

filtration through sand impregnated with vegetable growth, and after adding algæ to the water, the nitrites are increased. The growth of larvæ in a water is as a rule accompanied by an increase of nitrites, though the nitrification does not seem to be increased on the addition of either ammonium salts or nitrates to the water, or on fouling the water by animal excretions.

The arm-lengths of the larvæ are not specially affected by vegetable growth, though by water filtered through sand impregnated with algæ and diatoms they are somewhat diminished. They are considerably increased on development of the larvæ in water purified by being kept in darkness, and in aerated water. They are greatly diminished in water previously heated to 100°, but not in that heated to from 50° to 77°. In water exposed to sunlight they are also diminished. They are increased in water fouled by most animals and by dead Echinoids, but in that fouled by living Echinoids are diminished.

During a period of seven months the specific gravity of the Aquarium water was found to vary from 1·02859 to 1·02964 at 15·56° C. The specific gravity was on an average about 0·00040 greater than that of the open sea water. The free ammonia varied from 0·185 to 0·350 milligram per litre, and the albuminoid from 0·111 to 0·182 milligram.

*Report of the Kew Observatory Committee for the Year
ending December 31, 1897.*

The operations of The Kew Observatory, in the Old Deer Park, Richmond, Surrey, are controlled by the Kew Observatory Committee, which is constituted as follows :—

Mr. F. Galton, *Chairman.*

Captain W. de W. Abney, C.B.,
R.E.
Prof. W. G. Adams.
Captain E. W. Creak, R.N.
Prof. G. C. Foster.
Prof. J. Perry.
The Earl of Rosse, K.P.

Prof. A. W. Rücker.
Mr. R. H. Scott.
Mr. W. N. Shaw.
Lieut.-General Sir R. Strachey,
G.C.S.I.
Rear Admiral Sir W. J. L.
Wharton, K.C.B.

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The work at the Observatory may be considered under the following heads:—

- 1st. Magnetic observations.
- 2nd. Meteorological observations.
- 3rd. Solar observations.
- 4th. Experiments and Researches in connexion with any of the departments.
- 5th. Verification of instruments.
- 6th. Rating of Watches and Marine Chronometers.
- 7th. Miscellaneous.

I. MAGNETIC OBSERVATIONS.

The Magnetographs have been in constant operation throughout the year, and the usual determinations of the Scale Values were made in January.

The ordinates of the various photographic curves representing Declination, Horizontal Force, and Vertical Force were then found to be as follows:—

Declinometer: 1 inch = $0^{\circ} 22' 04$. 1 cm. = $0^{\circ} 8' 7$.

Bifilar, January 20, 1897, for 1 inch $\delta H = 0.0280$ foot grain unit.

„ 1 cm. „ = 0.00051 C.G.S. unit.

Balance, January 21, 1897, for 1 inch $\delta V = 0.0274$ foot grain unit.

„ 1 cm. „ = 0.00050 C.G.S. unit.

During the past year the magnetic curves have been free from any very large fluctuations. The principal variations that were recorded took place on the following days:—

January 2; February 4, 25—27; March 9—10; April 2, 20, 23—24; May 17; June 16—17; July 31; October 1—2, 28; November 17; December 11, 20—21.

The hourly means and diurnal inequalities of the magnetic elements for 1897, for the quiet days selected by the Astronomer Royal, will be found in Appendix I.

In the present year a correction has been applied for the diurnal variation of temperature, use being made of the records from a Richard thermograph as well as the eye observations of a thermometer placed under the Vertical Force shade.

The mean values at the noons preceding and succeeding the selected quiet days are also given, but these of course are not employed in calculating the daily means or inequalities.

The following are the mean results for the entire year:—

| | |
|---------------------------------|------------------------|
| Mean Westerly Declination | $17^{\circ} 6' 4$. |
| Mean Horizontal Force | 0.18342 C.G.S. unit. |
| Mean Inclination | $67^{\circ} 19' 6$. |
| Mean Vertical Force | 0.43906 C.G.S. unit. |

Observations of Absolute Declination, Horizontal Intensity, and Inclination have been made weekly, as a rule.

As in 1896, a table of recent values of the Magnetic Elements at the Observatories whose publications are received at Kew was contributed to 'Science Progress,' and appeared in the August number. A similar table, but containing more recent data, will be found in Appendix IA to the present Report.

In July, M. Moureaux, of the Parc Saint-Maur Observatory, near Paris, paid a visit, and a comparison was made of his and the Kew magnetic instruments, a detailed report of which has been drawn up by the Superintendent, and published in the Royal Society's Proceedings, vol. 62, p. 156.

The magnetic instruments lent to the Jackson-Harmsworth Polar Expedition have been returned, and in October some observations were taken with them by Mr. Albert Armitage, the Magnetic Observer in the expedition, and the Observatory Staff, with a view to standardizing the Arctic Observations.

Dr. van Rijkevorsel spent some time at the Observatory, in March and April, comparing his magnetic instruments with the Kew unifilar and dip circle.

Information on matters relating to various magnetic data have been supplied to Dr. E. Atkinson, Professor Arnold Lupton, and Captain Schück, and the latter gentleman compared his instruments with the Observatory standards.

II. METEOROLOGICAL OBSERVATIONS.

The several self-recording instruments for the continuous registration of Atmospheric Pressure, Temperature of Air and Wet-bulb, Wind (direction and velocity), Bright Sunshine, and Rain, have been maintained in regular operation throughout the year, and the standard eye observations for the control of the automatic records duly registered.

The tabulations of the meteorological traces have been regularly made, and these, as well as copies of the eye observations, with notes of weather, cloud, and sunshine, have been transmitted, as usual, to the Meteorological Office.

With the sanction of the Meteorological Council, data have been supplied to the Council of the Royal Meteorological Society, the Institute of Mining Engineers, and the editor of 'Symons' Monthly Meteorological Magazine.'

On June 21, observations with the Campbell sunshine recorder, of the original wooden bowl pattern, were suspended, by direction of the Meteorological Council.

Electrograph.—The auxiliary battery of 60 chloride of silver cells

used with this instrument was received back from the makers on January 11.

Before restarting the instrument, the Clifton Quadrant Electrometer was taken entirely to pieces, all parts thoroughly cleaned and dried, and new sulphuric acid put in the inner jar.

The battery was tested, each row of cells being examined and the voltage determined.

The electrograph was started on January 19, and has been in constant operation since, with the exception of one or two short stoppages due to freezing of the water jet, or other accidental causes. Owing presumably to the changes introduced last year, there has been a great improvement in the behaviour of the apparatus. There are still, however, one or two directions in which further improvement is desirable.

On September 29, one-third of the cells in the battery were taken off, to make a corresponding contraction in the scale values, which was expedient in view of the high potentials usually recorded during the winter months.

Notwithstanding this, several hours' record have been lost owing to the trace being off the sheet. It is difficult at present to see how such loss can be avoided, without either duplicating part at least of the apparatus, so as to get two curves, one showing ordinary and the other extraordinary potentials (positive and negative), or else by risking possible loss of negative trace by shifting the position, on the sheet, of the zero line.

The scale value was determined, by direct comparison with the Portable Electrometer, White, No. 53, on January 19, May 4, and on September 29, before and after the change above referred to.

The comparisons showed that up to the date of the change the scale value had remained practically constant.

Inspections.—In compliance with the request of the Meteorological Council, the following Observatories and Anemograph Stations have been visited and inspected:—Fleetwood, Stonyhurst, Armagh, Dublin, Valencia, Falmouth, and St. Mary's (Scilly Isles), by Mr. Baker; Radcliffe Observatory (Oxford), Yarmouth, North Shields, Alnwick Castle, Fort William, Glasgow, Aberdeen, and Deerness (Orkney), by Mr. Constable.

III. SOLAR OBSERVATIONS.

Sun-spots.—Sketches of Sun-spots have been made on 165 days, and the groups numbered, after Schwabe's method.

Particulars will be found in Appendix II, Table IV.

Taking into consideration the elaborate photographic work now done elsewhere, the Committee consulted the Solar Physics Com-

mittee and other eminent astronomers on the subject, with the result that they decided that the eye observations should cease at the end of 1897.

IV. EXPERIMENTAL WORK.

Fog and Mist.—The observations of a series of distant objects, referred to in previous Reports, have been continued. A note is taken of the most distant of the selected objects which is visible at each observation hour.

Atmospheric Electricity.—The comparisons of the potential, at the point where the jet from the water-dropper breaks up, and at a fixed station on the observatory lawn, mentioned in last year's Report, have been continued, and the observations have been taken nearly every month.

A comparison of these observations with the corresponding results from the electrograms encourages the belief that there has been no progressive change of insulation in the electrograph, such as was met with prior to the late alterations and improvements.

Advantage was taken of the occurrence of some very thick fogs in November, to carry out six sets of observations of the potential at various heights from the ground to 70 feet above.

Aneroid Barometers.—The experiments referred to last year have been continued, and a considerable number of interesting conclusions have been arrived at. It is hoped that the results will be ready for publication in the course of the present year.

Platinum Thermometry.—In accordance with the arrangement alluded to in last year's Report, Dr. J. A. Harker came to the Observatory in January to do some work in platinum thermometry. The authorities of the International Bureau of Weights and Measures at Sèvres having consented with the greatest readiness and courtesy to a comparison by Dr. Harker, in their laboratories, of the scales of the hydrogen and platinum thermometers, the Committee decided to do all in their power to make the scheme successful. It had been from the first the hope of the Committee that platinum thermometry would prove a valuable auxiliary in direct comparison of mercury thermometers, especially at temperatures outside the range 0° to 100° C., and the opportunity of a comparison with the standard gas thermometer of the Bureau International thus occurred very opportunely.

After Dr. Harker's arrival at Kew it was found that somewhat extensive alterations would be required to fit the existing resistance box for the work at Sèvres, and it also appeared undesirable that the Observatory should be deprived for some months of the means of using platinum thermometers. A new resistance box was accordingly ordered from Messrs. Crompton & Co., embodying the alterations

suggested by the experience of Dr. Harker and the Observatory staff. On its completion, this box was taken to Sèvres by Dr. Harker in July, together with two or three of the platinum thermometers previously in use at the Observatory, and some new ones of higher resistance. Since then Dr. Harker has been engaged on the proposed research in co-operation with Dr. Chappuis of the International Bureau. It is expected that the investigation, so far as practicable at present, will be concluded in a few months.

The inconsistencies in the behaviour of the Callendar-Griffiths resistance box, referred to last year, having been proved to arise principally from the uncertainties of the plugs, it was sent to the makers (the Cambridge Scientific Instrument Company) for readjustment. They made use of the opportunity to introduce, at their own expense, a new system of plugs. In it the plugs are isolated, so that manipulating one leaves the tightness of the others unaffected. Another source of trouble proved to be thermo-electric currents generated in the patent thermo-electric key; the key accordingly has been enclosed, at the suggestion of Mr. W. N. Shaw, in a box, and the defect though still existent appears much reduced.

Experiments have been continued on the fixity of zero of platinum thermometers and the degree of consistency in the results obtained with them. Further attention has also been given to the comparison of platinum and mercury thermometers at high temperatures. This is a subject of increasing urgency in view of repeated requests for direct high temperature verifications which cannot as yet be satisfactorily dealt with.

Mercury Thermometry.—To assist in perfecting a method of high temperature verifications, some high range thermometers of the Jena glasses 16^{III} and 59^{III} have been ordered from Berlin. They are to be verified at the Reichsanstalt before delivery.

At the request of Messrs. Powell & Sons, Whitefriars, experiments are being made as to the thermometric properties of different kinds of glass. Particulars of the chemical composition of the glass will be published, with the results obtained, when the experiments are completed.

An apparatus for the comparison of meteorological maximum and minimum thermometers in the horizontal position has been designed by Mr. Casella, and is at present under construction.

