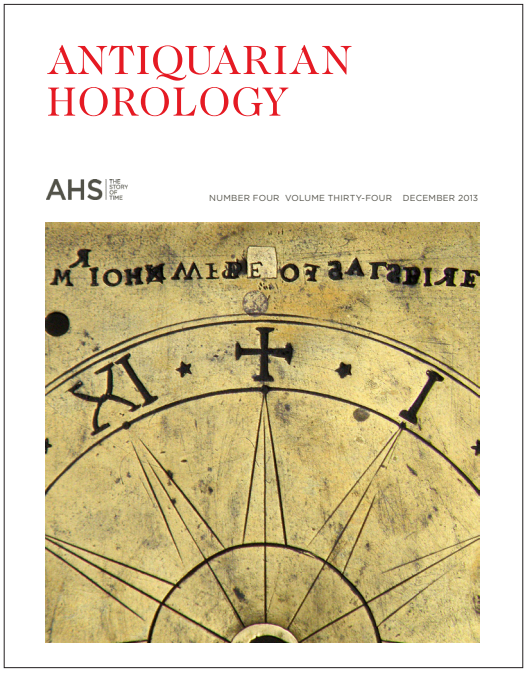
Victor Pérez Álvarez

Mechanical clocks in the medieval Castilian royal court

Antiquarian Horology, Volume 34, No. 4 (December 2013), pp. 489–502



Volume 34 No. 4 (December 2013) has 144 pages.

It contains the articles listed below, as well the regular sections Horological News, Book Reviews, AHS News, Letters to the Editor and Further Reading.

Mechanical clocks in the medieval Castilian royal court

Víctor Pérez Álvarez*

The mechanical clock came to the Iberian Peninsula in the first half of the fourteenth century, probably through the kingdom of Aragon because of its commercial and political connections with Italy. The presence of clocks in the medieval Aragonese royal court has been documented, but very little is known of their existence in the Castilian royal court because of the lack of sources. This article examines the history of the mechanical clock and the royal court of Castile from the late fourteenth century to the beginning of the sixteenth century, drawing on published and unpublished sources collected in various Spanish archives. The most fruitful document dates back to 1504 and contains detailed descriptions of three outstanding domestic clocks, which are given here in an English translation.

Introduction

In Spain there are internationally recognized specialists in the history of science and technology, but Spanish tradition in this area is not as intense as in the United Kingdom. Most medieval studies in this area have been focused on Islamic science and technology because of the strong influence of Islam on the medieval Iberian Peninsula. There is less interest in the history of mechanical clocks and timekeeping in Spain. There are no societies like the English Antiquarian Horological Society or the Italian HORA, nor are there clock collections like those of the British Museum or the London Science Museum, except for the royal collection, which is owned by the Spanish Crown and administered by Patrimonio Nacional (National Heritage). But because of fires in royal palaces, most of the pieces date only from the eighteenth century onwards and they are distributed across various locations. The oldest piece in this collection is a table clock made in 1583 for Felipe II by Juan de Evalo, his chamber clockmaker. It is the only piece dating back to the sixteenth century.[1]

Spanish historiography of mechanical clocks begins at the end of the nineteenth century with Cesareo Fernández Duro, who found very few medieval references, none of them related to the royal court.[2] From the mid-1950s to the early 1990s there was renewed interest in historical horology headed by Luis Montañés Fontenla. He and his followers were more interested in existing antique pieces than in historical documents from archives. They researched into the royal collection but found very few medieval facts to add to those from Fernández Duro and no medieval studies

The author (vpamm@yahoo.es) is currently preparing a doctoral thesis on medieval Castilian horology in the Department of Ancient and Medieval History at the University of Valladolid. He studies the spread and the use of the mechanical clock until the mid-sixteenth century, combining social history with the history of technology.

1. J. R. Colón de Carvajal, *Catalogo de relojes del patrimonio nacional* (Madrid: Patrimonio Nacional, 1987).

2. C. Fernández Duro, *Disquisiciones náuticas,* vol. IV (Madrid: Imprenta, estereotipia y galvanoplastia de Aribau y Compañia, 1879), pp. 83–107. Captain Fernández Duro served in the Spanish navy and wrote an extensive book in six volumes about navigation. The studies on clocks and time measurement are in the chapter entitled 'Cronometría'in the fourth volume.

Fig. 1. Map showing the regions and towns mentioned in this article.

into Castilian horology of any relevance were published. Because of the abundance of sources in the Kingdom of Aragon, in the first half of the twentieth century some well-known documents were reported from this area. One is the account book on the construction of the tower clock for the castle of Perpignan. This exceptional document was known since the 1930s,[3] but was only fully published in 1982.[4] The fact that it was done by an English expert is very significant. Over recent decades Amelia Aranda Huete has continued the research into Spanish horology, focusing on jewelry and the clocks of Patrimonio Nacional.[5] This is only a broad outline of the state of the art in Spain. There is very little interest in this subject and most work is centered on outstanding pieces from the eighteenth and nineteenth centuries. The lack of studies into medieval Castilian horology and the need for comprehensive research has motivated me to prepare a thesis on this subject. It will be based on a wide range

3. Ll. Camós Cabruja, 'Dietari de l'obra del rellotge i la campana del castell de Perpinyà l'any 1356', *Homentage a Antoni Rubió i Lluch,* vol. III (Barcelona, 1936), pp. 423–446.

4. C. F. C. Beeson, *Perpignan 1356. The Making of a Tower Clock and Bell for the King´s Castle* (London: The Antiquarian Horological Society, 1982).

