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M.A. Pictet

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employment; but, so far as that from the truth, they may justly be considered among the most difficult problems of chemistry; and it is only from the rigid and constantly similar results of such experiments, that we can hope to attain an intimate knowledge of the principles with which nature has originally operated.

[To be continued.]

XXXIX. *Comparison of the Definitive Metre with a Standard of the English Measures, carried from London to Paris by M. A. PICTET, Professor of Philosophy at Geneva*.*

AS the measurement of the earth, and researches respecting the figure of it, had, at various times, and in different countries, during the course of the 18th century, been an object of the labours of the most distinguished philosophers †, when an idea was lately conceived in France of deducing from the dimensions of our globe a standard of unity, to which every thing susceptible of measurement or weight could be referred, it was necessary to make an effort proportioned to the importance of an enterprise become a national concern. In the midst, therefore, of a long and destructive war, and amidst a thousand difficulties of every kind, a series of triangles was established between Dunkirk and Barcelona, comprehending the tenth part of an arc of the meridian extending from the equator to the pole, that is to say, the fourth part of the whole circumference of the globe; and the ten millionth part of this arc so determined was adopted as representing the unity of the whole metric system. This plan was executed with standards composed of substances capable of resisting the influence of the weather; and by then establishing, as was carefully done, the exact ratio of the length of the metre to that of a common pendulum which swings seconds, on the borders of the sea, in a given latitude, the determination of this unity was rendered independent of any catastrophe that might alter or destroy its types, in the construction of which all those resources presented by philosophy and the arts, now brought to a very high degree of perfection, were employed.

On the other hand, geodesic operations, designed to fur

* From *Bibliothèque Britannique*, by professor Pictet, No. 148.

† Swedish astronomers are now employed in again measuring a degree of the meridian, which was measured in Lapland under the polar circle by the French academicians above sixty years ago.

nish materials for a new map of Great Britain, were undertaken, about 25 years ago, in England, and have been carried on since that time. These labours, begun by the late general Roy, have been conducted with a great deal of sagacity and precision, and the results of them may afford interesting data in regard to the figure of the earth. A distinguished member of the Royal Society of London, Sir George Schuckburgh, has employed himself, with success, in researches calculated to establish the precise length of the standards, which have served as a basis to all the geodesian measurements made in England.

It was therefore to be regretted that labours so analogous in their nature, carried on in two neighbouring countries, and susceptible of acquiring, by comparison, a new degree of interest, should remain unconnected for want of a real standard of the measures of one of these countries, viz. England. We experienced this regret in a very lively manner at different periods; and we can with truth assert, that if the hope of procuring this mean of comparison was not the only motive of the journey undertaken by one of us to England, it was a strong inducement towards it.

Our colleague, professor Pictet, when he arrived at Paris, took some steps to obtain an authentic metre, in order that he might submit it to examination before the Royal Society of London, of which he is a member; but, in consequence of the shortness of his stay in Paris, these steps were not attended with the desired effect. He, however, took advantage of a longer residence in England to procure from Troughton, an artist celebrated for his accuracy in constructing and dividing geometrical and astronomical instruments, a standard exactly similar to one he had constructed for Sir George Schuckburgh, and to which that philosopher referred the principal English measures in the memoir above mentioned. Our colleague also caused to be constructed by the same artist the comparative apparatus of Sir George Shuckburgh, consisting of two excellent microscopes, one of which is furnished with a micrometer that divides the English inch into ten thousand equal parts. On his return to Paris he took the earliest opportunity of laying these articles before the Minister of the Interior and the National Institute. This learned body named three of its members to proceed to a regular comparison of the definitive metre with the standard just mentioned. This labour, of a simpler nature than it might at first appear, employed the commissioners during five sittings of four hours each, and was conducted with all the care and attention that the nature of the object required.

C. Prony,

C. Prony, to whom these researches were particularly interesting, as it is to him we are indebted for a French translation of general Roy's memoir on the first trigonometrical measurements made in England, noted down the results; and it was in the cabinet of that learned man, and by the assistance of a comparative apparatus belonging to him, that the principal operations were made. He was so kind as to transmit to us an authentic copy of the report given in to the Institute; a production thought to be so generally interesting, as to be read in the public sitting of the last quarter. He adds, "that this report will be soon followed by a memoir, in which he will give more circumstantial details respecting the observations he made; together with a description and drawing of his comparative apparatus." In the mean time we shall lay before our readers the report, assuring them that we have taken every possible care, in revising the proofs, to avoid typographical errors.

