Life & Works of Martin Altman, Engineer to the Hapsburgs

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While looking for sources for my PhD thesis on history of Spanish horology, in 2011, I come across various inquisition trials against clockmakers from the 16th to the 18th centuries in the Archivo Histórico Nacional of Madrid. One against Martin Altman dating from 1560 to 1574 seemed particularly interesting as he served King Philip II of Spain. After consulting bibliography on history of science and technology in Renaissance Spain only brief mentions to Martín Altman were found in a Nicolás García Tapia's monograph[1] and in David Goodman's *Power and Penury*[2], neither of them mentioning the Inquisition trial. Some monographs about the introduction of Lutheranism in Spain do mention the trial, but without studying the professional side of Martin Altman.[3] The trial is an invaluable source of very detailed information about the life, the customers and the social network of Altman and other makers from the Spanish Royal Court of that period. I decided not to include this information in my PhD thesis because it fell outside its chronological scope and because Altman deserves to be studied on its own. Since then I have gathered different sources from other archives to carry out a research project after finishing this thesis. By 2017, when I took up again the Altman's research, this person has attracted the attention of other historians, including M. Vázquez Manassero, who discovered a charter of nobility issued to him by the Emperor Ferdinand II. Vázquez also cites another ongoing research project that connects Altman with Cardinal Granvelle.[4]

The aim of this article is to summarise the known available sources to study the person of Martin Altman, to trace the different places he lived and to offer an overview of the different works he did during his life. My intention is not to exhaust the research possibilities about Altman, but to offer a starting point for future research.

The Sources

Among the available sources to study the life and work of Martin Altman, the Inquisition trial against him is the richest in details. The Spanish Inquisitorial Justice was administered by different territorial boards, whose records were almost completely destroyed after the abolition of the Inquisition in the 19th century. By fortune, the Toledo board archives, which jurisdiction includes Madrid and contains Altman's trial, are an exception that confirms the rule and are kept at the Archivo Historico Nacional of Spain. Actually, it is not one, but three trials, all kept in the same bundle under the same shelf mark.[5] The first one starts in April 1560 when Fabian, sword-guards maker, reports Altman to the Inquisition board for Lutheran and terminates on June after being absolved and his goods returned to him. The second trial starts in October 1568, when the clockmaker Juan de Evalo reports Altman for breaking fasting in Lent and before receiving communion. Once again, the board cannot demonstrate these accusations but terminates the trial in August 1569 after sentencing him to pay a huge fine, to be confined in a monastery for six months and to four years banishment from the Royal Court, now permanently established in Madrid. Just before Altman's banishment, a report against two witnesses who declared against him in his second trial, triggers his third trial. Fortunately for Altman it terminates in October 1571 without any consequence for him and shows his efforts to hide other Lutherans from the Spanish Inquisition.

The trials are a mine of information about different aspects of Altman's life and the horological trade in Madrid in the second half of the 16th century. Following his first detention in 1560, the Inquisition board received letters from Altman's customers describing and claiming back the clocks and watches they left in his workshop for servicing. The declarations of the witnesses and other documents from the trials draw a detailed picture of Altman's social network in Madrid and Toledo allowing us to know the names of his friends, neighbours, apprentices and customers and how his relationship was with many of them.

Altman exiled in Seville between 1571 and 1574 to serve the sentence of his second Inquisition trial, where he continued working as clockmaker and engineer. After his exile he returned to the Royal Court in Madrid and litigated with Bartolome de Granara, a Genovese living in Spain, for payment of a loan. The new trial started in 1576 before the Corregidor of Madrid, the local judicial authority, but was escalated to the Real Chancillería of Valladolid, whose archive keeps the trial.[6] It includes testimonies of people who knew Altman and that have witnessed against him before the Inquisition board in the 1560s, including again Juan de Evalo. The Chancilleria trial provides more information on the objects he traded with and on his delicate financial situation after overcoming the Inquisition.

Both trials are the richest available sources to study Altman's life and social network. But, in addition to them, other documents help to know better aspects of his life as an engineer, for example his reports to the king about his inventions and to claim money owed to him by the Crown. For example, in one of these reports Altman offers to the king Philip II different military inventions, including toxic smoke bombs, a diving suit to recover objects from shipwrecks and a method to repair damaged vessels in the middle of battles. The importance of the Spanish navy for Philip II to keep his maritime empire under control might have made Altman consider his proposals relevant for the king.

There are other documents regarding his activity as clock and watchmaker, including trading contracts about buying and selling clocks. Probably the most interesting source for understanding his horological business is the sale of his workshop at the Plaza Mayor of Madrid in 1591, which includes an inventory of tools, new clocks made by him and others to be repaired for their owners. This inventory together with the letters of his customers claiming their clocks and watches to the Inquisition board when he was arrested in 1560, contain invaluable information about his customers and their horological tastes.

Altman left other documents concerning the different activities he carried out in his life in Spain. The Archivo de Protocolos de Madrid, for example, keeps a huge collection of notarial records from that period including the sale of this workshop, the translation into Spanish of his nobility privilege given by the Emperor Ferdinand and different agreements about loans he needed to take out after the challenge of the Inquisition.

These are the main but not the only known sources about Altman, and others will be used and mentioned in this article. In addition, new sources could be discovered in the future which could shed more light on Altman as other research works in progress previously mentioned will.