5. A. Aranda Huete, 'El reloj, símbolo de poder social en la Europa Humanista', in M. Cabañas Bravo, A. López Yarto, W. Rincón García (eds.), *Arte, Poder y Sociedad en la España de Los Siglos XV a XX* (Madrid: CSIC, 2008), pp. 153–167; A. Aranda Huete, 'El coleccionismo de relojes en el reinado de Carlos IV y María Luisa de Parma', *Revista de Museología*, 36 (2006), 105–111; A. Aranda Huete, 'Los relojes del reinado de Fernando VI y Bárbara de Braganza', *Reales Sitios: Revista del Patrimonio Nacional*, 181, (2009), pp. 60–76.

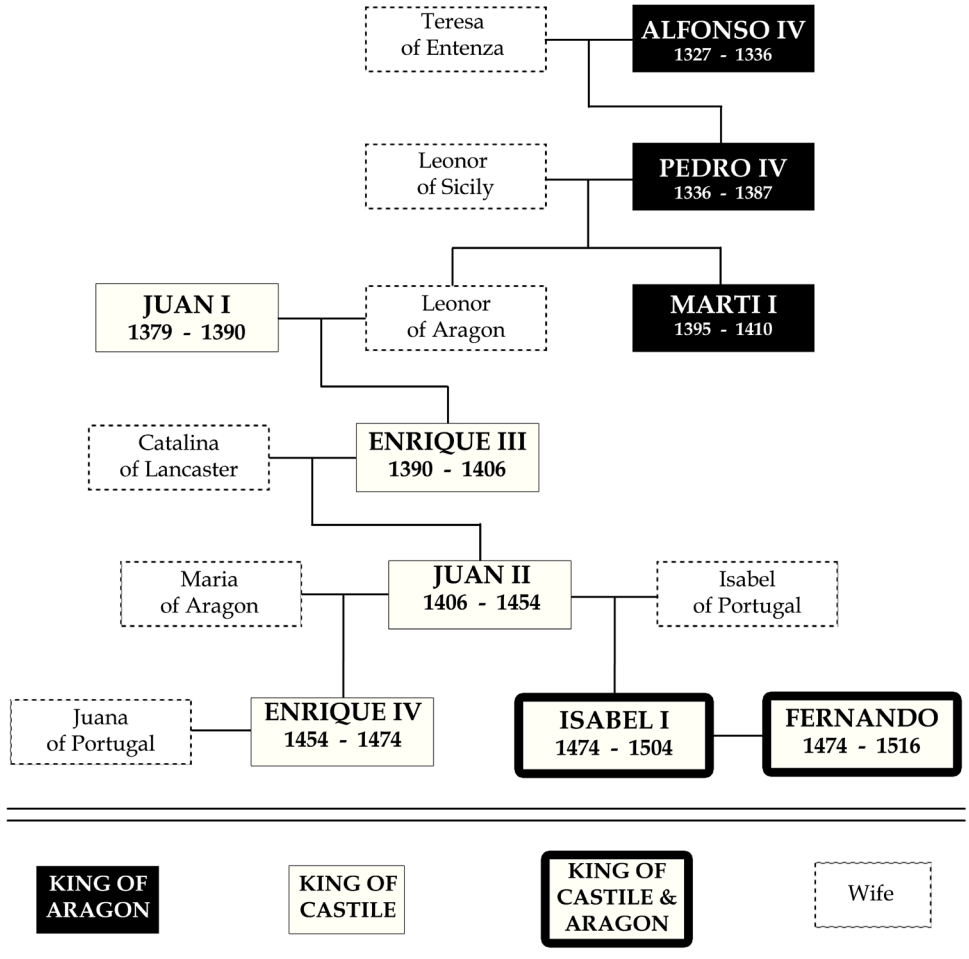


Fig. 2. Family tree of the rulers discussed in this article, with the periods of their reign.

of published and unpublished documents from the end of the fourteenth to the mid sixteenth centuries. Many of the published sources are unknown to historians of horology and have never been used for this purpose. This paper is just a preview of one of the chapters of my thesis.

The first clocks in Spain

The earliest evidence for the existence of mechanical clocks in the Iberian Peninsula comes from the documents of the Archivo de la Corona de Aragón. In 1332, Fermin, a master clockmaker, built a clock for Alfonso IV (1327–1336).[6] He may be the same Bernardo Fermin, *magistri dels alarotges*, who receives payment twenty years later.[7] King Pedro IV (1336–1387) was particularly interested in clocks and astronomical instruments. There are several documents from his time about his collection of astrolabes, atlases and clocks, some of them concerning the clockmakers and clock-keepers who looked after his instruments. During his long reign mechanical clocks became a commonly seen object in the

6. E. Junyent, 'Pórtico Erudito', in Luís Montañés (ed.), *Cuadernos de Relojería*, (Madrid-Valencia: Albatros, 1982), pp. 61–62. I have been unable to locate this document.

7. ACA, Reg. 669, fol. 179v. A. Rubió i Lluch, *Documents per l'historia de la cultura catalana migeval*, vol. I (Barcelona: Casa de Caritat, 1921), pp. 96–97.

royal court of Aragon.[8] He used them at least twice as diplomatic gifts and he commissioned the construction of the tower clock for his palace-castle at Perpignan in 1356, the first known in the Iberian Peninsula. The existence of clocks in the royal court is also well documented at the time of his successors.[9]

