

TRIBUTE TO HUBERT SARTON,

Clockmaker-Mechanic honoured by several Sovereigns, Brother of the Order of the Lion of Belgium, Member of the Institute of the Emulation Society, established in Liège for the Sciences and the Fine Arts, in 1779, and licensed in 1781, under the reign of the Bishop and Prince of Liège, the Count Charles de Velbruck, of glorious memory, heretofore Lord, Master and Commissioner of the noble City of Liège;

WITH HIS FELLOW CITIZENS,
FRIENDS OF THE ARTS AND SCIENCES,

Or abridged description of some of his inventions and his improvements in the various parts of horology and the higher mechanics, carried out by him from the year 1772 until January 1822, the time of his last invention and perfection of hydraulic machinery for the use of Holland;

With the approvals of the Royal Academy of Sciences in Paris, the Imperial and Royal Academy of Brussels, the Emulation Society of Liège, the English Academy in the same city, the Advisory Committee for the Arts and Manufactures in Paris, and the Royal Academy of Sciences and the Humanities in Brussels, etc.

LIEGE,

PUBLISHED BY J.A. LATOUR.

1822.

According to a text by Henaux, *Etudes historiques et littéraires sur le wallon*, of 1843:

“See the description of his inventions and improvements, in a booklet entitled *Hommage de Hubert Sarton* to his fellow-citizens, friends of the Arts and Sciences, in octavo thirty-two pages composed by the lawyer Hognoul and printed by J.A. Latour, printer and publisher, rue du pont d’Isle, Liège in 1822.”

A facsimile of this book and the above authorship information were supplied by Joseph Flores.

FOREWORD.

Several reasons engaged the author of the inventions and improvements in the mechanical art and the works of horology, whose brief description will follow, to give them some publicity, in the hope that the powerful Monarch, guard and enlightened valuer of the arts and letters, as well as the impartial and educated part of the public, will favourably accommodate the collection, which, so far, has not been well known. The double reception of the Sovereign and of his compatriots is the sweetest, noblest prize which an artist can receive from his vigilant and useful work.

Another reason still, is that of the recognition, for which the author is deeply sincere towards the person of this Monarch, his majestic Sovereign, who condescended to confer on him the rank of Brother of the Order of the Lion of Belgium, with the emoluments of a pension and reversion of half to his widow.

A higher reason is to stimulate and give birth to emulation, as much as it is in the power of the author, in the spirit of young people who embrace horology or the higher mechanics; seeing that, by making progress there, by inventing objects of recognized utility, or only even by improving them (because to improve is to invent), these young people have the assurance to obtain, at the same time, glory and rewards.

It was through the particular study of sciences and arts that Greece gave to the Roman followers of this noble inclination, and after borrowing its wisdom, they managed to give law to all the people of the world. Some, with the example of their champions, applied to it; but if they improved several branches of human knowledge, in others they went in quite slow steps, and horology was of this number; because it was only towards end of the year 1690 that skilful artists managed to give some perfection to the measurement of time.

But, today the art of horology, treated with all the knowledge necessary for its perfection by the most erudite artists, must undoubtedly go hand in hand with the most distinguished and most useful arts, since by presenting the more surprising masterpieces to skilful men, it shows us the precision of astronomical work, which obtains for the navigator his safety, by approaching very near to the desired knowledge of the longitude, etc. Though horology had only made weak progress in France under the reign of François 1st., this monarch considered it worthy of his attention. But in 1718, this art, very much esteemed in England, started to enjoy some consideration in France, by the crowd of skilful people that Mr. *Law* attracted to Paris, under the control of Mr. *Desully*, one of the most expert clock and watch makers at that time.¹ Following the example of the English and the French, several other nations applied themselves to it, owing to the protection which their sovereigns granted to them. In the Netherlands in particular it flowered, under the auspices of the late His Royal Highness Prince Charles of Lorraine, dedicated guardian of arts and sciences; and the lands of Liège had the same advantage with the advent of Prince Charles, Count of *Velbruck*, of glorious memory. Under these good princes, friends of arts and sciences, the genius of the inhabitants of Liège was revived; and remembering the great men of all kinds which this country formerly produced and still produces, they reflected, they consulted, they studied and made new works from the research of foreigners, for the perfection and finishing of what they discovered, etc., etc.

In 1815, with the happy advent of our majestic Sovereign the King of the Netherlands, the emulation of the artists of Liège again took on its old ardour, thanks to the munificence of the monarch who granted his high and powerful protection to them.

Horology, formerly in the class of mechanical arts, is today in that of the liberal arts, since it requires one who deals with inventions or improvements, to have sufficient knowledge in various parts of the sciences, to know to how to choose between the various systems, that which is simplest and most exact, to be able to draw up new plans for watches and clocks, and to combine and execute small planetary gears or other instruments useful in physical and astronomical demonstrations or lessons. This science needs the artist to be educated in theoretical geometry, to determine the curve of the teeth of wheels and pinions of watches and clocks, in mechanics, to know how to advantageously use forces and to employ them with economy, and finally an infinity of other sciences which it would be too long to report here.

1 Henry Sully, an Englishman who moved to France and published, in 1714, *Règle artificielle du temps*.

It is only by long work and in stages that one can manage to execute with precision, and to acquire the genius necessary for invention, by associating theory with labour, that is so useful to him, etc.