Life and Itinerary

In this section we are going to study his life, the different places he lived in and how he started serving the Habsburgs (Table 1). We know very few facts about Altman's early life mostly thanks to the Inquisition records. From the different refences he made to his own age his birthdate can be established to be in or *c.* 1530.[7] Three different documents mention his birthplace. According to the Spanish translation of his nobility privilege he was born in Schweidnitz.[8] When in his first Inquisition trial in 1560 is asked about his origin and family he replies to be born in 'Brozsla' in Bohemia[9], but in his second trial of 1568 he states to be from 'Gelis Singa', 'near to Bohemia', land of the Emperor.[10] The former seems a poor transcription of Breslau, the later must be 'Schläsing' or 'Silesia', a region pertaining to the crown of Bohemia that was integrated in

Table 1. Martin Altman's itinerary	
Dates	**Places**
1530	Is Born in Silesia.
1546 or 1547 for half year	Moved to Breslau, at merchant 'Hanz Queldrel's' home.
c. 1547 for half year	Leipzig.
1547 or 1548, for half year	Frankfurt.
1548 - 1551	Mainz and Strasbourg.
1551 - 1555	Augsburg, where he learned horology and engineering.
1555	Starts serving Charles V.
1555-1559	Flanders, Brussels, England. Starts serving Philip II of Spain.
1559/1560	Moves to Toledo with the Royals Court of Philip II (Spain).
February to July 1560	First Inquisition trial.
1561	Likely moves to Madrid with the Royal Court.
1562	Receives a nobility Privilege from Emperor Ferdinand.
1563	Serves Philip II at the Monzon Courts.
Nov. 1568 to April 1570	Second Inquisition trial.
Oct. 1569 to Oct. 1571	Third Inquisition trial.
1570 - 1574	Exile in Seville.
1591	Sells his workshop in Madrid to leave the Spanish Court.
1592	Italy: Genoa, Florence and probably Venice.

the Imperial possessions after the Mohács battle in 1526. Both Breslau and Schweidnitz are Silesian cities. In addition, Altman declares that his grandfather, named Alte Paule, was governor of 'Petrisvalde', now Peterswaldau near to Schweidnitz, and two of his sons, Alte Paule and Simon Alte, both uncles of Martin, were priest and sacristan at this place. About his father we only know his name, 'Niculas Altman'[11] and that he was clockmaker as well.

In his statement before the Inquisitors on 23rd December 1568 he mentions the different places where he had lived before being arrested in Toledo for the first time. According to this, he left his father's home in 1546, aged 16, for Breslau where he lived with the merchant 'Hanz Queldrel'. Then he moved to Leipzig, Frankfurt, Mainz, Strasbourg and finally to Augsburg, where he lived between 1551 and 1555. Before arriving in Augsburg, Altman fought in the Schmalkaldik wars with Charles V against the Lutherans commanded by the Duke of Saxony. In 1592 Altman confirms his participation in the war[12], which started in 1546, the same year he left Breslau.

In Augsburg he spent the most decisive years of his life. Although he probably started learning horology in his father's workshop[13], in Augsburg he was apprentice to Simon Friederich, master clockmaker[14], 'whose name -says Altman- he remembers better than his father's'.[15] The regulations of the Augsburg Clockmakers guild established an apprentice period of three years, then the apprentice could leave his master's home.[16] Although the regulations came into force a few years later, Altman could spend three years with Simon Frederique before moving to Tomas Geiger's house[17], master maker of 'big clocks' and spit jacks.[18] Georg Gutterman, a member of a prominent family of Augsburg clockmakers[19], lived with Altman also in Thomas Geiger's house. They should know each other very well because they both moved to Spain together, lived in the same house for a short period[20] and were arrested and accused of Lutheranism by the Spanish Inquisition in two different trials.[21]

From the 1550s and during the rest of the 16th century, Augsburg was the leading centre of clockmaking in Europe and a major production centre of scientific instruments, armour and other metal goods.[22] The city attracted artisans from other Imperial territories. Augsburg was also a major political decision-making centre of the Empire, where some of the most influential Imperial Diets took place, including those of 1530, 1547 and 1555. On the occasions of the Diets, the physical presence of the Imperial and other attendants' courts, allowed the craftsmen and dealers to do business with wealthy noblemen and to take commissions from them. Some craftsmen enrolled in their courts and left Augsburg with them after the Diet[23], including Altman, as he himself states in 1589[24] and 1592.[25] The 1555 Diet met in Augsburg to sign a peace treaty that terminated the religious wars of Charles V against the Lutherans. Charles was in Brussels and did not attend the Diet in person, but his brother Ferdinand represented him.[26]

According to Altman's statement before the Inquisition in 1568, Charles V ordered him to join the Imperial Court in Brussels and to move with them to Spain. The Charles V trip to Spain was delayed due to the lack of funds and Altman spent four years in Brussels between 1555 and 1559, where he opened his own workshop, probably his first one. During that period, he travelled to England as well, but he doesn't mention exactly when, or for how long and for what purpose. Charles' son, Philip II of Spain, was king consort of England between 1554 and 1558, the period he was married to Mary Tudor. King Philip visited his wife very few times and for very short periods. Altman probably accompanied him during his three months visit to the Queen in England from Brussels in 1557.[27]

Philip II moved to Spain in 1559 bringing with him servants, craftsmen, engineers and artists from the Low Countries and other parts of Europe, including Altman. The Royal Court settled in Toledo until 1561 when the king ordered the move to Madrid for good. Altman, who lived in Spain for more than three decades, moved with the court to Toledo[28], where he was arrested by the Inquisition for the first time in 1560. He had arrived about one year before, did not speak Spanish at that time and required assistance to testify to the Inquisition board. He probably moved to Madrid in 1561 when following the court and by 1568 he had established his house and workshop at the Plaza Mayor[29], where it remained until he sold it in 1591.[30] As far as we know from the known sources, Altman was away from Madrid during his second and third Inquisition trials, when he was moved to Toledo, and then during his banishment in Seville between 1571 and 1574 approximately. He also left Madrid on other occasions to serve the king during his trips, but he was based there. During his period in Madrid he made, serviced and sold clocks to different custom-

ers, took care of the Royal horological collection, made fireworks for celebrations and trained different apprentices in his workshop.

But after his return from Seville, things started to worsen for Altman. His hand was severely injured as a consequence of a harsh torture session by the Inquisition[31] and, although in later documents he doesn't mention any health issue, his hand likely suffered long term physical damage. His arrest also worsened his economic situation and he applied for permission to the Inquisition board to spend a few weeks in Madrid before his banishment to collect debts, the King being one of his debtors. By 1592 Philip II owed him about three thousand ducats, a huge amount of money. He complained to the king several times about that and in 1589 he stated that if he was not paid he would have to leave the Spanish Royal Court.[32] Martín Altman was not bluffing and two years later, in 1591, Tommaso Contarini, the ambassador of Venice in Madrid, gave him the opportunity to leave Spain to serve the Duke of Venice. Altman did not give it a second thought, sold his workshop in Madrid[33] and left Spain for Italy after almost four decades serving the Habsburgs. In his journey to Venice, while spending a few months in Genoa, he received a tempting offer from the Grand Duke of Tuscany, who promised to allow him to live comfortably in the Palazzo Vecchio in Florence for six months if he committed to keep his stay secret. Altman accepted and spent six months in Florence but after that he offered his services to Venice again and asked for an opportunity to present his inventions to the Venetian Duke.[34]

At this point we lose track of Altman and we do not know what happened next. Further research in the Archivio di Stato of Venice could reveal if he finally was allowed to show his inventions to the Duke and if he sponsored him. Altman was then older than sixty, a quite advanced age for the period and he could likely have died during the decades of the 1590s or 1600s.

