THE NAPIER TERCENTENARY CELEBRATION.

By FLORIAN CAJORI.

The Napier Tercentenary Celebration which was held in Edinburgh, July 24–27, was a marked success, notwithstanding the rather limited attendance of British mathematicians, some of whom had left for the meeting of the British Association for the Advancement of Science in Australia. There were present in Edinburgh a considerable number of Germans, French, Russians, Americans, and a few from other countries. Altogether there were over forty foreigners. It may be worthy of note that when, on July 28, war alarms began to come in, all delegates from the European continent took a hasty departure for their respective countries.

The opening exercises on Friday, July 24, were of a general nature, Lord Moulton delivering the principal address. On Saturday morning the papers relating to the history of logarithms were read; on Monday came research papers on logarithms or allied topics. Saturday afternoon the members were invited to a garden party at Merchiston Castle, for some years the abode of John Napier. It was interesting to see the representative mathematicians going there, making, so to speak, a pilgrimage to a shrine. Lord Moulton's address was delivered in the hall of the Edinburgh Students' Union.

The address of Lord Moulton, one of the Lords of Appeal, was interesting, first of all, because it was a mathematical address written by a great judge. This was not strange at all to those who remembered that in his undergraduate days at Cambridge Lord Moulton distinguished himself in mathematics and later served for a few years as fellow and lecturer. It was he who brought out the second edition of Boole's Calculus of Finite Differences. Lord Moulton's address was a remarkable one. One of his statements near the beginning—that the invention of logarithms came on the world as a bolt from the blue—might indeed be questioned by the historian, but the main part of his address, which endeavored to show the evolution of logarithms in Napier's mind, to reconstitute the process of discovery by deciphering the half-effaced records of its growth, is worthy of most careful study.

The meeting on Saturday morning opened with Professor Hobson of Cambridge in the chair. Dr. J. W. L. Glaisher of Cambridge gave an address on the work of Napier, stating that it was the more marvellous because Napier had no notations, such as we have now, to guide him. Dr. Glaisher said that he himself always assumed that the geometrical form in which the invention was given to the world was the original form, but Lord Moulton's suggestion, that the original form was arithmetical, was well worth a careful examination.

The second paper was a note sent in by Dr. G. Vacca of Rome, Italy, pointing out that Paciolo's solution, in 1494, of the problem, to find in how many years a sum would double itself at a given rate of compound interest, involved the calculation of the logarithm of 2—the first logarithm computed before Napier.

Professor G. A. Gibson of Glasgow discussed the transition from Napier's original logarithms to those of base 10. He pointed out that the theorem that the sum of the logarithms of two numbers was the logarithm of their product, was not accurately true for Napier's original logarithms; nor would it have been true for Briggs's suggested improvement; it was Napier himself who first suggested making the logarithm of unity zero.

Professor David Eugene Smith of Columbia University gave a paper on the law of exponents in works of the sixteenth century and their influence on Bürgi, whose *Progress-Tabulen* (1620) contained an anti-logarithmic table. The importance of the arithmetical relationships conceived by the Germans approached so closely to the idea of the logarithm that it was cause for wonder that Napier and Briggs were not anticipated. Lieutenant Salik Mourad of the Turkish Navy said that logarithms were brought into Turkey in 1714. Professor Florian Cajori of Colorado College read a paper on algebra in Napier's day and alleged prior inventions of logarithms. A novel point in this paper was to the effect that Benjamin Martin, an English writer of the eighteenth century, claimed that Edward Wright deserved priority over Napier, having published a table of logarithms in 1599, sixteen years before Napier. Wright published in 1599 a "table of latitudes" which could indeed be interpreted as a system of logarithms, but Wright used it simply in correcting certain errors in navigation; the logarithmic concept was at that time foreign to him, and Martin's claim cannot be allowed. Cajori gave a careful analysis of the claims of priority which have been made by different historians for Napier and for Bürgi, and came to the conclusion that most of the statements made in histories and cyclopedias are open to serious objection.

A paper by Dr. Sommerville of St. Andrews, on Napier's rules and trigonometrically equivalent polygons, contained some interesting extensions to non-Euclidean space.

On Monday morning Professor David Eugene Smith occupied the chair and introduced Professor Bauschinger of Strassburg who spoke in German and discussed certain formulas relating to the development of a function of two variables in terms of spherical harmonics. He was followed by Professor H. Andoyer of the University of Paris who spoke in French and explained the construction of his trigonometric and logarithmic tables, published in 1911. These tables contain logarithms to 17 figures for every hundredth of the quadrant. Thereupon, Professor d'Ocagne of the Polytechnic School in Paris gave, in French, two short historical notes; one that the principle of the millionaire calculating machine was invented in 1893 by a young French mechanician, Léon Bollée; the other note had reference to the development of nomography. As there were about twenty papers, altogether, to be presented on Monday morning and the early afternoon, the time of presenting them had necessarily to be greatly curtailed. Among the other speakers of the day were Mrs. Gifford, Dr. J. R. Milne, Mr. Hudson, Mr. H. S. Gay, Mr. J. C. Fergusson, Mr. Schooling, Dr. A. Hutchinson, and Dr. W. F. Sheppard.

The principal papers read at the celebration will be published in a volume and will doubtless prove of great interest to mathematicians. It will contain many matters of historic importance. In connection with the congress there was held a very remarkable exhibition of calculating machines, models, old and recent books on logarithms, and relics of Napier. This display was held beneath the same roof as the recently instituted mathematical laboratory of the University of Edinburgh. Among the Napier relics were sets of "Napier's Bones" and early editions of his books. That there was no tendency to minimize the work of Bürgi as an inventor of logarithms was evident from the fact that Bürgi's *Progress-Tabulen* of 1620 and Gieswald's pamphlet of 1656 in which occurs the first publication of Bürgi's explanation of his tables were among the exhibits. These two publications were loaned by the city of Dantzig. Very few, if any, of the mathematicians present had ever before seen them. Dr. Glaisher who has been interested in logarithmic tables for over a quarter of a century had never before enjoyed the opportunity of examining them. It is proposed, in the forthcoming publication of the proceedings of the celebration, to insert photographs of the title-page and of an inside page of Bürgi's book of 1620.

The exhibit included a superb collection of portable sun-dials which were used before the days of watches, of theodolites, of dialling instruments and of sectors. The exhibition of calculating machines was probably the largest ever seen. It included the highly complicated machines of today, some of which are worked by hand, some by electricity. There was an exhibit of planimeters and integraphs by G. Coradi of Zürich, by A. Ott of Kempten in Bavaria, by the University of Glasgow, and by the University of Edinburgh. There was also a large display of old and new slide rules, periodogram analysis apparatus, chronographs, equation-solvers, synthetizers, coördinographs, logarithmic and semi-logarithmic paper, radian polar paper, and collinear-point nemograms. A conspicuous machine was Edward Roberts's tide-predicting machine, which was awarded the Grand Prix at the Franco-British Exhibition of 1908. A photograph of Lord Kelvin's tide predicting machine was also shown.

Of special interest to geometers and crystallographers was the display of mathematical models. Dr. Sommerville's semi-regular polyhedra and his projection model of the 600-cell in space of four dimensions evoked attention. All sorts of linkages, and anaglyphs producing stereoscopic effects by viewing bi-colored diagrams through absorption screens, were seen in another part of the room.

The Royal Society of Edinburgh published a large and admirable handbook of the exhibition, of 343 pages, edited by E. M. Horsburgh, lecturer on technical mathematics in the Edinburgh University. This book will be a valuable addition to any mathematical library.