ABRIDGED DESCRIPTION

Some of the inventions and improvements in the various parts of horology and higher mechanics, with the approvals of the Academy of Science of Paris, of the Imperial and Royal Academy of Brussels, of the Emulation Society of Liège, of the English Academy of the same city, of the advisory committee for Arts and Manufacture of Paris, and of the Royal Academy of Sciences and the Humanities of Brussels, etc. etc. and which were invented or executed from January 1772 to January 1822, by Hubert Sarton, honorary horologist and mechanic to several sovereigns; Brother of the Order of the Lion of Belgium, member of the institution of the Emulation Society, established at Liège, for the Sciences and the Fine Arts, in 1779, and licensed in 1781, under the reign of the Bishop and Prince of Liège Count Charles de Velbruck, Master and Commissioner of the noble City of Liège.

IN 1772.

Hubert Sarton invented and made his first clock for His Royal Highness Duke Charles of Lorraine, governor general of the Austrian Netherlands, etc., etc.

It is a large clock surmounted by the figure of the sun, which rises and sets at the right hour, compared to the duration of the days and the nights. It makes its revolution in 24 hours, divided into 24 meridians, and indicates the true hour of this star, from its rising until its setting, and its passage through the meridian line with precision, as with its various elevations. One sees the duration of the days and the nights for each principal place on the globe, each sign of the zodiac, with its degrees, the equinoxes, the solstices, and consequently the beginning and the ending of each season.

This clock also shows the various phases of the moon, marking its age and its synodical revolution, which it completes in 29 days, 12 hours and 44 minutes.

It beats the seconds; the movement of the mark in the center of the dial is by an escapement without recoil.

The same clock has the equation of time, marking the hour of true or apparent time, as well as the mean or equal hours; it sounds the hours and the half hours. The movement and the chiming, also the rest of the work, has a double weight, and has only twenty pounds and three feet of descent to run for six weeks, without being wound, and the movement does not stop while it is wound.

A perpetual calendar displays the days of the week and the date of the month, whether it has 28, 29, 30 or 31 days; this is done by a hand which moves from the last day to the first day of the next month by itself. It is even correct in leap years. It has a very curious calendar contrived so that it could exactly mark for ten thousand years, if the metals and the other bodies were not subject to the ravages of time. This is done by means of four mobile dials, placed in parallel on a horizontal line. Each one is divided into ten equal parts carrying ten digits, 1, 2, 3 up to zero.

The first moves in one tenth part of each year, it makes one turn in ten years. Then it makes the tenth part of the second dial act, which makes one turn in one hundred years. The same operation is made for the third which completes a turn in thousand years, and thus to the fourth which makes one revolution in ten thousand years.

The pendulum regulating this clock, is composed of different metals, steel and brass, arranged to obviate the variations caused by temperature on metals, by its effects of dilation and contraction; a hand which moves over a portion of a graduated circle, indicates the various degrees of the temperature.

This clock is described in summary in the catalogue, with a number of other invaluable effects in the

estate of this great prince, much enlightened friend and protector of artists and men of letters; see page 27, articles 73 and 80, of the edition of the year 1781.²

The second piece, invented and presented to this prince by the same artist, is a domestic clock which has the property of showing the hour and the minute, by only one dial, in various parts of an apartment successively; it is also included in the number of the invaluable effects in the same catalogue.³

A third piece is a half-second clock with chiming, the work suspended and moving without communication, and serving as the regulator; going eight days without needing to be wound up. The author then devised his *manual dial for the equation of time*, which he presented to this prince, who was extremely satisfied with it. It is used is used to regulate clocks and watches by the movement of the sun. It was examined by the scientist Guillaume Mercer, professor of astronomy, member of the English academy, established in Liège, who declared,

Twenty-ninth July 1774, have examined this dial, and found it exact, for civil use.

It is composed of two hands, one of which shows the daily variation of the true hour of the sun with the mean hour of clocks or watches; the other is intended to extract the difference; so as to ensure the clock or watch always shows the true time of the sun without needing to resort at every moment to sun dials or meridians. This first clock was worth to the author the honour of being appointed clockmaker-mechanic to His Royal Highness Prince Charles of Lorraine, etc., and the newspapers of time also made an honourable mention of this work and several others, which were also quoted very advantageously. The artist obtained the same titles from LL. AA. RR. the Duke of Saxony-Tesehen and the archduchess, his majestic wife, governors general of the Austrian Netherlands, etc., etc.

1st and 29th March, 1776.

Advertisement in the Gazette of Liège, N^o. 27 and 29.

Hubert Sarton, honorary clockmaker-mechanic to his Royal Highness Prince Charles of Lorraine, and his Highness Prince bishop of Liège, published the invention which he had just made of a new machine for the extraction of coal, without employing horses, or chains, or ropes, with more rapidity and in greater abundance, employing the workers constantly, without intermittency and dangers, and considerably decreasing the cost and expenditure which, up to now, were inseparable. Though this machine deserved an honourable mention on behalf of the late Mr. Morand, intimate adviser to S. A. C. the Prince of Liège, member and librarian of the Royal Academy of Sciences of Paris, in his great work on coal, folio 1448, under the heading of machines in the table of contents, this mechanism remained forgotten until the time when its inventor developed it, by petition, to the preceding government, by asking for a patent for the improvement, which he obtained on the tenth of April 1813, for ten years.

