Henry Sully's Life Story - Chapter 5 PARIS (Part I)

SULLY IN PARIS (1715 – 1720/21 - Part I) - *Draft*

This is the fifth chapter in the story of Henry Sully[1]: his arrival in Paris in 1715-16, where he quickly made important contacts within the watchmaking community, and established a name for himself at Court following a successful presentation to the Académie royale des sciences, in 1716. This ultimately led to Sully's important involvement in the establishment of horological factories in Versailles, and later, Saint Germain en Laye.

INTRODUCTION

As discussed in Chapter 4, Sully seemed to act as an intermediary or courier for messages from Leibniz (with whom he had been acquainted and discussed his ideas for a marine clock) to Nicolas Rémond, chief counsellor of the Duke of Orléans. Leibniz had provided a letter of introduction for Sully to the influential Rémond. Thus, it can be surmised that Sully had made some short trips to Paris prior to his settlement there in late 1715.

As indicated at the end of the previous chapter, Julien Le Roy recalled[2] that *"peace having been reached between the Emperor and the King of France,[3] the duke of Aremberg[4] decided to come to Paris; he decided to retain Mr. Sully by signs of generosity, and gave him a pension of six hundred livres, brought him to Paris and gave him an apartment at the Ansbac Hotel[5], facing Saint Benoit Street.[6]"*

Sully thus found himself moving with his young family again (his four children then aged 6 to 9 years old), this time to the French capital of Paris, which was to become the central focus of his life until his death in 1728. The story of Sully's arrival and early accomplishments in Paris will be told in this chapter.

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[1] Henry Sully (1679 – 1728) was born in Somerset England, trained as a watch-clockmaker in London, and spent most of his adult life on the Continent (the last 12 years in and around Paris), where he wrote several influential books and memoirs on horology (in French), and directed two short-lived watchmaking factories. He worked diligently for over 20 years to produce a working marine clock to measure longitude, which alluded him to the end.

[2] Sully, Henry, *Règle artificielle du temps*, Paris, 1737, pages 384-385

[3] The peace treaty between France and Austria was concluded on 7 March 1714 in the Baden city of Rastatt, bringing to and end the War of the Spanish Succession between both countries. Prince Eugene had negotiated the treaty on behalf of Austria.

[4] Leopold Philippe of Arenberg (1690-1754) was the 4th Duke of Arenberg, a wealthy aristocrat and military officer. He fought in the War of Spanish Succession in 1706, and was a field commander on several other European conflicts. He financially supported Sully's horological investigations and writing in Vienna. He moved to Paris in 1715, and Sully followed him there.

[5] Note that during this period, a "hotel" was not what we define it as today (i.e. a public place of accommodations where customers can rent rooms to stay for the night), but rather a luxurious home in the best areas of Paris, owned by persons of great wealth and influence, which complemented their equally sumptuous country properties and palaces. These "*hôtels particuliers*" were lavishly decorated by the finest craftsmen and artists, and often had a courtyard or garden on the property. Arenberg was a man of great fortune so could afford a fine hotel, providing ample lodging room for Sully and his children.

[6] This luxurious house (hotel) was located near Saint Germain des Prés, on the left bank of the Seine, in Paris.

Figure 1 Rue Saint Benoit, Turgot Plan of Paris 1739

HISTORICAL CONTEXT

Before discussing the last 12-14 years of Henry Sully's life, spent mostly in or around Paris, it is important to provide a historical overview of France, and Paris in particular, at that juncture in time. Better understanding the horological tradition in France will allow appreciating the challenges and opportunities that awaited someone like Sully, and the way he was able to influence the future of this discipline, in the rest of the 18th century, and beyond.

King Henry IV of France had signed the Edict of Nantes in 1598 to promote civil unity between Catholics and Protestants, within a largely Catholic country. The Edict also provided substantial rights to Protestants in France (also known as Huguenots), and marked the end of the religious wars that had plagued France during the latter half of the 16th century. The Edict was revoked by King Louis XIV in 1685, resulting in the exodus of many Huguenots from France to other countries, and the persecution of those who either chose, or were forced, to stay in France: their legal existence was refused, their marriages and children were considered illegitimate, and they were often prevented from working at a trade.

The presence in and around Paris of numerous members of royalty and aristocracy and of the countless professionals and senior officials administering the affairs of the nation, ensured the livelihood of trades providing luxury items for these upper layers of society. Such tradesmen included goldsmiths, silversmiths, tire-makers, dress-makers, tailors, and jewelers. Makers of clocks and watches (*horlogers*) also thrived in this cosmopolitan city, the center of power for the French Empire. Although watch-making centers existed in other parts of France (e.g., Blois, Lyon, and Toulouse), it was Paris (like London in England) that was the hub of watch-making and retailing activities.

The history of watch-making in France goes back to the 16th century (before then, clocks had been made for at least 200 years). At that time Blois was the center of such activities because it was home to the courts of Francois I, Charles IX, and Henry III. The trade was also established in Paris, where a guild (*Corporation des horlogers de Paris*) was formed in 1544 and signed by François I, later revised in 1600 and 1646. Watches were constructed with a verge escapement, and driven by a mainspring regulated by a fusee, first using catgut and then fine chains. They were generally highly decorated and engraved, often embellished with diamonds and precious stones, and were rather spherical in size, referred to as "onions." Following Christiaan Huygens's invention of the balance hairspring, first built for him by the Parisian *horloger* Isaac Thuret in 1675, watches became more accurate, a minute hand became prevalent, and rather than being almost solely decorative objects for the wealthy, they started on the evolutionary path to become reliable timekeepers for a broader range of owners and uses.

As mentioned earlier, the decision by Louis XIV to revoke the Edict of Nantes in 1685 greatly affected the progress and capabilities of French watch-making, because many *horlogers* were Protestant, and either could no longer legally practice their trade, or were compelled (along with many of their workers) to seek employment in other countries, notably England, Germany, and the Jura region of Switzerland. Almost overnight, the previously highly regarded French watch-making community fell into decline. England, which had produced a respected watch trade for many decades, quickly became the dominant watchmaking nation in Europe, under the leadership of outstanding men like Edward East, Thomas Tompion, Daniel Quare, George Graham, John Harrison, and many others. English watchmaking would reign supreme in Europe for almost 200 years, until it was supplanted by the Swiss and American watch industries.

