side of the sun, duplicate plates of each region being taken. He has also two spectroscopes, each with a single prism and with polarizing apparatus, for special study of the coronal light.

Members of the party from the Massachusetts Institute of Technology have found a good site near Sawah Loento, and are setting up in addition to their eclipse intruments, a number of geodetic instruments, among others a short-period pendulum. They also have a program of observations with magnetometers in continuation of their work in last year's eclipse, in which definite movements were detected in the magnets at the moment of totality.

The Japanese party, including Professors Shin Hiroyama and Seiji Hirayama, of Tokio, and five Japanese assistants, will probably find a station at Padang, as also will the parties from the Jesuit Colleges at Calcutta and Manila. We learn that a German expedition is to arrive on April 28th, and that Count de la Baume Pluvinel will arrive on the same date and proceed to Solok.

It is too early to speak of the chances of clear skies for the various parties, and at present it would seem that success is very precarious. It is fortunate that totality occurs at midday; the sky is frequently clear then, though many fleeting clouds pass over the sun. Meanwhile, the preparations are being pressed forward with a good will by observers and resident authorities alike.

SILAS W. HOLMAN.

SILAS WHITCOMB HOLMAN was born at Harvard, Massachusetts, Jan. 20, 1856, and graduated from the Massachusetts Institute of Technology in 1876, having made a specialty of the study of physics throughout his course. He was thereupon appointed to a position as assistant in the physical laboratory of that institution, but on account of illness did not enter upon his duties until a year later. Continuing in the service of the Institute, he was promoted to more advanced positions and was made professor of physics in 1893. Even at this date his health, never firm, had become much impaired, and a few years later it became necessary for him to relinquish active work. In 1897 he was made emeritus professor of physics. He died April 1, 1900.

Professor Holman's original contributions to science are of high merit and give evidence both of great skill in manipulation and of remarkably clear insight into the choice of methods for conducting a difficult investigation.

The most important of his researches are those upon the viscosity of air and carbonic acid as affected by temperature, which were published in the *Proceedings* of the American Academy of Arts and Sciences in 1876 and 1885, the first of which was based upon his graduating thesis at the Institute of Technology. These contain by far the most complete study of this difficult subject which had been made up to their date, and the results are still of standard value. Indeed, within the past few years, they have played an important part in the advancement of the kinetic theory of gases.

In the same *Proceedings* for 1886 is found a further noteworthy paper, written in conjunction with one of his pupils, upon the determination of fixed reference points for thermometric measurements at high temperatures in which several such points are established.

A number of years later, in 1895, appeared another group of papers, the last published by him, relating to the thermo-electric measurement of high temperatures, and a single paper upon calorimetry, which subjects had occupied much of his attention for some time previous. Of these, the one entitled

'Thermo-electric Interpolation Formulæ' is particularly valuable for its critique of the various methods of interpolation which have been employed in dealing with the results of high temperature observations, and that upon the 'Melting Points of Aluminium, Silver, Gold, Copper and Platinum,' published in collaboration with his pupils, Messrs. Lawrence and Barr, contains what are undoubtedly the best measurements of the points of fusion of these metals that had been obtained at the time of their publication. A third paper contains a description of a novel method of calibrating the LeChatelier thermo-electric pyrometer, and the fourth a new method of applying the cooling correction in measurements of the heat of combustion.

The papers of Professor Holman, thus far referred to, have all been published in the *Proceedings* of the American Academy. Several others of minor importance have appeared in different scientific journals. An extended critique upon thermometry of precision, presented at the Boston meeting of the American Association for the Advancement of Science in 1880 unfortunately was never printed.

Besides his published researches, Professor Holman was the author of several valuable scientific works. The two volumes of 'Physical Laboratory Notes,' prepared for the use of his pupils in the Massachusetts Institute of Technology, embody the results of many years of successful experience in teaching and form an important contribution to the literature of the subject. They contain much original matter and exhibit a rare discrimination in the selection and comparison of the methods of measurement which are discussed. This is particularly the case with the volume relating to electrical measurement and testing.

