiana two other heavy guns, the *Fregosina* and the *Colombina*, and an impressive bombard of four pieces, capable of firing two hundred and thirty kilograms of projectile.⁷³ Another giant gun was cast in 1489 by Giovanni di Jacopo from Augsburg, the controller of the Pisan armory. His basilisk weighed more than five tons of bronze.⁷⁴

This incessant production, these continuous experimentations, and these frequent variations of shapes and dimensions, led also to theoretical elaborations and attempt of classifications. Leonardo da Vinci studied the casting methods, the recoil of cannons, the motion of projectiles, and the nature of gunpowder. Niccolò Tartaglia worked on hypothetical and actual problems, combining ballistics and mathematics.⁷⁵ Francesco di Giorgio Martini tried to classify guns according to their length and to the weight of their shot, exalting, moreover, their superiority over ancient weapons. The ordnance listed in his treatise was actually produced across the whole Peninsula in the 1480s and 1490s. From the heavy bombards to the long basilisks, the Sienese engineer wrote down the characteristics, the length of barrels, the proportions of powder charges, and the calibers of all the “principal variety” of guns.⁷⁶

⁶⁹ ASF, Dieci di balia, Debitori e creditor, 22, 14v, 17v and 32r.

⁷⁰ ASF, Otto di pratica, Missive, 5, 109v.

⁷¹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 27, 276r.

⁷² ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 30, 249v; ASF, Dieci di balia, Missive, 20, 156v; ASF, Dieci di balia, Missive, 21, 122v e 146v.

⁷³ ASF, Dieci di balia, Missive, 21, 148r and 162r.

⁷⁴ ASF, Otto di pratica, Munizioni, 1, 9v.

⁷⁵ Andrea Bernardoni, “La fusione delle artiglierie tra Medioevo e Rinascimento. ‘Cronaca’ di un rinnovamento tecnologico attraverso i manoscritti di Leonardo,” *Cromohs* 19 (2014): 106-116.

⁷⁶ Francesco di Giorgio Martini, *Trattato di architettura civile e militare*, ed. Cesare Saluzzo (Turin: Tipografia Chirio e Mina, 1841), 245-247.

The first is the *bombarda*, with a common length from four and a half to six meters. Its stone weighs roughly one hundred and two kilograms [...]. The less the pieces of the gun, more will be its effectiveness [...].

The second is called *mortaro*, from one and a half to two meters long. It must be realized with a sole piece. Its stone weighs from seventy to one hundred kilograms [...].

The third is known as *commune* or *mezzana*, three meters long, and its stone weighs about seventeen kilograms.

The fourth is named *cortana*. Its anterior barrel is two and a half meters long, and one meter is the measure for the posterior one. Its stone weighs from twenty to thirty-five kilograms.

The fifth is the *passavolante*, and it is five and a half meters long. Its lead shot weighs five and a half kilograms.

The sixth is called *basilisco*, with a length from six and a half to seven and half meters. Its shot weighs about seven kilograms, and it can be produced with any metal.

The seventh is the *cerbottana*. It is long from two and a half to three meters. The lead shot weighs about one kilogram.

The eighth is named *spingarda*. It is two and a half meters long, and it has a stone shot weighed from three and a half to five kilograms.

In any case, this endeavor to classify and to rationalize firearms was merely theoretic. In everyday practice, these names could be attributed to other guns. A basilisk could be bigger even than a bombard, and a *cerbottana* and a *passavolante* could be the same thing.⁷⁷ A Florentine contract, signed in January 1493 with the German master Giovanni from Augsburg, highlights these differences.⁷⁸

Master Giovanni should make and cast all the undermentioned guns, priced at seventy *lire* every three hundred and forty kilograms of molten metal. He would purchase tools at his expenses, and the *Otto di Pratica* would supply the raw material, according to custom. The weight loss of these castings should not exceed the seven percent.

Every time he was requisitioned, master Giovanni should manufacture full *bombarde grosse* in one, or two, or three pieces, with a shot weight of one hundred and thirty-five kilograms or more.

Then, half bombards, with a shot weight of sixty-seven kilograms or more, in one piece or more.

Quarter bombards, thirty-three kilograms or more, in one piece or more.

Eighth bombards, thirteen kilograms or more, in one piece or more.

⁷⁷ For an English nomenclature of late fifteenth-century Italian artillery, see: Pepper, "Castles and cannon in the Naples campaign of 1494–95," 292-293.

⁷⁸ ASF, Otto di pratica, Deliberazioni, 5, 96v-97r. A Florentine *lira* was worth twenty *soldi*. Nine *soldi* corresponded approximately to the daily rate for unskilled workers during all the century.

Bombards for castles and city walls, from five to eight kilograms, in one piece or more.

Passavolanti, cortaldi, basilischi, in one piece or more, with a lead or iron projectile weighed thirty-three kilograms or more.

Half *passavolanti, cortaldi* and *basilischi*, from sixteen to thirty-three kilograms.

Quarter *passavolanti*, from eight to sixteen kilograms.

Serpentine, from one and a half to eight kilograms.

Spingarde, from one and a half to two kilograms.

Giovanni promise to the *Otto* to realized all these firearms honestly and loyally, like a skillful and capable craftsman.

Narrations of the French ordnance

In this lively context, during the late summer of 1494, appeared the French artillery of Charles VIII. Italian statesmen were aware of the force and the capabilities of this single piece, heavy bronze ordnance. Already in June 1492, the ambassador Zaccaria Contarini reported on royal firearms to the Venetian senate.⁷⁹

The king's bombards fire about thirty kilograms of iron shot. They are mounted on small carts, and, thanks to an admirable system, they can shoot easily, without any other support. It is said that Charles had countless spingards on carts. French use these guns in two cases. When the encampment is positioned, the soldiers form these carts into an impregnable fortification. When the army besieges a city, or a castle, these pieces demolish walls much more smoothly and in less time than our heavy bombards. People said that more than thirty thousand horses were necessary for the transportation of the ordnance of Louis XI. Now, the monarch carries twelve thousand horses with him.

This accurate judgment was successively reaffirmed and summarized by the Florentine agent in Lyon, Francesco della Casa, in June 1494.⁸⁰

French captains are speeding up the supplies for the fleet. Above all, they are moving a numerous and beautiful artillery. It is affirmed that this ordnance can raze fortresses and walls in a matter of hours, or in a few days, because of their unbroken bombardment.

⁷⁹ *Le relazioni degli ambasciatori veneti al senato*, I., 4., ed. Eugenio Alberi (Florence: Società Editrice Fiorentina, 1860), 23.

⁸⁰ *Négociations diplomatique de la France avec la Toscane*, I., ed. Abel Desjardins and Giuseppe Canestrini (Paris: Imprimerie Impériale, 1859), 311.

On the next day, the worried diplomats Guidantonio Vespucci and Piero Capponi express to Piero de' Medici their opinion on Gallic menace.⁸¹

French are conveying to Italy, by sea and by land, a large number of guns, all mounted on carts. These firearms are not large in size, but they can fire an iron projectile ranged from thirty to one hundred kilograms. It is said that gunmakers thicken their breech and gradually narrow the barrel up to the muzzle, in order to make them stronger. The pieces have, in the middle of their barrel, two trunnions, with which they can be laid and fixed to their carts. Every gun has its cart, its gunners, its ammunitions, and its proper cartridges. When the army stay at camps, the carts are arranged to form a bulwark. When captains want to start a battle, instead, they approach the enemy and open fire on his troops, forcing him into fighting. During siege, gunners unyoke horses from the carts, turn cannons to the fortress, and move artillery little by little, up to the walls. Here, they crumble all the defenses, aiming thirty or forty guns against towers, embrasures, and so on. It is said that these guns can pierce four meters of stone. Although the breach is small, the multitude of shots smashes the walls. Gunners do not cease fire day nor night. They do not take rest from shelling. So, French do not doubt that they can conquest Leghorn in a single day, and Pisa in two. They also make fun of the fortifications of Ostia. A gunner, back from Naples, bets his head on seizing Castel Nuovo in just two days. Though French love to boast, Francesco della Casa and other Florentines narrate frightening stories about these firearms.

The assertions of the Tuscan envoys were motivated not only by the military importance and the technical efficacy of French ordnance. The excellent organization of the royal artillery, in fact, the number of its officials and employees, the structure of its chain of command, had no parallel in contemporary Italian institutions. In Venice, for example, an “artillery supervisor” was established only ten years later.⁸² Beyond the Alps, on the contrary, Louis XI had started a serious reformation of his artillery corps already in 1470s.⁸³ In 1494, on the eve of the invasion, the office was composed by two “grand masters” of artillery, Jean de La Grange and Guyot de Louviers, a lieutenant, a captain of trains, and several commissioner for the custody of gunpowder, metals, and tools. A treasurer, moreover, along with five commissioners and an inspector, was entrusted with the payments of raw materials and salaries.

⁸¹ *Ibid.*, 401-402.

⁸² Panciera, *Il governo delle artiglierie*, 62-64.

⁸³ David Potter, *Renaissance France at war. Armies, culture and society* (Woodbridge: Boydell and Brewer, 2008), 152-157.

Soldiers and ordnance, instead, were subdivided into five permanent corps, the so-called *bandes*, respectively posted in Lower and Eastern Brittany, Brabant, Western Flanders, and Normandy. Every regiment ordinary included dozens of carters, carpenters, smiths, sappers, and hundreds of horses. Gunmakers and gunners did general and regular maintenance, and cast new weapons. During wartimes, their captains could recruit supplementary, “extraordinary” servants, as pioneers, masons, adjutants, matrosses, and gunners. In all, the king could rely on more than one hundred and fifty heavy guns, not counting the pieces stored in the arsenals of French cities.⁸⁴

Towards Naples. The performances of the royal artillery

Pepper demonstrated that, in the autumn of 1494, in Tuscany, the French army numbered about forty or fifty artillery pieces. French bulletins and Italian chronicles listed eight or nine cannons, four culverins, and at least thirty falcons.⁸⁵ All these weapons were cast with a single piece of bronze. The cannons weighed from two to four tons, had a length from two and a half to three meters, and fired twenty-two kilograms of iron projectile. The culverins, instead, were one meter longer, slimmer, and loaded with thirteen kilograms of iron shot. Last, but not least, the small falcons shot four kilograms of lead, and, generally, weighed less than five hundred kilograms.⁸⁶

The sight of this artillery impressed the most of Italians. Sebastiano Tedallini, a Roman priest, portrayed it as “the most beautiful ordnance of nowadays.”⁸⁷ According to Marino Sanudo, the havoc caused by French “spingards” could be compared to the damages inflicted by an average, traditional bombard.⁸⁸ Also the Sienese diarist Allegretto Allegretti call them

⁸⁴ Philippe Contamine, “L’artillerie royale française à la veille des guerres d’Italie,” *Annales de Bretagne* 71, no. 2 (1964): 221-261.

⁸⁵ Pepper, “Castles and cannons in Naples campaign,” 286-288.

⁸⁶ Ridella, *Produzione di artiglierie nel sedicesimo secolo*, 87-88; Vannoccio Biringuccio, *Pirotechnia* (Venice: Per Comin da Trino di Monferrato, 1558), 79v-80r; Sanudo, *La spedizione di Carlo VIII in Italia*, 127.

⁸⁷ Sebastiano Tedallini, “Diario romano,” ed. Paolo Piccolomini, in *Rerum Italicarum Scriptores*, XXIII., 3., ed. Giosuè Carducci and Vittorio Fiorini (Città di Castello: Lapi, 1904), 291.

⁸⁸ Sanudo, *La spedizione di Carlo VIII in Italia*, 473.

“small bombards.”⁸⁹ The difference between Italian and Ultramontane guns, however, was soon noticed by a Perugine humanist, Francesco Matarazzo.⁹⁰

The French firearms had unusual shapes, compared to our weapons. First of all, they were made with a single piece of bronze, and extremely long. Their shot could pass three meters of stone wall from one side to another. Moreover, these French pieces fired only iron balls, and they were called with original names. Transporters mounted them over two solid wheels, large or small, according to the weight of the gun. Carts were draft by horses.

Around 1520, Paolo Giovio, reconstructing the scene of the passage of French army through Rome, narrate the fear and the astonishment provoked by the royal firearms.⁹¹

More than thirty-six guns, mounted on carts, induced astonishment and fright among everyone. They were drawn by horses, at incredible velocity, over flat grounds and on slopes. The biggest of these, two and a half meters in length and two thousand kilograms of bronze in weight, were named cannons, and fired an iron ball as large as a man's head. After them followed the culverins, half as long again, but with a narrower barrel and a smaller shot. Falcons of different dimensions ended the parade. The smallest of them threw a ball similar in size to an orange. All these pieces were buckled on two thick trunnions, with which gunners could aim at the target. Lighter ordnance was transported on two wheels. The carriages of heavier weapons had four. In this case, the two rear wheels could be removed or put for speeding up or slowing down the march. The pace of cavalry could even be equaled by carthorses, across plains, due to the tremendous skill of carters and masters.

Another relevant description of these guns was made by Andrea Bernardi, a Forlivese barber, eyewitness to the French march in Romagna, during October and November 1494.⁹²

On Sunday, the French left Forli and pitched their tents in the village of San Martino and in its vicinity. Soldiers moved also all of their firearms [...], that is, nineteen carts, except six heavy guns. The largest was a cast bronze

⁸⁹ Allegretti, “Diario,” 835.

⁹⁰ Francesco Matarazzo, “Cronaca della città di Perugia,” *Archivio Storico Italiano* 16, no. 2 (1851): 63-64.

⁹¹ Paolo Giovio, *Le historie del suo tempo* (Venice: Appresso Domenico de' Farri, 1555), 59rv.

⁹² Andrea Bernardi, “Cronache forlivesi dal 1476 al 1517,” I., 2., ed. Giuseppe Mazzatinti, in *Monumenti storici pertinenti alle provincie di Romagna* (Bologna: Presso la Regia Deputazione di Storia Patria, 1896), 17-18.

weapon. It was three meters long, and its bore was sixty centimeters wide. Two bombards had a medium size. The others were three massive *passavolanti*, all manufactured with a single piece of metal. The smallest of them fired an iron ball big as a round loaf. These firearms were mounted on carts. These vehicles had a robust axle that connected two well carved wheels, in order to shoot incessantly and without shelters. The wheels had solid bent spokes, and were strengthened with thick iron plates and nails. Their diameter measured ninety centimeters, and their width half a meter. The hub, where the spokes met, was metallic, and well proportioned, and twenty-five centimeters high and wide. A large number of horses drafted these carts. The first heavy bombard was shift by twenty-two beasts, tied two by two with ropes and halters, the latter covered with black leather [...]. At least sixteen animals drew the other carts [...]. Gunners carried with them also powder and iron shots.

At the end of the campaign, in August 1495, the Vicentine engineer Basilio della Scola reported to Venetian officers on the quality and the quantity of enemy artillery stored at that time in Vercelli. In the preceding year, he was one of the commander of French trains. His account of the various pieces is probably one of the most reliable, contemporary description of the royal artillery.⁹³

Five serpentine cannons, two and a half meters long, fire sixteen kilograms of iron ball. Four culverins, or *passavolanti*, from three and a half to four meters long, shoot a projectile of ten and a half kilograms. Fourteen falcons, similar to spingards, are long two meters, and are loaded with lead shots, weighed from four to five kilograms.

On his way to Naples, however, Charles VIII rarely aimed his guns at Italian fortresses. Frequent reversal of alliances, tactical errors, popular rebellions, Milanese loans, ruthless violence, scarce resistance, and even a mystic aura facilitated his march toward the South. Only in five occasions the king had to lay siege to resistant castles, and his army was forced into battle just twice. The very first shots were fired by the French vessels during the encounter of Rapallo, in September 1494.⁹⁴ Philippe de Commines, in his *Mémoires*, remembered the massacre of Aragonese mercenaries carried out by the heavy artillery, “weapons never seen before” in the Peninsula.⁹⁵ The pieces were then landed in the harbor of

⁹³ Sanudo, *La spedizione di Carlo VIII in Italia*, 559.

⁹⁴ Francesco Guicciardini, *The history of Italy*, I., trans. from the Italian edition by Austin Parke Goddard (London: Printed for Z. Stuart, 1754), 144.

⁹⁵ Philippe de Commines, *Croniques du roy Charles huptieme* (Paris: A l’enseigne du Pellican, 1529), 8r.

La Spezia, in time to meet the terrestrial army at Florentine borders, in Lunigiana, while the enemy fleet withdrew from Liguria.⁹⁶

In Romagna, the Milanese captain Gaspare Sanseverino and the lieutenant Bérault Stuart, lord of Aubigny, had at their disposal at least twenty-two guns. These weapons were supervised by the “grand master” Jean de La Grange himself.⁹⁷ According to Giovio, the veteran condottieri of the Neapolitan army feared “enormously” the new firearms.⁹⁸ Their hesitations, however, allowed French to overawe the rulers of the region, including one of the most important allies of king Alfonso, Caterina Sforza.⁹⁹ The duke of Calabria was powerless to intervene when his foes besieged Mordano, in mid October.¹⁰⁰

On Monday, the French soldiers left their encampment, and reached Mordano. They attacked the castle from morning until night, unceasingly. Their artillery wore down all the defenses that surrounded the walls.

The town was sacked and burned.¹⁰¹ Nine days after, the village of Solarolo surrendered after a single, miss shot of a culverin.¹⁰² Consequently, the lady of Imola sided immediately with her former adversaries, granting them passage and provisions.¹⁰³

Then, the peoples of Italy, eager of novelties, began to embolden, noticing an extraordinary something never seen before. And that is, the easiness in transporting and handling a large amount of ordnance. At that time, French excelled in this exercise.

In northern Tuscany, the march of the army halted in front of the fortifications of Sarzana and Sarzanello. Pepper affirmed that these two newly built citadels were “formidable strongholds.”¹⁰⁴ Architecturally, the round corner bastions, the ravelins, the gun platforms,

⁹⁶ ASF, Otto di pratica, Responsive, 10, 305r; Pepper, “Castles and cannons in Naples campaign,” 267.

⁹⁷ Sanudo, *La spedizione di Carlo VIII in Italia*, 127.

⁹⁸ Giovio, *Le historie del suo tempo*, 43r.

⁹⁹ Cecil Clough, “The Romagna campaign of 1494. A significant military encounter,” in *The French descent into Renaissance Italy, 1494-1495. Antecedents and effects*, 204-205.

¹⁰⁰ Bernardi, “Cronache forlivesi,” 17-18.

¹⁰¹ Leone Cobelli, “Cronache forlivesi,” ed. Filippo Guardini, in *Monumenti storici pertinenti alle provincie della Romagna* (Bologna: Regia Tipografia, 1874), 358 ; Sanudo, *La spedizione di Carlo VIII in Italia*, 95.

¹⁰² Bernardi, “Cronache forlivesi,” 22.

¹⁰³ de Commynes, *Croniques du roy Charles huptieme*, 9v-10r.

¹⁰⁴ Pepper, “Castles and cannons in Naples campaign,” 269-270.

and the wide ditches certainly made these fortresses more “modern” than hundreds of Italian castles. However, in that autumn, Florentine officers complained frequently about the lack of ammunition, food, soldiers, gunners, artillery, and other defenses. By the end of October, the commissioner Piero Tornabuoni lamented the scarcity of money, “and this shortage is dismaying everyone.” Several of his desperate letters reported the complete “disorder” of the garrison, and regretted, moreover, the disinterest of his superiors, in Florence.¹⁰⁵

Following the surrender of Piero de’ Medici and Alexander VI,¹⁰⁶ Charles VIII proceeded rapidly towards Naples. According to Sanudo, “French do not draw their sword for fighting, but only for scaring.” Between Lazio and Campania, towns opened their gates to the invaders, lowering Aragonese flags and offering their devotion to the new monarch, “saint, fair, and conscientious man.” L’Aquila rebelled at the beginning of 1495. Angevin faction reemerged impetuously, while the whole kingdom was “burning.”¹⁰⁷

Only two castles opposed the relentless journey of the king. The “impregnable” fortifications of Montefortino was captured at the first assault.¹⁰⁸ Sanudo made a mistake in denying the shelling of the stronghold,¹⁰⁹ which towers collapsed, instead, under enemy fire.¹¹⁰

The army moved the artillery near Montefortino. This fortress was fortified by nature and by human intelligence. Nonetheless, neither weapons nor walls could stop the Gallic onslaught and the force of their ordnance. These cannons were longer than Italian guns, and shot thirty kilograms of iron ball. All these pieces fired at the same time. In a few moments, a larger part of the walls was crumbled. Through the breach, French and Swiss entered the town, and massacred inhabitants and guards.

Another bloodbath awaited Monte San Giovanni in the next days, on February. The mutilation of a French herald unleashed the Ultramontane anger upon the unfortunate village. Charles in

¹⁰⁵ ASF, Otto di pratica, Responsive, 10, 169r, 172r, 229r, 328r, 375r, 378r, 381rv, 417v

¹⁰⁶ Bartolomeo Cerretani, *Storia fiorentina*, ed. Giuliana Berti (Florence: Leo S. Olschi, 1994), 196-197 and 224-225; Piero Parenti, *Storia fiorentina*, I., ed. Andrea Matucci (Florence: Leo S. Olschki, 1994), 113-114 and 169-170; Sanudo, *La spedizione di Carlo VIII in Italia*, 106-107 and 183-186.

¹⁰⁷ Matarazzo, “Cronaca della città di Perugia,” 23; Sanudo, *La spedizione di Carlo VIII in Italia*, 154 and 187;

¹⁰⁸ ASF, Dieci di balla, Responsive, 38, 121r; Parenti, *Storia fiorentina*, I., 177; de Commines, *Croniques du roy Charles huptieme*, 16v.

¹⁰⁹ Sanudo, *La spedizione di Carlo VIII in Italia*, 207.

¹¹⁰ Sigismondo de’ Conti, *Storie dei suoi tempi dal 1475 al 1510*, II., ed. Giacomo Racioppi (Florence: Tipografia Barbera, 1883), 102-103.

person ordered its destruction. After eight hours of night shelling, and despite the rugged position of the fort, the infantry attacked the breach.¹¹¹ No one escaped.¹¹²

The garrison of Monte San Giovanni numbered three hundred men. Having confidence in the thickness of walls, and disbelieving the force of French artillery, they dared to harm the king's emissary [...]. This act inflamed the Gallic pride. Without any delay, soldiers assaulted the castle, driven by rage. In short, they charged in. Defenders were cut in pieces [...]. The castle was sacked and burned. This bitterness terrified the surrounding villages. Considering the cruel fate of Mordano and Montefortino, everybody believed that neither barrier nor warriors could stand up to the French army and the fury of its artillery without severe damage.

The massacres weakened the already crumbling Aragonese resistance. After the conquest of San Germano, the betrayal of Gian Giacomo Trivulzio, and the uprising of Capua, the march to Naples, in the mid February 1495, became a triumphal parade.¹¹³

In the capital, the last Aragonese loyalists barricaded themselves in the Castel Nuovo, in the Castel dell'Ovo and in the Torre di San Vincenzo. Within twenty days, the three strongholds surrendered to the new sovereign. According to Pepper their sieges did not represent "the classic victory of new guns over old fortifications."¹¹⁴ The Castel Nuovo, for example, did not suffer serious damage from French bombardment, even though the shortage of iron cannonballs and gunpowder prevented gunners from firing continuously and repeatedly.¹¹⁵ It is evident, however, that the attackers, thanks to their mobile ordnance, could threaten and conquest three fortified positions rapidly and successively. And it is a matter of fact, above all, that these cannons were already being assimilated into Italian warfare.

¹¹¹ de Commynes, *Croniques du roy Charles huptieme*, 17r; Sanudo, *La spedizione di Carlo VIII in Italia*, 209; de' Conti, *Storie dei suoi tempi dal 1475 al 1510*, II., 3.

¹¹² Giovio, *Le historie del suo tempo*, 70rv.

¹¹³ Giacomo Gallo, *Diurnali*, ed. Scipione Volpicella (Naples: Tipografia Largo Regina Coeli, 1846), 9; Ferraiolo, *Cronaca*, ed. Rosario Coluccia (Florence: Accademia della Crusca, 1987), 44-47; Notar Giacomo, *Cronica di Napoli*, ed. Paolo Garzilli (Naples: Dalla Stamperia Reale, 1845), 186-187; Giuliano Passero, *Giornali*, ed. Vincenzo Maria Altobelli (Naples: Presso Vincenzo Orsino, 1785), 65-68; Sanudo, *La spedizione di Carlo VIII in Italia*, 215-217 and 225-230.

¹¹⁴ Pepper, "Castles and cannons in Naples campaign," 280-281.

¹¹⁵ Sanudo, *La spedizione di Carlo VIII in Italia*, 234, 247, and 250; Passero, *Giornali*, 68-69; Notar Giacomo, *Cronica di Napoli*, 188-189; Giovio, *Le historie del suo tempo*, 74r.

A comparison between “traditional” and “modern” heavy firearms

In the day of Fornovo, in July 1495, the French artillery malfunctioned, most probably due to heavy rain.¹¹⁶ Cicognano from Castrocaro, an infantryman of the Italian league, witness of the battle, told his Forlivese friends that, if it were not for the bad weather, the Venetian army would be overwhelmed by the enemy shots.¹¹⁷ Several officers of the Most Serene Republic gave contrasting version of the initial phase of the encounter, now relating that firearms spared French a resounding defeat, now writing that adversaries lacked powder.¹¹⁸ Francesco Matarazzo, instead, reported that the all the pieces fired simultaneously, causing heavy casualties among men-at-arms and stunning many knights with a deafening noise.¹¹⁹ Philippe de Commines commented briefly that the king’s ordnance was undoubtedly superior to Italian guns, though neither the former nor the latter killed more than ten persons.¹²⁰

At that time, in any case, the royal artillery had already achieved the height of its fame. Italian rulers and mercenary captains were overly impressed by the Ultramontane siege strategy. The rapidity and the efficiency with which French gunners could move, aim, and fire their guns represented an absolute, frightening novelty. The practice of positioning numerous guns near the walls, the simultaneity of the explosions, the saturation bombardments, the use of iron cannonballs, and the immediate assaults were unprecedented in Italian Renaissance warfare.¹²¹ According to de Commines, Venetian senators were incredulous about the French way of seizing towns, which was simply “new, in Italy.”¹²²

In march 1486, the duke of Calabria and the Milanese condottiere Gian Giacomo Trivulzio required their Florentine allies to send several firearms towards their encampment, in Maremma. According to the two generals, the weapons were useful for acquiring reputation and scaring the surrounding villages. Moreover, they continually underlined that, without guns, every “insignificant hovel” could oppose resistance, slackening the operations.¹²³ In reality, every well garrisoned town could suffer weeks of shelling. In 1479, despite its isolation,

¹¹⁶ Bernardi, “Cronache forlivesi,” 60; Sanudo, *La spedizione di Carlo VIII in Italia*, 480.

¹¹⁷ Cobelli, “Cronache forlivesi,” 871.

¹¹⁸ Domenico Malipiero, “Annali veneti,” *Archivio Storico Italiano* 7, no. 1 (1843): 356-358 and 361.

¹¹⁹ Matarazzo, “Cronaca della città di Perugia,” 65.

¹²⁰ de Commines, *Croniques du roy Charles huptieme*, 31r.

¹²¹ Contamine, “L’artillerie royale française à la veille des guerres d’Italie:” 248; Pepper, “Castles and cannons in Naples campaign,” 291.

¹²² de Commines, *Croniques du roy Charles huptieme*, 20r.

¹²³ ASF, Dieci di balia, Responsive, 33, 470r, 493r .

Colle Val d'Elsa fiercely repelled Neapolitan and Sieneese assaults, in spite of the menace of seven bombards.¹²⁴ The fortress of Ficarolo drove back attackers for two months, during the Ferrarese war, before surrendering to Roberto Sanseverino.¹²⁵ Genoese troops defended Pietrasanta, in 1484, for the an entire autumn.¹²⁶ A bunch of Orsini loyalists controlled a fortified bridge for twenty days, mocking the papal soldier with the shots of their hand cannons.¹²⁷ Eight heavy Florentine bombards did not subdue Sarzana, in 1487.¹²⁸

Time did not favor prolonged sieges. Armies abounded in deserters, especially when the wages arrived too late.¹²⁹ The rigors of winter hindered marches, supplying, and plundering.¹³⁰ But the transportation of heavy, traditional bombards was certainly another major problems for commanders. Uneven roads were not suitable for the passage of giant, cumbersome machines. In May 1464, Milanese engineers had to organize the entire logistic of shifting of the *Corona*, the *Bissona*, and the *Liona*. The three weapons arrived in Genoa one month later, after a troubled journey, and with an exasperating pace of two kilometers a day.¹³¹ In 1468, king Ferrante had to hire dozens of smiths, carpenters, mule drivers, woodcutters and boatman for moving his artillery on the mountains of Abruzzo.¹³² On the way to Pisa, in June 1487, the wheels of two Florentine carriages sank into mud, driving the carters "in despair."¹³³ Several months before, the duke of Calabria waited for ten long days the allied bombards, the time required to cover the distance from Montepulciano to Montorio, a "difficult and wicked" travel.¹³⁴

The loans of ordnance highlights another aspect of the question. When the transport was impossible, or too much slower, republics and princes preferred to borrow firearms, and

¹²⁴ Allegretti, "Diario," 794-795

¹²⁵ Sergio Mantovani, "L'assedio di Ficarolo," in *Tra acqua e terra. Storia materiale in Transpadana* (Ferrara: Comunicarte, 2001), 13-53; Enrica Guerra, *Soggetti a ribalda fortuna. Gli uomini dello stato estense nelle guerre dell'Italia quattrocentesca* (Milan: Franco Angeli, 2005), 111-115.

¹²⁶ ASF, Dieci di balia, Missive, 20, 138v; ASF, Dieci di balia, Missive, 21, 128r.

¹²⁷ Pontani, "Diario romano," 53-54.

¹²⁸ ASF, Dieci di balia, Responsive, 37, 261r-262r.

¹²⁹ Hale, *Guerra e società nell'Europa del Rinascimento*, 116-122.

¹³⁰ Settia, *Rapine, assedi, battaglie*, 211-244.

¹³¹ Maria Nadia Covini, "Trasferimenti di gente d'arme tra logiche statali e relazioni con le realtà locali," in *Viaggiare nel Medioevo*, ed. Sergio Gensini (Pisa: Pacini, 2000), 228-230; Beltrami, "Le bombarde milanesi a Genova nel 1464," 799-800.

¹³² Storti, "Note e riflessioni sulle tecniche ossidionali del secolo quindicesimo," 248.

¹³³ ASF, Dieci di balia, Responsive, 37, 267v.

¹³⁴ ASF, Dieci di balia, Responsive, 33, 385v, 386r, and 462r; ASF, Dieci di balia, Responsive, 36, 330r, 352r, and 362r.

engineers, and gunners from the other members of their leagues.¹³⁵ Besides, only principal states could line up full trains of artillery.¹³⁶ Bronze bombard were expensive, and raw materials were equally costly.¹³⁷ In 1484, the Florentine commune purchased, for one thousand and seven hundred *lire*, two hundred kilograms of second hand metal, collecting them from merchants, apothecaries, sculptors, ropemakers, iron scrap dealers. Besides, more than one hundred and a half kilograms of copper were bought from the company of Benedetto and Francesco di Tanai de' Nerli, priced fifty-five florins each three hundred kilograms. Tin cost seventy-five florins every three hundred kilograms.¹³⁸ Sienese officials paid similar sums for several consignments of Venetian bronze in 1470s.¹³⁹

Significant expenditures concerned also transports. In Tuscany, oxen, mules, donkey, horses, and carts were rented, and they drivers indemnified. During campaigns, the *Dieci di Balìa* could spend more than one thousand golden florins for these expenses.¹⁴⁰ A large number of carriages was necessary for the shifting of every single dismantled piece of bombards and for the transportation of the indispensable accessories, as trestles, beds, ladders, and other wooden supports, frames, and mantlets.¹⁴¹ A Neapolitan treatise listed forty-eight carts exclusively for the shifting of all this equipment.¹⁴² For the reconquest of Otranto, in 1480, king Ferrante allocated two thousand ducats for the monthly pay of two hundred carts.¹⁴³ A Milanese account for 1472 reported that the cost for the moving of eight heavy bombards and eight spingards amounted to one hundred and eighty-eight carts and four hundred and thirty-four pair of oxen.¹⁴⁴ Nevertheless, not all the ordinary carts were suitable for bearing heavy loads. Florentine officers could not find any useful carriage in the Pisan countryside for carrying artillery in Lunigiana, in 1487. Engineers and "masters of carts"

¹³⁵ ASF, Dieci di balìa, Responsive, 37, 46r; Allegretti, "Diario," 784-786; Storti, "Note e riflessioni sulle tecniche ossidionali del secolo quindicesimo," 252; Ansani, "Geografie della guerra," 108-114.

¹³⁶ Mallett, *Signori e mercenari*, 165.

¹³⁷ Belhoste, "Nascita e sviluppo dell'artiglieria in Europa," 337-338; Ansani, "Craftsmen, artillery, and war production," 9-14; Hall, *Weapons and warfare in Renaissance Europe*, 93.

¹³⁸ ASF, Dieci di balìa, Entrata e uscita, 8, 90r-91v, 102v, 129v, and 130r.

¹³⁹ Ermini, "Campane e cannoni," 402-403 and 432-433.

¹⁴⁰ ASF, Dieci di balìa, Debitori e creditori, 39, 292v.

¹⁴¹ DeVries and Smith, *The artillery of the dukes of Burgundy*, 209.

¹⁴² BNF, Département des manuscrits, Italien 958, cc. 17v.

¹⁴³ ASF, Otto di pratica, Responsive, 1, 171v-172r.

¹⁴⁴ Visconti, "L'ordine dell'esercito ducale sforzesco," 469-472.

were then commissioned to manufacture new carriages, made especially for bombard. ¹⁴⁵
Three years before, in Arezzo, the same search was equally problematic. ¹⁴⁶

The recurrent scarcity of pioneers complicated matters further. They were indispensable for repairing roads, for building shelters, for leveling the ground, for positioning the encampment. Moreover, they were employed in moving, planting, aiming, firing, and repositioning the giant firearms. The victory itself “consists in pioneers.”¹⁴⁷ Without them, gunners could only twiddle their thumbs. The absence of this forced labor, or its lateness, could slow down an entire siege. Officials often lamented the daily desertions, the insubordinations, often caused by the brutal treatments of soldiers. ¹⁴⁸

Consequently, bombard shot infrequently, not to mention the breakdowns, the shortage of ammunition and powder, the scarce quality of saltpeter, the errors of the gunners, and the enemy sorties. The Neapolitan heavy guns fired at an average rate of seven projectiles every twenty-four hours, during the siege of Otranto, in 1480. ¹⁴⁹ Florentine charges exploded ten times per day, or even less, under the walls of Pietrasanta, in 1487. ¹⁵⁰ But all those difficulties and complications compelled Italian captains to devise new solutions long before the French invasion. The necessity for more maneuverable pieces was expressed already in 1477 by Orso Orsini. ¹⁵¹

During campaigns, I would supply the army with two bombard. The first should fire three hundred *libbre* of stone, and the second two hundred. Both these firearms should be made with one piece of bronze, and they should weight two and a half and one and a half tons, respectively. These weapons would be as effective as the guns of three pieces, which are heavier and cumbersome. Their breech should be eight centimeters thick, their muzzle four, and the bore should be strengthen with another metallic rim. The whole barrel should be reinforced and welded with forged iron hoops [...]. Similar bombard were undoubtedly efficient, and could be planted and moved quickly.

These guns should be used when the army is numerically disadvantaged. When the enemy is weaker, a captain could line up every sort of bombard,

¹⁴⁵ ASF, Otto di pratica, Missive, 5, 109v, 115r, and 124r; ASF, Otto di pratica, Missive, 7, 26r, 38v, 69r, 75v, 77v, 150r, and 152r.

¹⁴⁶ ASF, Dieci di balia, Missive, 21, 6v-8v.

¹⁴⁷ ASF, Dieci di balia, Responsive, 32, 63v.

¹⁴⁸ ASF, Otto di pratica, Missive, 7, 135r-136r; ASF, Dieci di balia, Responsive, 32, 24r, 146r, 171v, and 177r.

¹⁴⁹ ASF, Otto di pratica, Responsive, 1, 281r.

¹⁵⁰ ASF, Dieci di balia, Responsive, 32, 178v, 196rv, 200r

¹⁵¹ BNF, Département des manuscrits, Italien 958, 15r-17r.

including the awkward ones. In any case, less are the pieces of arms, more rapid is their positioning and their shifting, not requiring screwing and unscrewing, tying, and so on [...].

The vehicles for their transport should be two very high carts, equipped with two robust, iron axles. The bombards should be positioned under these iron bars, so that they could be loaded easily. Indeed, they could not fall from the carriage[...]. Thirteen pairs of oxen should be sufficient for dragging these carts.

The Neapolitan commander suggested also the use of standardized light firearms, identical in size, caliber, and charge, “so that every single gunner could manage each of them.”¹⁵² In 1467, the famous condottiere Bartolomeo Colleoni introduced spingards mounted on carts into Italian battlefields, an experimentation replied in Florence and Venice during the following decades.¹⁵³

French innovations, in 1494, fitted perfectly all of these Italian issues. The drastic diminution of weight, for example, affected production and transportation.¹⁵⁴ The manufacture of heavy guns did not require anymore thousands and thousands kilograms of expensive bronze. With the same quantity of metal, a gunmaker could manufacture at least two cannons, or several culverins, all cast in single, safer, handy pieces. These transformation would have led to an increase of the number of firearms. Between April 1497 and November 1498, Florentine craftsmen realized fifty-seven weapons, while the carpenters fabricated as many carriages, assembled on French models.

The new carts were reliable and resistant. Wheels were strengthened with nails and iron plates.¹⁵⁵ Stouter spokes and axles, moreover, permitted to withstand difficult journeys and impassable roads.¹⁵⁶

Never believe that things which differ from the ordinary are made at home, but if you would believe that I should make them such as to be more beautiful, you would err. For where strength is necessary, no account is taken of beauty, but they all arise from being safer and stronger than ours. The reason is this. When the carriage is loaded, it either goes on a level, or

¹⁵² *Ibid.*, 18rv.

¹⁵³ Claudio Rendina, *I capitani di ventura* (Rome: Newton & Compton, 1999), 196.

¹⁵⁴ Belhoste, “Nascita e sviluppo dell’artiglieria in Europa,” 335-336.