As was the case in England, the French watch-making trade during the late 17th and 18th centuries was based on a division of labor that saw individual watch components (wheels, pinions, plates, springs, screws, fusees, chains, balance cocks, dials, cases, and hands) manufactured by several distinct external suppliers (as many as 100) that specialized in the production of these individual parts using appropriate tools and skills, often handed down from father to son.

Later in the 18th century, a well-established network existed which allowed the regular flow of watch parts between areas of France and Switzerland. For example, during most but especially the latter part of the 18th century, it was not uncommon for a Parisian horloger to buy necessary parts (if not a complete "rough movement") made in the Jura or Neuchâtel regions in Switzerland; assemble, fine-tune, and "finish" these; get a local case maker to craft and fit a gold or silver case for the movement; have the case shipped to Geneva to have a beautiful enamel scene painted on it (possibly enhanced with precious stones); and then have the case shipped back to Paris where it was re-mated with the movement and sold in the store to a discriminating and affluent customer. Such was not the case at the start of the 18th century, when Sully arrived in Paris.

Thus, it was unlikely that the majority of the clocks and watches produced in a typical Parisian shop were actually made entirely within that shop, even though the horlogers employed there were probably quite able to do so. It made more economic sense to buy some or most of the components already made and use the skills of the horloger to "finish" the watch: assemble and

fine-tune its components, ensure proper meshing of wheels and pinions, adjust the escapement and hairspring, and fit it to a dial and case.

Although more sophisticated machines were becoming available at that time to make some of the components (for example, to cut wheel teeth, or make a fusee groove), these may not have been present in every watch maker's shop, some being used predominantly by specialist component makers who sold their parts to the *horloger* (fusee cone, wheels, mainsprings) (Figure 6). Ultimately, it was the maître-*horloger's* responsibility to ensure the quality of the watch once it was fully assembled and running properly, and his name inscribed on the watch movement and/or the dial would serve as his pledge of guarantee to the prospective owner.

From a technology perspective, watches had remained largely unchanged for almost two centuries. As previously mentioned, they still mostly used a verge escapement that made the watches substantially thicker than the ones that were to follow Jean-Antoine Lépine's innovations some decades later. They were still fitted with a fusee and chain, which moderated the variable force exerted by the mainsprings of the time. The balance hairspring introduced by Huygens in 1675 made verge watches more accurate (within a minute or two a day) and eventually, progress in design and execution allowed verge watches to become somewhat smaller in diameter and thickness (Figure 7).

In the late 17th century, Englishmen Barlow and Quare independently developed a repeating mechanism, which allowed the wearer to be reminded of the time at the press of a button, even when the watch was in a pocket or on a dark bedside table. The repeating mechanism was positioned between the bottom plate and the dial, and even though it further augmented the thickness of the watch, it was a popular feature that was often included in more prestigious watches in the 18th century, both in England and on the Continent.

Many 18th-century horlogers in France, England, and to a lesser degree Switzerland, were experimenting with other types of escapements to further improve the accuracy of timepieces. The desire to develop an accurate marine chronometer (to accurately measure longitude, a critical issue for marine navigation) was a strong driver in this area. Several interesting and sometimes curious escapements were developed during that period, some of them practical and others less so, including the virgule, double-virgule, cylinder, and duplex varieties. Eventually the lever escapement was to reign supreme.

Henry Sully arrived in France just before or after the death of the Roi-Soleil, Louis XIV (1643-1715). The extravagance continually displayed by this monarch, as well as the financially exhaustive wars that he carried out on the European Continent, had left his country on the brink of economic collapse. There existed an enormous public debt, the treasury was essentially bankrupt, credit was ruined, and revenues had been borrowed against for years in advance. The impact of this financial crisis played out on many levels: thousands of workers were without employment, bankruptcies were common, industry and manufacturing plants were idle, commerce was stagnant, and agriculture was in distress.[7]

[7] See Earl J. Hamilton, Prices and Wages in Paris under John Law's System, The Quarterly Journal of Economics, 1936.

At the time, France was ruled by Louis XIV's younger brother, Philippe II, the Duke of Orléans (1674-1723), who was nephew of the deceased king, and became the Regent for Louis XV, then only five years old. To further exacerbate the Regent's challenges, tension with the Parliament of Paris threatened further political strife, and declining business confidence in the country. Into this desperate situation, where the Regent was looking for anyone who may offer a solution, walked in Scottish economist and financier John Law[8], a man with bold ideas who would be given a country to experiment in implementing his ideas of a central bank, replacing gold with paper credit and then increasing the supply of credit, and reducing the national debt by replacing it with shares in economic ventures.

Such ventures included bringing English workers to help setup and manage French factories, where French workers would be trained in superior English methods. As we shall see later, Henry Sully ended up playing a significant role in horological factories.

A WATCH OF NEW CONSTRUCTION – SULLY and LE ROY

"*Règle artificielle du temps*"[9], first written and printed in Vienna in 1714 (as we have seen in an earlier chapter), was rewritten by Sully shortly after his arrival in Paris, and published there in 1717. It remains one of the most historically significant horological books - it touched on many aspects of watch construction and more importantly, for watch owners to whom the book is also addressed, it offered practical advice on selecting a good watch and taking care of it. The language is clear, articulate, easy to understand, which is even more remarkable in that Sully was writing in French, and not his native English.[10]

In the 1737 edition is featured the story of a particular watch, which resulted from the collaboration of Sully and the venerable Parisian watchmaker [*horloger*] Julien LeRoy[11]. The story of how the watch came to be, how it was designed and constructed, and what it led to, is told from two relevant and interesting perspectives, written many years apart by the two main protagonists.

Firstly, Sully himself devoted a chapter of his book to the watch and to the presentation he gave on its merits to the Académie Royale des Sciences, in June 1716. This chapter is found after page 192 in *Règles*, is preceded by a revealing preface, which leads into the actual description of the watch on page 201. The chapter ends, on pages 236-238, with a report of members of the Académie pronouncing themselves favourably on the qualities of the watch.

Secondly, in the memoirs that Julien LeRoy added to Sully's book when it was revised for a new edition in 1737, is one entitled "*Historical memoir on Mr. Sully's watch*", starting on page 275.

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[8] John Law (1671 - 1729) was a Scottish economist served as Controller General of Finances of France under the Duke of Orleans.

