Several interesting remarks, due to Dr. Gill, occur in the book. The method of carrying chronometers (much affected by navy quartermasters) by means of a strap passed through the handles and over the top, is condemned. Indeed, it is possible to stop a chronometer, temporarily, when so carried, by a peculiar twist of the arm. Dr. Gill recommends holding the chronometer with both hands in front of the body, the elbows being pressed against the sides. The spring of the arms is then a great safeguard.

In another place, having called attention to the very high accuracy attained by Commander Pullen after comparatively little practice, Dr. Gill refers to an interesting remark of Professor Winnecke's to the effect that "the best training for an astronomical observer is a long course of *accurate work* on land with the sextant."

The ordinary method of circummeridian altitudes was used in measuring the latitudes of the stations. Stars were observed both North and South of the zenith, and certain systematic differences in the resulting latitudes are explained as the result of a looseness of the web-frame in the tube. The experience gained is summarized (p. 48) for the benefit of future observers with the portable altazimuth, and any one would do well to consult Dr. Gill's remarks before beginning work with this somewhat difficult instrument.

The positions of the various astronomical stations are carefully described, and the bearings of many surrounding permanent objects are set down. The places of the stars used are almost all taken from the Ephemerides and the Cape Catalogue. The volume concludes with several appendices containing various details and examples of observations and reductions.

HAROLD JACOBY.

COLUMBIA COLLEGE, New York; 1891, *September*.

SOUTH AMERICAN LONGITUDES.

Telegraphic Determination of Longitudes in Mexico, Central America, the West Indies, and on the North Coast of South America, with the Latitudes of the Several Stations. By Lieutenants J. A. NORRIS and CHARLES LAIRD, U. S. N., published by order of Commodore F. M. RAMSAY, U. S. N., Chief of Bureau of Navigation, Navy Department. Washington, Government Printing Office, 1891; pp. 189.

THE above volume contains the results of longitude determinations executed by order of the U. S. Navy Department

in the years 1888, 1889, and 1890. As will be seen from the title, the observations have been made in very unfavorable locations, so far as the comfort and health of the observers were concerned. It is therefore an evidence of great endurance and skill that so much was accomplished during the short time many of the stations were occupied. We read how one of the observing parties was compelled to proceed with its entire observing equipment, including instruments, a hundred miles in canoes up the Coatzacoalcos River, poling against the current. And afterwards another hundred miles by mule-train through the "tangled intricacies of a tropical forest." This trip took fourteen days.

But we must here occupy ourselves chiefly with the methods and results of the expedition, from a scientific point of view. Eleven longitude stations were occupied altogether, and the careful way in which the observation spots have been described, and referred by exact measurements to local permanent landmarks, is very much to be commended (pp. 16–19). When possible, the sites occupied by previous observers were again used. The instruments employed were two prismatic transits made in 1874, by Stackpole of New York, for the Transit of Venus Commission. Six break-circuit chronometers and two chronographs were used. The values of the instrumental constants were very carefully determined in the field, and afterwards verified at Washington. Whenever it was found possible the exchange of longitude signals was made automatically, the distant observer's clock recording on the local chronograph. When this could not be done, in consequence of the weak current through long cable lines, a mirror galvanometer was used at each end. This was found to work quite satisfactorily. The mirror galvanometers were set up in the cable offices, and the sending and receiving times of the signals were recorded chronographically by the observer at each end of the line. For this purpose wires were run from the cable offices to the observing huts or tents, which were usually quite close.

No allowance was made for personal equation, as circumstances would not allow of any adequate determination of that quantity. In the reductions, the method of least squares was used throughout the longitude work. The observations were first preliminarily reduced, and normal equations were then formed for the determination of the minute corrections required by the preliminary values of the instrumental constants. The polar stars were weighted for declination, but it is not stated what formula was used in assigning the weights. The adopted clock-corrections, however, are *not* those derived from the least square solution, but the means of the results from the separate time-stars, the latter being

again reduced with the azimuth and collimation constants derived from the least square adjustment. The polar stars were excluded in this last process. The adopted values of the clock correction, however, are always very nearly equal to those obtained from the least square reduction, the greatest difference being $0^s.035$. (Vera Cruz, 1889, January 17; p. 69.)

The latitude work was all done by Talcott's method, the star-places being derived from the *American Ephemeris*, the *Jahrbuch*, and the Catalogues of Newcomb, Safford, the Coast Survey, and Greenwich Observatory.

The volume contains excellent maps showing the surroundings of the various astronomical stations, and closes with an appendix giving the results of the many valuable magnetic observations made by the members of the Expedition.

HAROLD JACOBY.

COLUMBIA COLLEGE, New York; 1891, *September*.

NOTES.

THE officers of Section A at the Washington Meeting of the American Association for the Advancement of Science were: Vice-President, E. W. Hyde of Cincinnati; Secretary, F. H. Bigelow of Washington. The following papers were read: The evolution of algebra, by E. W. Hyde; On a digest of the literature of the mathemathical sciences, by Alex. S. Christie; Latitude of the Sayre Observatory, by C. L. Doolittle; The secular variation of terrestrial latitudes, by George C. Comstock; Groups of stars, binary and multiple, by G. W. Holley; Description of the great spectroscope and spectrograph constructed for the Halsted Observatory, Princeton, N. J., and Note on some recent photographs of the reversal of the hydrogen lines of solar prominences, by J. A. Brashear; Standardizing photographic films without the use of a standard light, by Frank H. Bigelow; On a modified form of zenith telescope for determining standard declinations, and On the application of the "photochronograph" to the automatic record of stellar occultations, particularly dark-limb emersions, by David P. Todd; Principles of the algebra of physics, by A. Macfarlane; The zodiacal light as related to terrestrial temperature variation, by O. T. Sherman; On the long-period terms in the motion of Hyperion, by Ormond Stone; Exhibition and description of a new scientific instrument, the aurora-inclinometer, by Frank H. Bigelow; The tabulation of light-curves: description, explanation, and illustration of a new method, and Stellar fluctuations: distinguished