Tuesday afternoon (April 20), Lime Sulphur, Its Use and Manufacture. Evening, The Manufacture of Miscible Oils and Arsenical Insecticides.

Wednesday morning (April 21), The European Elm Scale, and the Codling Moth. Afternoon, The Orange Scale and the Citrus Mealy Bug. Evening, Exhibits of Insecticide Materials, Insect Collections, Apparatus illustrating Methods of Study, etc.

Thursday morning (April 22), Visit to Oakland Formicary. Afternoon, Forest Insects and Apiculture. Evening, Medical Entomology.

Friday morning (April 23), Methods Used in the Study of Sensory Reactions, Insect Photography. Afternoon, permanent organization.

The meeting was well attended, notwithstanding the enormous distances separating the workers on the Pacific coast. As had been hoped at the outset, a permanent organization was effected under the name Pacific Slope Association of Economic Entomologists. The constitution adopted requires that active membership shall be limited to the official and professional entomologists of the Pacific slope, while associate membership shall be open to agriculturists and to all others interested in the objects of this association. The following officers were elected:

President—Professor C. W. Woodworth, University of California, Berkeley, Cal.

Vice-presidents (representing each state concerned)—Professor R. W. Doane, Palo Alto, Cal.; Professor S. B. Doten, Reno, Nevada; Professor J. Elliott Coit, Phœnix, Arizona; Professor Fabian Garcia, P. O. Agricultural College, New Mexico; Professor E. D. Ball, Logan, Utah; Professor A. B. Cordley, Corvallis, Oregon; Professor A. L. Melander, Pullman, Washington; Professor L. F. Henderson, Moscow, Idaho; Professor C. P. Gillette, Fort Collins, Colorado; Professor R. A. Cooley, Bozeman, Montana; Professor Aven Nelson, Laramie, Wyoming; Hon. Thos. Cunningham, Vancouver, B. C.

Executive Committee—Mr. R. R. Rogers, San Francisco, Cal.; Mr. H. P. Stabler, Yuba City, Cal.; Mr. L. H. Day, Oakland, Cal.

Secretary-Treasurer—Professor W. B. Herms, University of California, Berkeley, Cal.

It is planned to hold the next meeting this summer at Portland, Oregon.

W. B. HERMS,
Secretary-Treasurer

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

THE 667th meeting was held on May 22, 1909, Vice-president Wead in the chair. Mr. Edwin Smith read a biographical sketch of Mr. William Eimbeck. Two papers were read.

Investigation of Dip Needle Corrections by Experimental Methods: P. H. DIKE, of the Carnegie Institution of Washington.

The values of the inclination, or dip of the magnetic needle, as observed by the absolute method with the dip circle, in general still require some correction, and the error is not eliminated by multiplying observations as the correction is a constant one for a given station. The correction is found to vary with the dip and the total force, and it is accordingly necessary to take account of this variation in the reduction of the observations made by the various expeditions of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington covering a large range of the magnetic elements. In the *Galilee* work on the Pacific Ocean dip circles were compared with observatory instruments over as wide a range of dip as possible ($+74°$ to $-68°$), and from the corrections thus obtained empirical formulæ were established by least square methods from which the probable corrections for intermediate values of dip were derived.

The purpose of the present investigation is to derive these corrections by comparison with a single standard instrument (an earth inductor) at one station and through the whole range of positive and negative dip. An artificial field is produced by a system of coils, through which a uniform current from a storage battery flows. Two coaxial coils of 80 cm. radius are mounted with axis vertical, 80 cm. apart, each coil having 100 turns of wire. A second pair 90 cm. in radius and 90 cm. apart are mounted with axis horizontal, the middle points of the axes of the two pairs of coils coinciding. The second pair has 50 turns each of wire. By regulating the currents in the two sets of coils any desired magnetic field can be produced at the center, and this field is extremely uniform over a considerable area. Two systems of coils are set up about 50 feet apart, the horizontal coils of one being in series with those of the other, and the vertical coils likewise in series with each other. Simultaneous observations with earth inductor and dip circle are made