The Engineer

After tracking Martin Altman's life, we will examine his professional activities including his works in different periods of his life, starting with his engineering works.

As engineer, he designed fireworks for civil purposes, for example to celebrate the birth of the crown prince of Spain.[35] He also made other military inventions described by him in a letter to the king in 1589, including different types of projectiles for cannons, shell bombs of various sizes that broke apart in small pieces, incendiary bombs and others with toxic smoke that would kill everyone who breathed it.[36] These projectiles were rare in that period but not at all new. It is significant that, according to Biringuccio, Samuel Zimmermann, a fireworks maker form Augsburg and author of a treatise on the subject in 1573, made sulphur bombs that resolved themselves into smoke.[37]

In his 1589 letter, in addition to these projectiles, he claimed to have invented a diving suit to repair vessels from the outside and to recover valuables from shipwrecks.[38] He presented some of these inventions to Philip II in 1589[39] and wanted to present them to the Duke of Venice in 1592 after leaving Spain.[40]

During his banishment in Seville, Martin Altman appears briefly in Jerez de la Frontera, a small city situated about ninety kilometres south of Seville. The river port was the backbone of the Jerez economy, but in 1507 an earthquake caused a landslide which fell into the channel that fed the port, changed its course and drained it. After that, a different port was used but it was quite far from the city and the merchandises needed to be transported by land. The city council wanted to restore the old port and asked for help from the best known engineers of the 16th and 17th centuries, including Martín Altman. After visiting Jerez de la Frontera in the Summer of 1573, he stated that he would be able to return the water to the old port by digging a course deep and wide enough to allow big vessels to dock in Jerez.[41] We do not have further information about the outcome of Altman's project, but everything suggest that it wasn't carried out, as Altman returned to Madrid the following year and the problem continued in the 17th century.

Altman was strongly interested in crafts other than horology, but he does not tell clearly from whom he learnt them. In 1592 he intimates to have acquired his knowledge about pyrotechnics and war machines during the Schmalkaldic war between 1546 and 1551. He was very likely in touch with other engineers in Augsburg and then in the Habsburg court in Brussels, including the famous Juanelo Turriano, although there is no further evidence about that. In addition, Altman might have taught himself from books on machines. When he was arrested the Inquisition confiscated all his goods, including his books and personal archive. According to different witnesses, Altman used to read a book by Luther which the Inquisition attorney looked for, but others were found at his house, including one about medicine printed in Frankfurt in 1548, two books from the Bible, an almanac[42] and two more about machines[43], whose titles are not mentioned. None of the books were in Spanish. They also found manuscripts whose contents are not described in the trial because the Spaniards were unable to read them. In addition to administrative documents about his professional activities, some of these manuscripts could have been technical treatises or notebooks but we will never know.

The Clockmaker

Martín Altman worked as engineer but earned his living as, and considered himself to be, a clockmaker. For example, in one letter to Philip II asking him to be paid the arrears of his salary, he explains again that his delicate financial situation would force him to stop making fireworks to focus on his profession: clockmaking.[44]

The objects contained in his workshops in the different cities in which he lived suggest that clockmaking was his main occupation and probably more profitable than engineering. I have mentioned previously that Altman's father was a clockmaker, that he likely started learning horology from him, but he was fully trained in Augsburg, the best place in Renaissance Europe to learn the craft. After spending four or five years in Augsburg, where he built up a socio-professional network, he moved to Brussels to join the Spanish Habsburgs court where he lived a few years and where he opened a workshop. We know almost nothing about the workshop, but the fact that someone stole some clocks from it confirms that it was a clockmaking workshop.[45] The few witnesses who mention it uses the Spanish word 'tienda', which means a place open to the public.

We have an indirect mention which shows that Altman ran a workshop in Seville during his banishment, although his professional life during these four years is not very well known. The council registers of Jerez de la Frontera mention him as 'clockmaker to the king' when he visits the place to propose an engineering public work project. Before returning to Madrid in 1574, he pawned in Seville his tools and other objects from his workshop contained in two big trunks, including new finished and unfinished clocks or watches, and models of machines.[46] This confirms once again his occupation as clockmaker.

The objects kept in his workshop in the Plaza Mayor of Madrid are better known thanks to the inventory attached to the sale document to Roberto Rabiller in 1591.[47] The inventory only contains time telling devices and horological tools. Altman had not given up his pyrotechnic inventions. All his tools and objects related to them where not included in the workshop sale and he presumably took them with him to Italy. Anyway, this inventory confirms he devoted himself to horology.

In Table 2 I have compiled a list of the horological instruments he made, serviced and traded with during his life. The information is organised in different fields containing the description of the object, its connection with