After having built, in suitable proportions, a model of the machine which he had devised, he made and repeated various experiments on December 31st, 1812, in the presence of Baron de Micoud, prefect of the department of Ourte, Mr. Liégeard, general secretary of the prefecture, and Mr. Blavier, engineer in chief for mines. The success of these experiments was noted by an officially written statement, which was addressed to his Excellency the Minister for manufactures and trade in Paris.

2 *Catalogue des effets précieux de feu son altesse royale le Duc de Lorraine et de Bar, etc., auctioned at Brussels on May 21st, 1781.* (Reproduced in Alfons Wins *L'horloge*, Mons, 1924. Available as a Google Book.)

3 The dial oscillates from side to side.

It was sent by the minister to the advisory committee for arts and manufactures, which made a favourable assessment, which it made known to the minister of the interior.

Next on March 11th, the prefect of the department of Ourte addressed a letter to the author of which this is a copy:

Liège, 11th March 1813

The Prefect, Chevalier of the Legion of Honour,

To Mr Sarton, mechanic, at Liège.

Sir, his Excellency the minister for manufactures and trade, to whom I had sent in communication the official report of the examination which was made in my presence, of a model of the machine that you invented to extract coal, has just informed me that he submitted it to the advisory committee of arts and manufactures, which made a rather favourable assessment of it, and gave it to his Excellency the minister of the interior.

The committee observes that this machine appeared proper to them to fulfil the object for which it is intended, provided however it is built with the care which its construction requires. He adds that one must especially give attention to modify it, so that the baskets are suspended by their center of gravity, in order to avoid the side pressure which they exert against the fixed and mobile ties, armed with hooks, which raise them up again.

I thought that it could only be useful to you to know the results of this examination, which is more particularly within the functions of his Excellency the minister of the interior.

I have the honour to be, Sir, your very humble and very obedient servant.

Signed Baron Micoud.

Footnote. This letter of the Prefect, dated March 11th, 1813, addressed to Mr. Sarton, to inform him of the favourable judgment of the advisory committee of Paris, was transmitted, in original, to His Majesty the King of the Netherlands, in the year 1816, with descriptions of other mechanical pieces of new invention, which he made known to His Majesty at the same time.

Extract of the registers of the Academy of Science at Paris, on December 23rd, 1778.

MM de Fouchy and Le Roy, who had been charged by the Academy, examined two machines made by Mr. Sarton, of Liège. One, a watch which is wound up while carrying it, the other, a clock whose dial is driven horizontally to the right and to the left to show the hour in different places at the same time. As for the watch, the Academy judged that these kinds of watches, by the nature of their effects, require parts which remove a great deal of the space required for the balance and the verge escape wheel; that they are not absolutely new, having already been made of this type; that these latter however have the considerable disadvantage not to run while they are wound, Mr. Sarton has cured this disadvantage very well by his construction; and, consequently, it appeared to the Academy to be worthy of its approval, as ingeniously laid out to be able to wind itself by the movement which a watch receives while carrying it. As to the clock, the Academy judged that it can be of use only in a small number of circumstances, but that it was well designed and well built for its effect, and in this respect it deserved praise.

In witness whereof I sign this certificate, in Paris, on December 28th, 1778.

The Marquis de Condorcet, perpetual secretary, and I affix the seal of the Academy.

In 1779.

The *Esprit des Journaux*, which was printed in Liège, announced in the month of September 1779, a new clock designed by Mr. Sarton, which at this time was displayed at the Emulation Society of the town of Liège, and whose description was part of the catalogue that it published of the pieces of the artists of Liège.

One could also find in the same *Esprit des Journaux*, September 1779, pages 342 and 343, the announcement of another clock with carillon, his design and an absolutely new type, which played the most varied airs in two parts, and imitated the piano forte with as much delicacy as precision.

In the first exhibitions of works of artists of Liège, which were displayed at the Emulation Society of Liège, one noticed two large regulators going one year without being wound, invented by the same, including one marking the seconds, minutes and hours in the center of a common dial, while the other regulator marked them on three different dials, of which one was concentric and the other two eccentric, in order not to have any dial-work train. Their hands were carried by the same axles as the wheels. These regulators also had a very particular property, which is not to be prone to the deviations which could be caused by the temperature on the wall, or on the case, against which they would be suspended; nor by a change which could occur there, to be put out of vertical, which is necessary for the confidence of an observant physicist or astronomer in the great operations.

Another seconds clock, invented by the same person, was also exhibited at the Emulation Society. It is of extremely simple construction, considering that it indicates, with precision, the hours and minutes of true time, by a new dial-work built with only one wheel, which turns circularly around the common center; this operates the advances and delays of the clock as the sun indicates them on sundials or meridians; the annual wheel and its ellipse, which produces this effect, makes its revolution in 365 days and six hours, because of the leap year; at the same time it produces a perpetual calendar of the days and the months.

This clock runs by a weight of one ounce, which is wound up by a train with a spring every two minutes, while the principal winding takes place every month.