V. VERIFICATION OF INSTRUMENTS.

The subjoined is a list of the instruments examined in the year 1897, with the corresponding results for 1896:—

| | Number tested in the year ending December 31. | |
|---------------------------------------|--|---------------|
| | 1896. | 1897. |
| Air-meters | 5 | 5 |
| Anemometers | 12 | 3 |
| Aneroids | 113 | 77 |
| Artificial horizons..... | 21 | 17 |
| Barometers, Marine..... | 84 | 167 |
| „ Standard | 72 | 101 |
| „ Station..... | 40 | 30 |
| Binoculars | 455 | 661 |
| Compasses..... | 3 | 51 |
| Deflectors | — | 4 |
| Hydrometers..... | 374 | 292 |
| Inclinometers | 8 | 5 |
| Photographic Lenses | 14 | 10 |
| Magnets..... | 4 | 2 |
| Navy Telescopes | 546 | 707 |
| Rain Gauges | 17 | 27 |
| Rain Measuring Glasses..... | 26 | 31 |
| Scales..... | 1 | — |
| Sextants..... | 591 | 694 |
| Sunshine Recorders..... | 2 | 10 |
| Theodolites | 5 | 29 |
| Thermometers, Avitreous, or Immisch's | 7 | 5 |
| „ Clinical | 13,772 | 17,270 |
| „ Deep sea..... | 74 | 119 |
| „ High Range | 52 | 37 |
| „ Hypsometric | 34 | 30 |
| „ Low Range | 62 | 71 |
| „ Meteorological | 4,098 | 2,874 |
| „ Solar radiation | 2 | — |
| „ Standard | 69 | 117 |
| Uniflars | 3 | 4 |
| Vertical Force Instruments | — | 4 |
| Declinometers | — | 3 |
| Total..... | <u>20,566</u> | <u>23,457</u> |

Duplicate copies of corrections have been supplied in 85 cases.

The number of instruments rejected in 1896 and 1897 on account of excessive error or for other reasons was as follows :—

| | 1896. | 1897. |
|--------------------------------------|-------|-------|
| Thermometers, clinical | 161 | 156 |
| „ ordinary meteorological.. | 56 | 38 |
| Sextants | 79 | 98 |
| Telescopes | 30 | 66 |
| Binoculars | — | 28 |
| Various | 43 | 56 |

Two Standard Thermometers have been constructed during the year.

There were at the end of the year in the Observatory undergoing verification 12 Barometers, 680 Thermometers, 24 Sextants, 12 Telescopes, 10 Binoculars, 20 Hydrometers, and 3 Sunshine Recorders.

VI. RATING OF WATCHES AND CHRONOMETERS.

The high standard of excellence to which attention was drawn in last year's Report has been maintained. Although the number of marks obtained by the watch standing first on the list is slightly lower than last year, yet the general average is as good, and no less than 108 movements have obtained the highest possible form of certificate (the class A especially good), which involves the attainment of 80 per cent. of the total marks.

The 680 watches received were entered for trial as below :—

For class A, 492; class B, 144; class C, 16; and 28 for the subsidiary trial. Of these 17 passed the subsidiary test, 161 failed from various causes to gain any certificate; 7 were awarded class C certificates, 109 class B, and 386 class A.

In Appendix III will be found a table giving the results of trial of the first 51 watches which gained the highest number of marks during the year. The highest place was taken by Messrs. Usher and Cole, of London, with a keyless going-barrel, Karrusel lever-watch, No. 29,106, which obtained 88·4 marks out of a maximum of 100.

The class C trial having been of late years but little called for, the Committee decided early in the year to suspend the further issue of class C certificates, and this rule came into operation on April 1.

The number of watches obtaining the class A certificate “especially good” having during the past few years largely increased, considerations of space forbid the publication of the rates and marks of all of them. Attention was drawn to this proposed change in the Report for 1896.

Appendix III embraces watches gaining 82·5 marks and upwards, the remaining 57, which obtained the distinction “especially good,” ranging from 82·3 to 80·0 marks.

Various representations having been made that changes are

desirable in the system of marks and in the dating of certificates, a circular has been issued to ascertain the general opinion of watch manufacturers and others interested in the matter.

Marine Chronometers.—During the year, 65 chronometers have been entered for the Kew A and B trials; of these 49 gained certificates, and 16 failed to pass.

The present box for the “cold” test of chronometers proving inadequate, it is intended during the winter of 1897–98 to fit up a larger and much improved chamber to hold a considerable number of movements. This, it is expected, will remove much of the difficulty and expense of maintaining the low temperature of 45° during the summer months.

The relay of the chronograph working in circuit with the standard mean-time clock “French” having proved rather uncertain in its action during the latter part of May, it was decided to have the entire apparatus overhauled. This was carried out in June by Messrs. E. Dent & Co., and an improved relay and new armatures were fitted. It has since performed well. During the interval the time signals were recorded on a galvanometer (P.O. pattern).

VII. MISCELLANEOUS.

Paper.—Prepared photographic paper has been supplied to the Observatories at Hong Kong, Mauritius, St. Petersburg, Toronto, Oxford (Radclyffe), and Stonyhurst, and through the Meteorological Office to Aberdeen, Batavia, Fort William, and Valencia.

Anemograph and Sunshine Sheets have also been sent to Hong Kong and Mauritius, and *papier Saxe* to Coimbra, and a number of Campbell-Stokes sunshine recorders to St. Petersburg. At the request of the India Office, a drum chronograph with best frictional governors, to be used for astronomical and transit work, was made by Messrs. Thomas Cook and Sons, of York, and, after erection and examination at Kew, was forwarded to the Colaba Observatory, Bombay.

Exhibition at the Crystal Palace.—Specimens of the curves from the various self-recording apparatus and cloud photographs were lent for exhibition at the Crystal Palace and safely returned.

Ships' Compasses.—With the kind assistance of Captain E. W. Creak, R.N., F.R.S., regulations have been laid down for the separate verification of old or additional cards for compass bowls previously tested.

Travellers' Azimuth Compasses.—After the conclusion of the special experiments mentioned last year, a report was submitted to the Royal Geographical Society.

Painting of the Building.—The whole exterior of the building was painted in April and May by H.M. Office of Works.

Seismograph.—An application for a grant of £60 for the purchase

and erection of a seismograph was favourably entertained by the Government Grant Committee. The instrument has been ordered from Mr. R. Munro, but has not yet been delivered.

National Physical Laboratory Committee.—A committee having been appointed by Government “to consider and report upon the desirability of establishing a National Physical Laboratory for the testing and verification of instruments for physical investigation, for the construction and preservation of standards of measurement, and for the systematic determination of physical constant and numerical data useful for scientific and industrial purposes; and to report whether the work of such an institution, if established, could be associated with any testing or standardising work already performed wholly or partly at the public cost,” the Chairman and the Superintendent gave evidence before it.

It is also proposed that the National Physical Laboratory Committee should visit Kew Observatory at an early date.

Library.—During the year the library has received publications from

21 Scientific Societies and Institutions of Great Britain and Ireland,

102 Foreign and Colonial Scientific Establishments, as well as from several private individuals.

The card catalogue has been proceeded with.

Audit, &c.—The accounts for 1897 have been audited by Mr. W. B. Keen, Chartered Accountant, on behalf of the Royal Society, and by Professor Perry on behalf of the Committee.

The balance sheet, with a comparison of the expenditure for the two years, 1896 and 1897, is appended.

PERSONAL ESTABLISHMENT.

The staff employed is as follows:—

C. Chree, Sc.D., F.R.S., Superintendent.

T. W. Baker, Chief Assistant.

E. G. Constable, Observations and Rating.

W. Hugo, Verification Department.

J. Foster “ “

T. Gunter “ “

W. J. Boxall “ “

G. E. Bailey, Accounts and Library.

E. Boxall, Observations and Rating, and seven other Assistants.

A Caretaker and Housekeeper are also employed.

(Signed) W. GRYLLS ADAMS,

pro Chairman.

March 29, 1898.

Comparison of Expenditure during the Years 1896 and 1897.

| Expenditure. | 1896. | 1897. | Increase. | Decrease. |
|--|------------|----------|-----------|-----------|
| Administration :— | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Superintendent | 500 0 0 | 500 0 0 | | |
| First Assistant | 273 18 0 | 331 18 0 | 58 0 0 | |
| Office | 105 12 1 | 119 6 1 | 13 14 0 | |
| Rent, Fuel, Lighting, &c. | 88 13 3 | 88 9 2 | | 0 4 1 |
| Caretaker | 68 18 0 | 70 4 6 | 1 6 6 | |
| Incidental Expenses | 149 18 2 | 113 2 3 | | 36 15 11 |
| | 1186 19 6 | 1223 0 0 | 73 0 6 | 37 0 0 |
| Normal Observatory :— | | | | |
| Salaries—Observations, &c. | 301 17 8 | 320 2 10 | 18 5 2 | |
| Incidental Expenses | 77 1 4 | 48 1 4 | | 29 0 0 |
| Prop. Adm. Expenditure | 237 0 0 | 244 12 0 | 7 12 0 | |
| Researches :— | | | | |
| Salaries | | 110 0 0 | 110 0 0 | |
| Purchase of Apparatus, &c. | 153 6 1 | 209 11 1 | 56 5 0 | |
| Prop. Adm. Expenditure | 355 10 0 | 366 18 0 | 11 8 0 | |
| Tests :— | | | | |
| Salaries | 812 3 6 | 898 11 6 | 86 8 0 | |
| Incidental Expenses | 189 14 11 | 203 0 6 | 13 5 7 | |
| Prop. Adm. Expenditure | 475 19 6 | 489 4 0 | 13 4 6 | |
| Commissions :— | | | | |
| Purchases for Colonial Institutions, &c. | 185 6 3 | 398 18 2 | 213 11 11 | |
| Prop. Adm. Expenditure | 118 10 0 | 122 6 0 | 3 16 0 | |
| Purchase of Stock | 471 1 0 | | | 471 1 0 |
| Gross Expenditure.... (showing an increase of £33 15s. 2d.). | 3377 10 3 | 3411 5 5 | 533 16 2 | 500 1 0 |
| Extraordinary Expenditure. | | | | |
| Researches :— | | | | |
| Salaries | | 110 0 0 | 110 0 0 | |
| Purchase of Apparatus, &c. | 150 4 2 | 206 0 7 | 55 16 5 | |
| Commissions :— | | | | |
| Purchases for Colonial Institutions, &c. | 185 6 3 | 398 18 2 | 213 11 11 | |
| Purchase of Stock | 471 1 0 | | | 471 1 0 |
| | 806 11 5 | 714 18 9 | 379 8 4 | 471 1 0 |
| Leaving for Ordinary Nett Expenditure | 2570 18 10 | 2696 6 8 | 154 7 10 | 29 0 0 |
| (showing an increase of £125 7s. 10d.). | | | | |

Kew Observatory. Account of Receipts and Payments for the year ending December 31st, 1897.

