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Alexis Rochon

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the chafe. A tenth part of the dogs used were not wolf-dogs, which never were in any number in the hands of the common people. I conceive also, that these dogs having *no nose*, other kinds were necessary to find the game and follow the scent of it. Scahil described wolves with such perfect accuracy, that I have no doubt of his being well acquainted with the animal."

XI. *Observations on Platina, and its Utility in the Arts, together with some Remarks on the Advantages which reflecting have over achromatic Telescopes. By ALEXIS ROCHON, Director of the Marine Observatory at Brest. From the Journal de Physique, 1798.*

[Concluded from page 27.]

FORGED PLATINA.

THE reader must recollect that all metals are easily melted after they have been reduced into very thin plates. Thus gold leaf melts at the flame of a taper, though not excited by a blow-pipe. In this manner also philosophers are enabled to melt those small glass globules which serve them as simple microscopes. This observation is sufficient to indicate the process that must be pursued in the operations in regard to forged platina. The platina is first purified by means of nitre and sandifer (*sel de verre*); this mineral is then divided into very minute particles, either by trituration, or by solution in nitro-muriatic acid or diluted nitric acid, according to the method of my colleague Tillet.

Nitre, antimony, arsenic, and, in short, every substance which becomes volatilized, may be employed for this operation; but arsenic ought to be preferred, because it is more easily dissipated. The platina being thus divided into exceedingly small particles, must be exposed to a strong fire, which must be excited still more by the oxygen gas that disengages

disengages itself from nitre in combustion. In this violent fire the particles of the platina become agglutinated ; and by forging them at a white heat repeated times, the workman is able to give them sufficient adhesion to stand being hammered into plates. The well-known labours of Sickengen on forged and laminated platina render it unnecessary to say any thing further on this subject. He allowed me to see his process ; and to that favour I am indebted for the knowledge necessary to enable me to treat a difficult subject absolutely foreign to my studies.

CAST PLATINA.

Cast platina is infinitely more interesting to the arts ; and it is on this labour that I have bestowed my chief attention. The process which perfectly succeeded with me, to cast crucibles and large pieces of platina of different forms, was, to melt the metal according to the method of Scheffer, by a mixture of arsenic and sandifer. The fire must be moderate ; and for this reason there must be at least ten pounds of arsenic and four pounds of sandifer to melt one pound of platina. The mass then will be in a state of perfect fluidity when poured into the mould, though the fire be scarcely sufficient to fuse silver. Platina in this state is exceedingly fragile and brittle ; were it exposed to a red heat, the operation would absolutely miscarry. The arsenic, by disengaging itself too rapidly, would reduce it to scales, which would no longer have any adhesion. It may readily be conceived, that this accident must have occurred to me more than once. I have, however, been able to avoid it by enclosing the pieces of platina which I had moulded in a box of plate-iron, filled with sand and pounded charcoal. I then exposed them for more than a month to a fire graduated from the heat of boiling water to that which fuses silver. Platina in this state no longer resembles a metal : it might rather be taken for a metallic calx. The particles which
compose

compose it are very close ; but they have only a very feeble adhesion, like that of an earthen vessel dried in the shade. It is then that the platina must be exposed to the most violent fire ; and when the metal has undergone that operation it resumes its natural state, becomes sonorous, malleable, and the strongest heat gives it always new degrees of improvement.

A little time after I had read this memoir, the learned Dr. Ingenhouz begged me to unite into a mass for him about two ounces of platina, which he had carefully purified by means of the nitro-muriatic acid. I was obliged to enclose in a very thin leaf of platina all the fragments of this metal, which were too scattered and too minute to be subjected separately to the action of the fire and of the stamper ; but, when thus united, I gave them the highest degree of heat possible to be produced from charcoal excited by a pair of bellows ; and I soon obtained, by striking them with the stamper, a ductile and malleable mass. After the success of this experiment, I employed myself in purifying in the fire, and in a crucible, platina in grains, by means of nitre and sandifer, which must be afterwards washed in the nitric acid ; and by striking at a white heat those grains contained in the laminæ of platina, I procured at a small expense considerable masses of malleable platina. This process will render unnecessary hereafter the use of the oxyd of arsenic, unless the workman wishes to obtain, by casting, large crucibles or muffles of platina.