Table 2. Instruments made, serviced or traded by Martin Altman

N	Item description	Job	Price	Owner	Date
1	A monstrance clock.[1]	Service		Conde de Rivadavia, collected by Melchor Glaude.	12/06/60
2	*A clock that hangs in the air in a gilded pierced case, which has two parts, one holding the hand that shows the hours and the other one with the turning toothed wheels. It strikes the hours in a small iron bell. The clock hangs from a black silk string.*[2]			Described in latin by Claudio Sublet, almoner to the Queen Isabella of Valois, Philip II wife. Collected by Licenciado Juan Descario.	12/06/60
3	*A small clock/watch in a velvet pouch*.[3]	Service	60 reals	Pablo Descalante, Dalbion de Aragon servant.	12/06/60
4	[The clock/watch] *is gilded and shows the hours but doesn't strike them. It is square and smaller than the hand palm. It has a case and a key attached to it with a silk and gold string. The cut thing* [the glass of the opening] *which shows the hours when the case is closed is missing.*[4]	Service	3'5 ducats	Juan de Mendoza y Rivera.	14/06/60
5	*A round clock/watch in the shape of an apple* ('poma').[5]			Fray Juan Bolante, from the Peñafiel monastery.	14/06/60
6	A gilded clock/watch without any small bell.[6]			Collected by Francisco Ruiz, servant of the Emperor ambassador.	14/06/60
7	*A clock with the shape of a big tower with the bell missing, with the top uncovered, with a gilded rose on the small bell.* [Antonio Gentil said that] *the case and the key are missing.*[7]			Don Pedro Manrique, resident in Burgos. Collected by his maid Antonio Gentil.	15/06/60
8	*A small clock/watch in a horn case with an opening with a glass.*[8]			Gaspar Nuñez, resident in Valladolid.	15/06/60
9	A round gilded clock/watch.[9]			Collected by a Kings' servant	18/06/60
10	Two big clocks and two small clocks/watches.[10]			The King and prince Don Carlos. Collected by Alonso Davila, servant of don Diego de Cordova, His Majesty equerry.	20/06/60
11	*A small clock/watch with no bell in a brass case showing the Joseph story. With its black gilded leather custode garnished with black velvet inside, and the key of the clock/watch.*[11]	To sell it for its owner		*Miguel Fadda, servant of don Hieronimo de Barbera, His Majesty Chaplain.*	20/06/60
12	A Clock.[12]	Make	120 ducats		27/10/65
13	A clock/watch.[13]		74,5 ducats	Enrique Flamenco, servant of Juan Manrique.	28/01/69
14	A clock/watch which is not new.[14]		12 reals	Marques de Carpio.	28/01/69
15	A clock/watch[15]		70 ducats 470 reals owed	Duque de Alba.	28/01/69
16	A clock/watch.[16]			His Majesty.	22/04/79
17	Clocks/watches.[17]			Made by Hans de Havre, apprentice to Altman.	29/04/69
18	New unfinished clocks/watches in two trunks pawned in Seville.[18]			Martin Altman.	31/10/74
19	[A small watch] *with the shape of a gilded heart* [in its case].[19]			In possession of Esteban Doria, from Genoa, who lived at Lorenzo Espínola home, from Genova. Collected by Altman from him.	24/03/76
20	[A small gilded watch] *like a small nut* [in its case].[20]				24/03/76
21	[A small watch] *round and plain which strikes the hours* [in its case].[21]				24/03/76
22	A small watch which is missing.[22]				24/03/76

23	*A small breast watch.*[23]		13.090 maravedis	Martin Altman, taken to serve His Majesty.	20/05/80
24	The palace turret clock.[24]	Keep		King Philip II.	23/11/84
25	*A big gilded clock with all its accessories.*[25]		600 reals	Altman purchased it from Gonzalo de Cervantes.	31/05/85
26	*A big clock of the height of a man after being put together, which has all its parts, including its metal parts, pillars, hammers and eleven bells. The said clock is new, has carved metal doors and is unfinished. It is in a wooden case with a key in the shape of a crate.*[26]			Altman.	
27	*A small weigh driven clock with alarm.*[27]			Don Juan de Borja, the Empress seneschal.	22/03/91
28	*A clock/watch which shows the hours, round like an orange, which is under my possession since many years ago.*[28]			From a defunct trinitarian friar.	22/03/91
29	*A clock/watch like a sandbox* (A drum clock/watch).[29]			Matut former servant of Doctor Pero Nuñez.	22/03/91
30	*A breast striking watch which bell is broken.*[30]			Nicolás Ferero cashier of Juan Battista Riccio, from Genoa.	22/03/91
31	*A watch that shows the hours in the shape of a small gunpowder flask.*[31]	Service	4 ducats	A gentleman relative to don Luys de Toledo.	22/03/91
32	*A round clock/watch like a medium sized apple.*[32]			A company captain in Naples, an unknown person.	22/03/91
33	*A breast striking watch with alarm mechanism.*[33]			Ascoli Princess secretary.	22/03/91
34	*A big clock with a foot made like a round mirror with a big bell.*[34]	Service	40 reals owed	Marques de Tavera.	22/03/91
35	A breast oval watch which strikes the hours.[35]			Fray Juan Volante from Nuestra Señora de Atocha.	22/03/91
36	A breast watch which strikes the hours, slightly long ('tombado').[36]			Fray Juan Volante from Nuestra Señora de Atocha.	22/03/91
37	*One weight driven clock which is slightly big*[37]			Martín Idíaquez.	22/03/91
38	*Nine small and medium clocks/watches.*[38]			From different owners, in possession of Roberto Rabiller.	22/03/91
39	Sundial from/to Fuentes.[39]	Make	50 reals		22/03/91
40	A small watch which is missing.[40]	Service		Salerno Prince son.	22/03/91
41	A small oval watch better than the previous one.[41]				22/03/91
42	A gilded brass clock/watch.[42]	Made by Altman		Juan Hurtado de Mendoza, inherited from Iñigo Hurtado de Mendoza.	1624
43	Monstrance clock from c. 1600 with punched initials NA or MA.[43]	Attributed to Altman		Now in a private collection in Holland.	c.1600

