time in the mines of Lake Superior, and the largest recorded was found in 1857 in the Minnesota mine. It measured 45 feet in length, 22 feet at its greatest width and more than 8 feet at its thickest part, and contained over 90 per cent. pure copper. The total weight was about 420 tons.

THE *Observatory* gives the following from the *Daily Chronicle,* a leading London paper:

Actors and others are discussing what they shall do with the seventh day. There is a tiny island in the South Pacific where there is no seventh day, six days being the allotted span of every week. All travelers know that time is lost or gained in traveling east or west, and Chatham Island is just on the line of demarcation between times and dates. To keep in line with the almanac, therefore, the plan has been adopted of jumping the afternoon of one day and the morning of the next in every week, so that the islanders commence Wednesday, but at 10 o'clock switch on to Thursday afternoon.

UNIVERSITY AND EDUCATIONAL NEWS

THE children of the late James Dwight Dana (Silliman professor of geology at Yale University from 1850 to 1895) have offered to establish a fund which shall ultimately reach $24,000, the income to be used "to further study and research in geology."

BY the will of Frederick Blanchard of Tyngsboro, Harvard University receives for the use of the Museum of Comparative Zoology his entomological collection.

MRS. JOHN JOSEPH ALBRIGHT, of Buffalo, a trustee of Smith College, has given $60,000 toward the million-dollar fund. This gift is to establish what will be known as the S. Clarke Seelye professorship. The subscriptions now amount to about $500,000.

THE corporation of Yale University has passed a statute regarding sabbatical years, making it possible for a professor or assistant professor to take a half-year's absence on full salary as an alternative for a full year at half salary. A similar plan was adopted by the trustees of Columbia University several years ago.

ENROLLMENT figures for 1912–13 for all departments of Western Reserve University are announced this week at the university as follows: Adelbert College, 456; the College for Women, 354; the Graduate School (incomplete), 14; the Medical Department, 168; the Law School, 130; the Dental School, 127; the Library School (incomplete), 50, and the School of Pharmacy, 111. The total enrollment for all departments is 1,410. Western Reserve University, in its undergraduate departments, Adelbert College and the College for Women, has decided that, under ordinary conditions, no division of a class for recitation purposes is to exceed twenty-five persons. This vote, applying to all classes, means that in the freshman class of Adelbert College there will be seven divisions, and in the freshman class of the College for Women five divisions in all required subjects. Many large elective classes will be divided into two, three or four divisions.

DR. FRANK PELL UNDERHILL, assistant professor of physiological chemistry in the Sheffield Scientific School, Yale University, has been elected professor of pathological chemistry in the Medical School.

PROFESSOR R. C. PUNNETT has been appointed the first Arthur Balfour professor of genetics at Cambridge University.

DISCUSSION AND CORRESPONDENCE

RADIOTELEGRAPHIC ACHIEVEMENTS BY THE POULSEN SYSTEM

TO THE EDITOR OF SCIENCE: I wish to call attention to the important results being accomplished in this country by the Poulsen system of wireless telegraphy. This system and the work that is being done by it is of great scientific interest as well as practical importance, and inasmuch as almost nothing is generally known about it a brief account of its main features may be of interest to the readers of SCIENCE. Although not a physicist I am led to call attention to this subject because I have waited in vain to see any mention of it in scientific journals, and because numerous students of related subjects whom I know

have failed to take much interest in it. This lack of interest is apparently due to the prevailing prejudice against the claims of wireless telegraph companies in general.

The system of wireless communication in question is that invented by the Danish scientist Valdemar Poulsen, and is radically different from the Marconi and related spark systems. Instead of intermittent waves such as are sent out by the spark system, the Poulsen system sends undamped continuous waves by means of an arc. In transmitting a message the signals are given not by interrupting the current but by slightly varying the wave-lengths in a continuous wave train. Experience is proving that such continuous wave trains are far less affected by adverse atmospheric conditions and other obstacles, and are propagated long distances with much less power than the broken waves sent out by the spark system, and that they possess numerous other advantages. As a result, entirely reliable communication for long distances over land, and communication by day almost as well as by night, is made possible.

