

4

*Report of the Kew Committee for the Year ending
October 31, 1877.*

The Committee would commence their Report with the expression of their heartfelt regret at the decease of Mr. J. P. Gassiot, who had been, since 1851, among the most active Members of the successive Kew Committees, first of the British Association, and latterly of the Royal Society. Mr. Gassiot had not only devoted freely to the management of Kew Observatory a large portion of his valuable time, but also had, in 1871, most munificently endowed the establishment with the sum of £10,000 Italian Irrigation Stock, for the purpose of maintaining in a state of thorough efficiency the self-recording observations in terrestrial magnetism and in meteorology.

Committee.—The Committee is constituted as follows:—

General Sir E. Sabine, K.C.B., *Chairman.*

Mr. De La Rue, *Vice-Chairman.*

Capt. Evans.

Mr. F. Galton.

Vice-Adm. Sir G. H. Richards.

The Earl of Rosse.

Mr. R. H. Scott.

Lieut.-General W. J. Smythe.

Lieut.-General Strachey.

Mr. E. Walker.

Mr. R. H. Scott, at his own request, has been for the future relieved of the duties of Hon. Secretary, which he has performed ever since the Observatory came under the management of the Royal Society, and the duties of that post will be in future discharged by the Superintendent.

Magnetic Work.—The Magnetographs have been in constant operation throughout the year. The declination instrument was slightly deranged for a short period by the presence of some extremely minute organic fibres between the mirrors. In accordance with the usual practice, determinations of the scale-values of all the instruments were made in the first week of the new year.

The inconvenience occasionally experienced by the dropping, on to the Magnetographs, of water condensed in the smoke-tubes over the gas-burners has been obviated by the attachment of suitable catch-bottles.

The monthly observations with the absolute instruments have been continued as usual by Mr. Figg, and the results are given in the Tables appended to this Report. A re-determination of the moment of inertia of the magnet KC 1 was made in October; the value accorded with the previously found amount.

A paper "On the Temperature-correction and Induction-coefficients of Magnets," as determined in the results of various experiments at the Observatory, was read before the Royal Society, and printed in vol. xxvi. of the 'Proceedings.'

Sir Edward Sabine having brought the discussion of the Magnetical Observations carried on under his superintendence to a close in a final "Contribution," presented to the Royal Society (No. XV. Phil. Trans. vol. 167), represented to the War Office that he was able to dispense with the further services of the two Sergeants of the Royal Artillery who had acted as his clerks. These men were in consequence withdrawn on the 31st of March.

The documents deposited in Sir E. Sabine's late office have been presented by the "War Office" to the "Royal Society," and, in conformity with instructions received from the Council, will be retained in the custody of the Observatory. A detailed list of these documents and papers is now in course of preparation.

The tabulation of the magnetic curves, which was suspended at the time of writing the last Report, has been resumed, and Tables of the Declination have been completed as far as December 31st, 1876.

At the request of Prof. Balfour Stewart, the range of the declination-needle has been determined for every day during the years 1858-73 inclusive. The results have been discussed by him in a paper read before the Royal Society, March 22, 1877, entitled, "On the Variations of the Daily Range of the Magnetic Declination as recorded at the Kew Observatory," Proc. Roy. Soc. vol. xxvi.

In addition, magnetic data have been supplied to Dr. Atkinson, Prof. M'Leod, the Hydrographic Department, Messrs. Gee, Grove, and Groenman.

The officers attached to the late Arctic Expedition have visited the Observatory, and made several sets of observations with the instruments employed by them on their voyage, Kew being the base station to which all their observations are referred.

The Committee have received, with great satisfaction, a communication from Mr. R. Ellery, F.R.S., of the Melbourne Observatory, in which he states that, in deference to the opinions elicited by the circular of the Kew Committee from the chief authorities on terrestrial magnetism, as explained in last Report, the Government of Victoria has furnished funds for the erection of a new Magnetic Observatory at Melbourne.

Meteorological Work.—The several self-recording instruments for the continuous registration respectively of pressure, temperature, humidity,

wind (direction and velocity), and rain have been maintained in regular operation under the care of Mr. T. W. Baker, assisted by T. Gunter. The daily standard eye-observations for the control of the automatic records have been made regularly, as well as daily observations in connexion with the Washington synchronous system.

The Observatories of the Meteorological Council at Aberdeen, Armagh, Falmouth, Glasgow, Stonyhurst, and Valencia have been visited by Mr. Whipple, and their instruments inspected.