¹⁵⁵ Biringuccio, *Pirotechnia*, 115v-116v.

¹⁵⁶ Niccolò Machiavelli, *Libro dell’arte della guerra* (Venice: Appresso Gabriel Giolito de’ Ferrari, 1550), 96rv.

inclines to the right or left side. When it goes level, the wheels equally sustain the weight, which, being divided equally between them, does not burden them much. When it inclines, it comes to have all the weight of the load upon that wheel on which it inclines. If its spokes are straight, they can easily collapse, since the wheel being inclined, the spokes also come to incline, and do not sustain the weight in a straight line. And, thus, when the carriage rides level and when they carry less weight, they come to be stronger. When the carriage rides inclined and when they carry more weight, they are weaker. The contrary happens to the bent spokes of the French carriages. For when the carriage inclines to one side, it points on them, since being ordinarily bent, they then come to be straight, and can sustain all the weight strongly. When the carriage goes level and the spikes are bent, they sustain half the weight.

Change concerned also the tractive force of these vehicles. The reduction of weight and the adoption of the *carrette* allowed the substitution of slow teams of oxen with faster draft horses. This rapidity of movement was also accompanied by a significant improvement in the procedures for aiming. In fact, the introduction of trunnions facilitated enormously the tasks of gunners, fixing the pieces to cart, and permitting an easier pivoting of guns.¹⁵⁷ Therefore, sieges could start even with a small number of pioneers.

Another technical development was the extension of barrels. As noticed by many chroniclers, French firearms were longer than Italian weapons. Larger powder charges and lengthened weapons increased the velocity and the range of shot.¹⁵⁸ Moreover, the cumbersome stone projectiles were replaced by iron cannonballs. According to Vannoccio Biringuccio, these shots were totally unknown to Italian warfare before the French descent.¹⁵⁹ Cast iron missiles had several economical and strategic advantages. They combined the production efficiency and the cheapness of the raw material with the possibility of making smaller bores and firing heavy, damaging shot.¹⁶⁰

Thus, the French ordnance charmed all the Italian captains who served Charles VIII and Louis XII. Historians and chroniclers noticed its fearful fame and its technical innovations. And,

¹⁵⁷ Giovanni Santi Mazzini, *La macchina da guerra*, II. (Milan: Mondadori, 2006), 254.

¹⁵⁸ Sanudo, *La spedizione di Carlo VIII in Italia*, 265.

¹⁵⁹ Biringuccio, *Pirotechnia*, 117v.

¹⁶⁰ Hall, *Weapons and warfare in Renaissance Europe*, 94; Ridella, "Produzione di artiglierie nel sedicesimo secolo," 85.

in 1530s, Francesco Guicciardini would have summarized the past and the present of Italian artillery in a notorious excerpt from the *Storia d'Italia*.¹⁶¹

The largest pieces of the artillery we are speaking of, were called bombards, and from that time were spread through Italy, and made use of in sieges. Some of them were made of iron, and some of bronze, but they were of so large a size, that, on account of the little experience of the gunners, and clumsiness of their carriages, they were moved from place to place very slowly, and with great difficulty, and for the same reason were very unhandy when placed against the walls of a town. The intervals between the firings were so long, that a great deal of time was lost, and little progress was made in comparison to what we see in our days. This gave time to the besieged to cast up ramparts and fortifications behind the breaches at their leisure. But, notwithstanding all these impediments, the violence of the saltpeter, of which gunpowder is made, was such that, when these instruments were set on fire, the balls flew with so horrible a noise, and stupendous force, even before they were brought to their present perfection, that they rendered ridiculous all the instruments, so much renowned, invented by Archimedes and others, and used by the Ancients in sieges of towns. But now the French brought a much handier engine, made of bronze, called cannon, which they charged with heavy iron balls, smaller without comparison than those of stone made use of heretofore, and drove them on carriages with horses, not with oxen, as was the custom in Italy. And they were attended with such clever men, and on such instruments appointed for that purpose, that they almost ever kept pace with the army. They were planted against the walls of a town with such speed, the space between the shots was so little, and the balls flew so quick, and were impelled with such force, that as much execution was done in a few hours, as formerly, in Italy, in the like number of days. These, rather diabolical than human instruments, were used not only in sieges, but also in the field, and were mixed with others of a smaller size. Such artillery rendered Charles's army very formidable to all Italy.

In his *Pirotechnia*, Biringuccio wrote a similar exaltation of the new artillery.¹⁶²

Today the moderns proceed more intelligently and with greater reason, because experiments have enlightened them. They have moderated the superfluous and strengthened the weaknesses, abandoning the unwieldy and awkward bombards that threw heavy stone shot with a huge consumption of powder, guns that needed both a high expenditure on pioneers and a large number of working animals. Today craftsmen manufacture cannons easier to handle and to shift, due to their lightness. These weapons shoot iron cannonballs, smaller than the stone projectiles of

¹⁶¹ Guicciardini, *The history of Italy*, I., 147-149.

¹⁶² Biringuccio, *Pirotechnia*, 79rv.

bombards, but with a greater effects on targets, since they are made of an harder material and they are fired more frequently. Cannons can also be planted without supports and shelters.

Diffusion and assimilation of the new technology

In 1494, the French artillery seems to have been manufactured in Italy even before the king passed the Alps. According to the Venetian chronicler Marino Sanudo, in fact, transalpine and local gunmakers were already casting one hundred small firearms in Milan, in August. Shortly afterwards, these pieces were dispatched towards royal encampments, in the vicinity of Parma.¹⁶³

Another ally of Charles VIII, the “good French” Ercole I d’Este,¹⁶⁴ got very interested in these firearms. Since 1480s, the duke of Ferrara was trying to enhance the metallurgic production in his dominions for commercial and military purposes.¹⁶⁵ He was investing in ironworks and mines, gathering craftsmen and information. During his visit in France, in 1493, he probably saw the infamous royal artillery.¹⁶⁶ With the same attention to technical innovations he lead in Lombardy, in November 1494.¹⁶⁷

In his stay in Milan, the duke of Ferrara commissioned master Giovanni, the son of master Alberghetto, to made three models of *passavolanti*, one with French likeness, and two with different shapes. Ercole obtained from Ludovico il Moro fifty kilograms of copper. This metal was previously bought for the casting of the equestrian statue of Francesco Sforza. It was transported in Pavia, and then in Ferrara. Master Giovanni also went here.

It was not the first exchange of artisans and technology between these two courts. Already in 1480s, at the request of Ercole, several Milanese armorers, followed by their apprentices, reached Emilia.¹⁶⁸ In any case, the anonymous author of the *diario ferrarese* reported that Giovanni Alberghetti, along with other Ferrarese masters, crafted these French guns daily, in

¹⁶³ Sanudo, *La spedizione di Carlo VIII in Italia*, 70-71.

¹⁶⁴ Bernardino Zambotti, “Diario ferrarese,” ed. Giuseppe Pardi, in *Rerum Italicarum Scriptores*, XXIV., 7., ed. Pietro Fedele (Bologna: Nicola Zanichelli, 1937), 232.

¹⁶⁵ Manlio Calegari, “Nel mondo dei ‘pratici’. Molte domande e qualche risposta,” in *Saper fare. Studi di storia delle tecniche in area mediterranea*, ed. Manlio Calegari (Pisa: ETS, 2004), 15-18.

¹⁶⁶ *Négociations diplomatiques de la France avec la Toscane*, 267.

¹⁶⁷ Sanudo, *La spedizione di Carlo VIII in Italia*, 118-119.

¹⁶⁸ Emilio Motta, “Armaioli milanesi nel periodo visconteo-sforzesco,” *Archivio Storico Lombardo* 41, no. 1 (1914): 219.

haste. From January to November 1495, dozens of these *passavolanti* came out from the foundry of the Castello Estense. These culverins were long six and a half meters and mounted on carts.¹⁶⁹

In 1496, Ercole and his heir, Alfonso, embarked on an ambitious political, economic, and military project. They decided to construct a new furnace in Fornovolasco, in their possessions on the Apuan Alps, in order to foster the production of bronze artillery and iron shot. Ducal officers contacted and hired expert practitioners in alpine regions. In 1497, thanks to the contributions of miners, “masters of furnaces,” smiths, carpenters, charcoal burners, and many others, the mill was opened.¹⁷⁰ One year later, also Ludovico il Moro planned a similar factory of armor and ordnance. The workshops had to be erected in Vogogna, a small village on the Toce river, in the Val d’Ossola.¹⁷¹ In 1499, at least sixty French pieces were stored in the Castello Sforzesco, along with their carts and their ammunitions.¹⁷²

Contrary to its belligerent neighbors, the Republic of Venice was a latecomer to the new technology. The previous experiments with spingards mounted on carts, strangely, did not lead to an immediate adoption of original, innovative weapons.¹⁷³ Only in May 1496 the production of transalpine armaments started in the district of Cannaregio, under the supervision of Basilio della Scola, an engineer who served with Charles VIII during the Neapolitan campaign.¹⁷⁴

On this day, they began to fabricate several guns for shelling, like heavy bombards, mounted on carts, according to the French custom. These pieces are long like *passavolanti*, but thicker. They fire shots from three to six kilograms.

One hundred pieces were tested in Lido in November, cast probably by Paolo da Canal.¹⁷⁵ Some cannons, culverins, and falcons were used in Casentino, against Florentine fortifications,

¹⁶⁹ Anonymous, “Diario ferrarese dall’anno 1409 al 1502,” ed. Giuseppe Pardi, in *Rerum Italicarum Scriptores*, XXIV., 7., ed. Pietro Fedele (Bologna: Nicola Zanichelli, 1933), 137, 140, 164, 173 and 194; Sanudo, *La spedizione di Carlo VIII in Italia*, 485; Malipiero, “Annali veneti:” 562.

¹⁷⁰ Calegari, “La mano sul cannone,” 63-70.

¹⁷¹ Motta, “Armaioli milanesi”: 223.

¹⁷² Marin Sanudo, *I diari*, II., ed. Guglielmo Berchet (Venice: A spese degli editori, 1879), 1087.

¹⁷³ Sanudo, *La spedizione di Carlo VIII in Italia*, 465; Mallett, *L’organizzazione militare di Venezia nel Quattrocento*, 113.

¹⁷⁴ Marin Sanudo, *I diari*, I., ed. Federico Stefani (Venice: A spese degli editori, 1879), 146.

¹⁷⁵ *Ibid.*, 375.

by the end of 1498.¹⁷⁶ However, their transport was problematic, due to impassable mountain road, frequent breakings of carts, and scarcity of draught animals.¹⁷⁷

A strong impulse to the manufacture of new firearms was given by the war against Milan, in 1499. The allied French ambassador expressly requested cannons for the campaign, blaming old bombards. In July and in August, the officers of the Arsenal distributed hundreds of thousands kilograms of copper among their four gunmakers, Alberghetto Alberghetti, Sperandio de' Savelli, Paulo da Canal and Francesco from Venice.¹⁷⁸ The captain of infantry, Giovan Battista Caracciolo, solicit also some culverins for defending his encampment.¹⁷⁹ The high-powered ironworks of Brescia and Salò assured a constant provision of cannonballs.¹⁸⁰

In Siena, the first cannon was made, in July 1495, by Giacomo di Bartolomeo Cozzarelli. Other local gunmakers, as Carlo d'Andrea Galletti and Vannoccio di Paolo Biringuccio, worked in the capital and in Montepulciano, realizing bronze falcons. At the beginning of the sixteenth century, the Camera del Comune hired also Antonio di Giacomo Ormanni, Alessandro d'Antonio Giusi, and Vannino d'Antonio Vannini for defending its insecure borders with the fire of cannons.¹⁸¹ During their war against Florence, also the Pisan rebels experimented some firearms "according to the French custom." In May 1496, with the assistance of the French soldiers that garrisoned the town, they could manufacture five *passavolanti* of various sizes. These culverins, "beautiful and furious things," were soon pointed at the towers of Ripafratta. The castle surrendered in two days.¹⁸² A couple of years later, the Pisan army rushed the bastion of Stagno with one cannon and four culverins.¹⁸³

A long series of naval defeats against the French fleet, instead, compelled the Republic of Genoa to adopt cannons in the first months of 1497. The officers of San Giorgio, in fact, reasoned that the deciding factor in battles was the number and the size of enemy firearms. For preventing further losses of ships and freights, they ordered that every Genoese ship had to transport three and a half tons of bronze artillery, that is, two cannons and four falcons.¹⁸⁴

¹⁷⁶ *Ibid.*, 1112.

¹⁷⁷ Sanudo, *I diari*, II., 178, 196, 202 and 420.

¹⁷⁸ *Ibid.*, 963, 975, 1031, 1170.

¹⁷⁹ *Ibid.*, 1058.

¹⁸⁰ *Ibid.*, 120 and 1176.

¹⁸¹ Angelucci, *Documenti inediti per la storia delle armi da fuoco italiane*, 566-570.

¹⁸² Giovanni Portoveneri, "Memoriale," *Archivio Storico Italiano* 6, no. 2 (1845): 307.

¹⁸³ Sanudo, *I diari*, II., 149.

¹⁸⁴ Agostino Giustiniani, *Annali della repubblica di Genova*, II., ed. Giovanni Battista Spotorno (Genoa: Presso il libraio Canepa, 1854), 590; Bartolomeo Senarega, "De rebus genuensibus commentaria," ed. Emilio Pandiani, in *Rerum Italicarum Scriptores*, XXIV., 8., ed. Pietro Fedele (Bologna: Nicola Zanichelli,

The information on Neapolitan artillery after 1494 is quite scarce. Sanudo narrated that Ferrandino lacked bombards and gunners.¹⁸⁵ However, in November 1495, during the reconquest of the capital, several iron projectiles were realized in the naval arsenal “for the first time ever.”¹⁸⁶ Subsequently, the situation had improved. Rebel castles were struck by French-style guns since 1496.¹⁸⁷ An inventory dated 1499 listed ninety pieces among cannons, falcons, and culverins, a few captured from the routing enemy, and the most manufactured by Italian, Spanish, and French gunmakers in the foundries of the Castel Nuovo.¹⁸⁸

Federico d’Aragona, moreover, could even lend several weapons to his Roman allies, the Colonna.¹⁸⁹ According to Sigismondo de’ Conti, the Neapolitan armaments allowed the Colonna to maintain a significant predominance in the Lazio region. The strongholds of their opponents, the Orsini and the Conti, fell one after the other, in the winter of 1497.¹⁹⁰

The Colonna’s soldiers moved towards Torre Mattia. This castle seemed capable to resist to a prolonged assault, considering the thickness of its walls, the strength of the garrison, and the numerous shelters. Nonetheless, it was captured, because, along with other machinery, the besiegers carried two long French cannons with them. Those firearms could even have destroyed diamond walls.

A few weeks later, Colonna’s falcons decimated Orsini’s infantry in the battle of Montecelio. The victors chased the fugitives as far as the castle of Pratica.¹⁹¹

The town of Pratica perched on a rugged place. It seemed to brave every attack. Only a narrow trail led to its gate, surrounded by rocks and crags. Those circumstances, however, did not dismay Colonna’s troops, because winners do not know obstacles. They pitched their encampment nearby the walls, and, against all odds, the army carried its heavy cannons on the mountain [...]. Francesco Conti, the archbishop of Consa, escaped from the

1932), 60-61; Enrico Alberto d’Albertis, *Le costruzioni navali e l’arte della navigazione al tempo di Cristoforo Colombo* (Genoa: Tipografia regio istituto sordomuti, 1893), 232.

¹⁸⁵ Sanudo, *La spedizione di Carlo VIII in Italia*, 572.

¹⁸⁶ Ferraiolo, *Cronaca*, 81.

¹⁸⁷ Sanudo, *I diari*, I., 211.

¹⁸⁸ Luigi Volpicella, “Le artiglierie di Castel Nuovo nell’anno 1500,” *Archivio Storico per le Province Napoletane* 35 (1910): 308-348.

¹⁸⁹ Nicola Barone, “Notizie storiche raccolte dai registri curiae della cancelleria aragonese,” *Archivio Storico per le Province Napoletane* 15 (1890): 231 and 460.

¹⁹⁰ Sigismondo de’ Conti, *Storie dei suoi tempi dal 1475 al 1510*, I., ed. Giacomo Racioppi (Florence: Tipografia Barbera, 1883), 173-174.

¹⁹¹ *Ibid.*, 176-178.

town with two of his brothers. He then found shelter in the castle, sited on a steep cliff, and isolated from the village. Initially, the clergyman refused to surrender, but when, despite his opinion, he saw the cannons, he was forced to yield.

The astonishing, sudden conquests of their archrivals suggested to the Orsini to reopen their foundry in Bracciano immediately.¹⁹²

Obviously, also pope Alexander VI decided to provide his troops with the novel firearms. Around 1500, his son, Cesare Borgia could line up several cannons and hundreds carthorses.¹⁹³ Roman craftsmen supplied the gonfalonier of the Church with numerous new guns for his campaign in Romagna.¹⁹⁴

In Fano, the duke waited for his ordnance, led by Vitellozzo Vitelli across the Adriatic coast [...]. They were fifteen pieces, that is, two new culverins, which bore was thirty-five centimeters high, engraved with the pontifical coat of arms. Moreover, there was a third culverin, a little bit smaller than the other, marked with a square surmounted by a cross. The rest were five cannons and eight falcons, all crafted recently. The bore measured twenty-five centimeters for cannons, and twelve and a half centimeters for falcons.

In 1502, moreover, the pontiff bought from Luigi XII the Neapolitan artillery stored in the fortifications of Ischia, spending thirty-three thousand ducats for twelve cannons, sixteen culverins, and many other small firearms.¹⁹⁵ A few months later, the rebellion of Cere was suppressed by the firepower of countless “French pieces.” Witnesses reported that six thousand shots had hit the walls and the roofs of the town.¹⁹⁶

In the meanwhile, other important families of the Papal States were adopting the new technology. Astorre III Manfredi, lord of Faenza, purchased several new guns in Brescia. Guidubaldo from Montefeltro affirmed that French gunners were masters of artillery and war.¹⁹⁷ Moreover, the two condottiere brothers Paolo and Vitellozzo Vitelli owned twelve falcons, crafted by Florentine and Spanish artisans in their stronghold of Città di Castello.¹⁹⁸

¹⁹² *Ibid.*, 179.

¹⁹³ Sanudo, *I diari*, I., 464; de' Conti, *Storie dei suoi tempi*, 229 and 235.

¹⁹⁴ Bernardi, “Cronache forlivesi,” 312.

¹⁹⁵ Tedallini, “Diario romano,” 298.

¹⁹⁶ de' Conti, *Storie dei suoi tempi*, 266-267.

¹⁹⁷ Sanudo, *I diari*, II., 742 and 969.

¹⁹⁸ ASF, Dieci di Balìa, Missive, 59, 90v; ASF, Dieci di Balìa, Missive, 60, 101r; ASF, Lettere varie, 3, 40r, 116r and 153r.

Like Fabrizio and Prospero Colonna, like Virginio, Carlo, and Giordano Orsini, they personally had experience with the French ordnance during their service with the French army in 1495 and 1496.¹⁹⁹

The story of Vitelli's firearms was closely intertwined with the developments of Florentine artillery. In fact, since Paolo became the general captain of the Republican army, in May 1498, he frequently requested new French guns, tons of powder, and iron cannonballs from his employers, forcing them to increase the quality and the quantity of ordnance production.²⁰⁰

Nevertheless, the Gallic technology was not unknown to the military officers of the Republic. The royal cannons attracted attention and interest among its statesmen even before the slaughter of Montefortino and the conquest of Naples. In the first weeks of 1495, the *Dieci di Balìa* ordered one of their gunmakers, Francesco Telli, to reach Castrocaro for examining and drawing the falcons, the cannons, and the culverins left there by the king. Contemporaneously, the officials were constructing a new foundry in the center of Florence, nearby the old, abandoned college of the *Sapienza*.²⁰¹ Before the end of February, *maestro* Telli and Simone di Bronzi received eight two tons of copper and two hundred and a half kilograms of tin.²⁰² A few weeks later, the first ever French style firearm produced in Florence was sent to the Pisan encampment. It was a bronze cannon, put on a cart, "according to French custom."²⁰³ The *Dieci* commented to their officers that "this French artillery is very good and very effective."²⁰⁴

The business flourished immediately. In February 1495, a Pistoiese merchant offered several models of these guns to the *Dieci*.²⁰⁵

¹⁹⁹ Rendina, *I capitani di ventura*, 450; Passero, *Giornali*, 104; de' Conti, *Storie dei suoi tempi*, 195.

²⁰⁰ Giuseppe Nicasi, "La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504," *Bollettino della Regia Deputazione di Storia patria per l'Umbria* 17 (1911): 366.

²⁰¹ ASF, *Dieci di Balìa, Deliberazioni, condotte e stanziamenti*, 31, 149v. For the history of the college and the events that followed its construction, see: Emanuela Ferretti, "La Sapienza di Niccolò da Uzzano: l'istituzione e le sue tracce architettoniche nella Firenze rinascimentale," *Annali di storia di Firenze* 4 (2009); Ansani, "Geografie della guerra," 92-96.

²⁰² ASF, *Dieci di Balìa, Munizioni*, 5, 15v, 25r and 32r.

²⁰³ ASF, *Dieci di Balìa, Deliberazioni, condotte e stanziamenti*, 33, 245r.

²⁰⁴ ASF, *Dieci di Balìa, Missive*, 32, 79rv: "queste artiglierie franzesi sono molte buone et fanno grandi effecti."

²⁰⁵ ASF, *Dieci di Balìa, Responsive*, 38, 244r.

Here is a man who has beautiful models for making various kind of guns. He has acquired them from some Frenchmen. These models are perfect for crafting bombards, *passavolanti*, mortars and other pieces. They are fourteen or fifteen pieces. We could buy them for a reasonable price. I exhort your lordships to search for this man, and your lordships could see these models and grasp if they are just what you need. I think so.

In April, another Florentine gunmaker, Lorenzo di Giovanni, called *Cavaloro*, was sent in Castrocaro.²⁰⁶ Soon after, a Picard gunner, Pierre from Douai, was invited to work in the foundry of the *Sapienza*.²⁰⁷ The ambassadors in France even requested a “master of artillery” from the king.²⁰⁸ The *Dieci* decided also to build new furnaces in the border fortresses of Volterra and Firenzuola. In the capital, the castings continued incessantly until autumn 1495.²⁰⁹

Only in the first half of 1498, however, the Florentine craftsmen fully abandoned the Italian artillery for the French ones. The increase of war demand compelled this innovation. In this year, in fact, after the execution of Girolamo Savonarola and the defeat at San Regolo, the Republic took the offensive against Pisan rebels, leaded by its new captain. Several furnaces were repaired under the supervision of one of the Vitelli’s chancellors, while the officers hired carpenters and gunpowder makers.²¹⁰ Between July and September, Francesco Telli cast four tons of bronze, realizing ten falcons and three cannons of different forms. The same number of cannons was crafted by Lorenzo di Giovanni and his workmate, Ludovico del Buono.²¹¹

Another gunmaker, Bonaccorso Ghiberti, was adapting his creations to the French design. In that summer, the grandson of the famous Lorenzo produced three bronze cannons. In August, the *Dieci* ordered Bonaccorso to build a new furnace in his workshop for “an easier and better melting.”²¹² It was a useful improvement. The craftsman rapidly manufactured a falcon and another beautiful cannon, decorated with lion heads and “classic” ornaments. A

²⁰⁶ ASF, Dieci di Balìa, Missive, 31, 81r; ASF, Dieci di Balìa, Responsive, 38, 45r; ASF, Dieci di Balìa, Entrata e uscita, 12, 17v and 103v.

²⁰⁷ ASF, Dieci di Balìa, Munizioni, 5, 48r and 57v; ASF, Dieci di Balìa, Debitori e creditori, 26, 82v.

²⁰⁸ *Négociations diplomatique de la France avec la Toscane*, 659.

²⁰⁹ ASF, Dieci di Balìa, Entrata e uscita, 14, 134v, 168v and 304v; ASF, Dieci di Balìa, Entrata e uscita, 15, 288v; ASF, Dieci di Balìa, Entrata e uscita, 17, 238r; ASF, Dieci di Balìa, Munizioni, 5, 295r and 307r; ASF, Dieci di Balìa, Debitori e creditori, 34, 19v.

²¹⁰ ASF, Dieci di Balìa, Munizioni, 7, 390r; ASF, Dieci di Balìa, Entrata e uscita, 23, 23v and 241v.

²¹¹ ASF, Dieci di Balìa, Munizioni, 7, 367v, 387v, 427v and 508v.

²¹² ASF, Dieci di Balìa, Deliberazioni, condotte e stanziamenti, 48, 145r; ASF, Dieci di Balìa, Munizioni, 7, 390r; Dieci di Balìa, Entrata e uscita, 23, 242r.

third gun, three meters in length and with a shot weight of sixteen kilograms of iron, was realized in November.²¹³

Significantly, Bonaccorso reported in his personal notebook, the so-called *Zibaldone*, two references to French methods of casting artillery, related to the diameter of the shot.²¹⁴

A culverin or *passavolante* will weigh about one hundred and seven hundred kilograms, if it has a bore diameter of twenty or fourteen centimeters, a length of three and a half meters [...], and a rear part thick as two shot. Another culverin or *passavolante* will weigh about two tons, if it has a length of three and a half meters, and if it fires twenty-seven kilograms of lead [...]. French gunmakers are accustomed to cast the breech of their *passavolanti* three shot thick, that is, one for empty space and two for bronze, that is, every side of the chamber as much thick as the gap. This is their own way to craft guns with a shot weight of three kilograms of lead, or less. And for the pieces with a shot weight of ten, or thirteen, or seventeen kilograms of lead, they made these sides two and a half shot thick.

Other notes concerned the proportions and the measurements of cannons, the calculation of the weight of a piece according to his length, and the earth used on the molds of ordnance. Several drawings, instead, represented single-piece, bronze cannons mounted on carts, equipped with two spoke wheels, tailpieces, and different aiming systems.²¹⁵

At the same time, the use of a large number of cannons made iron cannonballs indispensable. As with the guns, Florentine masters assimilated the new technology immediately. The production, managed by one of the most important Florentine prospectors, Tommaso Marinai, started in the ironwork of Colle Val d'Elsa in the first months of 1495.²¹⁶ However, three years later, Florentine gunners had approximately available the same quantity of projectiles.²¹⁷ The necessities of the campaign against Pisa compelled the *Dieci* to accelerate the production. In July 1498, the *Dieci* signed a contract with a Angelo from Brescia and Baldo di Giovanni, a Lombard master and a Florentine merchant, for a furniture of a thousand projectiles.²¹⁸ In December, military officers also hired three masters, Giovanni di Piero from

²¹³ AOI, Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, 13230, 19r, 23r,24r and 25r; ASF, Dieci di Balìa, Munizioni, 7, 427v and 478r.

²¹⁴ BNCF, Banco rari, 228, 87v-88r.

²¹⁵ *Ibid.*, 55v and 82r-94v; Scaglia, *A miscellany of bronze works*, 492-493 and 498-513; Gille, *Leonardo e gli ingegneri del Rinascimento*, 116.

²¹⁶ ASF, Dieci di Balìa, Munizioni, 5, 37r; ASF, Dieci, Entrata e uscita, 14, 10v; ASF, Dieci di Balìa, Missive, 32, 96r.

²¹⁷ ASF, Dieci di Balìa, Munizioni, 6, 231v-233r.

²¹⁸ ASF, Dieci di Balìa, Munizioni, 7, 355rv and 457v.

Piedmont, Antonio di Giovanni from Germany, and Lancillotto di Voglino for casting iron shot in Pistoia, along with handguns, harquebuses, and spingards.²¹⁹

In the autumn of 1498, the Florentine artillery was very different compared to the past. The *Dieci* stopped definitively the purchases of old, iron spingards.²²⁰ Their army received exclusively new pieces for the campaign in Casentino. More than twenty thousand and three hundred kilograms of bronze were cast in thirty-seven guns, between February and September.²²¹ According to Marino Sanudo, Florentine army, at that time, had two hundred pieces mounted on carts, including twenty-five pieces among culverins and cannons.²²² One year later, in 1499, the Florentine troops besieged Pisa with at least eighty guns.²²³

The Florentine army numbered about fifteen thousand men between infantry and cavalry. They carried also eighty guns. There were fifty pieces between culverins and cannons, mounted on carts, and seven heavy bombardars. Florentine gunners fired about two hundred shot per hour on the wall and in the city. The entire world seemed to be getting destroyed.

A “revolutionary” deployment?

This last source, as well as many others, shows that the demands of actual combat compelled soldiers and rulers to use both “ancient” and “new” guns. All kinds of weapons were pressed into service, irrespective of their quality, or metal, or mobility. Until the first years of the sixteenth century, French cannons coexisted with Italian bombardars. In 1496, Florentine masters crafted three bronze heavy arms and a small, iron one.²²⁴ In Venice, Alberghetto Alberghetti realized two giant firearms in 1498. In the following months, Ludovico Sforza supplied Genoa with two bombardars and four culverins, while the Most Serene Republic defended the castle of Pizzighettone with a gun manufactured sixty years before. Even Louis XII seized Lombard castles with three aged weapons of his Piedmontese allies, along with

²¹⁹ ASF, Dieci di Balìa, Entrata e uscita, 23, 542r; ASF, Dieci di Balìa, Entrata e uscita, 30, 110r.

²²⁰ ASF, Dieci di balia, Debitori e creditori, 35, 7v.

²²¹ *Ibid.*, 18v, 53v, 213v, 223v, 161v; ASF, Dieci di balia, Munizioni, 7, 306v, 318r, 313v, 318r, 367v, 387v, 427v, 488r, and 508v.

²²² Sanudo, *I diari*, I., 1103. Regarding the carts, the Florentine documentation specifies that the all of the carriages produced after the French invasion were modeled on the Transalpine ones. See ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 33, 245r.

²²³ Portovenieri, “Memoriale,” 341-342.

²²⁴ ASF, Dieci di balia, Debitori e creditori, 31, 57v and 120v.

thirty-six pieces of the royal artillery.²²⁵ This utilization is revealed also by the permanence of the customary Italian terminology. Culverins were generally called *passavolanti*, and the cannons were often confused with *cortane*.²²⁶

Technical innovations, besides, were frequently combined with traditional machines. The creation of these hybrids would have revealed different paths in the adaptation and the development of the firearms.²²⁷ In Florence, for example, several falcons were equipped with a separate breech, like old spingards. The French fashioned ones, instead, were cast in a single piece.²²⁸ Lead shot often substituted iron cannonballs, also because armies were still not provided with enough new ammunitions. In 1499, the Florentine Signoria had to requested projectiles everywhere, in Mantua, in Ferrara, in Lucca, in Brescia, purchasing even contraband wares.²²⁹ At the same time, the factories of Ercole d'Este were about to shut up, due to the scarce quality of minerals and an insufficient overall productivity of missiles.²³⁰ In central Italy, average ironworks could not cast metal for this purpose, especially on an early stage of diffusion of the "alpine" blast furnaces.²³¹ This shortage of cast iron balls would have proved to be a serious problem and an annoying slackening for assailants, depriving them of the opportunity to hammer the walls and the morale of the defenders.²³²

Rulers ran into difficulties not only with the manufacture of shot, but also with the fabrication of the new carriages. Spokes, axles, and wheels were not so easy to reproduce. The vehicles seemed to break continuously, along the impassable mountain roads. Above all, the common oxen were still preferred to the unobtainable horses, with evident repercussions for

²²⁵ Sanudo, *I diari*, I., 1016; Sanudo, *I diari*, II., 759, 1104, and 1272.

²²⁶ ASF, Dieci di balia, Munizioni, 5, 295r and 324v; Anonymous, *Diario ferrarese*, 137 and 140.

²²⁷ Liliane Hilaire-Perez and Catherine Verna, "Dissemination of technical knowledge in the Middle Ages and the Early Modern Era. New approaches and methodological issues," *Technology and Culture* 47, no. 3 (2006): 537.

²²⁸ ASF, Dieci di balia, Debitori e creditori, 35, 161v.

²²⁹ Ansani, "The life of a Renaissance gunmaker," 773-775; Piero Parenti, *Storia fiorentina*, II., ed. Andrea Matucci (Florence: Leo S. Olschki, 2005), 280; ASF, Signori, Missive seconda cancelleria, 52r and 55v; AOI, Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, 13229, 26r; ASF, Signori, Missive seconda cancelleria, 21, 52v; ASF, Dieci di Balia, Entrata e uscita, 30, 171v-173r.

²³⁰ Enzo Baraldi and Manlio Calegari, "Pratica e diffusione della siderurgia indiretta in area italiana," in *La sidérurgie alpine en Italie*, ed. Philippe Braunstein (Rome: École Française de Rome, 2001), 102-116.

²³¹ Philippe Contamine, "Les industries de guerre dans la France de la Renaissance. L'exemple de l'artillerie," *Revue Historique* 221, no. 2 (1984): 258-262; Calegari, "La mano sul cannone," 65-66; Ansani, "Geografie della guerra," 100-101.

²³² Contamine, "L'artillerie royale française à la veille des guerres d'Italie:" 246-249.

the rapidity of the operations. The Venetian expedition in Tuscany, during the winter of 1498, would have highlighted these limitations.²³³

In order to avoid dangerous deficiencies, authorities were forced to make timely, systematic preparations for equipping their army with pieces, missiles, and gunpowder. They had also to stockpile copper and tin, iron, timber, sulfur and saltpeter, reorganizing the whole commodity chain. Officers tried to combine the “government of artillery” with the “governance of the production.”²³⁴ The Florentine procurement for the 1498 campaign in the Pisan countryside could be considered as a significant achievement. Founders realized thirty guns in just three months. Ambassadors signed contract for the supply of nitrate in Genoa, in Rome, and in Milan, while the gunpowder makers of the capital worked even overnight. A local merchant, along with a Lombard master, provided hundreds iron cannonballs. The *Dieci di Balìa* rented also “twenty-five horses and twenty-five carts” for the shift of light falcons. Their captain, however, was not very pleased. He would have requested “shot and powder, powder and shot,” again and again.²³⁵

In spite of their determined efforts, hence, states could not always maintain the new armaments. And, “without an effective logistical system, new technologies might be of little consequence in campaigns.”²³⁶ In general, anyway, the new ordnance was satisfying the needs of commanders in terms of mobility, surprise, and fright. Small town and minor posts, the “insignificant hovel” detested by the duke of Calabria, could not oppose resistance to their attacks. Paolo Vitelli would have conquered five fortified position in the course of a month and a half, in 1498. But, despite its indisputable qualities, the French-style artillery was not a “war-winning weapon.”²³⁷ In 1494, the Aragonese sovereigns were more betrayed than defeated, when their allies surrendered, and their people rebelled. The possibility to counter-attack the invaders with cannons and culverins did not save the Neapolitan kingdom from a second fall, in

²³³ Sanudo, *I diari*, II., 161 and 178.

²³⁴ Ansani, “Geografie della guerra,” 116-117.

²³⁵ An accurate study of both preparations and operations, entitled “Supplying the army. 1498. The Florentine campaign in the Pisan countryside,” will be published in the *Journal of Medieval Military History*.

²³⁶ Frank Tallett and David Trim, “‘Then was then and now is now.’ An overview of change and continuity in late-medieval and early-modern warfare,” in *European Warfare, 1350-1750*, ed. Frank Tallett and David Trim (Cambridge: Cambridge University Press, 2010), 23-25.

²³⁷ George Raudzens, “War-winning weapons. The measurement of technological determinism in military history,” *The Journal of Military History* 54, no. 4 (1990): 406-40; Hale, *Guerra e società nell’Europa del Rinascimento*, 44

1502.²³⁸ Pisa resisted two consecutive saturation bombardments, in 1499 and in 1500, carried out by Florentine and Gallic troops. In the first case, the assault failed also because of a lack of munitions.²³⁹

Victories and defeats, then, would have been determined by other political, diplomatic, and economic issues. In the Peninsula, besides, the rapid diffusion of cannons was preventing every opponent to establish a technological superiority. And the most recent fortresses were not giving any advantage too. The French artillery, in fact, would not have impacted on the construction of fortifications, at least not immediately. Military engineers would have resorted to the traditional “anti-gunpowder defenses” experimented through the whole fifteenth century, that is, the reduction of the height and the thickening of walls, the increase in the number of gunports, and the building of ravelins.²⁴⁰ In the Tuscan documentation, the term “bastion” would have still indicated a terreplein fortified with wooden structures and numerous firearms, located on the outside of the town perimeters.²⁴¹ The customary round towers would have proliferate until the third decade of the sixteenth century, while the bastioned front was still evolving from traditional forms.²⁴²

In addition, the cannons did not alter the figures of contemporary armies. For the challenging surrounding of Pisa, the Florentine Commune hired about eight thousand infantrymen, the same number marshaled for the operations against Pietrasanta in the preceding decade.²⁴³ A certain rise in the number of soldiers was probably provoked by prolonged operations and ambitious aims, rather than extensive uses of the new ordnance. In 1499, the Most Serene Republic recruited fifteen thousand men for invading the eastern part of the duchy of Milan, and not for seizing just one city or two.²⁴⁴ Moreover, this growth in

²³⁸ Piero Pieri, *Il rinascimento e la crisi militare italiana* (Turin: Einaudi, 1970), 324-341 and 394-398; Mallett, *Signori e mercenari*, 241-252; Volpicella, “Le artiglierie di Castel Nuovo,” 308-314; Pepper, “Castles and cannons,”

²³⁹ ASF, Signori, Missive seconda cancelleria, 21, 65r.

²⁴⁰ Kelly DeVries, “Catapults are not atomic bombs. Towards a redefinition of ‘effectiveness’ in premodern military technology,” *War in History* 4, no. 4 (1997): 466-467.

²⁴¹ ASF, Dieci di balia, Missive, 60, ff. 117v-118r; ASF, Lettere varie, 3, f. 255r.

²⁴² John Hale, “The early development of the bastion. An Italian chronology,” in ID., *Renaissance War Studies*, 16-27.

²⁴³ ASF, Signori, Missive seconda cancelleria, 21, 36v; ASF, Dieci di balia, Missive, 21, 64v.