I was the first who treated platina in a large mass in a manner truly useful to the arts : and though I have paid a great deal of attention to this labour, assisted by the information of the learned Isquierdo and the metallurgic talents of Daumy junior, I have employed my chief care in improving the mixture of platina with tin and the oxyd of arsenic, for the construction of large specula for telescopes, and, above all, for the specula of sextants and other instruments for determining

termining the longitude at sea. In the latter labour I have been well seconded by Carrochez and other artists who worked under my direction.

Being fully satisfied with the trials, of which I have given an account in the preceding memoir, I was desirous of constructing a telescope like that of Herschel. For this purpose, I engaged in the year 1790 a friend of the arts and sciences, the unfortunate Trudaine junior, to procure from Herschel a good seven-feet telescope. The superiority of the telescopes made by that able astronomer depends much more than generally believed on the Newtonian construction which he has adopted. The Gregorian telescopes are by no means to be compared to the former. An appearance of convenience made them however to be commonly adopted, though that construction presents great difficulties to be surmounted in the complete execution of it. But as it is always necessary in the use of telescopes, the magnifying powers of which are considerable, to adapt a magnifier that embraces a wide field, in order to find readily in the heavens the star to be observed, it may easily be perceived that it is a matter of indifference whether the telescope employed for that purpose be of the Gregorian or Newtonian construction; because in that case a direct or lateral view of the object is absolutely indifferent. The lateral sight is indeed much more convenient when the Newtonian telescope is well disposed on its stand. Herschel has adopted for his telescopes a construction still more ancient and simple; and though it approaches near to the origin of the art, it is no less useful when used for large instruments. I have admired the effects of it in his telescope of twenty feet; and I should have been enabled to form a better judgment of it in that of forty feet, but there then still remained some improvement to be made in the latter, which is unique in the annals of astronomy. It is certain that a small inclination given to a concave mirror of a long focus does not sensibly disfigure the image formed in its focus. This small inclination is sufficient to permit the observer to look through a strong magnifier at the image
of

of the star, without intercepting, by the head, the rays which proceed from it.

In the beginning of the year 1791, Trudaine entrusted to me the telescope which he had procured at London. Astronomy is indebted to Herschel for the noblest discoveries of this century. The name of that observer will be transmitted to the most distant ages. He has augmented our planetary system, and enriched it with a new planet, accompanied with several satellites. In 1671, Dominic Cassini, observing the moon with an excellent telescope of Campani, remarked in the obscure part of her, some small whitish nebulae. This interesting phenomenon did not escape the telescopes of Herschel; and after the year 1784, that able astronomer announced, that he had seen a burning volcano in the middle of the spot called *Aristarchus*. We find in the Memoirs of the Academy of Sciences for the year 1706 the following remarkable passage of De la Hire: "The small spot of *Aristarchus* is so brilliant, that some have believed it to be a volcano."

Are these small whitish nebulae bodies luminous of themselves, or do they enjoy only a borrowed light? Such is the question which I proposed to resolve, by assiduously observing these small nebulae, both with Herschel's telescope, and that which I caused to be constructed of platina in the course of the year 1791, on the model of that of the above astronomer. Being deprived, since September 1792, of the use of that instrument*, the construction of which had cost me great

* Telescopes of still greater magnifying powers might be so easily procured at Paris, that those who are truly interested in the progress of the arts and sciences are not a little astonished that the great telescope of sixty feet, announced in all our journals, is still a project; and that no one even so much as thinks of realizing it. Though the art of making large specula is attended with some difficulties, it however requires neither the same talents nor the same patience as that of constructing large achromatic object glasses. The catoptric telescope requires only the regular labour of a single surface, and it is the work of a few moments which forms or deforms the polish of the concave surface of a large speculum.

labour and much money, I was not able to continue this kind of observations.

This telescope of seven feet, which I consider as superior to that of Herschel of the same length, enabled me, during the time I had the use of it, to be convinced that the spot Aristarchus, if not a volcano, is at least a body luminous of itself. The grounds on which I found my opinion are agreeable to the principles explained by Bouguer in his Treatise on the Gradation of Light; for those spots of the moon which reflect most strongly the direct light of the sun did not exhibit to me in the shade the same appearances as Aristarchus, whatever efforts I made to augment the intensity of that feeble light which arises from the reflected rays of the earth. Besides, it is easy to conceive that a very lively fire, concentrated in the hollow of a crater, cannot disseminate the light which emanates from it: in that particular case, like a reverberator, it cannot be seen but under certain circumstances. It is remarked then, that it is in the months of Pluviose, Ventose and Germinal that this volcano is most *apparent*.

