PROCEEDINGS OF

THE ROYAL SOCIETY.

VOL. LXV. No. 413.

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Report of the Kew Observatory Committee for the Year ending December 31 1898 . . . . . .

CROONIAN LECTURE.—On the Relation of Motion in Animals and Plants to the Electrical Phenomena which are associated with it. By J. BURDON-SANDERSON, M.A., M.D., F.R.S. 37

Price Two Shillings.

MAY 10, 1899.

PROCEEDINGS

OF

THE ROYAL SOCIETY.

Report of the Kew Observatory Committee for the Year ending December 31, 1898.

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. A. W. Rücker.
Prof. W. G. Adams.	Dr. R. H. Scott.
Captain E. W. Creak, R.N.	Mr. W. N. Shaw.
Prof. G. C. Foster.	Lieut.-General Sir R. Strachey, G.C.S.I.
Prof. J. Perry.	Rear Admiral Sir W. J. L. Wharton, K.C.B.
The Earl of Rosse, K.P.	

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

I. Magnetic observations.
II. Meteorological observations.
III. Seismological observations.
IV. Experiments and Researches in connexion with any of the departments.
V. Verification of instruments.
VI. Rating of Watches and Marine Chronometers.
VII. 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 cm. = 0° 8′·7.
Bifilar, January 11th, 1898, for 1 cm. $\delta H = 0{\cdot}00051$ C.G.S. unit.
Balance, January 12th, 1898, for 1 cm. $\delta V = 0{\cdot}00050$ C.G.S. unit.

Owing to the gradual secular change of declination, the distance between the dots of light upon the cylinder of the magnetograph had become too small for satisfactory registration, and it was found necessary to alter the position of the zero line. From a similar cause it was also found necessary to re-adjust the balance of the vertical force magnetometer.

During the past year two magnetic storms, or periods of considerable disturbance of the needles, have been registered, the first on March 14–15, the second on September 9–10.

The extreme amplitude of the March disturbance was : horizontal force, 0·0050 C.G.S. unit; vertical force, 0·0057 C.G.S. unit, and declination, 1° 26′. In eight minutes, from 10.40 to 10.48 P.M. on the 15th, the horizontal and vertical components exhibited falls of 0·002 and 0·003 C.G.S. unit respectively. The most rapid change of declination occurred some thirty minutes later. Speaking generally, the most salient features were the large falls in both the horizontal and vertical components and the movement of the declination needle nearly 1° east of its normal position.

The second storm occurred on September 9—10. The principal disturbance commenced somewhat gradually about noon on the 9th, but one of its most striking features was an exceptionally rapid fall occurring simultaneously at 3.5 P.M. in the horizontal and vertical forces and in the westerly declination. The fall was so rapid as to be shown somewhat indistinctly on the photographic traces, but it amounted to at least 15′ in the declination and 0·0023 C.G.S. unit in the horizontal force. The recovery from this fall was also rapid.

The declination needle, on the same day, between 5.15 P.M. and 8.8 P.M. receded 54′ to the east, then turned and in the course of the next thirty-two minutes moved 59′ to the west. The horizontal force attained its extreme maximum and minimum at 2.42 P.M. and

8.30 P.M. respectively, the range amounting to 0·0050 C.G.S. unit (or about 1/37 of the whole component). Between 7.30 and 8.30 P.M., this element fell 0·0036 C.G.S. unit. The vertical force reached its maximum about 6 P.M., and its minimum about 8.30 P.M., but as the trace unfortunately got off the sheet near the minimum, it can only be said that the range of vertical force exceeded 0·0036 C.G.S. unit.

Both storms were presumably associated with the aurora simultaneously seen in the British Isles. The March storm was the largest recorded since August, 1894.

The hourly means and diurnal inequalities of the magnetic elements for 1898, for the quiet days selected by the Astronomer Royal, will be found in Appendix I.

A correction has been applied for the diurnal variation of temperature, use being made of the records from a Richard thermograph as well as of 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° 1′·4.
Mean Horizontal Force.....	0·18364 C.G.S. unit.
Mean Inclination	67° 17′·6.
Mean Vertical Force	0·43885 C.G.S. unit.

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

A table of recent values of the magnetic elements at the Observatories whose publications are received at Kew will be found in Appendix 1A to the present report.

In September Professor Luigi Palazzo of the Ufficio Centrale di Meteorologia, Rome, paid a visit to the Observatory for the purpose of comparing the Kew magnetic instruments and his own.

Dr. van Rijckevorsel also spent some time in the summer in making a further comparison between his magnetic instruments and those at Kew.

Mr. Hough, Fellow of St. John's College, Cambridge, who has recently been appointed chief assistant at the Royal Observatory, Cape of Good Hope, visited the Observatory from August 18 to September 1, in order to gain a knowledge of the method of observing with the Unifilar Magnetometer and Inclinometer.

At the request of Professor Moos, director of the Colaba Observatory, Bombay, copies of the horizontal force, the vertical force,

and the declination curves for certain selected days during the years 1892, 1893, and 1897 have been made and forwarded to him.

Information on matters relating to various magnetic data has been supplied to Dr. von Bezold, Professor Milne, and Mr. Gray.

The Observatory has been visited by Dr. A. Schmidt, of Gotha, Professor Eschenhagen, of Potsdam, and Professor Liznar, of Vienna, members of the International Conference on Terrestrial Magnetism, which was held at Bristol in September.

In spring the unifilar magnetometer and dip circle, previously lent to the Jackson-Harmsworth Polar Expedition, were put in order and lent to Mr. P. Baracchi, Acting Government Astronomer, Melbourne Observatory, for observational use in Australia and New Zealand, or in Antarctic exploration, as he might decide. Later in the year an old dip circle was put in order at the cost of Sir George Newnes, and lent for the use of the Antarctic Expedition, under Mr. Borchgrevink. It was also agreed that if Mr. P. Baracchi should be willing to transfer to Mr. Borchgrevink the unifilar magnetometer and dip circle referred to above, the Committee would raise no objection, provided Sir G. Newnes should become responsible for the safe return of the instruments.

A course of magnetic instruction was given to the two magnetic observers of Mr. Borchgrevink's expedition, Mr. Colbeck and Mr. Bernacchi, the latter of whom had already practised the use of magnetic instruments at Melbourne Observatory.

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.'

Electrograph.—This instrument worked in a satisfactory manner till May, when the action markedly deteriorated. Tests of the battery showed that its E.M.F. had fallen off considerably; this was so far remedied by cleaning and recharging the top row of cells. At

the same time a new silk suspension was fitted to the needle of the electrometer, and the instrument generally overhauled, and a new scale determination was carried out.

The records remained satisfactory until November, when the battery potential again began to fall off rapidly. Between November 24 and 27 the whole sixty cells were cleaned and recharged with a satisfactory result, and on the latter date one-third of the cells were removed to contract the scale, in order to record high winter values, as explained in last year's Report.

On several occasions it had been noted that the electrometer needle had a tendency to "set" when the acid in the interior jar had been in use for some time. This "setting" largely interfered with the freedom of the needle. It has, however, been considerably reduced, by substituting a single platinum wire connection for the double gridiron form hitherto employed.

In May another portable electrometer, No. 80, was purchased from White, of Glasgow; it is furnished with some additions to the usual pattern, which experience at the Observatory suggested as likely to prove beneficial in reducing induction effects. This electrometer has been used since, with the older instrument, White, No. 53, in obtaining the scale value of the self-recording instruments, determinations being made on February 7, April 1, May 26, June 16, September 6, and November 28.

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

III. Seismological Observations.

The seismograph referred to in last year's Report was delivered by Mr. R. Munro in March. It is of Professor J. Milne's "unfelt tremor" pattern, the motion recorded being that of a horizontal pendulum or boom with a long period of vibration (fifteen to eighteen seconds from rest to rest). It is intended to measure the tilting of the ground along an east-west line, the boom itself lying due north and south.

At the suggestion of Professor Milne, who visited the Observatory, the site selected for at least a temporary trial is in the basement, inside the double-walled wooden room, originally designed for pendulum observations, and sometimes used as a warm chamber for chronometers. At first difficulties were encountered from wandering

of the boom, which is still too liable to get off its pivot; but the record has been, on the whole, satisfactory for the latter half of the year. The following table gives particulars respecting the time of occurrence and amplitude in seconds of arc of the largest movements actually recorded :—

Date.	Time (G.M.T.). h.	m.		Amplitude. ″
June 29	7	19·8	P.M.	2·5
,, ...	,,	21·8	,,	3·4
,, ...	,,	26·7	,,	3·0
,, ...	,,	31·4	,,	2·2
August 31	8	34·9	,,	2·7
,, ...	,,	37·0	,,	1·5
,, ...	,,	37·8	,,	1·7
,, ...	,,	40·7	,,	1·6
November 17.....	1	44·3	,,	0·5
,, ...	,,	46·4	,,	0·6
,, ...	,,	58·6	,,	0·6

The times deduced for the commencement of the above-mentioned earthquakes were 6 h. 47·6 m., 8 h. 4·5 m., and 1 h. 37 m. respectively.

