

VI. *On the Difference of Longitude between the Greenwich and Paris
Observatories.* By EDWARD J. DENT.

Read January 12, 1838.

HAVING lately had occasion to visit Paris, I took advantage of the opportunity which presented itself of ascertaining, by the transit of chronometers, the meridian difference between the two observatories.

A memorial was presented, in the first instance, to the Lords Commissioners of the Admiralty, who were pleased to sanction the experiment, and to order the necessary arrangement to be made for it being carried into effect; the astronomers royal of the two observatories (G. B. AIRY, Esq. and M. ARAGO) offering, at the same time, every assistance requisite to the completion of the object.

Twelve chronometers were prepared for the experiment. They were taken out of their gimbals, placed in a wooden box, and packed in horse-hair. The route pursued was by coach to Dover, whence the water was crossed in a sailing-boat to Boulogne, and the journey to Paris completed by the diligence.

Between the comparison of the chronometers made at Greenwich, and that made at the observatory of Paris, there was an interval of seventy-two hours. After a space of fourteen days the instruments were returned by the diligence to Boulogne, whence they were conveyed by a steam-vessel to Greenwich. On this journey only forty-nine hours elapsed between the comparisons of the chronometers at the two observatories.

It should be remarked, that by passing through the paved towns, both in England and France, the chronometers were exposed to severe and continual concussion.

The most favourable arrangement for obtaining the nearest approximation to the difference of longitude will be to supersede the stationary rates, or the rates the chronometers had at the observatories, by applying the rate obtained, by subtracting the known quantity which each chronometer gained

or lost while at the observatory of Paris, from the difference of errors from mean solar time, obtained immediately before leaving, and upon arriving at, the Greenwich Observatory.

This quantity, which is in fact the amount of what each chronometer has gained or lost during the journey to Paris and back, divided by 5 days 1 hour (the total interval of time employed in performing both journeys), will give what we will term its "travelling rate."

The second method adopted is, to add the mean daily rate obtained during the last seven days at Greenwich, to the first seven days' rate after arriving at the Paris Observatory, and from these fourteen days' rate to derive a mean daily rate. The same calculation being repeated on returning to Greenwich, the rates thus deduced may be called "the stationary rates."

It is a remarkable fact, that whether the calculation in question be made by what I have termed the travelling rate, or by that which I have called the stationary rate, the results coincide to fourteen hundredths of a second, making the longitude of Paris Observatory east of Greenwich,

$$\begin{array}{r}
 9^{\text{m}} 21,28^{\text{s}} \text{ by stationary rates.} \\
 9 21,14 \quad \text{travelling rate.} \\
 \hline
 0,14 \text{ difference.}
 \end{array}$$

The official errors and rates received from the observatories are herewith expressed, and given in a tabular form; thereby supplying the information necessary to admit of the statements being placed in any other point of view.

Explanation of the Tables.

Table 1, gives the daily rates of the chronometers at the Greenwich and Paris Observatories.

Table 2, contains the official errors received from the observatories, with the mean daily stationary rates; also the travelling rate, and the results.

ED. J. DENT.

No. 84 *STRAND*,
14th December, 1837.

TABLE, No. 1.

Daily Rate of Twelve Chronometers by ARNOLD and DENT, at the Royal Observatories at Greenwich and Paris.

