

The sidereal clock (Dent, 38415) was electrically connected with a barrel chronograph designed by Mr. R. L. J. Ellery, Government Astronomer of Victoria.

No alteration in the adjustments of the clock, transit instrument, or electrical apparatus was made during the whole of the observations.

The transit instrument was made by Troughton and Simms, and the telescope has an aperture of 3 inches, with a focal length of 3 feet. The length of the axis from shoulder to shoulder (that is, exclusive of pivots) is 18 inches. The pivots are $1\frac{1}{4}$ inches long and $1\frac{1}{4}$ inches in diameter.

The transit instrument is provided with a reversing apparatus, by which the telescope can be reversed in a few seconds, without any of the risk that always attends the operation of reversing by hand. There are two finding circles, 4 inches in diameter, one on each side of the telescope. They are graduated to minutes, and can be set to show either altitudes or zenith distances. There are nine fixed vertical wires and one movable micrometer wire; seven of the fixed vertical wires are at intervals of about $3\frac{1}{2}'$ apart; besides which there is one extra wire on each side of the middle wire, and distant about $2'$ from it.

There are also two parallel horizontal wires about $3\frac{1}{2}'$ apart. The integer revolutions of the micrometer are read from a comb in the field of view, and the micrometer head is divided into one hundred parts.

The equatorial intervals of the wires have been computed from 60 transits of clock stars recorded by chronograph, and 30 transits of circumpolar stars recorded chiefly by "eye and ear." The means of these 90 transits give the following results: The wires are numbered 1 to 9, the wire No. 1 being nearest the clamp, so that with Clamp W. stars above the Pole will cross the wires in the order in which they are numbered. Wire No. 1 = +41.763s.; 2 = +27.877s.; 3 = +14.012s.; 4 = +9.219s.; 5 = -0.034s.; 6 = -9.294s.; 7 = -14.026s.; 8 = -27.846s.; 9 = -41.650s.

The value of one revolution of the micrometer screw has been determined from four sets of observations on σ Octantis (s.p.), comprising 154 observations in all, giving 88 results. The mean value of these 88 results gives $57.943''$ as the value of one revolution.

The value of one division of the striding level was found by causing it to ride on the zenith telescope, in which position I took 200 observations to the south meridian mark. The results proved that the curve of the bubble-tube was not regular, the value of one division varying from $\frac{2}{3}''$ at one part to $1\frac{1}{3}''$ at another. The value at the centre has been adopted, and is = $1.28''$. The correction of the level-error, as found by spirit-level, for inequality of the diameters of the pivots, was found to be $p = -.590''$ for Clamp W. The level-error as found and adopted is given in Table 2.

The error of collimation is given in Table 1. In the provisional calculations the mean value as obtained by observations of the meridian mark = +6.04" for Clamp W. was used throughout, but in the final reductions the collimation error for each night's work was found from the observations themselves, by comparing the results from clock stars Clamp E. with those from Clamp W.

The azimuth error was found in the usual way, by combining observations of circumpolar and clock stars, or by two circumpolar stars, one above and the other below the Pole. In applying the azimuth error, I have always adopted the error as found by the method of "least squares," in preference to taking the mean of the various values obtained. In using the method of "least squares" I have introduced weights on account of imperfect transits whenever the star was not observed on all the wires. I ought also to state that in all my calculations for azimuth error I have rejected α^2 Centauri, as its R.A., as given in the Nautical Almanac for 1883, is evidently in error. This may be seen by comparing "clock slow," as obtained from α^2 Centauri in Table 4, with "clock slow" in Table 5. Judging from the results in Tables 4 and 5, it would appear that the R.A. of α^2 Centauri, as given in the Nautical Almanac for 1883, would require a correction of about +.9s.

The azimuth error for each night is given in Table 3.

Table 4 gives the meridional transits of all the stars observed. In reducing the star transits, the correction for diurnal aberration has always been applied to the observed times of transit, using the - sign for upper transits and the + sign for lower transits.

The tabular right ascensions of the Nautical Almanac have been corrected according to a list supplied by the Sydney Observatory.

The adopted errors and rates of the transit clock are given in Table 5. In taking the mean of the clock stars observed on each night, weights have been applied for incomplete transits and also for the position of the star. Thus, if p = the weight due to the number of wires observed according to formula (129), page 198, Vol. 2, Chauvenet, then the weight given to each clock star = $p \cos. \text{dec.}$

The rates on the exchange days, as given in Table 5, have been deduced from the curves shown on the diagram opposite that table.

With regard to the personal equations given at the bottom of Table 5, I have already explained how the personal equation $A - L = +.07s.$ has been obtained. With regard to my own personal equation in receiving time-signals, the following explanation is necessary:—

In receiving longitude signals at Wellington by cable, the comparatively slow motion of a beam of light was observed in two different ways. During the interchange of signals with Sydney, on the night of December 5, 1883, the first movement of the spot of light was noted, but during the interchanges on the nights of December 15, 16, and 18, 1883, a screen was fixed at 200 divisions to the left of the zero of the scale, so that the spot of light was not visible to the person receiving the signals until it had passed this screen.

In order to ascertain the observer's personal equation, or loss of time in noting these signals, several trials were made in the following manner: The sid. clock (Dent, 38415) at Mount Cook Observatory was made to send a weak current to influence the reflecting galvanometer as nearly as possible in the same manner that the cable influenced it. These currents were sent at intervals of 8, 10, or 12 seconds, and were recorded simultaneously on the chronograph. The observer tapped an ordinary Morse key (which also recorded on the chronograph) as soon as possible after noting the signal, and this was generally continued for 50 or 100 signals.