Aragon, influenced by Italy, developed a royal administration very soon. As there was strong consciousness of the need for filing documents, a royal archive was created in Barcelona in 1318 for keeping the documents produced by the royal administration. This is known nowadays as the Archivo de la Corona de Aragon, which contains one of the richest documental collections in Europe from the late Middle Ages. On the other hand, after unsuccessful attempts in the fifteenth century, the central archive of Castile was created only in 1540 by Emperor Carlos V in Simancas.[10] As a result, there are very few medieval documents in Simancas. In spite of this serious lack of sources there is some evidence of mechanical clocks not only in Simancas but also in other archives. Before the invention of the foliot escapement, there are some testimonies on the use and construction of clepsydrae from the Islamic and Hellenistic tradition. One of them is the *Libros del Saber de Astronomia* ('Books of knowledge of astronomy'), a famous encyclopædic treatise compiled in 1276–77 and directed by Alfonso X el Sabio ('the Wise', 1221–1284).[11] It contains a very detailed description of two sundials, a candle clock and two clepsydrae. The description of one of the clepsydrae and the instructions on how it works and how it should be kept are very practical, so it seems that this clepsydra existed. As Alfonso el Sabio was very interested in science, this treatise may be the first factual reference on the use of clock devices in the Castilian royal court. This treatise has been used as *terminus post quem* for dating the invention of the mechanical clock because of the absence of a foliot escapement. During the next decades the mechanical clock appeared in England and in Italy, but we know of none in Castile until 1366, when a silversmith constructed the first clock for the cathedral of Toledo.[13] This fact was first published by Sixto Ramón Parro, a Toledean canon from the mid-nineteenth century, who wrote a guide to the cathedral. He used the archive but when one checks the documents that he used, many mistakes are discovered. As we have not found the source used by Parro, perhaps because it is now lost, this information is not completely reliable, because it does not seem plausible that a silversmith built a tower clock. It could be a smaller, chamber clock or the clockmaker may not have been a silversmith. On the other hand, the cathedral of Toledo was the richest in Castile and its archbishops were the most powerful in Spain, so the date 1366 could be correct for the first Castilian tower clock. The next recorded were built in Salamanca in 1378,[14] in Seville in 1380,[15] and in Burgos in 1386.[16]

8. Beeson, *Perpignan 1356*, pp. 1–8.

9. Junyent, 'Pórtico'; J. Vielliard, 'Horloges et horlogers catalans a la fin du Moyen Âge', *Bulletin Hispanique*, 3–4, (1961), 161–168.

10. A. de la Plaza Bores, *Guía del investigador* (Madrid: Subdirección General de Archivos, 1980), p. 23.

11. S. A. Bedini, 'The compartmented cylindrical clepsydra', *Technology and culture*, 2 (1962), 116.

12. H. A. Lloyd, *Some outstanding clocks over seven hundred years 1250–1950* (Woodbridge, Suffolk: Antique Collectors' Club, 1981), pp. 5–6.

13. S. Ramón Parro, *Toledo en la mano.* Tomo I (Toledo: Severiano López Fando, 1857), p. 72.

14. M. Gómez Moreno, *Catálogo monumental de España: provincia de Salamanca. Texto* (Salamanca: Caja Duero, 2005), p. 149.

15. J. Suberbiola Martínez, 'La introducción del reloj mecánico en Málaga y Granada (1491–1492)', *Baetica. Estudios de arte, geografía e historia*, 29, (2007), pp. 293–302.

16. M. Rico Santamaría, *La catedral de Burgos patrimonio del mundo* (Vitoria: Heracio Fournier S.A., 1985), pp. 140–141.

A clock for a Castilian princess

Clocks were also used in the mid-fourteenth century by Pedro IV of Aragon, but we have hardly any facts about them in the Castilian royal court from this time because of the lack of documents. The oldest known reference to a clock is in a letter dated 6 February 1376 written by Pedro IV to one of his daughters. Although her letter does not survive, we know from the King's letter that she had asked among others for Dolceta, perhaps a maid from the court of Pedro IV, and that she had shown interest in having a clock. The King explains that cannot send Dolceta, because her mother wouldn't allow her to travel outside the kingdom. But he did send her a clock, which he described in detail. It was a small alarm clock with three bells and an astrolabe dial showing the zodiac, sun, moon and fixed stars and with plates adjustable for any latitude in the Kingdom of Aragon.[17]

The letter doesn't specify the name of the daughter. Vielliard stated without evidence that it was Joana, and Beeson reiterated this.[18] However, this is not correct. Pedro IV had two daughters living at this time: Joana, married to the Count of Ampurias, and Leonor, married in 1375 to Juan, the crown prince of Castile. As the King says that he is unable to send Dolceta to a foreign country, the addressee cannot have been Joana, who as the Countess of Ampurias lived in Castellon de Ampurias in Aragón. This means the recipient of the clock was Leonor, who was married to the crown prince and lived in Castile.

Why did Leonor want it? Did she miss the mechanical clocks of her father? Was it difficult to get one in Castile at that time? We think that the mechanical clock may have arrived in the royal house of Castile one or two decades before 1376 because its presence is well documented in Aragon, France or Italy, the surrounding areas with which Castile had political or commercial connections. In 1375 the kings of Aragon and Castile ended their hostilities in the peace agreement of Almazan, a village near the frontier. They also arranged the wedding between Leonor and Juan as a symbol of peace between both kingdoms. In this context the mechanical clock for Leonor can be considered a diplomatic gift. As it was a complicated astronomical machine, Pedro IV may have intended to amaze the Castilian Royal Family. Since the clepsydra given by Harum al-Rashid to Charlemagne,[19] clocks and astronomical instruments and complex machines have been used for diplomatic purposes. Pedro IV gave another clock to his granddaughter Mary, Queen of Sicily, and his successor Juan I sent a quadrant to the Count of Foix.[20]

Another gift of a clock

After the gift to Leonor the next fact we have from Castile is another gift of a clock from Martí I of Aragon to Enrique III of Castile (1390–1406), his nephew, on 20 February 1403.[21] The Aragonese king writes: 'We send you a good working clock that will show you the hours all day and night long.' Neither an astronomical face nor complicated mechanisms are mentioned, so it could be a plain mechanical clock with a simple face plate and a bell on its top. Martí I emphasizes that it is intended to be used as a timeteller, in contrast to the complicated astronomical clock given to Leonor by Pedro IV. Anyway, both documents show clocks used as a gift in an early period of clockmaking history.

