One object well attained is success, and it is to be hoped that the book will reach sufficient sales through the reasonable accomplishment of this object, so that the author may be encouraged to write another and more extended volume which may meet the needs of the electrical engineering students.

The author is to be congratulated upon the remarkable freedom of his first edition from typographical errors. In other respects he is perhaps not always so fortunate, as in some of his definitions, which are not always adapted to give a proper physical conception to the student. Also, in certain parts of the book, the descriptive matter is inexact or inadequate —especially is this true in the chapter on armature windings, where no attempt is made to present the rational laws of windings, and the short descriptions are inadequate and the diagrams too small to be thoroughly serviceable. Such faults, however, may be readily corrected in another edition, the compliment of an early demand for which we cordially wish for the author.

All in all, we heartily welcome the book to a useful sphere and compliment the author on his success. But we must regret that he did not make a book which might occupy the more important place of a scientific college text-book on applied electromagnetism and the construction of dynamos.

DUGALD C. JACKSON.

DISCUSSION AND CORRESPONDENCE.

A NEW FIELD FOR KITES IN METEOROLOGY.

TO THE EDITOR OF SCIENCE: Although kites carrying recording instruments to a height exceeding three miles have rendered great services to meteorology at Blue Hill and elsewhere, they have been subject to the limitation of requiring a wind that blows at least twelve miles an hour. In certain types of weather—notably anti-cyclones—the winds are light and consequently observations with kites can rarely be obtained at these times. It also happens frequently that, while the wind at the ground is sufficient to raise the kites, it fails completely above the cumulus clouds so that the kites are unable to penetrate this calm zone.

By installing the kites and apparatus on a steamship, not only can kites be flown in calm weather, but observations may be made above the oceans where little is known about the conditions of the upper air. It is evident that a vessel steaming twelve knots an hour through a calm atmosphere will raise the kites to the height they would attain in a favorable natural wind, while the force of strong winds can be moderated by steaming with the wind. In this way, kites can be flown on board a steamer, under almost all conditions and probably more easily than on land, since the steadier winds at sea facilitate launching them. Wherever these observations in the upper air may be made, there is always a station at sea-level and not far distant horizontally with which to compare them.

To test the practicability of this method of flying kites, experiments were undertaken on August 22, 1901, with the aid of my assistants, Messrs. Fergusson and Sweetland, upon a tow-boat chartered for this purpose to cruise in Massachusetts Bay. Anti-cyclonic weather conditions prevailed, and a southeast wind blew from 6 to 10 miles an hour, but at no time with sufficient velocity to elevate the kites, either from sea-level or from the summit of Blue Hill. With the boat moving 10 miles an hour toward the wind, and within an angle of forty-five degrees on either side of its mean direction, the resultant wind easily lifted the kites and meteorograph with 3,600 feet of wire to the height of half a mile.

While it is desirable to have a vessel that can be started, stopped and turned at the will of the meteorologist, as was the case in the experiments described, it is nevertheless probable that soundings of the atmosphere can often be made from a steamship pursuing its regular course, and such are about to be attempted by me on a steamer eastward bound across the North Atlantic. Although observations above all the oceans are valuable, the exploration of the equatorial region is the most important, since, with the exception of a few observations on the Andes and on mountains in central Africa, we know nothing of the conditions existing a mile or two above the equator. The need of such data to complete our theories of the thermo-

dynamics and circulation of the atmosphere was urged by the Russian meteorologist, Woeirof, at the Meteorological Congress in Paris last year. North and south of the equator, within the trade-wind belts, kites might be employed to determine the height to which the trades extend, and also the direction and strength of the upper winds, concerning which the high clouds, rarely seen in those latitudes, furnish our only information. In order to deduce the velocity of the upper current from the resultant velocity recorded at the kite, it is necessary to ascertain the direction of this latter force, which could be done from the orientation of the kite.

A. LAWRENCE ROTCH.

BLUE HILL METEOROLOGICAL OBSERVATORY, August 24, 1901.

GRADUATE COURSES IN SCIENCE.

AT the request of the editor, I have drawn up a list of the graduate courses in pure science offered by several of our leading universities during the academic year 1901–1902. Chicago, Columbia, Cornell, Harvard, Johns Hopkins, Pennsylvania and Yale have been chosen because during the past four years each of these universities has almost invariably conferred from 20 to 40 doctorates of philosophy, whereas no other university in our country has on the average conferred more than eight.

This information has been collected from the most recently issued announcements of graduate courses to be given by the respective universities during the ensuing academic year, and has been made as complete as the material at command will permit. In some instances the announcements of courses fail to distinguish clearly between primarily undergraduate courses and purely graduate courses, and the compiler has in such cases endeavored to discriminate as carefully as possible. Wherever the information has been obtainable, there is added in parenthesis to the announcement of each course the number of hours a week for which that course is scheduled. Unless otherwise stated, the common denominator employed is the unit hour per week during the entire academic year. Laboratory hours are distinguished by italics. The graduate courses given at the University of Chicago during the summer quarter of 1901 have been omitted, as also the graduate courses given at the recent summer sessions of several of the universities.

ANATOMY.

(Consult also Zoology.)

Chicago.

Professor Barker: Seminar; Advanced work and original research.

Columbia.

Professor Huntington: Laboratory courses in animal morphology.

Harvard.

Professors Dwight and Dexter: Research course in anatomy.

Johns Hopkins.

Professors Mall, Harrison and Bardeen: Advanced work and original investigation (daily).

Professors Mall, Harrison, Drs. Sudler, Lewis: Systematic instruction in gross human anatomy (afternoons).

Professor Bardeen, Drs. Knower, MacCallum: Systematic instruction in histology, microscopic anatomy, neurology, and embryology (mornings).

Pennsylvania.

Professor Jayne: Research in human anatomy.

Yale (see Zoology).

ANTHROPOLOGY.

Chicago.

Professor Starr: Physical anthropology, lab. (*4*); Laboratory work in anthropology (*4*); Japan (4, 6 wks.); Pueblo Indians of New Mexico (4, 1 qr.).

Columbia.

Professor Boas: Ethnography of America (2); Statistical study of variation (2); Physical anthropology (2); American languages (2).

Professor Farrand: General introductory course (2); Ethnology, primitive culture (2).

Professors Boas and Farrand: Research work in physical anthropology, ethnology and North American languages (daily).

Harvard.

Professor Putnam: American archeology and ethnology (research).

Drs. Woods, Dixon: General anthropology (3).

Dr. Dixon: Primitive religions ($1\frac{1}{2}$); Special ethnology ($1\frac{1}{2}$).

Yale.

Professor Sneath: Philosophical anthropology (2).

Professor Sumner: (See Sociology and statistics.)

ASTRONOMY.

Chicago.

Professor Hale: Solar physics (8); Stellar spectroscopy (8); *ditto* (4).

Professor Frost: Astronomical spectroscopy (4); Stellar spectroscopy (4); Celestial photometry (4, 1 qr.).