confines his descriptions to that form with the exception of a particular quadrant already referred to.

The fourth chapter treats of the methods which can be used most advantageously for determining time, latitude, longitude and azimuth.

The appendix, which, as already stated, gives attention to geographic determinations in the air, contains also a description with illustrative examples, of methods for determining time, latitude and azimuth without the use of graduated circles, methods for the application of which only a watch and a spool of thread are necessary auxiliaries.

The reader will be attracted by the beautiful typography and the excellence of the illustrations which enhance the value of the book.

O. H. T.

SCIENTIFIC JOURNALS AND ARTICLES.

The opening (October) number of volume 12 of the *Bulletin of the American Mathematical Society* contains the following articles: 'The Elementary Treatment of Conics by Means of the Regulus,' by Charlotte Angas Scott; 'Arzela's Condition for the Continuity of a Function Defined by a Series of Continuous Functions,' by E. J. Townsend; 'Galois Field Tables for $p^n \leqq 169$,' by W. H. Bussey; Notes; New Publications.

The November number of the *Bulletin* contains: 'Report of the Twelfth Summer Meeting of the American Mathematical Society,' by F. N. Cole; 'A Set of Generators for Ternary Linear Groups,' by Ida May Schottenfels; 'Note on the Structure of Hypercomplex Number Systems,' by Saul Epsteen; 'A Geometric Property of the Trajectories of Dynamics,' by Edward Kasner; 'On the Possible Numbers of Operators of Order 2 in a Group of Order 2^m,' by G. A. Miller; 'On the Arithmetic Nature of the Coefficients in Groups of Finite Monomial Linear Substitutions,' by W. A. Manning; 'A Modern Calculus of Variations' (Review of Bolza's Lectures on the Calculus of Variations), by E. R. Hedrick; 'Two Books on Analytic Geometry' (Review of Smith and Gale's Elements of Analytic Geometry and Introduction to Analytic Geometry), by O. D. Kellogg; Notes; New Publications.

The American Naturalist for September contains the following articles: 'Interrelationships of the Sporozoa,' by Howard Crawley, which opens with an excellent statement of the lines along which these animals have developed, and concludes that the term sporozoa should be used as a temporary and convenient cloak to cover certain protozoa. A 'Contribution to Our Knowledge of the Myxinoids,' by Julia Worthington, contains a large amount of interesting information, based on the Californian *Bdellostoma dombeyi,* concerning these little-known 'fishes.' F. C. Baker contributes 'Notes on the Genitalia of *Lymnea.*'

Bird Lore for September–October has three excellent illustrated papers, telling how to attract and preserve the winter birds. 'Our Avian Creditors,' by Ernest H. Baynes; 'The Winter Feeding of Birds,' by Mabel Osgood Wright, and 'How to Attract the Winter Birds,' by Edward H. Forbush. W. W. Cooke presents the twelfth paper on 'The Migration of Warblers' and there are 'Notes on Winter Feeding' by a number of contributors. Under the Audubon Societies is an appeal for funds for the widow of Game Warden Bradley and for the prosecution of his murderer, which it is hoped may meet with a ready response.

The Museums Journal of Great Britain has a frontispiece and brief article on the Central Section of the Museum of the Brooklyn Institute and an account of 'A Papier-maché Model of the Monk-fish.' The appointment of A. B. Skinner as director of the Albert and Victoria Museum is announced, he taking the place vacated by Sir C. Purdon Clarke. Mr. George Murray has resigned his position of keeper of the department of botany in the British Museum, a place he has held for the last ten years.

Three good papers appear as separates from the report of the Commissioner of Fisheries for 1903–1904: 'A Revision of the Cave Fishes of North America,' by Ulysses O. Cox; 'The Life History of the Blue Crab,' by W. P. Hay, and 'The Crab Industry of Maryland,' by Winthrop A. Roberts.

THE Report of the Manchester Museum for 1904–1905 notes a deficiency in the finances of about $1,000, but causes one to wonder how so much good work as is accomplished by this institution can be done on an income of less than $15,000.

DISCUSSION AND CORRESPONDENCE.

CONTRIBUTIONS TO OUR KNOWLEDGE OF THE AERATION OF SOILS.

UNDER the above title Dr. Edgar Buckingham presents the results of a series of investigations relating to an important subject, in Bulletin No. 25 of the Bureau of Soils. As a practical problem in soil management the securing of those conditions which will insure a deep and ample ventilation is extremely needful; and hence any essential advance in our knowledge of the principles governing soil aeration is important. In the letter of submittal it is stated:

This paper presents for the first time definite information regarding the rate at which a gas escapes by diffusion from the soil into the atmosphere, or *vice versa*. It shows that the rate of diffusion varies approximately as the square of the porosity of the soil, and that this diffusion follows the laws for the free diffusion of gases. It thus becomes possible to calculate the rate of aeration in any particular soil from results obtained in experiments on free diffusion. Tables are given showing the rate of escape (and consequently, for a condition of equilibrium, the rate of formation as well) of carbon dioxide in the soil when the porosity of the soil and the concentration of the carbon dioxide at any given depth are known. The paper shows further that the aeration of soils is almost entirely due to diffusion phenomena changes in barometric pressure having very little influence in comparison.

The author in his 'Concluding Remarks' says:

1. We have measured the rate of flow of air under pressure by transpiration and of air and carbonic acid by diffusion, through four widely different soils, in varying states of structure, compactness and moisture content.

2. We have shown that the speed of diffusion of air and carbonic acid through these soils was not greatly dependent upon texture and structure, but was determined in the main by the porosity of the soil.

3. We have shown that the rate of diffusion was approximately proportional to the square of the porosity.

4. We have shown that when this relation is used to compute from our results the rate of free diffusion when no soil is present, it gives a result which is entirely consistent with what is already known from the work of other experimenters on the free diffusion of gases.

5. We have shown that when the porosity of a soil is reduced by compacting it, the ease with which air flows through it under the driving influence of a difference of pressure is greatly reduced, varying as the sixth or seventh power of the porosity.

6. We have investigated the depths to which free outside air might penetrate soils to different depths, under such barometric variations as are to be expected in average cases, if the outside air remained distinct from the soil air.

7. We have shown how to compute the rate of escape of carbonic acid from the soil by diffusion under given conditions of pressure, temperature, porosity and concentration of carbonic acid.

8. We have compared the linear velocities of diffusion and barometric transpiration, and hence—

9. We have shown that the escape of carbonic acid from the soil and its replacement by oxygen take place by diffusion and are determined by the conditions which affect diffusion, and are sensibly independent of the variations of the outside barometric pressure.

The foregoing remarks and conclusions are based on the mathematical treatment of a very limited series of laboratory experiments, which, however, have been executed with great care. The subject is one so complex and intricate that it can not be solved by so short and direct a cut and it is a matter for exceeding regret that this piece of work, admirable in itself so far as it goes, should be given out by the Department of Agriculture with so much of assurance of finality for its conclusions before they have been checked by even a single field observation or experiment. Almost infinite injury is done to the cause of agricultural science and to the growth of the Department of Agriculture along sound and enduring lines by prematurely exploiting results of investigation, striving to get them before the public eye of practical men—congressmen, farmers, merchants and manufacturers—but