RECEIPTS.

| | £ | s. | d. |
|---|-------|----|----|
| To Balance from Year 1896 | 130 | 1 | 2 |
| Royal Society:— | | | |
| Gassiot Trust | 444 | 1 | 4 |
| " Income Tax returned..... | 14 | 19 | 8 |
| " | 459 | 0 | 7 |
| Meteorological Council:— | | | |
| Allowance | 400 | 0 | 0 |
| Postages, &c. | 13 | 11 | 11 |
| " | 413 | 11 | 11 |
| Tests:— | | | |
| Verification | 1695 | 6 | 10 |
| Rating | 611 | 5 | 11 |
| Lenses | 2 | 9 | 1 |
| " | 2309 | 1 | 10 |
| Researches:— | | | |
| Government Grant Committee for purchase of Seismograph | 60 | 0 | 0 |
| Commissions executed for Colonial and Foreign Institutions, &c. ... | 427 | 15 | 4 |
| Rents | 4 | 13 | 0 |
| Dividends on India Stock | 43 | 19 | 8 |
| | £3848 | 3 | 6 |

PAYMENTS.

| | £ | s. | d. |
|--|-------|----|----|
| By Normal Observatory:— | | | |
| Salaries—Observations, Tabulations, &c. | 320 | 2 | 10 |
| Incidental Expenses, Photographic Paper, &c. | 43 | 1 | 4 |
| Proportion of Administration Expenditure | 244 | 12 | 0 |
| " | 612 | 16 | 2 |
| Researches:— | | | |
| Salaries | 110 | 0 | 0 |
| Purchase of Apparatus, &c. | 209 | 11 | 1 |
| Proportion of Administration Expenditure | 366 | 18 | 0 |
| " | 686 | 9 | 1 |
| Tests:— | | | |
| Salaries | 898 | 11 | 6 |
| Incidental Expenses—Apparatus, &c. | 203 | 0 | 6 |
| Proportion of Administration Expenditure | 489 | 4 | 0 |
| " | 1590 | 16 | 0 |
| Commissions:— | | | |
| Purchase of Instruments and Photographic Paper for Colonial and Foreign Institutions, &c. | 393 | 18 | 2 |
| Proportion of Administration Expenditure..... | 122 | 6 | 0 |
| " | 521 | 4 | 2 |
| Balance—In London and County Bank | 396 | 1 | 7 |
| Awaiting Banking | 20 | 8 | 6 |
| In hand (Petty Cash) | 20 | 8 | 0 |
| | £3848 | 3 | 6 |

ADMINISTRATION EXPENDITURE.

| Particulars. | £ | s. | d. | Apportionment. | £ | s. | d. |
|-------------------------------------|-------|----|----|-------------------|-------|----|----|
| Superintendent | 500 | 0 | 0 | Observatory | 244 | 12 | 0 |
| First Assistant Librarian, &c. | 451 | 4 | 1 | Researches | 366 | 18 | 0 |
| Rent, Fuel, &c. | 88 | 9 | 2 | Tests | 439 | 4 | 0 |
| Cartmaker, Repairs, &c. | 183 | 6 | 9 | Commissions | 122 | 6 | 0 |
| | £1223 | 0 | 0 | | £1223 | 0 | 0 |

Audited on behalf of the Royal Society and found correct,
18th of January, 1898.

(Signed) W. B. KEEN, *Chartered Accountant*.

On behalf of the Committee, supervised and approved,
19th January, 1898.

(Signed) JOHN PERRY.

ESTIMATED ASSETS.

| | £ | s. | d. | £ | s. | d. |
|---|-----|----|----|--------------|-----------|----------|
| By Balance as per Statement | | | | 436 | 18 | 1 |
| £1300 India 3½ per cent. Stock, value on January 1, 1898..... | | | | 1521 | 0 | 0 |
| Payments due:— | | | | | | |
| Meteorological Council—Allowance, Postages, &c. | 100 | 9 | 10 | | | |
| Test Fees..... | 606 | 13 | 8 | | | |
| Commissions | 168 | 6 | 0 | | | |
| Stock:— | | | | 875 | 9 | 6 |
| Blank Forms and Certificates | 61 | 14 | 5 | | | |
| Standard Thermometers | 76 | 12 | 0 | | | |
| | | | | 138 | 6 | 5 |
| | | | | <u>£2971</u> | <u>14</u> | <u>0</u> |

January 10th, 1898.

ESTIMATED LIABILITIES.

| | £ | s. | d. |
|--|--------------|-----------|----------|
| To Administration accounts—Gas, Rent, Repairs, &c..... | 31 | 1 | 4 |
| Observatory accounts—Photographic Paper, &c. | 7 | 14 | 6 |
| Tests accounts—Repairs, Apparatus, &c. | 44 | 18 | 4 |
| Commissions | 124 | 3 | 3 |
| Researches | 14 | 17 | 11 |
| Government Grant Committee for Seismograph..... | 60 | 0 | 0 |
| General Balance | 2688 | 18 | 8 |
| | <u>£2971</u> | <u>14</u> | <u>0</u> |

(Signed) CHARLES CHREE,
Superintendent.

List of Instruments, Apparatus, &c., the Property of the Kew Observatory Committee, at the present date out of the custody of the Superintendent, on Loan.

| To whom lent. | Articles. | Date of loan. |
|---|---|---------------|
| G. J. Symons, F.R.S. | Portable Transit Instrument | 1869 |
| The Science and Art Department, South Kensington. | Articles specified in the list in the Annual Report for 1893. | 1876 |
| Professor W. Grylls Adams, F.R.S. | Unifilar Magnetometer, by Jones, No. 101, complete. | 1883 |
| | Pair 9-inch Dip-Needles with Bar Magnets . . . | 1887 |
| Lord Rayleigh, F.R.S. | Standard Barometer (Adie, No. 655) | 1885 |
| Radcliffe Observatory, Oxford. | Black Bulb Thermometer <i>in vacuo</i> | 1897 |

APPENDIX I.

MAGNETICAL OBSERVATIONS, 1897.

Made at the Kew Observatory, Old Deer Park, Richmond, Lat. $51^{\circ} 28' 6''$ N. and Long. $0^{\text{h}} 1^{\text{m}} 15^{\text{s}}.1$ W.

The results given in the following tables are deduced from the magnetograph curves which have been standardised by observations of deflection and vibration. These were made with the Collimator Magnet K.C. I. and the Declinometer Magnet marked K.O. 90 in the 9-inch Unifilar Magnetometer by Jones.

The Inclination was observed with the Inclinator by Barrow, No. 33, and needles 1 and 2, which are $3\frac{1}{2}$ inches in length.

The Declination and Force values given in Tables I to VIII are prepared in accordance with the suggestions made in the fifth report of the Committee of the British Association on comparing and reducing Magnetic Observations.

The following is a list of the days during the year 1897 which were selected by the Astronomer Royal, as suitable for the determination of the magnetic diurnal inequalities, and which have been employed in the preparation of the magnetic tables:—

| | |
|-----------------|---------------------|
| January | 6, 9, 22, 23, 26. |
| February | 2, 9, 17, 18, 20. |
| March | 14, 15, 16, 18, 20. |
| April..... | 3, 11, 12, 15, 22. |
| May | 8, 9, 12, 16, 28. |
| June..... | 8, 9, 10, 12, 30. |
| July | 1, 9, 13, 18, 26. |
| August..... | 4, 5, 6, 24, 31. |
| September | 13, 18, 19, 26, 28. |
| October..... | 5, 9, 13, 20, 21. |
| November | 7, 8, 12, 23, 30. |
| December..... | 8, 13, 26, 27, 28. |

Table I.—Hourly Means of the Declination, as determined from the

| Hours | Preceding noon. | Mid. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
|----------------------|-----------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| (17° +) West Winter. | | | | | | | | | | | | | |
| 1897. | / | / | / | / | / | / | / | / | / | / | / | / | / |
| Months. | | | | | | | | | | | | | |
| Jan. .. | 11·4 | 7·9 | 8·0 | 8·2 | 8·4 | 8·3 | 8·2 | 8·2 | 8·0 | 7·8 | 7·8 | 8·9 | 10·2 |
| Feb. .. | 11·6 | 8·3 | 8·6 | 8·6 | 9·0 | 8·9 | 8·8 | 8·4 | 8·0 | 8·0 | 7·8 | 7·8 | 10·1 |
| March. . | 11·6 | 6·8 | 6·9 | 7·2 | 7·1 | 7·0 | 6·8 | 6·9 | 6·1 | 4·7 | 4·7 | 6·2 | 8·7 |
| Oct. .. | 8·9 | 3·9 | 3·8 | 3·9 | 4·2 | 3·9 | 3·7 | 3·3 | 2·5 | 1·9 | 2·1 | 3·6 | 6·6 |
| Nov. .. | 7·2 | 3·0 | 3·2 | 3·7 | 3·9 | 4·3 | 3·8 | 3·7 | 3·7 | 3·6 | 3·6 | 4·5 | 5·9 |
| Dec. .. | 4·7 | 2·4 | 2·8 | 3·3 | 3·3 | 3·3 | 3·4 | 3·2 | 3·1 | 3·1 | 2·9 | 3·3 | 3·8 |
| Means | 9·2 | 5·4 | 5·6 | 5·8 | 6·0 | 6·0 | 5·8 | 5·6 | 5·2 | 4·9 | 4·8 | 5·7 | 7·6 |
| Summer. | | | | | | | | | | | | | |
| | / | / | / | / | / | / | / | / | / | / | / | / | / |
| April.. | 13·3 | 7·6 | 7·4 | 7·5 | 7·2 | 6·9 | 7·0 | 6·1 | 4·8 | 3·6 | 3·8 | 5·4 | 8·1 |
| May .. | 12·3 | 7·6 | 7·4 | 7·1 | 6·8 | 6·4 | 5·5 | 4·5 | 3·5 | 3·0 | 4·2 | 6·3 | 9·5 |
| June .. | 10·4 | 5·9 | 5·9 | 5·5 | 5·2 | 4·7 | 3·1 | 2·3 | 2·3 | 2·4 | 3·4 | 6·0 | 8·0 |
| July .. | 9·8 | 5·1 | 4·8 | 4·7 | 4·2 | 3·5 | 2·3 | 1·3 | 1·8 | 2·2 | 2·8 | 4·9 | 7·7 |
| Aug. .. | 9·8 | 4·2 | 4·3 | 4·3 | 4·1 | 3·8 | 3·0 | 2·2 | 1·6 | 2·0 | 2·9 | 5·1 | 7·7 |
| Sept. . | 9·5 | 3·4 | 3·2 | 3·3 | 3·2 | 2·7 | 3·6 | 3·2 | 2·7 | 2·2 | 3·1 | 4·5 | 6·5 |
| Means | 10·8 | 5·6 | 5·5 | 5·4 | 5·1 | 4·7 | 4·1 | 3·3 | 2·8 | 2·6 | 3·4 | 5·4 | 7·9 |

Table II.—Diurnal Inequality of the

| Hours | Mid. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Summer Means. | | | | | | | | | | | | |
| | -0·7 | -0·8 | -0·9 | -1·2 | -1·7 | -2·3 | -3·1 | -3·6 | -3·8 | -3·0 | -1·0 | +1·6 |
| Winter Means. | | | | | | | | | | | | |
| | -1·0 | -0·8 | -0·6 | -0·4 | -0·4 | -0·6 | -0·8 | -1·2 | -1·5 | -1·6 | -0·7 | +1·2 |
| Annual Means. | | | | | | | | | | | | |
| | -0·9 | -0·8 | -0·8 | -0·8 | -1·1 | -1·4 | -1·9 | -2·4 | -2·7 | -2·3 | -0·8 | +1·4 |

NOTE.—When the sign is + the magnet

selected quiet Days in 1897. (The Mean for the Year = $17^{\circ} 6' 4''$ West.)