Many other pieces of his invention, too many to detail here, decorated the annual exhibitions of that society for a long time.

1783

Literal extract of the minutes of the Imperial and Royal Academy of Sciences and the Humanities of Brussels, at its meeting of January 24th, 1783.

The Commissioners named, for the examination of the new escapement presented by Mr. Sarton, clockmaker-mechanic to His Highness the Prince Bishop of Liège, having reported to Academy that they had examined this object, and that this artist had gone to one of them with a clock movement to which he had applied his escapement which, instead of pins, presents triangular teeth on each side of the limb, whose tops terminate with the circumference of the same radius as of the wheel, by which expedient the drops and the lifts of the anchor are always equal, without any recoil or shock which can deteriorate the isochronism of it.

The Academy, having read this report, can only approve this new escapement, which it believes deserves a distinguished place among the inventions of this type: it believes it to be very good for astronomical observations and to improve marine watches, and can only give just praises to its author, who is also known very favourably.

Made in Brussels, the twenty-eighth January 1783.

(Signed) J. Des Roches, perpetual secretary.

Louis XVI, King of France, proposed, in the year 1784, three prizes for the repair or rebuilding anew of the famous machine of Marly, invented, under Louis XIV, by Rennequin Sualème, inhabitant of Liège.⁴ Sarton, his compatriot, contributed. He provided plans and memoirs, accompanied by a 15 foot model, for a new hydraulic machine of his invention. The regrettable conditions that started with the unfortunate Louis XVI, prevented the implementation of such a useful project: none of the pieces sent to the competition were put to work. That has allowed to the author to say something of this invention.

His new hydraulic machinery had the property to raise water to the aqueduct, which is five hundred feet above the level of the river, with a volume of 1365 pounds of water in 20 seconds (as the old machine of Marly raised), which is the time of one revolution of the 14 wheels which are 36 feet in diameter and which are set up on the river, in Marly. This quantity of water does not correspond to the force of these 14 wheels, whose product is 408,576 pounds force calculated according to the average factors.

1788.

Extract of a report submitted to the Imperial and Royal Academy of Sciences and Humanities at Brussels, on the construction of a compensation Regulator, presented for its examination, by Mr. Sarton, clockmaker-mechanic to His Highness Celcissime the Prince of Liège, and member of the Emulation Society of the same city.

We the undersigned Commissioners named by the Imperial and Royal Academy of Sciences and Humanities at Brussels, to examine the compensation regulator which Mr. Sarton submitted for its examination and its judgment, and which he demonstrated in our presence, let us state we have thoroughly examined all the mechanism, as well as the principles on which it is built.

It is long ago that the variations which cold and heat produce on various metals were observed, and the relationships were determined with much precision. The clock industry especially found very useful, for the uniform measurement of time, the observations and experiments which the physicists made on this subject, and the most skilful artists of this century were exerted to build astronomical clocks, able to compensate for the different expansion of metals by heat, and to thus obtain in all the variations of cold and heat, a uniform movement of the pendulum and equal oscillations. Of all the pendulums of this kind which have been invented until today, though all built approximately on the same principle, and with same metals, steel and brass, that of Mr. Sarton appears to us to be preferable, by its great simplicity, and the facility to be regulated by the observer with the highest possible degree of accuracy, without anything disturbing the work and stopping the movement of the pendulum.

4 King Louis XIV needed a large water supply for his fountains at Versailles; the amount of water needed per day for these fountains was not much less than the amount of water used per day in the city of Paris. The Machine de Marly, completed in 1684, consisted of fourteen gigantic water wheels, each roughly 11.5 meters or 38 feet in diameter, that moved 221 pumps to bring water 177 yards (162 m) up a hillside from the Seine River to the Louveciennes Aqueduct.

This invention proves that Mr. Sarton had clear and definite ideas of what he undertook to do, and that he possesses the principles of good mechanics.

In consequence we believe that he deserves the praises and the approval of the academy and the encouragement of the most distinguished of all those who are interested in the progress of the sciences and useful arts.

Made at Brussels, five November 1788.

(Signed) the Abbot Marci Prevot, the Abbot Chevalier, the Abbot Mann.

This report was read and approved at the meeting of the Academy, on ten November 1788, and I certify the present extract is in conformity with the original and the judgment of the Academy.

(Signed) the Abbot Mann, perpetual secretary.

Extract of the report of the Commissioners named by the Emulation Society established in Liège, for the Sciences and the Fine Arts, on a new observation watch.

We the undersigned Commissioners named by the Emulation Society to note the properties and the use of a new observation watch, invented by Mr. Sarton, we declare that the experiments that he made, at a general meeting of the society, and which he repeated in our presence, appeared very satisfactory to us and in conformity with his report, read at the public meeting of the aforesaid society, held on the eighteenth February 1788. We believe, consequently, that this useful invention is made to honour its author, and that it deserves the approval of the society.

Made in Liège, on February 20th, 1788.

(Signed) L.F. de Saive, F. Villett, Depaix, Tréfoncier.

I declare that the report above was approved by the Emulation Society, and that it is in conformity with the original. In witness whereof I sign this certificate.

(Signed) Reynier, Perpetual secretary.