GREENWICH.												
1837.	897	663	797	820	718	647	780	978	928	1017	623	777
August 20	+1,2 ^s	+1,2 ^s	+2,2 ^s	+1,1 ^s	-2,2 ^s	0,0 ^s	+2,7 ^s	-1,4 ^s	-3,4 ^s	+1,7 ^s	+3,0 ^s	+3,5 ^s
21	1,2	1,3	2,3	1,1	2,1	0,0	2,7	1,4	3,4	1,8	3,0	3,6
22	0,2	1,0	2,0	0,3	2,4	-0,3	2,3	1,6	3,8	1,5	2,8	3,0
23	0,8	0,9	1,9	0,4	,9	0,1	2,8	1,2	3,9	1,8	2,9	3,0
24	0,6	1,8	2,8	0,7	1,2	0,0	3,2	0,7	2,4	2,8	3,0	3,6
25	0,2	1,5	2,6	1,0	1,1	+0,2	3,0	0,5	2,9	2,8	3,4	3,6
26	0,9	2,0	3,4	0,8	1,6	1,0	3,2	0,7	3,7	2,6	3,2	3,7
PARIS.												
30	+0,8	+1,4	+3,5	+1,2	-1,5	+0,4	+3,1	-0,7	-3,2	+1,1	+3,2	+3,7
31	0,7	1,6	3,9	1,0	1,7	0,4	3,3	1,5	4,2	1,3	3,5	3,9
Sept. 1	0,4	1,8	3,3	0,6	1,5	0,7	3,1	1,0	3,7	1,2	3,1	3,8
2	0,0	1,5	3,5	0,7	1,7	0,3	3,0	0,9	4,0	1,8	3,4	3,4
3	0,4	2,0	3,6	1,0	0,9	0,2	3,2	0,5	3,4	2,4	3,4	3,9
4	0,3	2,0	4,4	1,0	1,3	1,1	3,2	0,6	3,3	1,4	2,9	3,6
5	0,5	1,9	4,5	0,7	1,0	0,2	3,0	0,8	2,7	1,5	3,5	3,9
6	0,2	2,0	3,8	0,9	1,3	0,2	3,1	0,6	3,8	1,8	3,2	3,6
7	0,2	1,9	3,1	0,0	1,4	0,4	3,0	0,9	3,8	2,3	3,3	3,6
8	0,2	1,8	3,5	0,3	1,5	0,1	2,9	0,9	3,9	1,7	3,2	4,0
9	0,9	1,8	-0,6*	0,4	1,2	-0,3	2,7	0,7	3,3	1,6	2,7	3,6
10	0,1	2,3	+4,4	1,0	1,2	0,4	3,1	0,8	4,2	2,1	2,6	4,0
11	-0,1	2,0	3,5	0,6	1,1	0,2	2,6	0,6	2,6	2,3	3,2	3,7
12	+0,3	1,7	3,5	0,4	1,6	0,5	2,4	1,0	2,7	1,3	3,5	3,0
GREENWICH.												
17	+0,9	+1,8	+2,8	-0,9	-0,4	+0,2	+3,0	-0,6	-3,6	+3,2	+2,9	+4,2
18	1,0	1,9	2,8	1,0	0,3	0,2	3,0	0,6	3,5	3,2	2,9	4,3
19	0,0	1,5	2,1	0,5	0,8	0,9	2,9	1,4	3,5	4,0	2,7	4,0
20	0,2	1,0	1,9	1,6	1,2	-0,6	2,8	1,4	2,8	2,8	2,6	4,9
21	0,4	1,5	2,3	1,1	0,9	+0,1	3,2	1,2	3,7	2,7	3,4	4,2
22	0,8	1,7	2,4	1,1	1,2	0,0	2,9	0,9	4,3	3,2	3,0	4,2
23	0,9	1,8	2,7	1,7	0,9	0,2	3,1	1,1	3,2	2,9	2,7	3,6

* Omitted in the calculation for the mean daily rate.

TABLE, No. 2.

Official Rates and Errors at the Royal Observatories at Greenwich and Paris.

