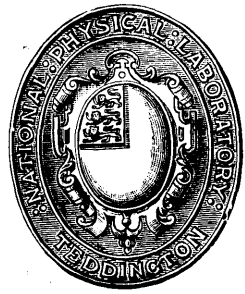

THE

NATIONAL PHYSICAL LABORATORY.

REPORT OF THE OBSERVATORY DEPARTMENT,

RICHMOND, SURREY,

AND OF

THE OBSERVATORY, ESKDALEMUIR,

LANGHOLM, DUMFRIESSHIRE,

FOR THE YEAR 1908.

WITH APPENDICES.

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1909.

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INTRODUCTION.

THE Report of the Observatory Department is in many respects complete in itself and appeals to a different class of workers from that interested in the Physics, Engineering and Metallurgy Departments. It has, therefore, been thought desirable to issue it separately.

With it is now included the first Report of the Eskdalemuir Observatory. This consists mainly of a statement as to the equipment of the Observatory and the installation of the apparatus. In future it is hoped to add tables of the Magnetic and Meteorological results obtained.

R. T. GLAZEBROOK.

NATIONAL PHYSICAL LABORATORY.

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OBSERVATORY DEPARTMENT, RICHMOND.

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Chief Assistant—T. W. Baker, F.R. Met. Soc.
Senior Assistants—E. G. Constable, J. Foster, W. J. Boxall.
Junior Assistants—E. Boxall, G. Badderly, A. C. Cooper, B. Francis, A. G. Williams, W. J. Stockwell.
Student Assistant—J. S. Dines, B.A.
Boy Clerks—B. Johnson, W. R. Corrin, Jun., G. H. Harris, R. R. Strand, J. G. Durham, F. Levin.
Caretaker, &c.—W. R. Corrin, Sen., with wife as housekeeper.

THE OBSERVATORY, ESKDALEMUIR,

LANGHOLM, DUMFRIESSHIRE.

Superintendent—G. W. Walker, M.A., A.R.C.Sc.
Observer—A. E. Gendle.
Computer—W. C. Parkinson.
Mechanic and Caretaker—M. Black, with wife as housekeeper.
Assistant to Mechanic—R. Laidlaw.

REPORT ON THE OBSERVATORY DEPARTMENT FOR THE YEAR ENDING DECEMBER 31, 1908, MADE BY THE SUPERINTENDENT TO THE DIRECTOR.

The work at the Kew Observatory in the Old Deer Park at Richmond, now forming the Observatory Department of the National Physical Laboratory, has been continued during the year 1908 as in the past.

This work may be considered under the following heads :—

I. Magnetic observations.
II. Meteorological observations.
III. Seismological observations.
IV. Experiments and Researches in connection with any of the departments.
V. Verification of instruments.
VI. Rating of Watches and Chronometers.
VII. Miscellaneous.

I. Magnetic Observations.

The magnetographs have been in constant operation throughout the year, and the usual scale value determinations were made in February.

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

Declinometer: 1 cm. = 0° 8′·7.
Bifilar, for 1 cm. $\delta H = 0{\cdot}000505$ C.G.S. unit.

On February 11th the clock was dismounted and cleaned, and the lenses carefully wiped. A new brass wire cord was fitted to the driving weight.

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 on August 4th it was considered desirable to alter the position of the moveable dot by slightly altering the inclination of the mirror attached to the magnet.

During the past year, two magnetic storms or periods of considerable disturbance of the needles have been registered. The first occurred on September 11—12, the second on September 29—30, when a fine display of aurora was generally observed. An account of these disturbances appeared in "Nature," September 24, and October 8. With these exceptions, the curves have been generally quiet all through the year.

The hourly means and diurnal inequalities of the Declination and Horizontal Force for 1908 for the quiet days selected by the Astronomer Royal have been tabulated as usual, and the results will be found in Appendix I, together with the monthly means of the Inclination as derived from the absolute observations. Owing, however, to the disturbance of the vertical force produced by electric trams, it has been found impossible to tabulate the curves for this element satisfactorily. This has led to the omission of the tables of diurnal inequalities of vertical force and inclination published previous to 1902.

A correction has been applied to the horizontal force curves 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.

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 were the mean results for 1908 :—

From curves	Mean Westerly Declination.....	16° 16'·9 W.
	Mean Horizontal Force	0·18515 C.G.S. unit.
From absolute observations, corrected	Mean Inclination	67° 0'·9 N.
	Mean Vertical Force.....	0·43651 C.G.S. unit.

The absolute observations have been reduced to the mean value for the day by applying corrections based on the diurnal variation observed in previous years.

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 Ia.

At the request of the Hydrographer a course of Magnetic Instruction has been given to Lieutenants F. A. Reyne, R.N. and R. L. Hancock, R.N.

On the application of Dr. Bauer, head of the Department of Terrestrial Magnetism in the Carnegie Institution, Washington, facilities were afforded to Mr. J. C. Pearson, in March, for taking magnetic observations in order to compare his instruments with those of Kew.

At the request of the Under Secretary of State for the Colonies, Mr. A. E. Young, of the Federated Malay States Government, was afforded facilities for taking magnetic observations from May 25—29.

At the request of Mr. P. Baracchi, Mr. J. M. Baldwin, who has been appointed to the staff of the Melbourne Observatory, was received at the Observatory on July 21 and 24, and was shown the magnetic instruments and the methods employed in determining the temperature and induction coefficients.

A complete set of self-recording magnetographs constructed by Adie, London, were erected in the Experimental House in June, and examined before being sent to the new observatory at Eskdalemuir.

At the request of the Cambridge Instrument Co., experiments were made with an Inductor of their construction, and some improvements suggested.

Unifilar magnetometer, Dover, 140, and Dip Circle, Dover, 120, were lent to Eskdalemuir Observatory during the summer months to assist in some observational work there.

In view of the fact, pointed out some years ago by the Superintendent, that the usual plan of taking deflections at only two distances—30 and 40 cms.—is theoretically imperfect, leaving out of account one term in the law of action between two magnets which is not really negligible, a practice has been made, commencing with July, 1908, of observing at an additional distance, viz., 22·5 cms. This enables account to be taken of a higher term in the law of action above referred to. For 1908 use has been made as in the past only of the deflections at 30 and 40 cms., so that no discontinuity has yet been introduced. It is intended,

however, to reduce the observations of the last six months of 1908 in two ways, (i) employing only the 30 and 40 cms. observations, (ii) employing also the 22·5 cms. observations, thus obtaining the difference between the two methods. If on fuller examination the theoretical advantages accruing from observing at 3 distances should appear to exceed any compensating disadvantages, a change in the system of reductions will probably be introduced with the commencement of 1909.

II. Meteorological Observations.

The several self-recording instruments for the continuous registration of Atmospheric Pressure, Temperature of Air and Wet-bulb, Wind (direction, pressure 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 have been 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 Office, data have been supplied to the Institute of Mining Engineers, and the editor of "Symons Monthly Meteorological Magazine."

Regular cloud observations have also been made with the Fineman nephescope on 42 days, in connection with the International scheme of balloon ascents, the results being transmitted through the Meteorological Office.

The usual meteorological tables will be found in Appendix II.

Solar Radiation.—The observations commenced last year with the Ångström Pyrheliometer have been made a part of the regular routine. On bright days osbervations are usually made between 11.30 a.m. and 12.30. A summary of the results will be found in Table IV, Appendix II. In addition to the observations near noon, observations extending over a considerable part of the day have been made on several occasions. The results however, from these, and from observations at times when visible cloud intervened, are not included in the table.

Earth Thermometers.—The two Symons' earth-thermometers on the lawn, one at a depth of 1 foot and the other at a depth of 4 feet, have been read at 10 a.m., 4 p.m., and 10 p.m. daily throughout the year, and the 10 a.m. readings have been forwarded weekly to the Meteorological Office, together with the corresponding readings of the Solar Radiation and Terrestrial Radiation thermometers. A summary of the results appear in Appendix II, Table V.

Atmospheric Electricity.—The Electrograph worked generally in a satisfactory manner during the year.

The chloride of silver battery which had been in use for several years began to fail early in the year, and it was decided in March to remove it, and use in its place a set of 30 special Leclanché cells. These were put into use on March 27th, and, so far have proved satisfactory, the potential, which is measured thrice weekly by a Paul "moving-coil" galvanometer, keeping steady at about 43 volts.

Determinations of the scale value of the Electrograph were made on February 25, March 9, May 7 and 18, July 24 and November 5.

A series of curves—ten a month—have been selected as representative of the variations of potential on electrically "quiet" days, defined as days when irregular fluctuations of potential are fewer than usual. These curves have been tabulated and the results appear, with the permission of the Meteorological Office, in Appendix II Tables VI. and VII. Owing presumably in large measure to the fewness of the selected days, the values deduced from the actual curve measurements in Table VI. show in some months a considerable non-cyclic element. This element has been eliminated from the diurnal inequality in Table VII. in the way customary in dealing with meteorological data.

Observations on the rate of loss of electric charge have been made throughout the year with an Elster and Geitel "Dissipation Apparatus." The observations were made in a systematic way between the hours of 2 and 4 p.m., except on days when rain was falling or the wind was high. An abstract of the results appears in Appendix II, Table VIII. As usual a_+ and a_- denote the percentage losses per minute of positive and negative charges respectively.

Inspections.—In compliance with the request of the Meteorological Office, the following Observatories and Anemograph Stations have been visited and inspected:—Stonyhurst, Fleetwood, Armagh, Dublin, Kingstown, Valencia, and Roche's Point, by Mr. Baker; and Radcliffe Observatory (Oxford), Alnwick, North Shields, Holyhead, Pembroke (St. Ann's Head), Plymouth, Falmouth, and Scilly Isles, by Mr. Constable.

III. Seismological Observations.

Professor Milne's "unfelt tremor" pattern of seismograph has been maintained in regular operation throughout the year; particulars of the time of occurrence and the amplitude in millimetres of the largest movements are given in Appendix III, Table I. The largest disturbances recorded took place on March 26 and December 28, the latter being the Sicilian earthquake.

A detailed list of the movements recorded from January 1 to December 31, 1908, has been made and sent to Professor Milne, and will be found in the circulars for 1908 of the British Association "Seismological Investigations" Committee.

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 previous Reports, have been continued, and the observations have been taken every day when possible, excluding Sundays and wet days. The ratios of the "curve" and the "fixed station" readings have been computed for each observation. Besides checking the action of the self-recording electrometer, these serve to reduce the curve readings.

Solar Radiation.—Experimental observations have been in progress throughout the greater part of the year with Radio-integrators designed by the late Dr. W. E. Wilson, F.R.S.

Pressure Tube Comparisons.—In co-operation with the Meteorological Office, a comparison is being made of the older and newer types of suction apparatus in the Dines' Pressure Tube Anemometer. For this purpose there were erected on the roof in July two anemometer heads, one representing a complete instrument of the new type and the other only a suction apparatus of the old pattern. The observational work is being carried out by Mr. J. S. Dines, B.A., who became a Student-Assistant on November 1st.

Hygrometrical Observations.—Mr. J. S. Dines is also engaged on some comparative observations of different types of hygrometrical apparatus, to throw further light on measurements of vapour pressure or relative humidity in spaces having no natural active air ventilation.

V. Verification of Instruments, exclusive of Watches and Chronometers.

The subjoined is a list of the instruments—exclusive of watches and chronometers—examined in the year 1908, compared with a corresponding return for 1907.