Without special very careful experiments it would be difficult to say what is the probable error in fixing the precise times. Independent measurements of the photographic trace may agree to 0·1 or 0·2 of a minute, but there is room for a certain amount of doubt as to the proper values to attribute to the time marks on the sheet.

In the case of the times of commencement of a disturbance the uncertainty is greater, because the movement may be initially infinitesimal, and because a tiny movement arising from a different source (such movements being not uncommon) might intervene.

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, referred to in last year's Report, have been continued, and the observations have been taken twice every month.

During October some simultaneous observations were made with

the two portable electrometers, the one situated on the pillar in the garden, the other at the same height on a tripod stand, at some distance in the park. It is hoped that time will be found to repeat the experiments on sufficiently numerous occasions to allow some conclusions to be drawn.

Aneroid Barometers.—The experiments referred to in the last three "Reports" were continued in the early part of the year. The results have been discussed by the Superintendent in a paper recently published in the Society's 'Transactions.'

Platinum Thermometry.—The experimental work carried out at the International Bureau of Weights and Measures at Sèvres by Dr. J. A. Harker in co-operation with Dr. Chappuis has only just terminated. It has comprised a careful comparison of certain platinum thermometers belonging to the Observatory with a gas thermometer belonging to the Bureau, over the range $-30°$ C. to $+600°$ C.

Dr. Harker brought back the platinum thermometers, resistance box, &c., to the Observatory late in December, and is about to be engaged in preparing the results for publication. In view of this and other special thermometric work in contemplation, the Committee have temporarily secured the services of Dr. Harker in the capacity of special assistant to the Superintendent.

Experiments have been continued at the Observatory itself on the fixity of zero, and the general behaviour of platinum thermometers, which have shown, amongst other things, the expediency of carefully checking the behaviour of the "leads."

Experimental work on the comparison of platinum and mercury thermometers has also been continued, and it is hoped that it will shortly be possible, utilising the results of Dr. Harker's work at Sèvres, to issue certificates to high range mercury thermometers embodying the results of direct comparison.

Mercury Thermometry.—The experiments on thermometers of different kinds of glass made by Messrs. Powell and Sons, to which reference was made last year, have been continued. Further thermometers are being made by Messrs. Powell, of a pattern suggested by the Superintendent, with which it is hoped to experiment at higher temperatures.

V. Verification of Instruments.

The subjoined is a list of the instruments examined in the year 1898, with the corresponding results for 1897:—

	Number tested in the year ending December 31.	
	1897.	1898.
Air-meters	5	1
Anemometers	3	11
Aneroids	77	169
Artificial horizons	17	9
Barometers, Marine	167	122
,, Standard	101	58
,, Station	30	55
Binoculars	661	374
Compasses	51	44
Deflectors	4	3
Hydrometers	292	463
Inclinometers	5	5
Photographic Lenses	10	13
Magnets	2	2
Navy Telescopes	707	681
Rain Gauges	27	12
Rain Measuring Glasses	31	10
Scales	—	2
Sextants	694	750
Sunshine Recorders	10	15
Theodolites	29	26
Thermometers, Avitreous, or Immisch's	5	10
,, Clinical	17,270	17,962
,, Deep sea	119	79
,, High Range	37	56
,, Hypsometric	30	38
,, Low Range	71	94
,, Meteorological	2,874	3,296
,, Solar radiation	—	2
,, Standard	117	66
Unifilars	4	6
Vertical Force Instruments	4	—
Declinometers	3	—
Total	23,457	24,434

Duplicate copies of corrections have been supplied in 84 cases.

The number of instruments rejected in 1897 and 1898 on account of excessive error, or for other reasons, was as follows :—

	1897.	1898.
Thermometers, clinical	156	173
„ ordinary meteorological	38	92
Sextants	98	106
Telescopes	66	60
Binoculars	28	30
Various	56	26

Two Standard Thermometers have been constructed during the year.

There were at the end of the year in the Observatory, undergoing verification, 7 Barometers, 550 Thermometers, 50 Sextants, 20 Telescopes, 59 Binoculars, 2 Hydrometers, 2 Sunshine Recorders, 5 Rain Measures, and 2 Rain Gauges.

VI. Rating of Watches and Chronometers.

The high standard of excellence to which attention has been drawn in previous Reports has been maintained. Although the number of watches sent for trial this year is less than last year, yet the general average is as good, and 66 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 483 watches received were entered for trial as below :—

For class A, 383; class B, 73; and 27 for the subsidiary trial. Of these 17 passed the subsidiary test, 116 failed from various causes to gain any certificate, 55 were awarded class B, and 295 class A.

In Appendix III will be found a table giving the results of trial of the first 50 watches which gained the highest number of marks during the year. The highest place was taken by Mr. S. Yeomans, Coventry, with a keyless going-barrel, Karrusel lever-watch, No. 76,152, which obtained 89·2 marks out of a maximum of 100.

Representations having been made to the Committee that some changes were desirable in the system of marks and dates on certificates, a circular was issued (as mentioned in last year's Report) to ascertain the general opinion of manufacturers and others interested in the matter, but the replies received showed no unanimity of opinion in favour of any one specified change, whilst a considerable number were quite satisfied with the existing conditions. Finally some small alterations were made, mainly in matters of detail.

The objection to the certificates that sustained most support—though even on this question opinions were fairly divided—was that the date suggested to the customer, in the case of any but the most recently tested watch, a line of criticism that would not naturally have presented itself. In consequence it was urged that the possession of a

Kew certificate was a very doubtful advantage to any watch remaining unsold for several years in a retailer's hands. The Committee could not see their way to alter the invariable practice of dating Kew certificates, but they agreed, in order to minimise the source of complaint, that a watch tested at the Observatory not less than three years previously, should be admitted to a fresh trial at half the usual fee.

Marine Chronometers.—During the year, 70 chronometers have been entered for the Kew A and B trials; of these 33 gained certificates, 21 failed, and there are 16 in hand.

The new cold-air chamber, to which a preliminary reference was made in last year's Report, has been completed, and has proved very convenient.

It consists of three separate divisions, each isolated from the others, and separated by a 3-inch space packed with flake charcoal, this same packing being continued on all sides of the divisions, the size over all being $6\frac{1}{4}$ ft. by $6\frac{1}{4}$ ft. by 3 ft.

The centre chamber, 3 ft. by 3 ft. by 2 ft., is fitted with sliding racks for the chronometers, and the division on either side is for the ice. This is supplied in blocks, which rest on boards, and drain away into a trap and gulley. The chronometer chamber is furnished with trays to hold potassic chloride for drying purposes, and with maximum and minimum thermometers.

The doors are packed with flake charcoal, and are so arranged that the ice stores can be filled or emptied without any disturbance of the chronometer chamber.

VII. Miscellaneous.

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

Anemograph and Sunshine Sheets have also been sent to Hong Kong and Mauritius.

Gas Thermometer.—Sir Andrew Noble, K.C.B., having generously offered to present a gas thermometer to the Observatory, and to defray the cost of sending an assistant to Berlin to study the method of using a similar instrument at the Reichsanstalt, at Charlottenburg, the Committee gladly accepted the gift. The construction of the instrument has not yet been completed.

Pendulum Observations.—In July Mr. F. Laurin and another officer of the Royal Austrian Navy swung half second pendulums in the sextant room on the spot where observations were made some years ago by von Sterneck.

Electric Tramways.—During the year a variety of schemes have been promoted for applying electric traction on the trolley system to tram lines in the neighbourhood of the Observatory, and one of these schemes, promoted by the London United Tramway Company, for a new line between Kew Bridge and Hounslow, passing within 1,300 yards of the Observatory, has received the sanction of Parliament. The Committee, roused by the fate that has befallen the magnetic observatories at Toronto and Washington, requested Professor Rücker and Professor Perry to take the matter in hand. A series of experiments made at various places in London and Leeds, under the general supervision of Professor Rücker, showed that electric railways and tramways, satisfying presumably all the existing requirements of the Board of Trade, produced very sensible disturbances in a declinometer at distances of two or three miles. This fact was brought before the notice of the Royal Society, who in turn entered into communication with the Board of Trade, with the result that the following clauses were inserted in the London United Tramway Company's Bill:—

1. The whole circuit used for the carrying of the current to and from the carriages in use on the railway shall consist of conductors, which are insulated along the whole of their length to the satisfaction in all respects of the Commissioners of Her Majesty's Works and Public Buildings (in this section called the "Commissioners"), and the said insulated conductors which convey the current to or from any of such carriages shall not at any place be separated from each other by a distance exceeding one-hundredth part of the distance of either of the conductors at that place from Kew Observatory.

