existing treatise on the varied subjects included under its comprehensive title.

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SCIENTIFIC JOURNALS AND ARTICLES.

THE February number (Vol. VIII., No. 5) of the *Bulletin of the American Mathematical Society* contains a report of the eighth annual meeting of the Society, by the secretary; a report of the January meeting of the Chicago Section, by T. F. Holgate; a review of Wilson's Vector Analysis, by Alexander Ziwet; a review of books by M. Simon and J. M. Hill on Euclid, by J. S. Coolidge; 'Notes' and 'New Publications.' The March number of the *Bulletin* contains the following articles: 'The Application of the Fundamental Laws of Algebra to the Multiplication of Infinite Series,' by Florian Cajori; 'Concerning the Class of a Group of Order p^m that Contains an Operator of Order p^{m-2} or p^{m-3}. p being a Prime,' by W. B. Fite; 'Proof that the Group of an Irreducible Linear Differential Equation is Transitive,' by Saul Epsteen; 'Lines of Length Zero on Surfaces,' by L. P. Eisenhart; 'Some Properties of Potential Surfaces,' by Edward Kasner; a review of Gibson's Calculus, by W. F. Osgood; 'Shorter Notices' of Cohen's Theory of Numbers and Beman's translation of Dedekind's Essay on the Theory of Numbers, by L. E. Dickson, and of the Annuaire des Bureau des Longitudes, by E. W. Brown; 'Notes' and 'New Publications.'

The American Naturalist for February opens with an article by W. M. Wheeler on 'A New Agricultural Ant from Texas, with remarks on the known North American Species,' the new ant being *Pogonomyrmex imberbiculus*, while the notes include a key for the identification of the species. Under the caption '*Phyllospadix* as a Beach-builder,' R. E. Gibbs presents some new information regarding its life-history and shows how its spreading tufts hold the sand and produce sand-bars. G. H. Shull gives 'A Quantitative Study of Variation in the Bracts, Rays, and Disk Florets of *Aster Shorti* Hook., *A. Novæ-angliæ* L., *A. puniceus* L. and *A. prenanthoides* Muhl., from Yellow Springs, Ohio.' The number contains the 'Quarterly Record of Gifts, Appointments, Retirements and Deaths,' and it is noted that hereafter these will appear in the numbers for February, May, August and November. The gifts for the past year to schools, colleges, libraries and museums amounted to $43,233,635, and this does not include Mrs. Stanford's transfer of securities to Stanford University nor any appropriations made by national, state or local governments.

The Popular Science Monthly for March contains a long and well-illustrated article by J. C. Branner on 'The Palm Trees of Brazil,' describing the appearance and uses of many species. Alexander F. Chamberlain treats of 'Work and Rest: Genius and Stupidity,' drawing the inference that brief periods of intense work and long periods of rest produce better results than long periods of steady application. 'Science in 1901' is a résumé of progress along various lines from wireless telegraphy to the better understanding of yellow fever, reprinted from the London *Times*. Ellis P. Oberholtzer describes 'Franklin's Philosophical Society,' the oldest scientific society in the country, and W. H. Dall contributes an appreciative biographical sketch, with portrait, of the late Alpheus Hyatt. W. G. Sumner tells of the comparatively recent extraordinary outbreak of 'Suicidal Fanaticism in Russia,' and Lindley M. Keasbey discusses 'The Differentiation of the Human Species,' believing that mankind was homogeneous prior to the glacial period. E. B. Titchener, after considering the problem 'Were the Earliest Organic Movements Conscious or Unconscious,' decides in favor of the necessity of mind at the first appearance of life. Finally we have the full text of the 'Trust Deed by Andrew Carnegie creating a Trust for the benefit of the Carnegie Institution.'

SOCIETIES AND ACADEMIES.

AMERICAN PHYSICAL SOCIETY.

THE regular bimonthly meeting of the Physical Society was held at Columbia

University on Saturday, February 22. The severe storm in the region near New York at that time delayed the arrival of many of those present, and doubtless prevented others from coming. But the attendance was satisfactory in spite of the storm, and the meeting an enjoyable one.