²⁴⁴ Pieri, *Il rinascimento e la crisi militare italiana*, 378-379; Priuli,

military manpower would have been determined also by famine, poverty, and unemployment, the severe consequences of five years of uninterrupted war.²⁴⁵

Therefore, the complexities of contemporary societies diminish the importance of the “watershed” caused by the appearance of the French guns.²⁴⁶ The supposed “departure in warfare” proposed by Geoffrey Parker seems to be denied not only by the evidences of chronicles and registers, but also by the ordinary use of the armaments, which testified to irregular patterns of deployment and assimilation into the actual warfare.²⁴⁷ Certainly, the assimilation of the French artillery could resemble the “punctuated equilibrium” discussed by Clifford Rogers, with “evolutionary change” which “occurs during short periods of rapid development.”²⁴⁸ However, these accelerations were the results of interrelated elements. The technical transformation was possible thanks to the steady improvements matured in the broader, receptive milieu of the Italian Renaissance. And the technological “bursts,” above all, would have been only a part of the premises of future political implications. The roots of the “early modern state,” of a centralizing government, are complex and numerous.²⁴⁹

French ordnance, then, was not so “revolutionary.” The adoption of the new pattern was immediate, but its affirmation required attempts, failures, and, above all, time. External pressures speeded up or slowed down its diffusion. Alliances permitted and favored the exchange of projects, drawings, goods, and artisans. Wars urged the mobilization of every resource, the production of newer arms, and the use of old bombards. The context, however, was encouraging. French fashion, in general, fascinated several courts, and attracted princes

²⁴⁵ Franco Cardini, *Quell'antica festa crudele* (Milan: Arnoldo Mondadori, 1995), 187-190; Hale, *Guerra e società nell'Europa del Rinascimento*, 110-113; Hall, *Weapons and warfare in Renaissance Europe*, 218.

²⁴⁶ Parker, *La rivoluzione militare*, 117-122.

²⁴⁷ The shift of focus from the “new-technology success stories” to “the world of ordinary use” has been suggested by David Edgerton, “Innovation, technology, or history. What is the historiography of technology about?” *Technology and Culture* 51, no. 3 (2010): 681 and 686; John Staudenmaier, “Rationality, agency, contingency. Recent trends in the history of technology,” *Reviews in American History* 30, no. 1 (2002): 171.

²⁴⁸ Clifford Rogers, “The military revolutions of the Hundred Years’ War,” *The Journal of Military History* 57, no. 2 (1993): 272-278.

²⁴⁹ See, for example, the essays contained in the already cited *Origini dello stato. Processi di formazione statale in Italia fra medioevo ed età moderna*. Other doubts were raised by Kelly DeVries, “Gunpowder weaponry and the rise of the early modern state,” *War in History* 5, no. 2 (1998): 127-145; Hale, *Guerra e società nell'Europa del Rinascimento*, 274-280; Hall, *Weapons and warfare in Renaissance Europe*, 201-235.

and soldiers.²⁵⁰ Renaissance engineers were still thirsty for novelty and experimentations.²⁵¹ Military market was thriving. States had men, knowledge, and tools for acquiring innovations, and the public demand was playing an important, leading role in the introduction of technological improvements. Indeed society was inspiring innovations, while information and culture spread through handbooks, craft mobility, migrations, encounters.²⁵²

The French royal artillery clearly contributed to part of these innovations, with its impact on Italian warfare. In the following decades, the intensive diffusion of mobile cannons would have had serious consequences on fortifications, logistics, and tactics in the whole Peninsula. At the beginning of the sixteenth century, however, these transformation were not completely carried out. It was not a sudden technical, or political, or military “revolution.” The process depended on innumerable, different, interdependent factors.²⁵³ But the new guns, undoubtedly, constituted a significant, potential instrument of change. And, from the point of view of productivity, they would have represented an interesting challenge.

²⁵⁰ Bernardi, *Cronache forlivesi*, 75.

²⁵¹ Gille, *Leonardo e gli ingegneri del Rinascimento*, 8-12; Schulz, “La migrazione di tecnici, artigiani ed artisti,” 89-94; Calegari, “Nel mondo dei ‘pratici’. Molte domande e qualche risposta,” 14-33.

²⁵² Guido Guerzoni, “Novità, innovazione e imitazione. I sintomi della modernità,” in *Il rinascimento italiano e l’Europa*, III. *Produzione e tecniche*, 67-72; Molà, “Il mercato delle innovazioni,” 215-222; Ansani, “The life of a Renaissance gunmaker,” 777-780; Long, *Artisans and practitioners and the rise of the new sciences*, 127-131; Franco Franceschi, “Regional states and economic development,” in *The Italian Renaissance State*, ed. Andrea Gamberini and Isabella Lazzarini (Cambridge: Cambridge University Press, 2012), 444-466.

²⁵³ Pamela Long, “The craft of premodern European history of technology: past and future practice,” *Technology and Culture* 51, no. 3 (2010): 698-714; Stone, “Technology, society, and the infantry revolution of the fourteenth century,” 364-365.

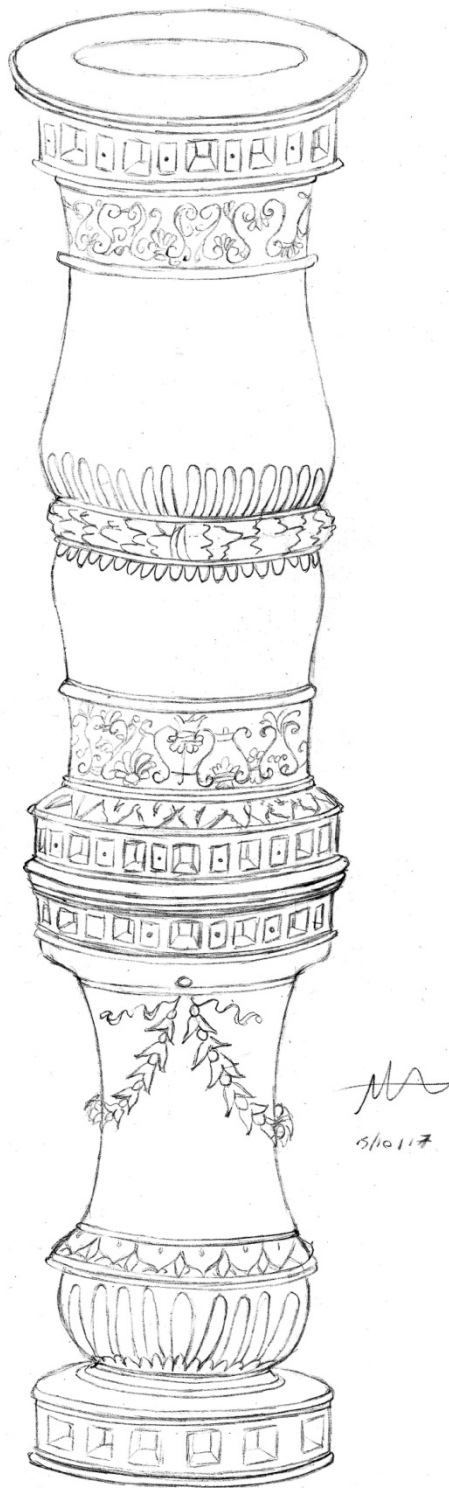


Figure 6. An ideal bombard, sketched by Francesco di Giorgio Martini in 1490s
Firenze, Biblioteca Nazionale Centrale, Magliabechiano II.I.141
Drawing by Angela Marino

ARTICLE VII

SUPPLYING THE ARMY. 1498.

THE FLORENTINE CAMPAIGN IN THE PISAN COUNTRYSIDE

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In spite of a generic awareness of their impact on operational choices, the ammunition supplies have sparked scarce interest among scholars of Renaissance Italy.¹ Little is known on the manufacture and the commerce of weapons in the fifteenth-century Peninsula, or on the technological innovations, or on the construction of new arsenals.² Historians have focused more on the theoretical studies of eminent engineers, on the formation of their humanistic culture, than on the actual practices of smiths and gunmakers.³ Parade, gilded armor have often stolen the glance of art experts, but the state orders of thousands cuirasses were completely neglected by economists.⁴ The extensive, lively market of the indispensable

¹ Enrico Stumpo, "La finanza di guerra negli antichi stati italiani," in *Storia economica della guerra*, ed. Catia Eliana Gentilucci (Rome, 2008), p. 196; William Caferro, "Warfare and economy in Renaissance Italy," *The Journal of Interdisciplinary History* 39, no. 2 (2008), pp. 198-200; Richard Goldthwaite, *The economy of Renaissance Florence* (Baltimore, 2009), pp. 400-01.

² Manlio Calegari, "Nel mondo dei 'pratici'. Molte domande e qualche risposta," in *Saper fare. Studi di storia delle tecniche in area mediterranea*, ed. Manlio Calegari (Pisa, 2004), pp. 9-33.

³ Andrea Bernardoni, "Le artiglierie, da manufatto tecnico alla riflessione scientifica degli ingegneri del Rinascimento," *Quaderni storici* 130, no. 1 (2008); Bernardoni, "La fusione delle artiglierie tra Medioevo e Rinascimento. 'Cronaca' di un rinnovamento tecnologico attraverso i manoscritti di Leonardo," *Cromohs* 19 (2014); Gustina Scaglia, "A miscellany of bronze works and texts in the *Zibaldone* of Buonaccorso Ghiberti," *Proceedings of the American Philosophical Society* 120, no. 6 (1976); Scaglia, "Drawings of machines for architecture from the early *Quattrocento* in Italy," *Journal of the Society of Architectural Historians* 25, no. 2 (1966); Bertrand Gille, *Leonardo e gli ingegneri del Rinascimento*, trans. Adriano Carugo (Milan, 1972); Pamela Long, *Artisans, practitioners and the rise of the new sciences* (Corvallis, 2011), pp. 94-126.

⁴ Silvio Leydi, "Le armi," in *Il rinascimento italiano e l'Europa. Commercio e cultura mercantile*, eds. Franco Franceschi, Richard Goldthwaite and Reinhold Mueller (Treviso, 2007), pp. 171-90; Stuart Pyhrr, José Godoy, and Silvio Leydi, *Heroic armor of the Italian Renaissance. Filippo Negrolì and his contemporaries* (New York, 1998); Luciana Frangioni, "Aspetti della produzione delle armi milanesi nel XV secolo," in *Milano nell'età di Ludovico il Moro* (Milan, 1983), pp. 195-200; Mario Scalini, "L'armatura fiorentina del Quattrocento e la produzione d'armi in Toscana," in *Guerra e guerrieri nella Toscana del Rinascimento*, eds. Franco Cardini and Marco Tangheroni (Florence: 1990), pp. 83-126.

propellants of artillery, the saltpeter, was regarded with the same indifference, as the introduction of new shapes and new materials in the fabrication of ordnance.⁵ Sporadic publications on the management and production of firearms cannot fill all the blanks in the field,⁶ and cannot be compared to the complete analyses offered by the international literature.⁷ Mines and furnaces, at least, have been studied by archaeologists and specialists in Medieval craftsmanship.⁸

Besides, only recently the military historiography of the fifteenth-century Peninsula has evolved from its aged paradigms.⁹ Proposed by Niccolò Machiavelli in his most famous works,¹⁰ the juxtaposition of unreliable mercenary companies and regretted citizen armies has been finally overcome by a gradual reevaluation of the military establishments of kingdoms,

⁵ Silvia Bianchessi. "Cavalli, armi e salnitro fra Milano e Napoli nel secondo Quattrocento," *Nuova rivista storica* 82 (1998); Fabrizio Ansani, "Craftsmen, artillery, and war production in Renaissance Florence," *Vulcan* 4 (2016), pp. 12-13.

⁶ Walter Panciera, *Il governo delle artiglierie. Tecnologia bellica e istituzioni veneziane nel secondo Cinquecento* (Milan, 2005); Calegari, "La mano sul cannone. Alfonso I d'Este e le pratiche di fusione dell'artiglieria," in *Pratiche e linguaggi. Contributi a una storia della cultura tecnica e scientifica*, ed. Luciana Gatti (Pisa, 2005), pp. 55-76; Renato Ridella, "L'evoluzione strutturale nelle artiglierie di bronzo in Italia fra XV e XVII secolo," in *I cannoni di Venezia. Artiglierie della Serenissima da fortezze e relitti*, eds. Carlo Beltrame and Marco Morin (Florence, 2013), pp. 13-28; Ridella, "Produzione di artiglierie nel XVI secolo: i fonditori genovesi Battista Merello e Dorino Il Gioardi," in *Pratiche e linguaggi*, pp. 77-134; Merlo, Marco. "Armamenti e gestione dell'esercito a Siena nell'età dei Petrucci. Le armi," *Rivista di Studi Militari* 5 (2016).

⁷ See, for example: Kelly DeVries, *Medieval military technology* (Peterborough, 1992); Kelly De Vries and Robert Douglas Smith, *The artillery of the dukes of Burgundy* (Woodbridge, 2005); Philippe Contamine, "L'artillerie royale française à la veille des guerres d'Italie," *Annales de Bretagne* 71, no. 2 (1964); Contamine, "Les industries de guerre dans la France de la Renaissance. L'exemple de l'artillerie," *Revue Historique* 221, no. 2 (1984); David Bachrach, "The military administration of England. The royal artillery," *The Journal of Military History* 68, no. 4 (2004); Dan Spencer, "The provision of artillery for the 1428 expedition to France," *The Journal of Medieval Military History* 13 (2015); John Francis Guilmartin, *Gunpowder and galleys. Changing technology and Mediterranean warfare at sea in the 16th century*, (London, 2003).

⁸ Angelo Nesti and Ivan Tognarini, *Archeologia industriale. L'oggetto, i metodi, le figure professionali* (Rome, 2003), pp. 70-106; Enzo Baraldi, "La siderurgia In Italia dal XII al XVII secolo," in *La civiltà del ferro. Dalla preistoria al terzo millennio*, ed. Walter Nicodemi (Milan, 2004), pp. 147-86.

⁹ Caferro, "Continuity, long-term service and permanent forces: a reassessment of the Florentine army in the fourteenth century," *The Journal of Modern History* 80, no. 2 (2008), 219-23; Claudio Donati, "Strutture militari degli Stati Italiani nella prima età moderna: una rassegna degli studi recenti," in *Società Italiana di Storia Militare. Quaderno 2000*, ed. Piero Del Negro (Rome: Edizione Scientifiche Italiane, 2003), pp. 45-62.

¹⁰ Niccolò Machiavelli, *Il principe*, ed. Mario Martelli (Rome, 2006), bks. 12-13; Machiavelli, *L'arte della guerra*, in *L'arte della guerra. Scritti politici minori*, eds. Denis Fachard, Giorgio Masi, and Jean Jacques Marchand (Rome, 2001), bk. 1; Machiavelli, *Discorsi sopra la prima deca di Tito Livio*, I., ed. Francesco Bausi (Rome, 2001), bk. 2.

duchies, and republics. Several contributors have highlighted the importance of these permanent offices in the formation of regional states, in the organization of armies, and in the repercussions of war on tax systems.¹¹

The purpose of this paper, then, will be the examination of one of the indispensable functions of those institutions, that is, the supplying of arms and money to soldiers during a campaign. The context will be the northern Tuscany of the late fifteenth century, at the time of the war between the Florentine Republic and its Pisan rebels. This conflict, in fact, represents an indicative case of the appearance of new technologies on battlefield, their assimilation, and their considerable, direct effects on production. Moreover, the account-books of the Dieci di Balìa, the ten officials responsible for Florentine warfare, offer the opportunity to study the output levels of armament industry, the costs of ammunitions, and the quality of weaponry.¹² The correspondence of this office, along with the dispatches of the Signoria and the letters of condottieri and commissioners, permits to document also the solutions to awkward transportations, the difficulties with the scarcity of equipments, the role of the public demand in the introduction of innovations, and the problematic adaptation to new patterns and strategies. Lastly, diaries and chronicles highlight the results of sieges and battles, and the political tensions between Florentine factions.

¹¹ Francesco Storti, *L'esercito napoletano nella seconda metà del Quattrocento*, trans. Enrico Basaglia (Salerno, 2007); Michael Mallett, *L'organizzazione militare di Venezia nel Quattrocento* (Rome, 1989); Maria Nadia Covini, *L'esercito del duca. Organizzazione militare e istituzioni al tempo degli Sforza* (Rome, 1998); Enrica Guerra, *Soggetti a ribalda fortuna. Gli uomini dello stato estense nelle guerre dell'Italia quattrocentesca* (Milan, 2005); Roberto Farinelli and Marco Merlo, "La Camera del Comune. Miniere, metallurgia, armi," in *L'età di Pandolfo Petrucci. Cultura e tecnologia a Siena nel Rinascimento*, ed. Petra Pertici (Siena, 2016), pp. 189-225. For comprehensive and comparative surveys, see: Piero Pieri, *Il Rinascimento e la crisi militare italiana* (Turin, 1970), pp. 257-398; Mallett, *Signori e mercenari. La guerra nell'Italia del Rinascimento*, trans. Alghisi Princivalle (Bologna, 2006); Luciano Pezzolo, "La 'rivoluzione militare'. Una prospettiva italiana," in *Militari in Età Moderna. La centralità di un tema di confine*, eds. Alessandra Dattero and Stefano Levati (Milan, 2006), pp. 32-59.

¹² An outline of the tasks of these officers can be found in Guidubaldo Guidi, *Lotte, pensiero e istituzioni politiche nella Repubblica Fiorentina dal 1494 al 1512*, II. *Gli istituti sovrani e di governo* (Florence, 1992), pp. 787-799 and 804-808. An incomplete, superficial investigation of their documentation has been recently made by Andrea Guidi, "The Florentine archives in transition. Government, warfare and communication," *European History Quarterly* 46, no. 3 (2016), pp. 466-67.

Internal turmoil, external rebellions. The origins of the campaign

The events of 1498 and 1499 cannot be understood without a brief, indispensable summary of the internal power struggles that exacerbated the Florentine public life after the exile of Piero de' Medici and the fall of his regime.¹³ During the first years of the republican restoration, in fact, three were the major rival parties that competed for preponderance in public councils. The powerful "sect" of the "holy prophet" Girolamo Savonarola ruled "everything," in the capital. It was composed by the so-called *frateschi*, or *piagnoni*, or *pinzocheri*, upholders of a popular, "broader" government. Their foes were the oligarch *arrabbiati*, and the radical, violent youth of the *compagnacci*. Last but not least, the nostalgic *palleschi*, or *bigi*, aspired the Medici's return and the revival of the "old state." In several occasions they were pleaded guilty of plots, but their support was anyhow indispensable for governing the town.¹⁴

Furthermore, other interests grouped and divided the Florentine citizens. The opposition between the common people and the aristocratic magnates often developed into fierce conflicts over the extension of political rights, the electoral systems, and the fiscal legislation.¹⁵ The ambitious, "perverted" elite was repeatedly accused of concentrating the power in its hands, assigning public officers to "friends" and "unworthy men," and increasing taxation in order to oppress the common people.¹⁶ The auspicated "union of the city," invoked continuously during parliamentary sittings, was simply a chimera.¹⁷

Our city was in complete disorder. The hope was lacking. The expenditures were multiplying. Artisans could not work, poor men could not feed their families. We could not stand this suspense. Our citizens, moreover, were

¹³ Leonardo Morelli, "Cronaca," in *Delizie degli eruditi toscani*, XIX., ed. Ildefonso di San Luigi (Florence, 1785), p. 199; Piero Parenti, *Storia fiorentina*, I., ed. Andrea Matucci (Florence, 1994), pp. 149-51; Filippo, Alamanno, and Neri Rinuccini, *Ricordi storici*, ed. Giuseppe Aiazzi (Florence, 1840), pp. 152-157; Luca Landucci, *Diario fiorentino* (Florence, 1969), ed. Iodoco del Badia, pp. 73-76 and 89-90.

¹⁴ Bartolomeo Cerretani, *Storia fiorentina*, ed. Giuliana Berti (Florence, 1994), pp. 222-23 and 233-34; Filippo de' Nerli, *Commentari dei fatti civili occorsi dentro la città di Firenze*, ed. Colombo Coen (Trieste, 1859), pp. 112-20; Francesco Guicciardini, *Storia fiorentina*, eds. Piero and Luigi Guicciardini (Florence, 1859), pp. 139-41; Parenti, *Storia fiorentina*, I., pp. 167-69 and 190-91; Piero Vaglianti, *Storia dei suoi tempi*, eds. Giuliana Berti, Michele Luzzati, and Ezio Tongiorgi (Pisa, 1982), pp. 31-41.

¹⁵ Giorgio Cadoni, *Lotte politiche e riforme istituzionali a Firenze tra il 1494 e il 1502* (Rome, 1999), pp. 19-84; de' Nerli, *Commentari*, pp. 134-35; Jacopo Nardi, *Istorie della città di Firenze*, ed. Lelio Arbib (Florence, 1842), pp. 119-20.

¹⁶ Cerretani, *Storia fiorentina*, p. 230; Piero Parenti, *Storia fiorentina*, II., ed. Andrea Matucci (Florence, 2005), pp. 53-54 and 191.

¹⁷ Parenti, *Storia fiorentina*, I., p. 272.

split. Some craved to steal the government from the people, establishing an oligarchy. Others wanted to oppose this peril, even at cost to seize arms. The supporters of the past regime hoped to recall Piero de' Medici. Selfishness and ambition incited everyone. Even the Signoria was divided. Florentines were proving to be enemies of each other.

Another cause of bitter controversy was the foreign policy. The "pacific friar" exhorted his followers to trust the promises of the king of France, the victorious "divine minister" guided by the "holy sapience." This confidence in Charles VIII was encouraged also by merchants and bankers, worried about the loss of privileges and prestige in Transalpine fairs, and menaced by royal banishments.¹⁸ Faith and fear, as well as money and markets, consolidated an unstable alliance, despite all the deceits perpetrated by "wicked," "perfidious," and "thieving" French.¹⁹ Florentines, moreover, were suspicious of Italian diplomacy. According to Francesco Guicciardini, the duke of Milan, Ludovico Sforza, often spoke in public against the republican regulations. To people's eyes, the "Moro," as he was called, was secretly planning to establish an oligarchic government in collusion with the *arrabbiati*, the *bigi*, and other "principal citizens." The gentry was more and more considered subversive, antagonist of the "good, popular way of living."²⁰

This already critical situation was undoubtedly worsened by the war with Pisa. The city of the leaning tower had rebelled against the Florentine "unbearable tyranny" on November 9th 1494, during the stay of Charles VIII. Shouting for "people and freedom," Pisans occupied the "old citadel," confiscated the weapons from traders, expelled their rulers, and pledged loyalty to the king. In the vicinity, the inhabitants of Lari, Vico, Ponsacco, and Cascina joined the revolt immediately.²¹ Lucca and Genoa backed the turmoil.²² In a few days, Florence lost its most important regional market,²³ one of its principal arsenals,²⁴ and a "large quantity" of its

¹⁸ Landucci, *Diario fiorentino*, pp. 108-109; Parenti, *Storia fiorentina*, I., pp. 207, 251, and 282-83; Nardi, *Istorie della città di Firenze*, p. 96.

¹⁹ Rinuccini, *Ricordi storici*, pp. 138-39; Landucci, *Diario fiorentino*, p. 112.

²⁰ Guicciardini, *Storia fiorentina*, p. 145; Parenti, *Storia fiorentina*, I., pp. 210-11 and 315-16; Nardi, *Istorie della città di Firenze*, p. 99.

²¹ Giovanni Portoveneri, "Memoriale," in *Archivio Storico Italiano* 6, no. 2 (1845), pp. 287-88; Vaglianti, *Storia dei suoi tempi*, pp. 14-20; Cerretani, *Storia fiorentina*, pp. 210-11; Parenti, *Storia fiorentina*, p. 129.

²² Portoveneri, "Memoriale," pp. 294-95; Paolo Giovio, *Historie del suo tempo*, I. (Venice, 1555), f. 81v.

²³ Goldthwaite, *The economy of Renaissance Florence*, pp. 149-58; Giuliano Pinto, "Cultura mercantile ed espansione economica di Firenze," in *Vespucci, Firenze e le Americhe*, eds. Giuliano Pinto, Leonardo Rombai, and Claudio Tripodi (Florence, 2014), pp. 9-10.

soldiers. Pisan men-at-arms, in fact, abandoned the Florentine encampment, “and all of them are now against us.”²⁵

Since then, a wearing military campaign would have raged across the entire Tuscany. Nor the king nor his envoys could obtain the surrender of the “obstinate” Pisans, notwithstanding the pacts between his majesty and the Republic.²⁶ Florence reacted by force of arms in December 1494, sending its troops toward San Miniato.²⁷ Conscript infantrymen were mobilized in the Pistoiese region, while the “brave” Florentine youth reached the encampment. According to Luca Landucci, the chance of plucking attracted also numerous peasants.²⁸ By the end of the winter, a large part of the Pisan countryside was reconquered, but, on March, the upset of Montepulciano led to a mounting tension on the southern, Sienese border.²⁹ The fighting on two fronts had imaginable consequences. Undisturbed, the Pisans made several incursion into Valdinievole and into Maremma. With the help of the French garrisons of the “new citadel” and Gascon mercenaries, they also assaulted Montecarlo and Librafratta.³⁰ In May 1495, the fall of the latter, and the “betrayal” of the Gallic troops, raised a storm of protest. Citizens blamed the Dieci di Balìa on a “deliberate” rout, “planned for subjugating our people.” Charles VIII became a “unworthy, disloyal, perfidious, barbarous assassin.” The enraged Florentines would have cursed him again in the following months. On September 14th, during a first siege of Pisa, the same French garrison, the same “traitors,” opened fire on Florentine soldiers, forcing them to withdraw.

Florentines hired many soldiers, entrusting them to the Guidubaldo from Montefeltro, duke of Urbino, a young man, more talented for literature than war. The Dieci, moreover, appointed Francesco Valori and Paolantonio Soderini as general commissioners. Our army fiercely entered the suburb of Saint Mark, nearby the walls of Pisa, and several men-at-arms got over the city gates. Rebels were dismayed. However, despite our bribes and their promises, the French troops began to aim its guns at our encampment, from

²⁴ Fabrizio Ansani, “Geografie della guerra nella Toscana del Rinascimento. Produzione di armi e circolazione dei pratici,” *Archivio Storico Italiano* 651 (2017), pp. 106-108.

²⁵ ASF, Dieci di balìa, Responsive, 38, f. 29r.

²⁶ Among the other things, these covenants provided for the “restitution” to Florence of Pisa and Livorno at the end of the Neapolitan expedition. See *Négociations diplomatique de la France avec la Toscane*, I., eds. Abel Desjardins and Giuseppe Canestrini (Paris, 1859), pp. 601-06.

²⁷ ASF, Dieci di balìa, Missive, 31, ff. 36v and 47r.

²⁸ Landucci, *Diario fiorentino*, p. 98.

²⁹ ASF, Dieci di balìa, Missive, 32, ff. 92r, 97v, 102r, and 176rv.

³⁰ Parenti, *Storia fiorentina*, I., pp. 205, 208, 216-217, and 223; Portovenieri, “Memoriale,” pp. 303-309; Giovio, *Historie*, I., ff. 83v-84r.

the citadel. Like mortal enemies, they bombarded our brigade, killing several of our men. Our officers, then, ordered the retreat.

Not content with that, the French captain sold also the “new citadel” to the rebels, a few days after the attack.³¹

Nonetheless, the republican government did not accept the aid of the forming Italian League, the alliance between Venice, Rome, Milan, and other minor states, against the French menace. This intransigence lasted long. The royal lies, the “victorious overcoming” at Fornovo, the retreat in Asti, the return of Charles in Lyon, did not change the minds of the *frateschi* rulers, comforted by Savonarola’s sermons, and frightened by a probable “confusion” and a possible “revolution.”³² Ludovico Sforza tempted the *arrabbiati*, but without any significant results. The confederation, then, was compelled to defend Pisans, for obtaining the Florentine support. The first Milanese and Genoese contingent arrived in Tuscany in the autumn of 1495, along with Venetian money.³³ In the next year, even the Holy Roman Emperor, Maximilian I, besieged Livorno, but his expedition resulted in an unexpected, resounding failure.³⁴ During the following season, the campaign would have dragged by. Victories would have alternated with defeats. Fortresses and towns would have been conquered and then lost. Diplomacy and war reached an impasse. Nor the Florentine efforts nor the allied reinforcements would have broken the stalemate, until the spring of 1498.

Springtime in Florence, springboard for war

The situation would have changed radically, in those weeks. In Florence, the politics took another sudden twist. Savonarola was losing popularity, due to papal excommunications, and because of the split of his party. During the vespers of the Palm Sunday, on April 8th, a small group of *compagnacci* assaulted the monastery of Saint Mark, followed by a large number of armed citizens, with the purpose of “annihilate their opponents.”³⁵ The surprised *frateschi* barricaded themselves in the temple, defending its doors with prayers and handguns. During

³¹ Portovenieri, “Memoriale,” pp. 322-323; Parenti, *Storia fiorentina*, I., pp. 265-66; Rinuccini, *Ricordi storici*, p. 149; Landucci, *Diario fiorentino*, pp. 115-16; Guicciardini, *Storia fiorentina*, pp. 135-37. Giovio, *Historie*, I., ff. 142r-144v; Cerretani, *Storia fiorentina*, p. 230.

³² Guicciardini, *Storia fiorentina*, p. 145; Parenti, *Storia fiorentina*, I., pp. 207, 236, 243-44, and 251.

³³ Portovenieri, “Memoriale,” pp. 324-25; Vaglianti, *Storia dei suoi tempi*, pp. 37-38; Giovio, *Historie*, f. 147v; Landucci, *Diario fiorentino*, p. 116.

³⁴ Nardi, *Istorie della città di Firenze*, pp. 102-10; Parenti, *Storia fiorentina*, II., pp. 47-61.

³⁵ Vaglianti, *Storia dei suoi tempi*, p. 46.

the tumult, the principal exponent of their faction, Francesco Valori, was chased and killed by his rivals. The Signoria, then, decided to storm the church with artillery, “like it was a castle,” and to support the attackers with trained infantrymen. Eight hours later, the Dominican friar was arrested.³⁶ His capture preceded the fall of his followers. Forty of them were charged with misconduct, favoritism, and clientelism, and punished with exiles, fines, and temporary exclusions from public offices.³⁷ The *arrabbiati* were finally overthrowing their adversaries.³⁸

Simultaneously, the *piagnoni* lost another symbolic leader. Charles VIII, in fact, passed away in Amboise on April 7th. The death of the French sovereign was a turning point in Florentine foreign policy. The swaggering Milanese faction, in fact, renewed and strengthened its relations with Ludovico Sforza. The former enemy was delighted at the possibility to bring to a successful conclusion his preceding diplomatic efforts. The duke offered to the new government a financial aid for the Pisan war, promising also to mediate between Florence and its Genoese enemies.³⁹ Although the letters from Lombardy were received with “relief” and “happiness” by rulers, the common people had a very different opinion on the subject. Piero Parenti and Jacopo Nardi reported the union was feared to conceal and stage an oligarchic coup. Piero Vaglienti accused explicitly the Moro of being a “whore,” doubting that he extended the hand of friendship only to be protected against his aggressive Venetian neighbors and from the pretensions of the new king of France, Louis XII, who was claiming the Milanese duchy because of his grandmother’s inheritance.⁴⁰

The Republic underwent a further major upheaval in the next month. On May 20th, the Venetian and Pisan troops routed the Florentine forces at San Regolo. The army, run into an ambush, suffered heavy losses. Several condottieri were imprisoned, and eighty men-at-arms were grabbed or killed. The rest of cavalry was deprived of horses and arms. About one hundred and fifty infantrymen died, while most of the survivors disbanded. The Florentine commissioner, Guglielmo de’ Pazzi, and the general governor, the count Rinuccio from

³⁶ Guicciardini, *Storia fiorentina*, pp. 171-74; Cerretani, *Storia fiorentina*, pp. 246-48; Landucci, *Diario fiorentino*, pp. 170-71; Nardi, *Istorie della città di Firenze*, pp. 150-53; Cambi, “Istorie,” in *Delizie degli eruditi toscani*, XXI., ed. Ildefonso di San Luigi (Florence, 1785), pp. 119-21.

³⁷ ASF, Consulte e pratiche, 64, ff. 82r-85v

³⁸ Cambi, “Istorie,” pp. 121 and 132; Parenti, *Storia fiorentina*, II., pp. 167-75; de’ Nerli, *Commentari*, p. 132, Nardi, *Istorie della città di Firenze*, p. 162.

³⁹ ASF, Consulte e pratiche, 64, ff. 59r-60r; Biagio Buonaccorsi, *Diario* (Florence, 1568), p. 2; Parenti, *Storia fiorentina*, II., p. 158; Cerretani, *Storia fiorentina*, p. 257.

⁴⁰ Parenti, *Storia fiorentina*, II., p. 184; Nardi, *Istorie della città di Firenze*, pp. 172-73; Vaglienti, *Storia dei suoi tempi*, p. 54.

Marsciano, escaped imprisonment fortuitously, but they were soon charged with imprudence and greed.⁴¹

Our commanders noticed six hundred light horses plundering in Maremma. The men-at-arms of the count Rinuccio and the infantrymen of Ciriaco from Borgo Sansepolcro, then, went to meet the foes. Treacherous countrymen, however, informed the rebels about our counterattack, and Pisans were able to prepare an ambush between San Regolo and Lari. Our brigade, in the meanwhile, assaulted the enemies, and recover their booty. Hankering after loot, our troops fell into the trap, and routed.

Apart from the defeat, the Marzocco's officers had to face other severe difficulties, in those weeks. The political turmoil in the capital had serious repercussions on the management of the encampment, entrenched in the proximity of the border town of Pontedera.⁴² Guglielmo de' Pazzi complained repeatedly about the delays of orders, the indiscipline of mercenaries, and, above all, the shortage of money and food. At the end of April, the hay for horses and oxen was lacking. On May 6th, the commissioner had to put down a mass brawl between "our desperate and starving soldiers." He had to "buy on credit, begging for everything."⁴³ After the rout, the new, *arrabbiati* Dieci decided to drastically remedy the whole plight, "not only securing towns, but also taking the offensive."⁴⁴

Italian captain, French warfare

The numerous letters dispatched from the Palazzo dei Priori on May 21st testify all of the measures taken by officers to confront the immediate perils. According to Parenti, "if our plans used to proceed slowly, now we are animated." Several thousand florins were collected from the convicted *frateschi*. The Dieci urgently requested five hundred infantrymen from the Pistoiese commune, and called to arms several condottieri, as Alessandro Bentivoglio from Bologna, Ottaviano Riario from Forli, and Astorre Baglioni from Perugia. They also sent to the

⁴¹ ASF, Dieci di balia, Responsive, 57, ff. 137r and 207r; Parenti, *Storia fiorentina*, II., p. 179; Vaglianti, *Storia dei suoi tempi*, p. 51; Nardi, *Istorie della città di Firenze*, pp. 173-74; Marino Sanudo, *I diari*, I., ed. Federico Stefani (Venice, 1879), pp. 966-67 and 974-77; Domenico Malipiero, "Annali veneti," *Archivio Storico Italiano* 7, no. 1 (1843), p. 503; Girolamo Priuli, "Diari," I., ed. Arturo Segre, in *Rerum Italicarum Scriptores*, XXIV., 3., ed. Giosuè Carducci and Vittorio Fiorini (Città di Castello, 1912), p. 82.

⁴² ASF, Dieci di balia, Responsive, 57, f. 169r; Parenti, *Storia fiorentina*, II., p. 184.

⁴³ ASF, Dieci di balia, Missive, 56, f. 155v; ASF, Dieci di balia, Responsive, 57, ff. 147r, 189r, and 211r.

⁴⁴ ASF, Dieci di balia, Missive, 58, f. 125r.

encampment another general commissioner, Benedetto de' Nerli, tasked with resisting the Pisan attacks until the arrival of the new general captain, Paolo Vitelli from Città di Castello.⁴⁵

The nominated commander of the army had already served in Florentine forces, like other members of his family. His father, Niccolò, fought against Sieneese and Neapolitan troops after the Pazzi's conspiracy, and was restored to the *signoria* of Città di Castello by Lorenzo de' Medici in 1482. His older brothers, Camillo and Giovanni, were Florentine *connestabili*, that is, heads of mercenary infantrymen, during that decade.⁴⁶ Paolo followed their footsteps with his own company, led with his younger brother, Vitellozzo, earning the esteem of allies and enemies.⁴⁷ In September 1495, they were under the walls of Pisa. Two years later, the Republic paid to them twenty-five thousand florins for the services of three hundred man-at-arms, encamped in Valdichiana. Their correspondence for 1497 reveals the "friendship" between the Vitelli and the leaders of the Savonarola's faction, as Paolantonio Soderini and Francesco Valori. Moreover, one of their secretaries, Cerbone Cerboni, stayed permanently in Florence.⁴⁸

Far from Tuscany, along with Camillo, Paolo and Vitellozzo gained a valuable military experience at the time of Charles VIII's expedition. The three relatives, in fact, were hired by the king, as well as other Italian condottieri. During the march toward Naples, they were probably impressed by the Ultramontane siege strategy, by the crushing of Montefortino and Monte San Giovanni. The rapidity and the efficiency with which French gunners could move, aim, and fire their guns represented an absolute, frightening novelty. The practice of positioning numerous guns near the walls, the simultaneity of the explosions, the saturation bombardments, the use of iron cannonballs, and the immediate assaults were unprecedented in Italian Renaissance sieges.⁴⁹ The brothers learned a lot from this warfare, about the use of ordnance and the infantry tactics, the strict discipline and the violent brutality.⁵⁰ Vitellozzo and

⁴⁵ ASF, Dieci di balia, Missive, 56, f. 172rv; ASF, Dieci di balia, Missive, 57, 141v; ASF, Dieci di balia, Missive, 58, ff. 127r-128r. See also Parenti, *Storia fiorentina*, II., p. 179; Sanudo, *Diari*, I., p. 973.

⁴⁶ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, f. 31r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 24, ff. 58v-59r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 27, f. 250v;

⁴⁷ Sanudo, *Diari*, I., p. 547.

⁴⁸ ASF, Lettere varie, 3, 6r; ASF, Lettere varie, 5, ff. 37r, 71r, and 87r; ASF, Lettere varie, 9, f. 2r.

⁴⁹ Contamine, "L'artillerie royale française à la veille des guerres d'Italie," p. 248; Pepper, "Castles and cannons in Naples campaign," in *The French descent into Renaissance Italy. Antecedents and effects*, ed. David Abulafia (Aldershot, 1995), p. 291.