NATIONAL INSTITUTE.

Extract from the Registers of the Class; Sitting of the 6th Nivose, Year 10 (Dec. 27, 1801.)

A member, in name of a commission, read the following report on a comparison of the standard metre of the Institute with the English foot:

"C. Piéctet, professor of philosophy at Geneva, submitted to the class, in the month of Vendémiaire last, an interesting collection of objects relating to the sciences and the arts, which he procured during his travels in England.

"Among these objects was a standard of the English measures on a brass ruler, strong and well polished, about 49 English inches in length, 36 of which make the English yard, and divided along its whole length, by lines exceedingly fine, into tenths of an inch.

"This standard was constructed, at the request of C. Piéctet, by Troughton, an artist of London, who has the well-earned reputation of dividing instruments with great accuracy: it was compared at London with another standard made by the same artist for Sir George Schuckburgh, and it was found that the difference between these two standards was no more than the difference between each of the divisions, that is to say, quantities absolutely insensible.

"The standard of C. Piéctet, then, ought to be considered as identical with that of Sir George Schuckburgh: a detail of the experiments which ascertain the exactness of the latter, may be seen in the Philosophical Transactions for 1798.

"C. Piéctet had laid before the Institute, together with

the above rule, divided into tenths of an inch, a comparer or instrument proper for estimating the small differences between the measures, constructed by the same artist, and of which the following is a short description :

“ The comparer is composed of two microscopes with threads, which are placed in a vertical situation. The faces of the rule to be examined being horizontal, and at a convenient distance from each other, by making them move along a metal rod with divisions, one of the microscopes remains fixed near one of the extreme lengths of the point to be compared, and serves to assure the immobility of that point; the second microscope is towards the other extremity of the same length, and fixed also; but the frame which bears these threads may be moved by means of a micrometer screw the threads of which are equal to $\frac{1}{1000}$ th of an inch English; and the plate passed over by the index being divided into another 100 parts, gives $\frac{1}{100000}$ th of an inch English for every division of the plate. By means of this arrangement, if the microscopes are first placed in such a manner that the inter-sections of their threads correspond to the extremities of any length intended to be compared with another which differs from it by a quantity less than $\frac{1}{100}$ th of an inch, the difference of the two lengths, by employing the micrometer, may be estimated in 10,000th parts of an inch.

“ The threads placed in the focus are disposed obliquely in regard to the lines of division, so that a correspondence is known to have taken place when a line of division divides into two equal parts the acute angle formed by the two threads.

“ We shall here observe, that, in the year 1785, Ramsden employed, in the like manner, two microscopes, adapted to an instrument he had invented to measure the dilatation of metals. General Roy gave a description of this instrument in the 75th volume of the Philosophical Transactions.

“ C. Picquet offered to entrust the clafs with the English standard and the comparer above described, to enable them to determine the ratio of the metre to the English foot: the clafs accepted this offer with gratitude, and charged C. Legendre, Mechain, and myself, (Prony,) to join with C. Picquet in order to determine the ratio between the standard of the platina metre and the English foot.

“ The following is a short account of the result of the labour undertaken on this subject at the house of Lenoir for a first comparison :

“ The 49 inches of the English rule terminate at divisions traced out on one of the faces of that rule; and the standards
of

of platina and iron of the Institute have no division, the length of the metre being given by the distance between their extremities. This circumstance prevented, on the one hand, the length of a metre from being taken immediately on the standards with the microscopes; and, on the other, did not permit the immediate estimation of the metre of the Institute in English inches, by the process employed for fixing the standard of the new measures; a process which consists in resting the extremity of the metal rule subjected to examination against the knee of a fixed gauge, and applying to the other extremity a sliding knee, constructed for estimating the difference between the measures, the ratio of which is to be determined, or the identity of which is to be ascertained.

"The artist Lenoir tried to surmount these obstacles by employing a copper rule, a metre in length, cut at its extremities into a very sharp bevel, in such a manner, that this rule could be compared with the standard of the Institute according to the usual method of extreme contact, and which being placed above the English rule, the edges of the bevel produced on the surface of that rule the effect of divisions parallel to those delineated upon it. By these means, the microscopes could be used for estimating in inches, and ten thousandth parts of an inch, the distance between these edges.

"By this method, the standard metre of platina, and another metre of iron, both belonging to the Institute, were compared with the English foot; the two former measures being constructed in such a manner, that at the temperature of melting ice they are equal to each other and to the ten millionth part of a quarter of the meridian. It was found that at the temperature of 15.3 degrees of the centigrade thermometer the platina metre was equal to 39.3775, and the iron metre to 39.3788 English inches, measured on the rule of C. Picet.