In 1804 H. Sarton invented and made a new clock according to the decimal system. This piece is composed of three wheels without dial-work, and two hands carried by the axels of the two wheels indicating the hours, the minutes and the seconds of this new system, which is ten hours instead of twenty-four per day, one hundred minutes per hour, and one hundred seconds per minute. The same hand indicates at the same time the twenty-four hours of the solar day, with sixty minutes per hour. This piece was displayed for a long time to the eyes of the public in Liège, and then with the representative of the people Robert, at the time of his stay in our city, where it was strictly observed and found exact and in conformity with the observations, according to the decimal divisions. After that it was sent to Paris, where it was received very well, and recognized as the simplest, in its construction, of all those which had been designed and made hitherto.

1804. Another invention by the same person. It is a large meridian clock which was used for a long time to teach at the house of the author, where it fulfilled the functions of a true public regulator, indicating the true hours and the minutes of solar time. This piece occupied approximately four square feet of surface. It was surmounted by an artificial sun, which rose and set at the time right, making its revolution in 24 hours, indicating the meridians from its rising until its setting, and its passage on the meridian line, with precision, and also the various elevations and the duration of the days and nights, for each principal place of the globe.

The moon was also represented, marking its age and its various phases, and completing its synodical

revolution in 29 days, 12 hours and 44 minutes. The movement of this clock gave the seconds accurately without recoil, by the new escapement invented by him in 1783, and marked, with a perpetual calendar, the days of the week, the twelve months and the years, etc., etc.

The pendulum or regulator of this clock, was built of various metals, assembled so that they obviated the variations caused by the temperature. All the effects of this large clock were put in action by a weight of only two ounces, continuously wound by a train with a spring.

During the course of the year 1816, H. Sarton made known to His Majesty the King of the Netherlands, that he had just made several other mechanisms of new invention. At the same time he seized the opportunity to present to this prince the descriptions of the preceding discoveries together with the plans and memoirs and original approvals, of the academies Royal of Sciences of Paris, Imperial and Royal of Brussels, the Emulation Society of Liège, the English Academy of that city and the advisory committee of Arts and Manufactures of Paris, etc., etc.

One of these last inventions, addressed to the king in 1816, was a machine of war of a mechanism which one can be sure was very important, without fearing the risk of being taxed with temerity or of vain presumption. It must be enough to say here, that it is entirely related to operations of land and sea war, and that it is capable of high and deep combinations, as well as useful results. (*State secret*).

Another mechanism, is a *chair moving* at will, for the use of patients, who directs, according to the kind of disease, the movement of chaises, horses, and other more or less strong locomotors, according to the requirement of the case. The wheelchair works by any type of movement, by degrees, at will and according to the advice of professional men, or the whole body in general or on some particular members. Transport is easy, and it is very economical for less affluent patients.. Its use in a room can avoid them being exposed to the air, in unfavourable temperatures for the evils of which they are overpowered. It can only be infinitely useful, by making it common in old people's homes and the private health houses.

A third mechanism consists of a *autograph chronometer*, used to measure distances on main roads, by showing the number of leagues that one travels, either at night or during the day, either in a private coach, or mail coach or otherwise, up to a distance of 400 thousand meters, or one hundred leagues of road. The autograph chronometer, by preserving the display while the carriage is stopped, gives the traveller all the facilitates he needs. The operation is all done in the machine itself and indicated according to the principles of decimal calculation.

These are not the only advantages offered by this chronometer. Geometricians, engineers and land-surveyors can use it in their respective operations. It is the same for private individuals, for the purpose of knowing and measuring the extent of their grounds, without using the chain, or the pole, whose operation, as one knows, is not only very long, but prone to error.

Engineers, for example, will be able, by the means of the chronometer, to know very quickly, without the assistance of anybody and with great facility, the lines or measurements of main roads, to fix with accuracy the placement of barriers, offices, customs houses, weigh stations, etc., and even to regulate the expenditure on roads, either when they are repaired or when new ones are built.

In 1817 His Majesty thought fit to transmit all these pieces to the respective departments of the interior and of war, which received all the information necessary. Then, the general commissioner of war, Count de Goltz, presented to His Majesty the report, which was found very satisfactory. And the author, having very humbly begged this prince to condescend to confer on him the rank of Brother in the Order of the Lion of Belgium, the monarch filled this desire, by granting the title to him, with the advantages attached to it. Consequently, on the third January 1818, the Minister of State, chancellor of the order, Mr. de Roël, sent to the author the decoration attached to his rank, accompanied by a covering letter, which expresses the benevolence of the Sovereign, by those marks so honourable to the author.

Letter of the Minister.

His Majesty has just named you, Sir, Brother of the Order of the Lion of Belgium.

I have the honour herewith to send you the decoration attached to your rank.

I offer to you, Sir, my sincere congratulations on this flattering mark of the benevolence of our Sovereign, and ask you to accept the expression of my distinguished feelings.

(Signed) The Minister of State,

Chancellor of the Order of the Lion of Belgium

Roel.

The Hague, January 3rd, 1818.

To Mr H. Sarton, mechanic at Liège.

The decoration of Brother of the Order of the Lion of Belgium, consists of a medal, carrying on one side the legend, *virtus nobilitat*, and on other the crowned Lion of Belgium. The ribbon which fastens it is Nassau blue with a rather broad orange stripe.