The greatest advances in the development of this system are being made in the western part of the United States, largely by persons now or heretofore connected with Stanford University. Stations ranging in power from 5 to 30 kilowatts are in operation in the large cities on the Pacific Coast, from Seattle to San Diego, and at Phœnix, El Paso, Fort Worth, Kansas City and Chicago. Telegraphic messages are being transmitted constantly, day and night, along the Pacific Coast and as far east as El Paso, and messages are sent from there by night to and from the comparatively low-power stations so far installed at Fort Worth, Kansas City and Chicago. Since the recent establishment of a 30-kilowatt station at San Francisco with two 440-foot towers it has been found possible to send messages direct from the coast to Fort Worth and Kansas City, and do away with the intermediate relays. Within the past few weeks a station has been completed at Honolulu and every day from 1,000 to 4,000 words of news and private messages are sent thither by the San Francisco station. This news appears in the Honolulu daily paper and, by virtue of its cheaper cost than news by cable, is affording the people there for the first time complete news of the world each day. This distance is more than 2,350 miles and is the longest over which continuously successful wireless communication has ever been established. Furthermore it is the longest single span of ocean necessary to cross in circling the globe, and forecasts trans-Pacific wireless communication in the near future. The power used at these Pacific coast stations is only a small fraction of that necessary for sending messages by the spark system across the two thousand miles of ocean from Ireland to Nova Scotia.

With the aid of mechanical transmitters and receivers from 100 to 300 words per minute are accurately sent and received by the Poulsen system over distances of several hundred miles, and a method has been devised whereby two messages can be sent or two received simultaneously over the same antenna. The wave-lengths can be readily varied, and, as each station has its assigned wave-length to which it keeps its receiving apparatus attuned, messages can be sent to any point desired without troubling other stations. Or, if desired, all stations within range can receive the same message simultaneously. Messages sent by the Poulsen system are not read by operators of other systems and the stations do not experience the interference from outside operators which is so troublesome a feature of the spark stations.

In addition to telegraphic communication the Poulsen system has been proved successful for wireless telephony. I can personally attest the simplicity and clearness of this method of transmitting speech, having telephoned more than two years ago between Stockton and San Francisco, a distance of 80 miles over land. Subsequently speech has been carried in this way from San Francisco to Los Angeles, 450 miles, but as yet no thorough tests have been made of the system's telephonic possibilities, attention having been concentrated upon the telegraph.

There are other novel and important features of the Poulsen system which it would take too long to mention. As yet only a beginning has been made in developing its possibilities. The next step will be to test and put in use generators of increasing powers, from which increasing ranges are expected. The success so far attained has advanced the science of communication considerably beyond its generally recognized limits, and affords sound basis for the expectation that a few years will see much of the present work not only of ocean cables but also of long distance telegraph lines done by undamped electromagnetic waves transmitted through space.

ROBERT ANDERSON

WASHINGTON, D. C.,
November 6, 1912

PICTURES OF PSYCHOLOGISTS

HAVING the Open Court series pictures of psychologists and philosophers, I have often wished that I had those of present-day psychologists on the walls of my recitation room. I have often thought of writing to psychologists for their photographs, but that would be a good deal of trouble and if a number followed that plan it would become a nuisance to those whose pictures were most desired. A continuation of the Open Court series would be desirable, but who is to decide which of the living men should be included and would not such a series be unprofitable because of its inclusions and omissions?

The following plan occurs to me as a means of getting what is desired without any of the above disadvantages. Let those desiring photographs name the ones whose pictures are desired to the one who is willing to take charge of the matter. That one can then procure one photograph of each person named and have a plate made from it of the same size as the Open Court series and arrange with a photographer to furnish photos from these plates at a reasonable rate.

Are there enough who desire such pictures to make it worth while to inaugurate the plan? This can be answered if all who are interested will at once write to me signifying their desires and naming at least a few of the men whose pictures they wish. Prominent educators and perhaps other men of science might be included if they were asked for. If interested do not fail to write at once.

E. A. KIRKPATRICK

FITCHBURG, MASS.

SCIENTIFIC BOOKS

The Spider Book. A Manual for the Study of the Spiders and Their Near Relatives, The Scorpions, Pseudoscorpions, Whip-scorpions, Harvestmen, and Other Members of the Class Arachnida, Found in America north of Mexico, with Analytical Keys for Their Classification and Popular Accounts of Their Habits. By J. H. COMSTOCK. Garden City, New York, Doubleday, Page & Co. 1912. Pp. xv + 707; 771 figs.

This work, the most recent of the series of well-known nature books published by Doubleday, Page & Company, fills a long-felt need, since the spiders are the most abundant and conspicuous representatives of a large group of organisms, which have never aroused an interest, in the American student at least, at all commensurate with their biological and economic importance. The author has arranged the vast amount of material, which he has accumulated during more than a decade of enthusiastic study, in conformity with the plan adopted in the preceding volumes of the series, throwing the emphasis on the classification and subordinating the morphological, ethnological and chorological data to this arrangement. By way of introduction to the main subject of the volume the various lower groups of Arachnida are briefly discussed. This portion of the work, apart from the useful tables for identification, does not rise above the level of many zoological text-books, and some of the sections, as, *e. g.*, those on the ticks and mites, scarcely do justice to our present knowledge or to the economic importance of the subject. The account of the spiders, which are, after all, *the* subject of the book, is preceded by chapters on