[9] *Regle artificielle du temps, traité de la division naturelle et artificielle du temps, des horloges et des montres de différentes constructions, de ma manière de les connoître & de les regler avec justesse. Par Mr. Henry Sully, Horloger de Monseigneur le Duc d'Orleans. De la Societe des Arts. Chez Gregoire Dupuis a Paris 1737* [revision of original 1717 edition].

[10] Interestingly, although several German editions were produced, this book was never translated into English.

[11] Julien LeRoy (1686-1759) was born in Tours and trained by his father who was a clockmaker. He moved to Paris in 1703 and quickly established a reputation as an outstanding worker. Eventually he opened up a workshop and sold clocks and watches for many years in the exclusive Place Dauphine area. He was conferred the title "*horloger du Roi*" in 1739.

In the following 17 pages, LeRoy told the story of the watch and his participation in its design and construction, the conversations he had had with Sully about it, and his later opinions on aspects of the watch, reflections stemming from twenty additional years of watchmaking experience he had at the time of the new edition. LeRoy also briefly discussed the history surrounding the watch, in the part of the book entitled "*Memoir to serve for the history of horology, from 1715 to 1729*". This memoir, from pages 381 to 413, essentially consists of a biographical overview of Sully's life and work, from LeRoy's firsthand perspective.

It is interesting to read in Sully's memoir the detailed descriptions of the various aspects of his "new watch", and the way that these innovations (not all successful as it turned out) came about through discussions between the two watchmakers, both in their prime at the time. Prior to this, horological books and treatises did not quite go to this level of detail in describing the components of a watch and their relationships, and doing so in such exquisite details and flowing literary style. Sully wrote very clearly in an engaging style, which demonstrates how formidable a communicator he must have been, both verbally and in writing. This skill allowed him to impress and befriend many important people over the years, talking to them about his ideas and plans, horological or otherwise.

We have seen in previous chapters that since completing his apprenticeship in London under Charles Gretton[12], around 1705, Sully had gone to the Continent where he spent a few years in Holland (The Hague and Leiden), then some time in Frankfurt-on-Mein, and finally residing in Vienna for a while. During this time, he raised a family[13], repaired watches for a living, read all he could find on watch and clockmaking, discussed horology with numerous people in the trade, and made a name for himself among people of influence and wealth. In this way, Sully was able to combine his knowledge of watchmaking practices in England, and compare them with practices on the continent.

Sully and LeRoy met in 1715, introduced by English steel spring maker William Blakey[14], when Sully had relocated to Paris with his family, under the patronage of the Duke of Arenberg. LeRoy had married earlier that year, and was establishing himself as one of the better *horlogers* around Paris. Recalling these events in 1737, he writes:

> *A common friend, Mr. Blakey of London, skillful spring-maker, whom [Sully] had asked to introduce him to a known horloger, brought him to me, Rue des Petits Augustins. Since our first conversation we argued about the merits of English and French watches, but I felt I defended the weaker side: Parisian watches, especially the repeating ones, lagged behind those of London because they were only half as expensive, which prevented most if not all horlogers to produce works as finished and perfect in all regards, as they were capable of. Being neighbours, I soon paid him a visit; we talked again about our Art, he showed me some of his tools, made and finished with great skill, as well as a nice machine to cut wheels, and some parts very well made, which seemed to me for a large*

[12] Charles Gretton (1647/8 – 1731) was a prominent London clock/watchmaker during what is called "the golden age of English clockmaking". His shop was at "the Ship on Fleet Street" and Sully apprenticed and worked under him from 1695-1705.
[13] His first wife Anne (or Anna) Horton died after giving birth to four children in quick succession, in the Netherlands.
[14] William Blakey senior (1688 – 1748) was apprenticed as a watchmaker in 1701 and went to France where he was in charge of a steelworks in Normandy which provided springs and pinion wire for the watchmaking factory in Versailles, set up by John Law and run by Henry Sully. He was a described as a *horloger en ressorts*, a spring maker.

watch, of which he did not reveal the use, but which I suspected constituted a part of, or were destined for, a marine clock. [JLR]

Figure 2 – L: Henry Sully ca. 1717 - R: Julien LeRoy ca. 1740-50

LeRoy and Sully remained close acquaintances, and probably friends, until Sully's unfortunate death in 1728. The meeting and collaboration of these two remarkable men on the "watch of a new construction" in 1716 remains an important page of European horological history and deserves to be told in some detail, in this chapter.

Their meeting brought two great watchmaking traditions together: Sully, trained in London in the fine English tradition – which at the time was the recognized center of excellence for watchmaking worldwide; and LeRoy, trained by his father in Tours and then learning for a dozen years from great makers in Paris. Sully also brought to the table things he had learned while living and working in the Netherlands, Germany, and Austria. In Holland in particular, he probably discussed horology with some of the people who had worked closely with Christian Huygens (1629 - 1695), the Dutch physicist, mathematician and astronomer, whose inventions had revolutionized horology in the mid-17th century: the pendulum balance for the clock, and the balance hairspring for the watch.

Servicing and repairing many watches for his customers and patrons, Sully also thought greatly about what were some of the long-standing design and construction issues that could be improved upon, for reliability and accuracy. Much of this thinking permeates his earlier published writings on adjusting and maintaining watches, and certainly populates the pages of *Règles* - both the 1714 edition printed in Vienna, and the revised 1717 edition printed in Paris.

In challenging some of the age-old principles of verge-fusee watch construction, Sully was displaying an iconoclastic spirit striving for improvement in all he did and saw, and tried to educate and convince others to also understand and adopt his recommended new practices. This probably incurred the ire of many established watchmakers, both in England and on the Continent, who viewed his opinions as attacks on time-honoured traditions of watchmaking. In fact, it's possible that his critical opinions may have made him some enemies in the watchmaking community in London, and may have contributed to inciting Sully to seek out other practices on the Continent.