17. The King´s letter is ACA, Reg. 1093, fol. 74rº. This brief description of the clock is quoted from C. F. C. Beeson, 'Perpignan 1356 and the earliest clocks', *Antiquarian Horology* Vol. 6 (June 1970), 408-414; p. 408. For a more detailed description, see Beeson, *Perpignan 1356*, p.6.

18. Vielliard, 'Horloges', p. 165; Beeson, *Perpignan 1356*, p. 5.

19. D. S. Landes, *Revolution in time. Clocks and the Making of the Modern World* (Cambridge, Massachusetts, London: The Belknap Press of Harvard University Press, 1983), p. 24.

20. ACA, Reg. 1961, fol. 2rº, published in A. Rubió i Lluch, *Documents …* vol. II, p. 79–80, n LXXIX.

21. ACA, Reg. 2245, fol. 100rº. Junyent, 'Pórtico', pp. 63 cites the document with no reference, but we have located it in the ACA.

Clocks used to determine the speed of communication

We know that in 1405 Enrique III of Castile used clocks to measure time for an interesting and unusual purpose. He was married to Catalina of Lancaster, and in this year she was pregnant for the third time, after having given birth to two daughters. The King was ill and weakening, and Fernando of Antequera, an influential member of the royal family, intended to take the crown of Castile. Enrique III was very concerned about his succession and hoped for a son. Before the expected date of the birth he was in Segovia and his wife in Toro, about 155 kilometers away, but he desired to know the gender of the baby as soon as possible. For that purpose, he designed a line of fire and smoke signals between both cities, like an optical telegraph. On 4 March he ordered a trial to see how long it would take the message to arrive:

> I have ordered here, in Segovia, two smoke signals on Saturday night at two hours after midnight on the clock here and [...] they will be made on the stops until they arrive in Toro, so you must be on guard [in Toro] from two o'clock [onwards] to see the smoke signals. They must be very careful to know how long it took to arrive there after the two hours [2 o´clock] and after that, tell me as soon as possible in how many hours I will know the news [from Toro].[22]

The trial was to be in the reverse direction, from Segovia to Toro, and the first fire signal in Segovia should be made at two o´clock at night. The clock may have been in the royal court, or it may have been the public clock of the city. Once again, because of a lack of sources, we don´t know anything about the existence of public clocks in Segovia at this time, but both possibilities are plausible. A clockkeeper was working on the public clock of the main church of Toro in 1408,[23] so its existence three years earlier is probable. The letter about the smoke and fire signals is the oldest one we know issued by the chancery of the King of Castile which associates a clock with the royal court. It is not very accurate about where it was, or what it was like, but it shows that this instrument was known and familiar, and that it was used as a time measurer at least for specific purposes.

This document is very interesting for two reasons. The first is that it shows the necessity of coordinating two different clocks in distant places without visual and aural communication. The difference of longitude between Toro and Segovia is not relevant because the best instruments available at that time for time measuring, such as the astrolabe, were not accurate enough; but this problem appears at that time and the clockkeepers in both cities probably were asked to do their best. Secondly, at the end of the fourteenth century and the beginning of the fifteenth, the general introduction of the mechanical clock in areas such as Italy or the Teutonic Order territories changed the measuring unit of the time it took for 'urgent mail' to arrive from days to hours. It occurred only for military or political messages.[24] The letter from Enrique III shows the same phenomenon in Castile at the same time, with the addition that the smoke and fire signals would allow sending the message without any form of physical transport, thus the speed could be increased.

Juan II and Enrique IV

In the first decades of the fifteenth century the mechanical clock became more usual as an urban accessory, not only in the largest cities, but also in large towns and regional capitals such as Toro, Cuellar, Paredes de Nava or Villalpando. But we have very few facts on its use in the royal court until the time of the Catholic monarchs, which we will discuss later.

22. AHN, Diversos, Colecciones, Leg. 287, nº 18.

23. Archivo Diocesano de Zamora, Archivos Parroquiales, Toro, 227.1, leg. 119, nº 1.

24. G. Dohrn van Rossum, *History of the hour. Clocks and modern temporal orders* (Chicago: The University of Chicago Press, 1996), p. 331.

Juan II (1406–1454), Enrique III's son and successor, had a gold ring in his chamber with a *relox*, its description is from an account book of the years 1453–1454:

> A gold ring with a *relox* inside it, like a lion's head with a ruby in its mouth and with two small emeralds as eyes.[25]

The Spanish word *reloj* and its ancient forms *relox*, *relojo*, *relogio*, etc. refer to any instrument for time keeping such as a mechanical clock, a clepsydra, any kind of a sundial or even a hand bell. We haven´t translated the word in this quote because there is an interpretation problem. In the fifteenth century the most usual meaning of *relox* is 'mechanical clock', but in this context a small sundial seems more feasible than a mechanical instrument because of the small size of the ring.

We don´t know more about his horological interests, but we can also cite a document which has a vague relationship with the royal court. It is a payment dated 27 April 1442 of eleven thousand maravedis in an account book of Leon cathedral for the purchase of a clock. The person who receives the payment is Claus, and the document specifies he is 'King craftsman'.[26] This doesn't necessarily mean that he worked for the king, it may mean that he was tax-exempt according to any privilege awarded by the king to the cathedral. His name suggests that he is from central Europe, perhaps Flanders, Germany or France. The document doesn't specify his profession, so we can't state whether he was a clockmaker or not, and whether he had some relationship with the royal court or not. We don´t know what kind of clock he sold to the cathedral; the document doesn´t use the verbs 'to make' or 'to construct', but 'to buy' and this is unusual for tower clocks. Maybe it was a second-hand clockwork device or maybe a small domestic one. Eleven thousand maravedis is a large enough sum for either of these.

