

upon the neighbouring walls. When viewed from that distance, the rays proceeding from the reflector have all the rich effulgence of sunshine.

A piece of the ordinary sensitized paper, such as is used for photographic printing, when exposed to the action of the light for twenty seconds, at a distance of 2 feet from the reflector, was darkened to the same degree as was a piece of the same sheet of paper when exposed for a period of one minute to the direct rays of the sun, at noon, on a very clear day in the month of March.

The extraordinary calorific and illuminating powers of the 10-inch machine are all the more remarkable from the fact that they have their origin in six small permanent magnets, weighing only 1 lb. each, and only capable, at most, of sustaining collectively a weight of 60 lbs. ; while the electricity from the magneto-electric machine employed in exciting the electro-magnet was of itself incapable of heating to redness the shortest length of iron wire of the smallest size manufactured.

The production of so large an amount of electricity was only obtained (as might have been anticipated by the physicist) by a correspondingly large amount of mechanical force ; for it was found that the large electro-magnet could be excited to such a degree that the strong leather belt was scarcely able to drive the machine.

When the electro-magnet of the 10-inch machine was excited by means of the  $2\frac{1}{2}$ -inch magneto-electric machine alone, about two-thirds of the maximum amount of power from the 10-inch machine was obtained.

From a consideration of the combined action of the magneto-electric and electro-magnetic machines, the author points out a remarkable analogy, subsisting between the operation of the static forces of magnetism and of cohesion in modifying dynamical phenomena, which throws additional light upon the nature of the magnetic force.

On reviewing and comparing the whole of the analogous phenomena manifested in the operation of the magnetic and cohesive forces under the varied conditions to which the author invites attention, it appears to him that magnetism is a mode of the force of cohesion, or is, if the term be allowed, polar cohesion acting at sensible distances, the equivalent of magnetic force being obtained at the expense of an equivalent of ordinary cohesive force (in an axial direction) so long as the iron continues to be magnetized.

III. "Extract of a Letter from CHARLES CHAMBERS, Esq., Acting Superintendent of the Bombay Magnetic Observatory, to the President. Dated March 28, 1866." Communicated by the President. Received April 26, 1866.

You will probably have heard from Mr. Stewart that the opportunity of applying usefully the experience which I acquired at Kew has been tem-

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porarily accorded to me by the Bombay Government, by my appointment to the superintendence of this Observatory. The confirmation of my present appointment will probably depend upon the sanction of the scheme of improvements for the Observatory which I have just sent in for the consideration of Government. Meanwhile I have arranged the working power of the establishment so as to take up the reduction of the old observations, and I am sure you will be interested to learn that there is a probability of their turning out trustworthy and valuable. The separation of seven years of declination-disturbances has already been effected, with the results shown in the enclosed Tables and Curves; but as the whole series of observations (from 1845 to 1865) will include two complete cycles of the decennial period, and as the reductions have already been so long delayed, I propose completing the twenty-one years before discussing the connected questions and publishing the whole; it is, however, a *little* doubtful whether the opportunity of doing this will be afforded me, as the Indian Government, in sanctioning my appointment, have limited its duration to the end of next month; and though I am hopeful that, partly in consequence of a representation that I have made to the Government, of the wide scope for usefulness that is open to me here, and of what has been effected and has been engaged upon since my arrival six months ago, they may be induced to extend their approval of the appointment until the improvements suggested in my Report shall have been considered, yet it seems right, as there are some interesting points about the results already arrived at, that I should inform you of them whilst I may, especially as in case of a second reference of the matter to the home Government, you will, I believe, consider them good grounds upon which to recommend the continuance of the reductions of the twenty-one consecutive years of the Bombay observations.

Referring to page 283 of your paper in the Philosophical Transactions, 1863, it will be seen that these results supply the required knowledge of the laws of the disturbances at a station intermediate in longitude between Kew and Nertschinsk. The general characteristics of the westerly disturbance-diurnal-variation curve are the same as you describe for Pekin and Nertschinsk. The curve is remarkably regular, and the ordinates between 8 P.M. and 4 A.M. have scarcely appreciable values, being in the latter respect like the westerly curve for Hobarton, and the easterly for Kew and St. Helena. The maximum occurs at 11 A.M., which corresponds to about 18<sup>h</sup> Kew astronomical time, implying, by comparison with the corresponding hours of maximum at the other two eastern stations (Pekin and Nertschinsk), a rather slow propagation of the disturbing action from north to south of the eastern part of the northern hemisphere. The other curve (of easterly disturbance) presents a less systematic appearance; and the ratios are at no part of the day smaller than 0.64, or greater than 1.83.

The Table of aggregate values of disturbance in the several years points very distinctly to a minimum as occurring early in 1864, thus adding another to the determinations of this turning-point in three former cycles given by you in the third volume of the 'St. Helena Observations,' and confirming the conclusions you arrived at as to the propriety of the appellation "decennial" to the period in question. The Table does not extend far enough backwards to fix the time of maximum distinctly, but it suffices to place it with probability in the year 1859.

The principal requests that I have made in my Report are for a set of Kew magnetographs, and for a suitable room, and for a body of computers to work up the old observations.

Astronomical hours.		Ratios of the aggregate values of the declination-disturbances exceeding 1'·4 in amount at the several hours in the seven years from 1859 to 1865 inclusive.	
Bombay.	Kew (approximate).	Westerly disturbances.	Easterly disturbances.
12	7	·05	·70
13	8	·17	·68
14	9	·16	·64
15	10	·14	·84
16	11	·18	·69
17	12	·36	·71
18	13	·80	·92
19	14	·96	1·17
20	15	1·64	1·00
21	16	2·35	1·08
22	17	2·73	1·61
23	18	2·76	1·83
0	19	2·84	1·68
1	20	2·57	1·56
2	21	1·86	1·29
3	22	1·41	·99
4	23	1·06	·91
5	0	·61	·85
6	1	·40	·85
7	2	·45	·80
8	3	·16	1·00
9	4	·11	·79
10	5	·16	·70
11	6	·08	·72
Aggregate values in the seven years .....		2801·1	4538·7
		7339·8	

Aggregate values of all disturbances exceeding 1'4 in the several years from 1859 to 1865 inclusive.		Ratios of disturbance in the several years from 1859 to 1864 inclusive to the mean aggregate disturbance in the six years taken as unity.	
Years.	Aggregate values.	Years.	Ratios.
1859	1532·1	1859	1·43
1860	1421·6	1860	1·33
1861	951·8	1861	0·89
1862	1240·5	1862	1·16
1863	691·1	1863	0·64
1864	595·9	1864	0·56
1865	906·8	The ratio of the maximum in 1859 to the minimum in 1864 is as 2·6 to 1.	

IV. "On the Tides of the Arctic Seas.—Part III. On the Semi-diurnal Tides of Frederiksdal, near Cape Farewell, in Greenland.  
By the Rev. S. HAUGHTON, F.R.S. Received April 12, 1866.

(Abstract.)

The observations discussed in this paper by the Rev. Dr. Haughton were made for him (in 1863–64), at the request of Admiral Irminger of the Royal Danish Navy, by Missionary Asboe, at Frederiksdal, near Cape Farewell in Greenland.

They proved amply sufficient for the complete discussion of the semi-diurnal tide of that interesting locality; and the following results were obtained :—

1. Eccentricity of lunar orbit . . . . . 0·06786
2. Mass of earth as compared with mass of moon . . . 64·638
3. Depth of Atlantic deduced from heights . . . . . 10·03 miles.
4. Depth of Atlantic deduced from times . . . . . 3·30 miles.