2. If, in the opinion of the Commissioners, there are at any time reasonable grounds for assuming that, by reason of the insulation or conductivity having ceased to be satisfactory, a sensible magnetic field has been produced at the Observatory, the Commissioners shall have the right of testing the insulation and conductivity upon giving notice to the Company, who shall afford all necessary facilities to the engineer or officers of the Commissioners, or other person appointed by them for the purpose, and the Company shall forthwith take all such steps, as shall in the opinion of the Commissioners be required for preventing the production of such field.

3. The Company shall furnish to the Commissioners all necessary particulars of the method of insulation proposed to be adopted, and of the distances between the conductors which carry the current to and from the carriages.

It is understood that the above clauses will be insisted on by the Board of Trade in the case of any other tram line which can be shown to be a probable source of danger to the Observatory.

The Committee are much indebted to Professor Rücker and Professor Perry for the trouble they have taken in the matter, and they are also glad to express their acknowledgment of the valuable assistance rendered by the editors of scientific journals and various eminent men of science in educating public opinion. The Committee even hope that ere long tramway companies themselves will recognise the benefits accruing from improved insulation.

Whilst everything has been done, as far as can be foreseen, to protect the magnetographs, it is impossible to contemplate the future without some misgivings.

National Physical Laboratory. — The Government Committee, referred to in last year's Report, visited the Observatory on January 18th. In the course of the summer, that Committee submitted to the Lords Commissioners of Her Majesty's Treasury a report, embodying the following four recommendations:—

1. That a public institution should be founded for standardizing and verifying instruments, for testing materials, and for the determination of physical constants.

2. That the institution should be established by extending the Kew Observatory in the Old Deer Park, Richmond, and that the scheme should include the improvement of the existing buildings, and the erection of new buildings at some distance from the present Observatory.

3. That the Royal Society should be invited to control the proposed institution, and to nominate a Governing Body, on which commercial interests should be represented, the choice of the members of such Body not being confined to Fellows of the Society.

4. That the Permanent Secretary of the Board of Trade should be an *ex officio* member of the Governing Body; and that such Body should be consulted by the Standards Office and the Electrical Standardizing Department of the Board of Trade upon difficult questions that may arise from time to time or as to proposed modifications or developments.

In October, the Royal Society informed the Kew Observatory Committee that the Government had adopted the report generally, and were willing to provide funds for carrying it into effect; consequently the Royal Society asked for the concurrence of the Kew Observatory Committee in their action.

In reply, the Committee expressed their willingness to facilitate the execution of the scheme, and to continue to administer the Observatory pending the nomination of the new Governing Body. The arrangements were not completed before the close of 1898.

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

20 Scientific Societies and Institutions of Great Britain and Ireland,

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

The card catalogue has been proceeded with.

Audit, &c.—The accounts for 1898 have been audited by Mr. W. B. Keen, Chartered Accountant, on behalf of the Royal Society, and by Professor Carey Foster on behalf of the Committee.

The balance sheet, with a comparison of the expenditure for the two years, 1897 and 1898, 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.
G. Badderly, Verification Department, and six other Assistants.
A Caretaker and a Housekeeper are also employed.

(Signed) FRANCIS GALTON,
Chairman.

RECEIPTS.

	£ s. d.	£ s. d.
To Balance from Year 1897		436 18 1
Royal Society:—		
Gassiot Trust. Annual payment	443 11 2	
,, ,, Income Tax returned	15 0 2	
		458 11 4
Meteorological Council:—		
Allowance	400 0 0	
Postages, &c.	2 9 2	
		402 9 2
Tests:—		
Verification	1575 16 0	
Rating	614 8 0	
Lenses	5 13 9	
		2195 17 9
Researches:—		
Grant from Gunning Fund for comparisons of thermometer scales		120 0 0
Commissions executed for Colonial and Foreign Institutions, &c.		560 0 0
Rents		7 3 0
Dividends on India Stock		43 19 8
Messrs. D. and J. Welby for photographic residues		1 2 8
		£4226 1 8

Audited on behalf of the Royal Society and found correct,
17th January, 1899.
(Signed) W. B. KEEN, *Chartered Accountant.*

Examined on behalf of the Kew Observatory Committee, and approved,
18th January, 1899.
(Signed) G. CAREY FOSTER.

PAYMENTS.

	£ s. d.	£ s. d.
By Normal Observatory:—		
Salaries—Observations, Tabulations, &c.	336 15 6	
Incidental Expenses, Photographic Paper, &c.	41 1 7	
Proportion of Administration Expenditure	187 10 0	
		565 7 1
Researches:—		
Salaries	158 8 0	
Incidental Expenses, &c.	64 9 2	
Proportion of Administration Expenditure	375 0 0	
		597 17 2
Tests:—		
Salaries	918 6 0	
Incidental Expenses, Apparatus, &c.	222 9 5	
Proportion of Administration Expenditure	499 4 7	
		1640 0 0
Commissions:—		
Purchase of Instruments and Photographic Paper for Colonial and Foreign Institutions, &c.	529 3 1	
Proportion of Administration Expenditure	187 10 0	
		716 13 1
Seismograph—Cost of apparatus and sundries		55 15 0
Balance—London and County Bank	633 4 3	
Awaiting Banking	2 18 8	
In hand (Petty Cash)	14 6 5	
		650 9 4
		£4226 1 8

ADMINISTRATION EXPENDITURE.

Particulars.	£ s. d.	*Apportionment.*	£ s. d.
Superintendent	500 0 0	Observatory	187 10 0
First Assistant, Librarian, &c.	454 18 0	Researches	375 0 0
Rent, Fuel, &c.	87 16 6	Tests	499 4 7
Caretaker, Repairs, &c.	206 10 1	Commissions	187 10 0
	£1249 4 7		£1249 4 7

ESTIMATED ASSETS.

	£	s.	d.	£	s.	d.
By Balance as per Statement				650	9	4
£1300 India 3½ per cent. Stock, value on January 1, 1899				1511	5	0
Payments due:—						
Meteorological Council—Allowance, Postages, &c.	100	14	3			
Test Fees	610	2	9			
Commissions, &c.	108	16	0			
				819	13	0
Stock:—						
Blank Forms and Certificates	57	10	4			
Standard Thermometers	76	12	0			
				134	2	4
				£3115	9	8

January 20th, 1899.

ESTIMATED LIABILITIES.

	£	s.	d.
To Administration accounts—Gas, Rent, Repairs, &c.	44	17	9
Observatory accounts—Photographic Paper, &c.	14	14	4
Tests accounts—Repairs, Apparatus, &c.	14	19	0
Commissions	19	11	6
Researches	5	2	7
Grant from Gunning Fund for comparisons of thermometer scales	120	0	0
Unspent balance of Grant for Seismograph	4	5	0
General Balance	2891	19	6
	£3115	9	8

(Signed) CHARLES CHREE,
Superintendent.

Comparison of Expenditure during the Years 1897 and 1898.

Expenditure.	1897.			1898.			Increase.			Decrease.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Administration :—												
Superintendent.....	500	0	0	500	0	0						
First Assistant.....	331	18	0	333	8	0	1	10	0			
Office.....	119	6	1	121	10	0	2	3	11			
Rent, Fuel, Lighting, &c.	88	9	2	87	16	6				0	12	8
Caretaker.....	70	4	6	68	18	0				1	6	6
Incidental Expenses....	113	2	3	137	12	1	24	9	10			
	1223	0	0	1249	4	7	28	3	9	1	19	2
Normal Observatory:—												
Salaries—Observations, &c.....	320	2	10	336	15	6	16	12	8			
Incidental Expenses....	48	1	4	41	1	7				6	19	9
Prop. Adm. Expenditure	244	12	0	187	10	0				57	2	0
Researches:—												
Salaries.....	110	0	0	158	8	0	48	8	0			
Purchase of Apparatus, &c.....	209	11	1	64	9	2				145	1	11
Prop. Adm. Expenditure	366	18	0	375	0	0	8	2	0			
Tests:—												
Salaries.....	898	11	6	918	6	0	19	14	6			
Incidental Expenses....	203	0	6	222	9	5	19	8	11			
Prop. Adm. Expenditure	489	4	0	499	4	7	10	0	7			
Commissions:—												
Purchases for Colonial Institutions, &c.....	398	18	2	529	3	1	130	4	11			
Prop. Adm. Expenditure	122	6	0	187	10	0	65	4	0			
Seismograph.....				55	15	0	55	15	0			
Gross Expenditure.... (showing an increase of £164 6*s.* 11*d.*).	3411	5	5	3575	12	4	373	10	7	209	3	8
Extraordinary Expenditure.												
Researches:—												
Salaries.....	110	0	0	158	8	0	48	8	0			
Purchase of Apparatus, &c.	206	0	7	61	15	10				144	4	9
Commissions:—												
Purchases for Colonial Institutions, &c.....	398	18	2	529	3	1	130	4	11			
Seismograph.....				55	15	0	55	15	0			
	714	18	9	805	1	11	234	7	11	144	4	9
Leaving for Ordinary Nett Expenditure..... (showing an increase of £74 3*s.* 9*d.*).	2696	6	8	2770	10	5	139	2	8	64	18	11

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 *in vacuo*	1897
Mr. P. Baracchi (Melbourne Observatory).	Unifilar Magnetometer, by Jones, marked N.A.B.C., complete.....	1898
	Dip Circle, by Barrow, with one pair of Needles and Bar Magnets.....	1898
	Tripod Stand	1898
The Borchgrevink-Newnes Antarctic Expedition.	Dip Circle, by Barrow, No. 24, with four Needles and Bar Magnets.....	1898

APPENDIX I.