When I undertook a journey to London, by order of Government, for the benefit of the sciences, I employed myself in a particular manner in the improvement of flint glass; and I was convinced that the properest and simplest means for rendering flint glass fit for constructing large achromatic telescopes consist in removing the threads by means of a glass-cutter's wheel. When these faults are removed, the glass is to be kneaded in an oven and under a muffle, in such a manner as to give it almost the form and size of the object-glass required to be made. This process is amply described in my work entitled *Recueil de Memoires sur la Mechanique et la Physique*.

It was in this collection that I said that Euler had been the first who thought of correcting the aberrations of refrangibility by using substances of different refractive powers. Maupertius engaged to get constructed at Paris Euler's

ler's object-glasses, with water and glasses like that which Newton had imagined, to render the aberration of sphericity as little as possible; but this object-glass did not succeed, on account of the proportion since known between the refraction and dispersion of common glass and water. This proportion is by the diaphragm as 155 to 133 in regard to refraction, and as 100 to 67 in regard to dispersion. But the strong curvatures which must be given to destroy the aberration of refrangibility would occasion a very strong aberration of sphericity. Thus, what might be gained on one hand would be infallibly lost on the other. This was sufficient to make Euler's project miscarry, and to confirm the assertion of Newton, which tended to destroy all hope of being able to obtain achromatism in glass. Since that epoch the first knowledge of the strong dispersion of glass in the composition of which there is much lead, and which in England is known under the name of *flint glass*, has been ascribed to John Dollond. This appellation however is not that best suited to this kind of glass. But what is of most importance to be known here is, that the more lead, or rather minium, is employed in making glass, the more will its dispersive power be augmented. It was in the year 1759 that Dollond presented achromatic glasses, composed of flint and crown glass. He says in his paper printed in the *Philosophical Transactions*, that he found means to destroy with great ease the aberrations of refrangibility; but he confesses that he was stopped by an object more difficult to be surmounted, that of annihilating at the same time the aberration of sphericity. It was thought, and is still believed in France, that John Dollond was the inventor of achromatic telescopes; but we know that, some years after, Dollond's patent was attacked, on the ground that he was not really the inventor*.

XII. *A*

* The author here goes on to give what he considers a correct account of the origin of the invention; but as he is incorrect in almost every circumstance,

cumstance, we suppress the rest of his paper, and subjoin an article on the subject which appeared in the Gentleman's Magazine for October 1790, and which, we have been informed by Mr. Ramsden, contains a true statement of the facts:

“The inventor was Chester More Hall, Esq. of More Hall, in Essex, who about 1729, as appears by his papers, considering the different humours of the eye, imagined they were placed so as to correct the different refrangibility of light. He then conceived, that if he could find substances having such properties as he supposed these humours might possess, he should be enabled to construct an object-glass that would show objects colourless. After many experiments, he had the good fortune to find these properties in two different sorts of glass; and by forming lenses made with such glass, and making them disperse the rays of light in contrary directions, he succeeded. About 1733 he completed several achromatic object glasses (though he did not give them that name) which bore an aperture of more than $2\frac{1}{2}$ inches, though the focal length did not exceed 20 inches; one of which is now in the possession of the Rev. Mr. Smith, of Charlotte-street Rathbone-place. This glass has been examined by several gentlemen of eminence and scientific abilities, and found to possess the properties of the present achromatic glasses.

“Mr. Hall used to employ working opticians to grind his lenses; at the same time he furnished them with the radii of the surfaces, not only to correct the different refrangibility of rays, but also the aberration arising from the spherical figures of lenses. Old Mr. Bass, who at that time lived in Bridewell Precinct, was one of these working opticians, from whom Mr. Hall's invention seems to have been obtained.

“In the trial at Westminster-hall about the patent for making achromatic telescopes, Mr. Hall was allowed to be the inventor; but Lord Mansfield observed, that “it was not the person who locked up his invention in his scrutoire that ought to profit by a patent for such invention, but he who brought it forth for the benefit of the public.” This, perhaps, might be said with some degree of justice, as Mr. Hall was a gentleman of property, and did not look to any pecuniary advantage from his discovery; and consequently, it is very probable that he might not have an intention to make it generally known at that time.

“That Mr. Ayscough, optician on Ludgate-hill, was in possession of one of Mr. Hall's achromatic telescopes in 1754, is a fact which at this time will not be disputed.”