Names.	Nos.	Greenwich M.D.Rates, from 19th Aug. to 26th do. 1837.	Paris M.D.Rates, from 29th Aug. to 5th Sept. 1837.	Paris M.D.Rates, from 5th Sept. to 12th do. 1837.	Greenwich M.D.Rates, from 17th Sept. to 24th do. 1837.	Errors from M. T. Green- wich, Aug. 26th, at noon.	Errors from M. T. Paris, Aug. 29th, at noon.	Errors from M. T. Paris, Sept. 12th, at noon.	Errors from M. T. Green- wich, Sept. 14th, at noon.
Arnold & Dent	897	^s +1,00	^s +0,44	^s +0,26	^s +0,50	^m ^s +0 32,11	^m ^s − 8 48,4	^m ^s − 8 43,5	^m ^s +0 37,45
—	663	^s +1,23	^s +1,74	^s +1,93	^s +1,60	^m ^s +0 54,41	^m ^s − 8 23,1	^m ^s − 7 57,4	^m ^s −1 26,35
—	797	^s +2,30	^s +3,87	^s +3,63	^s +2,45	^m ^s +3 18,11	^m ^s − 5 54,7	^m ^s − 5 6,9	^m ^s +4 20,65
—	820	^s +1,00	^s +0,89	^s +0,51	^s −1,12	^m ^s +0 59,61	^m ^s − 8 22,0	^m ^s − 8 12,2	^m ^s +1 8,75
—	718	^s −2,00	^s −1,37	^s −1,33	^s −0,81	^m ^s −1 23,19	^m ^s −10 48,6	^m ^s −11 7,5	^m ^s −1 48,75
—	647	^s +0,07	^s +0,47	^s −0,10	^s +0,14	^m ^s +0 49,01	^m ^s − 8 30,4	^m ^s − 8 28,6	^m ^s +0 52,35
—	780	^s +2,74	^s +3,13	^s +2,83	^s +2,99	^m ^s +2 55,51	^m ^s − 6 17,7	^m ^s − 5 36,0	^m ^s +3 50,35
—	978	^s −1,40	^s −0,86	^s −0,79	^s −1,03	^m ^s −1 55,69	^m ^s −11 20,0	^m ^s −11 31,5	^m ^s −2 12,65
—	928	^s −3,61	^s −3,50	^s −3,61	^s −3,66	^m ^s −3 25,19	^m ^s −13 0,4	^m ^s −13 51,2	^m ^s −4 38,75
—	1017	^s +2,33	^s +1,53	^s +1,87	^s +3,14	^m ^s +2 28,81	^m ^s − 6 47,4	^m ^s − 6 23,6	^m ^s +3 1,35
—	623	^s +2,75	^s +3,29	^s +3,10	^s +2,90	^m ^s +2 34,01	^m ^s − 6 40,2	^m ^s − 5 54,5	^m ^s +3 31,35
—	777	^s +3,25	^s +3,63	^s +3,65	^s +4,06	^m ^s +3 31,71	^m ^s − 5 38,2	^m ^s − 4 47,3	^m ^s +4 40,85

CONCLUSIONS.

Difference of Meridians going.	Difference of Meridians returning.	Means.	M. D. Rate while Travelling.	Difference of Meridians deduced from Travelling Rate.	Remarks.
^m 9 ^s 22,67	^m 9 ^s 20,15	^m 9 ^s 21,41	^s + 0,09	^m 9 ^s 20,77	The daily rate of No. 797, on the 9th of September, is omitted in calculating the mean daily rate.
21,95	20,22	21,08	+ 1,24	21,23	
22,08	21,35	21,71	+ 2,92	21,58	
24,43	21,55	22,99	− 0,13	21,22	
20,54	20,89	20,71	− 1,32	21,44	
20,22	20,91	20,56	+ 0,31	20,33	
22,00	20,41	21,20	+ 2,61	21,04	
20,92	20,71	20,82	− 1,08	21,06	
24,54	19,86	22,20	− 4,51	21,66	
22,00	19,85	20,93	+ 1,73	21,41	
23,27	19,73	21,50	+ 2,31	21,14	
20,23	20,29	20,26	+ 3,62	20,78	
Means. } 22,08	20,49	21,28		21,14	
Mean Results { Difference of meridians by stationary rates 9 ^m 21 ^s ,28 travelling rates 9 21,14					