| Noon. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | Mid. | Succeeding noon. |
|---------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|------|------------------|
| Winter. | | | | | | | | | | | | | |
| ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' |
| 11.1 | 11.5 | 10.2 | 9.4 | 9.5 | 9.5 | 9.0 | 8.5 | 8.1 | 7.9 | 7.6 | 7.9 | 8.0 | 11.8 |
| 11.4 | 12.0 | 11.9 | 11.3 | 10.2 | 10.0 | 9.6 | 9.5 | 9.0 | 8.5 | 8.2 | 8.0 | 8.1 | 12.2 |
| 12.0 | 13.6 | 13.9 | 12.5 | 10.7 | 8.9 | 8.3 | 7.7 | 7.8 | 7.9 | 7.6 | 7.1 | 7.0 | 12.0 |
| 7.9 | 8.1 | 7.7 | 6.5 | 5.2 | 4.9 | 4.8 | 4.2 | 4.1 | 3.8 | 3.4 | 3.7 | 3.6 | 8.5 |
| 6.8 | 7.2 | 6.3 | 5.6 | 5.4 | 5.3 | 4.6 | 4.3 | 4.0 | 3.2 | 2.7 | 2.8 | 2.8 | 7.6 |
| 4.5 | 4.6 | 3.8 | 3.8 | 3.7 | 3.3 | 3.0 | 2.8 | 2.6 | 2.5 | 2.2 | 2.5 | 2.5 | 4.6 |
| 9.0 | 9.5 | 9.0 | 8.2 | 7.5 | 7.0 | 6.6 | 6.2 | 5.9 | 5.6 | 5.3 | 5.3 | 5.3 | 9.5 |
| Summer. | | | | | | | | | | | | | |
| ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' |
| 11.6 | 13.7 | 13.5 | 12.0 | 10.5 | 9.1 | 8.1 | 7.8 | 8.1 | 8.2 | 8.1 | 7.9 | 7.5 | 12.5 |
| 12.1 | 12.5 | 11.9 | 10.0 | 8.6 | 7.7 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.1 | 7.1 | 11.9 |
| 9.8 | 10.5 | 10.5 | 9.9 | 8.7 | 7.8 | 7.4 | 7.0 | 6.8 | 6.8 | 6.6 | 5.8 | 5.5 | 10.9 |
| 9.7 | 10.6 | 10.4 | 9.7 | 8.1 | 6.7 | 5.6 | 6.0 | 5.9 | 5.6 | 5.8 | 5.3 | 5.1 | 10.4 |
| 10.3 | 11.5 | 11.2 | 9.6 | 7.7 | 6.2 | 5.2 | 4.9 | 5.0 | 5.1 | 4.9 | 4.8 | 4.6 | 10.4 |
| 8.3 | 9.1 | 8.9 | 8.2 | 7.0 | 6.4 | 6.4 | 5.7 | 4.9 | 4.7 | 4.4 | 4.4 | 3.8 | 9.1 |
| 10.3 | 11.3 | 11.1 | 9.9 | 8.4 | 7.3 | 6.7 | 6.5 | 6.4 | 6.3 | 6.2 | 5.9 | 5.6 | 10.9 |

Declination as deduced from Table I.

| Noon | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | Mid. |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Summer Means. | | | | | | | | | | | | |
| ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' |
| +4.0 | +5.0 | +4.7 | +3.6 | +2.1 | +1.0 | +0.4 | +0.1 | 0.0 | 0.0 | -0.1 | -0.5 | -0.7 |
| Winter Means. | | | | | | | | | | | | |
| ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' |
| +2.6 | +3.1 | +2.6 | +1.8 | +1.1 | +0.6 | +0.2 | -0.2 | -0.5 | -0.8 | -1.1 | -1.1 | -1.1 |
| Annual Means. | | | | | | | | | | | | |
| ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' |
| +3.3 | +4.1 | +3.7 | +2.7 | +1.6 | +0.8 | +0.3 | 0.0 | -0.2 | -0.4 | -0.6 | -0.8 | -0.9 |

points to the west of its mean position.

Table III—Hourly Means of the Horizontal Force in C.G.S. units (corrected
(The Mean for the

| Hours | Preceding noon. | Mid. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
|-------------------|-----------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 18000 + Winter. | | | | | | | | | | | | | |
| 1897. Months. | | | | | | | | | | | | | |
| Jan. ... | 320 | 326 | 327 | 327 | 329 | 331 | 332 | 333 | 333 | 328 | 324 | 319 | 317 |
| Feb. ... | 324 | 335 | 335 | 334 | 334 | 335 | 336 | 335 | 336 | 334 | 330 | 326 | 325 |
| March.. | 319 | 337 | 337 | 337 | 337 | 338 | 339 | 340 | 340 | 335 | 326 | 320 | 319 |
| Oct. ... | 332 | 350 | 348 | 347 | 347 | 349 | 349 | 349 | 346 | 340 | 333 | 328 | 330 |
| Nov. ... | 339 | 345 | 345 | 344 | 347 | 349 | 351 | 351 | 349 | 348 | 343 | 337 | 338 |
| Dec. ... | 346 | 347 | 348 | 347 | 351 | 353 | 355 | 355 | 354 | 355 | 354 | 349 | 346 |
| Means.. | 330 | 340 | 340 | 339 | 341 | 342 | 344 | 344 | 343 | 340 | 335 | 330 | 329 |
| Summer. | | | | | | | | | | | | | |
| April... | 300 | 331 | 331 | 331 | 329 | 331 | 333 | 336 | 331 | 325 | 316 | 307 | 302 |
| May ... | 331 | 345 | 345 | 344 | 345 | 344 | 343 | 340 | 334 | 328 | 324 | 322 | 325 |
| June ... | 332 | 350 | 349 | 348 | 348 | 348 | 345 | 341 | 337 | 333 | 329 | 331 | 331 |
| July ... | 329 | 354 | 354 | 352 | 351 | 351 | 349 | 346 | 341 | 334 | 329 | 323 | 325 |
| Aug. ... | 331 | 348 | 348 | 347 | 347 | 346 | 345 | 342 | 338 | 330 | 327 | 327 | 330 |
| Sept. ... | 341 | 358 | 358 | 358 | 357 | 357 | 357 | 356 | 353 | 346 | 339 | 336 | 340 |
| Means.. | 327 | 348 | 347 | 347 | 346 | 346 | 345 | 343 | 339 | 333 | 327 | 324 | 325 |

Table IV.—Diurnal Inequality of the

| Hours | Mid. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
|---------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Summer Means. | | | | | | | | | | | | |
| | + '00004 | + '00003 | + '00003 | + '00002 | + '00002 | + '00001 | - '00001 | - '00005 | - '00011 | - '00017 | - '00020 | - '00019 |
| Winter Means. | | | | | | | | | | | | |
| | '00000 | '00000 | - '00001 | + '00001 | + '00002 | + '00004 | + '00004 | + '00003 | '00000 | - '00005 | - '00010 | - '00011 |
| Annual Means. | | | | | | | | | | | | |
| | + '00002 | + '00002 | + '00001 | + '00001 | + '00002 | + '00002 | + '00002 | - '00001 | - '00006 | - '00011 | - '00015 | - '00015 |

NOTE.—When the sign is + the

for Temperature) as determined from the selected quiet Days in 1897.
Year = 0.18342.)

| Noon. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | Mid. | Succeeding noon. |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------------------|
| Winter. | | | | | | | | | | | | | |
| 319 | 325 | 329 | 328 | 328 | 330 | 331 | 332 | 331 | 331 | 328 | 328 | 327 | 321 |
| 329 | 333 | 333 | 333 | 333 | 334 | 334 | 335 | 335 | 337 | 338 | 338 | 337 | 321 |
| 323 | 327 | 329 | 331 | 334 | 337 | 337 | 341 | 343 | 343 | 341 | 342 | 340 | 323 |
| 337 | 344 | 346 | 347 | 346 | 348 | 350 | 354 | 353 | 354 | 352 | 354 | 353 | 339 |
| 340 | 343 | 344 | 342 | 344 | 349 | 350 | 349 | 349 | 348 | 348 | 350 | 348 | 343 |
| 350 | 354 | 354 | 354 | 353 | 354 | 354 | 354 | 354 | 354 | 353 | 353 | 352 | 351 |
| 333 | 338 | 339 | 339 | 340 | 342 | 343 | 344 | 344 | 344 | 343 | 344 | 343 | 333 |
| Summer. | | | | | | | | | | | | | |
| 307 | 312 | 320 | 327 | 333 | 337 | 338 | 342 | 340 | 340 | 341 | 342 | 341 | 310 |
| 330 | 340 | 343 | 348 | 348 | 352 | 355 | 357 | 355 | 354 | 350 | 353 | 350 | 331 |
| 338 | 341 | 341 | 344 | 346 | 351 | 354 | 360 | 359 | 359 | 357 | 356 | 353 | 340 |
| 332 | 340 | 346 | 354 | 354 | 359 | 361 | 362 | 363 | 363 | 360 | 359 | 356 | 339 |
| 334 | 336 | 340 | 344 | 348 | 352 | 351 | 357 | 355 | 355 | 352 | 351 | 351 | 342 |
| 347 | 351 | 355 | 357 | 357 | 358 | 359 | 363 | 364 | 363 | 364 | 362 | 362 | 342 |
| 331 | 337 | 341 | 346 | 348 | 351 | 353 | 357 | 356 | 356 | 355 | 354 | 352 | 334 |

Horizontal Force as deduced from Table III.

| Noon. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | Mid. |
|---------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Summer Means. | | | | | | | | | | | | |
| - '00013 | - '00007 | - '00003 | + '00002 | + '00004 | + '00007 | + '00009 | + '00013 | + '00012 | + '00012 | + '00011 | + '00010 | + '00008 |
| Winter Means. | | | | | | | | | | | | |
| - '00007 | - '00002 | - '00001 | - '00001 | - '00000 | + '00002 | + '00003 | + '00004 | + '00004 | + '00004 | + '00003 | + '00004 | + '00003 |
| Annual Means. | | | | | | | | | | | | |
| - '00010 | - '00005 | - '00002 | - '00000 | + '00002 | + '00005 | + '00006 | + '00008 | + '00008 | + '00008 | + '00007 | + '00007 | + '00006 |

reading is above the mean.

Table V.—Hourly Means of the Vertical Force in C.G.S. units (corrected
(The Mean for the

| Hours | Preceding noon. | Mid. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
|-------------------|-----------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0.43000 + Winter. | | | | | | | | | | | | | |
| 1897. Months. | | | | | | | | | | | | | |
| Jan. ... | 896 | 911 | 912 | 912 | 912 | 913 | 912 | 912 | 913 | 913 | 911 | 909 | 909 |
| Feb. ... | 928 | 925 | 925 | 926 | 926 | 926 | 926 | 925 | 925 | 924 | 923 | 920 | 918 |
| March .. | 937 | 948 | 948 | 947 | 947 | 946 | 946 | 946 | 946 | 946 | 943 | 938 | 933 |
| Oct. ... | 863 | 882 | 882 | 882 | 882 | 881 | 880 | 881 | 882 | 882 | 879 | 875 | 873 |
| Nov. ... | 883 | 887 | 886 | 886 | 885 | 885 | 886 | 885 | 885 | 885 | 885 | 884 | 883 |
| Dec. ... | 892 | 886 | 886 | 887 | 888 | 888 | 889 | 888 | 888 | 888 | 887 | 887 | 886 |
| Means | 902 | 906 | 906 | 907 | 907 | 906 | 906 | 906 | 906 | 906 | 905 | 902 | 900 |
| Summer. | | | | | | | | | | | | | |
| April ... | 879 | 897 | 897 | 893 | 894 | 893 | 895 | 895 | 896 | 895 | 889 | 883 | 876 |
| May ... | 891 | 917 | 917 | 915 | 915 | 914 | 915 | 914 | 912 | 909 | 906 | 897 | 890 |
| June ... | 900 | 920 | 919 | 919 | 920 | 920 | 922 | 922 | 921 | 918 | 914 | 911 | 907 |
| July ... | 891 | 908 | 906 | 906 | 905 | 905 | 907 | 905 | 905 | 902 | 899 | 898 | 893 |
| Aug. ... | 896 | 914 | 915 | 915 | 914 | 914 | 916 | 917 | 916 | 914 | 907 | 901 | 898 |
| Sept. ... | 893 | 904 | 904 | 904 | 903 | 903 | 903 | 903 | 903 | 899 | 896 | 894 | 892 |
| Means | 892 | 910 | 910 | 909 | 908 | 908 | 910 | 909 | 909 | 906 | 902 | 897 | 893 |

Table VI.—Diurnal Inequality of the

| Hours | Mid. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
|---------------|----------|----------|----------|----------|----------|----------|----------|----------|--------|----------|----------|----------|
| Summer Means. | | | | | | | | | | | | |
| | + .00004 | + .00003 | + .00002 | + .00002 | + .00002 | + .00003 | + .00003 | + .00002 | .00000 | — .00005 | — .00009 | — .00014 |
| Winter Means. | | | | | | | | | | | | |
| | .00000 | .00000 | .00000 | .00000 | .00000 | .00000 | .00000 | .00000 | .00000 | — .00002 | — .00004 | — .00006 |
| Annual Means. | | | | | | | | | | | | |
| | + .00002 | + .00002 | + .00001 | + .00001 | + .00001 | + .00002 | + .00001 | + .00001 | .00000 | — .00003 | — .00007 | — .00010 |