⁵⁰ Pieri, *Il Rinascimento e la crisi militare italiana*, pp. 366-368; Cecile Clough, "The Romagna campaign of 1494. A significant military encounter," in *The French descent into Renaissance Italy*, p. 193. For the innovation of French guns, and their impact on Italian warfare, see: Pepper, "Castles and cannons in Naples campaign," pp. 286-91; Hall, Hall, *Weapons and warfare in Renaissance Europe*, 87-

Camillo mastered pike squares. Paolo, instead, got very interested in firearms, and especially in the cannons, in the culverins, and in the falcons of the royal artillery. After their return in Umbria, both of them commissioned Florentine and Pistoiese artisans to craft bronze harquebuses, molds for the casts of handguns, “French” spears for heavy knights, and infantry pole weapons “according to the Swiss custom.” A Spanish gunmaker, *maestro* Pietro, was entrusted, instead, with the manufacture of several falcons. Two cannons were also requested from the Florentine commune.⁵¹

The relationships with France and Florence led to a formal *condotta* with these states. The two-year contract was signed on February 12th 1498. Under its terms, Paolo and Vitellozzo had to maintain two hundred men-at-arms and two hundred mounted crossbowmen, with an annual, net wage of forty thousand florins.⁵² Despite the high number of troops, Paolo was not appointed with the title of general captain due to the previous agreements between the Republic and Charles VIII, which forbidden an unilateral designation.⁵³ The death of the king, and the incumbent Pisan menace, eventually favored the promotion.

On June 1st, Paolo received the ceremonial baton and the Florentine insignia from the Signoria, in praise of his “virtue and experience,” and with “honor, convenience, benefit, and reputation of the Republic.”⁵⁴ Someone, however, despised the appointment. The captain, in fact, was chosen in preference to the general governor, Rinuccio from Marsciano, who could vaunt sixteen years of uninterrupted career in the Florentine army.⁵⁵ The Dieci tried to explain their reasons, but the count felt very angry at the nomination, threatening to leave the encampment with his company and his five brothers, Lamberto, Ludovico, Bernardino, Pirro, and Alessandro. In the capital, his resentment and his “dishonor” were soon manipulated by the *frateschi* against the new *arrabbiati* officials. Once again, the political division of the city

95; Ridella, “Produzione di artiglierie nel XVI secolo,” pp. 78-87; Jean-François Belhoste, “Nascita e sviluppo dell’artiglieria in Europa,” in *Il Rinascimento Italiano e l’Europa*, III. *Produzione e tecniche*, pp. 335-43.

⁵¹ ASF, Lettere varie, 3, ff. 3r, 21r, 31r, 40r, 40r, 67r, 112r, 121r, 124r and 153r; ASF, Lettere varie, 5, ff. 9r and 36r; ASF, Miscellanea repubblicana, 3, e. 98, f. 79r.

⁵² ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 43, ff. 94r-99v.

⁵³ *Négociations diplomatique de la France avec la Toscane*, I., p. 604.

⁵⁴ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 43, f. 111v; Landucci, *Diario fiorentino*, p. 179; Vaglianti, *Storia dei suoi tempi*, p. 55.

⁵⁵ ASF, Otto di pratica, Missive, 7, ff. 40v-41r; ASF, Dieci di balia, Entrata e uscita, 17, ff. 20r-26r; ASF, Dieci di balia, Missive, 59, c. 81v; Ferdinando Ughelli, *Albero et istoria della famiglia de’ conti di Marsciano* (Rome, 1667), pp. 73-74.

had major repercussions on the conduct of the war. Only a significant rise in the governor's condotta convinced him to stay, but the appearance of obedience concealed a fierce rivalry, stirred up by the various factions, not counting the Venetian attempts to corrupt and hire the count.⁵⁶

In the meanwhile, the light cavalry of the rebels continued to raid the countryside. On June 3rd, two hundred horsemen appeared in the vicinity of Montecarlo. The formidable Venetian *stradiotti* ventured even into the neighborhood of Florence, sacking inns and burning vineyards around San Miniato, San Casciano, and Santa Gonda.⁵⁷ Nonetheless, Florentine spies reported numerous problems among their ranks. Men-at-arms were not properly paid. Gunpowder lacked. Above all, the Venetian officers, the *provveditore* Tommaso Zen and the "governor of the militia" Marco from Martinengo, were deeply unpopular among citizens and soldiers, because of their "villainy" and their quarrels.⁵⁸ On June 7th, however, Pisans decided to carry out a surprise assault against Ponsacco, in order to bar the way to enemy reinforcements. The artillery "heavily" damaged the town walls, but Florentine "perturbation" did not last long. On the next day, the night advance of the entire Vitelli's company from Montopoli compelled the attackers to withdraw recklessly at sunrise.⁵⁹

On June 8th, "two hundred men-at-arms, one hundred and fifty mounted crossbowmen, one hundred mounted hand gunners, and one thousand and five hundred infantrymen" entered the Florentine encampment in Pontedera, after a long, forced march through the Valdichiana, the Chianti region, and the Valdelsa.⁶⁰ According to the registers of the Dieci, the whole army numbered, on paper, seven hundred heavy knights, four hundred and fifty light cavalrymen, and more than four thousand foot soldiers.⁶¹ Infantry companies, nevertheless, were liable to desert, especially if they were not regularly paid. The commissioners lamented

⁵⁶ ASF, Dieci di ballia, Missive, 57, ff. 140v-141v and 157v-158r; ASF, Dieci di ballia, Deliberazioni, condotte e stanziamenti, 48, ff. 2v-3r; Guicciardini, *Storia fiorentina*, p. 186; de' Nerli, *Commentari*, p. 133; Buonaccorsi, *Diario*, p. 2; Cerretani, *Storia fiorentina*, p. 256; Parenti, *Storia fiorentina*, II., pp. 183-84; Sanudo, *Diari*, I., pp. 1005 and 1022.

⁵⁷ ASF, Dieci di ballia, Responsive, 57, ff. 237r, 270r and 271r; ASF, Dieci di ballia, Missive, 57, f. 156r; Landucci, *Diario fiorentino*, p. 179.

⁵⁸ Sanudo, *Diari*, I., pp. 985-86 and 990-91; Malipiero, "Annali veneti," pp. 506 and 509; Priuli, "Diari," I., p. 86.

⁵⁹ ASF, Dieci di ballia, Responsive, 57, ff. 310r, 311r, and 313r; ASF, Dieci di ballia, Missive, 60, ff. 6rv and 10v; Vaglianti, *Storia dei suoi tempi*, pp. 55-56.

⁶⁰ ASF, Dieci di ballia, Missive, 58, ff. 126v and 131r; Sanudo, *Diari*, I., pp. 990-92; Giuseppe Nicasi, "La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504," *Bollettino della Regia Deputazione di Storia patria per l'Umbria* 17 (1911), p. 346.

⁶¹ ASF, Dieci di ballia, Deliberazioni, condotte e stanziamenti, 48, ff. 2r-7v and 24v-26r.

immediately that many *connestabili* needed recruits, arms, back pays, and current salaries, describing their poor condition as a “chaos,” a “random living.” Soldiers besought the Dieci to be paid. Giorgio from Imola, for example, bemoaned that he could not “help his companions any longer.” The count Cecco from Montedoglio wrote that he had “nothing else to pawn,” that he felt “consigned to oblivion,” and that “even friars cannot be patient, with an empty stomach.” The inhabitants of Pescia referred that his brigade was constrained to “rob and burglarize” the subjects that it had to protect, protesting at its insults and harassment.⁶²

Guglielmo de’ Pazzi commented that “speeches and promises are useless, now, considering the great expenses for this camp,” and with good reason. Parenti calculated that the war had a daily cost of one thousand and six hundred florins. The Signori, then, had to impose a forced loan, a so-called *accatto*, scraping fifty thousand florins with an annual interest of twelve percent.⁶³ This sum would have spent on wages, and on ammunitions, because “soldiers would be useless, if we did not supply them with arms.”⁶⁴

Supplying the army

In the first half of June, the general commissioners Guglielmo de’ Pazzi and Benedetto de’ Nerli were disappointed at the “soaked, worthless gunpowder” present in the encampment. They requested the Dieci to dispatch saltpeter, and also all of the “new” culverins and falcons, along with carts and draught animals, in order to “protect our land” and “satisfy the captain.” At his arrival in Pontedera, in fact, Paolo Vitelli seemed to be very averse to the scarcity and disorganization of ordnance.⁶⁵ Nevertheless, Florentine firearms were not “superabundant.” A contemporary inventory of the arsenals of the capital itemized three heavy bronze bombards and two iron ones, three bronze cannons, twelve bronze falcons, twenty-six iron spingards, and four bronze *cerbottane*, mounted now on carts, now on trestles and beds.⁶⁶ The list represented the actual production of the city workshops, the combination between the new French models and the customary Italian manufacture.

⁶² ASF, Dieci di balia, Responsive, 57, ff. 252r and 342r; ASF, Dieci di balia, Responsive, 58, ff. 29r, 48r, 67r, and 80r; ASF, Dieci di balia, Missive, 58, 17rv.

⁶³ Parenti, *Storia fiorentina*, II., pp. 186, 190, and 194; Landucci, *Diario fiorentino*, p. 180; Vaglianti, *Storia dei suoi tempi*, p. 56.

⁶⁴ ASF, Dieci di balia, Missive, 60, f. 91r.

⁶⁵ ASF, Dieci di balia, Responsive, 57, ff. 323v, 325r, 342r, and 354r; ASF, Dieci di balia, Responsive, 58, f. 43v.

⁶⁶ ASF, Dieci di balia, Missive, 58, f. 135v; ASF, Dieci di balia, Munizioni, 7, f. 337v.

Florentine craftsmen were using tin and copper for the creation of their giant *bombarde* since 1450s, relying on the solid tradition of artists and bell founders. Thirty years later, the Republic was undoubtedly in the vanguard of bronze castings. In the public foundries of Florence and Pisa, several guns were realized by the renowned Alberghetto Alberghetti and Pasquino from Montepulciano, and even by Andrea del Verrocchio. Florentine masters experimented on mobile firearms, as *spingarde* “mounted on carts.” The Medici bank, moreover, invested heavily in the purchases of the metals.⁶⁷ After the fall of the regime, this state interest in artillery was also confirmed by the introduction of a significant technological improvement. In January 1495, soon after the passage of Charles VIII through Tuscany, the Dieci decided to build a new factory for the production of the “very good and very effective” French firearms. In March, the first ever bronze cannon produced in Florence was sent to the encampment, put on a cart, “according to French custom.”⁶⁸

Between the winter of 1495 and the spring of 1498, thirty-eight new guns were cast in the workshops of Florence, Volterra, and Firenzuola. Their designers were Francesco di Bartolomeo Telli, Bonaccorso di Vettorino Ghiberti, the grandson of the illustrious Lorenzo di Cione, and Lorenzo di Giovanni, called *Cavaloro*, as well as his associate, the “goldsmith” Ludovico di Guglielmo del Buono. Other foreign artisans were invited to work in the foundries, as Pierre from Douai, Johann from Augsburg, and Antonio Chiariti from Lucca. Even the ambassadors in France asked the king for a “master of artillery.”⁶⁹ All of these craftsmen copied the original French firearms, sketching their shapes and imitating the Transalpine methods of fusion.⁷⁰

A French culverin will weigh about one hundred and seven hundred kilograms, if it has a bore diameter of twenty or fourteen centimeters, a length of three and a half meters [...], and a rear part thick as two shot. Another culverin will weigh about two tons, if it has a length of three and a half meters, and if it fires twenty-seven kilograms of lead [...].

⁶⁷ Ansani, “Craftsmen, artillery, and war production,” p. 14.

⁶⁸ ASF, Dieci di balia, Munizioni, 5, ff. 15v, 25r, and 32r; ASF, Dieci di Balia, Deliberazioni, condotte e stanziamenti, 31, f. 149v; ASF, Dieci di Balia, Deliberazioni, condotte e stanziamenti, 33, f. 245r; ASF, Dieci di Balia, Missive, 32, f. 79rv. For a thorough examination of these sources, see Fabrizio Ansani, “The life of a Renaissance gunmaker. Bonaccorso Ghiberti and the development of Florentine artillery in the late fifteenth century,” *Technology and Culture* 58, no. 3 (2017), pp. 760-761.

⁶⁹ ASF, Dieci di balia, Responsive, 40, f. 356r; ASF, Dieci di balia, Debitori e creditori, 26, f. 82v; *Négociations diplomatique de la France avec la Toscane*, p. 659.

⁷⁰ BNCF, Banco rari, 228, 87v-88r

French gunmakers are accustomed to cast the breech of their culverins three shot thick, that is, one for empty space and two for bronze, that is, every side of the chamber as much thick as the gap. This is their own way to craft guns with a shot weight of three kilograms of lead, or less. And for the pieces with a shot weight of ten, or thirteen, or seventeen kilograms of lead, they made these sides two and a half shot thick.

These practitioners also combined technical innovations with traditional machines. Cannons and culverins were cast in a single, safer piece, but several falcons were equipped with a separate breech, like old spingards, or combined in a sort of ribauldequin.⁷¹

After assuming the command, Paolo Vitelli urged the Dieci to enhance the production of these new guns. Throughout the summer, he frequently, anxiously requested heavy and light ordnance, “as fast as the masters can manufacture it.”⁷² Captain’s chancellors supervised the construction of new private furnaces for “an easier and better melting,” whilst the Dieci ordered the reopening, the repairing, and the widening of the public foundry of the *Sapienza*. Finally, more than sixteen tons of bronze were cast in thirty-two pieces. They were twenty-two small falcons of various forms, loaded with one and a half kilogram of lead projectile, and, above all, ten cannons, “round, with trunnions,” long from three and a half to four and a half meters, weighed from one and a half to two tons, and armed with sixteen and a half kilograms of iron shot.⁷³ The price was fixed, as usual, at ten florins *di grossi* every three hundred and thirty kilograms of cast bronze. The cost of pieces weighing less than this measure, such as falcons, was set at eighty *lire* for the same quantity of molten metal.⁷⁴

The ordnance was promptly moved towards Pontedera, easily transported by the Arno river on numerous rafts, or dragged by oxen over the Tuscan hills. In any case, the servants of the Signoria were authorized to draft men and animals for completing the task. Several other falcons were rapidly shifted from the Vitelli’s stronghold of Città di Castello, so as to “they

⁷¹ ASF, Dieci di balia, Munizioni, 5, ff. 181rv and 360v-361r; ASF, Dieci di balia, Entrata e uscita, 13, ff. 190v-191r.

⁷² ASF, Lettere varie, 3, ff. 160r, 163r, 183r, 197r, 204r, 249r, 254r, and 256r.

⁷³ ASF, Dieci di balia, Munizioni, 7, ff. 367v, 387v, 427v, 488r and 508v; ASF, Dieci di balia, Debitori e creditori, 35, ff. 161v, 223v, 244r, 301r, 314r, and 317r; ASF, Dieci di balia, Entrata e uscita, 23, ff. 241v-242r; Landucci, *Diario fiorentino*, 183.

⁷⁴ ASF, Dieci di Balia, Munizioni, 5, f. 181rv; ASF, Dieci di Balia, Munizioni, 7, ff. 318r and 508v.

cannot halt, nor by day, nor by night.”⁷⁵ All of these guns were mounted on French style carts, vehicles that “had a robust axle that connected two well carved wheels, in order to shoot incessantly and without shelters. The wheels had solid bent spokes, and were strengthened with thick iron plates and nails” for withstanding difficult journeys and impassable roads.⁷⁶ The old wooden supports, beds and trestles, were dismantled and discarded.⁷⁷ The Dieci tasked with the manufacture of these new carriages Domenico di Pacino, also known as *Nolla*, Bartolomeo di Ventura Banchini, and the Pratese brothers Lorenzo and Francesco Bifolchi. Vitellozzo Vitelli lauded the “worthy” masters for their “incomparable” skills. In a couple of weeks, they realize fifteen *carrette*, each one priced fifty *lire*. Moreover, they crafted thirty pairs of “large” wheels, and modified several old carts with new spokes and new axles.⁷⁸ The Florentine officers also hired Niccolò di Antonio di ser Lolo “with twenty-five horses, twenty-five men, and twenty-five carts” for the shift of light pieces, with an exorbitant monthly salary of two hundred florins, and with the guarantee of free accommodations, free hay, and free firewood.⁷⁹ Antonio from Certaldo, instead, was charged with supervising land transports.⁸⁰ Thanks to these vehicles, Paolo Vitelli built a reputation as an “admirable” strategist, capable of “leading artillery over mountains and across rivers, like an ancient and strict Roman general.”⁸¹

The major problem of the new ordnance consisted in its iron projectiles. According to contemporary chroniclers, they were totally unknown to Italian warfare before the French

⁷⁵ ASF, Dieci di balia, Entrata e uscita, 30, ff. 86v-88r; ASF, Dieci di balia, Missive, 59, ff. 71v, 83r, 90v, 91v-92r, and 124v; ASF, Dieci di balia, Missive, 60, ff. 1r, 88r, 101r, and 104v; ASF, Dieci di balia, Responsive, 57, ff. 286r and 315r.

⁷⁶ Andrea Bernardi, “Cronache forlivesi,” I., 2., ed. Giuseppe Mazzatinti, in *Monumenti storici pertinenti alle provincie di Romagna* (Bologna, 1896), pp. 17-18; Niccolò Machiavelli, *Libro dell’arte della guerra* (Venice, 1550), f. 96rv.

⁷⁷ ASF, Dieci di balia, Missive, 60, f. 28r; ASF, Dieci di balia, Responsive, 58, f. 49r; ASF, Lettere varie, 3, f. 204r.

⁷⁸ ASF, Dieci di balia, Munizioni, 7, ff. 356r, 360r, 364v, 367r, 371r, and 446v-447r; ASF, Dieci di balia, Debitori e creditori, ff. 162v and 168v; ASF, Dieci di balia, Entrata e uscita, 23, ff. 207r and 210r; ASF, Lettere varie, 3, ff. 160r, 183r, and 350r.

⁷⁹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 47, f. 13r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, ff. 7v-8r and 75r; ASF, Lettere varie, 3, f. 220r.

⁸⁰ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, f. 27v.

⁸¹ ASF, Dieci di balia, Missive, 59, c. 123v; Cerretani, *Storia fiorentina*, p. 256; Parenti, *Storia fiorentina*, II., p. 192; Guicciardini, *Storia fiorentina*, p. 187.

descent.⁸² As with the guns, Florentine masters assimilated the new technology immediately, but Tuscan ironworks could not cast a sufficient quantity of cannonballs, both for the poor quality of local metal and for the dearth of adequate blast furnaces.⁸³ An effective saturation bombardment, however, needed hundreds of missiles.⁸⁴ The Dieci tried to deal with this issue in any way. On June 4th, they demanded from the town of Castrocaro all the shot that the French army had left here four years before, during its march towards Naples. The entreaty aroused a dispute about an hypothetical royal permission for signing the projectiles over to the Republic, but the subjects had to eventually give in, after a couple of weeks. Five hundred iron balls, so, were dispatched to the capital, a half for cannons, and a half for culverins. They cost nothing, except the mere transport and some thanks.⁸⁵ Nevertheless, the captain expected more projectiles, because he “did not intend to lift a siege due to their scarcity.”⁸⁶ Giovanni di Pierfrancesco de’ Medici, the general commissioner of the province of Romagna, suggested smuggling these *pallole* from the Venetian state, or acquiring them from the nearby factories of Piombino and Elba. A master of the Estense ironwork of Fornovolasco offered the Dieci his services and his goods.⁸⁷ In July, the officers signed a contract with Angelo di Filippo from Brescia and Baldo di Giovanni from Careggi for a furniture of a three hundred cast iron shot.

I remember that today, on July 21, 1498, we have made a bargain with Agniolo di Filippo from Brescia and Baldo di Giovanni from Careggi for cast iron shot, weighing up to fifty libbre each, according to the model. We will pay thirteen *lire* for every hundred libbre of metal, and Agniolo and Baldo have to hand two hundred cannonballs by August 5th and three hundred by the 10th of the same month. They have to bring the shot in Signa at their expense, except the custom duties of our territory.

⁸² Vannoccio Biringuccio, *Pirotechnia* (Venice, 1558), f. 117v; Francesco Guicciardini, *Storia d’Italia*, ed. Silvana Seidel Menchi (Turin, 1971), p. 78.

⁸³ ASF, Dieci di balia, Munizioni, 5, f. 37r; ASF, Dieci di balia, Munizioni, 6, ff. 231v-233r; ASF, Dieci di balia, Entrata e uscita, 14, f. 10v; ASF, Dieci di Balia, Missive, 32, f. 96r.

⁸⁴ Contamine, “L’artillerie royale française à la veille des guerres d’Italie,” pp. 247-48.

⁸⁵ ASF, Dieci di balia, Munizioni, 10, f. 243rv; ASF, Dieci di balia, Munizioni, 7, ff. 352v-386v; ASF, Dieci di balia, Debitori e creditori, 35, f. 164rv; ASF, Dieci di balia, Missive, 59, ff. 47v-48r, 60r, and 98v; ASF, Dieci di balia, Missive, 60, ff. 1r, 9v, 51r-52v, 60v; ASF, Dieci di balia, Responsive, 57, ff. 293r, 294r; ASF, Lettere varie, 3, f. 208r; Marino Sanudo, *La spedizione di Carlo VIII in Italia*, ed. Rinaldo Fulin (Venice, 1883), p. 127.

⁸⁶ ASF, Lettere varie, 3, f. 237r.

⁸⁷ ASF, Dieci di balia, Missive, 60, f. 120r; ASF, Dieci di balia, Responsive, 57, f. 283r.

The two bought the merchandise in Mantua, Brescia, and Bologna. One month later, the associates earned more than one thousand and two hundred *lire*.⁸⁸ The Dieci ordered also to sculpt traditional, inexpensive stone shot in the quarry of the gorge of Golfolina. Stonecutters prepared four hundred rocks for the cannons, and five hundred for the old bombards. The expense ranged from seven to fourteen *soldi* each. Other innumerable, small cast lead projectiles were made from six tons of metals.⁸⁹ At the end of August, nonetheless, the captain was still requesting “shot and powder, powder and shot.”⁹⁰

According to the Venetian payer in Pisa, Vincenzo Valier, the Florentine army could line up “two hundred guns mounted on carts, including twenty-five cannons and two bombards.” It is likely that also iron spingards and old *passavolanti* were pressed into service,⁹¹ obliging the general commissioners to engage several new gunners, and to spend more than one thousand and four hundred golden florins for their services. These masters had skills not only in aiming ordnance, but also in casting bronze, refining saltpeter, crafting incendiary missiles, repairing pieces, and carving vehicles. They came from the whole European continent. Francesco from Lucca received twenty florins for betraying Pisans. Cristoph and Johannes from the Holy Roman Empire offered a free period of probation for “demonstrating their virtues,” sponsored by Vitelli’s chancellor. Johannes Anzi was defined by the Dieci as “excellent” and “vain.” Bernardo from Novara presented himself as an “expert gunmaker” and a “perfect gunner.” Anton and Wilhelm from Freiburg, and Giovanni from Piedmont, boasted their abilities to realize “artillery, carts, shelters, bastions, battering rams, and other defensive and offensive engines.” All in all, Englishmen, Germans, Frenchmen, Gascons, Dutchmen, and Spaniards were on the Florentine payrolls, as well as many other Italians. Ioannis from Greece and Giovanni di Bartolomeo Boriani were their “heads” in the encampment.⁹² Their “tireless and important work,” their “promptness,” satisfied the captain.⁹³

⁸⁸ ASF, Dieci di balia, Munizioni, 7, ff. 355rv and 457v; ASF, Dieci di balia, Debitori e creditori, 35, f. 215v; ASF, Dieci di balia, Missive, 59, f. 108r; ASF, Dieci di balia, Missive, 60, ff. 70v, 102r, and 109v.

⁸⁹ ASF, Dieci di balia, Munizioni, 7, ff. 374v and 386r; ASF, Dieci di balia, Debitori e creditori, 35, f. 167v; ASF, Dieci di balia, Missive, 59, f. 95r.

⁹⁰ Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 366.

⁹¹ Sanudo, *Diari*, I., p. 1103.

⁹² ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, ff. 33v-35r, 61r, 107v-108v, and 173v; ASF, Dieci di balia, Missive, 58, f. 117r; ASF, Dieci di balia, Missive, 59, ff. 9r, 104r, and 122v; ASF, Dieci di balia, Missive, 60, ff. 87v and 129r; ASF, Dieci di balia, Responsive, 58, f. 43v.

⁹³ ASF, Lettere varie, 3, f. 322r.

The high number of firearms also necessitated the Republic raising the output of “mealed” and “corned” gunpowder, the first used for the charges of heavy artillery, the second for portable firearms.⁹⁴ During the summer, a new mill was opened in Leghorn, entrusted to Piero di Zanobi, called *Zucca*, one of the principal Florentine masters, active since early 1480s.⁹⁵ Another factory was constructed in the capital, near the Ponte alle Grazie, and equipped with a bronze boiler for “refining and drying” saltpeter. It was managed by a versatile engineer, Filippo di Giovanni, nicknamed *Pippa*, and Jacopo di Corso, also known as *Baia*. Officials enrolled also several carpenters in manufacturing the explosive in the pre-existent workshop of San Niccolò. The aforementioned Bartolomeo di Ventura Banchini, for example, did not craft only carts and wooden handles of arquebuses. He could also refine eleven tons of raw saltpeter and eight tons of “rotten and bad” gunpowder. Another collaborator, Nuziato, was simply a “painter.” The propellant of all of these artisans was paid five florins for every three hundred kilograms of saltpeter.⁹⁶

The encampment, also, was tooled up with riddles, boilers, scales, and other tools for making powder.⁹⁷ In the first days of August, however, the Dieci were compelled to requisition a large amount of explosive from their fortresses of Volterra, Leghorn, Arezzo, Cortona, Borgo Sansepolcro, and Pistoia. The consumption grew soon to such massive amounts that it exceeded the public productive facilities.⁹⁸ The appointees, then, commissioned private apothecaries to fabricate the compound. Giovanni di Stagio Barducci dispatched eight tons to magazines, and Giovanni di Simone Formiconi more than one thousand kilograms. Zanobi di Mechero, instead, purified the nitrate. This explosive was costly, approximately ten florins for every three hundred kilograms of raw material.⁹⁹ Five hundred kilograms of finished article, moreover, were acquired in the Papal States for forty-five florins.¹⁰⁰

⁹⁴ ASF, Dieci di balia, Missive, 59, f. 107v. For the different typologies of gunpowder, see Hall, *Weapons and warfare in Renaissance Europe*, pp. 69-74; Walter Panciera, “La polvere da sparo,” in *Il rinascimento italiano e l'Europa*, III. *Produzione e tecniche*, pp. 307-15.

⁹⁵ ASF, Dieci di balia, Entrata e uscita, 27, f. 25v; ASF, Dieci di balia, Missive, 59, ff. 25r and 115rv; ASF, Dieci di balia, Responsive, f. 45r.

⁹⁶ ASF, Dieci di balia, Munizioni, 7, ff. 373v, 428r, 451rv, 452v and 495v-498r; ASF, Dieci di balia, Debitori e creditori, 35, ff. 178v, 222v, 224v, and 225v; ASF, Dieci di balia, Entrata e uscita, 23, ff. 324r and 331r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, f. 144v. See also Ansani, “Geografie della guerra nella Toscana del Rinascimento,” pp. 86-88.

⁹⁷ ASF, Lettere varie, 3, ff. 196r and 197r.

⁹⁸ ASF, Dieci di balia, Missive, 59, ff. 77v, 81v, and 82v; ASF, Dieci di balia, Missive, 60, f. 74v.

⁹⁹ ASF, Dieci di balia, Munizioni, 7, 460v, 447v-478r, and 509r; ASF, Dieci di balia, Debitori e creditori, 35, ff. 226r, 231r, 236v, and 244r; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, f. 130r.

¹⁰⁰ ASF, Dieci di balia, Munizioni, 7, f. 358v; ASF, Dieci di balia, Missive, 60, f. 70v.

The overall expenditure was very, very considerable. By the end of the campaign, the Florentine guns consumed more than thirty-six tons of gunpowder, nine times more than the preceding year.¹⁰¹ For its transport, the Dieci had also to purchase about six hundred barrels. Their price was fixed to twelve *soldi* for the “small” containers, and fifteen for the “large” ones.¹⁰²

For improving and maintaining this levels of productivity, the Dieci had to collect a large quantity of raw materials, encouraging internal commerce and augmenting importations from the neighboring regions. The duties on the Volterranean yellow sulfur, for example, were temporarily abolished. Three hundred and thirty kilograms of this mineral had a value of seven florins. In the countryside, the cut down of willows and the production of charcoal was authorized and promoted, in spite of public or private rights to forests and timbers. Beech and chestnut, instead, were required for stoking furnaces and for casting metals. In general, three hundred and thirty kilograms of burnt wood cost twenty-seven *lire* and ten *soldi*.¹⁰³

Saltpeter, instead, was not artificially produced in Tuscany. It was “scarce as much as necessary.”¹⁰⁴ Merchants had to procure it abroad. Piero di Matteo Berti, a Florentine businessman, sold three and a half tons of raw nitrate for four hundred and thirty-seven florins. Giovanni Bentivoglio, the lord of Bologna, allowed his allies to pick up three hundred kilograms of refined material. The brothers Andrea and Faragano were rewarded with ten florins for the opening of their modest nitrary in Castrocaro. Small quantities of raw compound were also dispatched from the castles of Modigliana and Firenzuola, or bought from the aforementioned *Pippa*, or from Pratese and Viterbese masters, or from one the keepers of Florentine arsenals, Gaspare di Antonio Pasquini. All imports were exempted from taxes and tolls.¹⁰⁵

The most important deals, instead, were negotiated and signed by republican envoys to Italian courts. In August, in Genoa, the Florentine ambassador Braccio Martelli obtained four

¹⁰¹ ASF, Dieci di balia, Debitori e creditori, 35, ff. 22v, 110v, 180v, 242v, 251v, and 286v.

¹⁰² ASF, Dieci di balia, Munizioni, 7, f. 412v; ASF, Dieci di balia, Debitori e creditori, 35, f. 203v.

¹⁰³ ASF, Dieci di balia, Munizioni, 7, ff. 423r and 426v; ASF, Dieci di balia, Debitori e creditori, 35, ff. 228v and 255v; ASF, Dieci di balia, Missive, 58, f. 79r; ASF, Dieci di balia, Missive, 59, f. 104r; ASF, Dieci di balia, Missive, 60, f. 134r.

¹⁰⁴ ASF, Dieci di balia, Missive, 60, f. 128r.

¹⁰⁵ ASF, Dieci di balia, Munizioni, 7, ff. 341r, 344v, 347r, 361r, 362r, 381v; ASF, Dieci di balia, Debitori e creditori, 35, ff. 219r and 235v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, f. 124rv; ASF, Dieci di balia, Missive, 59, ff. 82v and 119v.

tons of saltpeter to the value of seven hundred florins, including various duties and chartered boats. He tried also to smuggle other material through a “secret way,” with the help of friendly retailers.¹⁰⁶ In the same period, Francesco Gualterotti, in Rome, traded eight tons of refined mineral with the Sienese banker Giulio Spannochì.¹⁰⁷

Today I met both the saltpeter maker, Antonio from Leccia, and a boy of these Spannochì. I have concluded a deal with them on eight tons of saltpeter. The price has been fixed at fifty ducats for every thirty-three kilograms of merchandise. The goods must be consigned to the customs officers of Florence within a month. The bankers will pay the expenses for transportations, except the tools of our state. The saltpeter has to be similar, or even better than the sample that I received from your lordships [...].

I could not obtain a discount, because these Spannochì know how to sell their stuffs timely, and how to move this materiel through the Sienese territory. Besides, they have not agreed to supply more saltpeter in less time. However, they have guaranteed that the first barrels will appear in our capital within fifteen days.

All of this mineral was rapidly “transformed in gunpowder.” A few weeks later, also Ludovico Sforza was persuaded to supply ten tons of “indispensable” refined nitrate, dispatching them from the Adriatic port of Pesaro. Nevertheless, despite urgency, the transport was slower and more problematic than expected, due to the lack of barrels, sacks, and mules. In the meanwhile, in Milan, a Neapolitan merchant offered a significant amount of goods to the Florentine emissary, Francesco Pepi.¹⁰⁸ By the mid of August, the Dieci affirmed that they “had bought so much saltpeter that masters can mix gunpowder until the end of the campaign.”¹⁰⁹

The army was provided also with portable firearms. Francesco from Asti cast numerous bronze harquebuses in Leghorn. Baldo di Giovanni from Careggi traded one hundred and sixteen iron harquebuses, purchasing them in Brescia, along with the cannonballs. The priced

¹⁰⁶ ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 48, 108v; ASF, Dieci di balìa, Missive, 60, ff. 88v-89r; ASF, Dieci di balìa, Responsive, 58, f. 338v.

¹⁰⁷ ASF, Dieci di balìa, Munizioni, 7, ff. 394v, 398v, 406v, 407v, and 409r; ASF, Dieci di balìa, Debitori e creditori, 35, f. 248r; ASF, Dieci di balìa, Entrata e uscita, 23, f. 351v; ASF, Dieci di balìa, Missive, 59, f. 127v; ASF, Dieci di balìa, Missive, 60, f. 143r; ASF, Dieci di balìa, Responsive, 58, ff. 175rv and 183r

¹⁰⁸ ASF, Dieci di balìa, Munizioni, 7, ff. 410v, 448v, and 511v; ASF, Dieci di balìa, Debitori e creditori, 35, f. 314r; ASF, Dieci di balìa, Missive, 60, ff. 128rv, 131v, and 136r; ASF, Dieci di balìa, Responsive, 54, ff. 60rv, 69r, 78v, and 89r; ASF, Dieci di balìa, Responsive, 58, f. 219v.

¹⁰⁹ ASF, Dieci di balìa, Missive, 59, f. 93v.

was fixed at twenty *lire* for every thirty-three kilograms of merchandise. The same cost had the twenty-eight pieces traded by Niccolò di Alessandro Machiavelli. A carter, Piero di Bino, sold instead eighty “heavy Brescian handguns” at three *lire* and three *soldi* each. The Dieci purchased also six hundred iron scouring sticks.¹¹⁰ Several iron harquebuses were also transported from Città di Castello. The captain himself solicited fuses, ramrods, trestles, and encourage the presence of “useful” foot soldiers and mounted units armed with hand guns. He appointed his secretaries and his servants to buy one hundred bronze firearms in Florence and in Bologna, along with their molds and their ramrods. He also contacted fifty Pisan *scoppiettieri*, convincing the general commissioners to hire their company.¹¹¹

The Republic supplied its army also with thousands and thousands darts. In June, thirty-eight thousand quarrels were stored in Florentine arsenals, alongside seventeen thousand bolts. Angelo di Filippo from Brescia and Baldo di Giovanni from Careggi deposited further twenty-seven thousand “common” arrowheads and five thousand “large” ones, as well as ten thousand “olive leaf, half-moon, pointed, and spiked” pieces for mounted crossbowmen. They received three thousand *lire*. Francesco de’ Nerli, instead, made one thousand *lire* from thirty-one thousand artifacts of “common” type.¹¹² Arrowheads were then fixed to shafts by assembly workers. Fletchers, instead, bound the feathers. The three brothers Nonni, Antonio, and Santi del Nonni manufactured almost eighty thousand darts, during the whole summer, purchasing the wooden part of quarrels over the Umbrian Apennines.¹¹³ Besides quarrels, the Dieci acquired linen thread for the manufacture of bowstrings. Eighteen thousand bobbins were shifted in Pontedera, at a cost of one hundred and eighty florins, more or less.¹¹⁴

¹¹⁰ ASF, Dieci di balia, Munizioni, 7, ff. 341rv, 421v, 447v, 466r, and 467v; ASF, Dieci di balia, Debitori e creditori, 35, f. 185v; ASF, Dieci di balia, Missive, 58, f. 83r.

¹¹¹ ASF, Dieci di balia, Responsive, 58, f. 43r; ASF, Lettere varie, 3, ff. 90r, 112r, 121r, 153r, 160r, 183r, 196r, 197r, and 204r; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 383 and 386. See also Pieri, *Il Rinascimento e la crisi militare italiana*, p. 373.

¹¹² ASF, Dieci di balia, Munizioni, 7, ff. 362r and 473r; ASF, Dieci di balia, Debitori e creditori, 35, f. 218v.

¹¹³ ASF, Dieci di balia, Debitori e creditori, 35, ff. 57v, 174v, and 246v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, f. 174r. For the production cycle of darts, see Ansani, “Craftsmen, artillery, and war production,” p. 17.

¹¹⁴ ASF, Dieci di balia, Munizioni, 7, ff. 350r and 478v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, f. 126r.

So, one arrow after another, one cannon after another, the Dieci would have spent six thousand and six golden florins on ammunitions, within the end of their semester, on December 1498.¹¹⁵

Market and mercenaries

Officers had at their disposal also steel and wooden crossbows, but these weapons were usually bought from soldiers. Infantrymen had the property of their bucklers, of their sallets, of their swords. They could purchase arms in camp, or in the shops of retailers of second-hand goods, or even from their employers. The Dieci usually deducted the price of these supplies from wages. The *connestabile* Dionigi Naldi, for example, received twenty crossbows, twenty-two cuirasses, and one hundred and fifty helmets instead of five hundred and fifty *lire* of salary. Generically, a breastplate could be sold at seven *lire*, a reinforced cuirass at sixteen *lire*, a simple armet at three *lire* and five *soldi*, a spear at twelve *soldi*.¹¹⁶ Men-at-arms, instead, preferred the renowned, resistant Lombard articles. Paolo and Vitellozzo Vitelli were indebted to *maestro* Giacomo di Pietro from Milan for six hundred and fifty ducats, the price of several gauntlets, spaulders, pauldrons, vambraces, greaves, “Swiss” breastplates, “Italian” and “French” armets, barbutes, helmets, and a full armor. During the Pisan campaign, they purchased one hundred and fifty “resistant” and “good-looking” cuirasses.¹¹⁷ In Florence, the brothers bought only horses of various breeds and coats, black, gray, bay, for warfare or transport. Their value fluctuated between fifteen and forty-three ducats.¹¹⁸ A tack maker from Borgo Sansepolcro also put forward to the captain a society for producing and trading saddles for the company.¹¹⁹

Giovannantonio, I beg you for asking Paolo and Vitellozzo if they want twenty-five or thirty saddles for them, at a fair price. I will made every tack at my expenses, saddle, stirrups, breastplates, girths, and blankets. I will sell the finished piece at two golden ducats [...]. Their lordships have only to hand me a list, signed by the purchasers of these saddle, men-at-arms, or mounted crossbowmen, or light cavalrymen. I hope to earn ninety-five ducats. I will halve the profit with their lordships, like a good and honest

¹¹⁵ ASF, Dieci di balia, Debitori e creditor, 39, f. 292v.