at every 20° of dip from + 80° to — 80°, with interchange of instruments on each dip, to eliminate station difference. Curves were shown representing the corrections thus determined for the four needles of a Dover land dip circle recently purchased, which is found to be an exceptionally good one. The corrections range from + 0′.5 to — 2′.8. The similarity of the curves for the four needles suggests that part of the error is inherent in the dip circle rather than in the needles. The station difference showed a regular variation with the dip, following approximately a sine curve. Possible variations in method and sources of error were discussed.

Ship dip circles in general exhibit a considerably larger variation in the correction with varying dip and force than the land instruments.

The Carnegie Institution Marine Collimating Compass: J. A. Fleming, of the Carnegie Institution of Washington.

The experience gained on board the Magnetic Survey yacht *Galilee* indicated the necessity for developing an instrument of greater precision for determining magnetic declination at sea. The instrument exhibited was devised by Mr. W. J. Peters, who is in charge of the ocean magnetic survey work of the institution.

The compass is of the liquid type. Four spherical mirrors are attached to the buoyant air chamber at intervals of ninety degrees, their optical centers being in the horizontal plane through the point of suspension. In the focus of each mirror there is a scale of thin, blackened German-silver wire. The optical arrangements are such that homocentric rays from the scales are reflected through the dilute alcohol in which the compass is mounted and issue as parallel rays into the air through windows exhibiting the scales each as seven luminous points one degree apart. The windows are segments of spherical shells, the centers of which are at the point of suspension so that the optical conditions are not altered by the rocking of the bowl and other motions at sea. The bowl swings in a perforated gimbal ring supported in a spindle-bearing cylinder with graduated base, thus making it possible to quickly orientate the optical systems. The usual form of binnacle stand with suitable alterations is used.

The method of observation calls for the measurement of the angle, a, between the collimator and a celestial body of known altitude, h. As the angle, c, between the zenith and the collimator is ninety degrees, the fundamental formula takes the form $\cos A = \cos a \cdot \sec h$ where A is the magnetic azimuth of the celestial body. (For small values of A more accurate results may be obtained by use of formula involving the tangents of half the sum and difference of a and h.) Errors in c due to rocking may be eliminated by suitable arrangement of a series of observations. Lack of perfect adjustment of collimator producing error in c of dc which may be easily measured and the resulting error in A corrected by $dA = -\cot B \cdot dc$, where B is the angle between the vertical plane and the great circle passing through the collimator and the celestial body. Owing to the trigonometrical relations involved, the conditions are not good for values of a less than 45° or more than 135° for the usual upper limit of altitude of 15°; it is for this reason that four collimators are used, as then suitable selection may be made.

A special instrument for measuring the angle a has been constructed, although the usual form of pocket sextant may be used for this purpose. This instrument, which may be called a circle of reflection, makes use of the law that the incident and reflected rays lie in the same plane normal to the mirror surface; the construction is such that the angular motion of the mirror is equal to the angle measured.

The advantages are: motion is practically restricted to the oscillation of the magnets; the celestial body observed upon and compass scale are seen simultaneously and all the observed quantities refer to the instant of observation; there are no movable parts subject to wear; graduation errors are limited to twenty-eight divisions, a number so small that each may be separately examined; error of eccentricity affects only the distance between mirror and corresponding window, hence the focal distance and consequently the scale values, but does not alter the constant for the middle of each scale. By the attachment of a suitable standard centrally to the bottom of the bowl horizontal intensity determinations by the method of deflections introduced by Dr. L. A. Bauer can be made and from the same measures accurate values of declinations may be derived.

The instrument is not intended for navigational purposes, but it is hoped that it may give much greater precision in the determination of declination at sea for use in the more careful study of the laws governing the distribution of magnetism over the globe.

R. L. Faris,
Secretary