Juan II was succeeded by his son Enrique IV (1454–1474), but despite there being more documents about his royal house, we have only two plain horological facts. The first is the gift of a *relox de aguja* to his wife, Juana of Portugal. It was purchased in February 1462 in Valladolid from a merchant named Ubert and cost sixty maravedis.[27] In horology an *aguja* is the hour hand on the dial, but sixty maravedis is too small a sum for a mechanical clock. An *aguja* in Spanish is also a long piece of metal or other material, so it can be interpreted as a gnomon and the *relox* as a sundial. The merchant doesn´t seem to be Castilian to judge by his name. The other fact we know from the time of Enrique IV is a collection of records on royal tax auctions. In an auction conducted in Écija on 10 February 1464 in the king´s houses, Sancho de Cota wished to bid for a tax on the last day of the auction deadline. He asked for a meeting with the king, but it was too late and he was going to bed, so Sancho de Cota waited by his bedroom door. The document says: 'After that [the bid], in the said city [Écija], it could be between eleven and twelve on the clock.'[28] The clock may have been a public one in Écija or perhaps a chamber clock for private use in the Court. Either way, this document shows the clock

25. AGS, CMC, 1ª época, leg. 84. Quoted in: F. P. Cañas Gálvez, 'La cámara de Juan II: Vida privada, ceremonia y lujo en la Corte de Castilla a mediados del siglo XV', in A. Gambra Gutiérrez, F. Labrador Arroyo, (eds.), *Evolución y estructura de la casa real de Castilla* (Madrid: Polifemo, 2012), p. 167.

26. ACL, Nº 9802, fol. 54vº. Summarized in: V. A. Álvarez Palenzuela, *Colección documental del Archivo de la Catedral de León. Actas Capitulares II (1419–1459)*. (León: Centro de Estudios e Investigación 'San Isidoro', Caja España de Inversiones, Archivo Histórico Diocesano, 2006), pp. 489–90.

27. AGS, CySR, leg. 97, fol. 236rº. Quoted in F. P. Cañas Gálvez, 'Las casa de Isabel y Juana de Portugal, Reinas de Castilla. Organización, dinámica institucional y prosopografía (1447–1496)', in J. Martínez Millán, Mª P. Marçal Lourenço (eds.), *Las relaciones discretas entre las monarquías hispana y portuguesa: Las casas de las reinas (siglos XV–XIX),* vol. 1 (Madrid: Polifemo, 2008), p. 138. My thanks to Diana Pelaz Flores for helping to find this document.

28. AGS, E.M.R., leg. 12, fol. 81–83.

Fig. 3. Portraits of Isabel and Fernando on the façade of Salamanca University. The relief was made around 1534, after their death. Photograph by the author.

as a practical object used just for timekeeping and with an important role in emphasizing that the bid had been made legally, within the stipulated period.

The clocks of Queen Isabel of Castile

This is everything we know on horology at the time of Enrique IV. Unfortunately, the lack of sources, especially of post-mortem inventories of all the kings cited up until this point, compelled us to look for indirect sources which show just a few details. But this changes from Isabel (1474–1504) onwards, the successor of Enrique IV. She was married to Fernando of Aragon and together they established the modern state in Spain (Fig. 3). The reign of Isabel I and Fernando V is considered the end of the medieval period and the first in modern Castile and Aragon. After their death, both crowns were joined in the same king. During their time the activity of the royal administration increased and more documents were produced, so we have more sources from this period.

Isabel was crowned Queen of Castile in 1474 but the earliest documents of clocks from her reign are in an account book dating back to 1483. There we find two sandglasses which cost 8 reals and two

payments to a silversmith, the first is for 3750 maravedis 'for gilding a clock', the second is in respect of various items and services, two of them related to a clock, maybe the abovementioned one.[29] Both payments are for a certain quantity of silver for a clock and for its craftsmanship. These documents are so ambiguous that we can´t establish what kind of clocks they were, or how many.

In December 1503 the Queen orders a payment of 25 ducats for a golden clock purchased from 'Lobo Frances'.[30] In the previous account book a payment of 5 ducats is also documented in the same year 'for the French clockmaker', without citing his name, but he could also be Lobo.[31] Was he a royal clockkeeper? One year earlier, 'a garnished box for the golden clock' was paid for, which perhaps was the same one purchased from Lobo Frances; this would mean that the Queen was in arrears in payment.

The Queen died in November 1504 and immediately after that the inventory of all her personal belongings was drawn up, which were located in her various royal residences.[33] This extensive document shows her vast fortune in jewels, clothes, furniture and other items and enumerates all her belongings with such detailed descriptions that we can consider it the richest document on horology in the medieval Castilian royal court. At least three of the mechanical clocks had outstanding automatons and other elements. The extended descriptions are given in full in English translation in the appendix.

The first one is an iron clock with six bells struck by six jacks.[34] It has two levels with six doors, of which five on the first level and two on the second level open. The description doesn´t specify its function or what they hold, but as they are twelve they could be related to the hours reckoned. The description mentions six elements on the upper level doors that can be removed from the clock to be placed at the feet of the jacks. Interpretation seems difficult; they were perhaps part of the striking mechanism. No clock face is mentioned. The description is too sparing regarding the movement, we can only deduce from it that the clock was weight driven, with four weights, four small weights that were probably counterweights and two small lead ones. The clock had four wood pieces for its installation and a wood case with a broken piece maybe for storage or for transport. The broken piece of the case and the doors that do not open lead us to believe that the clock was old and not in good working condition at the time when the inventory was compiled.