MAGNETICAL OBSERVATIONS, 1898.

Made at the Kew Observatory, Old Deer Park, Richmond, Lat. 51° 28′ 6″ N. and Long. $0^h\ 1^m\ 15^s{\cdot}1$ 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 Inclinometer 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 1898 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	3, 4, 7, 9, 23.
February	1, 3, 7, 26, 27.
March	1, 3, 4, 24, 31.
April	1, 9, 21, 22, 29.
May	7, 19, 21, 23, 25.
June	5, 13, 17, 20, 21.
July	2, 10, 15, 16, 18.
August	1, 8, 10, 15, 25.
September	6, 7, 12, 21, 26.
October	4, 8, 12, 16, 18.
November	5, 10, 14, 29, 30.
December	11, 12, 17, 23, 26.

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.						
1898. Months.	′	′	′	′	′	′	′	′	′	′	′	′	′
Jan. ..	6·1	3·3	3·5	3·8	3·9	3·6	3·4	3·2	3·0	2·9	3·0	3·3	4·3
Feb. ..	6·0	3·0	3·2	3·3	3·3	3·4	3·3	2·9	2·8	2·7	2·4	3·1	4·7
March.	5·4	1·3	1·3	1·3	1·2	0·9	1·0	1·0	0·8	0·1	−0·4	0·5	2·9
Oct. ..	4·8	−1·7	−1·6	−1·5	−1·5	−1·5	−1·7	−1·7	−2·5	−3·3	−3·0	−0·8	1·8
Nov. ..	2·2	−1·6	−1·7	−1·1	−0·8	−0·9	−1·0	−1·0	−0·9	−0·9	−0·8	0·3	1·5
Dec. ..	1·8	−1·5	−1·3	−0·8	−0·7	−0·8	−0·7	−0·8	−1·1	−1·3	−1·1	−0·3	0·1
Means	4·4	0·5	0·6	0·8	0·9	0·8	0·7	0·6	0·4	0·0	0·0	1·0	2·6
						Summer.							
	′	′	′	′	′	′	′	′	′	′	′	′	′
April..	6·2	0·6	0·8	0·6	0·5	0·4	0·1	0·3	−0·5	−1·0	−1·1	0·5	2·8
May ..	6·7	1·5	1·5	1·2	0·9	0·2	−0·8	−2·3	−3·4	−3·1	−2·1	1·4	4·8
June ..	5·7	1·1	1·0	0·9	1·0	−0·3	−1·8	−2·8	−3·0	−2·8	−2·4	−0·3	2·9
July ..	5·3	0·9	0·3	0·2	−0·3	−1·0	−2·3	−2·9	−2·9	−2·6	−1·6	0·5	2·7
Aug. ..	6·6	0·0	0·0	−0·3	−0·7	−1·0	−1·7	−1·9	−2·4	−2·4	−0·9	1·3	3·4
Sept...	6·4	−0·3	−0·5	−0·9	−0·8	−1·4	−1·8	−2·3	−2·4	−2·3	−1·6	0·8	3·2
Means	6·2	0·6	0·5	0·3	0·1	−0·5	−1·4	−2·0	−2·4	−2·4	−1·6	0·7	3·3

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	−1·0	−1·2	−1·8	−2·7	−3·3	−3·7	−3·7	−2·9	−0·6	+2·0
					Winter Means.							
	′	′	′	′	′	′	′	′	′	′	′	′
	−1·0	−0·9	−0·6	−0·6	−0·7	−0·7	−0·9	−1·1	−1·4	−1·4	−0·4	+1·2
					Annual Means.							
	′	′	′	′	′	′	′	′	′	′	′	′
	−0·8	−0·8	−0·8	−0·9	−1·3	−1·7	−2·1	−2·4	−2·6	−2·2	−0·5	+1·6

NOTE.—When the sign is + the magnet

selected quiet Days in 1898. (The Mean for the Year = 17° 1′·4 West.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.	Succeeding noon.
					Winter.								
′	′	′	′	′	′	′	′	′	′	′	′	′	′
5·6	5·7	5·0	4·4	4·2	4·0	3·7	3·4	3·1	2·8	2·9	3·0	3·3	5·6
6·0	6·4	6·4	5·9	4·9	4·5	4·0	3·6	3·6	3·2	3·0	2·9	2·6	5·6
5·5	6·6	6·6	5·5	4·3	3·5	3·3	2·9	2·6	2·4	1·8	1·8	1·6	5·1
3·3	3·7	3·1	1·9	0·3	0·1	−0·1	−0·3	−0·8	−1·3	−1·6	−1·5	−1·8	4·5
2·6	2·9	2·0	1·2	0·8	0·6	−0·1	−0·4	−0·5	−0·8	−1·1	−1·1	−1·1	2·3
1·3	1·3	0·9	0·2	−0·1	−0·6	−0·6	−0·9	−1·1	−1·4	−1·3	−1·2	−1·3	1·1
4·1	4·4	4·0	3·2	2·4	2·0	1·7	1·4	1·2	0·8	0·6	0·7	0·6	4·0
					Summer.								
′	′	′	′	′	′	′	′	′	′	′	′	′	′
5·6	7·3	7·3	5·8	4·5	3·4	2·4	1·8	1·9	1·8	1·4	1·1	0·8	6·6
7·7	8·4	7·8	5·8	3·8	2·0	1·2	1·3	1·7	1·7	1·6	1·4	1·1	6·1
5·3	5·8	5·3	4·1	3·2	2·3	1·9	1·3	0·8	1·0	1·5	1·3	1·0	6·1
5·4	6·5	5·5	4·6	3·1	2·0	1·7	1·6	1·5	1·5	1·3	1·0	0·9	6·2
5·8	7·2	6·8	5·9	4·0	2·4	1·6	1·2	1·0	1·0	0·9	0·6	0·4	6·9
5·5	6·4	5·3	3·2	1·3	0·2	−0·1	0·3	0·1	−0·7	−0·5	−0·4	−0·6	5·1
5·9	6·9	6·3	4·9	3·3	2·1	1·5	1·3	1·2	1·1	1·0	0·8	0·6	6·2

Declination as deduced from Table I.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
					Summer Means.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+4·6	+5·6	+5·0	+3·6	+2·0	+0·7	+0·1	−0·1	−0·1	−0·3	−0·3	−0·5	−0·7
					Winter Means.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+2·6	+3·0	+2·5	+1·7	+0·9	+0·6	+0·2	−0·1	−0·3	−0·7	−0·8	−0·8	−0·9
					Annual Means.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+3·6	+4·3	+3·8	+2·7	+1·5	+0·7	+0·2	−0·1	−0·2	−0·5	−0·6	−0·6	−0·8

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.							
1898. Months.													
Jan. ...	349	351	352	351	352	353	355	358	357	355	351	347	348
Feb. ...	353	362	361	361	361	363	364	366	366	365	362	358	357
March..	346	356	354	356	357	355	357	359	360	358	351	345	340
Oct. ...	355	369	370	369	366	368	369	368	366	361	353	348	348
Nov. ...	366	369	369	368	370	371	374	377	376	372	365	359	361
Dec. ...	378	381	382	382	383	384	384	384	385	383	384	385	382
Means..	358	365	365	364	365	366	367	369	368	366	361	357	356
						Summer.							
April...	343	360	358	358	357	356	356	354	354	348	343	338	338
May ...	362	373	372	369	369	369	367	362	352	345	342	340	341
June ...	359	373	372	371	371	370	369	365	361	353	350	348	351
July ...	362	370	369	370	370	370	370	364	357	351	347	347	356
Aug. ...	358	378	375	373	373	372	369	366	362	356	351	349	355
Sept. ...	333	355	356	357	354	352	351	348	344	339	334	328	331
Means..	353	368	367	366	366	365	364	360	355	349	345	342	345