A paper on the 'Velocity of Light,' by President Michelson, took the place of the president's annual address, which could not be delivered at the holiday meeting of the Society on account of Professor Michelson's unavoidable absence. The paper contained a brief discussion of the various determinations of the velocity of light, together with the determinations of the ratio of the electrostatic and electromagnetic units, and of the velocity of electric waves. The conclusion was reached that the great theoretical importance of demonstrating, or disproving, the absolute equality of these three quantities made a redetermination of the velocity of light desirable. Certain criticisms, from the theoretical standpoint, of the revolving mirror method, which up to the present time has given the most consistent results for V, were also mentioned. A method was proposed which combined the advantages of both the method of Cornu, in which a toothed wheel was used, and the method of the revolving mirror, as used by Michelson and by Newcomb. While free from the objections that have been suggested in connection with the latter method, the method proposed promises a higher accuracy than has ever heretofore been reached.

In a paper on 'Magneto-striction in Bismuth,' by A. P. Wills, experiments were described which were intended to detect any change in length in bismuth produced by longitudinal magnetization. Similar tests by Bidwell had shown an appreciable elongation for a magnetic field of less than 2,000 c. g. s. units. The experiments of Professor Wills were made with a stronger field and with an arrangement of levers of sufficient sensitiveness to show a much smaller elongation than that reported by Bidwell; but no effect could be observed.

In a paper entitled, 'The Transmission of Sound Through Solid Walls,' Mr. F. L. Tufts gave the results of determinations of the transmitting power for sound of various nonporous walls. The results were in many respects different from what would probably be anticipated from a hurried consideration of the case. For example, a wall of sheet lead, in spite of its great density and its lack of elasticity, was found to transmit much more sound than a glass wall of equal thickness. Two walls separated by an air space were no more effective in cutting off sound than the same two walls in contact. The results indicate that the sound is transmitted in such cases by the forced vibration of the wall as a whole, not by the elastic waves carried through the wall. Other things being equal, that medium which yields most to pressure steadily applied will transmit best.

Professor A. G. Webster, in a paper on the 'Spherical Pendulum,' showed some very pretty traces illustrating the vibrations of a pendulum whose motion is not restricted to one plane and whose amplitude is large. The traces were made by photographing the path of a small incandescent lamp attached to the pendulum bob. The theory of such a pendulum was briefly discussed, and it was shown that the traces actually observed were in close agreement with those predicted by theory.

Certain distorted coronas, produced by a medium containing drops of moisture of different sizes, were described by Carl Barus in a paper entitled 'The Flower-like Distortion of Coronas Due to Graded Cloudy Condensation.' The author developed the theory of such coronas and showed that it was in agreement with observation.

A second paper by Professor Barus dealt with 'Persistent Nuclei Produced by Shaking Solutions of Solids, Liquids or Gases.' The author stated that whereas the nuclei produced by pure water were very fleeting, nuclei produced by solutions persisted until removed by gravity. It follows that small droplets of solutions do not evaporate below a certain dimension, very large compared with molecular dimensions.

The results of measurements of the current between a cold metal and an incandescent carbon kathode were presented in a paper by

Ernest Merritt and O. M. Stewart. Curves were shown giving the observed relation between current and potential difference for different degrees of incandescence and for different air pressures. At low pressures (0.05 mm. or less) these curves were similar to the 'saturation' curves observed in the case of conduction due to Röntgen rays, etc. With increasing potential difference the current at first increased, reached a maximum at about six volts, and then remained practically unaltered for higher potentials, even up to 120 volts. At pressures in the neighborhood of one millimeter the curves were of the same character at low potentials; but instead of remaining constant throughout the whole range from six volts to 120 volts, the current remained unaltered until a potential difference of about thirty volts was reached, and then increased rapidly for higher voltages. The authors suggest that the result may be explained by the ionization of the residual gases by the negative ions from the incandescent carbon.

The Society voted to request the Council to arrange for a summer meeting of the Society in connection with Section B of the American Association for the Advancement of Science.

ERNEST MERRITT.

AMERICAN MATHEMATICAL SOCIETY.

A REGULAR meeting of the American Mathematical Society was held at Columbia University on Saturday, February 22. Vice-President Maxime Bôcher occupied the chair. Thirty members were in attendance at the two sessions. The Council announced the election of the following persons to membership in the Society: Professor Edward Brand, Howard College, Ala.; Mr. D. R. Curtiss, Harvard University; Miss Alice B. Gould, Boston, Mass.; Dr. Carl Gundersen, Columbia University; Mr. A. F. van der Heyden, Middlesbrough, Eng.; Rev. Jean de Seguier, S. J., Paris, France; Mr. J. W. Young, Cornell University. Fourteen applications for membership were received.