The examination and checking of the work of the self-recording Observatories of the Meteorological Committee was discontinued in November 1876, and the scales and appliances used in the work returned to the Meteorological Office. Mr. Aldridge, an assistant engaged in the work, accepted an appointment from the Meteorological Committee. Mr. Harrison is employed at Kew, subject to the condition that he may be at any time sent to any of the Observatories to relieve the officer in charge in case of illness or other cause, if required by the Meteorological Council to do so. The tabulation of the Kew meteorological traces is performed by Mr. Hawkesworth.

This change of arrangements has involved a considerable reduction in the amount allowed by the Meteorological Office to Kew, as its central Observatory. This sum is now £150, instead of £400, as heretofore.

Electrograph.—The cause of derangement of this instrument having been apparently removed, by dismounting and thoroughly cleaning it, its action has been fairly satisfactory throughout the year.

Considerable difficulty has been experienced at times in maintaining the cistern of the water-dropping collector in a sufficiently insulated condition. The substitution of a set of Varley's telegraph insulators for the ebonite supports previously used has been attended with good results. The tabulation of the curves obtained from this instrument has not yet been commenced.

An instrument having been constructed for the Royal Observatory, Greenwich, similar to the one at Kew, certain minor alterations in the details have been introduced which Mr. Whipple's experience has suggested.

Photoheliograph.—The re-examination of the measurements of the Kew sun-pictures, as noticed in former Reports, has been steadily carried on throughout the year by Mr. Whipple, assisted by Mr. M'Laughlin, who has been temporarily engaged for this purpose.

The rate of progress has been somewhat slow during the past year, owing to the enormous number of spots visible on the sun's surface during the (maximum) year (1870) now under discussion. On several days, recently measured, more than 150 spots have had their positions determined. Mr. Marth is still engaged on the reduction to heliocentric elements. *

All of these operations have been conducted at the expense of Mr. De La Rue.

The eye-observations of the sun, after the method of Hofrath Schwabe, have been made daily by Mr. Harrison, when possible, as described in the Report for 1872, in order, for the present, to maintain the continuity of the Kew record of sun-spots.

Extra Observations.—The Solar-radiation Thermometers are still observed daily.

The Campbell Sundial, described in the 1875 Report, continues in action, and the improved form of the instrument, giving a separate record for every day of the duration of sunshine, has been regularly worked throughout the year and its curves tabulated.

Wind Component Integrator.—The Wind Component Integrator, an instrument which automatically resolves the velocity of the wind into its rectangular components, which was exhibited by Prof. von Oettingen, of Dorpat, at the recent Loan Exhibition, having been lent by the Guarantors of that Exhibition to the Meteorological Council, has been erected in the sun-room of the Observatory at their expense. The instrument has been temporarily attached to the existing anemograph, and its gearing so modified as to enable it to print from type-wheels on a strip of paper the number of miles of wind passing over the building from the north, east, south, and west during every half-hour*.

At the request of the Editor of the 'Times,' a copy of the traces of the self-recording instruments on a reduced scale, together with an epitome of the general features of the weather, is now prepared. This is published every week in that journal, the cost to the Observatory being defrayed by the proprietors.

Verifications.—This branch of the work of the Observatory has been carried on with considerable success as usual. The following magnetic instruments have been verified:—

A set of Magnetographs for the Batavia Observatory.

” ” ” Potsdam Observatory.

A Collimator Magnet for Dr. van der Stok.

A Dip-circle, with extra needles, for Vice-Admiral Sir Charles Shadwell.

• Two Azimuth Compasses for Mr. Frewen.

There have also been purchased on commission and verified:—a Unifilar for Dr. Da Souza, Coimbra; a Collimator magnet for Mr. Kingston, Toronto; a Dip-circle for Prof. Weihrauch, Dorpat; a Dip-circle for Prof. Houzeau, Brussels Observatory; and two Dip-needles for Prof. Smirnow, Kazan. There are also now undergoing verification a set of Magneto-

* A complete description of this instrument, illustrated in detail, is to be found in the 'Repertorium für Meteorologie,' vol. v. No. 10, St. Petersburg, 1877.

graphs for the Brussels Observatory, and a Unifilar and Dip-circle for the Marine Observatory, San Fernando, Spain.

The following meteorological instruments have been verified, this portion of the work being entrusted to Mr. T. W. Baker, assisted by Messrs. Foster, Constable, and Gutter:—

Barometers, Standard	71
„ Marine and Station	113
	<hr/>
	184
	<hr/>
Aneroids	25
	<hr/>
Thermometers, ordinary Meteorological	1428
„ Boiling-point Standards	57
„ Mountain	22
„ Clinical	2281
„ Solar radiation	75
	<hr/>
	3863

In addition, 102 Thermometers have been tested at the melting-point of mercury. 12 Standard Thermometers have been calibrated and divided at Kew.