Table IV.—Diurnal Inequality of the

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
					Summer Means.							
	+ ·00005	+ ·00004	+ ·00004	+ ·00003	+ ·00002	+ ·00001	− ·00003	− ·00008	− ·00014	− ·00018	− ·00021	− ·00017
					Winter Means.							
	·00000	·00000	− ·00001	·00000	+ ·00001	+ ·00002	+ ·00004	+ ·00003	+ ·00001	− ·00004	− ·00008	− ·00009
					Annual Means.							
	+ ·00003	+ ·00002	+ ·00001	+ ·00001	+ ·00001	+ ·00002	·00000	− ·00002	− ·00007	− ·00011	− ·00015	− ·00013

NOTE.—When the sign is + the

for Temperature) as determined from the selected quiet Days in 1898. Year = 0·18364.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.	Succeeding noon.
						Winter.							
350	354	353	353	351	354	354	354	354	354	354	354	354	354
357	359	362	362	359	361	361	361	362	363	363	363	363	358
342	347	351	353	356	356	357	359	360	360	361	361	363	345
354	359	366	368	369	371	371	373	374	374	373	372	371	353
366	370	371	372	372	375	376	376	376	375	373	371	372	368
383	384	384	383	385	386	387	387	385	384	384	384	383	386
359	362	364	365	365	367	368	368	368	368	368	367	368	361
						Summer.							
343	350	353	354	356	360	366	366	365	363	360	361	361	342
347	353	360	364	369	374	376	380	381	380	378	377	375	361
359	365	371	371	373	376	378	380	379	376	375	373	372	355
363	365	369	375	375	377	379	380	378	380	379	376	375	360
361	361	363	366	370	374	380	382	383	384	382	382	380	364
340	349	351	352	354	357	360	363	365	365	362	362	362	350
352	357	361	364	366	370	373	375	375	375	373	372	371	355

Horizontal Force as deduced from Table III.

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

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.							
1898. Months.													
Jan. ...	892	899	899	899	899	899	898	897	897	896	895	895	897
Feb. ...	897	902	902	901	901	901	901	901	900	900	900	898	896
March ..	891	908	908	908	906	905	905	904	904	904	902	897	891
Oct. ...	850	862	862	861	861	862	861	862	863	862	857	852	852
Nov. ...	865	873	874	875	875	874	874	872	870	870	870	868	867
Dec. ...	868	863	863	862	862	863	864	864	864	863	863	863	862
Means	877	884	885	884	884	884	884	883	883	882	881	879	877
						Summer.							
April ...	875	898	897	896	896	895	894	893	893	891	888	884	879
May ...	878	898	897	896	896	898	898	899	897	892	885	878	873
June ...	883	894	892	892	891	892	894	892	891	889	883	876	873
July ...	893	905	905	903	903	902	904	903	902	900	895	893	889
Aug. ...	883	898	897	895	895	896	897	897	896	894	889	887	886
Sept. ...	830	853	852	851	850	850	850	851	851	849	846	840	837
Means	874	891	890	889	889	889	890	889	888	886	881	876	873

Table VI.—Diurnal Inequality of the

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
					Summer Means.							
	+ ·00003	+ ·00002	+ ·00001	+ ·00001	+ ·00001	+ ·00002	+ ·00002	+ ·00001	− ·00002	− ·00007	− ·00011	− ·00015
					Winter Means.							
	+ ·00001	+ ·00001	+ ·00001	+ ·00001	+ ·00001	·00000	·00000	·00000	− ·00001	− ·00002	− ·00004	− ·00006
					Annual Means.							
	+ ·00002	+ ·00002	+ ·00001	+ ·00001	+ ·00001	+ ·00001	+ ·00001	·00000	− ·00001	− ·00004	− ·00008	− ·00010

NOTE.—When the sign is + the

for Temperature), as determined from the selected quiet Days in 1898. Year = 0·43885.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.	Succeeding noon.
Winter.													
897	898	902	901	901	901	900	900	900	900	899	899	899	897
897	899	901	904	905	905	906	905	905	904	902	902	902	892
889	892	896	898	901	902	903	904	904	905	904	903	903	899
853	855	859	863	864	863	863	862	862	862	862	862	861	850
869	873	876	877	877	878	877	877	877	875	874	874	874	869
862	864	867	866	865	866	865	865	864	863	863	864	864	859
879	880	883	885	885	886	886	885	885	885	884	884	884	878
Summer.													
876	878	886	892	897	900	903	903	902	900	899	898	897	875
874	879	887	895	901	903	904	904	902	901	900	901	900	868
873	880	884	889	893	897	897	898	898	895	894	893	893	856
888	892	899	906	911	914	915	914	913	912	909	907	906	878
885	885	891	896	902	904	904	902	902	902	901	899	897	887
836	838	845	852	856	856	855	855	855	853	851	851	849	837
872	875	882	888	893	896	896	896	895	894	892	892	890	867

Vertical Force as deduced from Table V.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
Summer Means.												
−·00016	−·00012	−·00006	+·00001	+·00006	+·00008	+·00009	+·00008	+·00008	+·00006	+·00005	+·00004	+·00003
Winter Means.												
−·00006	−·00003	·00000	+·00002	+·00002	+·00003	+·00003	+·00002	+·00002	+·00002	+·00001	+·00001	+·00001
Annual Means.												
−·00011	−·00008	−·00003	+·00001	+·00004	+·00005	+·00006	+·00005	+·00005	+·00004	+·00003	+·00002	+·00002

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.						
1898. Months.	′	′	′	′	′	′	′	′	′	′	′	′	′
Jan.....	18·8	18·8	18·8	18·8	18·8	18·7	18·5	18·3	18·4	18·5	18·7	19·0	19·0
Feb.....	18·6	18·2	18·2	18·2	18·2	18·1	18·0	17·9	17·9	17·9	18·1	18·3	18·3
March..	18·9	18·8	18·9	18·8	18·6	18·7	18·6	18·4	18·4	18·5	18·9	19·2	19·3
Oct.....	17·2	16·6	16·5	16·6	16·8	16·7	16·6	16·7	16·8	17·1	17·5	17·7	17·7
Nov. ...	16·9	16·9	16·9	17·0	16·9	16·8	16·6	16·4	16·4	16·6	17·1	17·4	17·3
Dec.....	16·2	15·8	15·8	15·7	15·7	15·6	15·6	15·6	15·6	15·7	15·6	15·6	15·7
Means..	17·8	17·5	17·5	17·5	17·5	17·4	17·3	17·2	17·3	17·4	17·7	17·9	17·9
							Summer.						
	′	′	′	′	′	′	′	′	′	′	′	′	′
April...	18·7	18·2	18·3	18·3	18·3	18·4	18·4	18·5	18·5	18·8	19·0	19·3	19·1
May....	17·5	17·3	17·4	17·5	17·5	17·6	17·7	18·1	18·7	19·0	19·0	19·0	18·8
June ...	17·8	17·2	17·2	17·3	17·3	17·4	17·5	17·7	17·9	18·4	18·4	18·4	18·1
July....	17·9	17·7	17·8	17·7	17·7	17·6	17·7	18·1	18·5	18·9	19·0	18·9	18·2
Aug. ...	17·9	17·0	17·2	17·2	17·3	17·3	17·6	17·8	18·0	18·3	18·5	18·6	18·2
Sept....	18·1	17·3	17·2	17·1	17·3	17·4	17·5	17·7	17·9	18·2	18·5	18·7	18·4
Means..	18·0	17·5	17·5	17·5	17·6	17·6	17·7	18·0	18·3	18·6	18·7	18·8	18·5

Table VIII.—Diurnal Inequality of the

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

NOTE.—When the sign is +

and Vertical Forces (Tables III and V). (The Mean for the Year = 67° 17′·6.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.	Succeeding noon.
						Winter.							
′	′	′	′	′	′	′	′	′	′	′	′	′	′
18·8	18·6	18·8	18·8	18·9	18·7	18·7	18·7	18·6	18·6	18·7	18·7	18·7	18·6
18·4	18·3	18·1	18·2	18·5	18·3	18·4	18·3	18·3	18·2	18·1	18·1	18·1	18·2
19·1	18·9	18·7	18·7	18·6	18·6	18·5	18·4	18·4	18·4	18·3	18·3	18·1	19·2
17·3	17·1	16·7	16·7	16·6	16·5	16·5	16·3	16·3	16·3	16·3	16·4	16·4	17·3
17·0	16·8	16·8	16·8	16·8	16·6	16·5	16·5	16·5	16·6	16·7	16·8	16·7	16·9
15·7	15·6	15·7	15·8	15·6	15·6	15·5	15·5	15·6	15·6	15·6	15·6	15·6	15·4
17·7	17·6	17·5	17·5	17·5	17·4	17·4	17·3	17·3	17·3	17·3	17·3	17·3	17·6
						Summer.							
′	′	′	′	′	′	′	′	′	′	′	′	′	′
18·7	18·3	18·3	18·4	18·4	18·2	17·9	17·9	18·0	18·1	18·2	18·1	18·1	18·8
18·4	18·1	17·9	17·8	17·7	17·4	17·3	17·0	16·9	17·0	17·1	17·1	17·3	17·3
17·6	17·4	17·1	17·2	17·2	17·1	17·0	16·9	16·9	17·1	17·1	17·2	17·2	17·3
17·7	17·7	17·6	17·4	17·6	17·5	17·4	17·3	17·4	17·3	17·2	17·4	17·4	17·6
17·8	17·8	17·8	17·7	17·6	17·4	17·0	16·9	16·8	16·7	16·8	16·8	16·8	17·6
17·8	17·3	17·3	17·4	17·4	17·2	17·0	16·8	16·7	16·6	16·7	16·7	16·7	17·2
18·0	17·8	17·7	17·7	17·6	17·5	17·3	17·1	17·1	17·1	17·2	17·2	17·3	17·6