NOTE. —When the sign is + the

for Temperature), as determined from the selected quiet Days in 1897.
Year = 0.43906.)

| Noon. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | Mid. | Succeeding noon. |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------------------|
| Winter. | | | | | | | | | | | | | |
| 910 | 911 | 916 | 916 | 915 | 915 | 915 | 915 | 914 | 914 | 913 | 913 | 912 | 918 |
| 921 | 923 | 929 | 932 | 933 | 932 | 931 | 929 | 928 | 926 | 925 | 923 | 924 | 912 |
| 933 | 933 | 939 | 946 | 950 | 952 | 951 | 951 | 950 | 950 | 949 | 949 | 949 | 926 |
| 875 | 878 | 880 | 883 | 884 | 883 | 883 | 883 | 883 | 883 | 882 | 880 | 879 | 875 |
| 886 | 887 | 890 | 892 | 892 | 891 | 889 | 889 | 889 | 890 | 888 | 888 | 888 | 879 |
| 886 | 887 | 888 | 888 | 888 | 888 | 888 | 887 | 887 | 886 | 887 | 887 | 887 | 875 |
| 902 | 903 | 907 | 909 | 910 | 910 | 909 | 909 | 908 | 908 | 907 | 906 | 906 | 898 |
| Summer. | | | | | | | | | | | | | |
| 874 | 877 | 883 | 890 | 893 | 895 | 895 | 897 | 896 | 895 | 894 | 895 | 894 | 872 |
| 892 | 897 | 904 | 910 | 912 | 917 | 918 | 919 | 917 | 917 | 917 | 917 | 914 | 888 |
| 908 | 911 | 913 | 918 | 922 | 923 | 924 | 925 | 927 | 926 | 924 | 924 | 922 | 903 |
| 894 | 895 | 901 | 907 | 913 | 915 | 916 | 915 | 914 | 913 | 911 | 910 | 908 | 887 |
| 895 | 898 | 903 | 911 | 914 | 915 | 917 | 915 | 914 | 913 | 911 | 910 | 910 | 896 |
| 892 | 894 | 896 | 901 | 905 | 904 | 905 | 905 | 905 | 905 | 905 | 904 | 904 | 897 |
| 892 | 895 | 900 | 906 | 910 | 911 | 912 | 913 | 912 | 911 | 910 | 910 | 909 | 891 |

Vertical Force as deduced from Table V.

| Noon | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | Mid. |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Summer Means. | | | | | | | | | | | | |
| -00014 | -00011 | -00006 | 00000 | +00003 | +00005 | +00006 | +00006 | +00006 | +00005 | +00004 | +00004 | +00002 |
| Winter Means. | | | | | | | | | | | | |
| -00005 | -00003 | 00000 | +00003 | +00004 | +00004 | +00003 | +00003 | +00002 | +00002 | +00001 | 00000 | 00000 |
| Annual Means. | | | | | | | | | | | | |
| -00009 | -00007 | -00003 | +00001 | +00003 | +00004 | +00004 | +00004 | +00004 | +00003 | +00002 | +00002 | +00001 |

reading is above the mean.

Table VII.—Hourly Means of the Inclination, calculated from the Horizontal

| Hours | Preceding noon. | Mid. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
|------------------|-----------------|------|------|------|------|------|------|------|------|------|------|------|------|
| 67° + Winter. | | | | | | | | | | | | | |
| 1897. Months. | / | / | / | / | / | / | / | / | / | / | / | / | / |
| Jan..... | 20·8 | 20·8 | 20·8 | 20·8 | 20·6 | 20·5 | 20·4 | 20·4 | 20·4 | 20·7 | 21·0 | 21·2 | 21·4 |
| Feb.... | 21·4 | 20·6 | 20·6 | 20·7 | 20·7 | 20·6 | 20·6 | 20·6 | 20·6 | 20·7 | 20·9 | 21·1 | 21·1 |
| March... | 22·0 | 21·1 | 21·1 | 21·1 | 21·1 | 21·0 | 20·9 | 20·9 | 20·9 | 21·2 | 21·7 | 22·0 | 21·9 |
| Oct. | 19·2 | 18·4 | 18·6 | 18·6 | 18·6 | 18·5 | 18·4 | 18·5 | 18·7 | 19·1 | 19·5 | 19·7 | 19·5 |
| Nov. ... | 19·3 | 18·9 | 18·9 | 18·9 | 18·7 | 18·6 | 18·5 | 18·4 | 18·6 | 18·6 | 19·0 | 19·3 | 19·2 |
| Dec..... | 19·0 | 18·7 | 18·7 | 18·8 | 18·5 | 18·4 | 18·3 | 18·3 | 18·3 | 18·3 | 18·3 | 18·6 | 18·8 |
| Means.. | 20·3 | 19·8 | 19·8 | 19·8 | 19·7 | 19·6 | 19·5 | 19·5 | 19·6 | 19·8 | 20·1 | 20·3 | 20·3 |
| Summer. | | | | | | | | | | | | | |
| | / | / | / | / | / | / | / | / | / | / | / | / | / |
| April... | 21·7 | 20·1 | 20·1 | 20·0 | 20·1 | 20·0 | 19·9 | 19·7 | 20·1 | 20·4 | 20·9 | 21·3 | 21·5 |
| May.... | 19·9 | 19·8 | 19·8 | 19·7 | 19·7 | 19·7 | 19·8 | 20·0 | 20·3 | 20·6 | 20·8 | 20·7 | 20·3 |
| June ... | 20·1 | 19·5 | 19·5 | 19·5 | 19·6 | 19·6 | 19·9 | 20·1 | 20·4 | 20·5 | 20·7 | 20·5 | 20·4 |
| July.... | 20·1 | 18·9 | 18·8 | 19·0 | 19·0 | 19·0 | 19·2 | 19·3 | 19·7 | 20·0 | 20·3 | 20·6 | 20·4 |
| Aug. ... | 20·1 | 19·4 | 19·5 | 19·5 | 19·5 | 19·6 | 19·7 | 19·9 | 20·2 | 20·6 | 20·7 | 20·5 | 20·2 |
| Sept.... | 19·3 | 18·5 | 18·5 | 18·5 | 18·5 | 18·5 | 18·5 | 18·6 | 18·8 | 19·2 | 19·5 | 19·7 | 19·4 |
| Means.. | 20·2 | 19·4 | 19·4 | 19·4 | 19·4 | 19·4 | 19·5 | 19·6 | 19·9 | 20·2 | 20·5 | 20·6 | 20·4 |

Table VIII.—Diurnal Inequality of the

| Hours | Mid. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Summer Means. | | | | | | | | | | | | |
| | -0·1 | -0·1 | -0·1 | -0·1 | -0·1 | 0·0 | +0·1 | +0·4 | +0·7 | +1·0 | +1·1 | +0·9 |
| Winter Means. | | | | | | | | | | | | |
| | 0·0 | 0·0 | +0·1 | -0·1 | -0·2 | -0·2 | -0·2 | -0·2 | 0·0 | +0·3 | +0·6 | +0·6 |
| Annual Means. | | | | | | | | | | | | |
| | -0·1 | -0·1 | 0·0 | -0·1 | -0·2 | -0·1 | -0·1 | +0·1 | +0·4 | +0·7 | +0·8 | +0·7 |

NOTE.—When the sign is +

and Vertical Forces (Tables III and V). (The Mean for the Year = $67^{\circ} 19' 6''$.)

| Noon. | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | Mid. | Succeeding noon. |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|------------------|
| Winter. | | | | | | | | | | | | | |
| ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' |
| 21.3 | 20.9 | 20.8 | 20.8 | 20.8 | 20.7 | 20.6 | 20.5 | 20.6 | 20.6 | 20.7 | 20.7 | 20.8 | 21.3 |
| 20.9 | 20.7 | 20.9 | 20.9 | 21.0 | 20.9 | 20.8 | 20.7 | 20.7 | 20.5 | 20.4 | 20.4 | 20.5 | 21.2 |
| 21.6 | 21.4 | 21.4 | 21.5 | 21.4 | 21.2 | 21.2 | 21.0 | 20.8 | 20.8 | 20.9 | 20.8 | 21.0 | 21.5 |
| 19.1 | 18.7 | 18.6 | 18.6 | 18.7 | 18.6 | 18.4 | 18.2 | 18.2 | 18.2 | 18.3 | 18.1 | 18.1 | 19.0 |
| 19.2 | 19.0 | 19.0 | 19.2 | 19.1 | 18.7 | 18.6 | 18.7 | 18.7 | 18.8 | 18.7 | 18.6 | 18.7 | 18.8 |
| 18.5 | 18.3 | 18.3 | 18.3 | 18.3 | 18.3 | 18.3 | 18.3 | 18.3 | 18.3 | 18.4 | 18.4 | 18.4 | 18.2 |
| 20.1 | 19.8 | 19.8 | 19.9 | 19.9 | 19.7 | 19.6 | 19.6 | 19.6 | 19.5 | 19.6 | 19.5 | 19.6 | 20.0 |
| Summer. | | | | | | | | | | | | | |
| ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' |
| 21.1 | 20.8 | 20.4 | 20.2 | 19.9 | 19.6 | 19.6 | 19.4 | 19.5 | 19.4 | 19.3 | 19.3 | 19.3 | 20.8 |
| 20.0 | 19.5 | 19.5 | 19.3 | 19.4 | 19.3 | 19.1 | 19.0 | 19.1 | 19.1 | 19.4 | 19.2 | 19.3 | 19.8 |
| 19.9 | 19.8 | 19.9 | 19.8 | 19.8 | 19.5 | 19.3 | 19.0 | 19.1 | 19.1 | 19.1 | 19.1 | 19.3 | 19.7 |
| 19.9 | 19.4 | 19.2 | 18.9 | 19.0 | 18.7 | 18.6 | 18.5 | 18.5 | 18.4 | 18.5 | 18.6 | 18.7 | 19.3 |
| 19.8 | 19.8 | 19.7 | 19.6 | 19.4 | 19.2 | 19.3 | 18.9 | 19.0 | 19.0 | 19.1 | 19.1 | 19.1 | 19.3 |
| 18.9 | 18.7 | 18.5 | 18.5 | 18.6 | 18.5 | 18.5 | 18.2 | 18.2 | 18.2 | 18.1 | 18.2 | 18.2 | 19.4 |
| 19.9 | 19.7 | 19.5 | 19.4 | 19.4 | 19.1 | 19.1 | 18.8 | 18.9 | 18.9 | 18.9 | 18.9 | 19.0 | 19.7 |

Inclination as deduced from Table VII.

| Noon | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | Mid. |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Summer Means. | | | | | | | | | | | | |
| +0.4 | +0.2 | 0.0 | -0.1 | -0.1 | -0.4 | -0.4 | -0.7 | -0.6 | -0.6 | -0.6 | -0.6 | -0.5 |
| Winter Means. | | | | | | | | | | | | |
| +0.3 | +0.1 | +0.1 | +0.1 | +0.1 | 0.0 | -0.1 | -0.2 | -0.2 | -0.2 | -0.2 | -0.3 | -0.2 |
| Annual Means. | | | | | | | | | | | | |
| +0.4 | +0.1 | +0.1 | 0.0 | 0.0 | -0.2 | -0.3 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.3 |

the reading is above the mean.

APPENDIX IA.

