(No. 77.)



1894.

PARLIAMENT OF TASMANIA.

REPORT

BY LIEUTENANT AND COMMANDER PUREY-CUST, OF H.M.S. *DART*, RELATIVE TO THE DIFFICULTY IN ASCERTAINING THE CORRECT TIME WITH TRANSIT INSTRUMENTS AT THE OBSERVATORY, HOBART.

Return to an Order of the House of Assembly. (Hon. N. J. Brown.)

Laid upon the Table by the Premier, July 10, 1894; and ordered by the House of Assembly to be printed, July 11, 1894.

Cost of printing-£1 12s. 6d.



"Orlando," at Sydney, 21st April, 1894.

WITH reference to the Honorable the Premier's letter of 20th February last, I have the honor to forward for Your Excellency's information a Report in detail by Lieutenant and Commander Cust, of H.M.S. *Dart*, relative to the difficulty in ascertaining the correct time with Transit Instruments at the Observatory, Hobart.

I have the honor to be,

My Lord,

Your Excellency's most obedient Servant,

W. BOWDEN-SMITH, Rear-Admiral, Commander-in-Chief.

His Excellency the Right Honorable EARL OF GORMANSTON, K.C.M.G., Governor and Commander-in-Chief, & c., Tasmania.

DIFFICULTY IN ASCERTAINING CORRECT TIME WITH TRANSIT INSTRUMENTS AT OBSERVATORY, HOBART.

No. 4.

H.M.S. " Dart," in Frederick Henry Bay, 5th April, 1894.

SIR, IN accordance with your Memo. of 21st February as to the above, I have the honor to report as follows :---

1. Transit Instrument.—The instrument in use is of 2-in. aperture and $22\frac{1}{2}$ -in. focal length. It has none of the usual accessories of modern transit instruments, such as micrometer, tangent screw for sideway motion of the eye-piece, reversing apparatus, &c., which greatly facilitate and add to the excellence and accuracy of the observations obtained; still, in the hands of a careful observer, no doubt an accuracy sufficient for the purpose required, viz., the rating of chronometers, is obtained. Mr. Kingsmill has lately caused to be added a Bohenbergen eye-piece and amalgamated mercury-trough. This has greatly facilitated the speedy and correct adjustment for collimation and level. The amalgamated form of mercury-trough is especially essential on account of the vibration set up by the trans, which pass on either side of the Observatory at a distance of under a quarter of a mile on an average of four times every quarter of an hour.

2. Clocks.—There are two clocks. One, a sidereal, in the Transit Hut, is exposed to every variation of temperature, and in consequence has an ever-fluctuating rate; the other, a mean solar clock, in the Observatory building, has to be corrected every day at noon to exact mean time for dropping the ball, and can therefore be said to have no known rate. Consequently, in the event of cloudy weather no dependence can be placed on either of them, and the time is regulated by a single box chronometer kept in the Observatory building. At present there are no ready means of accurately comparing the clock in the Transit Hut used for observation with either the chronometer or the mean solar clock. At small expense a clock-face might be fitted close to the mean solar

My Lord,

(No. 77.)

clock, electrically connected with the sidereal clock, affording a simple and extremely accurate method of comparison between the two. This is the method usually employed in all observatories. A good standard clock is much needed. This could be placed in the cellar for the sake of uniformity of temperature, and electrically connected as above with the room in which is the mean solar clock.

3. Error in position of the Meridian mark on Mount Nelson.—In order to obtain this the distance of the Meridian mark from the Transit instrument was first ascertained by triangulating between the two, using certain data obtained from a local triangulation by Mr. Mault for a baseline. This distance was found to be 6479 feet. A wooden scale was then erected horizontally across the Meridiam mark, and graduated in arc so as to form a distant micrometer when viewed through the telescope of the Transit Instrument. This enabled the Azimuth error, as found by observation, to be actually shown in lineal distance at the Meridian mark.