	Number tested in the year ending December 31.	
	1907.	1908.
Air-meters	5	13
Anemometers	18	13
Aneroids	209	86
Artificial horizons	1	7
Barometers, Marine	95	53
,, Standard	92	113
,, Station	71	59
Binoculars	787	1,238
Compasses	29	30
Hydrometers	480	613
Inclinometers	8	6
Levels	—	13
Magnetographs	—	1
Magnets	5	3
Milk-test apparatus	72	—
Rain Gauges	10	11
Rain-measuring Glasses	17	37
Sextants	1,261	1,154
Sunshine Recorders	5	—
Telescopes	5,376	3,177
Theodolites	15	27
Thermometers, Clinical	20,427	18,752
,, Deep sea	70	5
,, *High Range	41	2

* The testing of high range thermometers has been transferred to Teddington.

Thermometers, Hypsometric	42	42
„ Low Range	32	112
„ Meteorological	5,397	4,719
„ Solar radiation	5	—
„ Standard	109	70
„ Other Forms	3	13
Unifilars	5	2
Miscellaneous	13	20
Total	34,700	30,391

Duplicate copies of corrections have been supplied in 31 cases.

The number of instruments rejected in 1907 and 1908 on account of excessive error, or for other reasons, was as follows :—

	1907.	1908.
Thermometers, clinical	144	82
„ ordinary meteorological	59	50
Sextants	179	175
Telescopes	184	164
Binoculars	57	242
Various	89	121

There were at the end of the year at the Observatory undergoing verification, 1 barometer, 159 thermometers, 3 hydrometers, 18 sextants, 413 telescopes, 108 binoculars, 2 dip circles, 10 various.

VI. Rating of Watches and Chronometers.

The number of watches sent for trial this year was 252 as compared with 246 in 1907.

The 252 watches received were entered for trial as below :—

For Class A, 175 ; class B, 42 ; and for the subsidiary trial, 35. Of these, 139 were awarded class A certificates, 33 obtained class B certificates, 30 passed the subsidiary test, and 50 failed from various causes to gain any certificate.

A marked improvement in performance was shewn, as compared with the preceding three years.

Of the 139 movements which passed the class A tests, no less than 79 obtained the distinction of " especially good," and the percentage number rose to 56·8, which is, so far, a maximum value, the nearest approach being 50·2 in 1904.

The following figures show the percentage number of watches obtaining the distinction " especially good " during the last ten years, as compared to the total number obtaining class A certificates :—

Year	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
Percentage " especially good "	26·6	35·4	35·5	31·6	42·4	50·2	44·7	47·5	43·0	56·8

15 watches obtained 90 marks and upwards, this being an increase of 4 on the previous maximum number.

In Appendix IV. will be found a table giving the results of trial of the 50 watches which gained the highest number of marks during the year. The first place was taken by the keyless going barrel bar-lever watch, No. 143263, sent by Patek Philippe and Co., Geneva, which obtained the high total of 94·2 marks.

This was closely followed—with 93·5 marks—by the keyless Tourbillon lever fusee watch No 302-8, sent by S. Smith & Son, London.

Marine Chronometers.—As was anticipated, the phenomenally large number of chronometers sent for trial in 1907 was not maintained, the number of entries falling to the more normal total of 82.

Of these, 64 obtained certificates, and 18 failed. The percentage of failures, 22, practically agrees with the mean of the last seven years.

VII. Miscellaneous.

Commissions.—The following instruments have been procured, examined, and forwarded to the institutions on whose behalf they were purchased :—

Dip Circle and Tripod Stand for St. Petersburg.
,, ,, Toronto.

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

Photographic paper has also been sent in quarterly instalments to the Indian Office for use in Indian observatories.

Sunshine cards have been sent to Hong Kong and St. Petersburg.

Comparison of English and Russian Standard Instruments.—At the request of General Rykatcheff, Head of the Russian Meteorological Service, facilities were afforded Mr. W. Dubinsky, of the Pavlovsk Observatory, for a comparison of magnetic instruments and barometers with the standards at Kew. The object of the comparison was to determine the difference between the standard instruments in the two countries, in accordance with a general scheme of intercomparisons approved by the last International Meteorological Conference.

Mr. Dubinsky brought with him a magnetometer and an inductor—both very fine instruments—of the type invented by Dr. H. Wild, and two barometers.

His work at the Observatory was carried on from October 5 to October 23, and included a number of comparisons with the Kew magnetometer and dip circle, and with both the old and the new standard barometers. The absolute observations with the Kew magnetic instruments—taken simultaneously with Mr. Dubinsky's observations—were made by Mr. T. W. Baker ; the corresponding barometer readings were taken by Mr. J. Foster. Both the magnetic and barometric conditions were very favourable.

Eskdalemuir Observatory.—Mr. G. W. Walker, Superintendent of the Eskdalemuir Observatory, came to Kew early in January and attended for several months, paying more special attention to the magnetic and meteorological work. In particular he took part in the testing of the Kew pattern magnetographs made by Mr. P. Adie, for Eskdalemuir. Whilst these were at Kew various defects were

remedied, but some points calling for improvement still remained when the instruments were removed to Eskdalemuir.

Eschenhagen Magnetographs.—These instruments, which belong to the Admiralty, and which are now at Eskdalemuir, are those which were in use at the "Discovery's" winter quarters in 1902-4. In the reduction of the Antarctic vertical force curves, certain very puzzling features presented themselves in connection with temperature effects, which were very large. Experiments to throw some light on the matter were carried out with the assistance of Mr. G. W. Walker and Mr. T. W. Baker before the instruments went to Eskdalemuir, and an explanation which seemed to fit all the observed facts was eventually arrived at. Without these experiments much greater uncertainty would have existed as to the reliability of the results eventually derived from the Antarctic vertical force curves.

National Antarctic Observations.—The volume dealing with the meteorological observations of the National Antarctic Expedition of 1902-4 contained a discussion by the Superintendent of the absolute temperature observations at "Winter Quarters." The volume of "Physical Observations" recently published contained the Superintendent's discussion of the pendulum observations made by Mr. Bernacchi at Melbourne, Christchurch (N.Z.), and winter quarters, and his discussion of the magnetic results obtained by Mr. Mossman, of the "Scotia" Antarctic Expedition in the South Orkneys. By permission of the Royal Society, the Superintendent was also able to include in his presidential address to the Physical Society of London in February an account of some of the results obtained from a study of the magnetograph curves at the "Discovery's" winter quarters. The study of these curves is now approaching completion. The tables embodying the hourly readings have already gone to the printer, and all the term hour and disturbed curves which it is intended to reproduce have gone to the engraver. At first, the satisfactory reduction of the vertical force curves was despaired of, but with the expenditure of a great amount of time and thought this has been eventually accomplished.

Earthquake of December 28.—An account of the Italian earthquake with copies of the records from the Milne seismograph and the declination magnetograph—which exhibited mechanical tremors—was communicated to "Nature."

Franco-British Exhibition.—The Superintendent served on the Meteorological Committee of the Science section. The exhibit of the observatory department consisted of a model of the magnetographs, some old instruments (including the Winstanley Radiograph, McLeod sunshine recorder, and Kelvin cage electrometer), photographs of magnetic instruments and of the recording barograph and thermograph, frames of cloud photographs and McLeod sunshine records, and a number of new frames (29 in all). These contained magnetic curves from Kew and the Antarctic ("Discovery" expedition) Kew barograms and thermograms (lent by the Meteorological Office) and a number of specially drawn diagrams, illustrating magnetic secular change, diurnal and annual variations in the magnetic and meteorological elements, and the analysis of the diurnal changes in Fourier "waves."

After the close of the Exhibition the new frames were hung on the walls of the Observatory.

Fire at the Observatory.—On July 3 a fire broke out in the evening after the staff had left. It was due to a plumber having left some burning coals in a brazier on the flat lead roof. Eventually the timbers below the lead got alight. The smoke was

fortunately noticed by the caretaker, W. Corrin, who was working in the garden, and with the assistance of Mrs. Corrin he succeeded in putting out the fire. Their promptitude in the matter is much to be commended.

There was considerable damage through water to the ceiling of the Superintendent's room, which was immediately under the portion of the roof burned, and to that of the Computing room in the floor below. But this damage was made good by the tradesman whose plumber was at fault. The roof was repaired by H.M. Office of works. There was no serious damage to the contents of the building.

Painting of the Building, and Repairs.—The whole exterior of the main building was painted by H.M. Office of Works during July and August. In the course of the year repairs were made by Messrs. Eldridge to the newer magnetic hut, some of whose timbers had rotted. They also painted both magnetic huts, the experimental house and the exterior of the building containing the clinical thermometer room.

List of Instruments, Apparatus, &c., the Property of the National Physical Laboratory Committee, at the present date out of the custody of the Director, on Loan.

To whom lent.	Articles.	Date of loan.
The Science and Art Department, South Kensington.	Articles specified in the list in the Annual Report for 1893	1876
Lord Rayleigh, F.R.S.	Standard Barometer (Adie, No. 655).....	1885
New Zealand Government.	Dip Circle, by Barrow, with one pair of Needles and Bar Magnets.....	1899
	Tripod Stand	1899
Lieut. Shackleton	Unifilar Magnetometer, by Jones, marked N.A.B.C.	1907

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

19 Scientific Societies and Institutions of Great Britain and Ireland,

117 Foreign and Colonial Scientific Establishments,

as well as from several private individuals.

The card catalogue has been proceeded with.

CHARLES CHREE,

Superintendent.

REPORT ON THE WORK OF THE ESKDALEMUIR OBSERVATORY FOR THE YEAR ENDING DECEMBER 31st, 1908, MADE BY THE SUPERINTENDENT TO THE DIRECTOR.

INSTALLATION OF APPARATUS.—The first report of the Observatory differs essentially in character from the normal annual Report to be expected in the future, inasmuch as it must be an account of the installation of instruments rather than a record of numerical results obtained.

The Superintendent arrived at the Observatory on May 11th, and simultaneously Messrs. Maple and Co. commenced the transfer of furniture and instruments into the houses and offices.

The caretaker occupied his house on May 13th, and the two assistants arrived on May 22nd. After fixing the laboratory tables and furniture, which was completed in about a fortnight, an examination of the scientific apparatus was made. The barometer and a slate slab belonging to the photographic barograph were found broken. In view of the great difficulty of transport to the Observatory it may perhaps be regarded as fortunate that no more serious damage was done.

Magnetic Instruments.—In view of the primary object of the Observatory, it was decided to start absolute magnetic observations at once in the magnetic huts, the superintendent and the two assistants each taking one complete set weekly. The first observations of Horizontal Force, Declination, and Inclination were made on May 29th, and the scheme was carried on for eight weeks, when certain changes had to be made in the observation huts. When these were completed, a series of determinations of the moment of inertia of the vibration magnet were made in August. A preliminary comparison made with the aid of magnetometer Dover, No. 140, and dip circle Dover, No. 120, borrowed from Kew, showed that if measurable differences exist between the absolute values obtained on the central piers of the two huts—whose distance apart is about 54 yards—they are less than 3γ in H.F., 1′ in declination and 0′·5 in dip. A more exact determination is in contemplation when the magnetographs are in full working order and the azimuths of the distant mark finally determined.

Observations three times weekly were resumed in October, and it is hoped that these may now be continued regularly without serious interruption.

Determinations of the azimuth of the fixed mark have been carried out both by sun and star observation, but final values can not be given until the arrangements for the time signal are complete.

It was intended to start the Eschenhagen magnetographs in June. The magnet house was, however, in such a bad condition from damp, that no delicate instruments could be installed at that time.

The magnet house not being available, the Eschenhagen recorders were set up in the seismograph room. The spare pillar provided a substantial base for the instruments. The recording cylinder had to be sent away to have certain defects removed, and on its return the apparatus was run at first with an oil lamp. Satisfactory traces, however, only began in November, when the acetylene gas was introduced.

Compensation of the temperature effect on the vertical force instrument is now

in progress, and it is hoped that this may be completed before the removal to the magnet house takes place.

The Adie magnetographs did not arrive here until September. The magnet house being still under treatment for damp, the instruments were set up in the general laboratory on strong wooden tables in order to test them as far as was possible. They had previously been examined at Kew.