¹¹⁶ ASF, Dieci di balia, Munizioni, 7, ff. 351r and 415r; ASF, Dieci di balia, Missive, 60, ff. 84r and 101v.

¹¹⁷ ASF, Lettere varie, 3, f. 237r; ASF, Lettere varie, 5, ff. 6rv, 7v, and 75r.

¹¹⁸ ASF, Lettere varie, 3, f. 53r; ASF, Lettere varie, 3, ff. 12r-13r.

¹¹⁹ ASF, Lettere varie, 9, f. 5r.

associate. However, at the moment, I beg fifty ducats from their lordships, in order that I can go to the fair and buy leather, saving some money. I hope, with the help of God, to craft all of these stuffs within six months.

The two condottieri often sold or lend to their troop also clothes and hoses, and paid and rewarded their men-at-arms with berets, *giornee* decorated with the white “French” cross, cloaks, tabards, “Turkish” *casacche*, and various and colorful textiles, as baize, velvet, plain weave, brocade, and satin. Paolo and Vitellozzo, instead, often dressed in elegant Transalpine fashion, with a certain proud.¹²⁰

The condottieri also looked after the barracks of their brigade. The Dieci refunded to them two thousand and seven hundred *lire* for two hundred and thirty five “tents for two bottoms.” Obviously, the captain had the privilege of “decent” mattresses, blankets, and pavilions.¹²¹ His dignity was also symbolized by the republican insignia. Florentine government offered to its general captains and its general governors the flag of the Commune, a large, square white standard with the red lily. The taffeta, the silk, and the manufacture came to fifty florins.¹²² Other banners were used for the cavalry squadrons and the infantry units.¹²³

Sir Cerbone, we are sending you six shields with six different liveries painted on them, along with an azure flag. You have to task a tailor with the making of six standards for the infantry as large as the azure one, and all of them have to be marked with the pictures of the shields and the numbers, one, two, three, etcetera. You have also to order five other white banners for the men-at-arms, but larger than the azure one. The first have to depict a calf, the second a lion, the third a black horse, the fourth a red eagle. For the fifth use a purple fleur-de-lis, which represents the coat of arms of the king of France. The symbols have to be visible and apparent.

¹²⁰ ASF, Lettere varie, 3, ff. 48r, 90r, 161r, 183r, 235r, 316r, and 320r; ASF, Lettere varie, 5, ff. 15r, 61r, and 62r; ASF, Lettere varie, 6, ff. 114r-131r. For these markets in clothes and textiles inside mercenary and “mercantile” companies, see Mario del Treppo, “Gli aspetti organizzativi, economici e sociali di una compagnia di ventura italiana,” *Rivista Storica Italiana* 85 (1973), no. 2, pp. 253-75; William Bernardoni, “La compagnia del capitano Micheletto Attendolo nella contabilità quattrocentesca della Fraternita dei Laici di Arezzo,” *Annali aretini* 22 (2014), pp. 115-44.

¹²¹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, f. 49r; ASF, lettere varie, 3, f. 160r.

¹²² ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 22, f. 190v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 30, f. 225v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 42, ff. 167v and 171v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, f. 92r; ASF, Dieci di balia, Entrata e uscita, 26, f. 59v.

¹²³ ASF, Lettere varie, 3, f. 99rv.

Contrary to other companies, the *vitelleschi* did not depend exclusively on the Dieci for the equipping their soldiers with spears. Through his brother-in-law, Francesco Bracciolini, Paolo could buy hundreds of pole arms in Pistoia. This town, at that time, was the Tuscan center of their production. Goods were sold in Florence, in Siena, in Lucca, and even in Pisa. Pace di Pippo and Donato di Giuliano were two of the most important manufacturers of shafts and iron pointed heads. A local wholesaler, Doffo di Piero Partini, controlled the market, dealing with customers, offering sales on “excellent stuffs,” and recommending his “very good friends.” Doffo tendered with the captain for one hundred items for infantry at sixty *lire*, and one hundred “French” spears for cavalry at twenty-two florins. The institutional buyers, instead, paid a bit more, both for traditional arms and new, Transalpine shapes.¹²⁴ In any case, the Dieci stocked up with shafts and spearheads, dispatching the finished products in their camps. At the end of the campaign, they had acquired ten thousand blades in Brescia and in Pistoia, and seven thousand and six hundred spears for infantrymen, light horse, and men-at-arms.¹²⁵

From Buti to Librafratta

In spite of all these expenditures, in the midsummer the army was still entrenched in the Florentine territory, in the vicinity of the village of Calcinaia, near to the Arno river. After the Pisan withdraw, the operations had slowed down. The only significant encounter took place on July 26th, when Paolo Vitelli set a trap for the enemy light cavalry in the surrounding of Cascina, capturing one hundred and fifty prisoners and fifty mules laden with food.¹²⁶ According to Parenti, the Florentine government, at that time, was not giving any order to move, or to attack. The captain, instead, waited for money, guns, and reinforcements, while engineers and architects tried to repair the walls of Ponsacco. Soldiers could only protect the indispensable harvesting of wheat, helping peasants and pioneers.¹²⁷

¹²⁴ ASF, Lettere varie, 3, ff. 21r, 49r, and 346r; ASF, Lettere varie, 5, ff. 33r and 112r.

¹²⁵ ASF, Dieci di balia, Munizioni, 7, ff. 342r, 351r, and 362r; ASF, Dieci di balia, Debitori e creditori, 35, ff. 168v, 173v, and 232v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, f. 145v; ASF, Dieci di balia, Missive, 59, f. 93v; ASF, Dieci di balia, Missive, 60, f. 91r; ASF, Dieci di balia, Responsive, 53, f. 154r.

¹²⁶ Vaglianti, *Storia dei suoi tempi*, pp. 56-57; Sanudo, *I diari*, I., pp. 1026-28; Priuli, “Diari,” I., p. 93.

¹²⁷ ASF, Dieci di balia, Missive, 59, f. 12rv; ASF, Dieci di balia, Missive, 60, ff. 18rv and 42rv; ASF, Dieci di balia, Responsive, 58, f. 48r; Parenti, *Storia fiorentina*, II., p. 188.

The Florentine officers, besides, had to supply their troops also with “ammunition of food.” Soldiers “cannot feed on Only Ghost,” wrote, provocatively, Guglielmo de’ Pazzi, remembering the necessity of “abundant” provisions in order to prevent desertions and protests. On the first half of June, the Dieci had to arrange a public bread market in the town of Pontedera. Several bakers, here, blend the flour lent by the government. Five servants supervised the production of nourishment, and its influx from the surrounding towns. In Florence, the Dieci often organized the transportation of bread from the capital to the camp. The monthly cost of *pane cotto*, biscuits, sacks, and baskets, could exceed the sum of five thousand *lire*, but the “mobile city” of an army could consume more food than expected.¹²⁸ At that time, this “fifth quarter” of Florence numbered about eight thousand “inhabitants,” not counting hundreds of merchants, artisans, carpenters, bricklayers, stonecutters, cooks, wives, lovers, prostitutes, boys, servants. It was necessary to raid the countryside for obtaining pigs, steers, and goats. Peasants, moreover, could sold meat, eggs, fruit, cheese, and the indispensable wine, the drink most beloved by soldiers.¹²⁹ Above all, villagers provided hay for men-at-arms. Bales, in fact, were granted to knights without any payment. In the valley of the Arno river, officials obliged every countryman to dispatch one kilogram of straw to Pontedera, threatening latecomers and reluctant subjects with fines and imprisonment.¹³⁰

Plundering and skirmishes engaged the troop until the arriving of a Milanese contingent, two hundred men-at-arms and two hundred and fifty mounted crossbowmen, led by the count Ludovico from Mirandola. In Romagna, another Lombard condottiere, Gaspare Sanseverino, better known as *Fracassa*, barred the way to enemy Venetian reinforcements. At the beginning of July, Ludovico Sforza was deciding to side manifestly with Florence, proposing the marquis of Mantua as the general captain of their league, and sending an envoy for reconciling Paolo Vitelli and Rinuccio from Marsciano. Another ambassador had to mediate between Florence and Siena.¹³¹

¹²⁸ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 33, f. 223v; ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, ff. 81v, 83v, 110v, 112v, and 113v; ASF, Dieci di balia, Missive, 59, f. 139rv.

¹²⁹ ASF, Dieci di balia, Responsive, 36, f. 214rv.

¹³⁰ ASF, Dieci di balia, Missive, 60, ff. 35v, 90v, 99v, and 103v.

¹³¹ ASF, Dieci di balia, Missive, 59, ff. 35v and 39v; ASF, Dieci di balia, Missive, 60, ff. 39rv and 43r; ASF, Consulte e pratiche, 64, ff. 87r-98r and 101r-102r; Parenti, *Storia fiorentina*, II., p. 190; Buonaccorsi, *Diario*, pp. 2-4; Vaglianti, *Storia dei suoi tempi*, pp. 57-58.

After various procrastinations, hence, the Dieci decided finally to make the most of the opportunity. In the general city council, they proposed a new tax on the Florentine countryside, attaining twenty thousand florins. A subvention of fifteen thousand ducats, moreover, was offered by the duke of Milan.¹³² This ready cash was spent in enlisting new infantry companies. In a couple of weeks, the treasurer of the Dieci, Alfonso Strozzi, enlisted more than one thousand *provvigionati*. Seven Florentine *connestabili* came forward with four hundred men. Dionigi Naldi moved five hundred companions from Romagna, and hundreds and hundreds of Italian, Swiss, and Spanish mercenaries followed the army, waiting for a contract. As usual, moreover, Pistoiese commune conscripted two hundred infantrymen. The Dieci issued also a peremptory proclamation, imposing upon every knight and every foot soldier to leave Florence and reach the encampment immediately, and menacing corporal punishments for the deserters. Four citizens were assigned to review the troops.¹³³

Two thousand pioneers were also mobilized in the villages of Casentino, in the Scarperia region, and in the Pratese countryside. Several “loyal” and “reserved” spies were sent in Pisa and in Cascina, in order that “we can defend ourselves easily, and offend the rebels confidently.”¹³⁴ On August 15th, the officers solicited the new general commissioners, Piero Popoleschi and Jacopo Pitti, to finally guide the army towards an enemy position.¹³⁵

You ought to regard the desires of our city. The people expects some results from the provisions we have so difficultly made. Considering the proper supplies of artillery and gunpowder, and having hired five thousand infantrymen, we have already satisfied all of the captain’s demands. Here, in Florence, everyone judge that the victory consists in the quickness of your actions. The Signori, as well as private citizens, reminded us of soliciting your departure from the encampment. Within Friday, or Saturday, the troop has to begin its march, according to your wise opinion and to the captain’s experience and art. Be diligent. We would not like to be charged with delaying this expedition.

Notwithstanding another altercation between the captain and the governor, the Florentine soldiers left Calcinaia on August 19th, before dawn, pointing north, with the purpose of

¹³² ASF, Dieci di balia, Responsive, 54, ff. 49v, 69r, 94v and 95r; ASF, Consulte e pratiche, 64, ff. 97r-99r.

¹³³ ASF, Dieci di balia, Missive, 59, ff. 69rv, 94rv, and 95v; ASF, Dieci di balia, Missive, 60, ff. 85v, 91v, and 99r; Vaglianti, *Storia dei suoi tempi*, p. 58.

¹³⁴ ASF, Dieci di balia, Missive, 60, ff. 28v, 36v, and 72v-73r; ASF, Dieci di balia, Responsive, 58, f. 43r.

¹³⁵ ASF, Dieci di balia, Missive, 60, f. 90r. See also ASF, Consulte e pratiche, 64, ff. 105r-106r.

conquering the hills that dominated the Pisan plain and bordered the Lucchese territory. Florentine commanders, in fact, were trying to isolate the rebels from their allies, blocking the road towards Liguria and Emilia, and cutting off the daily arrivals of food, weapons, and reinforcements from the deceitful, treacherous neighbors.¹³⁶

Shortly after its departure, the army appeared under the walls of Buti. Thanks to their carts and their trunnions, fourteen cannons and fifty falcons were immediately fired. The bombardment lasted four hours. The town, nonetheless, did not surrender, and had to be taken by force. Its resistance was severely punished by the captain himself, according to the brutality of his French masters. He ordered the hanging of several inhabitants, and even children were imprisoned and sent in Florence. The hands of five gunners, moreover, were amputated, and hanged on the shoulders of the unfortunate soldiers.¹³⁷ Sanudo reported that this loss and this violence caused anguish and fear among the Pisan troops. Only twelve days before, they had believed that the Florentine army was disbanding. The maimed, above all, frightened to death the commissioner of the Most Serene Republic, Piero Duodo, and the Venetian general governor, Marco from Martinengo.¹³⁸ The new warfare was apparently working. The replacement of the old, cumbersome, giant artillery with a full train of mobile ordnance was speeding up the assaults. The siege of an “insignificant hovel” could not slacken the campaign anymore. On the contrary, the Florentine army had covered six miles, and shelled and seized a town, in just one day.

The news and the progresses cheered up and “united” Florentine people. Relying on the “hope of further and better successes,” four hundred thousand florins were collected in a few days, and handed to payers. The government announced also the *condotta* of Giovampaolo Baglioni from Perugia, a longtime friend of the Vitelli, with seventy men-at-arms and fifty mounted crossbowmen. Furthermore, beating the Venetian competition, the Commune and Ludovico Sforza hired the lord of Piombino, Jacopo IV Appiano, appointing him with the title of Milanese general governor, and entrusting to him two hundred knights.¹³⁹

¹³⁶ ASF, Dieci di balia, Missive, 59, ff. 101v-102r and 107r; Parenti, *Storia fiorentina*, II., p. 192

¹³⁷ ASF, Dieci di balia, Missive, 59, f. 111v; ASF, Dieci di balia, Missive, 60, ff. 101v and 102v; Landucci, *Diario fiorentino*, p. 183; Vaglianti, *Storia dei suoi tempi*, p. 59; Nardi, *Istorie della città di Firenze*, p. 177; Sanudo, *Diari*, I., p. 1068; Priuli, “Diari,” I., p. 95.

¹³⁸ Sanudo, *Diari*, I., pp. 1039, 1056, and 1062; Cerretani, *Storia fiorentina*, pp. 256-57. See also Pieri, *Il Rinascimento e la crisi militare italia*, p. 373.

¹³⁹ ASF, Dieci di balia, Deliberazioni, condotte e stanziamenti, 48, ff. 8v-9r and 10r-11r; ASF, Dieci di balia, Missive, 60, f. 92r; ASF, Lettere varie, 3, f. 259r; Sanudo, *Diari*, I., pp. 1058 and 1063.

Only the *frateschi* seemed to be displeased with the military and diplomatic achievements of the *arrabbiati* Dieci.¹⁴⁰ The Florentine rulers disputed also the objective of the expedition. The officers demanded from their commissioners to besiege Vico Pisano, one of the principal towns of the rebels, “well defended by eight hundred Venetian infantrymen and hundreds of armed peasants.” The captain, instead, preferred obstinately to storm the nearby fortress of Verruca, a formidable but remote observation post over the valley below. The Dieci protested “animatedly” against his decision, considering the enterprise to be “unnecessary, dishonorable and harmful for the reputation of our Republic and our powerful army,” and a “deceit of our soldiers for wasting time and requesting another pay.” They reaffirmed that “we cannot bear the cost of this campaign any longer, if you do not quickly get other significant results.”¹⁴¹

In the meanwhile, on August 28th, the village of Calci, located about ten miles east of Buti, gave in, along with its hamlets. Also the fortified monastery of Saint Michael, about a half mile west of Verruca, was occupied by Florentine forces in the same days. The captain ordered also the construction of a bastion over the Dolorosa, a high rocky spur placed in the neighboring woods. Then “we will move towards Vico, in order to satisfy our lords, even though we would rather attack the castle.”¹⁴² Between the army and the victory, however, there were two other major obstacle. The first was the soldiers’ request of money, interpreted again by the Dieci as a “regrettable and dishonest blackmail,” a “sign of disloyalty.” The second was a terreplein fortified with wooden structures and artillery, which protected the hillside of Vico.¹⁴³

Yesterday, on August 30th, with the help of God, we carried the ordnance to this bastion. Gunners fired a few shot, while we were pitching the tents of our encampment. The last night cannons hit the target repeatedly and vigorously. Now, enemies are abandoning the place, due to our bombardment. They are taking refuge in Vico. We hope that, with the help of God, the town will be captured soon. In any case, sir Corrado, you have to solicit coins and gunpowder from our lords, and especially the cash. There is no doubt at all that these soldiers will willingly die for this excellent Signoria, after receiving their wages.

¹⁴⁰ ASF, Dieci di balia, Missive, 60, f. 110v; Parenti, *Storia fiorentina*, pp. 192-93.

¹⁴¹ ASF, Dieci di balia, Missive, 59, ff. 112r-113r; ASF, Dieci di balia, Missive, 60, f. 102v.

¹⁴² ASF, Dieci di balia, Missive, 59, ff. 123v-124r; ASF, Lettere varie, 3, f. 254r; Sanudo, *Diari*, I., pp. 1064, 1073, and 1075.

¹⁴³ ASF, Dieci di balia, Missive, 60, ff. 117v-118r; ASF, Lettere varie, 3, f. 255r.

The Dieci replied that the seizing of Vico would have easily guaranteed the accumulation of “a large amount of money, which are the *nervus belli*,” demonstrating to the adversaries, and especially to Venetians, that “we are winning, wealthy, and united.”¹⁴⁴

On September 1st, the guns were aimed at Vico, but they malfunctioned, due to the heavy rain. Moreover, an enemy culverin, along with two falcons, was storming the batteries, damaging shelters, breaking three carts, and killing two gunners. Pisans were striving desperately to react to the Florentine predominance, supplying the besieged town with gunpowder, shot, and arrows. They also raided frequently the vicinity of Pontedera, and enlisted several infantrymen. Nevertheless, the rebel army was decidedly outnumbered by its foes. According to Vincenzo Valier, the Venetian commanders had at their disposal only one thousand foot soldiers and fifty cavalry squadrons, too few for attempting effective counterattacks. On September 4th, the infantry captain, Giacomo from Tarsia, struggled to create a diversion, fighting back against the garrison of the church of Saint Michael, and overcoming it.¹⁴⁵

This maneuver was probably too late. Two hundred soldiers had left Vico two days before, reducing the likelihood of enduring a strike. The Florentine ordnance, above all, was aimed at “the weakest and most undefended part of the walls,” as suggested by the same enemy deserters. Witnesses referred that artillery shot one hundred and fifty projectiles per day, breaching more than ten meters of stone.¹⁴⁶ On September 5th, four hundred infantrymen mutinied, “after the breaking of the wall, because they did not want to die.”

We had took control of Vico Pisano in this way. Our guns reduced the defenses to rubble, and we hoped to attack in the evening. However, our adversaries were scared, and they did not crave to await the battle. So, they entered negotiations, granting to us the possession of the town and of their guns. We promised to spare both the life and the belongings of the inhabitants.

¹⁴⁴ ASF, Dieci di balia, Missive, 60, ff. 125r-126r.

¹⁴⁵ ASF, Dieci di balia, Missive, 60, f. 127v; ASF, Lettere varie, 3, ff. 292r and 293r; Parenti, *Storia fiorentina*, II., p. 194; Sanudo, *Diari*, I., pp. 1074-76, 1078, and 1085.

¹⁴⁶ Landucci, *Diario fiorentino*, p. 183; Sanudo, *Diari*, I., pp. 1078 and 1084.

Paolo Vitelli menaced only the last, stubborn defenders with the mutilation of their hands. He also claimed the captured firearms, four culverins and several spingards and falcons.¹⁴⁷

After the conquest, the rest of the army split, coming back temporarily to Bientina, Pontedera, and Calcinaia. Carpenters and smiths repaired carts and cannons. Architects, stonecutters, and bricklayers reconstructed the damaged walls of Vico.¹⁴⁸ Condottieri, instead, solicited money. Again. And again. The captain was “on fire,” because of the “scarce provisions” of the Dieci for several condottieri, for the Milanese crossbowmen, and for “all the infantrymen, that are continuously breathing down our necks.” The cash was essential for “swelling the ranks of the companies” and for “persuading the brigade to stay with us, while the enemies are offering generous pays.” He also solicited “gunpowder, shot, and pioneers,” explaining that “the autumnal bad weather could halt the campaign soon,” and complaining that “everything has to be begged, everything arrives after one year.”¹⁴⁹

In Florence, the necessity of money led even to a modification in the electoral system. The officials responsible for the public debt were proposed exclusively by the Signoria, and then hurriedly voted. They were urged to lend fifty thousand florins. An irritated Vaglianti commented that “this war is waged by the savings of our people,” while “the magnates are getting richer from the interests on their loans.”¹⁵⁰

Citizens, however, could not get rid of this problem. Pisans did not give up. They fortified the town of Cascina, the tower of Foce d’Arno, and the fortress of Libbrafratta, digging moats, building ravelins, and realizing terrepleins. On September 10th, moreover, one thousand foot soldiers and one hundred and fifty mounted crossbowmen assaulted the bastion of the Dolorosa, endeavoring to regain the control of the adjacent hills.

This morning, at sunrise, the rebels reached the Dolorosa, bearing ladders and portable firearms. Here, they attacked our position, wounding forty of

¹⁴⁷ ASF, Dieci di balia, Missive, 59, f. 148v; ASF, Dieci di balia, Missive, 60, f. 135rv; Lettere varie, 3, f. 286r; Vaglianti, *Storia dei suoi tempi*, p. 59; Cerretani, *Storia fiorentina*, p. 257; Guicciardini, *Storia fiorentina*, p. 188; Nardi, *Istorie della città di Firenze*, pp. 177-78; Cambi, “Istorie,” pp. 134-35; Sanudo, *Diari*, I., pp. 1078-79 and 1085; Priuli, “Diari,” I., p. 99.

¹⁴⁸ ASF, Dieci di balia, Missive, 59, ff. 152v-153r; ASF, Dieci di balia, Missive, 60, ff. 138r, 143r, and 145r; Sanudo, *Diari*, I., pp. 1099 and 1103; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 385.

¹⁴⁹ Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 372-77, 382, and 384.

¹⁵⁰ Parenti, *Storia fiorentina*, II., pp. 194-95; Vaglianti, *Storia dei suoi tempi*, p. 60.

our men. Informed, the captain got on his horse, and prepared his company. He set off for the hills immediately. Vitellozzo, instead, left from Vico for Calci, in order to occupy the passes and block the roads towards Pisa, preventing the enemy retreat. At the sight of our forces, Pisans withdrew, but they soon encountered our soldiers hidden on the slopes. A skirmish broke out. After a while, the captain struck our foes from behind, putting them to flight. Finally, we captured six *connestabili* and one hundred *stradiotti*. We grabbed also the most part of their infantrymen, and Giacomo from Tarsia was seriously wounded.

It was a heavy defeat for the rebels. Their infantry was totally overwhelmed, and lost numerous crossbows, “countless” quarrels, and all of the guns. Florentines, on the contrary, became the “absolute masters” of the countryside. Vitellozzo raided as far as the gates of Pisa, plundering one hundred beasts of burden, and taking several captives among the peasants.¹⁵¹ Furthermore, on September 17th, the commissioners ambushed a Venetian convoy that transported five thousand kilograms of gunpowder from Ravenna to Pisa.¹⁵²

This rise was interrupted only by the umpteenth dissension within the Florentine government. According to Guicciardini, Rinuccio from Marsciano and “arrogant and inexpert” rulers, backed by the common people, coveted to besiege Cascina, or even Pisa, taking advantage of the enemy disbandment. Paolo Vitelli and his “supporters,” instead, were of the opinion that both these cities were “almost impregnable,” due to the “defense of valorous and desperate men” and the “high number of guns.” The captain would rather have surrounded the Pisan region, depriving the rebels of any possibility of military assistance from Venice, Lucca, and Genoa. At last, on September 23rd, he personally decided to march on Libbrafratta, completing the conquest of the hills and the encirclement of the countryside.¹⁵³

Today, on September 28th, we took control of the bastion of Libbrafratta in this way. As soon as the enemies saw our artillery, they shouted out ‘pacts, pacts,’ and demanded for capitulating within three hours. We did not agree, and a skirmish broke out. After a little while, we seized the post definitively.

¹⁵¹ ASF, Dieci di balia, Missive, 60, ff. 140v-141r; ASF, Lettere varie, 3, f. 301r; Buonaccorsi, *Diario*, p. 10; Landucci, *Diario fiorentino*, pp. 183-84; Cerretani, *Storia fiorentina*, p. 257; Parenti, *Storia fiorentina*, II., p. 195-96; Sanudo, *Diari*, I., pp. 1092-93.

¹⁵² ASF, Dieci di balia, Missive, 60, f. 154rv.

¹⁵³ ASF, Dieci di balia, Missive, 59, p. 152r; ASF, Lettere varie, 3, f. 294rv; ASF, *Miscellanea repubblicana*, 3, e. 98, f. 50r; Guicciardini, *Storia fiorentina*, pp. 188-89; Parenti, *Storia fiorentina*, II., p. 197-98; Sanudo, *Diari*, I., p. 1105;

Two other towers fell three days later. The entire fortress yielded on October 3rd, after a “good bombardment.” In the same days, the army, “six thousand infantrymen, one thousand and five hundred light horses, and five hundred men-at-arms,” occupied also Filettole, securing the high valley of the Serchio river.¹⁵⁴

The war theatre would have later moved eastwards, in the mountain region of Casentino. The agreements between the Most Serene Republic and Piero de’ Medici, in fact, would have resulted in an invasion of Tuscany in the fall of 1498, and in an effective diversion from the Pisan campaign. In a “disordered” Florence, the *frateschi* and the *palleschi* gave “openly” the impression to conspire against the state. The firsts, above all, criticized and defame the Dieci di Balìa and all of the *arrabbiati* rulers. Parenti commented, sadly, that “we were so close to the victory. Now, we are on the brink of our ruin.”¹⁵⁵

Whilst the Venetian troops overflowed into the borders, Paolo and Vitellozzo Vitelli were compelled to leave from the encampment for Arezzo on mid November. The brothers carried with them the most part of the army, and, obviously, six cannons, two culverins, and nine falcons.¹⁵⁶

Conclusions

Numerous guns, saturation bombardments, unprecedented violence, immediate surrendering, and rapid movements. The victories of Paolo Vitelli seemed to be a triumph, for his French fashioned warfare. Five fortified positions, among towns and fortresses, fell one after the other, in the course of forty-seven days. Vico and its bastion, above all, were seized in less than a week. Compared to the sieges of the previous decade, the differences were many, and significant. The conquest of Citerna and Città di Castello, in 1482, required five months. Pietrasanta resisted Florentine assaults from August to November 1484. Eight heavy bombards did not subdue Sarzana in 1487, frustrating the republican commanders.

¹⁵⁴ ASF, Lettere varie, 3, ff. 298r and 304r; Landucci, *Diario fiorentino*, p. 186; Vaglianti, *Storia dei suoi tempi*, p. 60; Parenti, *Storia fiorentina*, II., p. 199; Cerretani, *Storia fiorentina*, p. 257; Buonaccorsi, *Diario*, p. 14; Sanudo, *Diari*, II., ed. Guglielmo Berchet (Venice, 1879), pp. 8 and 16; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 398-99.

¹⁵⁵ For this alliance between the Venetian government and the exiled son of Lorenzo the Magnificent, see Parenti, *Storia fiorentina*, II., pp. 193-212; Cerretani, *Storia fiorentina*, pp. 257-59; Nardi, *Istorie della città di Firenze*, pp. 179-83; Malipiero, “Annali veneti,” pp. 509-10

¹⁵⁶ ASF, Dieci di balìa, Entrata e uscita, ff. 69r, 72r, 73r, 75r, 81r, 82v, and 90r.

The new strategy was not slowed or hindered by the shift and the positioning of the traditional, cumbersome bombards. Gunners should not have to wait weeks for their weapons. Not even the absence of pioneers could halt the operations. The captain protested continuously about their desertion, but the ordnance could be transported everywhere, in spite of everything. By hand, if needed.¹⁵⁷ Carts and trunnions, moreover, permitted a simple aim. And the iron shot proved to be undoubtedly effective.

This rapidity, however, was counterbalanced by the necessity of a planned, constant, adequate supplying of projectiles, gunpowder, and firearms. The Dieci had to improve their management of the equipment. Within six months, the expenditures on ammunitions doubled, exceeding six thousand golden florins.¹⁵⁸ The production increased. New workshops were opened, and new craftsmen were employed in refining, mixing, assembling, casting. During the whole summer, gunmakers realized more than thirty pieces, as much as they had manufactured by the adoption of the French technology. The outputs reached the same, notable levels of the preceding years, when the Pisan factories were still under the Florentine control.

Nevertheless, the natural scarcity of the saltpeter and the frequent shortage of missiles compelled the officers to turn often to foreign markets. Dozens of cannons consumed high quantities of propellant, and were completely useless, without their proper shot. Timely provisions were becoming a serious problem, with evident repercussions. The lack of this indispensable materiel deferred the march of the army for two months and a half, while the soldiers pretended repeatedly to be paid.

Besides, the troops were the most recurring item on the balance sheet of the Commune.¹⁵⁹ Half of the incomes of the Dieci di Balìa was spent on *condottieri* and *connestabili*. Between June and December 1498, men-at-arms received thirty-six thousand golden florins. Infantrymen earned sixty-six thousand golden florins. But the cost of the conflict included also gunners, garrisons, commissioners, chancellors, spies, transporters, postmen, debts, and “extraordinary” expenses. By the end of the year, the officials disbursed

¹⁵⁷ ASF, Lettere varie, 3, ff. 287r, 291r,

¹⁵⁸ ASF, Dieci di balìa, Debitori e creditori, 34, f. 156r; ASF, Dieci di balìa, Debitori e creditori, 39, f. 292v; ASF, Dieci di balìa, Debitori e creditori, 40, f. 193r.

¹⁵⁹ ASF, Dieci di balìa, Debitori e creditori, 34, ff. 129r, 227r, and 235r; ASF, Dieci di balìa, Debitori e creditori, 39, ff. 292v; ASF, Dieci di balìa, Debitori e creditori, 40, ff. 182r, 199r, 200r.

more than two hundred thousand golden florins, tripling the payments of the three preceding semesters.¹⁶⁰

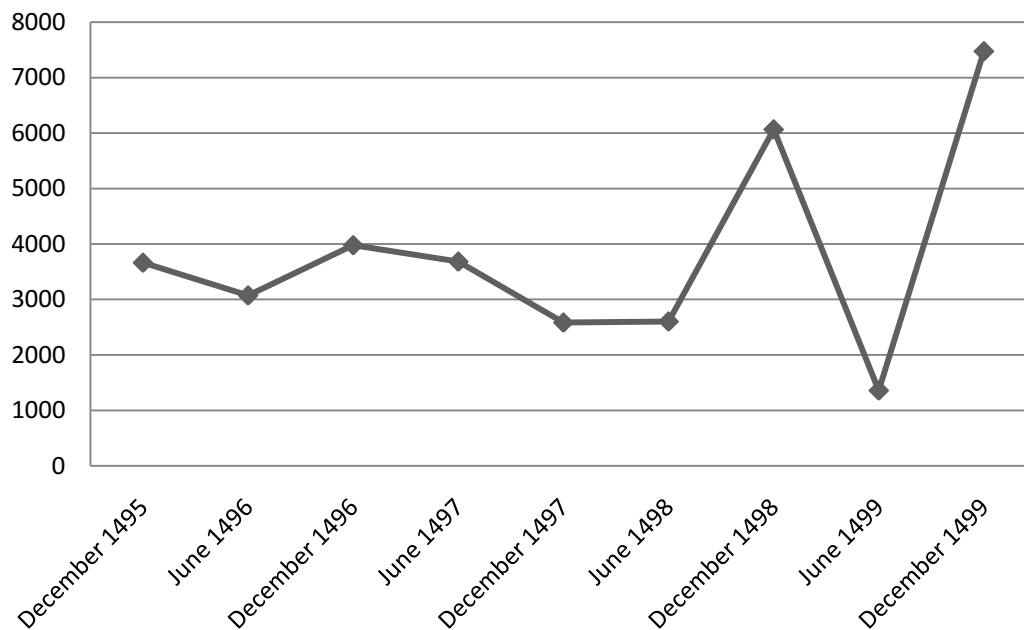
Florentine people found the consequent raises in taxation highly irritating. The accusations against the rival factions, the “evil” aristocracy, the “corrupt” government, and the “incapable” Dieci multiplied. Rulers and soldiers seemed to prolong the agony of an endless war.¹⁶¹ Another political crisis was imminent.¹⁶² Citizens would not have justify delays, in 1499.

¹⁶⁰ ASF, Dieci di balia, Debitori e creditori, 30, f. 293v; ASF, Dieci di balia, Debitori e creditori, 34, f. 238v; ASF, Dieci di balia, Debitori e creditori, 39, f. 292v; ASF, Dieci di balia, Debitori e creditori, 40, f. 202v.

¹⁶¹ Parenti, *Storia fiorentina*, II., pp. 207-10; Vaglianti, *Storia dei suoi tempi*, pp. 61-62.

¹⁶² Cadoni, *Lotte politiche e riforme istituzionali a Firenze tra il 1494 e il 1502*, pp. 101-75.

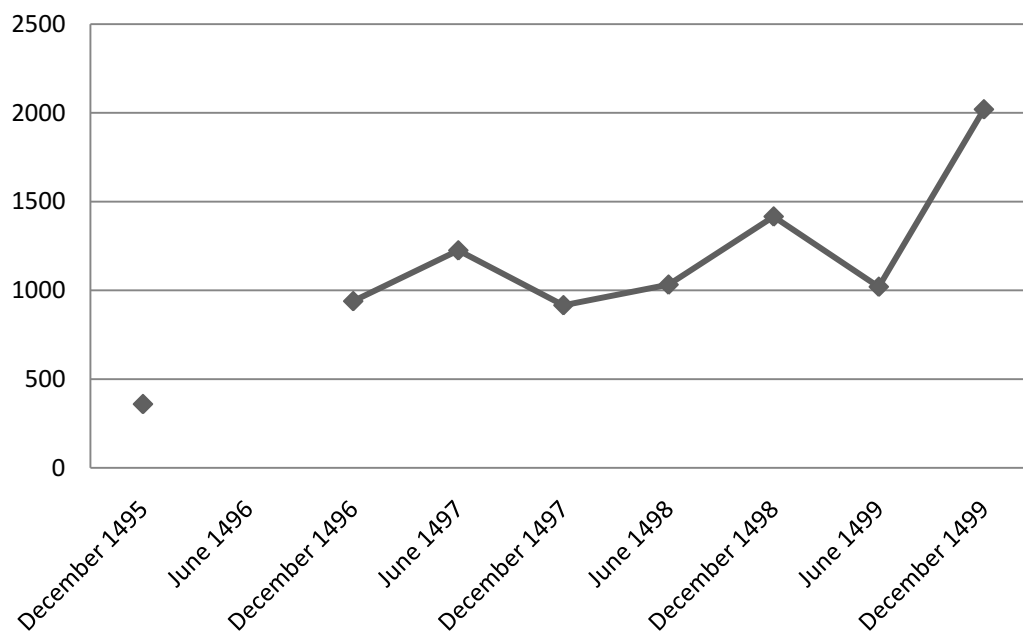
*Appendix 1. Expenditures on ammunitions of the Florentine Republic
December 1495 – December 1499*



Sources: ASF, Dieci di balia, Debitori e creditori, 25, f. 186r; ASF, Dieci di balia, Debitori e creditori, 29, f. 251r; ASF, Dieci di balia, Debitori e creditori, 30, f. 264r; ASF, Dieci di balia, Debitori e creditori, 34, f. 156r; ASF, Dieci di balia, Debitori e creditori, 39, f. 292v; ASF, Dieci di balia, Debitori e creditori, 40, f. 193r; ASF, Dieci di balia, Debitori e creditori, 43, f. 272v; ASF, Dieci di balia, Debitori e creditori, 45, f. 329v; ASF, Dieci di balia, Entrata e uscita, 15, ff. 238r, 255r, 277v, and 304v.

Notes: all costs are expressed in *fiorini d'oro in oro*.

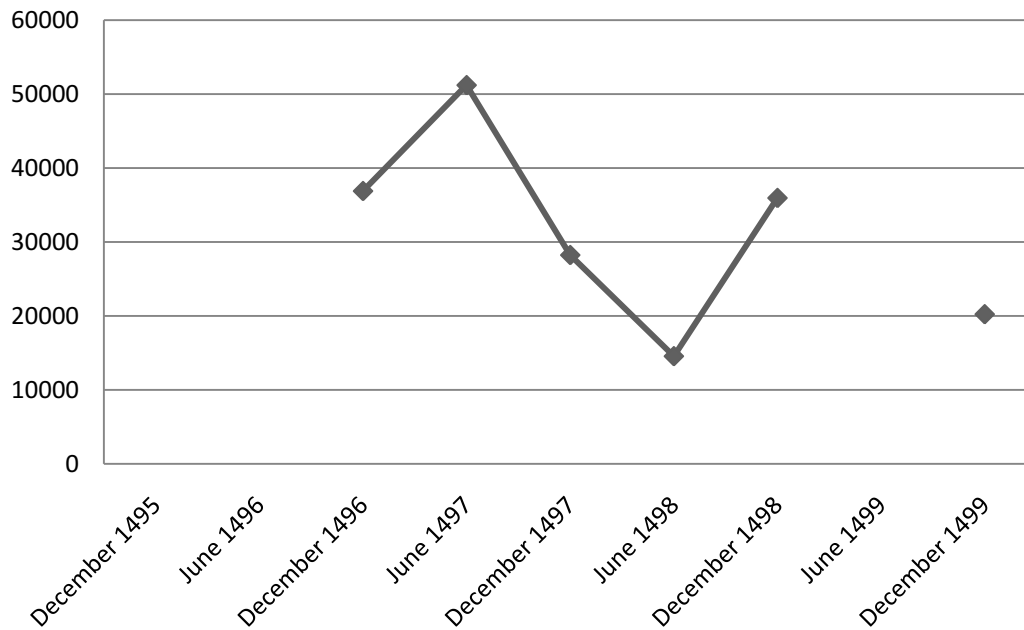
Appendix 2. Expenditures on gunners of the Florentine Republic
December 1495 – December 1499



Sources: ASF, Dieci di balia, Debitori e creditori, 25, f. 47r; ASF, Dieci di balia, Debitori e creditori, 29, f. 248r; ASF, Dieci di balia, Debitori e creditori, 30, f. 283r; ASF, Dieci di balia, Debitori e creditori, 34, f. 224r; ASF, Dieci di balia, Debitori e creditori, 39, f. 292v; ASF, Dieci di balia, Debitori e creditori, 40, f. 56r; ASF, Dieci di balia, Debitori e creditori, 43, f. 272v; ASF, Dieci di balia, Debitori e creditori, 45, f. 329v.