Inclination as deduced from Table VII.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
					Summer Means.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+0·3	0·0	−0·1	−0·1	−0·1	−0·3	−0·5	−0·6	−0·6	−0·6	−0·6	−0·5	−0·5
					Winter Means.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+0·3	+0·1	0·0	+0·1	+0·1	−0·1	−0·1	−0·2	−0·2	−0·2	−0·2	−0·1	−0·2
					Annual Means.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+0·3	+0·1	0·0	0·0	0·0	−0·2	−0·3	−0·4	−0·4	−0·4	−0·4	−0·3	−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.
Pawlowsk	59° 41′ N.	30° 29′ E.	1896	0° 21′·3 E.	70° 41′·6 N.	·16495	·47084
Katharinenburg	56 49 N.	60 38 E.	1896	9 47·5 E.	70 40·0 N.	·17811	·50765
Kasan	55 47 N.	49 8 E.	1892	7 30·8 E.	68 36·2 N.	·18551	·47345
			1895	10 35·3 W.	68 47·0 N.	·17400	·44821
Copenhagen ...	55 41 N.	12 34 E.	1896	10 29·5 W.	68 45·6 N.	·17422	·44824
			1897	10 24·4 W.	68 43·8 N.	·17450	·44826
Stonyhurst	53 51 N.	2 28 W.	1897	18 27·6 W.	68 53·9 N.	·17236	·44663
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.	1897	12 41·6 W.	67 49·0 N.	·18028	·44213
Potsdam	52 23 N.	13 4 E.	1897	10 9·7 W.	66 36·3 N.	·18775	·43398
Irkutsk.....	52 16 N.	104 16 E.	1896	2 5·2 E.	70 11·8 N.	·20139	·55929
Utrecht	52 5 N.	5 11 E.	1896	14 9·7 W.	67 4·5 N.	·18448	·43618
Kew.....	51 28 N.	0 19 W.	1898	17 1·4 W.	67 17·6 N.	·18364	·43885
Greenwich*....	51 28 N.	0 0	1897	16 50·4 W.	67 7·1 N. 67 6·5 N.	·18387	·43567 ·43546
Uccle (Brussels)	50 48 N.	4 21 E.	1897	14 27·3 W.	66 19·5 N.	·18917	·43145
Falmouth	50 9 N.	5 5 W.	1897	18 42·2 W.	—	·18595	—
Prague	50 5 N.	14 25 E.	1897	9 21·1 W.	—	·19884	—
St. Helier (Jersey).....	49 12 N.	2 5 W.	1898	17 7·9 W.	65 52·5 N.	—	—
Parc St. Maur (Paris)	48 49 N.	2 29 E.	1896	15 3·9 W.	65 1·6 N.	·19685	·42264
			1895	8 36·0 W.	63 9·0 N.	·20731	·40951
Vienna.....	48 15 N.	16 21 E.	1896	8 30·5 W.	63 7·1 N.	·20756	·40944
			1897	8 24·8 W.	—	·20785	—
			1898	8 20·8 W.	—	·20797	—
O'Gyalla(Pesth)	47 53 N.	18 12 E.	1896	7 46·9 W.	—	·21105	—
Odessa†	46 26 N.	30 46 E.	1897	4 47·3 W.	62 30·9 N.	·22039	·42372
Pola‡.....	44 52 N.	13 51 E.	1897	9 36·6 W.	60 28·0 N.	·22088	·38967
Nice.....	43 43 N.	7 16 E.	1897	12 18·8 W.	60 15·4 N.	·22318	·39059
Toronto.....	43 40 N.	79 30 W.	1897	4 53·0 W.	—	·16650	—
Perpignan	42 42 N.	2 53 E.	1896	13 55·3 W.	60 5·9 N.	·22398	·38948
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.	1896	1 53·7 E.	55 48·1 N.	·25670	·37775
			1894	9 41·7 W.	—	—	—
Capodimonte			1895	9 37·0 W.	56 37·9 N.	·24007	·36454
(Naples)	40 52 N.	14 15 E.	1896	9 32·1 W.	56 37·1 N.	·24040	·36484
			1897	9 26·3 W.	56 31·4 N.	·24075	·36406

* 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.

† Inclination and Vertical Force means from six summer months.

‡ Inclination and Vertical Force means from five months, January—May.

APPENDIX Ia—*continued.*

Place.	Latitude.	Longitude.	Year.	Declination.	Inclination.	Horizontal Force. C.G.S. Units.	Vertical Force. C.G.S. Units.
Madrid	40° 25′ N.	3° 40′ W.	1895	16° 6·6 W.	° ′ —	—	—
Coimbra.....	40 12 N.	8 25 W.	1896	17 36·8 W.	59 40·2 N.	·22620	·38662
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.	1896	17 35·9 W.	58 11·8 N.	·23346	·37648
			1897	17 31·6 W.	58 8·2 N.	·23385	·37624
			1898	17 27·7 W.	58 7·8 N.	·23413	·37660
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.	1897	0 23·3 E.	31 36·9 N.	·36547	·22497
Tacubaya.....	19 24 N.	99 12 E.	1895	7 45·6 E.	44 22·2 N.	·33428	·32764
Colaba(Bombay)	18 54 N.	72 49 E.	1896	0 33·8 E.	20 55·6 N.	·37463	·14326
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.	1896	9 48·7 W.	54 32·3 S.	·23913	·33572
Melbourne.....	37 50 S.	144 58 E.	1896	8 15·0 E.	67 18·3 S.	·23392	·55936

APPENDIX II.—Table I.

Mean Monthly Results of Temperature and Pressure. Kew Observatory. 1898.

Months.	Thermometer.								Barometer.*					Mean vapour-tension.
	Mean.	Means of—			Absolute Extremes.				Mean.	Absolute Extremes.				
		Max.	Min.	Max. and Min.	Max.	Date.	Min.	Date.		Max.	Date.	Min.	Date.	
1898.	°	°	°	°	°	d. h.	°	d. h.	ins.	ins.	d. h.	ins.	d. h.	in.
Jan.....	43·4	47·1	38·9	43·0	55·0	31 5 A.M.	27·6	8 2 A.M.	30·334	30·711	28 11 P.M.	29·321	1 0.10 A.M. & 5 „	·249
Feb. ...	41·2	46·7	36·0	41·4	56·3	1 3 P.M.	26·0	21 7 „	29·965	30·384	14 10 „	29·204	21 8 A.M.	·206
March..	40·0	46·5	34·0	40·3	57·4	18 4 „	26·3	30 6 „	29·895	30·272	11 1 A.M.	29·349	26 8 P.M.	·194
April...	47·6	56·1	39·3	47·7	64·0	8 3 „	28·7	6 6 „	29·925	30·278	7 10 P.M. 8 6 A.M.	29·327	12 1 A.M.	·247
May ...	52·1	59·0	45·4	52·2	71·7	23 NOON.	36·3	13 4 „	29·845	30·373	7 8 „	29·201	12 4 „	·298
June...	57·7	65·4	50·3	57·9	74·6	21 2 P.M.	41·4	1 2 „	29·997	30·293	17 8 „	29·463	25 3 P.M.	·355
July ...	61·7	70·4	53·0	61·7	80·1	15 5 „	44·1	11 4 „	30·116	30·389	10 10 P.M.	29·671	23 4 A.M.	·380
Aug....	63·9	72·9	55·2	64·1	83·9	22 1 „	47·0	8 1 „ 31 MIDT.	30·024	30·331	31 MIDT.	29·678	6 8 P.M.	·426
Sept....	60·8	71·8	50·2	61·0	88·3	8 2 „	35·1	29 6 A.M.	30·112	30·420	4 2 & 8 A.M.	29·574	30 5 A.M.	·375
Oct.....	53·4	58·9	48·1	53·5	67·1	3 3 „	38·0	13 3 „	29·845	30·370	2 8 „	28·744	18 6 „	·350
Nov. ...	45·8	50·6	40·0	45·3	60·0	3 11 A.M.	28·4	22 11 P.M.	29·860	30·370	18 10 „	28·764	25 3 „	·269
Dec. ...	45·5	49·9	40·5	45·2	56·3	4 1 P.M.	26·9	31 3 A.M.	30·088	30·542	22 11 „	29·083	29 4 P.M.	·257
Yearly Means	51·1	57·9	44·2	51·1	..	....	..	....	30·001	..	....	..	..	·301

* 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 1898.