There are certain defects in the optical arrangements which are under investigation and treatment with a view to their removal. Otherwise the instruments appear good, and in particular the vertical force instrument has maintained a constant high sensibility since it was set up. It was hoped that the compensation of temperature effect and the constancy of zero could be ascertained, but the warping of the wooden supports consequent on changes of temperature, etc., has defeated the experiments, and this matter can only be satisfactorily dealt with when the instruments are set up in the magnet house.

Meteorological Work.—Turning now to the Meteorological part of the work, the following is the historical order of initiation of records.

The Richard barograph was started on June 8th.

The check raingauge was started on June 11th, and 10 a.m. daily readings have been taken since then. A rainfall of 29·3 inches has been recorded from June 18th to December 18th.

10 a.m. daily readings of wet and dry bulb, maximum and minimum temperatures by Negretti's thermometers in a Stevenson screen have been made since June 16th.

10 a.m. daily eye readings of standard barometer commenced on June 18th.

10 a.m. daily weather notes, cloud, etc., commenced on June 18th.

The Beckley recording rain gauge was started on June 18th. It has occasionally failed to act properly, and in high winds, which frequently sweep up the hill from the S.W., it invariably records a smaller amount than the check raingauge.

The result is probably due to the slightly different positions and shape of the two gauges. One frequently sees the rain, not falling, but actually being driven up hill, and the loss due to this cause will differ in different exposures.

The Observatory is so wind swept that it would be interesting to place a second check rain gauge in some sheltered spot on Burncleugh Hill to the S.W.

The Campbell-Stokes sunshine recorder was erected on July 2nd, on a stone pier which commands the whole of the sky above the horizon.

It may be of interest to note that the first complete record taken on July 3rd gave unbroken sunshine from 5 a.m. to 6 p.m.

The Dines anemometer was brought here in May, but the pole for carrying the head was not erected until September. The instrument has run satisfactorily since September 2nd. The highest velocity recorded was a gust of 72 miles an hour.

The Richard thermograph arrived in November, and has been running since.

Tabulation of records according to the prescribed Meteorological Office forms was started as soon as each instrument was working properly, and this is now regularly carried out.

The photographic mercury barograph has been placed in the east underground room of the magnet house.

A large thermograph shed, from plans obtained from Greenwich by kind

permission of the Astronomer Royal, was erected during the summer, for the reception of the photographic dry and wet bulb thermograph.

The apparatus required extensive repair and modification in order to adapt it for out-door work. The instrument is still in the experimental stage of improvement, but regular work may be expected in a few weeks.

Seismological Work.—The Milne twin-boom seismograph was set up in September and started running with oil lamps on September 24th. When gas was available in November, the lamp was replaced by a gas jet. In accordance with Professor Milne's suggestion the period of the booms was made 18 seconds. The instrument has worked well and the zeros were remarkably constant until quite recently when a slight drifting occurred and still continues. This is being carefully watched. The results are regularly tabulated on the British Association forms.

Electrical Work.—The Ångström solar radiation apparatus has been put in working order, and at present wires are being carried to the top of the tower and a small platform for carrying the thermopile itself is in course of construction.

Preparations are being made for the installation of the apparatus for recording atmospheric electrical potential. The apparatus is not expected to be ready until February.

We have had to contend with a good many difficulties and delays during this year, and while we are not as far advanced as we had hoped, the progress made has been substantial and this is in no small measure due to the hearty co-operation of the assistants and the mechanic.

The work that has hitherto been carried out must be looked upon as tentative and provisional in its character, but arrangements have been made for tabulating and preparing for publication the observations taken after December 31, 1908.

Position of Observatory.—A small survey was necessary to fix the position of the Observatory on the ordnance map, and hearty thanks are due to the Ordnance Survey Department for their kindness in supplying, from the data given, our latitude and longitude. A determination of the exact altitude from a fixed bench mark on the school house at Davington has not yet been possible.

The latitude and longitude of the Standard Magnetic Hut are as follows :—

Latitude = 55° 18′·8 N.
Longitude = 3° 12′·3 W.
Height above sea level—about 800 feet.

Absolute Magnetic Observations.—The mean values found for June, 1908, were :—

Horizontal Force	=	·16828 C.G.S.
Declination	=	18° 33′·2 W. (subject to error of azimuth).
Inclination	=	69° 37′·4 N.

Library.—It is hoped that in course of time the Library of the Observatory may acquire a valuable collection of works dealing with meteorology in general, but more especially with terrestrial magnetism, atmospheric electricity and seismology. The Superintendent would be grateful for any gifts from other Observatories of books or papers bearing on these subjects, and for donations of back volumes of Transactions or Proceedings of Scientific Societies, as well as for offers to send such publications in future. These should be addressed to the Superintendent, The Observatory, Eskdalemuir, Langholm, Dumfriesshire.

Summary of Work now in progress.

Absolute Magnetic observations,* thrice weekly.

10.0 a.m. daily readings of temperature, maximum and minimum, wet and dry bulb, by Negretti's thermometers in Stevenson screen.

10.0 a.m., daily eye reading of standard barometer.**

10.0 a.m., daily reading of check rain gauge.†

10.0 a.m., daily reading of weather, clouds, etc.

Raingauge, recording. (Beckley) †.

Sunshine recorder, (Campbell-Stokes).**

Recording Anemometer, (Dines).

,, Barograph, (Richard).

,, Thermograph, ,,

,, twin-boom Seismograph, (Milne).

,, Magnetographs, (Eschenhagen)†† temporarily installed in seismograph room.

Recording photographic barograph,† still in experimental stage.

,, ,, thermograph,† still in experimental stage.

G. W. WALKER,
Superintendent.

* The unifilar Elliot, No. 60 and dip circle Dover, No. 74, used in these observations were given to the Laboratory by Sir Arthur Rücker and are those employed by Professor Thorpe and himself in their magnetic survey of the British Isles in 1890.

** Lent by the Meteorological Office.

† Instruments lent by the Meteorological Office, being those formerly at Fort William.

†† Lent by the Admiralty.

APPENDIX I TO REPORT OF SUPERINTENDENT OF OBSERVATORY DEPARTMENT.

MAGNETIC OBSERVATIONS, 1908, KEW OBSERVATORY.

Latitude 51° 28′ 6″ N., and Longitude $0^h\ 1^m\ 15^s.1$ W.

The results in the following Tables I to IV are deduced from the magnetograph curves, which have been standardised by observations of Declination and Horizontal Force. The observations were made with the Collimator Magnet K.C.I. and the Declinometer Magnet K. O. 90 in the 9-inch Unifilar Magnetometer, by Jones.

Inclination observations were also taken with the Inclinometer No. 33, by Barrow with needles $3\frac{1}{2}$ inches in length. Table V gives the monthly means of these observations as actually taken, and also as corrected to the mean of the day from previous years' results. It also gives monthly values of the Vertical Force, calculated from the corrected values of the Inclination and the mean monthly values of the Horizontal Force.

The values of Inclination and Vertical Force are a little influenced by electric tram currents, which produce apparently a slightly enhanced value of Vertical Force throughout the day. The Declination and Horizontal Force inequalities are not absolutely above suspicion in this respect, but any uncertainty that may exist in their case is undoubtedly small.

The Declination and Horizontal Force values given in Tables I to IV 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 1908 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	14, 16, 20, 21, 23.
February	2, 14, 15, 21, 28.
March	7, 13, 14, 15, 24.
April	3, 12, 13, 20, 21.
May	7, 15, 16, 17, 22.
June	2, 5, 16, 23, 25.
July	3, 4, 8, 19, 31.
August	5, 6, 16, 20, 28.
September	1, 2, 20, 21, 26.
October	10, 11, 16, 23, 24.
November	5, 16, 21, 22, 23.
December	2, 11, 15, 20, 21.

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

Hours	Preceding noon.	Midt.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
	(16° + West.)					Winter.							
1908. Months	′	′	′	′	′	′	′	′	′	′	′	′	′
Jan. ...	20·6	18·0	18·1	18·4	18·4	18·6	18·7	18·5	18·4	18·4	18·5	19·1	19·7
Feb. ...	21·9	18·9	19·3	18·9	19·1	19·1	19·1	18·8	18·7	18·0	17·5	18·2	20·1
Mar. ...	22·5	18·7	19·0	19·2	19·2	19·2	19·5	19·0	18·3	17·1	16·7	17·9	20·4
Oct. ...	19·7	14·2	14·3	14·6	14·7	14·5	14·7	14·1	13·4	11·7	11·8	13·5	16·4
Nov. ...	17·4	14·2	14·2	14·3	14·5	14·1	14·3	13·8	13·8	13·5	13·6	14·4	15·9
Dec. ...	16·5	13·1	13·3	13·7	13·9	13·9	14·0	13·9	13·8	13·6	13·8	14·4	15·3
Means	19·8	16·2	16·4	16·5	16·6	16·6	16·7	16·4	16·1	15·4	15·3	16·3	18·0
						Summer.							
	′	′	′	′	′	′	′	′	′	′	′	′	′
April ...	23·5	16·6	16·6	16·7	16·9	16·2	15·6	14·3	13·1	11·9	13·0	15·6	18·7
May ...	23·0	16·0	16·2	16·2	16·1	15·4	14·4	13·4	13·0	12·7	13·7	16·8	20·7
June ...	21·2	15·4	14·9	14·8	14·6	13·9	13·2	11·8	10·8	10·6	12·2	14·4	16·8
July ...	21·3	16·2	16·1	16·1	15·5	15·0	13·8	12·2	11·6	11·3	12·3	15·1	18·4
Aug. ...	21·8	14·5	14·0	14·2	14·2	14·0	13·6	11·7	11·4	11·5	13·2	15·0	18·1
Sept. ...	20·5	14·6	14·8	15·3	15·3	14·7	14·6	13·9	13·6	12·5	13·1	14·9	17·6
Means	21·9	15·6	15·4	15·5	15·4	14·9	14·1	12·9	12·2	11·8	12·9	15·3	18·4

Table II.—Diurnal Inequality of the

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

NOTE.—When the sign is + the magnet
,, ,, − ,,

Quiet Days in 1908. Mean for the Year = 16° 16′·9 West.

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Midt.	Succeeding noon.
					Winter.								
′	′	′	′	′	′	′	′	′	′	′	′	′	′
20·7	21·3	21·0	20·6	20·4	20·0	19·5	19·0	18·6	18·4	18·2	18·4	18·1	21·2
22·0	23·0	23·0	22·0	21·0	20·2	19·8	19·4	19·3	19·0	19·0	19·2	19·1	22·6
23·0	24·2	24·2	22·7	20·6	19·3	19·1	19·0	18·8	18·4	18·6	18·4	18·2	24·1
19·3	20·5	20·1	19·0	17·3	16·4	16·0	15·4	15·2	14·9	14·7	14·3	13·5	19·5
17·2	17·5	17·1	16·4	16·1	15·8	15·3	15·2	14·9	14·9	14·6	14·8	14·5	18·0
16·4	16·3	15·5	15·3	14·8	14·8	14·3	14·0	13·7	13·7	13·3	13·4	13·1	15·3
19·8	20·5	20·2	19·3	18·4	17·8	17·3	17·0	16·8	16·5	16·4	16·4	16·1	20·1
					Summer.								
′	′	′	′	′	′	′	′	′	′	′	′	′	′
22·3	23·9	23·2	21·6	19·7	18·0	17·2	16·9	16·9	16·7	16·5	16·3	16·2	21·6
23·1	23·5	22·7	21·5	20·4	19·1	17·9	16·7	16·8	16·4	16·1	16·2	15·9	22·5
19·6	21·4	22·1	21·0	20·0	18·6	17·2	16·5	16·4	16·4	16·0	15·9	15·5	20·5
20·9	22·1	22·8	22·1	20·3	18·7	17·6	17·1	16·9	16·8	16·8	16·8	16·4	20·8
21·3	22·8	22·6	21·0	18·8	16·9	16·2	16·2	15·9	15·6	15·3	14·9	14·4	22·0
20·1	20·8	20·8	19·7	18·3	17·0	16·8	16·8	16·3	16·3	15·8	15·6	15·4	21·1
21·2	22·4	22·4	21·2	19·6	18·1	17·2	16·7	16·5	16·4	16·1	16·0	15·6	21·4

Kew Declination as derived from Table I.