The term of Professor T. S. Fiske as member of the editorial board of the *Transactions* having expired, he was reelected for a term of three years. Dr. Edward Kasner was reelected assistant secretary. It was decided to hold the next summer meeting of the Society at Evanston, Ill., about the end of August.

The organization of a Pacific Section of the Society is now under consideration. The activity and number of members on the Pacific slope would appear to justify the Council in granting the desired authorization. The Chicago Section, founded in 1898, has proved a gratifying precedent.

The Annual Register of the Society has recently appeared, containing the list of officers and members, annual reports, constitution and by-laws, and a complete list of all periodicals now in the Society's library. The total membership of the Society is now 379, of whom 18 are life members. The treasurer's report shows a credit balance of over $2,000, in the face of a considerable expenditure for the *Transactions* and the *Bulletin*.

The following papers were read at the February meeting:

Dr. E. V. HUNTINGTON: 'A complete set of postulates for the theory of absolute continuous magnitude,' 'Complete sets of postulates for the theories of positive integral and positive rational numbers,' and 'A simplified definition of a group.'

Dr. M. B. PORTER: 'On the arithmetic nature of the zeros of Bessel functions.'

Dr. W. B. FITE: 'On a property of groups of order p^m.'

Professor L. E. DICKSON: 'The groups of Steiner in problems of contact.'

Dr. VIRGIL SNYDER: 'On the forms of quintic scrolls.'

Mr. PERCIVAL LOWELL: 'On the capture of comets by Jupiter.'

Mr. H. L. RIETZ: 'On primitive groups of odd order.'

Professor MAXIME BÔCHER: 'On systems of linear differential equations of the first order.'

Dr. E. J. WILCZYNSKI: 'Covariants of systems of linear differential equations.'

Professor JAMES MACLAY: 'On some associated surfaces of negative curvature.'

Professor E. W. BROWN: 'On the small divisors in the lunar theory.'

Mr. OTTO DUNKEL: 'Some applications of Green's theorem in one dimension.'

Mr. J. W. YOUNG: 'On a certain group of isomorphisms.'

Dr. A. S. Gale: 'On the rank, order and class of algebraic minimum curves.'

Mr. W. H. Roever: 'Brilliant points and loci of brilliant points.'

At the close of the regular program Professor A. G. Webster gave a résumé of a paper, also read before the American Physical Society, on 'The Motion of a Spherical Pendulum,' illustrating it with photographs and stereopticon views.

The next meeting of the Society will be held on Saturday, April 26. The Chicago Section will meet at the University of Chicago on Saturday, March 29.

F. N. Cole,
Secretary.

MEETING OF THE NEBRASKA ACADEMY OF SCIENCE.

The twelfth annual meeting of the Nebraska Academy of Science was held the 24th and 25th of January, 1902, at the University of Nebraska, Lincoln, Nebraska.

The President's address, given by Professor E. W. Davis, was upon the subject, 'The Numerical Basis of Induction'; the remainder of the program being composed of the following papers:

'A Method of Instruction in Crystallography,' by Professor E. H. Barbour, in which he described an original method of instruction by the use of paper models to illustrate the extension of the faces; and plaster of Paris models, to allow of cutting in various planes, in which may be imbedded strings to show the position of the axes. He also showed apparatus for casting the latter.

'Preliminary Notice of a Bacterium Associated with Apple Rot,' by Mr. P. J. O'Gara, a review of experiments tending to show that rotting of apples is due to bacilli hitherto undescribed.

'Some New Properties of Conics,' by Dr. Carl C. Engberg, in which he illustrated some new facts bearing upon the transformation of well-known curves into other curves in accordance with certain assumed conditions.

'Report of Progress of the Nebraska Geological Survey': Professor E. H. Barbour.

'The Quadrat Method in Phytogeography,' by Dr. F. E. Clements, in which the author described the way in which this method was applied and gave some curious results of an attempt to estimate plant population under certain conditions.