Notes: all costs are expressed in *fiorini d'oro in oro*.

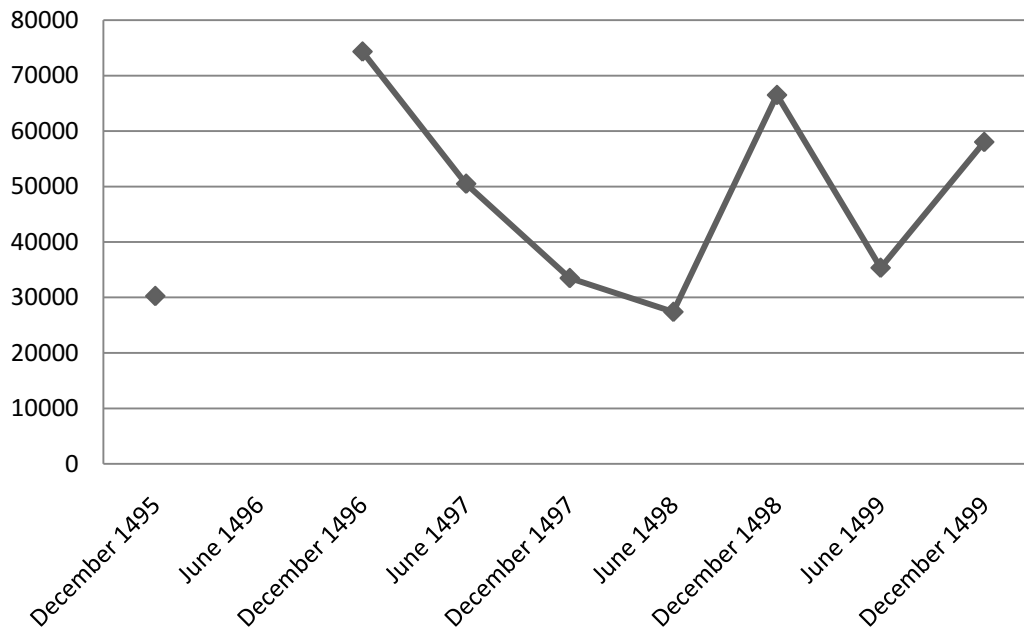
Appendix 3. Expenditures on heavy and light cavalry of the Florentine Republic
December 1495 – December 1499



Sources: ASF, Dieci di balia, Debitori e creditori, 29, ff. 247r and 254r; ASF, Dieci di balia, Debitori e creditori, 30, f. 247r; ASF, Dieci di balia, Debitori e creditori, 34, ff. 129r and 227r; ASF, Dieci di balia, Debitori e creditori, 39, ff. 292v; ASF, Dieci di balia, Debitori e creditori, 40, ff. 182r and 199r; ASF, Dieci di balia, Debitori e creditori, 43, f. 272v; ASF, Dieci di balia, Debitori e creditori, 45, f. 329v.

Notes: all costs are expressed in *fiorini d'oro in oro*.

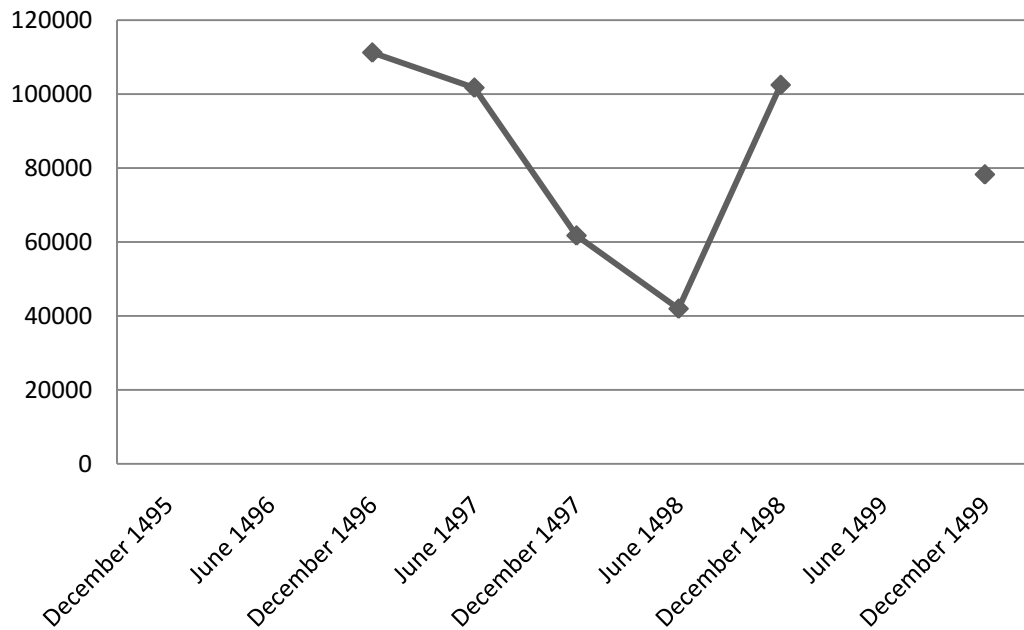
Appendix 4. Expenditures on infantry of the Florentine Republic
December 1495 – December 1499



Sources: ASF, Dieci di balia, Debitori e creditori, 25, f. 173r; ASF, Dieci di balia, Debitori e creditori, 29, f. 252r; ASF, Dieci di balia, Debitori e creditori, 30, f. 289r; ASF, Dieci di balia, Debitori e creditori, 34, f. 235r; ASF, Dieci di balia, Debitori e creditori, 39, ff. 292v; ASF, Dieci di balia, Debitori e creditori, 40, f. 200r; ASF, Dieci di balia, Debitori e creditori, 43, f. 272v; ASF, Dieci di balia, Debitori e creditori, 45, f. 329v.

Notes: all costs are expressed in *fiorini d'oro in oro*.

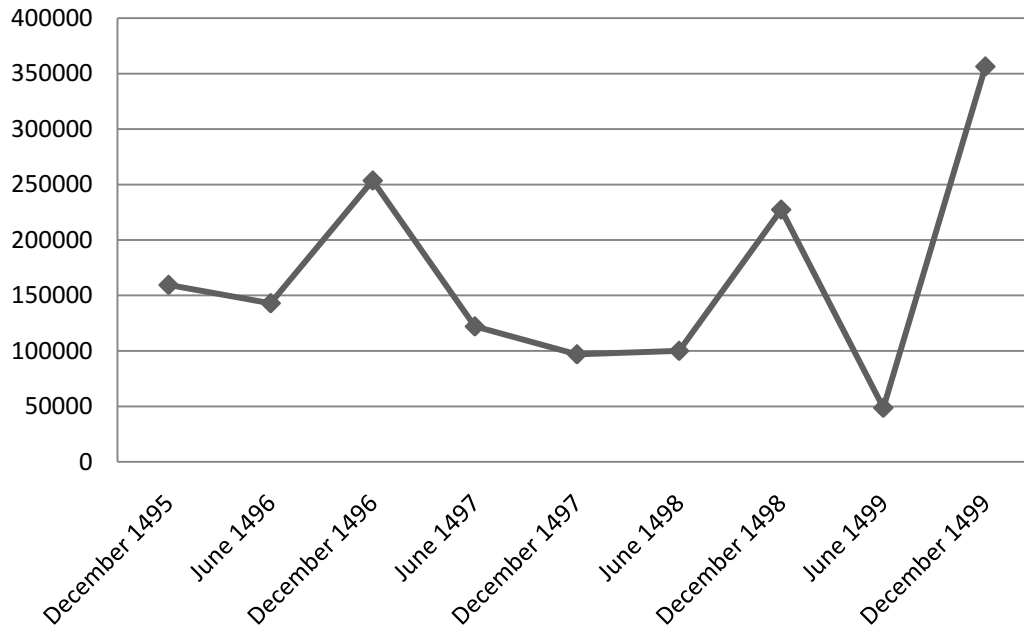
Appendix 5. Overall expenditures on army of the Florentine Republic
December 1495 – December 1499



Sources: ASF, Dieci di balia, Debitori e creditori, 29, ff. 247r, 252r, and 254r; ASF, Dieci di balia, Debitori e creditori, 30, ff. 247r and 289r; ASF, Dieci di balia, Debitori e creditori, 34, ff. 129r, 227r, and 235r; ASF, Dieci di balia, Debitori e creditori, 39, ff. 292v; ASF, Dieci di balia, Debitori e creditori, 40, f. 200r; ASF, Dieci di balia, Debitori e creditori, 45, f. 329v.

Notes: all costs are expressed in *fiorini d'oro in oro*.

Appendix 6. Overall military expenditures of the Florentine Republic
December 1495 – December 1499



Sources: ASF, Dieci di balia, Debitori e creditori, 29, f. 255v; ASF, Dieci di balia, Debitori e creditori, 30, f. 293v; ASF, Dieci di balia, Debitori e creditori, 34, f. 238v; ASF, Dieci di balia, Debitori e creditori, 39, f. 292v; ASF, Dieci di balia, Debitori e creditori, 40, f. 202v; ASF, Dieci di balia, Debitori e creditori, 43, f. 272v; ASF, Dieci di balia, Debitori e creditori, 45, f. 329v; ASF, Dieci di balia, Entrata e uscita, 15, ff. 178v and 315r.

Notes: all costs are expressed in *fiorini d'oro in oro*.

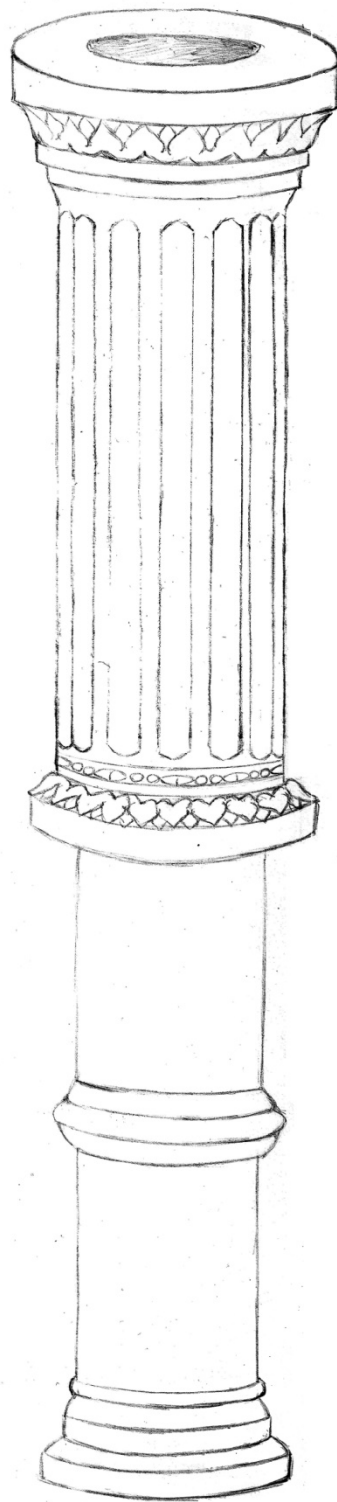


Figure 7. An ideal bombard, depicted by Matteo de' Pasti in 1470s
Oxford, Bodleian Library, Douce 289
Drawing by Angela Marino

ARTICLE VIII
SUPPLYING THE ARMY. 1499.
THE SIEGE OF PISA

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The Venetian invasion of the mountain region of Casentino, in September 1498, had undoubtedly diverted Florentine attention from the reconquest of Pisa.¹ The menace of a heavy defeat, as well as the threat of a Medicean restoration, represented a serious problem for the troubled Republic, now compelled to fight on two fronts, “with a daily expenditure of one thousand and fifty hundred florins.”² Only after five months of stalemate, encouraged by Ludovico Sforza, the opponents entered into negotiations.³ They were both wearied by “the draining of wells full of ducats” and “the bargaining, the extortion” of their mercenaries.⁴

In the first days of April 1499, however, the two peace agreements proposed by the duke of Ferrara dissatisfied each one of the three contenders. Pisans protested firmly against the loss of their “freedom,” complaining about the numerous, important concessions to Florentines, such as the cession of public incomes, the assignment of city fortresses, and the appointment of foreign criminal judges. To this unconditional submission, they preferred to abandon the town, or to die bravely, defending the walls against their “bloodthirsty” enemy.⁵ Venetian senators, instead, accused Ercole d’Este of treason, blaming him for dooming their

¹ Biagio Buonaccorsi, *Diario* (Florence, 1568), pp. 16-19.

² Piero Parenti, *Storia fiorentina*, II., ed. Andrea Matucci (Florence, 2005), pp. 217.

³ Domenico Malipiero, “Annali veneti,” *Archivio Storico Italiano* 7, no. 1 (1843), p. 530; Buonaccorsi, *Diario*, p. 17; Luca Landucci, *Diario fiorentino*, ed. Iodoco del Badia (Florence, 1969), pp. 192-193; Giovanni Cambi, “Istorie,” in *Delizie degli eruditi toscani*, XXI., ed. Ildefonso di San Luigi (Florence, 1785), p. 137; Francesco Guicciardini, *Storia fiorentina*, eds. Piero and Luigi Guicciardini (Florence, 1859), pp. 194-195.

⁴ ASF, Consulte e pratiche, 64, ff. 184r-185v; Piero Vaglianti, *Storia dei suoi tempi*, eds. Giuliana Berti, Michele Luzzati, and Ezio Tongiorgi (Pisa, 1982), p. 70; Parenti, *Storia fiorentina*, II., p. 252. For the economic situation in the lagoon, see: Malipiero, “Annali veneti,” pp. 527-528 and 535; Girolamo Priuli, “Diari,” I., ed. Arturo Segre, in *Rerum Italicarum Scriptores*, XXIV., 3., ed. Giosuè Carducci and Vittorio Fiorini (Città di Castello, 1912), pp. 103, 109, 113 and 117.

⁵ ASPI, Comune di Pisa, Divisione C, 25, f. 199rv.

allies to “slavery,” and charging him of nullifying years of fights, efforts, and expenses.⁶ Last but not least, Florentines found the pacts “insulting and disgraceful,” since they would have taken control over their rebels “in the name only.”⁷

At least, the infamous accords stipulated also the cessation of hostilities between the three states, from April 25th onwards. The troops of the Most Serene Republic, in particular, would have had to leave Tuscany, abandoning both the valley of Casentino and the countryside of Pisa. From this point of view, the resistance of the “fifth power of Italy” against the most dominant army of the Peninsula was a remarkable achievement. Although, this accomplishment was certainly not that military success that it could have been.

During the winter war, the Florentine companies had had several chances to trounce the foreign invaders. An easy, decisive attack on the enemies, barricaded and isolated in the town of Bibbiena, was yet avoided by the general captain, Paolo Vitelli.⁸ Thanks to his unprecedented hesitation, the commander was supposed to be either inadequate as a leader or greedy for more money.⁹ Someone reported that he was manipulated into loafing by a group of “evil citizens.”¹⁰ In any case, his stalling tactics resulted only in a partial disruption to enemy supplies, and in a “gentle,” futile offensive.¹¹

The people of the capital could not stand this disheartening idleness. According to common belief, the entire campaign had been only “a continual succession of frauds” committed by soldiers.¹² Four thousand infantrymen and three thousand knights had given the impression of “not caring at all about our success,” while the most significant assaults were carried by peasants and lumberjacks, led by the belligerent abbot of the monastery of Camaldoli, Basilio Nardi.¹³ Other political scandals were created by the “presumptuous” and

⁶ Malipiero, “Annali veneti,” pp. 537-538; Priuli, “Diari,” I., p. 116; Marino Sanudo, *Diari*, II., ed. Guglielmo Berchet (Venice, 1879), pp. 589-590.

⁷ Guicciardini, *Storia fiorentina*, pp. 200-201; Parenti, *Storia fiorentina*, II., pp. 252-254.

⁸ ASF, Dieci di balia, Entrata e uscita, 30, ff. 69r, 70v, 72r, 73r, 75r, 81r, 82v and 90r.

⁹ Parenti, *Storia fiorentina*, II., pp. 209, 219, and 241.

¹⁰ Cambi, “Istorie,” pp. 137 and 139; Guicciardini, *Storia fiorentina*, pp. 191-192; Cerretani, *Storia fiorentina*, ed. Giuliana Berti (Florence, 1994), p. 259; Vaglianti, *Storia dei suoi tempi*, p. 62.

¹¹ Cerretani, *Storia fiorentina*, p. 259; Nardi, *Istorie della città di Firenze*, p. 186; Bartolomeo Masi, *Ricordanze*, ed. Giuseppe Corazzini (Florence, 1906), pp. 40-41.

¹² Bartolomeo Cerretani, *Storia fiorentina*, p. 261.

¹³ Jacopo Nardi, *Istorie della città di Firenze*, ed. Lelio Arbib (Florence, 1842), p. 187; Parenti, *Storia fiorentina*, II., p. 227; Guicciardini, *Storia fiorentina*, p. 191; Vaglianti, *Storia dei suoi tempi*, p. 66.

“imprudent” general commissioners, through the reckless concessions of safe conduct to public enemies, such as Piero de’ Medici and Guidubaldo from Montefeltro.¹⁴

These blunders and these delays were mostly due, however, to the extreme fragmentation of the Florentine society. The peril of an irremediable defeat had not faded the deep divisions between *frateschi* and *arrabbiati*, common people and oligarchic aristocrats.¹⁵ The conflict, on the contrary, was perceived as an opportunity for annihilating the opposition, for subjugating the people, or for overthrowing the institutions. Not to mention the machinations of Medicean conspirators, the “slowness” of war was attributed to the contrast between the Milanese faction and the party of the French king, a friction embodied even in the military hierarchy.¹⁶ The ongoing rivalry between Paolo Vitelli and Rinuccio from Marciano for the command of the army represented not only a “pernicious disunity” within the encampment, but also the frequent renewal of *condotte* of both the captain and the governor, along with the consequent surge in the number of their men-at-arms, “raised the expenses so much that the city could not bear the whole cost of its troops.”¹⁷

Further problems were caused by different economic factors. The high interest rates on forced loans, for example, made several magnates “exploiters of their community and destroyers of their motherland,” that is, profiteers.¹⁸ Privileged dodgers, moreover, were censured for their friendship with tax collectors.¹⁹ For a few commentators, the individual profit favored even the first ratification of the unfair pact with Venetians.²⁰

¹⁴ Parenti, *Storia fiorentina*, II., pp. 212 and 233; Landucci, *Diario fiorentino*, p. 192; Vaglianti, *Storia dei suoi tempi*, p. 67; Guicciardini, *Storia fiorentina*, p. 192; Nardi, *Istorie della città di Firenze*, p. 187.

¹⁵ Vaglianti, *Storia dei suoi tempi*, p. 66; Parenti, *Storia fiorentina*, II., pp. 210 and 221.

¹⁶ Landucci, *Diario fiorentino*, p. 192; Parenti, *Storia fiorentina*, II., pp. 211 and 219.

¹⁷ Guicciardini, *Storia fiorentina*, pp. 197-199; Parenti, *Storia fiorentina*, II., pp. 209 and 239.

¹⁸ Vaglianti, *Storia dei suoi tempi*, p. 61. For the connection between the growth of public debt and the stabilization of political dependences in Renaissance Florence, see Louis Marks, “The financial oligarchy in Florence under Lorenzo,” in *Italian Renaissance Studies*, ed. Ernest Jacob (New York, 1960), pp. 123-147; Alison Brown, “Public and private interest. Lorenzo, the Monte and the Seventeen Reformers,” in *Lorenzo de’ Medici. Studi*, ed. Gian Carlo Garfagnini (Florence, 1992), pp. 103-138; Anthony Molho, “Debiti pubblici ed interessi privati nella Firenze tardomedievale,” in *La Toscana al tempo di Lorenzo il Magnifico Politica, economia, cultura, arte* (Pisa, 1996), 825-838 and 850-854; Lauro Martines, “Forced loans. Political and social strain in Quattrocento Florence,” *The Journal of Modern History* 60, no. 2 (1988), pp. 300-311.

¹⁹ Parenti, *Storia fiorentina*, II., p. 208.

²⁰ Nardi, *Istorie della città di Firenze*, p. 194.

The Dieci di Balìa, in particular, were publicly criticized for embezzling in the private interest of their relatives and friends.²¹ In the first weeks of the campaign, in fact, the random appointment of too many commissioners had squandered “sixty thousand ducats,” causing a “complete confusion” over the transmission and the application of orders.²² The opposing city camps did not restrict themselves to rebuke these “thefts.” Displaying defamatory writings in the busiest crossroads of the capital, the “sects” incited the citizens to kill political adversaries and to set fire to their houses.²³

The popular faction appropriated this “intense hatred” soon. In May, it staged a protest against the “spendthrift Dieci,” opposing the re-election of the ten officials, thought to be the “major cause of wars and debts.”²⁴ At the same time, the population agitated against the lockout of public positions, planned by the ruling, “malicious” leaders of *frateschi*. Everyone lamented that “nor authority nor wealth are within our reach.”²⁵

Thus, the “resented citizens” mounted a stiff resistance in the general city council, and “decided not to approve further taxations, considering how wickedly money was wasted.” Laws were not promulgated, and magistrates were not voted in.²⁶ Within a month, the persistent obstructionism had major repercussions on Florentine domestic affairs. On May 31st, a new electoral, sweeping reform abolished nominations and introduced draws, broadening access to government posts.²⁷ On June 3rd, above all, the Dieci did not enter the office, leaving the Republic without a proper military ministry.²⁸

Nevertheless, a new offensive against the rebels was close to be launched. On June 7th, the Florentine general commissioner briefed the Anziani of Pisa that the truce had eventually

²¹ Guicciardini, *Storia fiorentina*, p. 202; Cerretani, *Storia fiorentina*, p. 259.

²² Well testified by the sources, these perks amounted to thirty-seven thousand florins. See ASF, Dieci di balìa, Entrata e uscita, 30, ff. 38v-39v.

²³ Parenti, *Storia fiorentina*, II., pp. 212-213.

²⁴ Nardi, *Istorie della città di Firenze*, pp. 188-189; Guicciardini, *Storia fiorentina*, pp. 201-203; Parenti, *Storia fiorentina*, II., p. 258.

²⁵ Nerli, *Commentari*, pp. 134-135; Parenti, *Storia fiorentina*, II., pp. 240 and 243-244.

²⁶ Parenti, *Storia fiorentina*, II., p. 240; Nerli, *Commentari*, p. 135; Vaglianti, *Storia dei suoi tempi*, p. 67.

²⁷ Guicciardini, *Storia fiorentina*, pp. 203-204; Parenti, *Storia fiorentina*, II., pp. 263-264; Nerli, *Commentari*, p. 136.

²⁸ Giorgio Cadoni, *Lotte politiche e riforme istituzionali a Firenze tra il 1494 e il 1502* (Rome, 1999), pp. 113-144; Guidubaldo Guidi, *Lotte, pensiero e istituzioni politiche nella Repubblica Fiorentina dal 1494 al 1512*, II. *Gli istituti sovrani e di governo* (Florence, 1992), pp. 791-792.

expired, and that the peace agreement was definitively invalidated.²⁹ Despite offers and promises, the rebels had persistently refused to obey the conventions between their former protectors and their previous lords.³⁰

They are defenseless, they are alone, and yet they are pertinacious, waiting for external support, and relying upon our weakness and our disagreement [...]. Even though they are despaired, they don't lose heart. Therefore, we couldn't, we shouldn't believe that they will voluntarily fall under our yoke [...]. For these reasons, the force of arms is the sole means for reclaiming Pisa. A military intervention is necessary.

The government consulted repeatedly about the opportunity to attack, assessing the costs of an umpteenth expedition, and arguing that a simple demonstration could have sufficed to get the rebels back to the negotiating table. The citizens agreed on pillaging the Pisan countryside, "for the moment. Next, we will figure out what to do," according to "opportunity and utility."³¹

The same Signoria took on the responsibility for organizing and directing these initial operations. The prior Dieci were invited to cooperate informally with the officers in the planning of the sack. And yet each of the city factions, as usual, "intended to end this long-lasting war for its own benefit."³²

Return to the Pisan countryside

Before leaving, the Dieci di Balìa had to handle the deteriorated relation with their general captain. Paolo Vitelli was in fact insisting on several, "disagreeable" claims in order to lead the new campaign. In the first days of May, the officers had already debated over an higher premium for his service, and a separate contract for his brother Vitellozzo. During the following weeks, the commander requested also the cancellation of a personal debt, which amounted to sixteen thousand golden florins, and an advance of ten thousand ducats. And also his brother Giulio, the bishop of Città di Castello, made the most of these negotiations, demanding several ecclesiastical benefices in the diocese of Anghiari. Republican envoys, at

²⁹ ASPI, Comune di Pisa, Divisione C, 25, f. 238r; ASPI, Comune di Pisa, Divisione C, 31, f. 790r.

³⁰ BNCF, Carte Machiavelli, 1, e. 75, f. 1rv; Vaglianti, *Storia dei suoi tempi*, p. 75; Parenti, *Storia fiorentina*, II., p. 266; Cerretani, *Storia fiorentina*, p. 261.

³¹ ASF, Consulte e pratiche, 65, ff. 17r-18v and 29rv; ASF, Acquisti e doni, 1, e. 3, f. 1r; Nardi, *Istorie della città di Firenze*, p. 196.

³² Guicciardini, *Storia fiorentina*, p. 203; Parenti, *Storia fiorentina*, II., pp. 259 and 266.

last, had to grant the possession of captured artillery, the addition of sixty knights to his *condotta*, and the payment of twelve thousand florins.³³

The sudden elevation of the captain, however, would have really annoyed the governor. The quarrel between the two commanders intensified. Paolo Vitelli expected his subordinate to be under contractual obligations, reaching a settlement over an “unquestioning obedience.” Rinuccio from Marciano showed a total disregard for this “inappropriate” agreement. On the contrary, he denied “to obey to such a soldier,” reserving to take orders only from the state commissioners. He even refused to participate to the expedition, unless the Signori protected the prerogatives of his rank, which included the position of his pavilion, his signature on the joint announcements, and other minor privileges.³⁴

In Florence, “this contention sparked off a major, further dispute between the advocates of both condottieri.” The Signori investigated several possibilities of resolving the controversy, including the transfer of the governor to the valley of Serchio, between Lucca and Pisa. Eventually, the officers appointed an emissary to the count, trying to mediate the differences and to placate the commanders, “because their disunity ruins the city,” and “this competition is reckless.”³⁵ Surprisingly, the pacification was as swift as effective. Bernardo Nasi persuaded Rinuccio from Marciano into joining up with Paolo Vitelli, “without imposing any condition.” Since then, “the two vied only for pleasing each other.”³⁶

Once this problem was solved, other concerns were raised about the preparations for the campaign. According to the condottieri, the success of the plunder depended upon the recruitment of two thousand infantrymen and the employment of a sufficient number of pioneers. These troops would have been useful for repelling any enemy counter-attack, permitting the army to move nimbly all over the Pisan plain.³⁷ In order to finance the expedition, the Signori claimed one hundred thousand florins from the city councils.³⁸

³³ ASF, Consulte e pratiche, 65, ff. 9r-10r and 16r; Nerli, *Commentari*, p. 136; Giuseppe Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” *Bollettino della Regia Deputazione di Storia patria per l’Umbria* 21 (1915), pp. 112-116.

³⁴ ASF, Lettere varie, 6, ff. 139rv and 155r; Parenti, *Storia fiorentina*, II., pp. 266-267; Nerli, *Commentari*, p. 136; Buonaccorsi, *Diario*, p. 23.

³⁵ ASF, Acquisti e doni, 1, e. 3, ff. 1r-2v; ASF, Signori, Missive seconda cancelleria, 21, f. 10rv; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 125-126.

³⁶ ASF, Signori, Missive seconda cancelleria, 21, ff. 14r, 15v, and 17r; ASF, Lettere varie, 6, f. 139rv.

³⁷ ASF, Signori, Missive seconda cancelleria, 21, f. 7rv; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 114 and 127-128.

³⁸ ASF, Signori, Missive seconda cancelleria, 21, f. 10v; Vaglianti, *Storia dei suoi tempi*, p. 75.

On June 10th, the captain arrived in Pontedera. Three days later, the governor followed on. Their companies encamped in the village of Fornacette, nearby the enemy stronghold of Cascina.³⁹ Several small bands of soldiers started immediately to cut grain and to burn barns, “until our enemies cannot avail of a single ear.”⁴⁰ Despite the absence of pioneers and infantrymen, the mercenaries devastated the country “as far as the gates of Pisa.” On June 16th, the army occupied the village of Settimo and the abbey of San Savino, barring the road to Cascina.⁴¹

The “obstinacy” of their adversaries had in fact convinced the Signori to escalate the war. On June 14th, the officers decided to deliver on the siege of this town, “which we have recently promised to our people for raising funds for this campaign.”⁴² The captain agreed with this decision, underlining the ease of a conquest as well as the opportunity to gain control of the entire Pisan countryside. Once again, he demanded a large number of reinforcements and a consistent supply of munitions, that is, guns, powder, and shot. Above all, he complained to rulers about “begging for money,” because “we endure more to be paid, than to defeat our foes.”⁴³

Within June 17th, seven falcons, one culverin, three cannons and two bombards were shipped to the encampment through the fluvial port of Signa. More than three hundred barrels of powder were also consigned to the gunners, along with five hundred iron and four hundred lead projectiles. The Signori guaranteed that “ammunition will not lack.”⁴⁴ In the meanwhile, they provided also thousands of florins for six hundred heavy knights, seven hundred light horsemen, three thousand conscript and professional infantrymen, and two thousand pioneers.⁴⁵

³⁹ Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 123 and 127.

⁴⁰ ASF, Signori, Missive seconda cancelleria, 21, ff. 15r and 20r; ASF, Lettere varie, 6, f. 139v; ASPI, Comune di Pisa, Divisione C, 25, ff. 249r and 250r; Buonaccorsi, *Diario*, p. 23; Landucci, *Diario fiorentino*, p. 196; Parenti, *Storia fiorentina*, II., p. 268; Giovanni Portoveneri, “Memoriale,” *Archivio Storico Italiano* 6, no. 2 (1845), p. 340.

⁴¹ ASF, Signori, Missive seconda cancelleria, 21, f. 20r; Parenti, *Storia fiorentina*, II., p. 268; Portoveneri, “Memoriale,” p. 340; Ser Perizolo, “Ricordi,” *Archivio Storico Italiano* 6, no. 2 (1845), p. 394.

⁴² BNCF, Carte Machiavelli, 1, e. 71, ff. 1r-2v; Parenti, *Storia fiorentina*, II., pp. 268 and 270.

⁴³ ASF, Signori, Missive seconda cancelleria, 21, ff. 14v and 18r; ASF, Lettere varie, 6, ff. 141v and 147r; Parenti, *Storia fiorentina*, II., p. 268; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 133.

⁴⁴ ASF, Signori, Missive seconda cancelleria, 21, f. 20v; Landucci, *Diario fiorentino*, p. 197; Vaglianti, *Storia dei suoi tempi*, p. 75.

⁴⁵ Vaglianti, *Storia dei suoi tempi*, p. 75; Parenti, *Storia fiorentina*, II., p. 268.

The opposing forces amounted, instead, to sixty dismounted crossbowmen, two hundred and forty infantrymen, and seven hundred townspeople. Nevertheless, several soldiers were deserting, “tempted by the enemy pay, by the enemy booty.”⁴⁶ The Pisan commissioner carped at the Anziani about the lack of reinforcements, “men, men, men, good men, brave men.” However, the defenders were scared away by the “widespread rumor” of the enemy “French customs,” that is, an immediate bombardment and a merciless assault, those tactics followed victoriously by Paolo Vitelli during the preceding conquest of Buti, Vico, and Librafratta.⁴⁷

These predictions would have been confirmed soon. On June 21th, the Florentine army reached Cascina. The commissioners offered easy terms of surrender, but the rebels did not hoist any white flag, attempting instead a surprise sortie.⁴⁸ Therefore, the captain positioned quickly the first batteries, in order to shield pioneers during the construction of shelters and the excavation of trenches. In the following day, the cannons were disposed too, while the absence of carpenters delayed the placement of heavy bombards.⁴⁹

Nonetheless, the heavy rain and the enemy counter-fire hampered the offensive. Only on June 25th, in the early morning, “more than twenty-five heavy guns” opened fire on the town, knocking down about thirty meters of ramparts.⁵⁰ After “twenty-six hours” of uninterrupted shelling, the garrison capitulated.⁵¹ On June 26th, the Signori could finally rejoice at this “sudden” victory, “and all of our subjects are astonished and impressed.” The conquest of Pisa “is reckoned to be easier by now.”⁵²

Numerous prisoners were took to the prisons of Florence, including the commissioners and the castellan of the rebels.⁵³ Only their leader, Rinieri della Sassetta, remained in the encampment, guarded by the men-at-arms of both captain and governor. Unexpectedly, this

⁴⁶ ASPI, Comune di Pisa, Divisione C, 25, ff. 248v, 250r, and 251rv.

⁴⁷ ASPI, Comune di Pisa, Divisione C, 32, f. 12r. See also *Supplying the army. 1498*.

⁴⁸ Nardi, *Istorie della città di Firenze*, p. 196; Vaglianti, *Storia dei suoi tempi*, p. 75; Parenti, *Storia fiorentina*, II., p. 270.

⁴⁹ ASF, Signori, Missive seconda cancelleria, 21, ff. 26v-27r; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 134-135 and 137.

⁵⁰ ASF, Lettere varie, 9, f. 3r; ASPI, Comune di Pisa, Divisione C, 25, ff. 254v and 255r.

⁵¹ Bonaccorsi, *Diario*, p. 23; Parenti, *Storia fiorentina*, II., p. 270; Cerretani, *Storia fiorentina*, p. 261; Vaglianti, *Storia dei suoi tempi*, p. 75; Nardi, *Istorie della città di Firenze*, p. 196; Guicciardini, *Storia fiorentina*, p. 204; Filippo, Alamanno, and Neri Rinuccini, *Ricordi storici*, ed. Giuseppe Aiazzi (Florence, 1840), p. 162; Portoveneri, “Memoriale,” p. 340.

⁵² ASF, Signori, Missive seconda cancelleria, 21, f. 31r.

⁵³ Vaglianti, *Storia dei suoi tempi*, p. 75; Landucci, *Diario fiorentino*, p. 197; Parenti, *Storia fiorentina*, II., p. 270; Portoveneri, “Memoriale,” p. 340.

“public enemy, traitor to the Republic,” managed to get away, “frightened of a capital sentence or a life imprisonment,” that is, “inappropriate punishment for a soldier.”⁵⁴ The people protested at this “further deceit,” but the government could only lie about it, “declaring that Rinieri had been intentionally released, in order that he could favor our operations.”⁵⁵ In any case, for this escape, the captain was widely blamed, once again.⁵⁶

Summer workers

By the end of June, the Signori recommended the commissioners to take full advantage of the temporary disbandment of the enemies, a perfect opportunity for occupying the surroundings of their city.⁵⁷ Without hindrance, the soldiers encamped nearby Riglione, halfway between Cascina and Pisa. The observation tower of Foce, not far away from the mouth of the Arno, was captured shortly afterwards. Almost encircled, the Pisans abandoned their only remaining post in the countryside, burning the fortified terreplein of Stagno to the ground.⁵⁸

In the meantime, following the advice of his astrologer, the captain fixed the date for the eventual siege of Pisa on the first days of August.⁵⁹ So, “for favoring the help of the stars,” the preparations commenced immediately. In the beginnings of July, the officers questioned the commander on the requirements for the enterprise, “from the most insignificant to the most important one.”⁶⁰ The Signori were particularly dubious about the “ordinary and extraordinary” expenditures, considering that the Republic had exhausted its purse, and that the people had been “squeezed dry.” Forty thousand florins of ready cash were spontaneously furnished by a group of magnates, even if the government refused to pay any interest on their loan.⁶¹ Besides, a “large quantity of capitals” was the sole means for winning.⁶²

⁵⁴ ASPI, Comune di Pisa, Divisione C, 25, f. 256v.

⁵⁵ Parenti, *Storia fiorentina*, II., pp. 270-271; Vaglianti, *Storia dei suoi tempi*, p. 76.

⁵⁶ Guicciardini, *Storia fiorentina*, pp. 204-205; Cerretani, *Storia fiorentina*, p. 261; Buonaccorsi, *Diario*, pp. 23-24.

⁵⁷ ASF, Signori, Missive seconda cancelleria, 21, f. 31rv.

⁵⁸ ASF, Signori, Missive seconda cancelleria, 21, ff. 34r and 37r; ASPI, Comune di Pisa, Divisione C, 25, ff. 258v-259r; Cerretani, *Storia fiorentina*, p. 261; Buonaccorsi, *Diario*, p. 24; Vaglianti, *Storia dei suoi tempi*, p. 76; Portoveneri, “Memoriale,” p. 341.

⁵⁹ Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 143-144.

⁶⁰ ASF, Signori, Missive seconda cancelleria, 21, f. 35v.

⁶¹ ASF, Signori, Missive seconda cancelleria, 21, ff. 33v, 36v, and 38r; ASF, Consulte e pratiche, 65, ff. 58r-68r; Parenti, *Storia fiorentina*, II., p. 275.

⁶² ASF, Signori, Missive seconda cancelleria, 21, f. 38v.

Having raised money, the Signori had to satisfy several other requests made by their “rude and greedy” general captain once too often. His salary, for example, had to be paid in golden currency. The company of his brother Vitellozzo had to be increased with twenty-five men-at-arms. His friends had to be hired and pleased. His debts had to be paid off.⁶³ Despite the “unfairness” of these claims and the disappointment of the citizens, “everything was granted.”⁶⁴

As usual, the condottiero “required also large procurement of weapons and a large recruitment of soldiers, in order to be at an advantage over the enemy, at the cost of unbearable disbursements.”⁶⁵ Munitions, men, and funds had to be provided within July 28th, otherwise “we won’t advance for any reason.”⁶⁶ The state envoys repeatedly consulted him about the numbers of combatants and supplies.⁶⁷ He demanded at least eight thousand infantrymen and one thousand pioneers.⁶⁸ Above all, he assessed the quantity of gunpowder at fifty tons, more or less.⁶⁹

In Florence, the production of the propellant was still entrusted to Piero di Zanobi and Jacopo di Corso. A new contract with the Dieci di Balìa was signed in February, for a monthly commission for four and a half tons of material. The monthly salary was fixed to six golden florins for the two masters, and two for their three assistants. The officers would have conceded, moreover, all the public facilities to the artisans.⁷⁰ During the summer, the Signori reached similar agreements with their habitual private suppliers. The apothecaries Giovanni Barducci and Giovanni Formiconi would have received a payment of forty-five florins for every three hundred and thirty kilograms of material.⁷¹

⁶³ ASF, Signori e collegi, Condotte e stanziamenti, 17, ff. 86v-87r; ASF, Consulte e pratiche, 65, ff. 41r-46v and 67r-69r; ASF, Lettere varie, 6, f. 181rv.