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

points to the West of its mean position.

,, ,, East ,, ,,

Table III.—Hourly Means of the Horizontal Force in C.G.S. Units in 1908. (Mean for the

Hours	Preceding Noon.	Midt.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
·18000+						Winter.							
1908. Months.													
Jan.	519	522	519	519	520	522	524	525	528	527	524	523	521
Feb.	503	519	517	516	516	517	522	524	524	522	516	511	509
March ...	499	524	520	520	520	520	522	523	523	514	506	499	496
Oct.	485	511	510	507	508	510	510	510	509	497	486	480	481
Nov.	502	510	509	506	507	508	508	510	510	506	500	497	501
Dec.	507	516	513	511	512	513	516	517	519	516	516	512	511
Means ...	503	517	515	513	514	515	517	518	519	514	508	504	503
						Summer.							
April	489	517	515	515	514	513	514	516	512	504	491	485	488
May	502	524	524	521	521	520	520	515	509	500	496	493	493
June	505	528	524	519	521	521	520	520	514	506	498	494	496
July	507	526	523	520	522	521	521	520	513	506	499	496	497
Aug.	488	516	513	512	512	511	508	505	500	492	486	483	489
Sept.	495	513	508	506	506	504	502	500	497	489	483	480	481
Means ...	498	521	518	516	516	515	514	513	508	500	492	489	491

Table IV.—Diurnal Inequality of the Kew

Hours.	Midt.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
					Summer Means.							
	+·00006	+·00004	+·00001	+·00002	+·00001	·00000	−·00002	−·00007	−·00015	−·00022	−·0020	−·00024
					Winter Means.							
	+·00002	·00000	−·00002	−·00001	·00000	+·00002	+·00003	+·00004	−·00001	−·00007	−·00011	−·00012
					Annual Means							
	+·00004	+·00002	·00000	·00000	·00000	−·00001	+·00001	−·00001	−·00008	−·00015	−·00019	−·00018

NOTE.—When the sign is + the

(Corrected for Temperature) as determined from the Selected Quiet Days Year = 0·18515).

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Midt.	Succeeding Noon.
						Winter.							
519	523	527	527	526	528	527	526	526	525	525	525	525	518
507	512	517	515	512	515	520	520	522	524	523	525	524	510
498	504	513	518	522	525	527	531	529	529	530	529	526	508
488	495	502	507	510	512	515	518	519	518	514	516	513	489
506	509	510	511	511	513	515	516	516	515	513	512	510	500
513	516	516	515	516	516	518	519	519	519	519	517	517	514
505	510	514	516	516	518	520	522	522	522	521	521	519	507
						Summer.							
492	499	511	515	521	522	526	527	526	526	524	523	522	498
501	508	518	522	525	529	531	532	535	532	531	530	528	500
505	507	516	521	533	536	534	537	534	531	530	530	529	508
500	504	514	526	531	531	535	534	535	535	534	534	530	506
500	507	515	519	521	520	525	531	532	530	529	524	523	504
494	499	501	503	508	510	512	515	516	516	515	515	514	492
499	504	513	518	523	525	527	529	530	528	527	526	524	501

Horizontal Force as derived from Table III.

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Midt.
					Summer Means.							
−·00016	−·00010	−·00002	+·00003	+·00009	+·00011	+·00013	+·00015	+·00016	+·00014	+·00013	+·00012	+·00010
					Winter Means.							
−·00010	−·00005	−·00001	·00000	+·00001	+·00003	+·00005	+·00007	+·00007	+·00007	+·00006	+·00006	+·00004
					Annual Means.							
−·00013	−·00008	−·00001	+·00002	+·00005	+·00007	+·00009	+·00011	+·00011	+·00010	+·00009	+·00009	+·00007

reading is above the mean.

Table V.—Mean Monthly Values of Inclination and Vertical Force during the Year 1908.

1908.	Mean time of Observation. p.m.	Inclination Observed.	Inclination reduced to the mean value for the day.	Vertical force (mean value for the day.) C.G.S. Units.
	h. m.	° ′	° ′	
January	2 57	67 1·6	67 1·4	·43689
February	3 1	67 1·1	67 1·0	·43660
March	3 27	67 1·1	67 1·0	·43663
April	3 18	67 1·1	67 1·2	·43656
May	3 34	67 0·6	67 0·8	·43655
June	3 40	67 0·2	67 0·6	·43649
July	3 43	67 0·6	67 1·0	·43664
August	3 50	67 1·0	67 1·3	·43655
September	3 48	67 0·7	67 0·7	·43616
October	1 58	67 1·9	67 1·8	·43659
November	3 25	67 1·1	67 1·0	·43639
December	2 54	66 59·7	66 59·5	·43604
Mean for year	...	...	67 0·9	·43651

APPENDIX Ia.

MEAN VALUES, for the years specified, of the Magnetic Elements at Observatories whose Publications are received at the National Physical Laboratory.

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.	1905	0 59·8 E.	70 36·1 N.	·16540	·46975
Sitka (Alaska)	57 3 N.	135 20 W.	1906	30 3·3 E.	74 41·7 N.	·15592	·56646
Katharinenburg	56 49 N.	60 38 E.	1905	10 27·2 E.	70 48·3 N.	·17692	·50819
Rude Skov	55 51 N.	12 27 E.	1907	9 50·0 W.	68 44·0 N.	·17423	·44765
*Eskdalemuir	55 19 N.	3 12 W.	1908	18 33·3 W.	69 37·3 N.	·16830	·45307
Flensburg	54 47 N.	9 26 E.	1903	11 28·0 W.	68 12·5 N.	—	—
Barth	54 22 N.	12 45 E.	1903	9 52·9 W.	67 37·6 N.	·18261	·44363
Stonyhurst	53 51 N.	2 28 W.	1907	17 43·8 W.	68 46·4 N.	·17398	·44795
Hamburg	53 33 N.	9 59 E.	1903	11 10·2 W.	67 23·5 N.	·18126	·43527
Wilhelmshaven	53 32 N.	8 9 E.	1906	12 5·4 W.	67 39·3 N.	·18178	·44224
Potsdam	52 23 N.	13 4 E.	1906	9 29·6 W.	66 18·4 N.	·18879	·43022
Irkutsk	52 16 N.	104 16 E.	1905	1 58·1 E.	70 25·0 N.	·20011	·56250
de Bilt (Utrecht)	52 5 N.	5 11 E.	1906	13 24·2 W.	66 53·3 N.	·18569	·43508
Valencia (Ireland)	51 56 N.	10 15 W.	1908	20 55·7 W.	68 16·3 N.	·17870	·44841
Kew	51 28 N	0 19 W.	1908	16 16·9 W.	67 0·9 N.	·18515	·43651
Greenwich	51 28 N.	0 0	1907	15 59·8 W.	66 56·1 N.	·18533	·43522
Uccle (Brussels)	50 48 N.	4 21 E.	1906	13 49·0 W.	66 2·9 N.	·19045	·42870
			1907	13 42·9 W.	66 2·3 N.	·19048	·42859
Falmouth	50 9 N.	5 5 W.	1908	17 54·7 W.	66 31·4 N.	·18798	·43279
Prague	50 5 N.	14 25 E.	1907	8 31·4 W.	—	—	—
Cracow	50 4 N.	19 58 E.	1907	5 47·9 W.	—	—	—
St. Helier (Jersey)	49 12 N.	2 5 W.	1907	16 27·4 W.	65 34·5 N.	—	—
Val Joyeux (near Paris)	48 49 N.	2 1 E.	1906	14 51·3 W.	64 47·9 N.	·19740	·41945
Munich	48 9 N.	11 37 E.	1906	9 59·5 W.	63 10·0 N.	·20657	·40835
			1907	6 55·8 W.	—	·21142	—
O'Gyalla (Pesth)	47 53 N.	18 12 E.	1908	6 49·6 W.	—	·21127	—
Pola	44 52 N.	15 51 E.	1907	8 49·3 W.	60 7·0 N.	·22214	·38656
Agincourt (Toronto)	43 47 N.	79 16 W.	1905	5 42·2 W.	74 34·7 N.	·16422	·59535
Toulouse	43 37 N.	1 28 E.	1905	13 56·3 W.	60 49·1 N.	·22025	·39439
			1899	2 11·0 E.	55 52·1 N.	·25614	37785
			1900	2 16·4 E.	55 53·2 N.	·25594	·37783
			1901	2 21·3 E.	55 54·4 N.	·25571	·37777
Tiflis	41 43 N.	44 48 E.	1902	2 27·1 E.	55 56·2 N.	·25542	·37777
			1903	2 32·5 E.	55 58·6 N.	·25505	·37781
			1904	2 37·1 E.	56 0·9 N.	·25476	·37792

* From absolute observations, June and July.

APPENDIX 1A—*continued.*

Place.	Latitude.	Longitude.	Year.	Declination.	Inclination.	Horizontal Force, C.G.S. Units.	Vertical Force, C.G.S. Units.
	° ′	° ′		° ′	° ′		
Capodimonte (Naples)	40 52 N.	14 15 E.	1906	—	56 13·5 N.	—	—
Tortosa	40 49 N.	0 30 E.	1907	13 42·8 W.	58 4·8 N.	·23274	·37362
Madrid	40 25 N.	3 40 W.	1901	15 35·6 W.	—	—	—
Coimbra	40 12 N.	8 25 W.	1905	17 1·5 W.	59 6·4 N.	·22900	·38273
*Mount Weather (Virginia)	39 4 N.	77 54 W.	1908	3 39·4 W.	—	—	—
Baldwin (Kansas)	38 47 N.	95 10 W.	1906	8 30·1 E.	68 45·1 N.	·21807	·56081
Cheltenham (Maryland)	38 44 N.	76 50 W.	1906	5 22·0 W.	70 27·3 N.	·20035	·56436
Athens	37 58 N.	21 23 W.	1903	5 20·2 W.	52 4·2 N.	·26114	·33508
San Fernando	36 28 N.	6 12 W.	1907	15 31·8 W.	54 52·8 N.	·24809	·35273
Tokio	35 41 N.	139 45 E.	1901	4 36·1 W.	49 0·0 N.	·29954	·34459
Zi-ka-wei	31 12 N.	121 26 E.	1905	2 30·3 W.	45 37·1 N.	·33009	·33729
Dehra Dun	30 19 N.	78 3 E.	1906	2 39·2 E.	43 29·8 N.	·33365	·31625
Helwan	29 52 N.	31 21 E.	1905	3 12·7 W.	40 36·2 N.	·30059	·25767
Havana	23 8 N.	82 25 W.	1905	2 58·0 E.	52 57·4 N.	·30531	·40452
Barrackpore	22 46 N.	88 22 E.	1906	1 14·1 E.	30 26·4 N.	·37259	·21894
Hong Kong	22 18 N.	114 10 E.	1907	0 5·9 E.	31 3·0 N.	·37009	·22281
Honolulu (Hawaii)	21 19 N.	158 4 W.	1906	9 21·7 E.	40 1·8 N.	·29220	·24545
Toungoo	18 56 N.	96 27 E.	1906	0 43·6 E.	22 59·2 N.	·38715	·16423
Alibag (Bombay)	18 39 N.	72 52 E.	1907	1 3·8 E.	23 15·5 N.	·36862	·15843
Vieques (Porto Rico)	18 9 N.	65 26 W.	1906	1 33·2 W.	49 47·7 N.	·28927	·34224
Manila	14 35 N.	120 59 E.	1904	0 51·4 E.	16 0·2 N.	·38215	·10960
Kodai-Kanal	10 14 N.	77 28 E.	1906	0 36·3 W.	3 21·1 N.	·37425	·02192
Batavia	6 11 S.	106 49 E.	1906	0 54·1 E.	30 48·5 S.	·36708	·21889
Dar-es-Salaam	6 49 S.	39 18 E.	1903	7 35·2 W.	—	—	—
Mauritius	20 6 S.	57 33 E.	1907	9 13·6 W.	53 49·0 S.	·23461	·32075
Rio de Janeiro	22 55 S.	43 11 W.	1906	8 55·3 W.	13 57·1 S.	·24772	·06164
Santiago (Chile)	33 27 S.	70 42 W.	1906	14 18·7 E.	30 11·8 S.	—	—
Melbourne	37 50 S.	144 58 E.	1901	8 26·7 E.	67 25·0 S.	·23305	·56024
Christchurch (N. Z)	43 32 S.	172 37 E.	1903	16 18·4 E.	67 42·3 S.	·22657	·55259

* From first 6 months only of the year.