MEAN VALUES, for the years specified, of the Magnetic Elements at Observatories whose Publications are received at Kew Observatory.

| Place. | Latitude. | Longitude. | Year. | Declination. | Inclination. | Horizontal Force. C. G. S. Units. | Vertical Force. C. G. S. Units. |
|--------------------------------|-----------|------------|-------|--------------|-----------------------------|--------------------------------------|------------------------------------|
| Pawłowski | 59 41 N. | 30 29 E. | 1895 | 0 15.7 E. | 70 42.4 N. | ·16478 | ·47072 |
| Katharinenburg | 56 49 N. | 60 38 E. | 1895 | 9 43.3 E. | 70 39.8 N. | ·17808 | ·50750 |
| Kasan | 55 47 N. | 49 8 E. | 1892 | 7 30.8 E. | 68 36.2 N. | ·18551 | ·47345 |
| Copenhagen ... | 55 41 N. | 12 34 E. | 1894 | 10 41.3 W. | — | ·17373 | — |
| Stonyhurst | 53 51 N. | 2 28 W. | 1896 | 18 31.2 W. | 68 57.7 N. | ·17202 | ·44726 |
| Hamburg | 53 34 N. | 10 3 E. | 1896 | 11 36.7 W. | 67 38.8 N. | ·18061 | ·43921 |
| Wilhelmshaven | 53 32 N. | 8 9 E. | 1896 | 12 46.8 W. | 67 51.7 N. | ·17994 | ·44229 |
| Potsdam | 52 23 N. | 13 4 E. | 1896 | 10 14.3 W. | 66 38.4 N. | ·18747 | ·43404 |
| Irkutsk | 52 16 N. | 104 16 E. | 1895 | 2 6.6 E. | 70 11.1 N. | ·20132 | ·55872 |
| Utrecht | 52 5 N. | 5 11 E. | 1895 | 14 15.5 W. | 67 7.4 N. | ·18435 | ·43691 |
| Kew | 51 28 N. | 0 19 W. | 1897 | 17 6.4 W. | 67 19.6 N. | ·18342 | ·43906 |
| Greenwich*.... | 51 28 N. | 0 0 | 1896 | 16 56.5 W. | { 67 10.0 N. 67 9.3 N. } | ·18367 | { ·43622 ·43598 } |
| Ucele (Brussels) | 50 48 N. | 4 21 E. | 1896 | 14 32.5 W. | 66 23.5 N. | ·18925 | ·43300 |
| Falmouth | 50 9 N. | 5 5 W. | 1896 | 18 47.5 W. | 67 5.0 N. | ·18554 | ·43888 |
| Prague | 50 5 N. | 14 25 E. | 1896 | 9 25.5 W. | — | ·19858 | — |
| Parc St. Maur (Paris) | 48 49 N. | 2 29 E. | 1895 | 15 9.4 W. | 65 2.9 N. | ·19664 | ·42263 |
| Vienna | 48 15 N. | 16 21 E. | 1894 | 8 43.6 W. | 63 12.1 N. | ·20740 | ·41061 |
| O'Gyalla (Pesth) | 47 53 N. | 18 12 E. | 1895 | 7 52.5 W. | — | ·21080 | — |
| Odessa† | 46 26 N. | 30 46 E. | 1896 | 4 49.6 W. | 62 33.9 N. | ·22038 | ·42452 |
| Pola | 44 52 N. | 13 51 E. | 1896 | 9 41.7 W. | 60 31.8 N. | ·22061 | ·39042 |
| Nice | 43 43 N. | 7 16 E. | 1897 | 12 12.8 W. | 60 15.4 N. | ·22318 | ·39059 |
| Toronto† | 43 40 N. | 79 30 W. | 1896 | 4 50.1 W. | — | ·16645 | — |
| Perpignan | 42 42 N. | 2 53 E. | 1895 | 14 0.4 W. | 60 8.5 N. | ·22363 | ·38958 |
| Rome | 41 54 N. | 12 27 E. | 1891 | 10 45.1 W. | 58 4.6 N. | ·2324 | ·3730 |
| Tiflis | 41 43 N. | 44 48 E. | 1895 | 1 48.1 E. | 55 47.0 N. | ·25681 | ·37764 |
| Capodimonte (Naples) | 40 52 N. | 14 15 E. | 1893 | 9 47.0 W. | 56 42.1 N. | — | — |
| Madrid | 40 25 N. | 3 40 W. | 1895 | 16 6.6 W. | — | — | — |
| Coimbra | 40 12 N. | 8 25 W. | 1895 | 17 42.0 W. | 59 43.6 N. | ·22581 | ·38685 |
| Washington .. | 38 55 N. | 77 4 W. | 1894 | 3 39.9 W. | 70 34.3 N. | ·19979 | ·56646 |
| Lisbon | 38 43 N. | 9 9 W. | 1895 | 17 39.1 W. | 58 15.7 N. | ·23344 | ·37731 |
| Zi-ka-wei | 31 12 N. | 121 26 E. | 1895 | 2 15.6 W. | 45 55.1 N. | ·32679 | ·33743 |
| Hong Kong | 22 18 N. | 114 10 E. | 1896 | 0 26.0 E. | 31 41.3 N. | ·36461 | ·22509 |
| Colaba (Bombay) | 18 54 N. | 72 49 E. | 1895 | 0 36.9 E. | 20 48.5 N. | ·37444 | ·14230 |
| Manila | 14 35 N. | 120 58 E. | 1896 | 0 51.0 E. | 16 39.7 N. | ·37868 | ·11333 |
| Batavia | 6 11 S. | 106 49 E. | 1896 | 1 22.0 E. | 29 29.5 S. | ·36768 | ·20795 |
| Mauritius | 20 6 S. | 57 33 E. | 1895 | 9 55.1 W. | 54 37.1 S. | ·23937 | ·33706 |
| Melbourne | 37 50 S. | 144 58 E. | 1896 | 8 15.0 E. | 67 18.3 S. | ·23392 | ·55936 |

* Of the two values of the Inclination and Vertical Force, the first is based on observations with 3-inch dip needles only, the second on combined observations with needles of 3, 6, and 9 inches.

† New magnetic observatory; only four last months' results available in 1896.

‡ Determinations of Inclination and Vertical Force suspended in course of 1896, owing to disturbing action of electric tramway.

APPENDIX II.—Table I.
Mean Monthly Results of Temperature and Pressure. Kew Observatory.
1897.

| Months | Thermometer. | | | | | Barometer.* | | | | | Mean vapour-tension. | | |
|--------------|--------------|------|------|--------------------|-----------|---------------------------------|--------------------|--------|--------|-------------------|----------------------|--------------|-------|
| | Means of— | | | Absolute Extremes. | | | Absolute Extremes. | | | | | | |
| | Mean. | Max. | Min. | Max. | Date. | Min. | Date. | Mean. | Max. | Date. | | Min. | Date. |
| | | | | | | | | | | | | | |
| 1897. | | | | | d. h. | | d. h. | ins. | ins. | d. h. | ins. | d. h. | |
| Jan.... | 35.9 | 39.3 | 32.5 | 48.2 | 1 2 A.M. | 23.8 | 188 & 9 A.M. | 29.896 | 30.589 | 2 10 A.M. | 29.213 | 30 2 P.M. | |
| Feb. ... | 43.6 | 47.7 | 39.5 | 56.3 | 26 3 P.M. | 28.1 | 18 3 " | 30.113 | 30.659 | 16 11 " | 29.173 | 2 7 & 8 A.M. | |
| March.. | 45.1 | 51.2 | 39.2 | 60.9 | 23 3 " | 30.3 | 9 6 " | 29.698 | 30.161 | { 20 11 " & NOON. | 28.778 | 3 10 " | |
| April.. | 46.2 | 53.1 | 39.6 | 66.9 | 27 5 " | 28.3 | 11 7 " | 29.866 | 30.301 | 15 11 P.M. | 28.997 | 1 7 " | |
| May ... | 51.5 | 60.6 | 42.8 | 72.1 | 18 NOON. | 33.7 | 13 3 " | 29.978 | 30.437 | { 15 11 " & MIDT. | 29.343 | 27 5 P.M. | |
| June... | 61.1 | 69.6 | 52.7 | 84.0 | 24 1 P.M. | 44.6 | 10 4 " | 30.028 | 30.344 | 12 8 " | 29.447 | 18 3 " | |
| July ... | 63.6 | 72.6 | 55.0 | 80.1 | 24 3 " | 43.6 | 8 4 " | 30.021 | 30.387 | 11 8 " | 29.577 | 20 2 " | |
| Aug.... | 62.5 | 71.5 | 54.8 | 87.7 | 4 2 " | 48.0 | 13 4 " | 29.844 | 30.249 | 3 10 " | 29.501 | 8 2 " | |
| Sept.... | 55.2 | 62.0 | 48.2 | 68.3 | 29 3 " | 38.8 | 19 5 " | 30.006 | 30.531 | 13 9 " | 29.409 | 1 MIDT. | |
| Oct.... | 50.2 | 57.4 | 43.6 | 65.2 | 17 1 " | 30.0 | 7 7 " | 30.179 | 30.608 | 21 10 " | 29.446 | 15 11 P.M. | |
| Nov. ... | 45.5 | 50.1 | 39.8 | 58.7 | 13 NOON. | 28.6 | 26 7 " | 30.196 | 30.748 | 21 11 " | 29.162 | 29 4 A.M. | |
| Dec. ... | 40.7 | 45.1 | 35.6 | 55.1 | 16 " | 21.8 { 25 7 P.M. } 26 2 A.M. | | 29.957 | 30.666 | 22 10 " | 29.032 | 10 11 P.M. | |
| Yearly Means | 50.1 | 56.7 | 43.6 | .. | | .. | | 29.982 | .. | | .. | | |
| | | | | | | | | | | | | 294 | |

* Reduced to 32° at M.S.L.

This table has been compiled at the Meteorological Office from values intended for publication in the volume of "Hourly Means" for 1897.

Meteorological Observations.—Table II.
Kew Observatory.

| Months. | Mean amount of cloud (0=clear, 10=over-cast). | Rainfall.* | | | Weather. Number of days on which were registered | | | | | | Wind.† Number of days on which it was | | | | | | | | | | |
|-------------------|---|------------|------------|-------|--|-------|-------|--------------------|------------|-----------------|---------------------------------------|----|-------|----|-------|----|-------|----|-------|---|----|
| | | Total. | Maxi- mum. | Date. | Rain. ‡ | Snow. | Hail. | Thun- der- storms. | Clear sky. | Over- cast sky. | Calm. | N. | N. E. | E. | S. E. | S. | S. W. | W. | N. W. | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 1897. | | ins. | ins. | 8 | 18 | 8 | .. | .. | 3 | 19 | .. | 9 | 5 | 4 | 2 | 3 | .. | 5 | 3 | 4 | 5 |
| January..... | 7.5 | 1.930 | 0.645 | 8 | 18 | 8 | .. | .. | 3 | 19 | .. | 9 | 5 | 4 | 2 | 3 | .. | 5 | 3 | 4 | 5 |
| February..... | 8.2 | 2.185 | 0.725 | 4 | 13 | .. | .. | .. | 4 | 20 | .. | 2 | 2 | 4 | 2 | 2 | 9 | 4 | 3 | 5 | 1 |
| March..... | 7.4 | 3.610 | 0.540 | 2 | 19 | 2 | 3 | 1 | 2 | 19 | 5 | 2 | 3 | .. | 1 | 3 | 10 | 10 | 2 | 1 | 2 |
| April..... | 7.2 | 1.315 | 0.285 | 27 | 13 | .. | .. | 1 | 1 | 14 | .. | 4 | 6 | .. | 2 | 5 | 5 | 2 | 3 | 2 | 3 |
| May..... | 5.7 | 1.135 | 0.280 | 30 | 12 | .. | .. | 1 | 8 | 8 | .. | 5 | 6 | 4 | 1 | 3 | 8 | 4 | 4 | 4 | 1 |
| June..... | 6.7 | 2.535 | 0.815 | 8 | 12 | .. | .. | 2 | 4 | 13 | .. | 3 | 5 | .. | 1 | 6 | 4 | 3 | 4 | 4 | 5 |
| July..... | 5.3 | 0.935 | 0.625 | 19 | 5 | .. | .. | 2 | 8 | 6 | .. | 4 | 4 | 4 | .. | 1 | 8 | 7 | 4 | 4 | 6 |
| August..... | 6.3 | 2.620 | 0.640 | 31 | 17 | .. | .. | 1 | 4 | 10 | .. | .. | 3 | 2 | 3 | 4 | 16 | 5 | .. | 5 | 2 |
| September.... | 7.0 | 1.955 | 0.415 | 1 | 11 | .. | .. | 1 | 2 | 15 | .. | 3 | 5 | 2 | 2 | 6 | 7 | 7 | 4 | 4 | 7 |
| October..... | 5.9 | 0.580 | 0.140 | 25 | 8 | .. | .. | .. | 7 | 11 | .. | 3 | 5 | 2 | 3 | 5 | 4 | 1 | 2 | 2 | 9 |
| November.... | 7.3 | 0.895 | 0.320 | 27 | 9 | .. | .. | .. | 2 | 19 | 1 | 2 | 7 | 7 | .. | 2 | 9 | 1 | 1 | 2 | 8 |
| December... | 6.2 | 2.140 | 0.510 | 7 | 18 | .. | .. | 1 | 5 | 9 | 3 | 3 | 1 | 6 | 1 | 5 | 10 | 4 | 1 | 1 | 6 |
| Totals and means. | 6.7 | 21.835 | | | 155 | 10 | 3 | 10 | 50 | 163 | 9 | 40 | 52 | 41 | 14 | 41 | 89 | 53 | 35 | | 56 |

* Measured at 10 A.M. daily by gauge 1.75 feet above ground.