In his Preface to the description of his new watch, Sully writes:

> *Most of the workers only repeat what they saw their master do, without much thinking. Others lack knowledge, don't know enough about the utility, and rely a bit too much on imagination, which rarely yields worthwhile results when not guided by science. […] It is generally true that the best reasoned theories require experience to be confirmed. It is also true that in analysing a theory, whose principles are known, one can easily distinguish what is being demonstrated, from what is simply probable. [HS]*

He goes on to say, referring to the positive effect generated by his reading of his memoir on the new watch to the Académie:

> *… the advantageous approval of [the Académie] has generated some jealous people, who applied efforts to discredit the bit of merit that my work had given me […] and it is for this reason that I am more interested at this time to make this memoir public […] this is less the description of a new watch, then an exposé of the shortcomings of those made until now. Enlightened people will see the good side of this, that one is attempting to perfect the Arts, and I flatter myself that the saner part of people in the [horological] profession will gratefully receive the present of this memoir. But those who don't have great interest that too much be known about the underlying theory have a certain right, which it looks like they may use, to disapprove both this work and its author. This isn't a bad thing, on the contrary it is desirable to stimulate emulation in young people, whose future works will contribute to the honour and the good of the State. [HS]*

As will be pointed out later, many of the horlogers of Paris spoke up against Sully, when on the heels of his success at presenting his new watch to the Académie, he had asked to admitted to the Guild of horlogers[15], normally closed to foreigners unless they had done an apprenticeship in Paris. One of those who spoke against him was Julien LeRoy himself, at the urging of many of his fellow horlogers. Sully concludes his preface:

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[15] The "*Corporation des horlogers de Paris*" was created by François I in 1544 and updated in 1583, 1646, 1707 and 1719. It regulated the practice of horology in and around Paris (apprenticeships, masterpiece, membership, inspectors, etc.)

I am not angry with those who have risen up against something they do not know, and now they can finally see with their own eyes the basis upon which I was given the approval of the Académie, which seems to have given them so much grief. Am I felt to be mistaken? I will oblige anyone who takes the trouble to challenge me and will honour the critique, having no other goal than to enlighten myself with the truth. [HS]

In his description of the watch, Sully writes:

The principal objective of horology is accurate time measurement. We know what degree of perfection has been attained by clocks, and we know all too well how far portable watches are from this. We endeavour to close the gap and if the hard road prevents us from taking large steps, we must still aim for small improvements. I don't mean to reverse usual construction principles for watches, only to make them better. I will only suggest things that are evidently useful, and that skillful workers can execute as easily as they do every day. [HS]

He then explained that two main things render watches imperfect timekeepers, namely friction and wear. Sully went on to describe all the ways that friction can limit a watch's accuracy and reliability, whether it stems from the mainspring rubbing on the barrel top, bottom and sides, or the various pivots of the watch. In particular he described how the top pivot of the fusee is generally larger than the bottom one, to accommodate the winding square, and that he felt this was a great flaw in even the best English watches.

French watches often had the larger pivot on the bottom of the fusee, which Sully felt was a better design to reduce friction. Of course, this was because many French watches were wound through a hole in the dial, whereas English ones were wound from the back of the movement, preferring not to mar the elegance of the fine English dials with a winding hole.

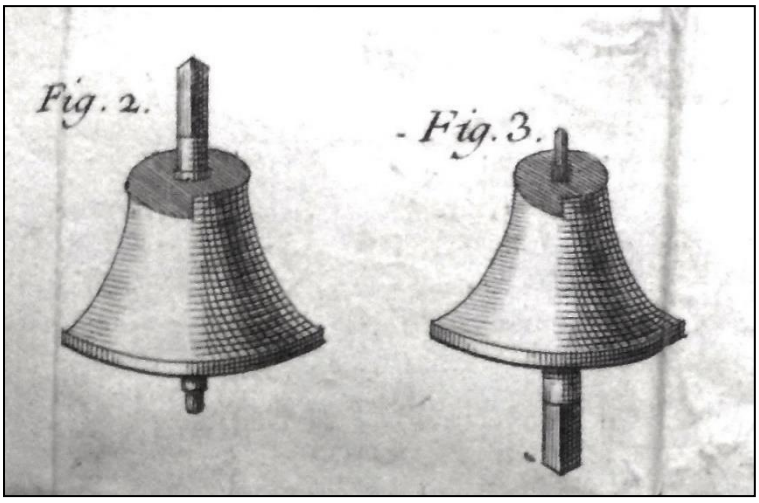

Figure 3 - Illustration of fusee pivot sizes

Sully also wrote about the crucial importance the balance wheel pivots play in the accurate operation of the watch. Not only due to the large amount of friction that the oscillations generate, but also the shocks that it has to assume in its operation, especially the top pivot which is close to the balance wheel, which has most of the weight. He also advocated using a solid brass balance wheel instead of one traditionally made of steel, to avoid problems associated with magnetism and rust.

BUILDING THE NEW WATCH

In LeRoy's memoir[16] he recalls that in May 1715, the "late Mr. Sully" benefitted from a pension from the Duke of Arenberg, with whom he [and his family] lived in a furnished hotel[17] in the neighbourhood where LeRoy lived and worked.

> *[Sully] proposed that I make him a simple watch "en blanc" [mechanism] under the conditions that we would have conversations on all the main parts it would contain, and in this way reciprocally help each other from our individual knowledge, and do all the research necessary to discover new ways to perfect, wherever possible, the construction of the envisioned watch. Our first conversation dealt with the arrangement of the parts, what is referred to in our Art as the movement calibre [which] serves to mark on one of the plates the places where one must install the pillars, the wheels and the barrel; it is this calibre or plan which determines the size of the watch, of its wheels and of their relative positions. [The calibre] that we agreed upon at our first conversation appears advantageous: whether the watch is worn flat or suspended, the axis of the crown wheel is always parallel to the horizon, and thus conserves the same distance from the balance. [JLR]*

In his original description of the watch, Sully describes the need for the new calibre arrangement with regard to the crown wheel axis:

> *When the watch is suspended, the balance axis is vertical whereas the crown wheel axis is horizontal; and when the watch is laid flat, the balance axis becomes horizontal and the crown wheel axis is vertical. These two situations change slightly the meshing of teeth of the crown wheel with the balance verge pallets […] the least change in the meshing affecting the running of the watch. Since the more the pallets engage on the teeth, the greater the balance vibrations become, therefore slower [and vice versa]. In the usual construction of watches, the meshing of the pallets in the crown wheel's teeth is necessarily greater when the watch is suspended, so that even well-made watches run slower in this position. [HS]*

This illustrates the extent of the discussions that Sully and LeRoy were having about all the components of the new watch, openly challenging long-accepted practices for making the

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[16] *Memoire historique sur la montre de M. Sully, Règle artificielle du temps*, 1737, Paris, pp. 275-292.