APPENDIX II.—Table I.

Mean Monthly Results of Temperature and Pressure for Kew Observatory.

1908.

Months	Thermometer.								Barometer.*					Mean vapour tension.
	Means of—				Absolute Extremes.					Absolute Extremes.				
	Mean.	Max.	Min.	Max. and Min.	Max.	Date.	Min.	Date.	Mean.	Max.	Date.	Min.	Date.	
	°	°	°	°	°		°		ins.	ins.		ins.		in.
January ...	37·1	41·7	32·0	36·9	53·9	27th 1 P.M.	19·4	5th 10 P.M.	30·163	30·642	20th MIDT. & 21st 1 A.M.	28·879	8th 2 A.M.	·185
February ...	42·3	47·8	37·1	42·5	53·5	17th 3 ,,	30·9	2nd 8 A.M.	30·099	30·753	6th 10 P.M.	29·097	29th 4 ,,	·213
March	40·9	46·6	35·5	41·1	56·6	24th 1 ,,	27·4	15th 6 ,,	29·853	30·265	14th 11 ,, and MIDT.	29·169	6th 4 P.M.	·198
April	44·0	50·9	38·0	44·5	62·4	29th 4 ,,	28·0	9th 6 ,,	29·943	30·397	6th 11 P.M.	29·285	25th 5 ,,	·215
May	56·8	64·2	48·8	56·5	76·0	31st 5 ,,	41·6	23rd 5 ,,	30·003	30·536	27th 10 ,,	29·401	6th NOON.	·346
June	60·2	69·3	51·1	60·2	79·3	4th 5 ,,	41·1	7th 3 ,,	30·083	30·414	27th 7 A.M.	29·654	14th 4 A.M.	·372
July	62·7	71·0	55·1	63·1	81·2	3rd 4 ,,	49·7	20th 4 ,,	30·015	30·459	29th 9 ,,	29·399	17th 5 P.M.	·421
August	60·1	67·8	52·9	60·4	79·7	3rd 5 ,,	46·2	12th 5 ,,	29·994	30·412	3rd 1 ,, and 3 ,,	29·388	31st 10 P.M.	·386
September	55·9	64·1	48·1	56·1	76·0	30th 2 ,,	37·3	13th 6 ,,	29·985	30·318	5th 10 ,,	29·178	1st 10 A.M.	·369
October.....	53·9	61·6	47·1	54·4	76·2	2nd 3 ,,	33·6	25th 2 ,,	30·132	30·473	22nd 11 ,,	29·899	27th 4 P.M.	·357
November...	47·0	51·9	41·2	46·6	58·3	1st 2 ,,	26·1	10th 7 ,,	30·058	30·457	30th 11 P.M.	29·417	23rd 2 A.M.	·271
December...	40·7	44·1	36·3	40·2	52·6	10th 1 ,,	14·7	30th 9 ,,	29·936	30·522	31st MIDT.	28·758	11th 7 ,,	·217
Means	50·1	56·8	43·6	50·2	...	...	...	...	30·022	...	...	...	...	·296

* Reduced to 32° at M.S.L., but not corrected for the influence of gravity.

This table has been compiled at the Meteorological Office from values intended for publication in the volume of " Hourly Means " for 1908.

APPENDIX II.—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.	Thunder storms.	Clear sky.	Overcast sky.	Gales.§	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.‖
1908.		ins.	ins.																	
January	6·5	1·835	1·600	7	7	1	0	0	6	18	2	4	5	3	2	2	10	3	2	12
February	6·6	1·190	0·370	16	14	1	1	0	3	14	1	2	0	0	0	1	9	9	8	4
March	7·4	2·405	0·790	25	19	4	1	0	0	13	2	7	1	4	2	3	6	6	2	5
April	7·2	2·315	0·590	28	14	5	2	0	4	17	1	11	5	3	1	1	3	5	1	1
May	7·0	1·365	0·330	29	13	0	0	1	1	13	0	3	2	4	1	2	10	8	1	2
June	5·9	1·930	0·715	1	7	0	2	2	4	9	0	5	6	4	1	1	7	3	3	4
July	6·9	2·435	0·710	16	14	0	0	2	2	13	0	5	3	2	1	4	10	4	2	5
August	6·5	2·465	0·670	23	15	0	0	1	2	10	0	7	4	2	0	2	9	3	4	3
September	6·8	1·400	0·860	3	14	0	0	1	3	13	2	2	1	1	2	7	10	6	1	7
October	5·4	2·170	0·655	18	9	0	0	0	7	9	0	3	3	8	6	6	4	1	0	11
November	6·8	0·680	0·220	21	9	0	0	0	3	13	2	2	4	5	1	5	8	3	2	5
December	8·5	2·075	0·510	14	17	3	0	0	2	23	1	1	2	3	4	10	5	4	2	6
Totals and Means	6·8	22·265			152	14	6	7	37	165	11	52	36	39	21	44	91	55	28	65

* Measured at 10 A.M. daily by gauge 1·75 feet above ground. † As registered by the Robinson 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 25 miles an hour in at least one hour of the twenty-four) using the factor 2·2.

‖ In a "calm" the mean wind velocity for the twenty-four hours has not exceeded 3·7 miles an hour.)

APPENDIX II.—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.* Miles per hour.		
	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.
1908.	h. m.		h. m.		°	°		°	°		Miles.	Miles.	
January	32 36	13	5 54	29	58	82	17	26	12	12	8·4	29	2
February	77 48	27	7 24	12	82	95	28	28	19	13	8·7	26	22
March	103 48	28	8 6	24	87	112	24, 30	28	18	15, 20	8·2	29	8
April	151 18	37	12 36	17	102	120	30	32	18	9	9·5	26	16
May	190 54	40	13 0	27	119	135	31	43	31	11	8·0	21	29
June	259 0	52	13 42	15, 26	125	140	10	45	32	7, 22	7·2	19	20
July	187 0	38	14 12	1	125	138	15, 30	49	39	19	6·6	20	10
August	205 18	46	13 36	2	121	135	4, 7	45	33	12	7·5	24	27
September	144 24	38	11 6	7	114	129	2	42	29	13	6·3	29	1
October	108 24	33	8 36	6	96	117	1, 2	40	24	25	6·1	23	21
November	60 6	23	6 48	8	77	97	13	32	14	10	7·2	25	8, 23
December	23 24	10	4 36	11	57	85	10	31	12	31	6·8	25	10
Totals and Means	1544 0	34·6									7·5		

* As indicated by a Robinson anemograph, 70 feet above the general surface of the ground, the factor 2·2 being used.

† Read at 10 A.M., and entered to the previous day.

‡ Read at 10 a.m., and entered to the same day.

APPENDIX II.—Table IV.

Measurements of Solar Radiation, with the Ångström Compensation Pyrheliometer.

1908.

Month.	Days of Observation.	On bright days only, between 11.30 a.m. and 0.30 p.m.						
		Mean Value. *	Maximum.			Minimum.		
			Value. *	State of Atmosphere.	Direction of Wind.	Value. *	State of Atmosphere.	Direction of Wind.
January	3	0·642	0·918	Clear	N.W.	0·448	Misty	W.S.W.
February	7	0·813	0·940	Thin haze	W.N.W.	0·566	Misty	S.W.
March	6	1·041	1·182	Clear	W.N.W.	0·846	Misty	N.
April	5	1·057	1·187	Clear	N.W.	0·862	Hazy	N.E.
May	10	1·152	1·304	Extreme visibility	W.S.W.	0·966	Hazy	N.N.E.
June	7	1·091	1·254	Extreme visibility	S.S.W.	0·922	Smoky haze	E.
July	9	1·030	1·212	Clear	S.W.	0·900	Hazy	N.E.
August	5	1·167	1·259	Extreme visibility	W.N.W.	1·047	Clear	N.N.W.
September ...	6	1·064	1·190	Extreme visibility	S.S.W.	1·002	Clear	N.
October.....	5	0·948	1·090	Clear	S.E.	0·852	Clear	S.E. byE.
November ...	9	0·730	1·006	Clear	W.	0·566	Misty	E.
December.....	4	0·601	0·661	Clear	S.	0·548	Clear	N.W.

* Expressed in gramme-calories per sq. cm. per minute.

APPENDIX II.—Table V.

Earth Thermometers. 1908.

Month.	1 foot Thermometer.							4 foot Thermometer.				
	Arithmetic Mean of Readings at 10 a.m. and 10 p.m.					Mean Excess of Temperature.		Arithmetic Mean of Readings at 10 a.m. and 10 p.m.				
	Mean.	Max.m.	Date.	Min.m.	Date.	10 p.m. over 10 a.m.	4 p.m. over 10 a.m.	Mean.	Max.m.	Date.	Min.m.	Date.
January	36°·2	41°·5	27	33°·2	14	+0°·03	+0°·05	42°·5	45°·0	1	41°·6	19
February	39·7	43·3	21	36·3	4	+0·50	+0·35	42·4	43·4	26	41·9	6, 7, 8, 9 & 10
March	40·5	44·8	31	37·5	16	+0·77	+0·52	42·9	43·7	31	42·3	23
April	44·6	48·8	30	42·0	25	+1·02	+0·62	44·7	45·1	20 & 21	43·9	1 and 2
May	55·7	60·3	31	51·0	1	+1·50	+0·92	49·6	52·5	31	45·1	1
June	61·4	64·4	4	59·3	7	+1·54	+1·05	55·2	56·7	30	52·9	1 and 2
July	63·2	66·4	31	60·1	14	+1·20	+1·11	57·8	59·0	31	56·9	1, 2 & 3
August	62·3	66·2	4	58·0	31	+0·89	+0·88	59·0	59·8	7	58·0	31
September	56·8	59·9	30	54·4	13	+1·08	+0·83	56·6	57·9	1 and 2	55·5	17, 18 and 19
October	54·4	59·7	2	47·1	25	+0·42	+0·43	55·6	56·8	6	52·9	31
November	46·4	51·1	1 and 2	41·6	10	+0·36	+0·20	50·7	52·9	1, 2 & 3	48·9	28, 29 and 30
December	42·7	46·6	1	36·0	31	+0·04	+0·02	47·5	48·9	1, 2, 3 and 4	45·5	31
Yearly Means and Extremes	50·3	66·4	July 31	33·2	Jan. 14	+0·78	+0·58	50·3	59·8	Aug. 7	41·6	Jan. 19

APPENDIX II.—Table VI.—Hourly Means of Atmospheric Electric Potential on selected "Quiet"
19