Meteorological Observations.—Table II.

Kew Observatory.

Months.	Mean amount of cloud (0=clear, 10=overcast).	Rainfall.*			Weather. Number of days on which were registered							Wind.† Number of days on which it was								
		Total.	Maximum.	Date.	Rain. ‡	Snow.	Hail.	Thunderstorms.	Clear sky.	Overcast sky.	Gales.§	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.‖
1898.		ins.	ins.																	
January.....	8·4	0·910	0·295	5	10	..	..	..	1	22	..	1	1	2	5	1	13	5	3	10
February....	7·0	1·275	0·225	27	17	2	..	..	1	12	1	5	1	..	..	2	9	7	4	1
March.....	7·3	1·175	0·300	3	11	4	1	..	2	15	3	11	5	2	1	1	5	5	1	4
April.....	5·7	1·025	0·270	27	12	..	1	1	5	9	1	..	5	4	2	7	5	4	3	4
May.....	8·0	2·460	0·370	19	20	..	..	1	..	19	..	6	4	4	1	3	5	5	3	2
June	7·3	1·375	0·345	26	14	..	2	1	..	13	..	7	3	1	..	3	10	4	2	2
July.....	6·2	0·670	0·210	1	5	..	..	1	4	9	..	6	4	3	..	3	3	6	6	4
August	5·6	1·110	0·555	7	9	..	..	1	5	9	..	3	2	3	2	2	10	5	4	5
September...	4·1	0·420	0·235	29	6	..	..	..	8	2	..	1	4	4	1	4	8	5	3	5
October	7·7	3·345	0·815	29	12	..	..	..	2	20	..	..	7	6	1	6	7	1	3	5
November...	6·7	2·050	0·400	25	13	1	..	..	4	12	..	3	1	6	4	5	5	5	1	11
December ...	7·0	2·405	1·110	6	10	..	..	..	5	16	1	2	..	..	..	6	16	5	2	4
Totals and means.	6·7	18·220			139	7	4	5	37	158	6	45	37	35	17	43	96	57	35	57

* 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.

§ In a "gale" the mean wind velocity has exceeded 45 miles an hour in at least one hour of the twenty-four.

‖ In a "calm" the mean wind velocity for the twenty-four hours has not exceeded 5 miles an hour.

Meteorological Observations.—Table III.

Kew Observatory.

Months.	Bright Sunshine.				Maximum temperature in sun's rays. (Black bulb *in vacuo*.)			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.
1898.	h. m.		h. m.		deg.	deg.		deg.	deg.		miles.	miles.	
January	27 12	11	5 48	7	63	90	22	35	21	11	7·7	32	31
February	68 36	24	8 30	26	82	97	16, 26	29	16	21	12·3	35	2
March	92 54	26	9 0	15	85	115	18	28	17	13	12·5	43	24
April	143 54	35	12 30	16	106	119	16	31	17	5	10·8	36	30
May	146 54	31	13 12	7	111	126	14	40	28	1	10·5	32	3
June	166 18	34	14 36	11	121	135	20	45	35	3	10·1	28	25
July	211 42	42	14 48	24	125	141	6	47	34	11	7·7	24	29
August	205 36	46	12 12	12	123	144	14	50	39	8, 9	10·9	34	18
September	210 12	55	10 48	4	117	133	8	43	26	29	7·7	23	29
October	68 18	21	8 36	1	89	109	23	43	29	13	10·2	27	14, 22
November	60 0	22	6 24	1	74	101	5	34	19	23, 30	8·7	31	2
December	51 6	21	6 12	23	67	84	4	34	17	23	12·4	50	27
Totals and Means	1452 42	31	..	..	97	..	..	38	..	..	10·1	..	..

* 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.

APPENDIX III.—Table I.

RESULTS OF WATCH TRIALS. Performance of the 50 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. ±	Mean change of rate for 1° 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.	Change of rate with change of position.	Temperature compensation.	
											0—40	0—40	0—20	0—100.
			secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.				
S. Yeomans, Coventry	76152	S.r., g.b., s.o., "Karrusel"	+5·8	+6·0	+6·1	+6·2	+6·5	0·4	0·03	3·7	32·0	39·3	17·9	89·2
Baume & Co., London	103037	G.b., s.o., "Tourbillon" chronometer	−1·7	−2·2	−2·2	−1·1	−0·6	0·3	0·04	3·2	34·0	37·7	17·3	89·0
Fridlander, Coventry	25569	S.r., g.b., s.o., "Karrusel"	+1·9	+2·2	+2·5	+2·4	+2·6	0·4	0·04	3·2	32·0	39·0	17·6	88·6
Montandon-Robert, Geneva	1079	D.r., g.b., s.o.	−1·6	−2·9	−2·7	−4·3	−1·3	0·3	0·02	5·2	33·4	36·6	18·5	88·5
S. Smith & Son, London	1898–1	G.b., d.o., pocket chronom., "Karrusel"	+1·4	+0·6	+0·1	+2·2	+1·2	0·3	0·04	4·0	33·1	37·6	17·4	88·1
Montandon-Robert, Geneva	1097	D.r.,g.b., s.o., seconds chronograph	+2·0	+1·6	+2·1	+0·2	+4·5	0·3	0·04	7·0	34·4	36·1	17·5	88·0
Fridlander, Coventry	25570	S.r., g.b., s.o., "Karrusel"	+0·9	+0·9	+1·2	+2·9	−0·6	0·3	0·04	4·7	33·9	36·8	17·3	88·0
E. Flinn, Coventry	18213	S.r., g.b., s.o., "Karrusel"	+3·3	+3·0	+3·1	+4·4	+5·2	0·4	0·02	4·0	32·2	37·0	18·5	87·7
Baume & Co., London	103031	G.b., s.o., "Tourbillon" chronometer	−2·2	−0·9	−0·6	−1·9	−2·7	0·3	0·06	4·5	33·9	37·1	16·2	87·2
Montandon-Robert, Geneva	1102	D.r.,g.b., s.o., minute chronograph	−0·8	+1·7	+0·6	−0·2	+1·6	0·3	0·04	4·5	33·4	36·5	17·3	87·2
Baume & Co., London	103038	G.b., s.o., "Tourbillon" chronometer	+2·3	+1·7	+2·3	+2·8	+3·9	0·4	0·05	4·7	32·7	37·6	16·9	87·2
W. Matthews, Coventry	36679	S.r., g.b., s.o., "Karrusel"	+0·7	+0·5	+0·9	−0·1	+0·9	0·4	0·06	4·8	32·0	38·7	16·3	87·0
S. Yeomans, Coventry	76673	S.r., g.b., s.o., "Karrusel"	−1·2	−0·7	−1·1	−0·7	−0·2	0·4	0·06	3·8	32·1	38·7	16·1	86·9
W. Matthews, Coventry	95200	S.r., g.b., s.o., "Karrusel"	+1·0	−0·8	+0·4	−0·4	−0·4	0·3	0·08	6·0	34·3	37·6	14·6	86·5
W. Vasel, London	1799	S.r., g.b., d.o.	−3·3	−4·3	−2·4	−1·5	−2·1	0·4	0·03	5·2	31·7	36·5	17·9	86·1
J. Adams, Coventry	6315	S.r., g.b., s.o., "Karrusel"	−4·5	−5·0	−4·9	−1·5	−2·9	0·4	0·03	5·0	32·8	35·1	18·1	86·0
S. Yeomans, Coventry	76689	S.r., g.b., s.o., "Karrusel"	−0·5	−0·5	+0·6	−0·1	−2·8	0·4	0·03	5·2	31·4	36·6	17·8	85·8
Carley & Co., London	50163	S.r., g.b., s.o., "Karrusel"	+1·0	+0·2	−1·5	+0·3	+1·5	0·5	0·04	4·3	30·7	36·9	17·5	85·1
J. White & Son, Coventry	35928	S.r., g.b., s.o.	−1·0	+1·5	−2·5	−1·0	−1·2	0·5	0·03	7·2	30·1	36·2	18·3	84·6
Usher & Cole, London	29278	S.r., g.b., d.o., "Karrusel"	−2·1	−2·8	−2·1	−1·7	−1·4	0·6	0·04	4·2	28·5	38·6	17·3	84·4
Fridlander, Coventry	14683	S.r., g.b., s.o.	+1·2	−0·7	−2·0	+1·1	+0·9	0·4	0·04	4·7	31·5	35·2	17·5	84·2
J. Kellie, Liverpool	88. 87160	S.r., g.b., s.o., "Karrusel"	+2·5	+3·3	+3·4	+1·5	+2·2	0·5	0·05	5·7	30·0	37·5	16·5	84·0
Fridlander, Coventry	14725	S.r., g.b., s.o.	−1·8	−1·1	−5·0	+0·7	−0·4	0·4	0·02	8·0	31·0	34·0	18·9	83·9
R. Thorneloe, Coventry	1677	S.r., g b., s.o., "Karrusel"	+2·3	+1·0	+1·2	+5·2	+2·8	0·5	0·02	6·0	30·1	35·2	18·6	83·9
Baume & Co, London	246988	D.r.,g.b., s.o., minute chronograph	−3·0	−8·2	−3·0	−2·6	−1·2	0·4	0·02	8·5	32·3	32·5	18·9	83·7