[17] It was a feature of Paris in the 17th and 18th to have nobles, aristocrats and rich Parisians live in veritable small palaces built in the city for them, which were called "*hôtels particuliers*" (private hotels). Arenberg would have owned or rented such a lavish house.

various parts, and the relationships between them. In hindsight, writing twenty years later, LeRoy said this about the new caliber arrangement vis-à-vis the position of the crown wheel axis:

> *Even though [this new arrangement] seemed good and seduced us at the time, the new calibre has not been very successful; there are good reasons for this that we hadn't thought about, and by which we can easily prove that it is not as good as [the approach] that is most in use here, which for a long time has also generally been followed by English watchmakers. [JLR]*

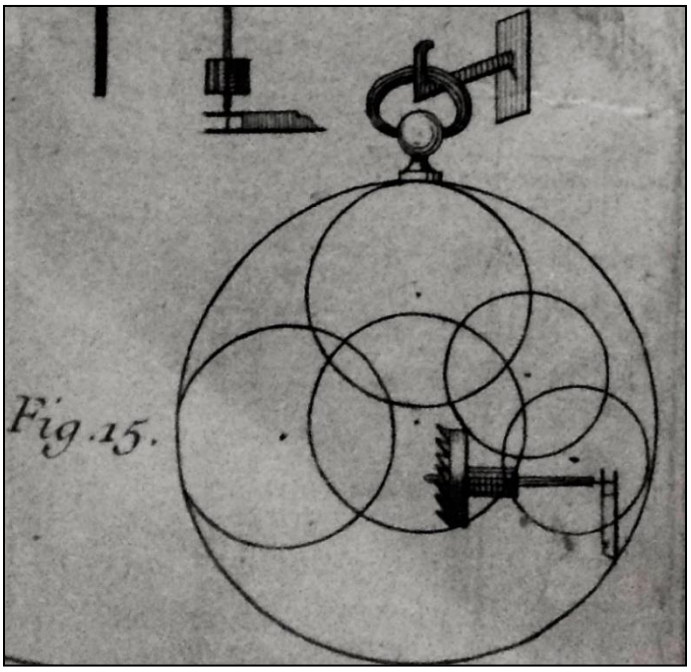

Figure 4 – Sully and LeRoy's new watch calibre layout

Therefore, not all the ideas that Sully came up with and discussed with LeRoy, and that went into the watch that was presented with great élan to the Académie, resulted in broadly accepted changes to the practice of watchmaking, both in Paris and in Sully's native England. Yet, this illustrates that Sully constantly strived for improvements and beneficial changes to the status quo, even though he didn't always hit the mark, or convinced enough people that he was right. In his historical memoir, LeRoy described it as Sully's *"passion that he had his entire life to contribute with all his energies to improving horology"*.

A prominent aspect of watchmaking that Sully and LeRoy tried to tackle in the new design was the age-old problem of friction. Metal pivots turning in metal holes, teeth of wheels and axle pinions meshing with each other, the mainspring rubbing against itself and the walls of the barrel as it unwound, all of these frictions added up to considerable resistance which, especially when the imperfect oils used at the time, could quickly age and change the accuracy of the watch or severely slow it down, and eventually stop it altogether. Sully painstakingly described all the areas of the watch where this friction occurs, and means that could be used to try to minimize it.

One such means was the way to ensure that oil remained where it was needed, by the pivots turning in their holes in the watch plates. LeRoy describes his interactions with Sully in this entertaining recollection:

> *Mr. Sully told me that oil qualities differ so much that one must choose the most convenient one: too thin and it evaporates quickly in the air and heat of the pocket; too dense and it thickens into a glue in little time. When he asked me if we should put more or less at each pivot, I answered that more was better, to counteract the thickening caused by dust in the air, or worn off the metal parts by use. I told him that Mr. Gaudron[18], the Regent's horloger, had said that if we could put a small oil bottle at each watch pivot, it would retain its precision longer. [Sully] was struck by this notion, and told me when he left that he wouldn't be able to sleep until he had thought about all the ways that he could execute this. Indeed, I believe he didn't sleep, and as he lived close to me, he came early the next morning in bed clothes to ask me for an old watch plate and a piece of brass of the same thickness, to try out some ideas he had come up with during the night.*
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> *On the evening of that same day he brought me, all happy, the piece of brass secured by a screw on the plate, on which he had dug out a half sphere depression, linked by a canal to a small hole he had made with a pivot drill; I was as excited as he was about the discovery. To celebrate, we had supper together and agreed, glass in hand, to name "reservoir" the new way of holding a lot of oil on the watch pivots; but the next day all was changed, and the joy of the previous day had turned to disappointment; because he brought to me, with a sad look, the reservoir, from which all the oil had leaked out during the night, between the edges of the plate and the piece of brass screwed onto it.*
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> *This flaw seemed to us at first so considerable that it appeared impossible to fix it; however, he found a way, and to do it he dug a small groove around the reservoir, and filled it with a thin streak of yellow wax, thereby sealing it hermetically, and the oil no longer leaked out because the pressure of the screw pressed the wax and stopped the connection between the reservoir capacity and the small hole he had drilled. This addressed our need in this area, and I made the movement with the reservoirs, that he finished himself, and presented it the next year to the Académie. [JLR]*

We can easily imagine, in LeRoy's informal retelling, the two men leaning together over a bench trying to come up with a solution that seems almost awkward to us now, but was so novel at the time and excited them like a couple of school boys. Sully staying up all night to mull over a solution, and then showing up dishevelled at LeRoy's shop the next day, is a telling picture of the passion that drove him to attempt so many things and courageously follow many ambitious horological ventures in life.

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[18] Pierre Gaudron (1690 – 1745) prominent Parisian horloger. Clockmaker to the Regent, the Duke of Orléans.

