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FOR 1878

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SPENCER F. BAIRD

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PREFACE.

THE present volume is the eighth of a series commenced in 1871, and which, although entirely unconnected with a work having somewhat the same object—the "Annual of Scientific Discovery"—took up the record of scientific and industrial progress where the latter left it off, after having been published since 1850.

A modification of the original plan of the "Annual Record" was commenced in the volume for 1877. Previous to that it consisted of two parts—first, a general summary of progress in the various branches of science; and, secondly, a series of abstracts of special papers, credited to the work in which they were published. These abstracts, although prepared by several specialists, were without indication of their authorship. The experience of several years showed that in attempting to give abstracts of anything like the most important announcements of the year, more space was required than could be spared for the purpose; and it was therefore determined to enlarge the scope of the first division, and make it include a greater amount of detail, each summary to be prepared by some eminent specialist, and to be headed by his name.

This plan was found to give entire satisfaction to the patrons of the "Annual Record," and it has therefore been followed on the present occasion. In the table of contents will be found an analysis of the several articles, while a very minute alphabetical index will permit easy reference to any particular facts recorded.

SPENCER F. BAIRD.

SMITHSONIAN INSTITUTION, March 1, 1879.

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Any of the above works sent by mail, postage prepaid, to any part of the United States, on receipt of the price.

J. Asmus gives, in the *Annalen für Hydrographie*, pp. 285 and 333, a review of various methods of graphically presenting the deviations of ships' compasses.

In reference to the subject of earth currents, possibly some light may be thrown by the observations that have been made upon them by underground telegraph lines, on the occasion of the longitude determinations between Berlin and Altona, a preliminary account of which is published by Albrecht in the *Astronomische Nachrichten*. The special object of the investigation was to determine the nature of the curve which indicated the intensity of the galvanic current on telegraph lines of different lengths, both above and below the earth. It is found that the increase of intensity was decidedly less for lines below than for those above the surface.

Professors Ayrton and Perry, of the College of Engineering, Tokio, Japan, communicate to the *Philosophical Magazine* a short note, proposing the hypothesis that the phenomena of earth currents, terrestrial magnetism, and atmospheric electricity are due to the fact that the earth is an electrified condenser, whose capacity or potential is continually changing on account of its rotation and its annual orbital motion, the successive cooling and warming of the air, the formation of clouds and rain, etc., etc. These changes produce electric currents tending always to restore the equilibrium, whence follow the phenomena in question. They suggest that observations of atmospheric electricity may be used to predict atmospheric changes.

An important memoir by Edlund upon Atmospheric Electricity and the Aurora is published in the *Transactions* of the Stockholm Academy, and translated in the *Philosophical Magazine*. Edlund first shows that "unipolar induction" is fully explained by his theory that the galvanic current consists in the translatory motion of a fluid going in the positive direction, or of two fluids following opposite directions. The latest confirmation of this theory is the experiments of Lemstrom. Edlund then proceeds to apply these views to the earth, whose lower atmosphere is a poor conductor lying between two good conductors, viz., the rotating solid and liquid globe and the external thin inter-planetary gas. Regarding the solid nucleus as a magnet, whose axis makes a certain angle with the terrestrial axis of rotation, and whose atmos-

phere and oceans are in motion, we have at once the phenomena of unipolar induction; and he then deduces the distribution of atmospheric electricity, terrestrial magnetism, auroral display, etc., etc., in minute agreement with actual observations. An excellent abstract of this paper is given in the *Zeitschrift für Meteorologie*.

S. Tolver Preston communicates to the *Popular Science Review* for January a popular article on the same subject—i. e., the inductive effect produced by the rotation of a magnet on its axis—and incidentally suggests that the motion of the tides may cause an electric disturbance.

A memoir by K. S. Lemstrom on the Causes of the Earth's Magnetic Condition is published as an academic disquisition by the University of Helsingfors. The work is divided into five chapters: first, the observed magnetic condition from the earliest dates to the present time; second, the theories of Euler, Gauss, and Hansteen; third, an attempt at explanation by means of a new theory of his own; fourth, further experimental data tending to establish this theory; and, fifth, further conclusions from the results which he has deduced. An imperfect acquaintance with the Swedish language forbids our saying more than that Dr. Lemstrom appears to have attempted to apply Professor Edlund's views to the electric induction of a rotating earth, and to have deduced a number of general results agreeing closely with observed phenomena.

The determination of the force of gravity by observations of the pendulum having attained great exactness by the use of the Bessel-Repsold symmetrical reversion pendulum, it has become important to investigate small sources of error that had previously escaped attention, and the last volume of the *Proceedings* of the fifth General Conference of the International European Geodetic Commission contains important papers by C. S. Pierce, Celloria, Oppolzer, and Plantamour on the corrections necessary on account of the vibrations of the supports upon which the pendulum rests. The general tendency of these vibrations is to give the length of the seconds pendulum too short, by a quantity that may amount to a considerable fraction of a millimeter.