The following is the list of miscellaneous instruments which have been verified:—

Hydrometers	249
Rain-gauges	11
Dial Anemometers (Robinson's)	5

In addition to those for the Admiralty, the Meteorological Council, and the opticians, a number of instruments of various kinds have been verified for the Standards Department and the Ordnance Department, Woolwich.

The total increase in the number of instruments verified over last year has been 680, and in fees earned £25 11s. 2d.

There are now at the Observatory undergoing verification 56 Thermometers, 1 Hydrometer, and 35 Barometers.

London Office for receipt of instruments for verification.—Arrangements have been made with Mr. Strachan, of the Meteorological Office, who now receives instruments for verification at Kew, at 116 Victoria Street, Westminster, and takes charge of them on their return.

Mr. Galton's apparatus for testing Thermometers has continued to work satisfactorily; and a paper containing a description of the instrument, with an illustration, has been published in vol. xxvi. of the 'Proceedings of the Royal Society.'

The new Cathetometer has received some slight additions tending to improve its usefulness.

One Theodolite, three Sextants, and a Clinometer have been verified.

Experiments have been made with the new Deep-sea Sounding Thermometer, invented by Messrs. Negretti and Zambra; and the Committee have under consideration the construction of an apparatus for the purpose of verifying this class of instrument under varying hydraulic pressure.

A system has also been organized for etching a "Hall-mark," as in the annexed figure, upon all Thermometers which have been verified. A pantagraph has been purchased for the purpose of engraving this mark and a register number upon the instruments.



The old "Royal Society" Standard Barometer, constructed by Newman in 1837, under the direction of Mr. Baily, which has been in a defective condition since its removal from the Society's Rooms in Somerset House in 1857, having been lent to the Kew Committee by the Council of the Royal Society for one year, has been thoroughly repaired and both its tubes refilled, and is now erected at the Observatory, with a view of making a lengthened series of comparisons with the two normal Barometers of the establishment.

Comparison of Standard Barometers.—The Astronomer Royal having courteously offered the Committee every facility for a suggested comparison between the Greenwich and Kew Standard Barometers during April and May last, a number of carefully selected Portable Standard Barometers were conveyed to and fro between Greenwich and Kew on three separate occasions, and a large number of comparative readings were obtained by the Superintendent and Messrs. Baker and Foster.

A complete detailed account of the experiment has been drawn up, and will be laid before the Royal Society.

A determination has been made of the daily range of the Thermometer at Kew for the past twenty-one years, viz. 1855–75, inclusive. The results have been discussed by Prof. Balfour Stewart, and embodied by him in a paper "On the Variations of the Daily Range of Atmospheric Temperature as recorded at the Kew Observatory," Proc. Roy. Soc. vol. xxv. No. 178.

Meteorological data have been supplied, among others, to Mr. G. J. Symons, the Secretary of the Northern Institute of Mining Engineers, the Secretary of the Midland Institute, and the Editors of 'The Times' and 'Illustrated London News.'

Pendulum Experiments.—The apparatus specified in the Report for 1875, as granted by the Committee to the Hydrographer for the service of the Arctic Expedition, was returned to the Observatory shortly after the arrival home of the vessels; but no observations having been made

with the pendulum apparatus, it was not re-erected at Kew, nor base operations repeated.

Instruction given.—One assistant from the Standards Department received instruction in the manipulation of thermometers, and Dr. Taaffe in the use of meteorological instruments.

Waxed Paper supplied.—Waxed paper has been supplied to the following Observatories :—

Armagh,
Batavia,
Bombay,
Lisbon,

Mauritius,
San Fernando,
Stonyhurst,
St. Petersburg,

and the Meteorological Office.

A supply of chemical and photographic material has also been procured for the Mauritius Observatory.

Loan Exhibition.—The old instruments lent to the Science and Art Department, enumerated in last year's Report, remain for the present deposited in the galleries at South Kensington.

A "Diplôme d'honneur" has been presented to the Committee by the Société Française de Photographie for the curves exhibited at their recent exhibition of objects illustrating the adaptation of photography to scientific purposes.

Workshop.—The several pieces of Mechanical Apparatus, such as the Whitworth Lathe and the Planing Machine, procured by Grants from either the Government-Grant Fund or the Donation Fund, for the use of the Kew Observatory, have been kept in thorough order; and many of them are in constant, and others in occasional use at the Observatory; but the funds of the Committee do not at present allow of the employment of a Mechanical Assistant, although one is much needed.

