and not to the data of the computation. The value of the present testimony depends wholly on the judgment of his son in estimating coincidences, and does not depend on the judgment of either father or son as mathematical experts.—ED. NATION.]

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NOTES

Attributed to Peirce by Max Fisch on the basis of very strong internal evidence. For this case, see K. L. Ketner, "Peirce and Turing," forthcoming in *Semiotica*. Unassigned in Haskell, *Index to* The Nation.

—The death of Mr. Charles Babbage, the inventor of calculating machines, is announced. He was born December 26, 1792. The analytical power of his mind was early manifested. In 1815, when he was only twenty-two years old, appeared his remarkable "Essay towards the Calculus of Functions," a very general and profound sort of algebra, of which he was the chief author. About 1822, he made his first model of a calculating machine. It was a "difference engine," that is, the first few numbers of a table being supplied to it, it would go on and calculate the others successively according to the same law. This, at least, is as correct as so short and easy a statement can be. In the following year, at the request of the Royal Society, the Government made a grant of £1,500 to enable Mr. Babbage to proceed with the construction of his machine. In 1829, the Government largely increased this sum, and in 1830 assumed the property of the machine, and declared their intention of defraying the cost of completing it. This Mr. Brunel estimated at £12,000 at a time (February, 1831) when from £8,000 to £9,000 must have been spent. It was in 1830 that Babbage published his "Enquiry into the Causes, of the Decay of Science in England," a savage attack on the management of the Royal Society; on Mr. Pond, the Astronomer Royal; on Captain Sabine, and other influential scientific men. But it was after the publication of this book that Government agreed to furnish the engine. In 1833, a portion of the engine, sufficient to illustrate the working of the whole, was put together. It was a wonderful piece of workmanship, of a precision then unknown, and since unrivalled. To make it, it had been necessary not only to contrive new tools, but to lay a scientific foundation of the principles of tools, and to educate the mechanics who were to use them. Not a penny of the money paid by the Government ever went into Mr. Babbage's pocket, but, on the contrary, he had always advanced the money to pay the workmen until the Treasury warrants were issued, so that he was usually in advance from £500 to £1,000. In 1833, Mr. Babbage declined to continue this system, and, in consequence, the engineer discontinued the construction of the engine, dismissed the workmen, and took away all the tools. During the suspension of the work caused by this circumstance, the great misfortunate of his life

befell Mr. Babbage. He discovered the possibility of a new *analytical* engine, to which the difference engine was nothing; for it would do all the *arithmetical* work that that would do, but infinitely more; it would perform the most complicated *algebraical* processes, elimination, extraction of roots, integration, and it would find out for itself what operations it was necessary to perform; and the principle of this machine was such as immensely to simplify the means of attaining the object of a difference machine. One would suppose that, finding himself so unlucky as to have thought of such a thing, Babbage would at least have had the sense to keep it strictly to himself. Instead of that, he wrote immediately and communicated it to the Government! Before that, all was going smoothly; after that, they never would advance another penny. But it must be admitted that Mr. Babbage himself does not seem to have been very ardent to go on with the old machine after the new one was invented. Of course, neither has been constructed. Another difference engine has since been made by a Swede, named Scheütz. This machine is now at the Albany Observatory, and a duplicate of it is used in the office of the Registrar-General in London. Recently, an important new plan for such an engine has been invented in this country; and careful estimates show that it could be constructed for at most $5,000. But the analytical engine is, beyond question, the most stupendous work of human invention. It is so complicated that no man's mind could trace the manner of its working through drawings and descriptions, and its author had to invent a new notation to keep account of it. This mechanical notation has been found very serviceable for simpler cases.

—Mr. Babbage wrote some works which come within the department of political economy. He has introduced several principles of rather subsidiary importance; but his books are more valuable for the striking facts which they contain. He was also the author of one of the Bridgewater Treatises. He was a single-minded and honorable man of science, who hated intrigues and charlatanry. He was witty and entertaining, and knew how to make himself agreeable to the public, but he did not do it by anything verging upon claptrap. He would invent a ballet or invent an automaton to play *tit-tat-too*, but he did not confound such things with his scientific claims. He was a real genius, but with a not infrequent fault of genius, an egregious and lamentable vanity. There is a trace of it, perhaps, in the following sentence, which may be taken as his epitaph: "If," he says, "it is the will of that Being who gave me the endowments which led to the discovery of the analytical engine that I should not live to complete my work, I bow to that decision with intense gratitude for those gifts, conscious that through life I have never hesitated to make the severest sacrifices of fortune, and even of feelings, in order to accomplish my imagined mission."

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NOTES

Probably by Peirce. James Mills Peirce was his brother. Charles had considerable experience as a "computer," one who calculated (often using logarithmic tables) routine equations for scientific experimenters.

—A very handsomely printed and well-arranged collection of "Three and Four Place Tables of Logarithmic and Trigonometric Functions," by Professor James Mills Peirce (published by Ginn Brothers, Boston), which lies upon our table for notice, reminds us of another debt which the world owes to Mr. Babbage. The publication of his logarithms in 1826 makes an era in the art of computation. They were the first ones in which the proper pains were taken to avoid errors, especially by the thorough examination of the stereotype plates. They were also the first ones of which the arrangement, shape, and size of type, manner of ruling, and color of ink and paper, had been determined upon only after careful experimentation. Babbage tried fifty different colors of paper and ten of ink, and found that the blackest ink upon light buff paper was the least fatiguing to the eye. Much attention has since been paid to all such points which facilitate or expedite computation, and some principles of dividing the page by ruled lines have been discovered which were unknown to Babbage. In 1841, Mr. De Morgan called attention to the great advantages of four-place tables. They can be used with twice the speed of five-place tables, and with four times the speed of seven-place tables, and, as De Morgan pointed out, for navigation and most ordinary purposes have all the accuracy which is desirable. Three-place tables are a later notion. They were strongly advocated by Mr. T. Chappelier in 1863; and we know those who have used them for the last four years with unspeakable comfort for all rough approximate work. For ordinary people who do not have enough calculations to make to keep them in practice in using even five-place tables, the three and four-place tables may, in many cases, be of real utility, if the use of them is once learned.

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NOTES

Probably by Peirce; unassigned in Haskell, *Index to* The Nation. He was studying this topic at that time; the discussion of "various other names" is a distinctive feature of his approach.

'Geometry of Position' is the title of a small octavo volume of 192 pages by Robert H. Graham (Macmillan). Strictly construed, the title denotes a branch of geometry in which the relations of forms in space are considered only in so far as they depend upon position, exclusive of all ideas of quantity or magnitude and all metrical relations. But the absolute separation of the geometry of position and the geometry of magnitude is impracticable if not impossible, and hence various other names have been