Observations were made, as opportunities offered, on various nights, of pairs of stars differing considerably in declination, of polar stars and pairs of circumpolar stars at opposite culminations, with the following results, viz. :---

Date.	Stars.	Azimuth Error of Meridian Mark, W. of Meridian.
<u> </u>		. //
February 23	σ Octaulis	61
	λ Argus and ε Leonis	63
March 2	Pollux and ζ Argus	62
	δ Germinorum and ζ Argus	63
	κ Argus and ϵ Leonis	72
March 6	β Argus and ϵ Leonis	67
	κ Argus and ϵ Leonis	64 ·
	β Cancri and ε Argus	67
	ν Cancri and κ Argus	59
March 22	σ Octaulis	72
March 28	ζ and β Octaulis	60
	au Octaulis	62
	γ Leonis and ζ Argus	61
March 31	σ and 3274 Octaulis	64
	ζ and τ Octaulis	62
		64

The resulting mean deviation of 64" of arc shows the present position of the Meridian mark to be 2 ft. 0 in. to the westward of the True Meridian. This corresponds very nearly with the error that Mr. Kingsmill had previously estimated and allowed for.

The probable error of the observations by the method of cast squares is $\pm 2^{\prime\prime}$. This corresponds to a lateral distance of ± 1 inch at a distance of 6479 feet. The meridian mark in its present position is quite useless for the purpose intended, and I would suggest that it be moved 2 feet eastwards into the true meridian, and also that there be cut in on the face of the stone in addition to the present \otimes a few micrometer teeth on either side, exactly similar to the marking of the present temporary wooden scale. This would enable the residual small errors in Azimuth of the Transit Telescope to be at any time during daylight read off in seconds of arc and allowed for in the usual manner, instead of the frequent injurious alterations of the adjusting screws of the instrument.

4. I would further wish to point out that although when this alteration is effected the time by the Transit Instrument will be obtained with all the accuracy necessary for the purpose, yet that the present means of communicating it to the Shipping in Port by means of the Time Ball are quite inadequate and liable to error. Signals are sent from the Observatory to the signalman at the Flagstaff, Fort Mulgrave, where the Time Ball is situated, by electricity during the last minute previous to 1 p.m. The electrical fittings are so inferior that they frequently break down entirely for days together. Mr. Ellery, the Government Astronomer at Melbourne, whilst recently in Hobart, gave as his opinion that this might be remedied by a very simple alteration. Again, the Ball is hoisted by a rope and winch, and in order for the Ball to appear to drop at 1 p.M. it is necessary for the signalman to let go the winch handle a certain time beforehand; this he does when he sees the last time signal at 2 seconds to 1 p.M. He actually lets go about 1 second to 1 p.M., and the Ball itself drops about half a second past 1 o'clock. By dint of long practice and habit this error is fairly constant, and varies from 0.5 seconds to 0.8 seconds too late; but it is obvious that the error is liable to variation, and that under the circumstances it is absolutely impossible for the man to drop the Ball exactly at 1 P.M. This, I think, might be obviated by some simple automatic method of dropping it to work with the assistance of a relay by the same electric current, from the Observatory, that works the Time Signal. It would be a good plan in future, when the Time Ball fails in accuracy, to hoist it again immediately half-mast, close up at 1.55, and drop it in the usual manner at 2 P.M., publishing the error in the next morning's paper. This is the usual method adopted in many ports in similar cases.

5. Lists of Stars.—The Nautical Almanac is quite inadequate for Transit work, especially in south latitudes, by reason of the small numbers of stars, and especially south polar stars, for which the apparent places are given. It is seldom or never used even at the Royal Observatory, Greenwich; the French "Connaissance des Temps," published annually, price 4fr. 75cts., being much preferable: *e.g.*, in the "N.A." the apparent places of 224 time stars are given and I south polar star; in the "Connaissance" 360 time stars and 11 south polar stars. I would suggest that this work be added to the Observatory Library.

6. Geographical Position.—The position of the Transit instrument has been calculated from that of the Transit pier in the Barrack Reserve and by the U.S. Transit of Venus Expedition in 1874. As this latter stone is the standard of longitude for Tasmania, I would suggest that a permanent record be cut on it giving the exact latitude and longitude. These are as furnished by the Melbourne Observatory; viz.,—Lat., 42° 58′ 24″.6 S.; Long., 147° 19′ 57″.0 E.

> I have the honor to be, Sir,

Your obedient Servant,

HERBERT E. PUREY-CUST, Lieutenant and Commander.

The Commander-in-Chief H.M. Ships, Australic.

WILLIAM GRAHAME, JUN., GOVERNMENT PRINTER, TASMANIA.