Library.—During the year the Library has received as presents the publications of

10 English Scientific Societies and Institutions,

40 Foreign and Colonial Scientific Societies and Institutions,

and numerous pamphlets from various individuals. A few standard works of reference have been purchased, and a number of periodicals bound.

The Committee have also purchased the small Scientific Library belonging to the late Mr. John Welsh, F.R.S., formerly Superintendent of the Observatory, which has been for some years stored in the building.

Observatory and Grounds.—For the protection of the Observatory against fire, a portable hand-pump and two dozen fire-buckets have been purchased, the latter being distributed throughout the building.

The room formerly occupied by the Sergeants of the "Magnetic Office"

has been made use of since their departure by the assistants engaged in the verification of thermometers, Messrs. Foster and Gunter.

The floor of the Computing-room has been covered with linoleum.

The exterior of the Workshops has been painted, and the roofs of the Verification-house and Magnetic Observatory have been made water-tight.

A gravelled path has been cut across the lawn, for giving more convenient access to the Rain-gauges and Magnetic house.

Owing to the giving way of part of the embankment separating the River Thames from the Old Deer Park, on the morning of January 2nd, the basement of the Observatory was again flooded, the water rising to an extent higher than has been previously experienced, covering the floors of the Magnetograph-, Photographic-, and Pendulum-rooms to a depth of three or four inches. By laying down planked ways, the instruments were maintained in action, and no interruption was experienced in the work of the Observatory. The water was withdrawn from the building by the aid of a fire-engine, which, with a gang of labourers, was sent by the Commissioners of Woods and Forests for the purpose.

Staff.—The Staff employed at Kew are as follows:—Mr. G. M. Whipple, B.Sc., Superintendent; T. W. Baker, First Assistant; J. W. Hawkesworth, J. Foster, H. M'Laughlin, F. G. Figg, R. W. F. Harrison, E. G. Constable, T. Gunter, C. Robinson, and J. Dawson.

Mr. E. G. Aldridge, having accepted an appointment at the Meteorological Office, left the Observatory in December.

Visitors.—The Observatory has been honoured by the presence, among others, of:—

Prof. W. G. Adams, F.R.S.
 Sir John Alleyne.
 Prof. Bogrul.
 Mons. Egroff.
 Mr. G. T. Kingston.
 Dr. Köppen.

Prof. Marié Davy.
 Prof. Mascart.
 Mons. Salleron.
 Prof. H. J. S. Smith, F.R.S.
 Baron van der Heerdt.
 Prof. Zeyers.

The Committee have received from Sir Edward Sabine a large portion of his books relating to Physical Science, as a donation to the Library of the Kew Observatory, and have sent to their Chairman an expression of their high appreciation of the interest which by this gift he continues to evince in this institution, over which he has presided for so many years.

APPENDIX I.

*Magnetic Observations made at the Kew Observatory, Lat. 51° 28' 6" N.,
Long. 0^h 1^m 15^s.1 W., for the year October 1876 to September 1877.*

The observations of Deflection and Vibration given in the annexed Tables were all made with the Collimator Magnet marked K C 1, and the Kew 9-inch Unifilar Magnetometer by Jones, the property of the Magnetic Office, directed by General Sir E. Sabine.

The Declination observations have also been made with the same Magnetometer, Collimator Magnet N E being employed for the purpose.

The Dip observations were made with Dip-circle No. 33, the needles 1 and 2 only being used; these are 3½ inches in length.

The results of the observations of Deflection and Vibration give the values of the Horizontal Force, which, being combined with the Dip observations, furnish the Vertical and Total Forces.

These are expressed in both English and metrical scales—the units in the first being one foot, one second of mean solar time, and one grain; and in the other one millimetre, one second of time, and one milligramme, the factor for reducing the English values to metric value being 0.46108.

By request, the corresponding values in C.G.S. measure are also given.

The value of $\log \pi^2 K$ employed in the reduction is 1.64365 at temperature 60°.

The induction-coefficient μ is 0.000194.

The correction of the magnetic power for temperature t_0 to an adopted standard temperature of 35° Fahr. is

$$0.0001194(t_0 - 35) + 0.000,000,213(t_0 - 35)^2.$$

The true distances between the centres of the deflecting and deflected magnets, when the former is placed at the divisions of the deflection-bar marked 1.0 ft. and 1.3 ft., are 1.000075 ft. and 1.300097 ft. respectively.