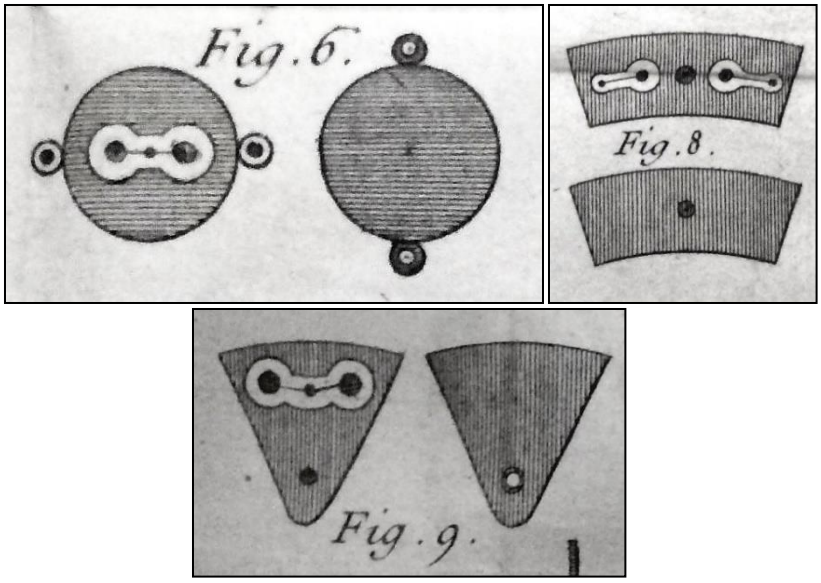

Figure 5 - Examples of Sully's oil reservoirs

Following the various conversations between the two watchmakers, and experimentations to arrive at solutions to the issues raised by the Englishman, LeRoy proceeded to build the watch for Sully. He recalls:

> *The frequent visits that he paid me and the mutual pleasure that we found in discussing together our Art, in which I found him very skillful, as he often came to repair watches of the Duke of Arenberg or of his friends, created such a friendly bond between us that [Sully] proposed that I make him the watch discussed at the end of his book [Règles, 1717]. Sometime after that [early in 1716], the Duke of Arenberg went to live at the Cloître de St Germain l'Auxerrois [in Paris]. Mr. Sully accompanied [his benefactor] and fell in love with a young woman of that neighbourhood, which interrupted all our horological conversations; such that he forgot about me and the watch he had ordered. I only saw him again three or four months later when he came to pick it up. I learned afterwards that he was married*[19]*, and a little while later, that he had finished and presented the watch, unbeknownst to me, to the Académie, from which he had received an advantageous certificate, which he wanted to use to be received Maître Horloger [master watchmaker], even though a foreigner. [JLR]*

Unpacking this story a bit, one can detect a certain difference of opinion between Sully and LeRoy as to who in fact had built the new watch, and why LeRoy had not been told by his newly re-married friend that he had finished the watch in order to present it to the Académie, in the manner and with the detailed exposé that Sully reproduced in his Description.

Certainly, the two watchmakers had collaborated in formulating design elements, even though it was Sully who had initiated the discussions and tasked LeRoy with building the movement for

[19] Henry Sully married Angélique Potel in Paris, on 22 November 1716. With a second wife now able to look after his children and household, Sully likely felt freer to pursue some of his horological interests and career aspirations.

him. The Frenchman probably felt he deserved at least a mention, when Sully made his presentation to the august members of the Académie, and was possibly a little disappointed by this slight on the part of his friend.

There are also a few incongruencies in LeRoy's memory of the sequence of events. The presentation of the watch to the Académie took place sometime in June 1716 (confirmed by the date of the report on his presentation). Also, marriage records found by the author indicate that Sully married his second wife, Angélique Potel, on 22 November 1716. Therefore, the presentation preceded Sully's marriage by several months.

PRESENTATION TO THE ACADEMIE

The painting in the figure below depicts the Académie Royale des Sciences in 1667, shortly after its creation, where sat King Louis XIV. Surrounding the august group of scientists and dignitaries are books, globes, maps, animal skeletons, scientific instruments, and at least one clock. The building in the back of the painting is the new Paris observatory. A similar imposing scene could have been met by Sully fifty years later, when he presented his new watch design to the Académie, in June 1716. The Regent of France, Duke of Orléans, could likely have sat in the central chair, surrounded by all the notable scientists, astronomers, and mathematicians of the day.

In the years he had spent in the Netherlands, Germany, and especially Vienna, Sully had had the opportunity to meet and discuss horology with many influential and aristocratic people. Probably, some of Sully's influential acquaintances (Leibniz[20] for one, and certainly his benefactor Arenberg), would have urged him to make himself known in Paris, and utilize his effective oratory skills to promote himself in front of the members of the Académie. One can wonder whether Sully, through his acquaintance Blakey, may have sought out a reputable Parisian watchmaker to help him develop the product he was going to showcase as his own creation.

Circumstances and fate played a large role in the lives of many people during the turbulent and opportunistic times that followed the death of King Louis XIV, and Sully was only one of many to find himself at the right place at the right time with the right skills and ambition to fulfill a need. Undoubtedly, the positive impression he made at the Académie contributed to him being asked to lead watchmaking factories in Paris a couple of years later.

[20] Gottfried Wilhelm Leibniz (1646-1716) was a prominent German polymath and one of the most important logicians, mathematicians and natural philosophers of the Enlightenment. He made major contributions to physics and technology, and anticipated notions that surfaced much later in philosophy, probability theory, biology, medicine, geology, psychology, linguistics, and computer science. [Wikipedia]

Figure 6 - Académie Royale des Sciences, Louis XIV, 1667

LeRoy continues the story by saying that many of his fellow Parisian horlogers approached him, and were somewhat "*alarmed at [Sully's] reputation, which had spread like a lightning bolt*" [after the presentation to the Académie]. The inference here is probably not to Sully's reputation as a formidable watchmaker and toolmaker, which LeRoy himself had observed on many occasions, but possibly to a tendency for the Englishman to use a situation (and people) to his advantage.

The other thing that the Parisian horlogers urged LeRoy to do, was join them in opposition to Sully's request to join the *Corporation des horlogers* [guild of watchmaking] in Paris, given that it was well known that Julien had played a key role [unrecognized by the Académie] in the watch that was creating so much stir. LeRoy continues:

> *[I joined them] at their request, Mr. Sully was not received Master watchmaker, and he held it a bit against me. But as he was made to realize that he had undermined me [by not indicating the role LeRoy had played in the watch], we patched things up so quickly between us that we didn't have time, so to speak, to notice that we had even been upset with each other. [JLR]*

Indeed, friendship won out in the end, and LeRoy may have regretted undermining his friend. He goes on to state, looking back twenty years later, that the opposition of the watchmaking community to his acceptance into the guild had in fact been a good thing for Sully, because his influential friends then convinced the Regent to provide ongoing funding (of 1500 livres annually) to help him continue his work - and feed his family, consisting of a second wife, and three or four young children from his first marriage.

According to LeRoy, the Scotsman financier John Law, who was playing an increasingly important role in the financial affairs of France through his influence with the Regent, "*was charged to deliver the funding himself, and had gone to see [Sully] on this occasion. Works that he saw in his house, the keenness of mind that he noticed in his discourse, joined to all the good that he had heard about him, and made him believe that he would be very well suited to lead a horological factory*".