Month.	Midt.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.
January	269	258	244	223	212	222	241	265	283	302	305	291
February	161	153	147	145	150	150	147	166	187	196	205	204
March	235	211	191	181	167	167	183	210	248	285	290	244
April	200	180	155	132	128	130	148	173	184	182	189	200
May	97	85	82	81	80	86	92	110	126	128	131	125
June	115	111	107	101	101	114	124	137	153	158	156	155
July	124	109	101	100	92	94	96	107	125	140	140	122
August	128	116	104	97	99	103	115	135	164	166	149	130
September ...	133	113	110	107	108	125	154	173	163	151	130	105
October.....	114	105	107	106	97	102	115	125	128	125	119	108
November ...	188	171	153	144	145	156	169	179	193	203	208	203
December.....	171	176	161	154	160	156	155	171	195	210	195	181

APPENDIX II.—TABLE VII.—Diurnal Inequality of Atmospheric Electric
19

Month, &c.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	Noon.	1 h.
January	−11	−26	−47	**−59**	−48	−29	− 3	+15	+35	+38	+24	− 2	−23
February	−21	−26	**−29**	−24	−25	−28	−12	+ 5	+13	+20	+19	− 2	− 9
March	−11	−30	−40	**−53**	**−53**	−39	−14	+21	+54	+59	+15	−21	−31
April	− 5	−30	−53	**−58**	−57	−41	−18	− 8	−11	− 6	+ 4	−13	−11
May	−16	−19	−22	**−24**	−19	−15	− 1	+12	+13	+15	+ 8	+ 4	− 5
June	−15	−18	**−24**	**−24**	−14	− 6	+ 4	+17	+20	+19	+17	+ 6	− 6
July	− 2	− 7	− 8	−14	−13	−11	− 2	+12	**+24**	**+24**	+10	− 2	−11
August	−15	−24	**−29**	−27	−23	−13	+ 4	+28	+30	+17	+ 2	− 5	− 6
September ...	−17	−19	−21	−20	− 6	+18	+34	+27	+17	0	−20	**−25**	**−25**
October.....	−17	−15	−16	**−25**	−20	− 8	+ 2	+ 5	+ 2	− 4	−14	−13	−12
November ...	−23	−39	**−47**	−45	−34	−21	−11	+ 4	+14	+20	+16	+ 5	+ 1
December.....	+ 1	−11	**−17**	−13	**−17**	**−17**	− 4	+17	**+29**	+16	+ 4	0	−10
Winter	−13	−26	**−35**	**−35**	−31	−24	− 7	+10	+23	+24	+16	0	−10
Equinox	−12	−24	−33	**−39**	−34	−18	+ 1	+11	+15	+12	− 4	−18	−20
Summer	−12	−17	−21	**−22**	−17	−11	+ 1	+17	+21	+19	+ 9	+ 1	− 7
Year	−12	−22	−30	**−32**	−27	−18	− 2	+13	+20	+18	+ 7	− 6	−12

*Principal maxima and

(in volts) from the Self-recording Kelvin Water-dropping Electrograph
Days (10 each month).
08.

Noon.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	Midt.
266	246	236	238	255	278	297	315	317	305	292	281	267
180	173	172	165	167	204	226	227	221	233	221	194	175
204	194	191	199	204	216	246	286	297	276	267	262	244
183	186	194	208	201	202	231	265	273	267	262	244	225
122	112	100	106	108	110	133	156	160	164	154	139	127
141	127	116	118	123	123	132	143	156	171	171	149	126
107	96	90	91	89	88	100	111	118	131	138	133	123
121	119	108	112	116	111	126	155	168	158	131	120	113
98	96	96	97	100	105	124	161	173	163	155	143	120
109	110	111	122	146	166	158	157	148	138	127	117	112
190	185	182	186	184	188	211	230	225	206	184	170	166
177	165	160	167	173	181	187	191	193	198	190	187	175

Potential Gradient near the Ground in volts per metre of height.*
08.

2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	Midt.	Range of inequality.	Monthly and seasonal mean absolute values.
−33	−31	−13	+10	+31	+49	**+52**	+39	+26	+14	0	111	276
−10	−17	−15	+16	+34	+35	+29	**+39**	+28	+ 5	−13	68	159
−34	−27	−23	−12	+15	+51	**+61**	+42	+33	+28	+12	114	209
− 5	+ 8	0	0	+27	+58	**+65**	+58	+52	+33	+15	123	187
−18	−13	−12	−11	+ 7	+26	+29	**+32**	+21	+ 7	− 4	56	103
−16	−14	−11	−11	− 4	+ 5	+15	**+27**	+26	+ 8	−11	51	110
−16	−15	−17	**−18**	− 7	+ 1	+ 6	+17	+22	+19	+10	42	88
−15	−11	− 6	−11	+ 3	+26	**+38**	+30	+ 8	0	− 6	67	104
−25	−24	−21	−17	− 1	+30	**+38**	+32	+26	+17	− 2	63	104
−11	− 1	+21	**+40**	+32	+31	+23	+14	+ 4	− 5	− 9	65	113
− 1	+ 4	+ 3	+ 7	+30	**+48**	+44	+27	+ 7	− 5	− 8	95	176
−14	− 9	− 4	+ 3	+ 8	+11	+13	+17	+10	+ 7	− 3	46	150
−15	−13	− 7	+ 9	+26	**+36**	+35	+31	+18	+ 5	− 6	—	191
−19	−11	− 6	+ 3	+18	+42	**+47**	+36	+29	+18	+ 4	—	153
−16	−13	−12	−13	0	+14	+22	**+27**	+19	+ 8	− 3	—	101
−17	−12	− 8	0	+15	+31	**+35**	+31	+22	+10	− 2	—	148

minima are in heavy type.

APPENDIX II.—Table VIII.

"Electric Dissipation" (with Elster and Geitel apparatus).

Months. 1908.	Number of Days of Observation.	Mean Value.			Greatest Value.			Least Value.			$\frac{\Sigma a_-}{\Sigma a_+}$
		a_+	a_-	$\frac{a_-}{a_+}$	a_+	a_-	$\frac{a_-}{a_+}$	a_+	a_-	$\frac{a_-}{a_+}$	
January ...	11	0·250	0·412	1·91	0·719	1·142	3·29	0·087	0·223	1·07	1·65
February ...	13	·167	·404	1·99	·571	0·930	3·06	·047	·162	1·06	1·65
March ...	12	·170	·242	1·44	·218	·375	1·89	·118	·138	0·77	1·42
April ...	7	·167	·239	1·64	·293	·310	2·20	·070	·135	1·02	1·43
May ...	9	·330	·427	1·33	·562	·574	1·70	·192	·267	0·85	1·29
June ...	17	·373	·495	1·53	·792	·940	4·42	·110	·212	1·00	1·33
July ...	13	·350	·490	1·50	·738	·917	2·04	·217	·323	0·71	1·40
August ...	6	·324	·520	1·68	0·505	·688	2·17	·146	·317	1·23	1·60
September ...	13	·446	·709	1·81	1·110	1·246	2·83	·177	·323	1·12	1·59
October ...	15	·462	·614	1·43	0·877	0·975	2·23	·154	·268	0·87	1·33
November ...	12	·345	·583	1·77	0·654	0·999	2·76	·109	·202	0·92	1·69
December ...	11	0·438	0·495	1·19	0·918	0·957	1·64	0·143	0·126	0·76	1·13
Total, Means, and Extremes.	139	0·319	0·469	1·60	1·110	1·246	4·42	0·047	0·126	0·71	1·46

APPENDIX III.—Table I.

Register of principal Seismograph Disturbances. 1908.

No. in Kew register.	Date.	Commencement.	Time of Maximum.	Maximum Amplitude.	Duration.	Remarks.
		hr. min.	hr. min.	mm.	hr. min.	
823	Feb. 9	18 32·2	19 3·7	1·2	1 10	
828	March 5	2 42·2	3 28·3	1·5	1 42	
834	,, 25	19 32·6	19 45·4	1·0	32	
835	,, 26	23 15·0	23 55·4	12·3	3 0	
836	,, 27	4 0·0	4 40·3	3·9	2 24	
839	April 23	0 14·8	0 41·5	1·5	2 18	
841	May 5	6 45·0	7 20·7	1·0	1 12	
842	,, 15	8 49·4	9 9·7	2·3	1 37	
843	,, 17	12 40·5	12 47·3	1·0	23	
851	Aug. 17	11 5·3	11 43·8	2·5	2 35	
853	,, 20	10 11·3	10 34·4	2·0	1 5	
855	Sept. 4	17 1·0	17 6·2	1·0	19	
860	Oct. 13	5 32·0	6 1·0	1·4	1 10	Times approximate.
866	Nov. 6	7 31·6	7 59·0	1·9	1 20	
870	Dec. 12	13 15·0	13 44·9	2·2	1 32	
873	,, 28	4 23·6	4 31·1 4 32·7	> 17·0	2 10	Sicilian earthquake.

The times recorded are G.M.T., midnight = 0 or 24 hours.

The figures given above were obtained from the photographic records of a Milne Horizontal Pendulum ; they represent E—W displacements.

The scale value has been 1 mm. = 0″·56 from January to June.

,, ,, ,, = 0″·55 from June to October.

,, ,, ,, = 0″·56 from October to December.

APPENDIX IV.—Table I.

RESULTS OF WATCH TRIALS. Performance of the 50 Watches which obtained the highest number of marks during the year 1908.