The times of vibration given in the Table are each derived from the mean of 12 or 14 observations of the time occupied by the magnet in making 100 vibrations, corrections being applied for the torsion-force of the suspension-thread subsequently.

No corrections have been made for rate of chronometer or arc of vibration, these being always very small.

The value of the constant P, employed in the formula of reduction $\frac{m}{X} = \frac{m'}{X} \left(1 - \frac{P}{r^2} \right)$, is -0.00179.

In each observation of absolute Declination the instrumental readings have been referred to marks made upon the stone obelisk erected about a quarter of a mile north of the Observatory as a meridian mark, the orientation of which, with respect to the Magnetometer, was determined by the late Mr. Welsh, and has since been carefully verified.

The observations have all been made and reduced by Mr. F. G. Figg.

Observations of Deflection for Absolute Measure of Horizontal Force.

Month.	G. M. T.	Distances of Centres of Magnets.	Tempe- rature.	Observed Deflection.	Log $\frac{m}{X}$. Mean.	Observer.
1876.	d h m	foot.				
October	24 12 16 P.M.	1.0	50.2	0 44 1		F.
		1.3	.....	7 5 57	9.13370	"
	2 28 "	1.0	51.6	15 43 10		"
		1.3	.....	7 5 2		"
November	27 12 22 P.M.	1.0	51.8	15 43 9		F.
		1.3	.....	7 5 26	9.13361	"
	2 27 "	1.0	51.4	15 43 0		"
		1.3	.....	7 5 27		"
December	21 12 5 P.M.	1.0	44.6	15 43 37		F.
		1.3	.....	7 5 33	9.13321	"
	2 5 "	1.0	45.6	15 42 58		"
		1.3	.....	7 5 17		"
1877.						
January	25 12 41 P.M.	1.0	50.0	15 42 11		F.
		1.3	.....	7 5 3	9.13303	"
	2 24 "	1.0	51.6	15 41 58		"
		1.3	.....	7 4 40		"
February	23 12 25 P.M.	1.0	45.8	15 42 48		F.
		1.3	.....	7 5 13	9.13306	"
	2 16 "	1.0	46.8	15 42 46		"
		1.3	.....	7 5 10		"
March	27 12 28 P.M.	1.0	57.1	15 41 2		F.
		1.3	.....	7 4 27	9.13297	"
	2 35 "	1.0	59.5	15 40 31		"
		1.3	.....	7 4 12		"
April	25 12 27 P.M.	1.0	53.0	15 42 8		F.
		1.3	.....	7 4 57	9.13323	"
	2 18 "	1.0	56.8	15 41 21		"
		1.3	.....	7 4 45		"
May	28 12 33 P.M.	1.0	66.5	15 38 39		F.
		1.3	.....	7 3 29	9.13254	"
	2 15 "	1.0	67.6	15 38 8		"
		1.3	.....	7 3 11		"
June	26 12 25 P.M.	1.0	71.3	15 35 43		F.
		1.3	.....	7 2 10	9.13140	"
	2 20 "	1.0	71.6	15 34 50		"
		1.3	.....	7 1 35		"
July	25 12 31 P.M.	1.0	69.9	15 35 51		F.
		1.3	.....	7 2 1	9.13141	"
	2 16 "	1.0	70.8	15 35 8		"
		1.3	.....	7 1 52		"
August	28 12 25 P.M.	1.0	70.3	15 35 17		F.
		1.3	.....	7 1 52	9.13129	"
	2 27 "	1.0	72.5	15 34 54		"
		1.3	.....	7 1 38		"
September	26 12 23 P.M.	1.0	58.5	15 37 37		F.
		1.3	.....	7 3 0	9.13156	"
	2 22 "	1.0	64.7	15 36 35		"
		1.3	.....	7 2 26		"

Vibration Observations for Absolute Measure of Horizontal Force.