The story of Sully leading not one, but two horological factories, will be told in the following chapter, but it serves to illustrate the opportunities that offered themselves up to the Englishman, following his fortuitous decision to partner with LeRoy and present his new watch construction designs to the Académie.

LeRoy concludes the story of the watch by recalling what happened a few years later:

> *The new watch, not having been cleaned for around three years, was brought to me by Mr. Nicole[21], first-class geometer and of the Académie. As he was aware of the role I had played in this work, he asked me to take it apart in front of him, so that he could determine for himself the positive or negative effect of the "reservoirs". One can easily imagine that my curiosity matched his, the watch was taken apart on the spot, the reservoirs were inspected one after the other, and found to be still sufficiently full of oil, which had only turned slightly green. Since this observation seemed to me absolutely decisive in favour of using reservoirs, it confirmed the advantageous opinion I had already formed on the matter, and convinced me to not discontinue such a useful means to perfect watches. [JLR]*

LeRoy eventually changed his opinion however, and did not continue this practice. A friend had given him a translated copy of Newton's Optics, which gave LeRoy a better idea to manage the oil problem at the pivots, using capillary action between plates, and also by distancing pinions from the pivots, to prevent oil from easily migrating from one to the other.

For a long time after, however, horological literature continued to credit the invention of reservoirs by Sully, in the making of the "watch of new construction", as being one of his notable technical innovations and achievements. Whatever happened to Sully's new watch, after Nicole had asked LeRoy to inspect it on his bench, is anybody's guess. Probably one of the countless old watches from that era that have been lost forever for a myriad of reasons.

In closing, it is useful to reproduce some the text of the favourable "certificate" [as LeRoy called it] that the Académie issued to Sully, on 10 June 1716, following his presentation of the new

[21] François Nicole (1683 – 1758) was a French mathematician.

watch. The report was written and signed by Académie members Sébastien[22], Varignon[23], Cassini[24] and Saurin[25].

The illustrious status of these men of science gives an idea of the kind of audience to which Sully confidently presented his new watch design. His ability to communicate and defend his ideas to men of much greater social or scientific standing to his, was a key characteristic of Henry Sully all his life, since he had first approached Christopher Wren[26] and Isaac Newton[27] in London as a young man still completing his watchmaking apprenticeship. The report of the Académie reads:

> *We have carefully examined, on the order of the Académie, the memoir that was presented by Mr. Sully, entitled "Description of a watch of new construction", and containing the most considerable causes and the least known defects still found in portable watches, and ways to make the movements more accurate, and this accuracy more durable. We have also examined with the same care the parts of a watch executed by the author on the principles established in the memoir, and we have been so completely satisfied, both of the memoir and the watch, that we feel obliged to give him a testimony containing the ideas that we have conceived.*
> *We have noticed three principal things in the Author's invention. 1. A very considerable reduction of friction, by means that seemed to us equally simple and ingenious. 2. A singular skill to conserve remaining friction in a constant equality. 3. A shrewd arrangement of the watch by the inventor, which promises greater perfection, given that the traditional arrangement is one of the main causes of irregularity of the movement in a watch placed in different positions.*
>
> *Moreover, the careful and sensible attention of the author in his research, that is pleasantly seen in his memoir, joined with the order and cleanliness that rule, announce a talent that could become very useful, given that it is not commonly found in persons attached to the art of his profession. And the skillful precision evident in the execution of his watch, make us hope for more complete works from his hand than we have seen until now.*

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[22] Jean Truchet (1657 - 1729), known as Father Sébastian, was a French Dominican priest born in Lyon, who lived under the reign of Louis XIV. He was active in areas such as mathematics, hydraulics, graphics, typography, and for many inventions. [W]
[23] Pierre Varignon (1654 - 1722) was a French mathematician. He was educated at the Jesuit College and the University of Caen, where he received his M.A. in 1682. He took Holy Orders the following year. He was a friend of Newton, Leibniz, and the Bernoulli family. [W]
[24] Jacques Cassini (1677 - 1756) , was a French astronomer. Succeeds his father as member of the Académie in 1712. Becomes director of the Observatoire de Paris. Friend of Newton and Halley. [W]
[25] Joseph Saurin (1659 – 1737) was a French mathematician, who contributed to calculus.
[26] Sir Christopher Wren (1632-1723) was an English anatomist, astronomer, geometer, and mathematician-physicist, as well as one of the most highly acclaimed English architects in history. He was accorded responsibility for rebuilding 52 churches in the City of London after the Great Fire in 1666, including what is regarded as his masterpiece, St Paul's Cathedral, on Ludgate Hill, completed in 1710. [W] In addition to his remarkable architectural achievements, Wren also created many mechanical and scientific inventions in the areas of astronomy, physics, optics, and was an active member of the Royal Society.
[27] Sir Isaac Newton (1643-1727) English mathematician, physicist, astronomer, theologian, and author, was President of the Royal Society of London in 1703. He became a Commissioner of Longitude under the Act of 1714, and corresponded widely on proposals for finding longitude at sea. [W]

> *This report was unanimously approved by the entire body, and registered in the Memoirs of the Académie.*

It is easy to see, had he read this report at the time, how LeRoy could have been disappointed in not having been mentioned as a participant in making the timepiece that had so impressed the Académie. In essence, he had been treated by Sully as a nameless worker hired to do the work of implementing the "inventor's" vision and design. Much as LeRoy may have bemoaned the lack of mention of his name in this initiative, he could likely never have managed to make as convincing and successful a presentation to the august members of the Académie, as Sully was evidently able to.