The second clock was silvered and had the shape of an *arquilla*, which in Spanish could mean a small boat, a small chest or a small coffin.[35] We think that the scribe intended a small chest, because it had six sides. The clock exhibited the coat of the royal arms, a bundle of arrows, which is Queen Isabel's emblem, and an unknown inscription. The arrows were given by Fernando to Isabel as her emblem at their wedding, so this dates the clock from 1469 onwards unless if it was added latter. The inventory doesn´t mention the Fernando emblem, so it was probably intended for use by the queen. The clock had a face and a small copper bell struck by two automatons, as time indicators. Once again

29. Antonio de la Torre, E. A. de la Torre (eds.), *Cuentas de Gonzalo de Baeza tesorero de Isabel la Católica. Vol. 1, 1477–1491* (Madrid: Consejo Superior de Investigaciones Científicas, 1955), p. 21.

30. AGS, CSR, leg. 2, fol. 368. He signs as *Louet Francoys*.

31. Antonio de la Torre, E. A. de la Torre (eds.), *Cuentas*, vol. 2, p. 581.

32. AGS, CSR, leg. 2, fol. 523.

33. AGS, CMC, 1ª época, leg. 81; A. de la Torre y del Cerro, *Testamentaría de Isabel La Católica* (Barcelona: Vda. Fidel Rodríguez Ferrán, 1974).

34. AGS, CMC, 1ª época, leg. 81, fol. 117v.; *Testamentaría,* p. 251.

35. AGS, CMC, 1ª época, leg. 81, fol. 117r. ; *Testamentaría,* p. 255.

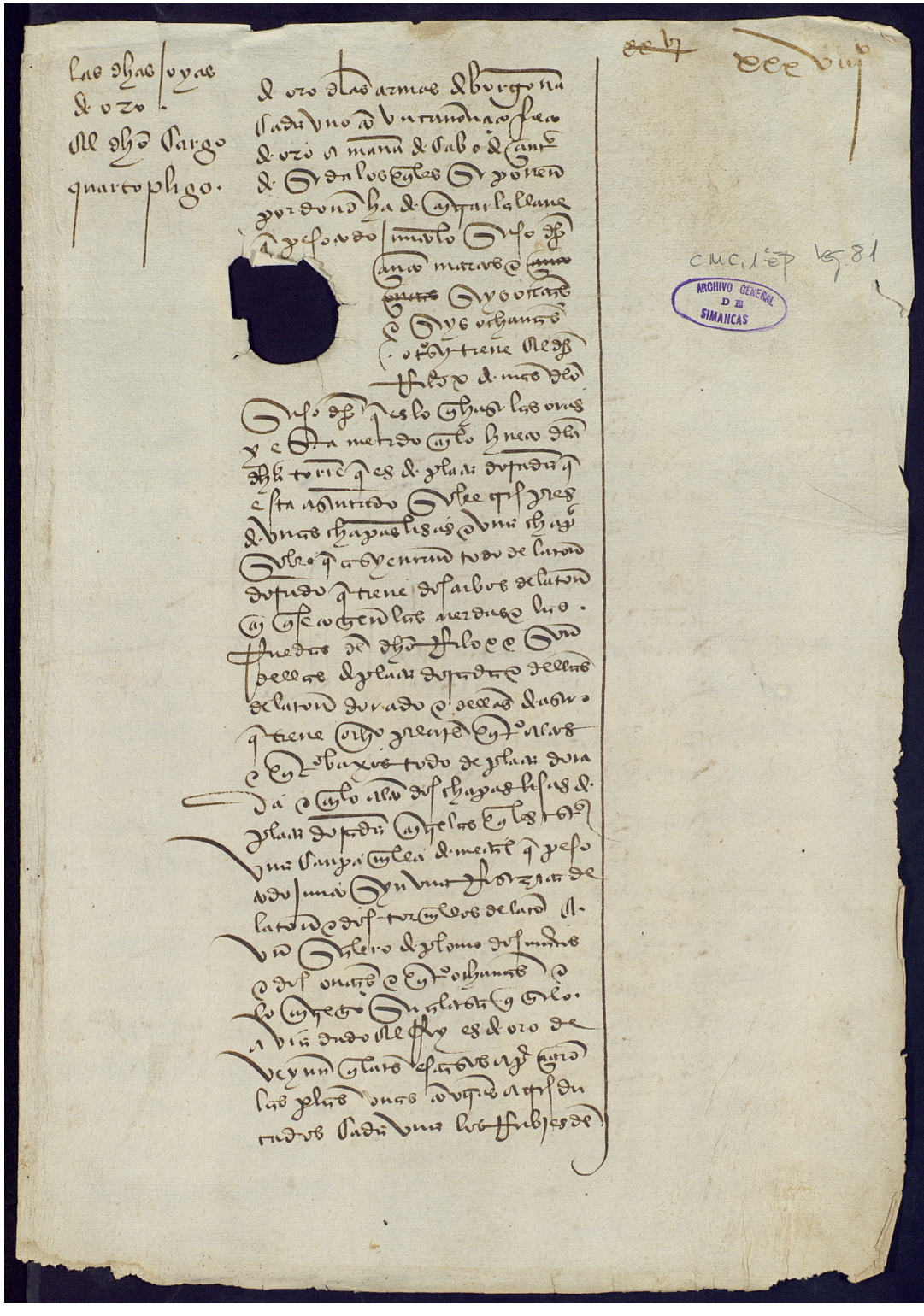


Fig. 4. Part of the description of the golden clock in the shape of a tower in the inventory drawn up after the death of Queen Isabel in 1504. Spain, Ministerio de Cultura. Archivo General de Simancas, CMC, 1ª época, leg. 81, pl. 38rº. For comment see note 36. For a complete translation see Appendix III.

the description of the clockwork is too sparing; it allows us to know that the wheels were made of iron. It was perhaps spring driven, as weights are not mentioned but ropes whose function could have been to connect the spring barrels with the fusees. The clock had its own leather case. It was sold to Pedro de Ayala, a silversmith.