Month.	G. M. T.	Tempe- rature.	Time of one Vi- bration.	Log <i>mX</i> . Mean.	Value of <i>m</i> .	Observer.
1876.	d h m	°	secs.			
October	24 11 32 A.M.	48·7	4·6285			F.
	3 10 P.M.	51·8	4·6276	0·31228	0·52843	"
November	27 11 21 A.M.	49·7	4·6304	0·31212	0·52829	F.
	3 15 P.M.	50·8	4·6286			"
December	21 11 17 A.M.	43·4	4·6270	0·31240	0·52820	F.
	2 44 P.M.	46·5	4·6262			"
1877.						
January	25 11 58 A.M.	48·4	4·6246	0·31285	0·52837	F.
	3 10 P.M.	52·4	4·6272			"
February	23 12 49 P.M.	44·8	4·6248	0·31269	0·52829	F.
	2 52 P.M.	46·4	4·6247			"
March	27 11 41 A.M.	55·9	4·6291	0·31260	0·52818	F.
	3 13 P.M.	58·0	4·6286			"
April	25 11 49 A.M.	51·3	4·6269	0·31281	0·52847	F.
	2 56 P.M.	57·0	4·6272			"
May	28 11 48 A.M.	65·4	4·6301	0·31290	0·52810	F.
	2 53 P.M.	65·5	4·6294			"
June	26 11 37 A.M.	70·6	4·6430	0·31129	0·52643	F.
	2 59 P.M.	71·3	4·6390			"
July	25 11 50 A.M.	67·6	4·6407	0·31139	0·52650	F.
	2 53 P.M.	70·5	4·6387			"
August	28 11 38 A.M.	68·0	4·6370	0·31212	0·52687	F.
	3 3 P.M.	71·4	4·6354			"
September.....	26 11 38 A.M.	56·7	4·6362	0·31142	0·52661	F.
	3 23 P.M.	66·5	4·6383			"

Dip Observations.

Month.	G. M. T.	Needle.	Dip.	Observer.	Month.	G. M. T.	Needle.	Dip.	Observer.
1876. Oct.	d h m	No.	° ' "		1877. Apr.	d h m	No.	° ' "	
	25 2 58 P.M.	1	67 46·69	F.		26 3 3 P.M.	1	67 46·47	F.
	2 59 "	2	46·87	"		3 3 "	2	45·56	"
	26 2 50 "	1	46·81	"		27 3 2 "	1	45·44	"
	2 50 "	2	46·93	"		3 2 "	2	45·68	"
Mean.....		67 46·82		Mean.....		67 45·79			
Nov.	28 2 57 P.M.	1	67 45·94	F.	May	29 3 0 P.M.	1	67 46·37	F.
	2 58 "	2	46·18	"		3 1 "	2	45·75	"
	29 3 24 "	1	46·75	"		31 3 5 "	1	44·88	"
	3 25 "	2	46·25	"		3 4 "	2	44·62	"
	Mean.....		67 46·28			Mean.....		67 45·40	
Dec.	21 3 37 P.M.	1	67 46·87	F.	June	27 2 59 P.M.	1	67 45·46	F.
	3 37 "	2	46·31	"		2 59 "	2	44·25	"
	22 2 50 "	1	46·25	"		28 2 56 "	1	45·75	"
	2 48 "	2	46·94	"		2 56 "	2	44·90	"
	Mean.....		67 46·59			Mean.....		67 45·09	
1877. Jan.	24 3 6 P.M.	1	67 46·69	F.	July	26 2 59 P.M.	1	67 44·69	F.
	3 9 "	2	45·75	"		3 1 "	2	43·63	"
	26 2 53 "	1	46·62	"		27 3 4 "	1	45·31	"
	2 51 "	2	45·56	"		3 4 "	2	44·40	"
	Mean.....		67 46·15			Mean.....		67 44·51	
Feb.	26 3 10 P.M.	1	67 46·50	F.	Aug.	29 2 59 P.M.	1	67 45·28	F.
	3 6 "	2	45·88	"		3 0 "	2	44·96	"
	27 2 57 "	1	46·00	"		30 3 0 "	1	46·25	"
	2 57 "	2	45·19	"		2 59 "	2	45·44	"
	Mean.....		67 45·89			Mean.....		67 45·48	
Mar.	28 3 2 P.M.	1	67 45·03	F.	Sept.	27 3 5 P.M.	1	67 45·53	F.
	3 2 "	2	45·47	"		3 7 "	2	45·31	"
	29 3 8 "	1	46·25	"		28 3 6 "	1	44·81	"
	3 8 "	2	45·54	"		3 6 "	2	44·40	"
	Mean.....		67 45·57			Mean.....		67 45·01	

Declination Observations.