Looking back on it all twenty years later, Sully being in the grave for ten years, LeRoy could not but graciously write, referring to his friend's innovations in the "new watch" of means to address lubrication issues:

> *[…] the more a horloger will know how make use of the effect of attraction, in configuring the parts of a horological work, and to fix the oil in the necessary places, the better he will be. All things being equal, this will seem even more true, in re-reading the comments made by Mr. Sully, to show how the pivots of a watch, especially those of the balance, need to be surrounded by oil. This article alone, and many others of his description, would justly deserve not only the praise conferred to him by the Académie, but also by the most skillful horlogers. [JLR]*

ANOTHER PRESENTATION TO THE ACADÉMIE

Later that year of 1716, Sully made another presentation to the Académie, entitled "*Montre pour la mer*" [literally "watch for the sea", or marine watch]. It is listed in *Recueil des machines approuvées par l'Académie* [Collection of machines approved by the Academy], and numbered 177. Most likely, this would have been the watch that Julien LeRoy mentioned he had seen parts of, when he had visited Sully in his dwellings:

> *He showed me […] some parts very well made, which seemed to me for a large watch, of which he did not reveal the use, but which I suspected constituted a part of, or were destined for, a marine clock.*

The description of the watch in the Academy document, says that it was "3 inches in diameter and the same in depth, of cylindrical shape". The escapement is unusual, consisting of two "pallets" installed near the center of a long balance arbour, which interacted with an escape wheel consisting of "15 or 20 teeth". The watch was suspended in a circular frame by "a suspension like the ones used for compasses" [probably what we call gimbals], so that "during the movements of the boat, the watch's suspension compensates for these various movements, by always placing itself through its own weight to a horizontal position".

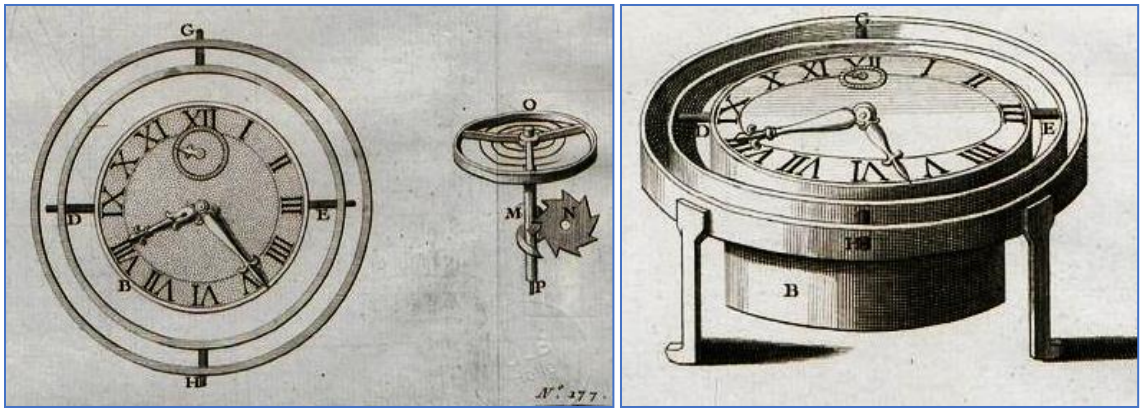

Figure 7 - Henry Sully's "Marine watch" 1716 (no. 177)

Together with this description of the marine watch, Sully also presented a new invention of his, a "means to avoid friction on watch escapements". It consisted of two series of four rollers, each attached to the watch plates, and which supported the movements of the balance pivots. In this way, rather than the pivot rubbing against the sides of the usual pivot hole in the plate, it was supported by the freely turning circular metal rollers. Each end of the balance pivot came to rest on diamonds or extremely polished hard stones. Note that in the diagram accompanying this 1716 memoir (numbered 177*), is pictured what looks more like a verge balance and balance, and in this case, the outer pivot of the crown or escape wheel is also fitted with a 4-roller assembly. Perhaps the idea of using the rollers in his marine watch had come from his frequent discussions on watches with LeRoy, we will probably never know.

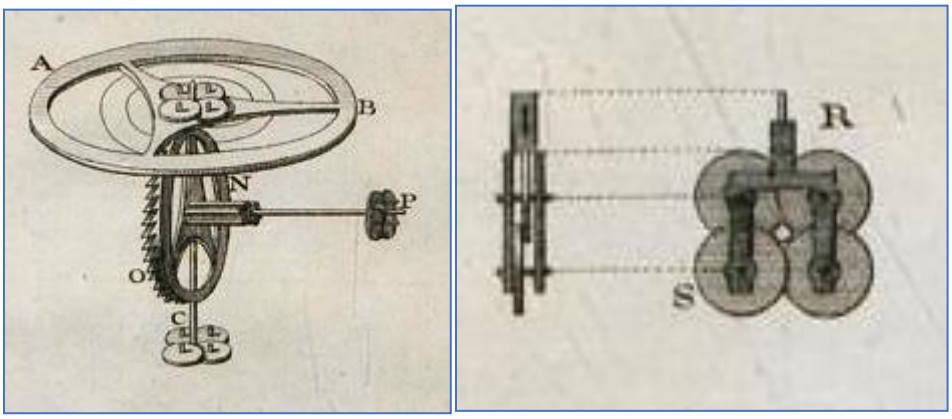

Figure 8 - Sully's *1716* roller design to avoid friction

Clearly, Sully had been busy on his own workbench in designing something different than the "watch of a new construction", which he had collaborated on with LeRoy. He possibly asked LeRoy to build him the "new construction watch" movement because he himself, in addition to looking after his children and courting the Parisian woman who was to become his second wife, was busy secretly building something altogether different (the marine watch with rollers), that he

possibly intended on presenting to the Académie on the heels of his successful presentation of the watch he had co-designed with LeRoy.

The following year, in 1717, Julien LeRoy's first son Pierre was born, who was to follow in his horological footsteps and take over the family business after his father passed away. Pierre must have met Sully many times as a boy, and the Englishman probably influenced him to eventually spend many years of his own adult life trying to solve the determination of longitude by marine clocks.

Julien got the opportunity to present some of his own horological innovations to the Académie in 1717 and 1719, no doubt inspired by Sully's success. He also made other presentations in 1728 and 1732. His reputation and business success grew steadily, and he raised four sons who all became successful in their individual professions. He was named "*horloger du Roi*" in 1739 and when he died, 20 years later, was greatly honoured by the horological community in Paris.

Building on the early notoriety gained after his arrival in Paris, Henry Sully was soon given the opportunity to lead a horological factory being setup by John Law[28] in Versailles. The story of this momentous event in Sully's life will be told in the next chapter.

[28] John Law (1671-1729) was a Scottish economist and financier with bold ideas who was allowed by the Regent of France to assist in improving the very bad state of financial affairs in France, following the death of Louis XIV. Law was able to implement a central bank, replaced gold with paper credit and then increasing the supply of credit, and reduced the national debt by replacing it with shares in economic ventures. He also championed business development ventures which involved bringing English workers to help setup and manage French factories, where French workers would be trained in superior English methods.