This order of civil merit was created on September 28th, 1815, by the States-General, on the proposal of the King. It is intended to honourably distinguish all those subjects of His Majesty who have given evidence of devotion to the country, zeal and fidelity in fulfilling their duties as citizens, or extraordinary capacity in sciences and arts.

The King is the grand master, and the grand mastery is attached in perpetuity to the crown of the Netherlands, etc., etc.

This was a new spur for him, and in order to give a testimony of his gratitude to this good prince, on twenty-eighth of June next he sent to him various other new discoveries he had completed and executed.

One consists in improvements which are applicable to the boring of artillery pieces.

The other is a machine to be used as an engine, providing the means of establishing, in Holland or the septentrional provinces, a national factory for the casting and boring of these parts without using steam engines; by removing $\frac{3}{4}$ of the frictions and, consequently, the expenses which they cause.

On August 7th next, the minister for public education, national industry and the colonies, Baron de Falck, made known to the inventor that the address which he had presented to His Majesty on the twenty-eighth June 1818, in which he announced, amongst other discoveries, the invention of a windmill of a new design, had resulted in a decree from His Majesty, which before making final arrangements on the aforementioned address, had charged the minister with the examination of this mill by the Academy of Sciences and Fine Arts of Brussels. Consequently, the minister invited him to transport the model there to be examined by the academy, and at the same time to give to them all the explanations needed.

Sarton went to Brussels with the model of his mill. He had the honour to be allowed, on the twelfth of October, to attend the meeting of the academy, where he presented the model as well as the explanatory report, while offering to explain anything which might cause the slightest doubt. Here is the report which was submitted and addressed to His Majesty.

Extract from the register of decrees of the Minister for public education, national industry and the colonies, on December 8th 1818.

Having been given an order of His Majesty of December fourth, No. 8, on the report which was submitted to him by this ministry, of the mechanical inventions of Mr. Hubert Sarton, of Liège, relating to a horizontal windmill, it was resolved: 1. To send to Mr. Sarton a copy of the report of the Academy of Sciences and Fine Arts in Brussels, on the windmill, and to inform him that the satisfactory state of the machines, that are used in cannon foundries to bore them, delayed the testing of the new machine proposed by him. 2. To inform Mr. Sarton that His Majesty, notwithstanding the above mentioned circumstances, wanting to testify his satisfaction, granted him a gratuity of for which a warrant for payment will be sent to him.

Sarton received this new gift of royal munificence with a feeling of gratitude, which, never to be extinguished in his heart, more and more animated by this feeling, by the desire to make himself useful and commendable to his country. He immediately put into execution the model, which he made out of brass, and he rendered the play or movement of the mechanism clear, which was intended to perforate three cannons at the same time, while turning constantly, and without variation, in the same direction, as well as the grinding stones. All these effects functioned and acted perfectly, notwithstanding all the changes of wind which could occur suddenly. This new machine being executed full size, would be suitable for saving Holland the daily expenses of engines, such as those steam engines, horse carrouels and those driven by the power of animals, by using the truly economic, natural and perpetual motor, known as the windmill, in the manner that he employed it at present for the new borer for artillery pieces. He joined to it the advantage of a particular indicator which he designed, to be able to know safely, at night as in daytime, the changes of the winds, and to be able to drive the sails of the mill without leaving the building where were the workshops, and to fix them with ease at the angle necessary for them. This new model was presented by the inventor to His Royal Highness Prince Frederic of Orange, Grand Master of the Artillery, who condescended to give him a place in his cabinet where he still is, from March 25th, 1819, when Sarton had the honour to be allowed a private audience with His Royal Highness, in front of whom he made it operate in all directions and all ways. His Royal Highness himself operated it by his hand, and testified his complete satisfaction to the inventor.

On May 12th, 1819, Sarton had the honour to show the same prince another new mechanism for the use of artillery, that he had just designed, and that he adapted to a small cannon, assembled on its mounting, which had the particular property to move the piece to the right and to the left by a pointer which, operated with only one hand, moved the piece with the greatest ease.

This model, though made small, represents a cannon of 24 gauge with a normal weight of 5400 pounds;. Being made in the large proportions which the principles require, it will produce the same advantages, and will only require for its movement or action, a force of approximately 15 pounds. Its rotation takes place circularly, as well as vertically, and independently of its mounting, whose position remains firm and motionless. Being made large, the pointer, giving movement to the piece, which is inclined at four degrees, and its range being 820 fathoms, produced a deviation of 5 lignes at the mouth, an extent of 88 feet. Thus the pointer will absolutely enable the master to imperceptibly track with his piece an individual or any other object, which one wished to reach and which would be prone to change place, by a sudden movement before the command to fire.

This mechanism can be easily adapted to large pieces as to smaller.

This very enlightened prince also condescended to give him a place in his cabinet, and also testified his satisfaction to the author, in a letter, with which he agreed to honour him and whose literal copy follows.

Brussels, 29th June 1819.