† As registered by the anemograph.

‡ The number of rainy days are those on which 0.01 inch rain or melted snow was recorded.

Meteorological Observations.—Table III.
Kew Observatory.

| Months. | Bright Sunshine. | | | | Maximum temperature in sun's rays. (Black bulb <i>in vacuo</i> .) | | | Minimum temperature on the ground. | | | Horizontal movement of the air.* | | |
|------------------------|---------------------------------|---------------------------------------|------------------------|-------|--|----------|---------|------------------------------------|---------|---------|----------------------------------|---------------------------|------------|
| | Total number of hours recorded. | Mean percentage of possible sunshine. | Greatest daily record. | Date. | Mean. | Highest. | Date. † | Mean. | Lowest. | Date. ‡ | Average hourly velocity. | Greatest hourly velocity. | Date. |
| | | | | | | | | | | | | | |
| 1897. | h. m. | | h. m. | | deg. | deg. | | deg. | deg. | | miles. | miles. | |
| January | 36 42 | 14 | 5 24 | 26 | 59 | 94 | 25 | 29 | 18 | 18 | 11.6 | 34 | 23 |
| February | 42 12 | 15 | 8 0 | 18 | 73 | 105 | 27 | 35 | 18 | 18 | 10.3 | 32 | 25 |
| March | 123 42 | 34 | 10 24 | 19 | 98 | 118 | 23 | 32 | 16 | 30 | 14.5 | 39 | 3 |
| April | 144 6 | 34 | 12 30 | 15 | 106 | 125 | 29 | 32 | 17 | 11 | 13.1 | 34 | 23 |
| May | 260 0 | 54 | 14 54 | 22 | 119 | 131 | 31 | 36 | 25 | 13 | 11.8 | 31 | 21 |
| June | 190 30 | 38 | 15 24 | 12 | 124 | 143 | 24 | 47 | 34 | 17 | 9.5 | 28 | { 8 26 |
| July | 261 36 | 53 | 14 48 | 15 | 127 | 136 | 3 | 47 | 31 | 8 | 8.9 | 32 | { 13 14 |
| August | 220 42 | 49 | 12 54 | 4 | 129 | 141 | 5 | 47 | 37 | 13 | 10.8 | 29 | 17 |
| September | 124 36 | 33 | 10 24 | 3 | 110 | 128 | 25 | 43 | 31 | 19 | 8.8 | 33 | 1 |
| October | 99 30 | 30 | 8 12 | 3 | 95 | 118 | 16 | 37 | 24 | 7 | 8.0 | 29 | { 16 17 |
| November | 26 42 | 10 | 5 18 | 29 | 67 | 94 | 18 | 35 | 18 | 26 | 9.4 | 37 | 29 |
| December | 44 42 | 18 | 5 36 | 11 | 62 | 85 | 15 | 30 | 18 | 4 | 13.5 | 43 | 29 |
| Totals and Means | 1575 0 | 32 | .. | .. | 97 | .. | .. | 37 | .. | .. | 10.8 | .. | .. |

* As indicated by a Robinson's anemograph, 70 feet above the general surface of the ground, the original factor 3 being used.
† Read at 10 A.M., and entered to previous day.
‡ Read at 10 A.M., and entered to same day.

Table IV.

Summary of Sun-spot Observations made at the Kew Observatory.

| Months. | Days of observation. | Number of new groups enumerated. | Days apparently without spots. |
|----------------------|----------------------|----------------------------------|--------------------------------|
| 1897. | | | |
| January | 12 | 7 | — |
| February..... | 7 | 6 | — |
| March..... | 19 | 5 | 1 |
| April..... | 14 | 6 | 3 |
| May..... | 20 | 6 | 5 |
| June | 16 | 2 | 4 |
| July..... | 16 | 7 | — |
| August | 15 | 6 | — |
| September..... | 15 | 7 | — |
| October..... | 12 | 3 | 6 |
| November..... | 10 | 4 | 3 |
| December | 9 | 5 | — |
| Totals for 1897 | 165 | 64 | 22 |

APPENDIX III.—Table I.

RESULTS OF WATCH TRIALS. Performance of the 51 Watches which obtained the highest number of marks during the year.

| Watch deposited by | Number of watch. | Escapement, balance spring, &c. | Mean daily rate. | | | | | Mean variation of daily rate. \pm | Mean change of rate for 10 F. | Difference between extreme gaining and losing rates. | Marks awarded for | | | Total Marks. |
|----------------------------------|------------------|--------------------------------------|------------------|----------------|---------------|------------|------------|-------------------------------------|-------------------------------|--|-------------------|--|---------------------------|--------------|
| | | | Pendant up. | Pendant right. | Pendant left. | Dial up. | | | | | Dial down. | Daily variation of rate with change of position. | Temperature compensation. | |
| | | | | | | secs. | secs. | | | | | | | |
| Usher & Cole, London..... | 29106 | S.r., g.b., d.o., "Karrusel" | secs. -3.1 | secs. -3.1 | secs. -3.3 | secs. -4.7 | secs. -3.6 | secs. 0.3 | secs. 0.03 | secs. 33.4 | 0-40 | 0-40 | 0-20 | 88.4 |
| A. E. Fridlander, Coventry..... | 14358 | S.r., g.b., s.o., "Karrusel" | -1.7 | -1.9 | -0.2 | -1.3 | -1.1 | 0.3 | 0.03 | 33.4 | 33.1 | 37.6 | 16.9 | 88.4 |
| S. Xomans, Coventry..... | 73560 | S.r., g.b., s.o., "Karrusel" | -1.4 | -1.6 | -0.2 | -1.3 | -1.0 | 0.4 | 0.03 | 34.0 | 31.9 | 37.6 | 16.4 | 88.0 |
| Usher & Cole, London..... | 29070 | S.r., g.b., s.o., "Karrusel" | -0.7 | +0.1 | +0.1 | +0.3 | -0.5 | 0.4 | 0.03 | 31.9 | 31.9 | 37.6 | 16.3 | 87.3 |
| U. Montandon-Robert, Geneva..... | 1076 | D.r., g.b., s.o., "Karrusel" | -0.7 | +0.1 | +0.1 | 0.0 | -0.2 | 0.4 | 0.03 | 31.7 | 33.5 | 37.6 | 16.3 | 87.3 |
| Newsons & Co., Coventry..... | 130196 | S.r., g.b., s.o., "Karrusel" | +1.3 | +3.1 | +3.1 | 0.0 | +1.4 | 0.5 | 0.01 | 31.3 | 31.3 | 37.6 | 18.2 | 86.9 |
| U. Montandon-Robert, Geneva..... | 50037 | S.r., g.b., s.o., "Karrusel" | +1.3 | +3.1 | +2.5 | +2.3 | +1.3 | 0.5 | 0.01 | 30.7 | 31.2 | 37.1 | 17.1 | 86.9 |
| Carley & Co., London..... | 1070 | D.r., g.b., s.o., bar-lever | -0.7 | +2.1 | +2.7 | +2.3 | +1.9 | 0.3 | 0.06 | 32.3 | 30.7 | 37.6 | 16.1 | 86.6 |
| U. Montandon-Robert, Geneva..... | 1069 | D.r., g.b., s.o., bar-lever | -2.8 | +3.0 | +2.4 | 1.4 | 1.4 | 0.4 | 0.04 | 31.5 | 31.2 | 37.3 | 18.0 | 86.1 |
| A. E. Fridlander, Coventry..... | 25221 | S.r., g.b., s.o., "Karrusel" | -2.2 | -2.6 | -2.4 | +0.8 | +1.4 | 0.5 | 0.02 | 32.6 | 33.0 | 33.9 | 13.9 | 85.9 |
| W. Matthews, Coventry..... | 92777 | S.r., g.b., s.o., "Karrusel" | -1.0 | -0.5 | -0.7 | -0.4 | -1.0 | 0.4 | 0.09 | 55.5 | 32.6 | 33.0 | 14.0 | 85.9 |
| S. Smith & Son, London..... | 183-219 | S.r., g.b., s.o., "Karrusel" | +4.0 | +2.5 | +3.3 | +1.8 | +5.1 | 0.4 | 0.03 | 7.5 | 31.3 | 36.0 | 18.2 | 85.5 |
| D.r., g.b., s.o., bar-lever | 25532 | | -0.6 | +0.1 | -0.7 | -0.1 | -2.2 | 0.4 | 0.05 | 3.7 | 31.2 | 37.6 | 16.7 | 85.5 |
| U. Montandon-Robert, Geneva | 1073 | "Tourbillon" chronometer, g.b., s.o. | +0.4 | +0.5 | -0.1 | +3.3 | +1.9 | 0.4 | 0.05 | 4.3 | 33.3 | 35.7 | 16.3 | 85.3 |
| Baume & Co., London..... | 103038 | D.r., g.b., s.o., bar-lever | -3.3 | +3.1 | +0.6 | +0.8 | +3.2 | 0.4 | 0.02 | 5.7 | 31.4 | 34.1 | 17.0 | 85.2 |
| U. Montandon-Robert, Geneva..... | 1071 | D.r., g.b., s.o., bar-lever | -3.1 | -2.5 | -2.9 | -2.0 | -1.7 | 0.5 | 0.05 | 3.7 | 30.1 | 33.1 | 17.0 | 85.2 |
| " " " " " " | 1074 | D.r., g.b., s.o., bar-lever | -0.1 | -1.1 | -1.7 | -2.1 | -0.5 | 0.4 | 0.03 | 5.8 | 30.9 | 37.3 | 16.9 | 85.1 |
| A. E. Fridlander, Coventry..... | 1086 | S.r., g.b., s.o., "Karrusel" | +1.5 | +1.6 | +0.9 | +0.3 | +3.4 | 0.4 | 0.04 | 6.0 | 32.6 | 35.0 | 17.3 | 84.9 |
| S. Smith & Son, London..... | 25518 | S.r., g.b., s.o., "Karrusel" | +1.6 | +1.5 | +1.0 | +1.5 | +2.6 | 0.5 | 0.02 | 6.5 | 30.4 | 33.8 | 18.6 | 84.8 |
| S. Smith & Son, London..... | 20793 | S.r., g.b., s.o., "Karrusel" | +1.6 | +1.4 | +1.0 | +1.5 | +2.6 | 0.5 | 0.02 | 4.7 | 30.8 | 33.1 | 15.8 | 84.8 |
| T. Russell & Son, Liverpool..... | 91043 | S.r., g.b., s.o., "Karrusel" | -1.6 | -1.3 | -0.1 | +0.1 | -1.6 | 0.5 | 0.03 | 4.0 | 28.7 | 37.0 | 18.1 | 84.7 |
| S. Russell & Son, London..... | 12317 | S.r., g.b., s.o., "Karrusel" | +0.3 | +0.3 | +0.1 | +1.2 | +0.3 | 0.6 | 0.03 | 6.0 | 30.7 | 37.7 | 16.2 | 84.6 |
| Williamson, Limited, London..... | 94419 | S.r., g.b., s.o., "Karrusel" | +3.8 | +3.5 | +3.3 | +3.2 | +3.3 | 0.5 | 0.03 | 6.3 | 28.8 | 37.7 | 18.1 | 84.6 |
| Carley & Co., London..... | 50182 | S.r., g.b., s.o., "Karrusel" | +7.4 | +6.0 | +6.2 | +6.7 | +7.7 | 0.6 | 0.03 | 5.2 | 29.8 | 37.7 | 18.1 | 84.6 |
| U. Montandon-Robert, Geneva..... | 1047 | D.r., g.b., s.o., bar-lever | -2.2 | -2.1 | -2.0 | -2.6 | +0.9 | 0.5 | 0.02 | 5.3 | 29.8 | 36.0 | 18.6 | 84.4 |
| A. E. Fridlander, Coventry..... | 14414 | S.r., g.b., s.o., "Karrusel" | +3.0 | +4.3 | +3.2 | -0.2 | -0.2 | 0.4 | 0.01 | 6.0 | 32.3 | 32.7 | 19.3 | 84.3 |