Table I—*continued.*

Watch deposited by	Number of watch.	Escapement, balance spring, &c.	Mean daily rate.					Mean variation of daily rate. ±	Mean change of rate for 1° 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.	Change of rate with change of position.	Temperature compensation.	
											0—40	0—40	0—20	0—100.
			secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.				
P. and A. Guye, London	12648	S.r., g.b., d.o.	+1·2	−2·2	−0·2	+2·0	+0·8	0·5	0·03	5·2	30·8	35·1	17·8	83·7
C. J. H. Marlow, Coventry	20438	S.r., g.b., s.o., "Karrusel"	+6·5	+6·2	+7·0	+3·3	+9·0	0·5	0·02	7·7	30·0	34·7	18·9	83·6
C. J. Hill, Coventry	149909	S.r., g.b., s.o., "Karrusel"	−0·5	+0·5	+1·2	+0·4	−1·3	0·6	0·01	5·8	27·3	36·8	19·3	83·4
Usher & Cole, London	29273	S.r., g.b., d.o., "Karrusel"	−1·2	−1·7	−2·3	−2·6	−1·4	0·5	0·06	5·5	29·4	38·0	15·9	83·3
Montandon-Robert, Geneva	1101	D.r., g.b., s.o., repeater and chronograph	+1·6	+0·5	+1·2	+3·9	+2·1	0·4	0·07	4·5	31·4	36·4	15·4	83·2
S. Smith & Son, London	191–222 25512	S.r., g.b., s.o., "Karrusel"	+4·9	+4·2	+4·8	+1·1	+4·7	0·5	0·04	7·2	30·6	35·5	17·1	83·2
Usher & Cole, London	29274	S.r., g.b., d.o., "Karrusel"	+1·5	+1·1	+1·4	+1·4	+5·1	0·5	0·03	6·7	29·8	35·2	18·2	83·2
W. Matthews, Coventry	36449	S.r., g.b., s.o., "Karrusel"	−0·3	−0·8	−0·4	−1·9	+0·3	0·6	0·04	5·5	28·0	37·7	17·5	83·2
Wales & McCulloch, London	3395	D.r., g.b., d.o.	−1·4	−0·7	−4·4	−1·4	−2·2	0·4	0·06	5·0	31·5	35·9	15·7	83·1
J. White & Son, Coventry	36123	S.r., g.b., s.o.	−5·8	−2·2	−5·0	−1·7	−0·9	0·4	0·01	8·2	31·0	32·7	19·2	82·9
W. Matthews, Coventry	36451	S.r., g.b., s.o., "Karrusel"	+0·9	+0·6	+0·4	+2·6	+2·4	0·5	0·05	4·2	29·7	36·4	16·7	82·8
S. Yeomans, Coventry	76674	S.r., g.b., s.o., "Karrusel"	+3·7	+4·1	+4·1	+3·0	+6·3	0·6	0·04	4·8	28·5	36·7	17·6	82·8
R. Thorneloe, Coventry	3734	S.r., g.b., s.o., "Karrusel"	+0·8	+0·9	+0·1	+2·2	+0·6	0·5	0·07	6·0	29·2	38·0	15·5	82·7
J. Player & Son, Coventry	29675	D.r., g.b., s.o., "Karrusel"	+3·6	+3·0	+3·3	+5·1	+4·2	0·3	0·11	6·0	33·3	37·4	11·7	82·4
W. Matthews, Coventry	36452	S.r., g.b., s.o., "Karrusel"	−3·0	−1·9	−5·1	−5·9	−2·3	0·5	0·01	6·3	29·4	33·9	19·1	82·4
J. Adams, Coventry	6955	S.r., g.b., s.o., "Karrusel"	−0·6	+0·4	+0·3	−3·2	−1·4	0·5	0·03	7·5	29·1	35·5	17·7	82·3
S. Yeomans, Coventry	76681	S.r., g.b., s.o., "Karrusel"	+1·1	+0·7	+1·4	+2·2	+3·6	0·4	0·09	6·0	31·7	36·5	14·0	82·2
Newsome & Co., Coventry	131071	S.r., g.b., s.o., "Karrusel"	−0·9	−1·0	−0·2	−1·2	+0·2	0·6	0·05	6·0	27·5	38·0	16·7	82·2
H. Williamson, Limited, London	54073	S.r., g.b., s.o., "Karrusel"	−2·9	−3·7	−3·7	+0·4	+0·3	0·5	0·07	6·0	29·9	36·7	15·5	82·1
Newsome & Co., Coventry	129438	S.r., g.b., s.o., "Karrusel"	+1·5	+1·4	+1·2	+3·0	+0·4	0·6	0·05	5·2	27·6	37·6	16·8	82·0
Carley & Co., London	50165	S.r., g.b., s.o., "Karrusel"	+0·8	+1·2	+1·6	+1·2	+1·1	0·6	0·08	6·8	27·6	39·2	15·0	81·8
C. J. Hill, Coventry	149910	S.r., g.b., s.o., "Karrusel"	+0·1	−0·2	+0·4	+1·9	+2·3	0·5	0·06	5·7	29·5	36·2	15·9	81·6
P. and A. Guye, London	7296	D.r., g.b., s.o.	+2·4	+1·4	+3·1	+3·1	+2·6	0·5	0·08	5·0	29·2	38·0	14·4	81·6
S. Yeomans, Coventry	76150	S.r., g.b., s.o., "Karrusel"	+0·3	+0·5	+1·5	+1·8	+1·6	0·6	0·08	6·5	28·7	37·7	14·9	81·3
C. J. Hill, Coventry	150010	S.r., g.b., s.o., "Karrusel"	+4·3	+5·4	+5·1	+3·3	+3·2	0·6	0·04	5·2	27·3	36·8	17·1	81·2

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			Total marks.
			Variation.	Position.	Temperature.	
			0—40	0—40	0—20	0—100.
Minute and seconds chronograph, minute repeater, and perpetual calendar, with phases of the moon	24987	S. Smith and Son, London	27·6	29·6	13·3	70·5
,, ,, ,, ,,	33349	Weill and Co., London	26·3	30·0	12·6	68·9
Minute chronograph and minute repeater	1101	Montandon-Robert, Geneva	31·4	36·4	15·4	83·2
,, ,, ,,	7464	Army & Navy C. S., London	27·2	32·2	15·5	74·9
,, ,, ,, (and split seconds)	2262	H. Golay, London	26·4	35·0	13·4	74·8
Minute and split seconds chronograph	12535	Baume and Co., London	29·8	31·0	17·3	78·1
,, ,, ,,	3320	H. Golay, London	26·0	34·4	14·8	75·2
,, ,, ,,	107962	Baume and Co., London	28·4	34·9	11·6	74·9
,, ,, ,,	30161	Pembroke Coleman, London	24·7	34·4	15·5	74·6
Minute and seconds chronograph	1102	Montandon-Robert, Geneva	33·4	36·5	17·3	87·2
,, ,, ,,	246988	Baume and Co., London	32·3	32·5	18·9	83·7
,, ,, ,,	121964	W. Russell, Glasgow	22·5	36·8	17·7	77·0
,, ,, ,,	115749	Stauffer, Son, and Co., London	25·7	36·0	14·8	76·5
Ordinary seconds chronograph	1097	Montandon-Robert, Geneva	34·4	36·1	17·5	88·0
Minute repeater	2314	H. Golay, London	28·4	29·9	17·0	75·3

Table II—*continued.*

Description of watch.	Number.	Deposited by	Marks awarded for			Total marks.
			Variation.	Position.	Temperature.	
			0–40	0—40	0—20	0–100.
"Non-magnetic"	192 B 292 25572	S. Smith and Son, London....	25·1	36·1	18·4	79·6
,, ...	192 A 291 25571	,, ,, ...	25·9	36·5	16·5	78·9
,, ...	02224	,, ,, ...	27·3	32·4	17·1	76·8
,, ...	189–249 25541	,, ,, ...	28·5	34·4	12·8	75·7
,, ...	35936	J. White and Son, Coventry ..	25·6	35·6	14·2	75·4