Having examined, Sir, with the greatest interest, the two models that you had the kindness to send to me, I hasten to discharge a very pleasant duty. It is to sincerely thank you for all the trouble that you have taken, and to testify to you, at the same time, my satisfaction of this new proof of your profound knowledge in the mechanical arts, and of your untiring zeal to perfect all that you consider. The theory, Sir, on which you based this new production of your inventive spirit, seems me to deserve the greatest approval.

Reiterating to you the assurances of my satisfaction and my esteem.

I am, Sir, your servant.

(Signed) Frederic, Prince of the Netherlands.

Extract of part of the report on the properties of the Windmill, invented by Sarton, mechanic, recognized and approved by the Royal Academy of Sciences and the Fine Arts at Brussels.

Mr. Sarton, having returned to Brussels on October 12th, 1818, was admitted to the meeting of the Academy, to which he presented a model of his mill, while offering to explain everything that could cause the slightest doubt. But the mechanism is so simple that it was enough to consider it, with due attention, to understand it perfectly.

This mill is driven by four sails intended to turn horizontally in two opposite directions; they are fixed to a vertical axis, etc., etc.

The author also added four stops to this mill which, at will, at the same moment and with the greatest ease and greatest safety, seize the ends of the four sails, and so suddenly suspend the movement, without causing the least damage, whatever the force and the direction of the wind.

According to these considerations, the commissioners named by the Academy estimate that, as for the interior mechanism and the external part, this very simple and very clever invention deserves to be welcomed, But another consideration, no less important, was drawn to their attention. It is the mechanism of the sails and the amount of force that they can transmit to the driving axle for the interior equipment. As for the first point, the author provided the most thorough understanding of the means of communication of movement to the machines that he could provide.

And as for the second point, it presents the only, but important and, dare we say it, insurmountable difficulty, which is inherent in any action on the sails of the mill (moved by the wind), whose direction is not parallel to the axis of rotation. Such would be a mill with vertical movement, whose sails would be successively struck perpendicularly by a cross-wind, as that which takes place in water mills.

But without taking the trouble to calculate it, which would be longer than difficult and even useful, one feels that the small difference, if it is one, which could result from their trapezoidal shape will not be an effect which deserves to be considered, especially when compared to that produced by ordinary vertical mills. I said above: (referring to windmills), because the same disadvantage would not occur with water mills. Indeed, in those the fluid never strikes at the same time two sails able to produce opposite movements. The interior of our mill would thus be very specifically applied to those which are driven, alternately by the current of the rising tide, coming into a channel, and then by that of the same downward tide, etc.

The interior mechanisms and external parts of this new windmill thus approved by the Royal Academy of Sciences in Brussels in its report, and consequently, I transferred them and made them suitable for windmills of oblique construction, by removing the system of horizontal sails, because of the deficiency shown in the aforementioned report. So that there can be no more doubt regarding the advantageous effects that I had advanced, this mechanism can be adapted very easily to all the oblique mills already built and in activity, as to those yet to be built.

In January 1820, I made my last invention. I conceived the idea for a new hydraulic machine specific to drying and draining water and marshes, and intended particularly for Holland.

When I discovered this new system, I hastened to make it known, under the date January 12th, 1820, to His Majesty the King of the Netherlands, as to my sovereign, to my benefactor, and an enlightened judge in such matters.

In January 1822 I made a last improvement to this machine, which I found very advantageous, so that it produces effects that cannot be over-appreciated; which is to use far less agents to run it and to operate it with a very great reduction in expenditure.

Such is the brief description of a part of my inventions.

Having arrived, after sixty years of work, at an extremely advanced age, my health does not permit me to undertake any more of these kinds of great works.

I will finish by particularly noting part of the different works of horology, made at various times for princes and princesses, and other great figures.

My observation watches were highly sort after and, without quoting here the princes of royal blood who were provided with them by me, here are the names of some famous persons and scientists who also asked for them, and who all testified to me their satisfaction by the most honourable letters, etc., etc.

On November 2nd 1803, Mr. Hamaide, native of Liège, trader and clock and watch maker, wrote to me from Saint-Petersburg in the following terms:

Your large clock, Sir, is on sale in the physics cabinet of Mr. Robertson, our compatriot. This piece, which does you honour, makes you known to all the great Lords, and to the Emperor. I hope to sell it soon.

This clock was similar to that which I made in 1772 for His Royal Highness the Duke Charles of Lorraine, general governor of the Austrian Netherlands. I had sold it to Mr. Hamaide, in Spa, in 1803.

On April 3rd, 1804, Mr. Robertson wrote to me from Saint-Petersburg in these terms:

You will oblige me, Sir, to have the kindness to make for me six electrometers similar to those which you sent to me in Paris. I wish that at soon as three are finished, you have the kindness to send them to me for Mr. Blomh and Molwo in Lubeck, and for Mr. Robertson in Saint-Petersburg. Please keep the other three; when I travel to Liège I will take them with me to Paris. Mr. Hamaide and my friend Mr. Culot enjoy good health and greet you. I am with the utmost consideration. Robertson."

These electrometers, with dials and hands, are to easily know the force of electricity in physical experiments.