⁶⁴ Parenti, *Storia fiorentina*, II., p. 276.

⁶⁵ Guicciardini, *Storia fiorentina*, p. 211.

⁶⁶ ASF, Signori, Missive seconda cancelleria, ff. 46v-47r; ASF, Lettere varie, 6, f. 177r.

⁶⁷ ASF, Signori, Missive seconda cancelleria, 21, ff. 34v-35r.

⁶⁸ ASF, Signori, Missive seconda cancelleria, 21, ff. 41r, 42r, 45r, 46v, and 47v; ASF, *Miscellanea repubblicana*, 5, e. 166, f. 1r; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 144-145.

⁶⁹ ASF, *Miscellanea repubblicana*, 5, e. 166, f. 1r.

⁷⁰ ASF, Dieci di balìa, *Deliberazioni, condotte e stanziamenti*, 46, ff. 12r and 52v.

⁷¹ ASF, Dieci di balìa, *Entrata e uscita*, 30, ff. 151v-152r.

The problem with the procurement of the primary raw material, however, was not solved. One year later, the shortage of saltpeter occurred again.⁷² The contemporaneous preparations for war in Venice and in Milan made the nitrate scarcer than usual, on the Italian market. Only a few foreign dealers could offer their goods to the Signoria, and even Florentine merchants, as Filippo del Vigna and Piero Berti, could dispatch only a modest quantity of the compound.⁷³

The officers, hence, had to track saltpeter down elsewhere. A first request was sent to the government of Lucca, on July 12th. The Signori sought about ten tons of nitrate, relying on the “common desire of peace and quiet.” The Anziani declined the proposal, affirming that they could not remove anything from the public arsenals without the consent of the city council, and recognizing “how dangerous is, in the present times, to face a shortage of saltpeter.”⁷⁴ A local dealer, however, decided against the state interest. Benedetto Buonvisi, in fact, sold five tons of material to a Florentine agent, earning six hundred and eighty golden florins.⁷⁵

On July 26th, another letter was sent to Gian Luigi Fieschi, one of the principal politicians of Genoa. The Signori explained that, “considering the stubbornness of our rebels, and pondering the possibility of a lengthy siege, we might have necessity of a great deal of gunpowder.”⁷⁶ A Florentine engineer, Filippo di Giovanni, reached the Ligurian port for soliciting the negotiations. At long last, another private seller, David Lomellino, shipped four tons of the product to Livorno, getting six hundred golden florins.⁷⁷

The Florentine emissary in Romagna, Niccolò Machiavelli, found out that the six tons of powder kept in the warehouses of Castrocaro “exploded two years ago, ruining the whole castle.”⁷⁸ The envoy demanded also four tons of propellant from Caterina Sforza, “offering to borrow or to buy them.” The lady of Forlì “replied that she has been lacking powder,” but she tendered to halve a load of saltpeter recently stored in the docks of Pesaro. The owner,

⁷² See *Supplying the army. 1498*.

⁷³ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 74r; ASF, Dieci di balia, Entrata e uscita, 30, ff. 141r; 163v, and 179r.

⁷⁴ ASF, Signori, Missive prima cancelleria, 51, f. 134rv; ASLU, Anziani al tempo della libert , 537, ff. 203r and 204v.

⁷⁵ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 31r; ASF, Dieci di balia, Entrata e uscita, 30, f. 154r; ASF, Signori, Missive seconda cancelleria, 21, f. 35r; ASLU, Colloqui, 3, f. 557.

⁷⁶ ASF, Signori, Missive prima cancelleria, 51, ff. 135v-136r.

⁷⁷ ASF, Signori e collegi, Condotte e stanziamenti, 17, ff. 45v and 74v; ASF, Dieci di balia, Entrata e uscita, 30, f. 188r; ASF, Signori, Missive seconda cancelleria, 21, f. 64r.

⁷⁸ ASF, Signori, Responsive, 12, f. 135r.

Leonardo Strozzi, contracted the whole quantity of the commodity, that is, six tons, priced seven hundred and fifty golden florins.⁷⁹

The Signori tried also to acquire one ton of the mineral from the Balìa of Siena, yet obtaining only three hundred kilograms.⁸⁰ The marquis of Massa, Alberico Malaspina, was instead deaf to the Florentine request.⁸¹ Enduring several refusals, and in spite of a general reluctance, the officers managed to collect about fifteen tons of saltpeter between the last weeks of June and the first days of August, all handed to their artisans. Giovanni Formiconi manufactured two tons of propellant. An elderly Stagio Barducci could only craft one hundred kilograms.⁸² Despite the absence of his partner, transferred to Livorno, Piero di Zanobi extracted twenty-one tons of powder alone, working all night long, and even during festivities.⁸³ The master accomplished so much in so little time, and the output was undoubtedly high, compared to the preceding years.⁸⁴ Nevertheless, it failed to meet the expectations of the general captain.⁸⁵

For this reason, the Signori had to “empty out all of our fortresses, which are the core of our dominion.”⁸⁶ The castellans of Arezzo, Borgo San Sepolcro, Volterra, and Castrocaro were ordered to deliver the most of the gunpowder at their disposal. A similar instruction was given to officers of smaller towns, such as Poppi, Dovadola, and San Gimignano. The explosive was also searched through the Valdarno. Even Vico Pisano, Cascina, Monte Carlo, and other posts nearby the enemy were completely cleared of it.⁸⁷ One after another, more than six tons of propellant were gradually brought in the encampment from the whole Florentine territory.⁸⁸

⁷⁹ ASF, Dieci di balìa, Entrata e uscita, 30, f. 180v; ASF, Signori, Responsive, 12, ff. 120r and 141r; BNCF, Carte Machiavelli, 2, e. 87, f. 1r; BNCF, Carte Machiavelli, 2, e. 88, f. 1rv.

⁸⁰ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 35r and 38r; ASF, Dieci di balìa, Entrata e uscita, 30, f. 193v; ASF, Signori, Missive prima cancelleria, 51, f. 142rv.

⁸¹ ASF, Signori, Missive seconda cancelleria, 21, f. 51r.

⁸² ASF, Dieci di balìa, Entrata e uscita, 30, ff. 192v and 194r.

⁸³ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 27v; ASF, Dieci di balìa, Entrata e uscita, 30, ff. 194v and 226r; ASF, Signori, Missive seconda cancelleria, 21, f. 50v.

⁸⁴ In 1495, for example, four masters had produced a similar quantity of explosive over a period of six months. See Fabrizio Ansani, “Craftsmen, artillery, and war production in Renaissance Florence,” *Vulcan 4* (2016), p. 6.

⁸⁵ ASF, Dieci di balìa, Entrata e uscita, 30, f. 226r.

⁸⁶ ASF, Signori, Missive seconda cancelleria, 21, f. 70v.

⁸⁷ ASF, Dieci di balìa, Entrata e uscita, 30, ff. 166v, 176v, 177v, 186r, 187r, and 217v; ASF, Signori, Missive seconda cancelleria, 21, ff. 50v-51r, 61v-62r, and 67r.

⁸⁸ ASF, Dieci di balìa, Entrata e uscita, 30, ff. 215v-216v.

In the first week of August, the Signori estimated the amount of the already dispatched powder at thirty tons. By the end of the month, they would have conceded that “all of our reserves are depleted.”⁸⁹

Nearly eight hundred barrels of powder were loaded onto barges, and transported by the Arno, along with hundreds of spears and thousands of arrows, lots of firearms and plenty of shots. Other tools, such as ropes and nails, shovels and hoes, were occasionally moved by land, often going through the river port of Signa.⁹⁰ This continuous movement of weapons between the city and the camp caused a certain “confusion” about their management. In order to avoid this disorder, the Signori appointed a particular commissioner “to receive materiel, to count up how many munitions come in, and to inform us about the needs of the encampment,” day by day.⁹¹ On July 13th, Domenico Federighi took charge of the magazines of Pontedera, organizing the distribution and the allotment of the equipment.⁹² The general commissioner were frequently invited to contact him for obtaining “timely and sufficient supplies.”⁹³

Moreover, the direction of the warehouse of Cascina was assigned to Michele Compagni, one of the two watchmen of the arsenals of the capital. His colleague, Gaspare Pasquini, remained in Florence, instead, helping the officers in bargaining with craftsmen, in buying goods, and in consigning armaments. Antonio from Verrazzano, a former “suboverseer” of the Dieci di Balìa, was entrusted with the accountancy of the whole procurement.⁹⁴ Tasked with the conveyance of the ordnance was Antonio from Certaldo.⁹⁵ Surprisingly, the inventiveness of this carter would have been fundamental to solve the issue of the lacking cannonballs.

⁸⁹ ASF, Signori, Missive seconda cancelleria, 21, ff. 68v and 88r.

⁹⁰ ASF, Dieci di balìa, Entrata e uscita, 30, ff. 135r, 146v, 147r, and 198v.

⁹¹ ASF, Signori, Missive seconda cancelleria, 21, f. 41v.

⁹² ASF, Signori e collegi, Condotte e stanziamenti, 17, ff. 20r, 28rv, and 82rv.

⁹³ ASF, Signori, Missive seconda cancelleria, 21, f. 47r.

⁹⁴ ASF, Signori e collegi, Condotte e stanziamenti, 17, ff. 26r, 27r, and 42v; ASF, Dieci di balìa, Entrata e uscita, 30, f. 129r.

⁹⁵ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 55v; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 46, f. 21v.

On July 23rd, the general captain and the general governor wrote a heartfelt letter to their secretaries, expressing their “unwillingness” and their “dissatisfaction.” For stressing the importance of the complaints, the two condottieri signed the missive “with our own hands.”⁹⁶

Antonio from Certaldo has informed us that only five hundred iron cannonballs are available for the enterprise, among the ones remained after the conquest of Cascina, the projectiles recovered under its ramparts, and the missiles purchased in Ferrara. This news was like a stab wound to our heart, because this ammunition is the most important, most indispensable requisite for this marvelous siege, and nothing can be done without it. In desperation, we have found a very good remedy to this shortage. Antonio, in fact, has told us that a large quantity of copper and bronze is stored in the public and private warehouses of the capital, hence cannonballs can be cast in these two metals. Our excellent Signori ought to collect this material and make shots from it. Each round must be suitable for our heavy guns, weighing from fifteen to seventeen kilograms.

We assure their lordships that we will not besiege Pisa if they do not guarantee an adequate supply of cannonballs, because our foes are strengthening their defenses, and our artillery is the sole means of subduing the rebels. Our masters will be berated and disappointed if they do not make this provision. Still, they should spare no expense and no efforts in pursuing this immortal glory, raising to fame among the other Italian powers.

We consider this procurement to be the fortune of this state, of this siege, and of the two of us.

The Signori considered this solution to be “very effective,” and relaid their commissioners that “our captain will want for nothing.”⁹⁷ Thus, five gunmakers, three bellfounders, and two mint workers were hurried into manufacturing the bronze munitions, trying to meet the set deadline.⁹⁸ The officials coped with improvisation. In a couple of days, they built the reverberatory furnace of each master. Francesco Telli, Lorenzo Cavaloro, Ludovico di Guglielmo, Bonaccorso Ghiberti, Giovanni Antonio Moro, Jacopo Pintegli, Giuliano d’Andrea, Jacopo del Mazza, and Damiano di Giovanni were also provided with charcoal and timber. A large amount of metal was collected from the arsenals of the capital. Five tons of copper, two tons of tin, and one and a half ton of brass were acquired from the Strozzi bank. Two tons of

⁹⁶ ASF, Lettere varie, 6, f. 168r.

⁹⁷ ASF, Signori, Missive seconda cancelleria, 21, ff. 52r and 53v.

⁹⁸ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 86r; ASF, Dieci di balia, Entrata e uscita, 30, ff. 172r-174v and 196r-197v.

used copper arrived from the castle of Firenzuola, even if they were “fused with earth and bricks.”⁹⁹

Several “rotten weapons,” such as damaged falcons and broken handguns, were handed to Bonaccorso Ghiberti. In his account books, the craftsman complained about this “useless, unworthy waste,” underlining the poor quality of the metals, and wondering at the large quantity of burnt material. In the presence of the Signoria, the artisan initially refused to obey the command of the government, but his attitude would have been mitigated by the promise of a larger payment.¹⁰⁰ A similar assurance had to be given to the other founders.¹⁰¹

In a short time, however, the castings were about to start. The Signori expected “nearly eighty shot per day” of their masters.¹⁰² Between July 29th and August 2nd, three hundred cast bronze cannonballs were dispatched to Cascina.¹⁰³ Within two weeks, Florentine masters would have craft six hundred and eighty-nine missiles. The cost of these “overpriced” goods amounted to three hundred and fifty golden florins, excluding the expense and the consumption of the raw materials.¹⁰⁴

A couple of florins were also paid to Andrea di Pasquino and Paolo Soglianni. The Signoria, in fact, would have commissioned these goldsmith to engrave a message on four gilded projectiles, with the intention of deriding and demoralizing the besieged rebels.¹⁰⁵

This cannonball does not bring hopes of our clemency. The virtues of our captain could not strike the fear of servitude into you, until now, but you will suffer an ordeal sooner rather than later.

⁹⁹ ASF, Entrata e uscita, 30, ff. 168v, 169v, and 170r.

¹⁰⁰ ASF, Dieci di balia, Entrata e uscita, 30, ff. 170v, 195v, and 212v; AOI, Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, 13229, ff. 50v-51r; AOI, Ricordanze di Bonaccorso di Vettorino di Lorenzo Ghiberti, 13230, ff. 33v-35r. See also Fabrizio Ansani, “The life of a Renaissance gunmaker. Bonaccorso Ghiberti and the development of Florentine artillery in the late fifteenth century,” *Technology and Culture* 58, no. 3 (2017), pp. 774-775.

¹⁰¹ ASF, Dieci di balia, Entrata e uscita, 30, ff. 172r-174v.

¹⁰² ASF, Signori, Missive seconda cancelleria, 21, f. 53v.

¹⁰³ ASF, Dieci di balia, Entrata e uscita, 30, f. 177r; ASF, Signori, Missive seconda cancelleria, 21, ff. 61v and 63v; Parenti, *Storia fiorentina*, II., 280; Vaglianti, *Storia dei suoi tempi*, p. 76; Anonymous, “La guerra del Millecinquecento,” *Archivio Storico Italiano* 6, no. 2 (1845), p. 367.

¹⁰⁴ ASF, Dieci di balia, Entrata e uscita, 30, ff. 171v and 173r; ASF, Signori, Missive seconda cancelleria, 21, f. 122v.

¹⁰⁵ ASF, Dieci di balia, Entrata e uscita, 30, f. 179v; AOI, Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, 13229, f. 50v; ASPI, Comune di Pisa, Divisione C, f. 190v.

According to chroniclers, the Pisan would have given instead numerous, contemptuous answers to these words of warning.¹⁰⁶

Beg for forgiveness, sinners. We are devoutly fighting for our motherland.
So far the incapacity of your captain is giving us freedom, rather than
holding us in captivity.

Before producing the bronze missiles, the Signori had tried their best for obtaining a sufficient number of iron projectiles, continuing with the previous attempts of the Dieci di Balìa at incentivizing the production of cast metal. After the problematic stockpiling of the previous campaign, the officers had in fact hired three masters especially “for manufacturing iron cannonballs.” Their workshop was opened, during the month of December, in the surroundings of Pistoia.¹⁰⁷ In February, Giovanni from Chieri, Anton from the Holy Roman Empire, and Lancillotto from Pistoia produced forty-five “heavy” shot for cannons and four “small” missiles for culverins.¹⁰⁸ The captain approved these shots as “very profitable.” In June, he told his chancellor to solicit their manufacture, “so that missiles won’t be in short supply.”¹⁰⁹

A general dearth of raw materials, however, would have affected this industry very soon. The iron mines, in fact, were not widespread on the Florentine territory.¹¹⁰ Thus, for “keeping their promise” to supply the army, the officers were compelled to recycle second-hand metal. Rusty weathervanes and old rods were bought in Florence, Arezzo, Cortona, Pontedera, Vico, and Cascina.¹¹¹ On July 26th, seven tons of this “scrap iron” arrived in Pistoia, but the poor quality of the metal hampered the production, causing “a few difficulties” to the furnace.¹¹² The Signori had even to sent two of their gunmakers for repairing the

¹⁰⁶ Anonymous, “La guerra del Millecinquecento,” p. 367.

¹⁰⁷ ASF, Dieci di balìa, Entrata e uscita, 23, f. 542r; ASF, Dieci di balìa, Deliberazioni, condotte e stanziamenti, 46, ff. 12v-13r.

¹⁰⁸ ASF, Dieci di balìa, Entrata e uscita, 30, ff. 29r, 41r, 67v, and 110r.

¹⁰⁹ Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 137.

¹¹⁰ Mario Borracelli, “Siderurgia e imprenditori senesi nel Quattrocento fino all’epoca di Lorenzo il Magnifico,” in *La Toscana al tempo di Lorenzo il Magnifico. Politica, economia, cultura, arte* (Pisa, 1996), pp. 1218-1220.

¹¹¹ ASF, Dieci di balìa, Entrata e uscita, 30, f. 169r; ASF, Signori, Missive seconda cancelleria, 21, f. 43v; ASF, Consulte e pratiche, 65, f. 61r.

¹¹² ASF, Signori, Missive seconda cancelleria, 21, f. 47v. Similar problems with the low quality of metals were noticed in the ironworks of Ercole d’Este. See Enzo Baraldi and Manlio Calegari, “Pratica e

malfunctioning plant.¹¹³ Nevertheless, from July to August, this team of founders could manufacture only one hundred and sixty-three projectiles, weighing two and a half tons.¹¹⁴

On July 16th, six other tons of “waste” were transported to Colle Val d’Elsa. Here, on behalf of the Republic, Ludovico Buonaccorsi rented and improved an entire ironwork for the purpose, ordering to construct adequate furnaces and reliable bellows, and purchasing the fuel for the flames in Siena.¹¹⁵ The master Simone from Romena directed the castings, along with two charcoal burners and two other assistants. From July to September, they crafted three hundred and ninety-four shot of various sorts, weighing a total of four and a half tons.¹¹⁶

The Signori tried even diplomacy to amass the materiel. On July 7th, the ambassador in Venice, Giovanni Battista Ridolfi, requested an official license to acquire iron cannonballs in Brescia. The former competitors denied the aid, because the Senate was “in want of projectiles.”¹¹⁷ On July 14th, another letter was sent to Giovanni Gonzaga, brother of the marquis of Mantua, demanding the concession of a number of missiles.¹¹⁸ Nevertheless, only the duke of Ferrara, Ercole d’Este, decided to lend two hundred shot.¹¹⁹

Among other things, the officers resorted to the licit and illegal markets. The Florentine right-hand man, Baldo from Careggi, succeeded in smuggling about a hundred shot out of the Venetian territory.¹²⁰ The agent in Lucca, Francesco Spina, bought, for about four hundred golden florins, four hundred and sixty-five cast cannonballs and eighty-eight forged rounds. The seller was, once again, Benedetto Buonvisi.¹²¹

Finally, the officers collected one thousand and six hundred iron shot, while one thousand stone missiles were sculpted by Simone del Pollaiuolo in the quarry of the Golfolina.

diffusione della siderurgia ‘indiretta’ in area italiana,” in *La siderurgia alpine en Italie*, ed. Philippe Braunstein (Rome, 2001), p. 102.

¹¹³ ASF, Signori e collegi, Condotte e stanziamenti, 18, f. 4v; AOI, Debitori e creditori di Bonaccorso di Vettorino di Lorenzo Ghiberti, 13229, f. 26r.

¹¹⁴ ASF, Dieci di balia, Entrata e uscita, 30, f. 199r.

¹¹⁵ ASF, Signori e collegi, Condotte e stanziamenti, 17, ff. 27r and 32r; ASF, Dieci di Balia, Entrata e uscita, 26, f. 320v; ASF, Dieci di balia, Entrata e uscita, 30, ff. 166v and 174v; ASF, Signori, Missive prima cancelleria, 51, f. 135r.

¹¹⁶ ASF, Signori e collegi, Condotte e stanziamenti, 17, ff. 22r, 32r, 37v, and 42v; ASF, Dieci di Balia, Entrata e uscita, 26, f. 321r.

¹¹⁷ ASF, Signori, Legazioni e commissarie, 24, ff. 28v-29r. See also Sanudo, *Diari*, II., 896.

¹¹⁸ ASF, Signori, Missive prima cancelleria, 51, f. 134v.

¹¹⁹ ASF, Dieci di balia, Entrata e uscita, 30, f. 164r; ASF, Signori, Missive prima cancelleria, 51, ff. 133r and 134v.

¹²⁰ ASF, Dieci di balia, Entrata e uscita, 30, f. 175r; ASF, Signori, Missive seconda cancelleria, 21, f. 55r.

¹²¹ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 21r; ASF, Dieci di balia, Entrata e uscita, 26, f. 320r; ASF, Signori, Missive seconda cancelleria, 21, ff. 35v and 64r.

The most of them were specially made for the bombards, weighing about sixty or seventy kilograms.¹²² Furthermore, the gunpowder makers prepared numerous incendiary projectiles. Jacopo di Corso provided two hundred and forty firebombs.¹²³ The two hundred and eighty shells crafted by Piero di Zanobi contained a lethal mixture of camphor, alcohol, pitch, varnish, turpentine, and powder.¹²⁴

These significant quantities of shot and powder had to suit a large number of guns. As usual, the captain would have relied on his weaponry to hammer the enemies, and its vast utilization was “the right way” to sap the shelters and to wear down the morale of the rebels. The commander, then, desired to “abound with artillery, so that our bombardments cannot be stopped by any nuisance, by any breakdown.”¹²⁵ Already in June, he had repeatedly requested the cannons left in Casentino after the winter war, still blocked by impassable mountain roads. The firearms arrived in Florence a month later, and were immediately transported to the encampment by river.¹²⁶

In any case, the Signori were not late in stirring other firearms from the city magazines. The commissioners were also allowed to shift several guns from Empoli and Pontedera.¹²⁷ From Livorno, instead, came the “miraculous” basilisk, a giant weapon of two pieces, seven meters long, loaded with thirty kilograms of metal.¹²⁸ Despite these spare arms, Paolo Vitelli was not satisfied. He demanded other ten brand new cannons, but the Signori alleged several difficulties with their production.¹²⁹ The captain then insisted on casting three or four firearms at least.¹³⁰ Finally, the officers had to grant one culverin and one cannon, realized by Ludovico di Guglielmo and Lorenzo Cavaloro.¹³¹

¹²² ASF, Dieci di balia, Entrata e uscita, 30, f. 192r.

¹²³ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 22r; ASF, Dieci di balia, Entrata e uscita, 30, ff. 168v and 191v.

¹²⁴ ASF, Dieci di balia, Entrata e uscita, 30, f. 191r.

¹²⁵ ASF, Lettere varie, 6, ff. 147r and 149v; ASPI, Comune di Pisa, Divisione C, 25, f. 266v. See also *Supplying the army. 1498*.

¹²⁶ ASF, Signori, Missive seconda cancelleria, 21, ff. 23rv, 25rv, and 43r; ASF, Lettere varie, 6, f. 111r, 149v; Landucci, *Diario fiorentino*, p. 197.

¹²⁷ ASF, Signori, Missive seconda cancelleria, 21, ff. 20v and 39v.

¹²⁸ ASF, Signori, Missive seconda cancelleria, 21, f. 64r; ASPI, Comune di Pisa, Divisione C, 25, ff. 265r and 274r; Vaglianti, *Storia dei suoi tempi*, p. 85; Portovenieri, “Memoriale,” p. 345.

¹²⁹ ASF, Signori, Missive seconda cancelleria, 21, f. 41v.

¹³⁰ ASF, Lettere varie, 6, f. 170r.

¹³¹ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 30r; ASF, Dieci di balia, Entrata e uscita, 30, f. 156v; ASF, Signori, Missive seconda cancelleria, 21, f. 20v.

Within July, the Signori would have gathered together a “beautiful ordnance,” pressing into service recent French guns and traditional Italian weapons. The former amounted to forty or fifty units, “among culverins and cannons, all mounted on carts.” The latter were two heavy and three small bombards, along with several mortars. The remaining pieces were mainly falcons and spingards.¹³²

For cushioning his irreplaceable artillery from the enemy missiles, the captain decided to substitute weak wooden mantlets with resistant wicker gabions, filled with rocks and earth.¹³³ Additional defenses were made with double wool mattresses and with bundles of branches.¹³⁴ For erecting and replacing these shelters, the Signori took on lots of carpenters and sappers.¹³⁵ Other masters were responsible for the carriages, the trestles, and the beds of the guns.¹³⁶

The Signori put numerous efforts into fulfilling the captain’s demand promptly. They had in fact to keep the momentum, “well aware of the hazards of losing time.”¹³⁷ Therefore, the most part of the materiel was transported to the encampment within the fixed term. On July 28th, the infantry companies arrived too. The camp would have been then populated by “about fifteen thousand men between infantry and cavalry composed the army.” According to a Pisan observer, “the enemy has on their payroll six hundred men-at-arms, five hundred mounted crossbowmen, eight thousand foot soldiers, four thousands conscripts, three thousand pioneers, and one hundred and fifty gunners.”¹³⁸ Florentine chroniclers reported about ten thousand infantrymen and one thousand heavy cavalymen, excluding skilled and forced labor.¹³⁹

The nourishment of this populous “mobile city” represented another challenging issue, for the government. According to the general commissioners, the subjects of the nearby

¹³² Vaglianti, *Storia dei suoi tempi*, p. 76; Cerretani, *Storia fiorentina*, p. 262; Portovenieri, “Memoriale,” p. 341; Anonymous, “La guerra del Millecinquecento,” pp. 365 and 376.

¹³³ Parenti, *Storia fiorentina*, II., p. 280; Anonymous, “La guerra del Millecinquecento,” p. 365.

¹³⁴ ASF, Signori, Missive seconda cancelleria, 21, ff. 78v, 80r, and 88r; Portovenieri, “Memoriale,” p. 343; Anonymous, “La guerra del Millecinquecento,” p. 377.

¹³⁵ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 31r; ASF, Signori, Missive seconda cancelleria, 21, ff. 45r and 48r.

¹³⁶ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 21v; ASF, Signori, Missive seconda cancelleria, 21, ff. 22v and 48r.

¹³⁷ ASF, Signori, Missive seconda cancelleria, 21, f. 38v.

¹³⁸ Portovenieri, “Memoriale,” p. 341; Anonymous, “La guerra del Millecinquecento,” p. 365.

¹³⁹ Cerretani, *Storia fiorentina*, p. 262; Vaglianti, *Storia dei suoi tempi*, p. 76; Parenti, *Storia fiorentina*, II., p. 279.

villages were in fact unable to prepare a meal for this multitude of combatants. Consequently, the appointees had to buy bread and wine away, in Empoli, in Castel Fiorentino, in Colle Val d'Elsa, in Signa, and even in Volterra and in Pistoia. Peasants and vendors were also expected to organize a daily market in the camp, "always assuming that they can earn their living and that they are well treated." In addition, the city officials responsible for the provision of grain, the Ufficiali della Grascia, guaranteed continuous distribution of bread among the tents. On July 31st, on the eve of the assault, the bakers of the capital would have cooked more than fifteen thousand loafs just to support their army.¹⁴⁰

Haste and ingenuity. The fortification of Pisa

At that time, the "extensive preparations" of the Republic had undoubtedly alarmed all the neighboring states. The government of Lucca, in particular, was worrying over reckoning and retaliation, due to its long-lasting duplicity in assisting Pisans and deceiving Florentines.¹⁴¹ The widespread rumors of an imminent invasion urged the government to fortify the capital, purchasing munitions, recruiting infantrymen, and hiring engineers. The troops were ordered to defend the towns of Viareggio, Mutrone, and Pietrasanta too. Moreover, aid and advice were asked from the lord of Bologna, the marquis of Mantua, and the duke of Ferrara. Three ambassadors were also sent to the Florentine encampment, "for mitigating every severe intention."¹⁴² Paolo Vitelli, however, had already promised to restore Pietrasanta to its former owners, "within eight days from the fall of Pisa."¹⁴³

Of course, the Pisans were in plight too, and not only because of the external threat. Since the departure of the Venetian garrison, in fact, they had experienced several financial difficulties. The usual trades with Lucca and Genoa had been hindered by the raging plague throughout the spring. The winter heavy rain had flooded the countryside, making the summer

¹⁴⁰ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 28v; ASF, Dieci di balia, Entrata e uscita, 30, ff. 206v-209r; ASF, Signori, Missive seconda cancelleria, ff. 44r, 51r, 59v, and 62r; Nicasi, "La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504," pp. 150-151.

¹⁴¹ Renzo Sabbatini, "Interessi economici e ragioni diplomatiche. La repubblica di Lucca tra Francia e Impero 'in tante revolutioni delle cose di Italia,'" in *Diplomazie. Linguaggi, negoziati e ambasciatori fra quindicesimo e sedicesimo secolo*, eds. Eleonora Plebani, Elena Valeri, Paola Volpini (Milan, 2017), pp. 165-187.

¹⁴² ASLU, Colloqui, 3, ff. 561-562 and 579-584.

¹⁴³ ASF, Miscellanea repubblicana, 5, e. 166, f. 1v.

harvest poor. The surviving grain had been cut and burnt during the enemy sack.¹⁴⁴ Poverty and famine had weakened the unity among the citizenry. Moreover, the refusal of the peace agreement had deepened the split, stinging the people into mistrust and dissension.¹⁴⁵ Peasants and artisans desired to return under the former dominion to get back peace and prosperity. The majority of the ruling magnates, instead, firmly rejected the accord, because “they were sixty or seventy thousand ducats in debt with Florentine merchants” and “doubted about vengeance.”¹⁴⁶

In April, these oligarchs had suggested three alternatives to the Venetian Senate. First of all, they proposed to sell the whole “real estate” of the city to the Florentines within the space of two months, fixing the prices of houses, fortifications, palaces, and workshops. They also considered the possibility of presenting the Most Serene Republic with “our city, our countryside, our fortresses, our children, our women, our capitals.” Lastly, they even offered to leave the city, requesting to be transported in an overseas possession, such as Cyprus and Crete.¹⁴⁷

A month later, the Anziani appointed ambassadors to all the states of the Peninsula, pressing for money, food, and troops. The diplomats reached the duke of Ferrara and the king of Naples. They reminded the rulers of Siena and Lucca that “Florentines wish to conquer the entire Tuscany.” The envoys had recourse even to the “divine court” through the pope. And letter was sent to the emperor too, pleading “for motherland, for freedom.”¹⁴⁸ This “confidence in our powerful allies,” however, was soon undermined by numerous rebuffs. In Venice, the messengers were not admitted to the public audiences. His Holiness was hesitant to bless the rebellion. The Sienese government flattered the emissary, promising everything, but offering nothing.¹⁴⁹ Even the citizens of Lucca refused the requests, averting “a possible Florentine reprisal,” on the advice of Ludovico Sforza.¹⁵⁰

The duke of Milan was in fact the mastermind behind several rejections, forbidding the Genoese, the Lucchese, and the Sienese from assisting the rebels. He was insisting, instead, on

¹⁴⁴ ASPI, Comune di Pisa, Divisione C, 25, f. 192rv; ASLU, Anziani al tempo della libertà, 136, f. 677.

¹⁴⁵ ASF, Signori, Missive seconda cancelleria, 21, ff. 20v-21r.

¹⁴⁶ ASF, Signori, Missive seconda cancelleria, 21, ff. 20v-21r, 25v, 43v, and 44v; Parenti, *Storia fiorentina*, II., pp. 242 and 270; Vaglianti, *Storia dei suoi tempi*, p. 77.

¹⁴⁷ ASPI, Comune di Pisa, Divisione C, 25, ff. 201v-202r.

¹⁴⁸ *Ibid.*, ff. 206r-214v, 234v, 231v-233r.

¹⁴⁹ *Ibid.*, ff. 241rv, 266rv, and 268v-269r.

¹⁵⁰ ASLU, Colloqui, 3, ff. 558-560.

their surrendering, “for the good, the peace, and the union of Italy.”¹⁵¹ In late June, the Pisans appealed the Moro for reaching a new compromise, but the negotiations failed when he sided openly with their foes. The masses accused him of this “waste of time,” of his “about-turn,” but the “Italian dragon” was at that time desperately needing Florentine reinforcements for repelling the imminent French and Venetian invasion of Lombardy.¹⁵²

Considering their diplomatic isolation, the rebels could only try to put up an effective defense. In order to “afford necessities” and raise revenues, the Anziani began to gather all the silver goods from ecclesiastical and public buildings, auctioning them in the markets of Lucca.¹⁵³ A taxation “on every single inhabitant” was also imposed, and money were collected especially for the “salaries of our soldiers.” The contribution was compulsory, and people paid up to five ducats for not being imprisoned.¹⁵⁴

On July 22nd, the Anziani designated six general commissioners “to supply and fortify the city,” along with a Venetian engineer, Sebastiano from Monselice.¹⁵⁵ In order to allow a clear shot for artillery, they decided to level houses, churches, vineyards, and copses all around the city. The suburbs of San Marco, San Giovanni, and San Bernardo were burned and abandoned. The height of gates and towers was lowered.¹⁵⁶ Moreover, a new ravelin was built near the Porta Calcesana, for preventing an assault from northwest. In the southern perimeter, the bastion and the ravelin of Stampace were fortified with several casemates.¹⁵⁷ Similar structures were walled up also in the surroundings of the fortress of the Cittadella Vecchia, which guarded the downstream areas of the river. The imposing Cittadella Nuova, instead, protected the opposite western bank.

The Pisans relied heavily on their massive walls, two meters and a half thick, and eleven meters high. For containing the “fury” of foes, however, it would have been necessary to erect an additional barrier six meters behind the ramparts. In the first days of the siege, men and women worked promptly and intensely at this terreplein, “five hundred meters long, nine

¹⁵¹ ASPI, Comune di Pisa, Divisione C, 25, ff. 222v-223r and 262v-263r.

¹⁵² ASPI, Comune di Pisa, Divisione C, 25, ff. 239r, 251rv and 252rv; ASF, Consulte e pratiche, 65, ff. 23r-26r and 37r-46v; Parenti, *Storia fiorentina*, II., pp. 269 and 273.

¹⁵³ ASPI, Comune di Pisa, Divisione C, 18, ff. 8v and 14rv.

¹⁵⁴ Giovanni Portoveneri, “Memoriale,” p. 339.

¹⁵⁵ ASPI, Comune di Pisa, Divisione C, 18, f. 16v; Anonymous, “La guerra del Millecinquecento,” p. 364.

¹⁵⁶ ASPI, Comune di Pisa, Divisione C, 25, f. 261r; ASF, Signori, Missive seconda cancelleria, 21, f. 15r; Portoveneri, “Memoriale,” pp. 340-341; Parenti, *Storia fiorentina*, II., p. 269.

¹⁵⁷ Anonymous, “La guerra del Millecinquecento,” pp. 364-365.

meters thick, and four meters high.” Two large, deep ditches were dug alongside it. Moreover, numerous “barrels and baskets, full of earth,” were put in front of the shelter for deflecting the blows of artillery.¹⁵⁸

As for munitions, the rebels had at their disposal a certain number of “mad culverins,” that is, “beautiful and furious things” copied from the new French models. One of this firearms, the “Bufalo,” was “so huge and so good that it can fire twenty kilograms of iron with great accuracy.”¹⁵⁹ Several cannons and “lots of falcons” were also available for gunners.¹⁶⁰ Many other traditional iron guns, such as bombards and spingards, were stored in the city arsenals too.¹⁶¹

A significant reserve of saltpeter and gunpowder was left in the two citadels by the Venetian garrison. The nitrate was also bought in Lucca, in Genoa, and in Palermo, and refined in the mills of the Vecchia.¹⁶² Iron projectiles were instead ordered from the mine of Fornovolasco, in the nearby region of Garfagnana, over the preceding months.¹⁶³ Stone ammunition were probably sculpted from the ruins of leveled houses and lowered towers. Three tons of lead, moreover, were extracted from the dismantled roofing of the city baptistery.¹⁶⁴ Incendiary missiles were crafted from pots and flasks.¹⁶⁵ The arrows of crossbowmen were poisoned.¹⁶⁶

So, “twenty-four men-at-arms, one hundred and fifty mounted crossbowmen, five hundred infantrymen, one thousand citizens, two thousand peasants,” led by Gurlino from Ravenna and Rinieri from Sassetta, were disposed to fight, waiting for the last showdown.¹⁶⁷

¹⁵⁸ Portovenieri, “Memoriale,” p. 342; Anonymous, “La guerra del Millecinquecento,” pp. 366-367.

¹⁵⁹ ASPI, Comune di Pisa, Divisione C, 42, ff. XXXVIIIv and CLIIIv; ASPI, Comune di Pisa, Divisione C, 80, f. 4r; Portovenieri, “Memoriale,” p. 307.

¹⁶⁰ Anonymous, “La guerra del Millecinquecento,” pp. 370 and 374.

¹⁶¹ ASPI, Comune di Pisa, Divisione C, 77, ff. 33r and 34v.

¹⁶² ASPI, Comune di Pisa, Divisione C, 31, f. 759r; ASPI, Comune di Pisa, Divisione C, 32, ff. 5r, 7r, and 62r. See also Sanudo, *Diari*, II., p. 68.

¹⁶³ ASMO, Archivio segreto estense, Cancelleria, Archivio per materie, Miniere e ferriere, 4.

¹⁶⁴ ASPI, Comune di Pisa, Divisione C, 18, ff. 37v-38r.

¹⁶⁵ Anonymous, “La guerra del Millecinquecento,” p. 371.

¹⁶⁶ ASF, Signori, Missive seconda cancelleria, 21, f. 62v; Landucci, *Diario fiorentino*, p. 198; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 156.

¹⁶⁷ Anonymous, “La guerra del Millecinquecento,” pp. 364 and 366.