Name.	Number of watch.	Escapement, balance spring, &c.	Mean daily rate.					Mean variation of daily rate. ± Unit 0·01 second.	Mean change of rate for 1°F. Unit 0·001 second.	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.		
			secs.	secs.	secs.	secs.	secs.			secs.	0—40	0—40	0—20		0—100.
Patek Philippe & Co., Geneva	143263	D.r., g.b., s.o., Bar lever	+0·8	−0·2	−0·4	+0·4	+0·1	21	1	2·0	35·8	38·5	19·9		94·2
S. Smith & Son, London	302—8	D.r., fusee, s.o., Tourbillon lever	+2·2	+1·7	+2·5	+1·7	+1·8	22	13	2·75	35·6	38·8	19·1		93·5
Patek Philippe & Co., Geneva	133901	D.r., g.b., s.o., Bar lever	−2·1	−2·0	−2·5	−2·3	−2·6	28	14	1·75	34·4	39·2	19·1		92·7
Vacheron & Constantin, Geneva	343175	D.r., g.b., d.o., Bar lever	−1·4	−1·9	−1·6	−1·5	−0·6	29	5	2·5	34·2	38·7	19·7		92·6
,, ,, ,,	334614	D.r., g.b., s.o., Bar lever	−1·8	−1·8	−1·7	−1·4	−0·7	28	8	2·0	34·3	38·6	19·5		92·4
Patek Philippe & Co., Geneva	132689	D.r., g.b., s.o., Bar lever	−2·9	−4·4	−3·5	−3·2	−2·9	25	15	2·25	35·0	38·2	19·0		92·2
,, ,, ,,	138637	D.r., g.b., s.o., Bar lever	−0·5	−0·9	−0·2	+0·5	+0·4	31	13	2·75	33·8	38·1	19·1		91·0
,, ,, ,,	138635	D.r., g.b., s.o., Bar lever	−0·5	−0·8	−0·8	−0·2	−0·7	36	16	3·0	32·9	39·1	18·9		90·9
H. Golay, London	2615	S.r., g.b., s.o., Tourbillon lever	−0·1	+0·6	+0·6	+0·5	+0·7	28	42	3·0	34·5	39·1	17·2		90·8
Patek Philippe & Co., Geneva	125301	D.r., g.b., s.o., Bar lever	+0·7	+0·1	−0·2	+0·2	+1·6	25	33	2·75	35·1	37·8	17·8		90·7
,, ,, ,,	138612	D.r., g.b., s.o., Bar lever	−1·7	−0·8	−0·5	+0·1	−0·1	31	12	3·25	33·7	37·8	19·2		90·7
,, ,, ,,	143307	D.r., g.b., s.o , Bar lever	−4·0	−3·4	−3·7	−2·0	−2·6	31	9	3·0	33·8	37·3	19·4		90·5
Vacheron & Constantin, Geneva	327961	D.r., g.b., s.o., Bar lever	−2·3	−2·7	−3·4	−1·5	−1·3	27	24	3·5	34·7	37·3	18·4		90·4
Golay, Fils & Stahl, ,,	28428	D.r., g.b., s.o., Bar lever	+2·4	+2·2	+2·2	+1·7	+1·7	28	45	2·75	34·4	38·9	17·0		90·3
Patek Philippe & Co., ,,	143277	D.r., g.b., s.o., Bar lever	+0·7	−1·2	+0·1	+1·4	+1·2	34	2	3·5	33·3	36·8	19·9		90·0
Vacheron & Constantin ,,	337953	D.r., g.b., d.o., Bar lever	0·0	+0·8	+0·1	+1·1	+1·4	37	9	2·75	32·6	37·9	19·4		89·9
Patek Philippe & Co., ,,	138638	D.r., g.b., s.o., Bar lever	−0·3	+0·3	−0·2	+0·1	+2·1	28	36	3·5	34·5	37·2	17·6		89·3
Vacheron & Constantin ,,	343302	D.r., g.b., d.o., Bar lever	+1·6	+3·3	+0·4	+1·2	+1·8	29	35	3·25	34·2	37·2	17·6		89·0
,, ,, ,,	339583	D.r., g.b., d.o., Bar lever	−6·1	−5·9	−4·8	−3·9	−4 1	36	12	4·5	32·9	36·6	19·2		88·7
,, ,, ,,	327958	D.r., g.b., s.o., Bar lever	−0·7	−1·2	−1·7	−0·4	+2·6	30	15	5·0	34·1	35·3	19·0		88·4
Jos. White & Son, Coventry	38176	S.r., g.b., s.o.	−2·3	−2·9	+0·2	−2·2	−1·2	27	38	4·75	34·6	36·3	17·4		88·3
Patek Philippe & Co., Geneva	143265	D.r., g.b., s.o., Bar lever	+0·2	−0·2	+0·6	+2·8	+1·5	30	30	4·75	34·1	36·2	18·0		88·3
Stauffer, Son & Co., London	215506	D.r., g.b., s.o., minute and split seconds chronograph	−1·7	−0·6	−2·0	−0·9	+0·1	41	13	3·5	31·9	37·3	19·1		88·3
A. Lange & Sohne, Glashutte	46992	D.r., g.b., s.o., Revolving escapement	−0·5	−0·7	−0·9	+2·6	+0·1	24	45	4·75	35·2	36·0	17·0		88·2
Vacheron & Constantin, Geneva	343197	D.r., g.b., d.o., Bar lever	+0·1	+0·6	−0·6	−0·7	+0·2	34	53	2·75	33·3	38·2	16·4		87·9
Baume & Co., London	32405	D.r., g.b., s.o., minute and split seconds chronograph	−0·1	+1·3	+1·9	−0·2	+0·3	34	33	4·25	33·2	36·8	17·8		87·8
Robert Milne, Manchester	1413	S.r., g.b., s.o., Karrusel	+1·0	+1·9	+2·0	+1·7	+4·1	38	21	6·5	32·4	36·8	18·6		87·8
Baume & Co., London	32401	D.r., g.b., s.o., minute and split-seconds chronograph	−0·3	−0·3	+1·1	+0·9	−2·2	30	37	4·25	34·0	36·2	17·5		87·7

TABLE I.—*continued.*

Name.	Number of watch.	Escapement, balance spring, &c.	Mean daily rate.					Mean variation of daily rate. ± Unit 0·01 second.	Mean change of rate for 1° F. Unit 0·001 second.	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—10
			secs.	secs.	secs.	secs.	secs.			secs.				
A. Lange & Sohne, Glashutte	45411	D.r., g.b., s.o., revolving escapement	+1·7	+1·2	+0·3	−1·4	−0·1	31	37	6·25	33·7	36·5	17·5	87·7
Stauffer, Son & Co., London	203150	D.r., g.b., s.o., minute and split seconds chronograph	+6·8	+6·8	+7·2	+5·0	+6·0	40	26	4·5	32·1	37·3	18·3	87·7
A. Lange & Sohne, Glashutte	46998	D.r., g.b., s.o., revolving escapement	+1·8	+1·7	+1·6	+1·5	+4·3	31	44	5·5	33·9	36·6	17·1	87·6
Baume & Co., London	32403	D.r., g.b., s.o., minute and split seconds chronograph	+5·4	+4·0	+3·3	+3·3	+4·1	35	44	7·0	32·9	37·7	17·0	87·6
Longines Watch Factory (Baume & Co.). St. Imier	1927922	D.r., g.b., s.o., Bar lever	+2·4	+4·4	+2·1	+1·6	+0·6	27	55	5·0	34·7	36·3	16·3	87·3
W. Matthews, Coventry	41728	S.r., g.b., s.o.	−1·3	+1·0	0·0	−1·8	−2·2	36	23	5·25	32·7	35·7	18·5	86·9
Wales & McCulloch, London	3695	—— g.b., d.o., annular Tourbillon chronometer	+0·3	+1·7	+0·9	+1·5	−0·2	46	25	3·75	30·7	37·5	18·4	86·6
E. Dent & Co., London	12165	D.r., fusee, d.o., Tourbillon lever	+1·5	+1·2	+1·8	+1·6	+1·8	56	27	5·0	28·9	39·3	18·2	86·4
J. W. Benson, London	2614	S.r., fusee, d.o., min. and split seconds chronograph, Tourbillon lever	−1·1	−1·2	−1·4	+0·8	+0·1	41	35	4·25	31·8	36·8	17·7	86·3
Thos. Mercer, London	7575	—— g.b., d.o., annular Tourbillon chronometer	+3·1	+3·8	+3·7	+4·1	+4·4	34	87	5·0	33·3	38·6	14·2	86·1
Stauffer, Son & Co., London	203152	D.r., g.b., s.o., min. and split seconds chronograph	+6·6	+8·0	+7·9	+8·1	+8·9	38	64	4·25	32·5	37·8	15·8	86·1
Patek Philippe & Co., Geneva	143283	D.r., g.b., s.o., Bar lever	+3·6	+4·2	+4·8	+2·7	+3·8	41	53	3·0	31·8	37·8	16·5	86·1
S. Smith & Son, London	302—9	D.r., fusee, d.o., Tourbillon lever	−0·8	−0·6	−0·8	+0·7	+1·2	41	43	5·5	31·8	36·8	17·1	85·7
A. Lange & Sohne, Glashutte	60271	D.r., g.b., s.o.	+1·5	−0·6	−1·8	+0·6	+0·5	35	54	5·5	33·1	36·1	16·4	85·6
C. J. H. Marlow, Coventry	23047	S.r., g.b., s.o.	−1·7	−0·4	+0·4	−0·7	−2·8	42	32	4·5	31·5	36·2	17·8	85·5
A. Lange & Sohne, Glashutte	60114	D.r., g.b., d.o.	−0·1	+1·6	−1·1	+1·4	+0·4	36	61	4·25	32·9	36·6	15·9	85·4
Patek Philippe & Co., Geneva	138617	D.r., g.b., s.o., Bar lever	−1·2	−0·1	−0·6	+0·1	−1·7	40	64	4·5	32·1	37·5	15·8	85·4
W. Vasel, London	22642	S.r., g.b., s.o., minute and seconds chronograph, minute repeater	−0·6	−0·2	−0·1	−1·1	−1·6	26	113	6·75	34·9	37·9	12·5	85·3
W. Richardson & Son, Coventry	150	S.r., g.b., s.o., Karrusel	−0·9	+0·5	+0·5	−0·5	+2·7	33	65	5·25	33·5	36·2	15·6	85·3
Baume & Co., London	32404	D.r., g.b., s.o., minute and split seconds chronograph	+1·0	+0·3	−3·3	−1·1	−2·7	37	24	7·0	32·5	34·1	18·4	85·0
,, ,,	32406	D.r., g.b., s.o., minute and split seconds chronograph	+0·5	−1·2	−0·4	−0·6	+2·6	37	52	5·75	32·5	35·6	16·5	84·6
Stauffer, Son & Co., London	203159	D.r., g.b., s.o., minute and split seconds chronograph	+3·9	+4·9	+4·5	+5·1	+3·2	50	44	5·25	30·0	37·5	17·1	84·6

d.r. = double roller. s.r. = single roller.
d.o. = double overcoil spring. s.o. = single overcoil spring. g.b. = going barrel.

APPENDIX IV.—TABLE II.

Highest Marks obtained by Complicated Watches during the year.

Description of watch.	Number.	Name.	Marks awarded for			Total Marks.
			Variation.	Position.	Temperature.	
			0—40	0—40	0—20	0—100
Minute and seconds chronograph, minute repeater	22642	W. Vasel, London	34·9	37·9	12·5	85·3
,, ,, ,, ,, (split seconds)	2521	H. Golay, London	26·0	35·4	13·8	75·2
	74804	W. E. Hurcomb, London	26·2	30·9	12·6	69·7
Minute and split seconds chronograph	215506	Stauffer, Son & Co., London	31·9	37·3	19·1	88·3
	32405	Baume & Co., London	33·2	36·8	17·8	87·8
	32401	,, ,,	34·0	36·2	17·5	87·7
	203150	Stauffer, Son & Co., London	32·1	37·3	18·3	87·7
	32403	Baume & Co., London	32·9	37·7	17·0	87·6
	2614	J. W. Benson, London	31·8	36·8	17·7	86·3
	203152	Stauffer, Son & Co., London	32·5	37·8	15·8	86·1
Minute and seconds chronograph	7521	Audemars Piguet & Co., London	30·4	36·5	15·4	82·3
	6343	Army & Navy C.S., Ltd., London	25·6	36·3	16·8	78·7
	2559	H. Golay, London	32·3	31·6	13·4	77·3
Minute repeater	2554	H. Golay, London	24·9	30·9	11·8	67·6

APPENDIX V.

MAGNETIC OBSERVATIONS, 1908, FALMOUTH OBSERVATORY.

Latitude, 50° 9′ 0″ N.; Longitude, 5° 4′ 35″ W. Height 167 feet above mean sea level.

Photographic curves of magnetic Declination and of Horizontal and Vertical Force variations have been regularly taken during the year.

The scale values of the instruments were determined on 15th July, 1908. The following values of the ordinates of the photographic curves were then found :—

Declination, 1 cm. = 0° 11′·7.
Bifilar, 1 cm. δ H. = 0·00053 C.G.S. unit.
Balance, 1 cm. δ V. = 0·00050 C.G.S. unit.

A scale value determination made in February, 1909, indicated that a change had occurred in the Balance since the determination made in the previous July. This necessitated the employment of interpolated values ranging from ·00052 in August to ·00060 per cm. in December.

The principal variations of the Magnetic Curves that were recorded took place on the following dates :—March 26, 27 ; May 26 ; August 9 ; September 5, 11, 12, 29, 30.

Observations with the Absolute Instruments have been made four times a month, of which the following is a summary :—

Determinations of	Horizontal Intensity,	47.
,,	Inclination,	47.
,,	Declination,	47.

The mean values of the Magnetic Elements for the year 1908 are as follows :—
Declination, 17° 54′·7 W.; Horizontal Force, 0·18798 C.G.S.; Vertical Force, 0·43279 C.G.S.; Inclination, 66° 31′·4 N.