Month.	G. M. T.	Uncorrected.		Corrected for Torsion.		Observer.
		Observation.	Monthly Mean.	Observation.	Monthly Mean.	
1876.	d h m		West.		West.	
October	25 12 29 P.M.	19° 35' 29"		19° 33' 45"		F.
	26 12 32 "	19 29 24		19 28 14		"
	27 12 39 "	19 30 11	19° 31' 41"	19 29 51	19° 30' 37"	"
November	28 12 31 "	19 26 19		19 26 54		F.
	29 12 28 "	19 26 5	19 26 12	19 26 5	19 26 29	"
December	22 12 34 "	19 25 10		19 25 10		F.
	23 12 35 "	19 27 58	19 26 34	19 28 19	19 26 44	"
1877.						
January	26 12 31 "	19 25 9		19 24 21		F.
	27 12 38 "	19 24 40	19 24 54	19 23 52	19 24 6	"
February	26 12 21 "	19 26 2		19 24 42		F.
	27 12 30 "	19 22 32		19 22 32		"
	28 12 23 "	19 23 20	19 23 58	19 24 13	19 23 49	"
March	28 12 26 "	19 28 37		19 26 28		F.
	29 12 34 "	19 27 19	19 27 58	19 28 10	19 27 19	"
April	26 12 35 "	19 21 38		19 24 1		F.
	27 12 32 "	19 24 22	19 23 0	19 25 19	19 24 40	"
May	29 12 28 "	19 22 40		19 24 11		F.
	30 12 35 "	19 23 27	19 23 3	19 24 27	19 24 19	"
June	27 12 30 "	19 25 46		19 23 53		F.
	28 12 25 "	19 22 43	19 24 14	19 25 4	19 24 28	"
July	26 12 26 "	19 23 56		19 22 57		F.
	27 12 33 "	19 23 19	19 23 37	19 24 18	19 23 37	"
August	30 12 29 "	19 20 22		19 20 52		F.
	31 12 31 "	19 20 23	19 20 22	19 19 53	19 20 22	"
September	27 12 23 "	19 21 41		19 22 36		F.
	28 12 34 "	19 21 25	19 21 33	19 21 25	19 22 0	"

Magnetic Intensity.

Month.	English Units.			Metric Units.			C.G.S. Measure.		
	X, or Horizontal Force.	Y, or Vertical Force.	Total Force.	X, or Horizontal Force.	Y, or Vertical Force.	Total Force.	X, or Horizontal Force.	Y, or Vertical Force.	Total Force.
1876. October ...	3-8841	9-5082	10-2712	1-7909	4-3841	4-7359	0-1791	0-4384	0-4736
November.	3-8838	9-5034	10-2664	1-7908	4-3819	4-7337	0-1791	0-4382	0-4734
December.	3-8868	9-5131	10-2766	1-7921	4-3863	4-7384	0-1792	0-4386	0-4738
1877. January ...	3-8896	9-5165	10-2809	1-7935	4-3879	4-7403	0-1793	0-4388	0-4740
February..	3-8887	9-5124	10-2766	1-7930	4-3860	4-7384	0-1793	0-4386	0-4738
March ...	3-8887	9-5008	10-2742	1-7930	4-3848	4-7373	0-1793	0-4385	0-4737
April	3-8886	9-5111	10-2754	1-7930	4-3854	4-7378	0-1793	0-4385	0-4738
May	3-8921	9-5165	10-2818	1-7946	4-3879	4-7408	0-1795	0-4388	0-4741
June	3-8899	9-5089	10-2738	1-7936	4-3844	4-7371	0-1794	0-4384	0-4737
July	3-8904	9-5054	10-2707	1-7938	4-3828	4-7357	0-1794	0-4383	0-4736
August ...	3-8941	9-5222	10-2877	1-7955	4-3906	4-7435	0-1795	0-4391	0-4743
September	3-8898	9-5082	10-2731	1-7935	4-3841	4-7367	0-1793	0-4384	0-4737

APPENDIX II.
 Meteorological Observations.—Table I.
 Kew Observatory.

Longitude 0^h 1^m 15^s·1 W. Latitude 51° 28' 6" N. Height above sea-level = 34 feet.

Mean Monthly Results from the continuous Records for the Twelve Months ending September 30th, 1877.

