now in the Peabody Museum of Harvard University and was collected by Messrs. Kidder and Guernsey. Also, in the Colorado State Historical Museum, are found specimens recovered by Dr. Paul S. Martin. The writer has been privileged to study these collections and finds numerous specimens of *C. moschata* and *C. pepo*. In the instance of the Peabody collection, some of the specimens are quite ancient. According to Kidder they are from the Basket Makers, a culture antedating the Cliff Dwellers, and are regarded by him as belonging to the period 1500 to 2000 B. C.

Interesting material of a similar character has come to light in the explorations made by Mr. Neil M. Judd under the direction of the National Geographic Society at Pueblo Bonito, New Mexico. In this material fragments of stems and seeds are found which are identified by Dr. C. V. Coville as *C. pepo* and *C. moschata*.

From the Everglades of Florida Dr. John K. Small has collected a plant of unknown origin which is running wild and is known as the Seminole Indian pumpkin, a variety of *C. moschata*.

In the Guadalupe Valley of southern Texas occurs a cucurbit closely related to *C. pepo* which appears to be indigenous. L. H. Bailey collected specimens in its natural habitat which he identifies as *C. texana*.

The fact that *C. pepo* and *C. moschata* are indigenous to North America seems clearly established. The nativity of the third species, *C. maxima*, the squashes, is still in the dark, and we are in hopes that the archeologists may in time be able to throw light upon this subject also.

A. T. ERWIN

IOWA STATE COLLEGE

STARLINGS IN OKLAHOMA

THAT the starling this winter invaded the state of Oklahoma may be of interest to some ornithologists and zoologists. The starlings have not been reported before this year for this state, but appeared in considerable numbers in Tulsa County in December, 1929, as reported by Miss Edith Force, of the Tulsa city schools. The birds appeared on the campus of the University of Tulsa at different times during the three weeks of cold weather beginning January 10. During this period, there was a snowfall of about twenty inches, and the thermometer reached the zero mark at different times. On the night of January 13, amidst a storm of snow and sleet, a starling flew through an open window of one of the dormitories where it was caught and identified the next morning. Dr. R. D. Bird, of the department of zoology, Oklahoma University, says that starlings appeared on the state university grounds and in the vicinity of Norman, Oklahoma, at the same time they were seen at Tulsa in January. The starlings left the above-mentioned communities when the cold weather broke up, during the first week in February, and so far as the writer knows, no one has observed them in this locality since.

H. D. CHASE

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SCIENTIFIC BOOKS

Operational Circuit Analysis. By VANNEVAR BUSH, Eng.D., professor of electric power transmission, Massachusetts Institute of Technology. With an appendix by Norbert Wiener, Ph.D., assistant professor of mathematics, Massachusetts Institute of Technology. John Wiley and Sons, Inc., New York; Chapman and Hall, Ltd., London, 1929.

IT is now nearly fifty years since Heaviside introduced the shorthand operational methods associated with his name for the solution of circuit problems arising in telegraph and telephone engineering. The adoption of these methods by engineers has been relatively slow. This has been due partly to a lack of a compact, orderly exposition of the methods and partly to a natural aversion to the intellectual labor of mastering a novel discipline which appeared to offer a less rigorous alternative to classical methods which had to be mastered in any case as a preliminary to the understanding of the new tools. Those who were only occasionally faced with such problems could scarcely be expected to make an attempt at such a mastery.

The great expansion of the field of communication engineering in the last twenty-five years and the applicability of its results to other fields (notably acoustics) have, however, forced an intensive development of the mathematical tools available, in which increasing attention has been paid to the Heaviside methods so that a considerable literature now exists. The present work is, however, the first attempt to embody the subject in text-book form.

Professor Bush is to be congratulated on the success with which he has performed his task. The superposition theorem, the integral theorem and the expansion theorem are developed in a manner to bring out clearly their interrelations and their relative contribution to the direct operational procedure. The fundamental grounding of the Heaviside methods in the Fourier analysis and their relation to the

theory of functions of a complex variable are adequately treated. The style in which the book is written is simple, direct and not lacking in a wit entirely appropriate to a disciple of his master, though free from the bitterness and even malice that so often characterizes the latter's amusing outbursts.