Notes

1. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 8r.
2. Idem, fol. 9r.
3. Idem, fol. 10r.
4. Idem, fol. 5r.
5. Idem,fol. 6r.
6. Ibid.
7. Ibid.
8. Idem, fol. 6v.
9. Idem, fol. 7r.
10. Ibid.
11. Idem, fol.12r.
12. Archivo General de Indias, Indiferente, 425, L.24, fol. 260v.
13. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 90v, 91r.
14. Ibid.
15. Ibid.
16. Idem, fol. 106r.
17. Idem, fol. 118r.
18. ARChVa, Pleitos civiles, Masas (F), Caja 771-4, fol. 14rº-15rº.
19. Archivo Histórico de Protocolos de Madrid, Prot. 959, (Pedro Gutiérrez de Molina), fol. 74.
20. Ibid.
21. Ibid.
22. Ibid.
23. Archivo General de Indias, Indiferente, 426, L. 26, fol. 204V-205r.
24. Archivo Histórico Nacional, Consultas de gracia, leg. 4409, n148
. 25. Archivo Histórico de Protocolos de Madrid, leg. 6106, fol. 562.
26. Idem, leg. 1310, fol. 252r.
27. Idem, fol. 254r.
28. Ibid.
29. Ibid.
30. Ibid.
31. Ibid.
32. Ibid.
33. Ibid.
34. Ibid.
35. Ibid.
36. Ibid.
37. Ibid.
38. Ibid.
39. Ibid.
40. Ibid.
41. Ibid
42. Ibid.
43. Amelia Aranda Huete, 'La presencia del reloj en la vivienda en época Moderna', in *Ars & Renovatio*, No. 3 (2015), p. 108.
44. H. M. Vehmeyer, *Clocks, their origin and development.* 1320-1880. Vol. I (Gent: Snoeck, 2004), p. 782.

Fig. 1 *Spring driven hanging clock, Augsburg, 1575, inv. no. WI1847. The author shows his gratitude to Dietrich Matthes and the Germanisches National Museum of Nurnberg for their help to procure the image of this clock. (CC).*

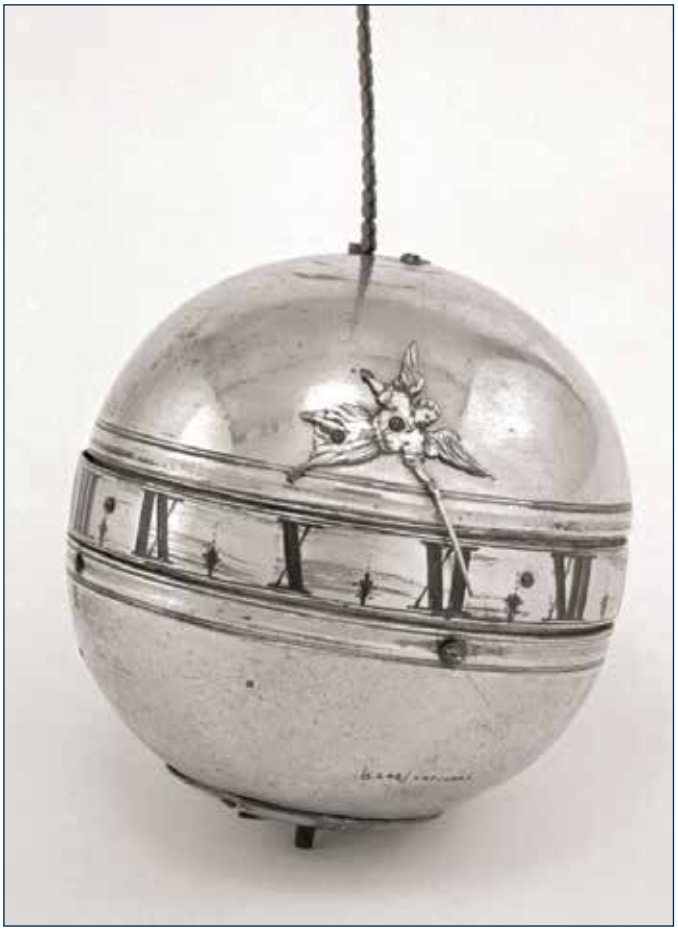

Fig. 2 *Hanging clock driven but its own weight. Jacobus Mayr, Augsburg, 1670-1680. British Museum, inv. no. 1958,1006.2085. © The Trustees of the British Museum.*

Altman, the price charged for his work on it, the owner of the object and the source where the information comes from. Obviously, it is not a comprehensive list and it includes only those clocks mentioned in the sources that are known. Future archival findings could contribute to enrich and maybe to change our current view on Altman's professional activity. His engineering and military inventions have been excluded from this Table.

Two groups of objects stand out from the rest. The first one, highlighted in pale blue, includes the clocks seized by the Inquisition from his workshop in 1560 and claimed back by their owners when they knew that Altman was arrested. This group offers only a partial view of his workshop, as only the clocks claimed by their owners are mentioned or described. Besides these objects, the workshop would likely contain more instruments unclaimed by their owners and others belonging to Altman including unfinished clocks made by him and used instruments purchased by him for refurbishing and reselling. All these objects remain invisible. The second group, highlighted in grey, is comprised by those from the 1591 inventory of his workshop, which shows a more complete overview as more objects were presumably included. Next to these groups we have included all additional mentions of clocks found in different sources, even those mentioned indirectly.

In the middle of the 16th century clock and watch making began to separate as different specialities within the field of horology in some places, including Augsburg, but the list suggest that Altman practiced both. One of the biggest devices he managed was probably the turret clock of the Royal Palace, which he looked after for four years at least.[48] Maybe it was not the first time he was in charge of a big clock; surely there were others as in Tomas Geiger's house in Augsburg during the 1550s.

Most time telling devices serviced or made by Altman were domestic clocks and portable watches. The Royal Palace turret clock (24) and the sundial (39) are the exceptions that confirm the rule. It is difficult to know the typology of many clocks from the list and how big they were, except that most are either weight or spring driven domestic clocks or portable spring driven watches. Both types are not clearly differentiated in the original sources unless when the descriptions explicitly mention their portability or their driving source. This issue is made worse by the fact that in Spanish the only one word 'reloj' means either clock or watch depending on the context. Sometimes a diminutive form like 'relojito' or 'relojico' is used for small portable watches but also for small weight driven domestic clocks.

Altman serviced many portable watches at different times of his life. Some are kept in a pouch or in a leather case, good evidence that they were meant to be moved frequently (3, 4, 8, 11). Particularly interesting are the two mentioned in 1574 in the shape of a heart (19) and of a nut (20) for their sizes and shapes. There are also various 'breast' or pendant watches (23, 30, 33, 35, 36) to be worn hanging from the neck, and there are also pomander watches of different sizes (5, 9, 28, 32).