The third of the outstanding clocks owned by Isabel of Castile is exceptionally well described (Fig. 4) with such an abundance of detail that its structure and its most noteworthy elements can be reconstructed in spite of some problems.[36] This golden clock is the richest one in the inventory; it was garnished with many rubies and pearls, and had some pierced panels and some statuettes. The description makes it clear that it was hexagonal tower shaped, but raises some problems with two groups of pillars and a second spire whose function remains unclear. We interpret it in the following way, at the risk of being mistaken. The clock had two floors, the first one had six twisted pillars with statuettes between them, the second floor had a battlements parapet over tracery panels and six round pillars to hold up a hexagonal, pierced spire. We don't know where the second spire was placed. The clockwork was placed inside of the tower and according to the description it seemed simpler than the mechanisms of the two other clocks. It had only two brass barrels for the ropes, and some wheels were made from gilded brass, some of them gilded silver and others were steel; probably they were visible and were part of the clock aesthetics. It had a bell as an acoustic indicator and a statuette of a man with a stick in his hand inside of the clock structure to show the hours on a dial. The figure of the man could be taken out of the clock. This outstanding piece was a gift from Felipe 'El Hermoso', Duke of Burgundy, to Queen Isabel.[37] According to the description, the clock had two symbols of the Burgundian ducal family. One of them was the pair of golden coats of arms next to the winding holes. The other one was the fire striker placed on the top of the spire.[38] The absence of the arms of Castile and the emblem of Isabel suggest that the clock wasn´t specifically constructed for that purpose. After the Queen´s death Felipe 'el hermoso' gave it to Juan of Luxembourg, Mosior de Villa.

There are more clocks in the inventory of Queen Isabel, but they aren´t well described and we can´t be sure they were mechanical. One of them is a non-working hexagonal clock which was sold to a clockmaker for 136 maravedis, a low price, perhaps because its poor condition. There is an iron clock found inside a trunk, which was sold for two ducats. We think it could be mechanical because it was made of iron and its relatively high price, but it is only a hypothesis. There was also a non–valued 'small golden clock',[39] maybe mechanical, which is the only one that could be the

36. AGS, CMC, 1ª época, leg. 81, fol. 37v–38v.; *Testamentaría,* pp. 86–87. Comment on Fig. 4: Transcription: Left margin: Las dichas joyas de oro al dicho cargo. Quarto pliego. / Right margin: xxxviii / Text: ... de oro de las armas de Borgoña/ cada vno con vn cañonçico fecho/ de oro a manera de cabo de çinta/ de seda los quales se ponen/ por donde ha de entrar la llaue/ que peso todo junto lo susodicho/ çinco marcos e seys ochauas ... // Translation: Left margin: The said golden ornaments in the said charge [Note: this refers to the group of ornaments in which the clock is included.] Fourth sheet. / Right margin: (Sheet) xxxviii. / Text: ... two coats with the arms of Burgundy, each one has a small golden cannon as the ends of a silk ribbon, which are in the place where the key is inserted (into the clock). Everything weighed five marks, six ounces and six eighths ...

37. Philip 'the Fair', who in 1496 married Johanna 'the Mad', daughter of the Catholic monarchs. As his wife inherited the crown of Castile, he became King of Castile but for a very short period because of his premature death.

38. R. Domínguez Casas, *Arte y etiqueta de los Reyes Católicos* (Madrid: Alpuerto, 1993), p. 680. The fire striker was chosen by Philip 'the Good' as his emblem around 1419. It was inherited by his successors and was also used for the necklace of the Order of the Golden Fleece, established by him.

39. *Vn rrelogico chequito de oro.*

clock purchased in 1503 from Lobo Frances.

Most of the Queen's valuable belongings were sold or were given to other people as diplomatic gifts, and this also goes for the three main clocks.

Conclusion

The oldest document which proves the existence of a mechanical clock in the kingdom of Castile dates back to 1376. Its earlier existence in areas politically or commercially linked with Castile leads us to believe that it could have been introduced into the royal court some decades earlier. The probable existence of a tower clock in Toledo in 1366 and one in Salamanca in 1378 suggests the same thing. But it is just a hypothesis that we can´t prove unless new unknown evidence is discovered. In the first decades of the fifteenth century many small Castilian towns constructed their first public clocks, thus it is unlikely not to have been a common instrument in the royal court.

The mechanical clock changed the way of dividing the day and its use as an instrument for timekeeping is shown in two of the documents that we have used for this paper. The letter about the smoke and fire signals is exceptional because of its content and shows the role of the mechanical clock in an uncommon situation which relates space to time. As we have seen, there are some parallel situations in the European context of that time. It was then used as a time instrument some decades later to state the deadline of the royal tax auctions. Here the time signal guaranteed the legality and validity of the auction. Nowadays, a clock is just an instrument for timekeeping, and both documents show the mechanical clock in the fifteenth century in this modern conception; but in the Middle Ages it was also intended for astrological purposes. This use was inherited from the clepsydrae and other astronomical instruments and is apparent at the royal court of Alfonso X el Sabio.[40] This use is also implicitly suggested by Pedro IV in the letter about the astronomical clock sent to Leonor in 1376.

Clocks in the Middle Ages were overall prestige elements, of great wonder to those who saw them. Outstanding chamber clocks made with gold and gemstones, with automatons or with complicated carillons all played this role and were frequently used as diplomatic gifts. But men were astonished by self-moving machines many centuries before the mechanical clock was invented; the clepsydra given by Harum ar-Rashid to Charlemagne in the ninth century or the automatons around the thrones of the Byzantine emperor and the Caliph of Bagdad in the tenth are well known examples.[41] All of them praise the political power of the rulers and show their desire to have the most advanced technology for this symbolic purpose. The mechanical clock inherited this role from the clepsydrae and automatons of the Hellenistic tradition, as we have seen with the ones of Leonor and Isabel.