A considerable number of interesting and suggestive problems conclude each chapter, and a valuable table of operational formulas is given as an appendix. Professor Bush's colleague, Professor Wiener, has contributed a brief but valuable appendix on Fourier analysis and asymptotic series. The bibliographical references are ample, and the text seems to be reasonably free from typographical errors.

It is to be hoped that in future editions the important subject-matter of Chapter XV, "Networks with Variable Parameters," may be treated at greater length. The problems arising under this heading are at the same time of the greatest importance and offer the most formidable difficulties. In particular, it would seem desirable to add some account of the "perturbation" methods of approximate solution, which Van der Pol has shown how to adapt from astronomical to vacuum tube circuit problems.

<div align="right">LYNDE P. WHEELER</div>

NAVAL RESEARCH LABORATORY

The Economics of Forestry. By W. E. HILEY, M.A., Oxford. Clarendon Press, 1930. Price 21/-.

NEW ground has been broken by the publication on March 20 of a book on "The Economics of Forestry," by Mr. W. E. Hiley, M.A., of the School of Forestry, Oxford. Mr. Hiley is well known in forestry circles not only in Great Britain but also in America and throughout the British Empire by reason of his publications on forestry subjects, one of the most important of which is his book on "The Fungal Diseases of the Common Larch." After the publication of this work he decided to give up the mycological side of forestry, being attracted by the possibilities of the practically unknown field of forest economics, and he started a course of lectures on this subject in the Oxford Forestry School. From this has developed the matter which has been so carefully and lucidly elaborated in the pages of this book, in which the theory of forest economics is applied to the practice of forestry in a more definite manner than has hitherto been done.

Whether the object of forestry should be to obtain the best financial returns has often been questioned; other objects, such as the fixation of mountain slopes and sand dunes, the regularization of the water flow and protection from wind, must always be kept in mind by the forest officer. But apart from these aspects of the subject, the prospect of obtaining satisfactory profits is a very important incentive to private afforestation; in state forestry, also, it is desirable that for every dollar spent the greatest possible value of timber should be produced in the shortest possible time. Thus, in fact, forest economics must be the determining factor in state, as well as private, forestry.

Owing to the long period of production in forestry, calculations have to be made with compound interest, and various methods have been used for estimating profitableness. Mr. Hiley particularly favors two methods: that of determining the "financial yield," which is the rate of compound interest earned on a plantation or forest on the money invested in it; and the method of "cost of production per cubic foot" calculated by allowing some fixed rate of interest on capital. With either method the costs of all operations and the value of intermediate returns are taken into account.

He has applied these methods to all British-grown species for which data are available, and has shown that, whereas Scots pine (*Pinus sylvestris*), for instance, is very expensive to grow and can yield only a low rate of interest on capital, Douglas fir (*Pseudotsuga taxifolia*) and Sitka spruce (*Picea sitchensis*) are very cheap to grow and may yield a comparatively high rate of interest. Since Scots pine is a very easy tree to cultivate and grows on cheap land, such a result is not at first obvious; the high cost of production is due to the slow rate of growth and the long rotation.

It is also shown that timber can be grown much more cheaply on good land than bad even when high prices have to be paid for good land. Heavy thinning is generally more profitable than light thinning, and wide planting than close planting. Also small sizes of timber are so much cheaper to grow than large sizes that, as virgin timber becomes scarcer, there will be very strong inducements towards the use of laminated wood and other artificial forms of large timber.

Thus far the book follows the course which we should expect the study of forest economics to follow in Britain, where reafforestation is the order of the day and a large amount of capital is being invested in making future forests. But in America, too, now that more and more attention is being paid to the reafforestation of denuded lands, it is becoming imperative that the relative economic attractiveness of various tree species and methods of management should be studied in detail. For the particular conditions covered by Hanzlik's data the author has calculated the most favorable rotation for growing Oregon pine ("Douglas fir") in the western states.