'A New Bat Parasite,' by J. C. Crawford, Jr., being a description of a new genus and species belonging to the family Hippoboscidæ which has hitherto only been reported in North America from New Mexico.

'The Fossil Bryozoa of Nebraska,' by Professor G. E. Condra, in which he stated that the total number of species known for the State was 51, of which a score were hitherto undescribed.

'On a New Form of Psychrometer,' by Mr. John Fossler, in which he described a form of psychrometer in which the thermometers were rotated about a vertical plane with such a small radius that the apparatus could be used in a very limited space without at the same time any loss in accuracy.

'New Bird Lice from Nebraska': M. A. Carriker, Jr.

'Notes on North American Bees': J. C. Crawford, Jr.

'Nebraska Water Mites': Dr. R. H. Wolcott.

The last three papers were entirely systematic, containing descriptions of new species, together with records of occurrence, and in the case of the last paper also a table for the separation of species and such biological data as would present a complete view of what is known of the hydrachnid fauna of the State.

'Some Observations on the Buried Rock Surface of Eastern Michigan': Dr. C. H. Gordon.

'On the Use of Closed Aquaria in Schoolrooms,' by Professor Haven Metcalf, in which the author also gave hints on what could be grown, where and how to gather it and the best methods of cultivating the same.

'Some Remarkable Fossil Shark's Teeth from Nebraska,' by Professor E. H. Barbour and Carrie Barbour, in which the authors called attention to some teeth of *Campodus* and other sharks much more perfectly preserved than any hitherto found.

'The Strength of Nebraska-grown Catalpa and Osage Orange,' by Professor G. R. CHATBURN, a paper of considerable practical importance for the suggestions made as to the properties of the woods named for various economic purposes.

'Progress of the State Botanical Survey': Dr. ROSCOE POUND.

'The Present Knowledge of the Distribution of *Daimonelix*,' by Professor E. H. BARBOUR, detailing the great extension in range of this curious fossil which has resulted from the work of the State and national geological surveys, together with researches carried on by private individuals in Nebraska and adjoining States.

'Some Recent Changes in the Nomenclature of Nebraska Plants,' by Professor C. E. BESSEY, these changes being rendered necessary by the modifications of nomenclature introduced in recent botanical text-books.

'Relative Humidity in Dwelling Houses,' by Professor G. A. LOVELAND, giving the results of experiments upon the humidity of houses heated by various means, and the results of experiments with various expedients to increase the degree of moisture.

'A New Form of Sunshine Recorder,' by Professor G. D. SWEZEY, describing an instrument capable of registering not only the total amount and hours of sunshine during the day, but also varying intensity.

'Suggestions for a Revision of *Alysidium*': Dr. ROSCOE POUND.

'Preliminary Table of the Described Species of *Andrena*': Professor L. BRUNER.

'Some Observations on the Leeches of Nebraska': Professor HENRY B. WARD.

The last three papers were largely systematic.

'Plant Formations of Colorado': Dr. F. E. CLEMENTS.

'Some Experiments on the Paving Bricks of Nebraska': Mr. C. A. FISHER.

'Discovery of the Laramie Cretaceous in Nebraska,' by Mr. C. A. FISHER, in which he called attention to observations which extended the formation over the Wyoming line into Nebraska.

'Notice of certain fine Selenite Crystals from Cedar County, Nebraska': Professor G. E. CONDRA.

Forty-five members of the Academy were in attendance and an unusual amount of interest manifested. The secretary reported on the publication of Vol. VII. of the Proceedings, being a volume of 170 pages and 15 plates, which had recently come from the press, and also upon the plans for the immediate publication, as Vol. VIII., of the proceedings of the present meeting.

Forty-four new members were elected and the following officers decided upon for the ensuing year:

President, Professor J. H. Powers, Doane College, Crete; *Vice-President*, Professor H. B. Duncanson, State Normal, Peru; *Secretary*, Dr. R. H. Wolcott, State University, Lincoln; *Treasurer*, Professor G. A. Loveland, United States Weather Bureau, Lincoln; *Directors*, Mr. William Cleburne, Omaha; Dr. C. H. Gordon, Lincoln; Professor A. A. Tyler, Bellevue College, Bellevue; Dr. A. S. Von Mansfelde, Ashland.