40. We can find some examples in the Castilian royal court in the thirteenth century, see A. J. Cárdenas, 'A learned King enthralls himself: escapement and the clock mechanisms in Alfonso X´s Libros del saber de Astrologia', *Disputatio. An international transdisciplinary journal of the late middle ages*, 2, (1997), p. 73.

41. H. Maguire, *Byzantine court culture from 829 to 1204* (Washington: Cambridge, Harvard University Press, 1997), p. 32; R. Kieckhefer, *Magic in the Middle Ages* (Cambridge, New York: Cambridge University Press, 1989), p. 101.

Appendix

Translation of the descriptions of the three clocks in the inventory drawn up after the death of Queen Isabel in 1504. Spain. Ministerio de Cultura. Archivo General de Simancas, CMC, 1ª época, leg. 81, fol 117 and 37v-38v.

I

An iron clock with six men in the middle with their mallets each to strike a metal bell. On each bell there is an acorn and next to each bell there is a pillar, inside which (the clock) are all the wheels and springs that make the clock run, four big weights, four small ones and two small lead weights with the strings from which they hang, and it has six doors, five of them open, and there is an iron arch in each door, and (the clock) has six doors more above it, two of them open. They have six pieces which are placed at the feet of the said men after being removed from the clock, which is in a black wooden case covered with red parchment, with its iron latches, bolts and lock, the said case is broken in one part, and [there are] four more pieces of wood to assemble the said clock on them and it has a key. It was given to Fernand Duque de Strada because of a mandate from Her Highness.

II

And a clock made as a small elongated chest covered with silver on all its six sides with two small windows in the silver at the front, which open, with two enameled emblems of arrows on them and between them there is a coat of the royal arms, and on the opposite side it has the same things, and there is an inscription on the upper part of the contour. It has a small copper bell on it with four circles and a silver rose on it, and it has on the top a silver eagle and a small silver lion with a stick in the hands of one of them which strikes the bell, the other one is missing, and there are many wheels and parts of iron with their ropes, and there is a silver hand on (the clock) which shows the hours. It is placed in its black leather case. It was sold for 5.500 maravedis to Diego de Ayala.

III

A golden clock in the shape of a tower with its file pierced spire, which has a smooth golden sheet under its base held by a brass screw, and the tracery panels[1] of the base are file pierced as a balcony,[2] and there are twelve rubies with their mounts on the tracery panel, six of them are big and the other six are medium-sized, all of them are irregular, with twelve big round pearls in their golden pin wheels[3] between the rubies, and it has six hollow twisted pillars between the base and the spire, six golden statuettes between the pillars, three of them are men and the other three are women, one of them has a green bunch in his hands, and there are six big irregular rubies on the pillars between them and twelve big round pearls in their pin wheels. It has a lion on each pillar where they are settled, the file pierced battlements of the tower, and with a file pierced tracery panel under them, and above that there is a spire with a plain, smooth and polished base and a big file pierced tracery panel as a balcony, which has another six round hollow pillars with six medium sized rubies in their mounts and twelve round medium sized pearls in their pin wheels, each one by itself, and there is an armed man on each pillar, with its feet settled on the green-enameled pillars; it has a golden man inside (of the clock) on a green rock which can be installed and removed, which has a small golden stick in his hand to show the hours, a pale pink enameled ribbon, a scimitar and

1. The original word is *suaje*, a very rare term. Here it could mean a pierced element, so we decided to translate it as 'tracery panel'.
2. The original word is *claraboya*, an architectonical term that in this text means 'balcony or parapet'. In gothic architecture it is used as an ornament and to illuminate the inside of the building. S. Covarrubias Orozco, *Tesoro de la lengua castellana o española* (Madrid: Luís Sánchez, impresor del rey, 1611), 'claraboya'.
3. The pin wheels of the pearls are just an adornment, they are not any part of the movement.

a pink enameled sporran, all made of gold, and the top of the polygonal spire has six sides, which have file pierced nailed sheets as a balcony on the said six sides, which have three mounted irregular medium sized rubies in their golden mounts, and the mounts are on roses, and three big round pearls, each one is on its golden pin wheel, and it has a black enameled rock on the top with a fire striker on it to make fire. The said statuettes are nailed with silver nails and (the clock) has four small brass crossbeams, and in the second spire there are four small silver screws, and it has two coats with the arms of Burgundy, each one has a small golden cannon as the ends of a silk ribbon, which are in the place where the key is inserted (into the clock). Everything weighed five marks, six ounces and six eighths. And apart from these things, the clock has what makes the hours (the movement), which is placed inside of the tower, it is of gilded silver and it lies on three feet of some smooth sheets and one (sheet) more in which they lie, all of golden brass, it has two barrels in which the ropes are wound, and the wheels of the said clock, some of them are of golden silver, others of gilded brass and others of steel. It has eight pillars, four on the lower part and four on the high part,[4] all of gilded silver, and at the top two plain gilded silver sheets and a small metallic bell between them. Everything weighed two marks, two ounces and four eighths with a lead saltcellar and without a small brass wheel and two brass screws. The King [Felipe 'el hermoso'] gave it to Her Highness [Isabel].

It is almost 21-carat gold, half ducat, the work valued at 60,000 maravedis. They valued the pearls at three ducats, the rubies of the foot at three ducats, the ones on the top of the middle pillars at three ducats, the ones on the top of the pillars of the spire at three ducats, the three on the top of the spire, the two bigger irregular ones at ten ducats each one and the other one at half a ducat, and the work at 60,000 maravedis. It is recorded in a payroll of King Felipe that this clock was given to Mosior de Villa.

4. The original text has: *que tiene ocho pilares, quatro altos e quatro baxos*, this could mean that they formed two floors or that four of them were shorter than the others.