The description of one of the clocks seized by the Inquisition in 1560 is more difficult to interpret (2). It has a gilded pierced case made from two pieces, one with the pointer showing the hours and the other one holding the mechanism. The clock strikes the hours

Fig. 3 *Monstrance clock showing NA or MA punched on the movement, maybe the signature of Martin Altman. Formerly in the Vehmeyer collection. Image taken from H. M. VEHMEYER*: Clocks, their origin and development. 1320–1880, *Vol. I, Gent, Snoeck, 2004, p. 782. Photo credits: Henk Stam.*

on a bell and hangs from a silk string. This may be interpreted as a pomander watch or a spherical spring driven domestic clock. The existence of pomander watches is well documented from the 1520s and 1530s and they were intended to be worn in pouches or hanging from the clothing.[49] Bigger similar domestic clocks were made in the 16th century, including one kept in the National Germanisches Nationalmuseum of Nuremberg, which could be used as a table clock or hanging from the ceiling, but in the first case the dial would be hidden (Fig. 1).[50] It could be interpreted also as a self-weight driven clock. The description doesn't mention the power source of the clock but the fact that it hangs from a silk string suggests this. This type of clocks exists from the 15th century[51] and they are still made in the 17th, although they are rare (Fig. 2).[52]

When Altman sold his workshop, he was making a complicated musical clock with eleven bells (26). The unfinished clock is included in the workshop sale agreement, but not in the inventory, which suggest its rarity and exceptional economical value. This is probably the most complex clock of the list and probably one of the most valuable ones he ever made.

We haven't found any mention to astronomical clocks, probably because they were not very usual at the Spanish court, although we know they existed in different collections of that period in Madrid, including the Royal collection.[53]

We also included in the list an existing clock, formerly in the Vehmeyer collection, which may be attributed to Martin Altman (43, Fig. 3). It is a gilded monstrance clock with a silvered dial ring showing the hours and minutes with two hands. According to the collection catalogue it has a punch with initials NA or MA, and it was made in South Germany around 1600.[54] Altman, who learned the craft in Augsburg and was active by 1591 in Spain and could likely still be few years later. Although these evidences are consistent with the attribution to Altman, they are not conclusive, and the object should be examined to look for clues which confirm or dismiss it.

Luckily, we know many of the names of Altman's customers, most of whom are noblemen and other people connected with the Royal Court, including the king Philip II. Altman's customers and social network will be studied further in a future article.[55] For now, I just want to point out that, apart from the King, Altman had another loyal customer during more than three decades: Fray Juan Volante. Volante was the owner of one watch seized by the Inquisition in 1560 (5) and of two more watches in 1591 (35, 36). He was also connected to the Royal Court, not only because he was a Friar at Nuestra Señora de Atocha[56], but also because he participated in a mission to the Philippines and was involved in a debate about how to evangelise Asia.[57]

Conclusions

In this article I have presented the most important sources known about Martin Altman, emphasising the relevance of the Inquisition trial because of its richness in details. All these documents allowed me to show Altman's professional side and life in broad strokes. Other aspects are not studied here, but will be in the future, for example his social network, which is well depicted in the Inquisition trial. We have focused our search for sources in Madrid, but archives from other cities could likely contain further useful documents, for example the 'Archivos Historicos Provinciales' of Toledo and Seville, which keep notary protocols from the 16th century. Other documents about him or mentioning him may be kept outside of Spain, for example in Augsburg, Florence and Venice. Finding sources about him in Italy could provide invaluable information because his life after he left Spain is barely known.

I have tracked his life and his works, but the person of Martin Altman deserves further research. For example, his social network can be explored further from the known sources, particularly from the Inquisition and Chancillería trials, in which different people witness against and for him, some in both trials. Currently I am researching the horological trade in Madrid during the Habsburgs which will be included in a future publication which will offer further details of the horological trade.

Notes and References

1. Nicolás García Tapia, *Patentes de invención españolas en el siglo de oro* (Madrid: Registro de la Propiedad Industrial, Ministerio de Industria y Energía, 1990), p. 24.

2. David Goodman, *Power and penury: government, technology and science in Philip II's Spain* (Cambridge: Cambridge University Press, 1988), p. 163.

3. Werner Thomas, *La represión del protestantismo en España, 1517-1648* (Leuven: Leuven University), 2001, p. 83.

4. Margarita Ana Vázquez Manassero, *El "yngenio" en palacio: arte y ciencia en la corte de los Austrias (ca. 1585-1640)* (Madrid: Fundación Juanelo Turriano, 2018), p. 115-121.

5. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16.

6. Archivo de la Real Chancillería de Valladolid, Pleitos civiles, Masas (F), Caja 771-4.

7. On 23rd December 1568 he states to be 38 and on 8th February 1570, 40 years old. Archivo Histórico Nacional, Inquisición, leg. 111,

exp. 16, fol. 85rº-86rº and 171rº respectively.

8. Archivo Histórico de Protocolos de Madrid, Prot. 1177, Francisco Suarez, fol. 465rº, Madrid, 1588.

9. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 3rº-vº, Toledo, 1560, June, 12.

10. Idem, fol. 85rº, Toledo, 1568, December, 23.

11. See footnote 9.

12. Fabio Mutinelli, ed., *Storia arcana ed aneddotica d'Italia, raccontata dai veneti ambasciatori, Vol II. secolo XVI* (Venezia: Pietro Naratovich, 1855), p. 46.

13. See note 14.

14. Altman mentions him later in the trial as 'Simon Frederique': Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 91rº-92rº, Toledo, 1569, February 19. Master Simon Friederich is mentioned in Maximilian Bobinger, *Kunstuhrmacher in Alt-Augsburg* (Augsburg: Rösler, 1969), p. 16.

15... 'que sabe el nombre [de su Maestro en Augsburgo] mejor que [el de] su padre', see previous note.

16. Eva Groiss, 'The Augsburg clockmaker's craft', in Klaus Maurice, and Otto Mayr, eds, *The clockwork universe. German clocks and automata 1550-1650* (New York: Neale Watson Academic Publications, Inc., 1980), p. 59. The regulations of the Augsburg clockmakers guild started to develop in the 1550s.

17 He mentions him as 'Tomagaire' which undoubtedly is the clockmaker Thomas Geiger, who transferred his workshop to his son also named Thomas Geiger in 1583; see Klaus Maurice, *Die Deutsche Räderuhr. Band I* (München: Verlag C. H. Beck, 1976), p. 294.

18. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 92rº, Toledo, 1569, February 16.

19. Mentioned in the trial as 'Jorge Gutreman'. Georg Gutterman pertained to an important family of makers in Augsburg, see Klaus Maurice, *Die Deutsche Räderuhr. Band I* (München: Verlag C. H. Beck, 1976), p. 293; The Guttermans were also involved in the city government of Augsburg, see Hansjörg Schelle, 'Neue Quellen und Untersuchungen zum Kreise Sophie von La Roches und C. M. Wielands 1. Teil', in *Lessing Jahrbuch*, 1988, Vol. XX (Göttingen: Wallstein Verlag), p. 209.

20. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 171rº y vº, Toledo, 1570, February 8.

21. Idem, fol. 59rº y vº, Toledo, 1569, February, 6

22. Michael L. Wayman, *The ferrous metallurgy of early clocks and watches studies in post medieval steel* (London, British Museum), 2000, p. 3; Alan Williams, *The knight and the blast furnace: a history of the metallurgy of armour in the Middle Ages & the early modern period* (Leiden: Brill, 2003), p. 361.

23. Peter Plassmeyer, *Christoph Schissler: The elector´s dealer,* in Giorgio Strano et al., eds, *European collections of scientific instruments, 1550-1750* (Leiden: Boston, Brill, 2009), p. 16. The 1546 Parliament was particularly relevant, as many important artists worked for the Emperor, including Tiziano, see Rose Marie Aulinger, 'Augsburg und die Reichstäge de 16, Jahrhundertsi', in *Welt im Umbruch. Augsburg zwischen Renaissance und Barock. Band III: Beiträge* (Augsburg: Stadt Augsburg, 1980), p. 15.

24. Archivo General de Simancas, GA, 268/148, fol. 35, El Escorial, 1589, June, 20. Altman states he started to serve the Emperor in 1555.

25. In 1592 Altman states that he started serving the Emperor *c*. 36 years before, see Fabio Mutinelli, ed., *Storia arcana ed aneddotica d'Italia, raccontata dai veneti ambasciatori, Vol II. secolo XVI* (Venezia: Pietro Naratovich, 1855), p. 46.

26. Geoffrey Parker, *Emperor. A new life of Charles V* (New Haven and London: Yale University Press, 2019), p. 463.

27 Idem, *Imprudent king. A new life of Philip II* (New Haven and London: Yale University Press, 2015), pp. 53-54.

28. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 29rº, Toledo, 1560, June, 22. Altman lives in Toledo at Gonzalo Lopez de Herrera's house.

29. Idem, fol. 40rº, Madrid, 1568, October, 30.

30. Archivo Histórico de Protocolos de Madrid, leg. 1310, Madrid, 1591, March, 22. Partially published in Esteban García Chico, 'Documentos para la historia del arte en Castilla. Maestros relojeros', in *Boletín del Seminario de Arte y Arqueología*, No. 32 (1966).

31. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 139vº, Toledo, 1569, July, 8. After the torture session he asked the board to allow him to leave for a spa to recover from the injuries of his hand.

32. Archivo General de Simancas, GA, 268/35, 1589, June, 20.

33. Archivo Histórico de Protocolos de Madrid, leg. 1310, Madrid, 1591, March, 22.

34. Fabio Mutinelli, ed., *Storia arcana ed aneddotica d'Italia, raccontata dai veneti ambasciatori, Vol II. secolo XVI* (Venezia: Pietro Naratovich, 1855), pp. 45-49.

35. Archivo Histórico Nacional, Consultas de gracia, leg. 4409, n148, Madrid, 1584, November 23. Could be either Prince Diego Felix b. 1575, either Prince Philip, b. 1578, future Philip III of Spain.

36. Archivo General de Simancas, GA, 266/177, El Escorial, 1589, September, 6; Alicia Cámara Munñoz, 'Cantería e ingeniería del Renacimiento en el puente de Zuazo en Cádiz', in *Lexicon. Storia e architettura in Sicilia e nel Mediterraneo*, No. 20 (2015), p. 19, footnote 20; David Goodman, *Power and penury: government, technology and science in Philip II's Spain* (Cambridge: Cambridge University Press, 1988), p. 163.

37. Simon Werrett, *Fireworks: pyrotechnic arts and sciences in European history* (Chicago: University of Chicago Press, 2010), p. 30.

38. In the second half of the 16th century, Martin Altman wasn't the only one trying to find reliable methods to dive, see María Dolores Higueras Rodríguez, 'La recuperación submarina en la Carrera de Indias: el riesgo necesario', in *La Casa de la Contratación y la Navegación entre España y las Indias* (Sevilla: Universidad de Sevilla, 2004), p. 708.

39. Archivo General de Simancas, GA, 266/177, El Escorial, 1589, September 6.

40. Fabio Mutinelli, ed., *Storia arcana ed aneddotica d'Italia, raccontata dai veneti ambasciatori, Vol II. secolo XVI* (Venezia: Pietro Naratovich, 1855), pp. 45-49.

41. Archivo Municipal de Jerez de la Frontera, Actas Capitulares, fol. 389v-390r, 393r and v, 397r. Jerez de la Frontera, 1573, June, 3, 5, 8 and 10. The 1507 earthquake and the visit of Martin Altman is mentioned in a publication from the second half of the 17th century: Fray Esteban Rallón, *Historia de la ciudad de Xerez de la Frontera y de los reyes que la dominaron desde su primera fundación, vol. III* (Cádiz: Universidad de Cádiz, Servicio de Publicaciones, 1997), p. 155. An upcoming study of the history of the hydraulic engineering works in Jerez de la Frontera by Manuel Romero Bejarano also studies the project proposed by Altman.

42. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 75rº y vº, Toledo, 1569, January 10.

43. Idem, fol. 92rº, Toledo, 1569, February 16.

44. Archivo General de Simancas, GA, 262/865, Madrid, 1589, June 28.

45. Archivo Histórico Nacional, Inquisición, leg. 111, exp. 16, fol. 27rº, Toledo, 1560, June 25. Altman had a bad relationship with his house landlord in Brussels and he accused

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him of stealing two or three clocks from his workshop.