"But these first observations made known to the commissioners that the process they employed might leave some uncertainty, in consequence of the great difficulty of placing the intersection of the threads at the exact extremity of the bevel of the rule, which served as a term of comparison. A reflection or irradiation of light which took place at that extremity, prevented our clearly distinguishing whether the optic axis of the microscope was exactly tangent to the small surface which terminated that bevel.

"To remedy this inconvenience, one of the commissioners *

* This method, as simple as ingenious, was proposed by C. Prony; and C. Paul of Geneva, who was accidentally present, carried it into execution: it was attended with complete success.

proposed

proposed the following method, which was adopted:—It consisted in tracing out, on a small slip or rule of metal, of the same thickness as the English rule, a very delicate line perpendicular to the length of the rule. This piece of metal was made to rest against a fixed knee, and the microscope with fixed threads was brought to the line above mentioned: the piece of metal containing that line was then removed, and the metre to be compared was put in its room, with one of its extremities resting against the fixed knee, and the piece of metal placed at the other. It is here evident that the line traced out on the piece of metal was in this new position at the exact distance of a metre from its former position when resting against the fixed knee; and, by making the threads of the second microscope correspond with this line, the distance between the points of intersection of the two threads was exactly a metre. To estimate the metre in English inches, nothing then was necessary but to put into its room the divided rule, to place a line of one of its divisions under that of the intersection of the threads which was fixed, and to estimate at the other extremity, by means of the microscope, the fraction of division, which with the whole number of these divisions gave the length of the metre.

“ The comparison was repeated on the 4th of Brumaire at the house of one of the commissioners by the method here described; and after several observations, which corresponded in a very satisfactory manner, it was found that, at the temperature of 12.75 degrees of the centigrade thermometer, the platina standard of the metre was 39.3781, and the iron standard 39.3795 English inches.

“ The two metres having been constructed to be equal at the temperature of freezing, the operation from which the preceding results were obtained may be verified by finding what the ratios would be at that temperature. For this determination we have the correct experiments of Borda, and the commission of weights and measures on the dilatation of platina, copper, and iron, from which it results, that for one degree of the centigrade thermometer, platina dilates 0.00000856, iron 0.00001156, and copper 0.00001783; and from these data it is found that, at the temperature of freezing, the platina metre of the Institute is equal to 39.38280, and the iron metre to 39.38265 English inches, measured on the standard of C. Picquet.

“ The difference 0.00015 between these two lengths, less than $\frac{1}{3000}$ th of a line, or $\frac{1}{200000}$ th of a metre, may be absolutely neglected. The result of our labour therefore is, that, supposing the platina and iron standards of the metre belonging

ing to the Institute, and the English rule of C. Picquet, at the temperature of freezing, the metres, which at that temperature are equal to each other and to the ten millionth part of the quarter of the meridian, are equal to 39'38272 inches measured on the English rule of C. Picquet.

“ Done at the Mathematical and Physical Class of the National Institute, Nivose 6, (year 10).

“ (Signed) LEGENDRE, MECHAIN;
and PRONY, Reporter.

“ The Class approves the report, and adopts the conclusions.

“ Certified agreeably to the original.

“ Paris, Nivose 26, year 10.”

XL. Letter from Count MOROZZO to C. LACEPEDE, respecting a Parrot hatched at Rome; together with some Observations on the duration of the Life of these Birds.*

NO one can know better than you do, that it is impossible to have the natural history of birds so complete as that of quadrupeds. To render it more perfect, we must collect, as you have done, all the new facts and correct observations made since the immortal Buffon published his work, in order that we may form a new one still more complete. That I may contribute towards this branch of natural history, permit me to send you an account of an interesting fact, viz. the history of two parrots of the family of the Amazons, which laid eggs several times, and which have reared a young one, brought forth at Rome in the course of the present year 1801.

1st, I shall first give you a history of these parrots, with an account of their laying and incubation.

2d, Of their habits and attachment, and in what manner they reared the young one.

3d, I shall examine the species to which they belong: I shall give a description of the male, the female, and the young parrot, and compare them with those given by ornithologists.

4th, I shall relate some very rare cases of parrots hatched in our climates, and the difficulties that oppose this circumstance.

5th, In the last place, I shall offer some conjectures on the duration of the life of parrots compared with that of other birds, which will give me an opportunity of observing that

* From the *Journal de Physique*, Ventose, an. 10.

there