In 1778, Mr. Leroy, director of the royal Academy of Sciences, in Paris, and keeper of the physics cabinet of the King at Passy, sent to me an engraved portrait of his father, the celebrated Julien Leroy, first clock and watch maker to the King, former director of the Society of Arts. This present, quite invaluable in my eyes, was accompanied by this honourable sentence, written in his hand below the portrait:

To Mr. Sarton, clock and watch maker of Liège, in consideration of his zeal for horology, on behalf of Mr. Leroy's son, director of the Royal Academy of Sciences in Paris, and keeper of the physics cabinet of the King at Passy.

It was around the same time that I found myself, in connection with mechanical arts, in contact with this erudite Academy, and particularly with my compatriot Mr. Morand, intimate adviser to S.A.C. the Prince of Liège, and librarian of the Royal Academy of Sciences in Paris. It was, I say, around this time that he wrote to me:

I request from you urgently, Sir, to agree to give me, for the Academy, the drawings which I promised that you would supply.⁵

In 1785, I made and delivered to the Baron General de Seckendorf, who had accompanied His Royal Highness Governor of the Netherlands to Spa, one of my observation watches. On August 16th, 1785, S.A.S. Mgr. the Duke of Aremberg, according to the praise that the Baron General of Seckendorf gave of his watch, "charged his secretary, Mr. Dey, to ask me to send one exactly the same to his hotel in Brussels."

In 1789, I made my chronometrographic watches for observations.

I will restrict myself here to say, in honour of this discovery, that they were required in our provinces and by foreigners to the point that, not being able to make enough by myself for the quantity of orders, I was obliged to employ foreigners to manufacture some for me; witnesses the following declaration transcribed literally:

We undersigned, declare that it is to Mr. Hubert Sarton, of Liège, that we owe the discovery of chronometrographic watches, etc. and that it is according to the plan that he agreed to provide us, that we have made them. In Le Locle on February 8th, 1789.

(Signed) Philippe Dubois et Fils."

On June 12th, 1789, Mr. Uhlig wrote to me from Brussels, by order of Her Royal Highness the governing Archduchess of the Netherlands, to have the piece, with set of flutes, which was ordered from me, because she was in a hurry to send it to its destination. On July 19th, 1789, the Austrian major general de

5 Although not certain, this may refer to Sarton's self-winding watch.

Zechenter wrote to me from Banat, where his general headquarters were, in connection with some observation watches and others with repetition, which the major general Baron de Kempelen, when stationed in Brussels, had undertaken to send him.

On July 21st, 1791, the Princess of Esterhasy ordered a second watch from me similar to that which I had previously had the honour to make for her.

On June 10th, 1792, Mr. Cantineau, secretary to Her Royal Highness the Princess and His Royal Highness the Duke of Saxony-Teschen, her husband, wrote to me from Brussels:

That the three gold watches which I had sent to Her Royal Highness madam, had arrived in the morning for this princess, at the same time as my letter of advice on their sending, with the order to pay me.

On November 15th, 1792, Count Charles de Palfy wrote to me from Venice, that he was charged, on behalf of one of his friends, to get him an observation watch, the same as that which I had sent to him in Vienna.

On January 21st, 1792, I sent two of the same to the Austrian generals Counts de Browne and de Zechenter. On May 22nd, 1792, Mr. Gernier, general advisor to the bishop of Tournai, wrote to me from Brussels:

That he was charged on behalf of an Austrian officer, to get him a good campaign watch with repetition and seconds" (adding with a benevolence without equal), not knowing a better artist than you. Sir, please send to me here, at the Refuge de Gembloux, if possible, a similar watch. I now have the repeating watch which you sold to me last year for the reigning Prince of Salm-Salm, and I will be extremely content.

On February 28th, 1793, His Royal Highness Prince Ferdinand of Prussia honoured me with the most flattering letter which he condescended to write to me in his own hand, from Berlin, under the date February 28th, 1792, on the occasion of my observation watches and several other works, for which he testified the greatest satisfaction to me. This great prince made me a particular honour, by condescending to sign himself: "I am with great esteem, Sir, your very affectionate friend, Ferdinand".

On August 11th, 1793, Viscount Desandrouin wrote to me from Brussels:

Sir, the watch that you made for me with so much care, is perfectly well, and according to the positive assurance that I gave of it to S.E. the plenipotentiary minister, this lord gives me the responsibility to say to you that he is completely content. I have the honour to be very sincerely, Sir, your very humble and very obedient servant. Signed, Viscount Desandrouin.

Count Destarray, commander of the Order of Marie-Therese, privy counsellor general of artillery and owner of a regiment of infantry in Austria, gave me the honour of writing from Brussels on November 18th, 1793 and February 21st, 1794, at the time of receiving one of my observation watches, to tell me that he had just written by post this day, to pay me the price of it.

On October 3rd, 1793, I received the same honour from His Royal Highness Duke Ferdinand of Wurtemberg, in a letter to me that he condescended to write in his own hand, dated at Hoster (a chateau located two miles from Liège) and expressed in these terms:

The Prince Ferdinand Duke of Wurtemberg has the honour to request Mr Sarton to agree to give the bearer the objects that he asked of him. The Prince, who cannot go to Liège himself, hopes that Mr. Sarton will render this service to him, and procure at the same time the pleasure of showing him the watches of his work of which he intended to make much praise.

On February 21st, 1794, Count, today Prince, Metternich, ordered from me a watch the same as that which I had delivered to Viscount Desandrouin in Brussels, etc.