The Academy passed resolutions commendatory of the United States Hydrographic Survey, and also resolutions endorsing the proposal to establish tree-planting reserves in Cherry County, Thomas County and in Grant and Arthur Counties in the sand-hill region of the State.

After the transaction of other minor business the Society adjourned for one year.

ROBT. H. WOLCOTT,
Secretary.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

AT the 547th meeting, held February 15, 1902, Dr. A. L. Day continued his paper begun at the previous meeting. He reviewed briefly the history of high temperature measurement from the Wedgewood clay pyrometer (1782) down to the most modern mechanical, electrical and optical methods. The interesting development of gas thermometry was treated in some detail; the remarkable early measurements of Prinsep, Pouillet and Becquerel with the more perfect gases and metallic bulbs; the hardly less remarkable, but unfortunate, experiments of Sainte-Claire Deville and Troost with iodine vapor in porcelain bulbs, which led pyrometric measurement in

the wrong direction for so many years; the extensive and nearly simultaneous researches of Dr. Barus in the Geological Survey and Holborn and Wien in the German Reichsanstalt; and finally the successful return to first principles at the Reichsanstalt, with the help of the electric oven and the experience of the long line of distinguished predecessors, in which the speaker himself had a part.

The various methods for carrying pyrometric measurements beyond the range of the gas thermometer by making direct comparisons with it as far as it is available, and extrapolating the empirical relation thus obtained, were then taken up; Violle's calorimetric method, by which he obtained the results generally accepted for twenty-five years or more; the electrical resistance method (Siemens, Callendar and others), depending upon the variation in the resistance of a platinum wire with the temperature; the thermoelectric method (Barus, Holborn and Wien, and others), depending upon the electromotive force developed in a pair of wires (*pt* 90 *rh* 10—*pt* 10 usually) whose junctions are maintained at different temperatures; and several others. In closing, some recently published optical methods were reviewed (Berthelot, Lummer, Holborn and Kurlbaum) which promise to extend the upper limit of measurable temperatures almost indefinitely though with what accuracy, in view of the extent of the extrapolation necessary, it is hardly possible yet to say.

Dr. Day gave as the approximate limit of accuracy of the best methods now available $\pm 1°$ up to $1000°$, $\pm 10°$ to perhaps $1600°$, $\pm 100°$ to $3000°$ or more. He did not consider that the limit had been reached either in the accuracy or range of pyrometric measurement or even of gas thermometry and expressed regret that no more attention was being paid to so promising a field in this country.

Dr. L. A. Bauer presented a paper on 'Energy and Entropy: Their Rôle in Thermodynamics and Thermochemistry.' As suggested by the title, the respective rôles played by the two fundamental principles of thermodynamics, the principle of the conservation of energy and the principle of the increase of entropy, were set forth and elucidated by examples. It was shown that as much is known about the physical properties of entropy as of energy, and that in the phenomena of heat the entropy principle first comes into play, prescribing the direction or method in which stable equilibrium can take place. After the state of equilibrium has been reached then the principle of energy can be applied. It was shown that it would be a gain, now that the entropy function has been found, to discard the historical method of establishing the entropy principle and instead adopt a method similar to that followed by Hertz with regard to the fundamental equations of electromagnetism—*i. e.*, begin with an equation expressing a relation between the specific heats at constant pressure and at constant volume which admits of experimental proof and which prescribes that the entropy function has the same essential property as energy, viz., of being independent of the path or process used in going from one state to another.

A relationship between entropy and the term introduced by Helmholtz—*wärmegehalt*, changed by von Bezold to *potential temperature* and used by him extensively in his paper on the 'thermodynamics of the atmosphere,' was established and the name *entropic* temperature in place of *potential* temperature suggested.

CHARLES K. WEAD,
Secretary.

DISCUSSION AND CORRESPONDENCE.

AGRICULTURE AND THE EXPERIMENT STATIONS.

THE agricultural experiment stations of the United States, which the Federal Government has established in the several States, have now themselves passed the experimental stage and have to a remarkable degree won the respect and confidence of the farming and allied interests which it is their function to serve. There are at present fifty-nine experiment stations more or less completely maintained by Federal funds, two of which are colonial, and one of which is in Alaska. The organization and location of the continental stations affords an interesting example of the effect of the application of political conceptions to scientific investigation.