Table I—continued.

| Watch deposited by | Number of watch. | Escapement, balance spring, &c. | Mean daily rate. | | | | | | Mean change of rate for 10 P. | Difference between extreme gaining and losing rates. | Marks awarded for | | | Total Marks. | | |
|-----------------------------------|------------------|---|------------------|-------|----------------|---------------|----------|-------|-------------------------------|--|-------------------|---------------------------------------|--------------------------|--------------|---|---------------------------|
| | | | Pendant up. | | Pendant right. | Pendant left. | Dial up. | | | | Dial down. | Mean variation of daily rate, \pm . | Daily variation of rate. | | Change of rate with change of position. | Temperature compensation. |
| | | | secs. | secs. | | | secs. | secs. | | | | | | | | |
| A. E. Fridlander, Coventry | 14303 | S. r., g. b., s. o. | -0.1 | +2.2 | -2.1 | +0.2 | +3.1 | 0.4 | 0.04 | 6.2 | 31.9 | 31.7 | 17.6 | 84.2 | | |
| A. E. Fridlander, Coventry | 52836 | D. r., g. b., s. o. | +0.3 | +0.5 | +0.2 | +0.2 | +2.2 | 0.5 | 0.03 | 4.7 | 30.5 | 35.5 | 18.1 | 84.1 | | |
| Newsome & Co., Coventry | 125063 | S. r., g. b., s. o., "Karrusel" | -1.0 | -0.5 | -0.5 | -1.7 | -0.1 | 0.5 | 0.04 | 5.0 | 32.5 | 37.0 | 17.6 | 84.1 | | |
| Newsome & Co., Coventry | 130331 | S. r., g. b., s. o., "Karrusel" | +0.2 | +1.7 | +0.7 | +3.4 | +4.9 | 0.4 | 0.03 | 6.5 | 29.4 | 33.6 | 17.9 | 83.9 | | |
| S. Smith & Son, London | 207581 | S. r., g. b., s. o., "Karrusel" | +2.2 | +1.4 | +2.3 | +3.4 | +4.4 | 0.4 | 0.05 | 4.2 | 31.0 | 36.4 | 16.5 | 83.9 | | |
| Williamson, Limited, London | 54417 | S. r., g. b., s. o., "Karrusel" | -1.1 | -1.3 | -1.7 | -1.0 | -0.1 | 0.4 | 0.08 | 5.3 | 33.0 | 33.3 | 14.5 | 83.8 | | |
| Newsome & Co., Coventry | 120959 | S. r., g. b., s. o., "Karrusel" | -2.6 | -2.6 | -1.8 | -2.9 | -2.3 | 0.6 | 0.04 | 7.5 | 27.9 | 33.8 | 17.1 | 83.7 | | |
| A. E. Fridlander, Coventry | 14333 | S. r., g. b., s. o. | -0.1 | +3.5 | -0.7 | +0.1 | -2.4 | 0.4 | 0.04 | 7.0 | 32.0 | 34.6 | 17.1 | 83.7 | | |
| H. Golay, London | 2156 | D. r., g. b., d. o., chronograph | -1.0 | +2.2 | -0.6 | +0.6 | -0.3 | 0.5 | 0.03 | 4.5 | 29.7 | 36.0 | 18.0 | 83.7 | | |
| W. Matthews, Coventry | 92275 | S. r., g. b., s. o., "Karrusel" | -1.1 | -2.1 | -0.6 | +2.4 | -1.0 | 0.4 | 0.07 | 5.7 | 32.5 | 35.6 | 15.4 | 83.5 | | |
| Jos. White & Son, Coventry | 35693 | S. r., g. b., s. o. | -1.2 | -2.1 | -1.9 | -0.4 | +3.6 | 0.5 | 0.01 | 7.2 | 31.0 | 32.8 | 19.7 | 83.5 | | |
| A. E. Fridlander, Coventry | 25517 | S. r., g. b., s. o., "Karrusel" | +4.3 | +3.9 | +4.9 | +3.0 | +4.6 | 0.4 | 0.10 | 7.0 | 32.3 | 37.7 | 13.4 | 83.4 | | |
| Rotherham & Sons, Coventry | 21777 | S. r., g. b., s. o. | +1.4 | +1.7 | -1.8 | +0.2 | +2.7 | 0.4 | 0.04 | 8.0 | 31.4 | 34.9 | 17.1 | 83.4 | | |
| Jos. White & Son, Coventry | 35762 | D. r., g. b., s. o. | +0.7 | +0.4 | +1.3 | +1.2 | +1.6 | 0.5 | 0.08 | 5.8 | 30.8 | 38.1 | 14.5 | 83.3 | | |
| Carter & Co., London | 50170 | S. r., g. b., s. o., "Karrusel" | -2.6 | -3.4 | -2.8 | -2.4 | -1.1 | 0.4 | 0.03 | 5.8 | 31.7 | 36.6 | 15.0 | 83.3 | | |
| A. E. Fridlander, Coventry | 25531 | S. r., g. b., s. o., "Karrusel" | -3.1 | -3.0 | -3.1 | -1.6 | -0.5 | 0.6 | 0.01 | 4.5 | 28.8 | 37.1 | 17.3 | 83.2 | | |
| S. Smith & Son, London | 20798 | S. r., g. b., s. o., "Karrusel" | +2.0 | +2.3 | +0.5 | -1.0 | -1.7 | 0.6 | 0.02 | 6.5 | 23.5 | 35.5 | 19.0 | 83.1 | | |
| A. E. Fridlander, Coventry | 14366 | S. r., g. b., s. o. | +0.4 | +0.4 | +2.4 | +0.4 | +1.1 | -2.2 | 0.4 | 0.03 | 6.3 | 32.2 | 35.7 | 16.0 | 82.9 | |
| D. Buckney, London | 30916 | D. r., g. b., s. o. | +1.5 | -1.4 | +0.6 | +2.7 | -0.6 | 0.5 | 0.04 | 5.7 | 30.4 | 35.0 | 17.4 | 82.8 | | |
| Thomas Hill & Co., Coventry .. | 2250 | S. r., g. b., s. o., "Karrusel" | +0.6 | +1.2 | +1.3 | +0.9 | +3.1 | 0.5 | 0.06 | 6.0 | 29.4 | 37.3 | 16.1 | 82.8 | | |
| A. E. Fridlander, Coventry | 25515 | S. r., g. b., s. o., "Karrusel" | -5.8 | -4.1 | -5.2 | -5.7 | -0.7 | 0.5 | 0.02 | 7.2 | 30.1 | 34.8 | 18.6 | 82.7 | | |
| C. J. H. Marlow, Coventry | 20439 | S. r., g. b., s. o., "Karrusel" | +1.4 | +0.6 | +1.5 | -0.5 | -0.6 | 0.6 | 0.01 | 7.0 | 28.4 | 36.8 | 17.5 | 82.7 | | |
| S. Smith & Son, London | 02222 | D. r., g. b., d. o., "non-magnetic" | -6.4 | -5.6 | -5.9 | -3.4 | -5.6 | 0.4 | 0.03 | 9.0 | 27.7 | 35.8 | 18.2 | 82.7 | | |
| Jos. White & Son, Coventry | 35417 | S. r., g. b., s. o. | -0.6 | -1.7 | -1.3 | -3.2 | -3.4 | 0.4 | 0.07 | 7.5 | 31.6 | 35.0 | 15.0 | 82.6 | | |
| S. Yeomans, Coventry | 76149 | S. r., g. b., s. o., "Karrusel" | -0.9 | -0.3 | -0.9 | -0.1 | +3.5 | 0.5 | 0.02 | 6.5 | 29.5 | 34.2 | 18.8 | 82.5 | | |
| Baume & Co., London | 12025 | S. r., g. b., s. o., "Karrusel" | +3.8 | +3.1 | +4.0 | +1.1 | +3.5 | 0.6 | 0.04 | 10.7 | 28.2 | 36.3 | 17.5 | 82.5 | | |

In the above List, the following abbreviations are used, viz. :—s.r. for single roller; d.r. for double roller; g.b. for going barrel; s.o. for single overcoil; d.o. for double overcoil; + for gaining rate; — for losing rate.

Table II.
Highest Marks obtained by Complicated Watches during the year.

| Description of watch. | Number. | Deposited by | Marks awarded for | | | |
|--|----------|--------------------------------|-------------------|-----------|--------------|--------------|
| | | | Variation. | Position. | Temperature. | Total marks. |
| | | | 0—40 | 0—40 | 0—20 | 0—100. |
| Minute chronograph and minute repeater | 52944 | Fridlander, Coventry | 31·0 | 33·4 | 14·4 | 78·8 |
| ” ” | 2203 | J. W. Benson, London | 28·3 | 27·9 | 17·5 | 73·7 |
| ” ” | 35574 | J. White and Son, Coventry .. | 19·7 | 34·8 | 16·2 | 70·7 |
| ” ” (and split seconds) | 152-1 | S. Smith and Son, London | 24·4 | 30·4 | 15·7 | 70·5 |
| Minute and split seconds chronograph | 167726 | Stauffer, Son, and Co., London | 29·4 | 35·8 | 13·4 | 78·6 |
| ” ” | 64681 | Golay, London | 24·7 | 34·6 | 17·1 | 76·4 |
| ” ” | 159-1899 | S. Smith and Son, London | 28·8 | 31·0 | 16·0 | 75·8 |
| ” ” | 3364 | Baume and Co., London | 27·0 | 32·2 | 13·5 | 72·7 |
| Minute and seconds chronograph | 2156 | Golay, London | 29·7 | 36·0 | 18·0 | 83·7 |
| ” ” | 246980 | Baume and Co., London | 28·8 | 33·4 | 19·3 | 81·5 |
| ” ” | 3029 | ” ” | 26·5 | 37·2 | 16·1 | 79·8 |
| ” ” | 29817 | Usher and Cole, London | 29·6 | 32·3 | 16·5 | 78·4 |
| Minute repeater | 52952 | Fridlander, Coventry | 30·0 | 30·6 | 14·9 | 75·5 |
| ” ” (and calendar) | 19750 | Oram and Son, London | 17·3 | 32·2 | 17·2 | 66·7 |
| “Non-magnetic” | 02222 | S. Smith and Son, London | 27·7 | 36·8 | 18·2 | 82·7 |
| ” | 14194 | Fridlander, Coventry | 30·5 | 33·4 | 16·8 | 80·7 |