In 1892 he published a treatise upon 'The Discussion of the Precision of Measurements,' the basis of which consisted of the notes of lectures given to his classes. This volume, which is quite unique in its contents, contains in convenient form a very compendious and lucid consideration of the application of the principles of least squares to the theory of observations, the calculation of their precision and the choice of proportions in designing physical apparatus to be used for measurement. Its value as a text-book has been very great.

The collection of four- and five-place logarithmetic tables, prepared in 1896, embodies several features of marked originality, and is prefaced by a brief but exceedingly useful discussion of the fundamental principles of computation which contains many useful suggestions for the economizing of labor.

The last work written by Professor Holman, entitled, 'Matter, Energy, Force and Work,' appeared in 1898 and is of a character widely different from any of those which preceded it. It is a philosophical study of the fundamental concepts of modern physics, in which the subject is approached from the point of view that matter and energy, rather than matter and force, are the primary entities with which physics, has to deal, and that matter itself may be dependent upon energy for its own existence. While not technical in its character, and intended especially for the help of teachers not wholly familiar with modern views, it is distinguished throughout by great clearness and is a remarkable presentation of the newer modes of viewing the subjects which it considers.

Valuable as are his scientific publications, however, Professor Holman's great work was that of a teacher of young men in the laboratory. From the beginning of his service as an assistant in the Rogers Laboratory of Physics his influence was marked, and by his patient labors extending through many years, he brought the work which was under his charge to a high state of develop-

ment. He possessed great skill in the planning of apparatus and methods and remarkable judgment as to the processes best suited either for purposes of instruction or for the securing of accurate scientific results. To the development of the Laboratory of Electrical Measurements in the Massachusetts Institute of Technology he gave for years his best endeavors, and to him is due the success of its work. He was also placed in charge of the newly instituted Laboratory of Heat Measurements, and though prevented by failing health from developing this as he would have chosen, he laid a solid foundation for those coming after him.

Professor Holman was born a teacher, and never grew weary in his profession. His personal relations with his pupils were very intimate. By that example which is better than the wisest precept, he impressed upon them the preeminent necessity of thoroughness, accuracy and honesty in all the work which they might be called upon to perform, either as students or in professional life. He is remembered by them with the most affectionate regard.

Reference has already been made to the interference of ill-health with the prosecution of the labors of Professor Holman. In fact, after reaching manhood he was never in good health, and during almost the whole of his active life as a teacher he struggled with a painful chronic disease, which gradually, though with some intermissions, sapped his strength. His cheerful disposition and persistence in carrying on his work were such that none but those who knew him well were aware of the fact that it was only his indomitable courage which prevented him from yielding to his malady for some years before it finally overcame him. In the spring of 1890 he was obliged to discontinue work for a time. He spent the following year abroad and came home much improved in health; but the relief was only temporary. In 1895 he finally gave up his work of instruction. For some years after this, however, though confined to his chair and at last even deprived of his sight, he continued to labor diligently and published the tables of logarithms and the work on matter and energy mentioned above. His latest years were his best ones, and his whole life was a fine illustration of the manner in which a noble spirit may rise superior to circumstances and produce the best results under conditions to which an ordinary mind would utterly succumb.

CHAS. R. CROSS.

SCIENTIFIC BOOKS.

Botany—An Elementary Text for Schools. By L. H. BAILEY. New York, The Macmillan Company. 1901. 8vo. Pp. xvi + 356. Price, $1.10.

Foundations of Botany. By JOSEPH Y. BERGEN, A.M. Instructor in Biology, English High School, Boston. Boston, U. S. A., Ginn & Company. 1901. 8vo. Pp. xii + 412 + 258. Price, $1.50.

Within the past three or four months two notable text-books on high-school botany have appeared, the one from the ready pen of Professor Bailey, of Cornell University, to whom we are already indebted for so many helpful and suggestive books on various phases of plant life, the other from Instructor Bergen, of one of the Boston High Schools, who also has the distinction of having written acceptably in the preparation of an earlier, very useful, although much simpler, text-book for high-school students.

The two books are quite different in both content and mode of treatment. Professor Bailey takes the quite extreme position that 'the schools and teachers are not ready for the text-book which presents the subject from the viewpoint of botanical science,' and is particularly opposed to the use of the compound microscope in high schools, as when he says: "The pupil should come to the study of plants and animals with little more than his natural