Months.	Thermometer *.				Barometer †.				Pressure.	
	Extreme maximum.		Extreme minimum.		Extreme maximum.		Extreme minimum.		Vapour-tension.	Dry air.
	Date.		Date.		Date.		Date.		ins.	ins.
	d	h	d	h	d	h	d	h		
1876. October	17	2 P.M.	31	9 P.M.	ins.	29-938	25	10 A.M.	ins.	29-597
November	14	1 "	10	10 "	30-353	29-884	4	10 P.M.	30-387	29-633
December	2	0 midt.	23	1 A.M.	30-316	29-493	10	10 A.M.	30-381	29-234
1877. January	19	2 P.M.	21	8 "	30-681	29-850	21	10 "	28-735	29-608
February	7	1 "	28	6 "	30-395	29-943	28	0 midt.	29-075	29-708
March	41	1 "	23	7 "	30-422	29-766	1	10 A.M.	28-814	29-559
April	4	2 "	20	5 "	30-294	29-767	30	0 midt.	28-982	29-521
May	8	3 "	5	4 "	30-422	29-882	1	10 P.M.	29-256	29-625
June	11	5 "	7	4 "	30-282	30-015	28	8 A.M.	29-412	29-639
July	31	4 "	8	4 "	30-318	29-920	9	10 "	29-116	29-514
August	20	1 "	24	6 "	30-206	29-875	24	9 "	29-375	29-455
September	11	2 "	25	6 "	30-410	30-066	27	10 "	29-666	29-741
Means .....	.....		.....		.....	29-867	.....		.....	29-570

The above Table is extracted from the Quarterly Weather Report of the Meteorological Office, by permission of the Council.

* The thermometer-bulbs are 10 feet above the ground.

† Readings unredduced to sea-level.

Meteorological Observations.—Table II.

Kew Observatory.

Months.	Rainfall*.		Weather †. Number of days of					Wind ‡. Number of days on which it blew											
	Mean amount of cloud (0=clear, 10=over-cast).	Total.	Maxi-mum.	Date.	Rain.	Snow.	Hail.	Thun-der-storms.	Clear sky.	Over-cast.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	
		in.	in.																
1876.																			
October	7.5	1.308	0.330	12	14	..	..	..	1	16	3	8	3	5	3	7	1	1	1
November	6.8	2.718	0.410	12	18	..	..	..	4	14	5	..	6	3	3	5	4	4	4
December	8.6	5.841	1.550	23	22	1	..	..	1	25	1	3	5	4	5	10	1	2	2
1877.																			
January	7.4	4.885	0.875	10	25	..	1	..	1	18	1	2	2	1	9	8	5	3	3
February	7.4	1.735	0.410	13	13	2	..	..	2	17	3	..	..	..	..	10	11	4	4
March	6.9	2.200	0.430	28	16	2	1	..	2	15	4	1	3	2	2	8	6	5	5
April	8.1	2.700	0.575	9	18	1	..	4	..	22	1	7	4	2	4	5	3	1	1
May	7.4	1.895	0.240	16	16	..	..	..	2	16	6	5	7	2	4	7	3	..	..
June	5.3	1.542	0.950	21	8	..	..	1	8	10	2	2	7	1	4	9	4	1	1
July	7.1	3.125	0.575	5	14	..	3	4	1	12	1	..	..	3	3	13	10	4	4
August	7.0	2.820	0.800	25	16	..	..	1	1	16	1	..	2	1	5	11	6	5	5
September	6.2	0.690	0.190	2	9	..	..	..	2	12	8	5	3	1	..	6	3	4	4
Totals .....	...	31.459	...	...	189	7	5	10	25	193	36	33	42	22	42	99	57	34	34

* Measured daily at 10 A.M. by gauge 1.75 ft. above surface of ground. † Derived from observations made at 10 A.M., noon, 2, 4, and 10 P.M.

‡ As registered by the anemograph.

Meteorological Observations.—Table III.

Kew Observatory.

Months.	Sunshine*.		Maximum temperature in Sun's rays †.			Horizontal movement of the air ‡.		
	Total number of hours.	Number of hours Sun was above horizon.	Mean.	Highest.	Date.	Average daily velocity.	Greatest movement in a day.	Date.
1876.								
October	h m	h m	95.9	119.9	9	196	470	9
November	64 0	328 53	80.2	103.5	14	213	508	12
December	67 0	263 47	63.2	95.0	1	295	636	4
1877.								
January	17 15	242 51						
February	38 42	259 12	73.5	94.5	30	337	694	30
March	72 33	278 8	89.7	103.5	17	299	570	20
April	101 6	367 20	98.4	117.4	28	245	517	20
May	74 54	415 1	102.2	122.4	22	314	824	16
June	140 30	482 27	113.0	129.1	15	250	581	28
July	223 12	494 29	130.8	144.4	30	264	657	1
August	183 30	496 46	128.0	141.9	29	211	391	23
September	203 42	449 6	127.1	136.5	21	239	500	28
	133 35	377 13	111.9	132.7	2	183	502	12

* Registered by Campbell sun-dial.

† Derived from the means of the indications of 4 black-bulb thermometers *in vacuo*, read daily at 10 A.M.

‡ As indicated by Robinson's anemograph, 70 feet above the general surface of ground.