46. '… dos baules grandes de carga questan en Sevilla en poder de un librero que mora en la calle de la sierpe, llenos de herramientas y mi arte y reloxes nuebos para acabar y vender y otros modelos de engenios…', Archivo de la Real Chancillería de Valladolid, Pleitos civiles, Masas (F), Caja 771-4, fol. 14rº-15rº, Madrid, 1574, October, 31.

47. Archivo Histórico de Protocolos de Madrid, leg. 1310, Madrid, 1591, March 22.

48. Archivo Histórico Nacional, Consultas de gracia, leg. 4409, n148, Madrid, 1584, November 23.

49. Dietrich Matthes, *Zeit haben. Tragbare Uhren vor 1550* (Dover, DE: Carpe Diem Publishing, 2018), pp. 53-76.

50. Ibid., p. 82.

51. Emmanuel Poulle, *Un constructeur d'instruments astronomiques au XVe siècle: Jean Fusoris* (Paris: Librarie Honoré Champion, 1963, p. 27.

52. A hanging clock from *c*. 1670-1680 is kept in the British Museum (inv. no. 1958,1006.2085) Instead from a string, it hangs from a chain. See Fig. 2.

53. Amelia Aranda Huete, 'La presencia del reloj en la vivienda en época Moderna' in *Ars & Renovatio*, No. 3 (2015), pp. 93-124.

54. H. M. Vehmeyer, *Clocks, their origin and development. 1320-1880. Vol. I* (Gent: Snoeck, 2004), p. 782.

55. Further details on some Altman customers mentioned in the 1591 inventory are offered in Margarita Ana Vázquez Manassero, *El "yngenio" en palacio: arte y ciencia en la corte de los Austrias (ca. 1585-1640)* (Madrid: Fundación Juanelo Turriano, 2018), pp. 123, 124.

56. Nuestra Señora de Atocha was particularly important for the Spanish monarchy during the 16th and 17th centuries. King Philip II contributed economically to the construction of the convent and felt a strong devotion for the Virgin of Nuestra Señora de Atocha, see Jesús Urrea and Maria Aranda, 'El templo, la capilla y el camarín de Nuestra Señora de Atocha de Madrid', in *Boletín delSeminario de Arte y Arqueología*, No. 77 (2011), pp. 119-140.

57. John Foreman, *The Philippine Islands* (New York: Charles Scribner's sons, 1899), p. 51; Fidel Pérez Mínguez, 'Don Juan de Idiaquez, embajador y consejero de Felipe II, 1514-1614' in *International journal on Basque studies*, **23**, (1) (1932), pp. 240-241.

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Fig. 2 *Sir George White (left), Keeper Emeritus of the Clockmakers' Museum Collection in London and Jonathan Betts (right) as they seal the case closed with a wax seal of 'Clock B' in April 2014 at the Royal Observatory.*

ect has generated quite a lot of discussion and controversy over the years, in particular claims that Harrison's approach could not work because it violates some supposed foundational principles in horology. This is why the next chapter, by Jonathan Betts (Fig. 2), is of such importance, as it covers the process of how multiple objective trials of Clock B's timekeeping were verified, a process which included many leaders in their field and the use of present day measuring equipment. As well as producing results acceptable within the profession it also resulted in the clock entering the Guinness Book of World Records. The next and final three chapters drill down further into the measuring process and the physics of the pendulum and compensation phenomena. These chapters get increasingly technical with increasingly complex graphs, statistics, technical diagrams and equations. Stephen Hawking was allegedly told that every equation he adds to his books would half the number of potential book sales. I don't know whether that is true, or whether he even said it, but either way I'm sure it's true that equations in a book could put some people off. I am reliably informed that they are all very elegant and accurate if you are able to understand them, however, luckily for me at least, an understanding of all of this technical detail is not needed in order to understand the principles presented and the story being told.

The question in my mind when reading this book and the surrounding commentary is whether Harrison's conceptual approach was a scientifically important missed opportunity to advance accurate land-based timekeeping prior to the inventions of the twentieth century. This book helps answer that question. The 12 authors of this book are probably the most authoritative voices you could ask for and the evidence they provide is all independently verifiable. Although some of the technical detail later in the book might be too much for some, the book is nonetheless clear and engaging and covers a topic of historical importance.

Tom Jackson

Astrolabes

Dominique and Eric Delalande, Patrick Rocca
Galerie Delalande, Paris 2020.Lge. 4°, (25 x 30cm), slip case, 2 vols, colour printed paper boards, pp. 607, copiously illustrated in colour
Available only from the Galerie Delalande, 35 rue de Lille, 75007 Paris. Price 220€.

Why write another book about astrolabes? There are already many. Perhaps because of the perennial fascination of an instrument which combines mathematical ingenuity, aesthetic satisfaction and high utility into a potent whole. The authors of the present work claim that the astrolabe remains mysterious, reserved to a few *cognoscenti*, and that a new approach offering a guide for the neophyte is needed. This is debateable. The classic work by Henri Michel, *Traité de l'astrolabe* (1947, reprinted with additions 1976), remains a standard reference for what concerns the technical aspects of the instrument for French readers, and it has been joined in recent years by a more popular treatment by J. N. Tardy, *Astrolabes* (1999), a crushingly technical account by Raymond d'Hollaender; *L'Astrolabe* (1993), and a more approachable work, *Cueillir les étoiles: autour des astrolabes de Strasbourg*, by François Debeauvais and Paul-André Befort (Strasbourg 2002). For English readers the magisterial work by William H. Morley, *Description of a planispheric astrolabe constructed for Shah Sultan Huzain Safawi… and … comprising an account of the astrolabe generally …* London 1856, reprinted in Robert T. Gunther, *The Astrolabes of the World*, 2 vols Oxford 1932 (reprinted 1976), has still to be bettered, although it is rivalled by Willy Hartner, 'The Principle and use of the astrolabe' in Arthur Upham Pope (ed), *A Survey of Persian Art,* iii, 1939. More recently a succinct, lucid account has been given by John North, 'The Astrolabe', (*Scientific American* ccxxx 1973), a beginner's guide published by the National Maritime Museum, Greenwich (1976), and a detailed historical and technical study by James E. Morrison, *The Astrolabe* (2007).

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