Trialing the artillery

On July 31th, the Florentine troops were ready to operate. On that day, a small contingent seized the solitary tower of Asciano, securing the nearby coastal swamps. The captain punished the strong resistance of the garrison with his habitual brutality. Five prisoners had both hands amputated, and their eyes were scratched without mercy.¹⁶⁸ It was the last warning for the rebels. At sunset, the army eventually moved in the direction of Pisa.¹⁶⁹

In the gloom, the camp was positioned in front of the south-eastern walls of the city, “regarded as the weakest part of the enemy fortifications.” The tents were pitched in a large area “between the monastery of San Donnino and the church of San Giovanni al Gatano.” Paolo Vitelli ordered immediately to aim all the cannons at the rampart between the bulwark of Stampace and the church of Sant’Antonio. In a single day, the weapons wiped out twenty-five meters of stone, and other seventy were pierced, and were supposed to collapse under the blows of bombards.¹⁷⁰ The Florentine gunners “fired about two hundred shot per hour on the wall and in the city. The entire world seemed to be getting destroyed.”¹⁷¹ Witnesses counted “from six hundred and fifty-three to seven hundred and fifty-five shots.”¹⁷²

In the evening, the captain rearranged the batteries. The cannons neared the edge of the external ditch, “fifteen meters away from the ramparts.” The bombards and the basilisk were planted at their back.¹⁷³ On August 2nd, the guns were pointed at three different spots, thirty meters distant from each other. The shelling “goes on without intermission.” The captain reported that another opening, seven meters wide, was made near the tower of Stampace. However, he solicited “powder and shot, powder and shot, powder and shot, powder and

¹⁶⁸ Landucci, *Diario fiorentino*, p. 198; Vaglianti, *Storia dei suoi tempi*, p. 78; Portovenieri, “Memoriale,” p. 341.

¹⁶⁹ ASF, Signori, Missive seconda cancelleria, 21, f. 60v; Vaglianti, *Storia dei suoi tempi*, p. 76; Landucci, *Diario fiorentino*, p. 198; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 156.

¹⁷⁰ ASF, Signori, Missive seconda cancelleria, 21, f. 62v; Cerretani, *Storia fiorentina*, p. 262; Parenti, *Storia fiorentina*, II., p. 280; Portovenieri, “Memoriale,” p. 341; Anonymous, “La guerra del Millecinquecento,” p. 365; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 156.

¹⁷¹ Portovenieri, “Memoriale,” p. 341.

¹⁷² Anonymous, “La guerra del Millecinquecento,” p. 367.

¹⁷³ Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 156.

shot, and shot and powder,” because “the victory, or the defeat, depend on these two things.”¹⁷⁴

The condottiero addressed this concern in several missives. On August 4th, he recognized the consumption of one hundred barrels of propellant per day, bemoaning the fact that “half of the ordnance is used intermittently.” On August 5th, he signaled his discontent with the distributor of munitions, and over the “disorder” of his shipments. On August 12th, he noticed that “due to the shortage of explosive, only six heavy guns out of forty have fired in the last five days.” Thus, he had to repeat that, without an opportune procurement, “every expense is vain.”¹⁷⁵

The Signori were mindful that “ammunition could lack in proportion to its use, turning a promising glory into a manifest infamy.” Nevertheless, they “judge this shortage to be too early. If so, we cannot remedy this problem, because a new gathering of saltpeter will take a long time.”¹⁷⁶ The officers had even admitted that “it is impossible to arrange all of these stuffs, during a campaign.”

Whichever Italian power could not provide a sufficient quantity of ammo, if too many guns had to be employed for such a long time. Everyone could easily understand this issue [...]. We are trying our best to solve this problem, but money cannot remedy it alone, since the complexity of the manufacture of both shot and powder.

The only way of getting round this dearth was a decisive, sudden assault. After a week, the rulers seemed to be already disappointed at the “lengthy delays” of the expedition.¹⁷⁷ But Paolo Vitelli did not share their pessimistic appraisal of the situation.

If someone says that this siege is dragging on, I tell him that, in recent years, not any expedition has been as demanding as this one. These excellent masters and these magnificent citizens, accustomed to fighting wars, can perhaps remember that castles and hovels used to resist to the powerful armies of every Italian state for months. Now, instead, we are besieging Pisa, and I can affirm that the operations are on track, regardless of robust

¹⁷⁴ ASF, Signori, Missive seconda cancelleria, 21, f. 63r; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 157.

¹⁷⁵ Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 157-160 and 162-163.

¹⁷⁶ ASF, Signori, Missive seconda cancelleria, 21, f. 68v.

¹⁷⁷ ASF, Signori, Missive seconda cancelleria, 21, ff. 63v-65v.

ramparts, many ditches, sturdy shelters, innumerable guns, and obstinate defenders.

He was only lamenting that “the enemies are fully equipped with munitions, while we are running out of everything. The rebels could attack us, at the moment, with their counter-fire.”¹⁷⁸ And Pisans, in fact, had already started to bother Florentines with their firearms. Several gunports were chiseled into the base of the walls, so that “a cannon and a culverin could intimidate their troops, killing and wounding their men.” Other gunports were realized in the Cittadella Vecchia, allowing the rebels to open fire on the left flank of their foes. Located “through its smoke,” the Florentine artillery was repeatedly forced to draw back and to stop the fire.¹⁷⁹

Along with the powder, therefore, the saltpeter was the “salvation of the city.”¹⁸⁰ It had been generously, privately supplied by several Lucchese magnates, along with troops and money. By mid August, a large part of their fellow citizens was firmly inclined towards Pisans, a support backed by the secret state council.¹⁸¹ The Florentines noticed this frantic activity, but could not prevent the arrival of both reinforcements and materiel from the valley of Serchio.¹⁸²

The assailants, however, were not giving up. Notwithstanding “the sturdiness of the ramparts, the artillery have razed them in four different places.”¹⁸³ About two hundred meters of walls had been destroyed in a week.¹⁸⁴ On August 8th, the captain ordered to demolish the crumbling tower of Stampace, and to raze its ravelin the ground. In the following day, the fire was concentrated on the eastern ravelin of the Cittadella Vecchia, in order to cease the enemy barrage. Moreover, dissembling two assaults on the breaches, Paolo Vitelli studied and tested the defenses of the rebels.¹⁸⁵

¹⁷⁸ Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 157-158 and 166-168.

¹⁷⁹ Vaglianti, *Storia dei suoi tempi*, p. 76; Anonymous, “La guerra del Millecinquecento,” pp. 368-370.

¹⁸⁰ ASPI, Comune di Pisa, Divisione C, 32, f. 62rv.

¹⁸¹ ASLU, Colloqui, 3, ff. 598-600 and 602.

¹⁸² ASF, Signori, Missive seconda cancelleria, 21, ff. 74rv and 85r; Parenti, *Storia fiorentina*, II., p. 285; Vaglianti, *Storia dei suoi tempi*, pp. 78-79; Landucci, *Diario fiorentino*, pp. 198-199.

¹⁸³ ASPI, Comune di Pisa, Divisione C, 25, ff. 268v-269r.

¹⁸⁴ ASF, Signori, Missive seconda cancelleria, 21, f. 64v; Vaglianti, *Storia dei suoi tempi*, p. 78; Anonymous, “La guerra del Millecinquecento,” p. 374.

¹⁸⁵ ASF, Signori, Missive seconda cancelleria, 21, ff. 69v and 70v; Anonymous, “La guerra del Millecinquecento,” p. 370; Portovenieri, “Memoriale,” p. 342; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 161-162.

On 10th, at dawn, the Florentine infantry launched a general attack on the bulwark. This “cruel battle” lasted about three hours. Pisans threw even incendiary missiles, and their artillery “wounded lots of our soldiers,” but the troops succeeded in scaling the ruins, raising the lily flag on the collapsed tower. Someone managed to venture into the city. At that very moment, the infantry columns would have had the possibility to assault the rear terreplein, but, inexplicably, “Vitellozzo did not want to strike again.” Paolo assented to the choice of his brother, ordering the retreat, and “wasting the chance of seizing the city.”¹⁸⁶

Besides, the Pisans were extremely afraid, and “our citizens and our rustics were dismayed at this assault. All of them forsook the shelters.” The southern quarter of the city was quickly abandoned. Numerous inhabitants fled to Lucca, and many others were ready to escape. So, “monitoring these movements, the Anziani appointed four ambassadors to negotiate with Florentines.”¹⁸⁷ On August 11th, the Florentine general commissioners granted a safe conduct to these envoys, informing the Signoria of this turnaround. The commanders suggested agreeing, “with no ifs or buts.” In Florence, the rulers debated whether or not this accord could be signed, and the city assembly resolved to require a total submission. After a long wait, however, “nobody from the Pisan side came in the encampment.”¹⁸⁸

The Signori were bitterly discontented with this “trick,” assuming it to be an “expedient for gaining time.” Above all, they could not “understand why the infantry has still not assaulted the terreplein.” The officers admonished again the commissioners to take action, because “the more you delay, the more you have problems.” The condottieri were pushed into “bringing this enterprise to a conclusion,” avoiding “boredom” and “hesitation,” and taking advantage of the “will our soldiers, who desire to fight and to die with honor.” In particular, the mercenaries “should care about their reputation, by now. They ought not to mind about the death of one hundred men.”¹⁸⁹

¹⁸⁶ ASF, Signori, Missive seconda cancelleria, 21, ff. 70v-71r; Guicciardini, *Storia fiorentina*, p. 207; Vaglianti, *Storia dei suoi tempi*, p. 79; Masi, *Ricordanze*, pp. 44-45; Parenti, *Storia fiorentina*, II., p. 282; Nardi, *Istorie della città di Firenze*, pp. 196-197; Cerretani, *Storia fiorentina*, p. 263; Buonaccorsi, *Diario*, p. 24; Anonymous, “La guerra del Millecinquecento,” p. 370; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 163.

¹⁸⁷ Portovenieri, “Memoriale,” pp. 342-343; Guicciardini, *Storia fiorentina*, p. 207; Cerretani, *Storia fiorentina*, p. 263; Masi, *Ricordanze*, pp. 44.

¹⁸⁸ ASF, Signori, Missive seconda cancelleria, 21, ff. 71r-73r; ASF, Consulte e pratiche, 65, ff. 74v-77v; Parenti, *Storia fiorentina*, II., pp. 282-284; Vaglianti, *Storia dei suoi tempi*, pp. 79-80.

¹⁸⁹ ASF, Signori, Missive seconda cancelleria, 21, ff. 71v-72v.

To complicate matters further, revenues were becoming more difficult to collect. Sixty-four thousand ducats had been already spent, and “the strongboxes are empty.”¹⁹⁰ The citizens were “prostrated and discouraged, observing these slow, lukewarm proceedings.” All the public councils were in turmoil. People accused rulers, commanders, and ministers. As for them, the Signori were worried about “the responsibility for having impoverished, for having assassinated our subjects in vain, for the purpose of equipping our army.”¹⁹¹ To drop this charge, they instructed the commissioners to determine a date for the battle and to circulate the rumors about a probable sack of Pisa, inducing warriors to stay in the encampment.¹⁹²

The first deadline of August 18th approached and passed, in spite of all the preparations. The term was extended to August 20th, and then set for August 22nd. The captain, however, postponed the encounter again, now demanding the wages of his companies, now requiring hundreds of conscripted reinforcements.¹⁹³ Finally, he decided to attack on August 25th, “once the walls are leveled further.”¹⁹⁴

In the meantime, in fact, the captain had directed his gunners to wipe out “more of the ramparts, so that soldiers could attack safely. He preferred to avoid a bloodshed.” Above all, he was alerted to the possibility that “falcons and spingards will slaughter the Florentines, if they had the presumption to storm the terreplein.” Thus, the army needed to gain an easier access to the earthwork. Several stonecutters were asked to splinter the walls manually, trying to drop the debris into the internal moat, but they made an unsuccessful attempt.¹⁹⁵

Carpenters and pioneers had instead buttressed the ruins of Stampace. Several heavy firearms were positioned in this new, four-storey casemate, with the intention of shelling the Cittadella Vecchia and the Porta a Mare. The latter, in particular, was the main aim of the operation. Through this entrance, in fact, the army would have easily penetrated the city, getting round the inner ditch. The rebels responded promptly by fortifying the gate, and by

¹⁹⁰ Ibid., f. 68r.

¹⁹¹ Ibid., ff. 76r-80r.

¹⁹² ASF, Signori, Missive seconda cancelleria, 21, ff. 76r and 78r; Parenti, *Storia fiorentina*, II., p. 287; Landucci, *Diario fiorentino*, p. 199.

¹⁹³ ASF, Signori, Missive seconda cancelleria, 21, ff. 79r, 81r, 84v, and 85rv.

¹⁹⁴ ASF, Signori, Missive seconda cancelleria, 21, ff. 84v-85r; Parenti, *Storia fiorentina*, II., p. 285; Vaglianti, *Storia dei suoi tempi*, p. 81.

¹⁹⁵ ASF, Signori, Missive seconda cancelleria, 21, f. 75v; Guicciardini, *Storia fiorentina*, p. 208; Anonymous, “La guerra del Millecinquecento,” p. 374; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 170.

building their own emplacement near the church of Sant'Antonio. Once again, they were trying to interfere with the enemy cannonade.¹⁹⁶

Since August 19th, “two cannons, two culverins, two falcons, and two spingards” fired continuously on the Porta, while mortars hit the city randomly. The basilisk and one of the bombards, instead, were aimed at the terreplein.¹⁹⁷ On August 25th, four other heavy pieces were “unexpectedly” placed on the wreckage of the ravelin, “a marvelous, hard effort, considering that this earthwork was ten meters high.” So, “making an awful din and giving an unbelievable fright,” the guns pounded the shelters of the rebels.¹⁹⁸

Nothing much else happened, all the rest of that day. In Florence, the population was waiting to hear from the commissioners by the hour, “even if no one doubted that our soldiers had conquered at least the southern half of Pisa.” In the evening, the main square was crowded with “perplexed” individuals. Only by night a messenger brought news that the battle was cancelled, “since the encampment was in complete disorder.”¹⁹⁹

Nobody has believed that this army was in such a mess, and nobody has acted against it. They have only insisted on the battle. However, making our preparations, we have found out that only one thousand infantrymen hanged around the camp, all dissatisfied with deferred payments. Along with the governor, I have talked to the commissioners, explaining that the soldiers will leave tomorrow, if they do not get their salary today [...]. Moreover, we have requested two thousand other foot soldiers, but these reinforcements have to arrive here within eight days. If our lords satisfy our demands, we will continue fighting, hoping for victory. Otherwise, the artillery will be lost, to the detriment of this Republic. We are sorry, but these are our excuses. We are sure that the Signori will blame us, but they will be undoubtedly wrong.

¹⁹⁶ Portovenieri, “Memoriale,” p. 343; Anonymous, “La guerra del Millecinquecento,” pp. 372-373; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 166.

¹⁹⁷ Anonymous, “La guerra del Millecinquecento,” p. 376; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 170 and 177.

¹⁹⁸ Anonymous, “La guerra del Millecinquecento,” pp. 376-377.

¹⁹⁹ Parenti, *Storia fiorentina*, II., p. 290, Vaglianti, *Storia dei suoi tempi*, p. 81; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 178.

"I came, I saw, I cheated"

The letter of the captain shocked the Signori. To their utter astonishment, the officers could not believe this "menace of a manifest ruin, after coming close to an indubitable victory."²⁰⁰ Nevertheless, they were certified that only one thousand and five hundred infantrymen had remained in the encampment. The soldiers, "after spending weeks in idleness," had been decimated by the "marshy air" of the Pisan countryside. Paolo Vitelli and Rinuccio from Marciano fell ill too. And the malarial fevers had taken the lives of four general commissioners.²⁰¹

Apart from the epidemic, combatants were deserting due to the delays of payments. Several companies had refused to be involved in the operations without receiving their salary first. According to the appointees, men were already clamoring, and the captain was indignant at the "sinister behavior" of the Signori, at their decision to skimp on this money, "saving a few thousand coins, after having spent a million and a half florins." His fellows "did not deserve a similar treatment."²⁰² In a long missive sent to his secretary, he expressed frustration over the shortage of gunpowder, the late supplies, and the absence of soldiers, pioneers, and stonecutters. But, "yes, my lords are right in stoning me to death, because this is the usual reward for loyalty and devotion."²⁰³

Both sides were accusing each other of acting in bad faith. During the general city council, the chancellor of the Signoria, Marcello Adriani, listed all the provisions made since the conquest of Cascina, demonstrating the efforts of the government and the faults of the commander. Besides, "anybody was surprised," and "no one can explain the whys and the wherefores of the situation." The masses, "despaired and fatigued, shouted at aristocrats and condottieri," accused of spinning yarns about the war.²⁰⁴ However, "difficulties emphasize virtues," and the majority of the citizens was not disheartened at all. In the last week of August, in order to prevent the rout of the army and the loss of the guns, merchants and

²⁰⁰ ASF, Signori, Missive seconda cancelleria, 21, f. 86r.

²⁰¹ ASF, Consulte e pratiche, 65, f. 92r; Guicciardini, *Storia fiorentina*, pp. 207-208; Bonaccorsi, *Diario*, p. 24; Nardi, *Istorie della città di Firenze*, p. 200; Vaglianti, *Storia dei suoi tempi*, pp. 81-82; Parenti, *Storia fiorentina*, II., pp. 290-291; Nerli, *Commentari*, p. 136; Masi, *Ricordanze*, p. 44; Anonymous, "La guerra del Millecinquecento," pp. 379-380; Ser Perizolo, "Ricordi," p. 394.

²⁰² ASF, Lettere varie, 6, f. 190r; ASF, Miscellanea repubblicana, 3, e. 98, f. 117r; Nicasi, "La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504," pp. 174-177, 178-179 and 188-189.

²⁰³ Nicasi, "La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504," pp. 179-182.

²⁰⁴ ASF, Consulte e pratiche, 65, ff. 85r-89v; Cerretani, *Storia fiorentina*, p. 263; Parenti, *Storia fiorentina*, II., pp. 290-293; Landucci, *Diario fiorentino*, p. 200.

magnates funded more than seventeen thousand florins. The Signori ordered to mobilize conscripts and to muster infantrymen. Moreover, the rulers imposed upon the captain to continue the siege, “averting ignominy” and “earning reputation.”²⁰⁵ The commander disagreed, and unwillingly conceived a new plan, “only to obey an order.” According to this scheme, the army should have attacked the north-western quarters of the city, hindering exchanges of goods and troops between Lucca and Pisa. Nonetheless, he was conscious that his extra demands for artillery, powder, and shot could be barely satisfied twice.²⁰⁶

In any case, the prompt disbursement let the army defend the encampment, maintaining the position in the ruins of Stampace, “which could be called Stamped, by now, because of the innumerable artillery hits it had suffered.” The bombardments were still continuing from both sides. Pisans had even aimed their “Bufalo” at the enemy casemate, with satisfactory results. Their gunners damaged cannons, destroyed wool shelters, and cracked beams, forcing the garrison to seek shelter from the return fire. On August 28th, the post was attacked as well, but the skirmish was not decisive.²⁰⁷

A more dangerous raid was carried out on the Florentine rear on August 31st. During a sortie, the rebel mounted crossbowmen captured an entire convoy nearby Cascina, depriving the adversaries of bread and wine, and affecting immediately the price of food. Similar ambushes multiplied in the following days. On September 4th, Pisan light cavalry managed to arrive to the encampment, quite undisturbed. Commissioners noticed that “Pisans are cockier than ever.” Florentines, on the contrary, “were abundant of nothing, except fear and hunger.”²⁰⁸

These hazardous circumstances led the captain and the governor to arrange a retreat. The Signori “felt offended” by this decision, considering “all the past procurement and all the future provisions.” They expected the commissioners to wait for reinforcements, money, and supply, “to the glory of the city.” The officers differed, above all, “about abandoning Stampace,

²⁰⁵ ASF, Signori, Missive seconda cancelleria, 21, ff. 86v-87r; ASF, Consulte e pratiche, 65, ff. 85r-94v, 96v-102v, and 109v-111r; Parenti, *Storia fiorentina*, II., pp. 291-292; Vaglianti, *Storia dei suoi tempi*, p. 85; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 193.

²⁰⁶ Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” pp. 191-192.

²⁰⁷ Anonymous, “La guerra del Millecinquecento,” pp. 377, 378, and 381; Portoveneri, “Memoriale,” p. 344.

²⁰⁸ Vaglianti, *Storia dei suoi tempi*, p. 82; Parenti, *Storia fiorentina*, II., pp. 293 and 297; Anonymous, “La guerra del Millecinquecento,” pp. 378-381; Portoveneri, “Memoriale,” p. 344; Nicasi, “La famiglia Vitelli di Città di Castello e la Repubblica Fiorentina fino al 1504,” p. 189.

because we have spent seventy thousand florins on putting a foot in Pisa, and we do not want to raise it without necessity." The condottieri, however, were not opened to suggestion. In spite of the severe reprimand, they would not have changed their minds, judging the aid "to be too late."²⁰⁹

On September 7th, "the Bufalo chased away the Vitelli." The army started to move backwards, marching along the river, and reaching the village of Vettola, two miles away from Pisa.²¹⁰ While departing, the "terrified" Florentines "left a huge quantity of munitions behind, that is, ladders, shot, carts, timber, tools, light guns, and even a culverin."²¹¹ Only part of the artillery could be safely transported to Cascina by land. The heaviest guns, instead, were hastily dismantled and shipped to Livorno. On the journey, however, a violent storm hit four overloaded boats, sinking them near the mouth of the Arno. Sailors and soldiers tried to hide the pieces under the sand, but the Pisan recovered them after a couple of days. The two bombards and the "famous" basilisk made a triumphal entrance in Pisa, along with iron cannonballs, pavises, spears, "so that our rebels can now offend our army with our weapons."²¹² The Signori commented laconically that "this expedition has been dogged by great misfortune." And, by some unlucky chance, even the Torre di Foce was lost, sold to Pisans by a disloyal guard.²¹³

On September 13th, Florentine troops withdrew further, stationing in San Savino. On the next days, the camp was definitively placed between Settimo and Cascina, and the ordnance shifted to Pontedera.²¹⁴ So, "in this way ended this expedition, even though we had relied on a potent force and a valorous captain, even though the rebels had been desperate and alone."²¹⁵

²⁰⁹ ASF, Signori, Missive seconda cancelleria, 21, ff. 93v-94v and 98r; ASF, Consulte e pratiche, 65, ff. 106r-111r.

²¹⁰ Anonymous, "La guerra del Millecinquecento," pp. 379; Portovenieri, "Memoriale," p. 344.

²¹¹ ASPI, Comune di Pisa, Divisione C, f. 274r; Bonaccorsi, *Diario*, p. 24; Portovenieri, "Memoriale," p. 345; Anonymous, "La guerra del Millecinquecento," p. 380.

²¹² ASF, Signori, Missive seconda cancelleria, 21, f. 102r; ASPI, Comune di Pisa, Divisione C, f. 274r; Landucci, *Diario fiorentino*, p. 201; Cerretani, *Storia fiorentina*, p. 263; Vaglianti, *Storia dei suoi tempi*, pp. 85-87; Bonaccorsi, *Diario*, p. 24; Parenti, *Storia fiorentina*, II., p. 297; Anonymous, "La guerra del Millecinquecento," p. 381; Portovenieri, "Memoriale," pp. 344, 348, and 349.

²¹³ ASF, Signori, Missive seconda cancelleria, 21, f. 102r; Parenti, *Storia fiorentina*, II., p. 297; Vaglianti, *Storia dei suoi tempi*, p. 87.

²¹⁴ ASF, Signori, Missive seconda cancelleria, 21, ff. 102r and 103r; Anonymous, "La guerra del Millecinquecento," pp. 381-382.

²¹⁵ Guicciardini, *Storia fiorentina*, p. 208.

A chronicler remarked that “Pisa was the tomb of the wealth, the honor, and the life of our Florentines, on account of the traitorous captain.”²¹⁶

Two weeks after this disastrous retreat, the Signoria secretly ordered to capture of Paolo Vitelli. The officers had in fact received several confirmations of his “infamy,” reported even by the general governor.²¹⁷ On September 28th, the “traitor” was arrested, and his correspondence impounded. Taken to Florence, the commander was immediately brought to trial. He was tortured into making an admission, but he denied all the allegations.²¹⁸ Thus, his opponents proposed a capital punishment for “recovering our lost honor.” His former supporters remained silent. The crowd shouted “hang him, hang him.”²¹⁹ Eventually, a council of citizens reaffirmed his disobedience, his “contempt,” and his “murders.”²²⁰

On October 1st, the Signoria, the Collegi, and Otto di Guardia found him guilty of treason and rebellion against the Republic.²²¹ According to the pleadings, he was charged with deliberately losing the siege, with retreating without the consent of the general commissioners, and with sinking part of the state artillery. Moreover, he had been prosecuted for trying to seize Cascina and Vico, in order to blackmail his masters, imposing on them a new contract and an unfair payment. Also the past accusations of idleness, incompetence, and disloyalty, made during the war in Casentino, were not forgotten nor forgiven.²²²

Therefore, Paolo Vitelli was summary beheaded on the roof of the public palace, in front of an expectant, joyful crowd.²²³ In the following days, the head of his infantrymen, Cherubino from Borgo a San Sepolcro, received a death sentence too. His chancellor, Cerbone Cerboni, was imprisoned. Both of them admitted that the captain had signed an agreement with the pope to give Pisa to Cesare Borgia, and Florence to Piero de’ Medici. According to their version,

²¹⁶ Parenti, *Storia fiorentina*, II., p. 299.

²¹⁷ ASF, Signori, Missive seconda cancelleria, 21, ff. 110v-111r and 112r.

²¹⁸ Cerretani, *Storia fiorentina*, pp. 264-265; Bonaccorsi, *Diario*, p. 25; Vaglianti, *Storia dei suoi tempi*, pp. 88 and 90; Guicciardini, *Storia fiorentina*, pp. 209-210; Nardi, *Istorie della città di Firenze*, p. 202; Parenti, *Storia fiorentina*, II., pp. 302-303; Nerli, *Commentari*, p. 137; Rinuccini, *Ricordi storici*, p. 144.

²¹⁹ Parenti, *Storia fiorentina*, II., pp. 303-305; Guicciardini, *Storia fiorentina*, p. 210.

²²⁰ ASF, Consulte e pratiche, 65, ff. 114v-117v and 154r-156r.

²²¹ ASF, Signori e collegi, Deliberazioni in forza di ordinaria autorità, 101, f. 89rv.

²²² ASF, Signori, Missive seconda cancelleria, 21, f. 112r; Nardi, *Istorie della città di Firenze*, pp. 200 and 204; Parenti, *Storia fiorentina*, II., p. 303.

²²³ Landucci, *Diario fiorentino*, p. 202; Masi, *Ricordanze*, pp. 45-46; Cerretani, *Storia fiorentina*, pp. 264-265; Vaglianti, *Storia dei suoi tempi*, p. 90; Cambi, “Istorie,” p. 144; Guicciardini, *Storia fiorentina*, p. 210; Parenti, *Storia fiorentina*, II., p. 305; Rinuccini, *Ricordi storici*, p. 144.

the captain had planned also to take control of Cortona and Borgo San Sepolcro, expanding his state and his power.²²⁴

In the capital, however, the public opinion was divided. Piero Parenti wrote that, “without confessing, the captain had saved our rulers from their faults,” and Piero Vaglianti noticed that several oligarchs had a part in his plot. Other compromising ties were underlined by Filippo de’ Nerli and Giovanni Cambi.²²⁵ Jacopo Nardi, Luca Landucci, and Bartolomeo Cerretani also accused the captain of being in collusion with the duke of Milan, deceiving Florentines again and again.²²⁶ Only Francesco Guicciardini tried to defend the former commander, but the “convincing evidence” of his innocence was a questionable matter of honor and reputation. The justification for the retreat after the capture of Stampace could have been easily interpreted as an incapacity to take an advantageous opportunity.²²⁷

If the defeated were not sure about his guilt, the winners would always have testified to the loyalty of the enemy leader. Pisans commented that he was “a victim of the rage of our adversaries.” His failure, besides, was “the results of our unexpected success.”²²⁸

Conclusions

Apart from his “rotten and greedy” behavior, Paolo Vitelli was not the only, truly responsible for the resounding defeat. According to a general commissioner, “several individuals wished the captain to fail, desiring only harm and disorder.”²²⁹ The divisions of the Florentine society into rival factions had undeniably slowed down the collection of money, and consequently the procurement of ammunition. Above all, the political maneuvers of the magnates and the long delays in war had fueled the suspicions of the common citizens. Disorders in the encampment were considered expedients for subversive activities, and the rout was even thought to be an

²²⁴ Vaglianti, *Storia dei suoi tempi*, pp. 90-91; Parenti, *Storia fiorentina*, II., pp. 306-307; Landucci, *Diario fiorentino*, p. 203; Nardi, *Istorie della città di Firenze*, pp. 204 and 206; Cambi, “Istorie,” p. 144.

²²⁵ Parenti, *Storia fiorentina*, II., pp. 303 and 306; Vaglianti, *Storia dei suoi tempi*, pp. 81-82 and 85-86; Nerli, *Commentari*, pp. 137-138

²²⁶ Nardi, *Istorie della città di Firenze*, pp. 198-200; Landucci, *Diario fiorentino*, p. 202; Cerretani, *Storia fiorentina*, p. 265.

²²⁷ Guicciardini, *Storia fiorentina*, pp. 211-214.

²²⁸ ASPI, Comune di Pisa, Divisione C, 25, f. 276r; Anonymous, “La guerra del Millecinquecento,” p. 382; Ser Perizolo, “Ricordi,” p. 394.

²²⁹ ASF, Consulte e pratiche, 65, f. 93v.

“achievement” of the oligarchs. In fact, “they cannot tolerate a victory of the people,” won without the misuse and the misconduct of the compromised Dieci di Balìa.²³⁰

As for them, the Signori did not accept the intrusion of aristocrats into military affairs. On the contrary, they supported the popular request to control expenses, to reduce an intolerable squandering, and to prevent the further enrichment of the wealthy.²³¹ Officials continuously reminded the commissioners of their financial straits, of the necessity to eke funds out.²³² And yet the Republic invested the considerable sum of two hundred thousand florins in the summer months.²³³ During the siege, forty thousand golden florins were disbursed for the soldiers only.²³⁴ From July 1st to August 31st, the overall cost of materiel amounted to more than four thousand golden florins, but they were not sufficient “to remedy for the shortage of missiles and gunpowder, the manufacture of which depends upon several factors.”²³⁵

The high consumption of propellant and the lack of metallic shot were probably another crucial aspect of the failure of the enterprise. Overconfident in his ordnance, the captain raised repeatedly this subject, but the Florentine Republic had not the actual possibility to manage an artillery warfare on such a large scale, and for such a long time. In the preceding campaign, the garrisons of Buti, Vico, and Librafratta had surrendered after a few hours. One year later, the defenders of Cascina had yielded in almost the same way. But the assault on a larger city, and the destruction of a thicker rampart, needed days of prolonged, incessant shelling.

Officers were not prepared for this eventuality. The propellant was constantly in short supply, and the fire was frequently intermittent. More than fifty tons of gunpowder went up in smoke during the four-week siege. The gunners consumed about fifteen tons of explosive more than the preceding year, and yet they were not enough.²³⁶ The Florentine masters worked incessantly through the whole summer, but they could not rely on a significant quantity of saltpeter for crafting the mixture. The purchases of the raw material were in fact

²³⁰ Nerli, *Commentari*, p. 138; Parenti, *Storia fiorentina*, II., pp. 284, 286, and 290.

²³¹ Parenti, *Storia fiorentina*, II., pp. 273, 275, and 281.

²³² ASF, Signori, Missive seconda cancelleria, 21, ff. 33v and 38v.

²³³ Parenti, *Storia fiorentina*, II., pp. 261 and 292; Vaglianti, *Storia dei suoi tempi*, p. 75.

²³⁴ Cerretani, *Storia fiorentina*, p. 262; Parenti, *Storia fiorentina*, II., p. 275; Landucci, *Diario fiorentino*, p. 198.

²³⁵ ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 33v; ASF, Signori, Missive seconda cancelleria, 21, f. 65v.

²³⁶ ASF, Dieci di ballìa, Entrate e uscite, 30, ff. 215v-216r; Signori, Missive seconda cancelleria, 21, f. 122r; Bonaccorsi, *Diario*, p. 24; Vaglianti, *Storia dei suoi tempi*, p. 76. See also *Supplying the army. 1498*.

discontinuous, and the state did not own any nitrary on its territory.²³⁷ Only in first years of the sixteenth century two public factories would have been opened in Arezzo and in Castrocaro, both entrusted to local masters.²³⁸

The logistic issue was worsened by the malfunction of the ironworks of Colle Val d'Elsa and Pistoia. The poor quality of metal, the partial incompetence of manpower, and the technological backwardness of furnaces determined an overall low productivity of missiles.²³⁹ According to officers and commanders, any shortage could have represented "a serious risk of defeat."²⁴⁰ When the army ran out even of bronze projectiles, the chance of victory decreased significantly. Without hundreds cast cannonballs, in fact, an effective saturation bombardment was impossible to perform.²⁴¹

At the beginning of the sixteenth century, in order to solve these problems, the Republic would have hired several alpine masters, following the contemporary example of the duke of Ferrara.²⁴² The furnace of Colle continued to function in the following years without interruption.²⁴³ Another workshop was built in Florence, in the foundry of the Sapienza. Here, several bellows, moved by an "ingenious device," allowed the production of hollow shells for incendiary missiles.²⁴⁴ In less than a decade, the Republic no longer suffered a shortage of missiles. According to contemporary registers, thousands and thousands of iron shot were fabricated in the dominion at that time.²⁴⁵ The bronze projectiles, instead, were never used again. The remaining seventy-four units were recycled into new cannons.²⁴⁶ The ones left under the Pisan walls were sold as precious souvenirs in Lucca.²⁴⁷

²³⁷ ASF, Signori, Missive seconda cancelleria, 21, f. 145v.

²³⁸ ASF, Dieci di balia, Munizioni, 9, f. 168v; ASF, Dieci di balia, Munizioni, 10, f. 20v; ASF, Dieci di balia, Debitori e creditori, 28, f. 40v.

²³⁹ Philippe Contamine, "Les industries de guerre dans la France de la Renaissance. L'exemple de l'artillerie," *Revue Historique* 221, no. 2 (1984), pp. 258-262; Calegari, "La mano sul cannone," in *Pratiche e linguaggi. Contributi a una storia della cultura tecnica e scientifica*, ed. Luciana Gatti (Pisa, 2005), pp. 65-66; Fabrizio Ansani, "Geografie della guerra nella Toscana del Rinascimento. Produzione di armi e circolazione dei pratici," *Archivio Storico Italiano* 651 (2017), pp. 100-101.

²⁴⁰ ASF, Signori, Missive seconda cancelleria, 21, ff. 61r, 63v, and 65rv.

²⁴¹ Contamine, "L'artillerie royale française à la veille des guerres d'Italie," *Annales de Bretagne* 71, no. 2 (1964), pp. 246-249.

²⁴² ASF, Signori e collegi, Condotte e stanziamenti, 17, f. 237v; ASF, Signori e collegi, Condotte e stanziamenti, 18, f. 125r; ASF, Signori, Missive seconda cancelleria, 22, f. 71r.

²⁴³ ASF, Otto di pratica, Munizioni, 2, f. 43v.

²⁴⁴ ASF, Dieci di balia, Munizioni, 10, ff. 41r e 66v.

²⁴⁵ *Ibid.*, ff. 67v, 76v-77r, 87v, 93r, 166r, 174v, and 187rv.

²⁴⁶ ASF, Dieci di balia, Munizioni, 8, ff. 188v-89r.

²⁴⁷ ASLU, Ufficio sopra l'entrate, 1, e. 2, ff. 48r, 55rv, and 63r.

With regard to ordnance, a third reason behind the Florentine defeat was the unexpected “aggressive defense” adopted by the rebels.²⁴⁸ The use of new cannons and “mad culverins” to shield a besieged post was in fact unprecedented, in the Peninsula. Compared with traditional spingards, these weapons could inflict an extensive damage among the enemy lines, wreaking havoc on soldiers and commanders, and impairing, above all, their own ordnance. The continuous counter-fire from the city had effectively hindered the attacks, contributing to slow down the entire operation. Thus, planned as rapid, the offensive lasted longer than expected, until the assailants retreated, decimated by malaria, and weakened by desertions.

Therefore, its first serious test highlighted strengths and weaknesses of French-style ordnance. Its performances were still impressive, compared to the customary, awkward bombards, but, against determined defenders and fortified cities, they were not astonishing “war-winning weapons.”²⁴⁹ Nevertheless, the complex procurement of ammunition would have compelled the Florentine Republic to develop and boost the manufacture of firearms, shot, and propellant, facing a “revolutionary challenge” in terms of administration, credit, and manufacture. Authorities should have arranged timely provisions for their troops, reorganizing the whole commodity chain, from the exploitation of natural resources to the distribution of weapons. Officers could not have improvised haphazard solutions to maintain and to deploy the new technology in an adequate manner. They rather had to combine appropriately the “government of artillery” with the “governance of production.”²⁵⁰

²⁴⁸ John Lynn, “The tracé italienne and the growth of armies: the French case,” *The Journal of Military History* 55, no. 3 (1991), p. 301; Michael Mallett, *Signori e mercenari. La guerra nell’Italia del Rinascimento* (Bologna, 2006), p. 169.

²⁴⁹ George Raudzens, “War-winning weapons. The measurement of technological determinism in military history,” *The Journal of Military History* 54, no. 4 (1990), pp. 407-410; Kelly DeVries, “Catapults are not atomic bombs. Towards a redefinition of ‘effectiveness’ in premodern military technology,” *War in History* 4, no. 4 (1997), pp. 464-470.

²⁵⁰ Frank Tallett and David Trim, “‘Then was then and now is now.’ An overview of change and continuity in late-medieval and early-modern warfare,” in *European Warfare, 1350-1750*, ed. Frank Tallett and David Trim (Cambridge, 2010), pp. 23-26; Enzo Baraldi, “Una nuova età del ferro: macchine e processi della siderurgia,” in *Il rinascimento italiano e l’Europa. Produzioni e tecniche*, ed. Philippe Braunstein and Luca Molà (Treviso, 2007), pp. 214-216; Walter Panciera, *Il governo delle artiglierie. Tecnologia bellica e istituzioni veneziane nel secondo Cinquecento* (Milan, 2005), pp. 213-216.



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