of "first seens" recorded averaged 120, but these were so bunched that 61 of them were recorded on 9 days. Three-fifths of all the arrivals came in the last 30 days of the season. The lack of uniformity in distribution became still clearer when only the arrivals of the last 30 days were considered. Indeed, in the years 1909-1916, half of all these arrivals were recorded on 2 days. One-half of all the arrivals of the last 30 days of the 14 seasons together were recorded on 63 days. A study of the weather maps for these 63 days showed that on 54 of these days there were approaching areas of low pressure, with south winds during the preceding night. On 5 other days there had been southerly winds either at Urbana or further south in the state. On 1 only of the 63 days was there a rather light northerly wind.

It seems fair to conclude that the near approach of a low from the west with the accompanying rise in temperature and southerly winds favors the northward migration of birds.—*Eleanor S. Brooks.*

WEATHER AND THE FADING RADIO SIGNALS *

The first report of the Bureau of Standards on its work with the American Radio Relay League was published in *QST*, the official organ of that body. The ARRL, the naval radio station at Anacostia, D. C., 17 transmitting stations and 243 receiving stations co-operated with the Bureau to determine if possible the cause for the fading of radio signals.

One theory takes into account the presence of the "Heaviside" surface in the atmosphere above the earth.

The boundary of the Heaviside surface is not considered as absolutely horizontal, but as changing from time to time. The permanently ionized region above the Heaviside surface is the region of permanent aurora, and is so good a conductor that waves cannot penetrate it. Any waves reaching it can only slide along it, just as waves slide along the even less perfectly conducting surface of the earth.

In daylight transmission, the waves cannot reach the Heaviside surface because of the intervening ionized stratosphere, and hence only those waves which travel along the earth's surface are useful during the daytime. In traveling along the earth's surface the waves are diminished in intensity by absorption of their energy in the earth. At night, on the other hand, the waves may reach the Heaviside surface, and slide along it without appreciable absorption.

Because of the variable absorption which may be introduced by the irregularities of the Heaviside surface and the adjoining regions the waves may vary rapidly in intensity. Small irregularities would affect short waves more than long waves.—*A. W. P.*

THE MEASUREMENT OF TIME

Time and Timekeepers, including the History, Construction, Care, and Accuracy of Clocks and Watches. By Willis I. Milham. New York, The Macmillan Company, 1923. Pp. xix, 609; 339 illustrations. Price $6.00.

The author of this volume is well known to students of Meteorology by virtue of his excellent textbook on the subject. While the interest of the meteorologist *as such* in Professor Milham's latest book will perhaps be largely indirect, he will find it none the less absorbing on this account: For probably nothing so profoundly controls the activities of

* Extract from "QST" for August and September, 1923.

each and every individual, and possesses such a common interest for everybody, as Time. The meteorologist may reflect, too, that all accurate time comes from the stars, and that astronomical observations are dependent (like nearly everything else) upon the weather; while it is to the meteorologist that the practical astronomer (who is likely to look upon the atmosphere as a necessary evil) must turn for much of the information that he needs in order to correct his observations for atmospheric effects. Then, in addition, precision timekeepers must be elaborately protected against the vagaries of the meteorological elements.

Our sense of time is among the most fundamental of the concepts which arise in the mind as a result of Experience. There are many aspects of the subject: The abstract philosophical problems concerning the origin of the concept of duration and the nature of time baffle the metaphysician; the accurate determination of time and time-intervals taxes to the utmost the skill of the practical astronomer and the experimental physicist; the problems of Chronology afford abundant exercise for the historian, the archaeologist, and the mathematician; and the design, construction, and care of precision instruments to measure time challenge the dexterity of man. The metaphysical treatment of time, for which we must turn to the works of the great philosophers, is not revelant to Natural Science as such, and makes little appeal to the average scientist. Such philosophical discussion of time as is necessary to physical science, and essential to that understanding of the nature and foundations of his subject which every physicist should have, is to be found in the admirable works of Poincaré (*Foundations of Science*, Science Press, 1913), Pearson (*Grammar of Science*, 3 ed., London, 1911), and Hobson (*Domain of Natural Science*, Cambridge Press, 1923), while the role which time plays in physical theories will be found set forth in discussions of the Theory of Relativity. The book under review has a brief introductory chapter on the different kinds of time (sidereal, true solar, mean solar, and standard), their determination and interrelations, and distribution by telegraph and wireless, but for an exhaustive treatment of this phase of the subject reference must be had to works on Spherical and Practical Astronomy, of which a list is given by the author. The great works on Chronology are those of Nilsson (*Primitive Time-Reckoning*, Skrifter Utgivna av Humanistiska Vetenskapssamfundet i Lund, I, London, 1920), and Ginzel (*Handbuch der mathematischen und technischen Chronologie*, 3 vols., Leipzig, 1906-1914). Finally, Professor Milham's book supplies an adequate treatment of Horology.

The book is intended for the general reader who is interested (and who is there who is not?) in time and timekeepers. It attempts, without being superficial, and without assuming any previous knowledge of technicalities, to cover the whole field of the measurement of time, and the history, construction, care, and accuracy of all varieties of time-indicators and timekeepers; and an extensive classified bibliography (an extremely desirable, and too often lacking, feature of such a book) of 500 titles is provided for him who desires further information on any particular topic. In the preparation of the work, the author searched the literature of the subject, inspected museum and private collections

of timekeepers in America and abroad, visited factories, and spent many hours with watch and clock repair men; the result is a most fascinating and valuable volume, clearly and interestingly written, and handsomely printed and illustrated, containing a wealth of useful and entertaining information.

The author takes up the history of the sun-dial, clepsydra, and other early timekeepers; follows this by the early history of clocks (which had certainly not made their appearance in 960 A. D.) up to 1360, the date of the first indubitable mechanical clock in the modern sense of the word, of which we have a complete and authentic description; and continues with the construction and further history of clocks and their individual parts, the construction and history of clock-watches and watches and their individual parts and numerous attachments, the care, repair, and accuracy of clocks and watches, and the history, construction, care, and accuracy of chronometers, tower clocks, electric clocks, and precision clocks; concluding with a history of clockmaking and watchmaking in America, a consideration of some modern European watchmakers, and a chapter on some individual clocks and watches that for one reason or another have become famous. An Appendix gives a chronological list of important names and events in the history of timekeepers, a glossary of technical terms, and a list of museum and private collections.—*Edgar W. Woolard.*

BRITISH ASSOCIATION MEETING

Toronto, August 6-13, 1924

The following circular was recently received by the Secretary:

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Burlington House,
London, W. 1.
February, 1924.

Sir (or Madam):

The Annual Meeting of the British Association for the Advancement of Science will take place this year in Toronto, from August 6 to 13 inclusive, under the Presidency of Major-General Sir David Bruce, K.C.B., F.R.S. The meeting will be attended by leading scientific men and women from Great Britain and elsewhere, and there is a general and intense desire on their part that the occasion should afford opportunity for personal contact with their colleagues in science in North America. In course of the work of Organising Committees of the various sections, both at home and in Toronto, your name has been mentioned as one whose presence is specially desired. Particulars of the arrangements for the meeting and for excursions in Canada after it, conditions of membership, and so forth, should reach you in due course; meanwhile we beg leave to express our most cordial wish that the meeting may be favoured by your presence, and hope for an early and favourable reply.

We are, Sir (or Madam),
Your obedient servants,

J. L. MYRES, F. E. SMITH } *General Secretaries.*
O. J. R. HOWARTH, *Secretary.*

It is hoped that many members of the American Meteorological Society will attend this meeting.—*C. F. B.*