The results in the following Tables, Nos. I, II, III, IV, V, VI, are deduced from the magnetograph curves which have been standardized by the absolute observations. These were made with the Collimator Magnet 66A and the Mirror Magnet 66C in the Unifilar Magnetometer No. 66, by Elliott Brothers, of London, and with the Inclinometer No. 86 by Dover of Charlton, Kent, employing needles 1 and 2, which are 3½ inches in length.

The effects of temperature on the Horizontal Force Curves are very small and have been neglected, but a temperature correction has been determined and applied to the Vertical Force Curves.

From the hourly means of Horizontal Force in Table III, and the corresponding Vertical Force in Table V, hourly values have been calculated for the Inclination. These and the corresponding diurnal inequalities appear in Tables VII and VIII.

The tables 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 time given is Greenwich Mean Time, which is 20 minutes 18 seconds earlier than local time.

The results are derived from the "quiet" days selected by the Astronomer Royal, mentioned on page 18 above.

EDWARD KITTO,

Superintendent and Magnetical Observer.

Table I.—Hourly Means of Declination at Falmouth on Five selected Quiet Days in each Month, 1908.

Hours	Midt.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Noon
	(17° + West.)				Winter.								
1908.	′	′	′	′	′	′	′	′	′	′	′	′	′
January	55·0	55·1	55·4	55·5	55·5	55·4	55·1	55·0	55·0	54·6	55·4	56·1	57·0
February	56·0	56·3	55·9	56·3	56·1	56·2	55·8	55·5	54·9	54·1	54·7	56·4	58·4
March	55·2	55·6	55·6	55·6	55·5	55·1	54·9	54·1	52·5	51·3	52·5	55·3	58·8
October.....	52·5	52·6	52·8	52·8	52·8	52·5	52·2	51·5	50·1	49·3	50·5	53·7	56·7
November.....	52·1	52·2	52·1	52·2	52·2	52·1	51·8	51·7	51·5	51·3	51·6	53·5	54·8
December.....	50·4	50·5	51·1	51·1	51·2	51·2	51·2	50·9	50·7	50·7	51·3	52·2	53·5
Means	53·5	53·7	53·8	53·9	53·9	53·8	53·5	53·1	52·4	51·9	52·7	54·5	56·5
					Summer.								
1908.	′	′	′	′	′	′	′	′	′	′	′	′	′
April	56·0	56·1	56·2	56·5	55·4	54·8	53·9	52·3	50·8	51·0	53·2	56·1	60·0
May	54·4	54·8	54·6	54·3	54·1	53·1	51·9	51·2	50·5	50·9	53·8	57·2	60·5
June	54·9	54·7	54·9	54·7	53·9	53·2	51·7	50·2	50·0	51·1	52·4	54·2	57·4
July	54·3	54·6	54·4	53·9	53·8	52·6	51·2	50·1	49·5	49·9	52·3	54·8	57·7
August	52·9	52·7	52·9	52·8	52·6	51·2	50·1	49·5	49·8	50·9	53·2	55·7	59·2
September ...	52·2	52·9	53·1	52·9	52·5	52·4	51·8	50·7	49·7	50·2	52·2	54·9	58·2
Means	54·1	54·3	54·4	54·2	53·7	52·9	51·8	50·7	50·1	50·7	52·8	55·5	58·8

Table II.—Diurnal Inequality of the Falmouth

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

Observatory, determined from the Magnetograph Curves
(Mean for the year = 17°54′·7 W.)

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Midt.
Winter.											
′	′	′	′	′	′	′	′	′	′	′	′
57·8	58·3	57·5	57·3	56·6	56·2	55·4	55·1	54·7	54·5	54·2	54·4
60·0	60·5	59·6	58·1	57·2	56·6	56·0	55·8	55·6	55·6	55·8	56·0
61·1	61·9	60·4	58·1	56·3	56·0	55·6	55·7	55·2	55·5	54·7	54·8
58·7	58·7	57·5	55·5	54·4	54·1	53·2	53·0	53·0	52·9	52·6	52·3
55·6	55·2	54·2	53·6	53·2	52·7	52·5	52·2	52·1	52·0	52·5	52·4
53·9	53·1	52·3	52·1	51·5	51·1	50·7	50·5	50·2	50·2	50·3	50·0
57·9	57·9	56·9	55·8	54·9	54·4	53·9	53·7	53·5	53·4	53·4	53·5
Summer.											
′	′	′	′	′	′	′	′	′	′	′	′
62·1	62·3	60·7	58·9	57·4	56·3	55·9	56·0	55·9	55·9	55·6	55·4
61·2	60·9	60·1	58·7	57·5	56·2	55·1	54·9	54·6	54·3	54·1	54·3
59·5	60·6	60·1	59·4	57·9	56·7	55·7	55·5	54·8	55·2	55·0	54·7
59·4	60·6	60·2	58·8	57·1	56·0	55·5	55·4	55·2	55·1	55·1	54·6
61·2	61·4	60·0	58·1	56·2	54·9	54·7	54·3	54·2	53·9	53·9	53·2
59·6	59·9	58·5	57·0	54·9	54·6	54·6	54·2	54·0	53·9	53·8	53·8
60·5	60·9	59·9	58·5	56·8	55·8	55·2	55·1	54·8	54·7	54·6	54·3

Declination as deduced from Table I.

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

Table III.—Hourly Means of Horizontal Force at Falmouth
Five selected Quiet Days in each Month, 1908.

Hours	Midt.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Noon
0·18000 + (C.G.S. units).						Winter.							
1908.													
January	802	801	801	801	803	805	806	806	806	805	803	800	797
February	797	797	797	797	799	800	802	801	801	794	788	784	781
March	802	802	803	802	803	804	805	804	797	788	781	775	777
October	795	794	794	795	796	796	796	793	785	774	765	763	767
November ...	793	793	792	792	794	794	794	793	791	784	778	780	784
December ...	801	800	799	800	801	804	804	804	802	801	799	795	796
Means	798	798	798	798	799	800	801	800	797	791	786	783	784
						Summer.							
1908.													
April	806	805	805	804	804	803	805	801	795	782	774	774	776
May	810	812	810	809	809	808	803	797	791	784	780	780	784
June	812	809	806	807	806	806	804	796	790	783	778	778	786
July	808	808	807	805	805	805	804	798	790	784	779	779	780
August	797	795	796	796	793	791	787	781	774	768	763	767	777
September ...	804	801	799	799	797	796	794	789	784	775	772	770	781
Means	806	805	804	803	802	801	800	794	787	779	774	775	781

Table IV.—Diurnal Inequality of the Falmouth

Hrs.	Midt.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Noon
						Summer Means.							
	+ ·00007	+ ·00006	+ ·00005	+ ·00004	+ ·00003	+ ·00002	·00000	− 00005	− ·00012	− ·00020	− ·00025	− ·00024	− ·00018
						Winter Means.							
	+ ·00002	+ ·00002	+ ·00002	+ ·00002	+ ·00003	+ ·00004	+ ·00005	+ ·00004	+ ·00001	− ·00005	− ·00010	− ·00013	− ·00012
						Annual Means.							
	+ ·00005	+ ·00004	+ ·00003	+ ·00003	+ ·00003	+ ·00003	+ ·00003	− ·00001	− ·00005	− ·00012	− ·00018	− ·00019	− ·00015

Observatory determined from the Magnetograph Curves on
(Mean for the year = 0·18798).

1.	2.	3.	4.	5	6.	7.	8.	9.	10.	11.	Midt.
Winter.											
801	803	801	799	803	805	803	802	802	803	802	803
784	792	791	790	793	798	798	799	801	800	802	802
782	788	794	799	802	804	808	806	806	808	808	805
775	782	787	792	796	798	799	801	799	797	797	795
788	791	790	790	792	796	797	797	795	794	793	792
800	799	799	801	801	803	804	804	802	803	801	800
788	792	794	795	798	801	801	802	801	801	801	800
Summer.											
785	793	800	805	807	811	811	811	811	810	808	808
789	799	807	809	812	814	815	817	816	815	812	810
790	797	802	812	816	817	819	817	814	815	814	814
784	793	803	811	813	815	816	817	818	816	816	813
787	794	797	799	799	805	810	812	808	807	804	804
788	793	794	799	800	803	805	806	805	805	805	805
787	795	800	806	808	811	813	813	812	811	810	809

Horizontal Force as deduced from Table III.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Midt.
Summer Means.											
−·00012	−·00004	+·00001	+·00007	+·00009	+·00012	+·00014	+·00014	+·00013	+·00012	+·00011	+·00010
Winter Means.											
−·00008	−·00004	−·00002	−·00001	+·00002	+·00005	+·00005	+·00005	+·00005	+·00005	+·00004	+·00003
Annual Means.											
−·00010	−·00004	·00000	+·00003	+·00005	+·00008	+·00009	+·00010	+·00009	+·00008	+·00008	+·00007

Table V.—Hourly Means of Vertical Force at Falmouth
Five selected Quiet Days in each Month

Hours	Mid$^{t.}$	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Noon
0·43000 + (C.G.S. units).						Winter.							
1908.													
January	272	273	273	274	274	274	274	274	273	272	272	272	273
February	267	267	267	267	266	266	266	265	265	265	263	259	258
March	297	297	297	297	297	297	297	298	299	297	293	288	286
October	302	303	303	302	302	302	301	301	301	299	294	289	288
November	275	275	275	274	274	273	272	271	271	271	270	266	266
December	280	280	279	279	278	278	277	278	277	276	276	274	273
Means	282	283	282	282	282	282	281	281	281	280	278	275	274
						Summer.							
1908.													
April	278	278	278	278	279	279	279	280	280	276	271	263	262
May.....	285	285	285	286	286	288	288	287	284	281	275	267	268
June	279	278	279	280	280	282	283	283	282	278	273	265	264
July.....	270	269	269	270	273	276	277	276	275	271	264	255	250
August	259	259	260	259	260	262	264	264	262	258	254	244	240
September	292	292	293	294	294	296	297	297	297	294	289	281	278
Means	277	277	277	278	279	281	281	281	280	276	271	263	260

Table VI.—Diurnal Inequality of the Falmouth

Hrs.	Mid$^{t.}$	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Noon.
						Summer Means.							
	+ ·00001	·00000	+ ·00001	+ ·00001	+ ·00002	+ ·00004	+ ·00005	+ ·00004	+ ·00003	·00000	− ·00006	− ·00014	− ·00016
						Winter Means.							
	+ ·00002	+ ·00002	+ ·00002	+ ·00002	+ ·00001	+ ·00001	+ ·00001	+ ·00001	+ ·00001	·00000	− ·00002	− ·00006	− ·00006
						Annual Means.							
	+ ·00001	+ ·00001	+ ·00001	+ ·00001	+ ·00002	+ ·00003	+ ·00003	+ ·00002	+ ·00002	·00000	− ·00004	− ·00010	− ·00011

Observatory, determined from the Magnetograph Curves on during 1908. (Mean for the Year = 0·43279).

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Midt.
Winter.											
272	274	275	276	276	276	275	275	275	275	275	275
260	263	267	269	268	268	266	265	264	264	264	264
287	291	295	298	299	298	298	297	297	296	296	296
291	296	301	305	304	302	299	298	297	297	297	298
269	272	274	273	272	270	269	268	268	268	268	269
276	279	281	281	281	280	279	279	279	278	278	278
276	279	282	284	283	282	281	280	280	280	280	280
Summer.											
263	270	276	279	282	282	281	279	278	278	278	277
275	282	288	290	293	294	293	291	289	287	286	285
266	271	277	281	284	286	287	285	284	283	282	281
255	258	264	270	276	277	277	275	272	270	268	267
244	251	260	265	269	269	267	267	266	265	263	262
280	283	290	294	297	296	295	295	294	293	292	291
264	269	276	280	283	284	283	282	281	279	278	277

Vertical Force as deduced from Table V.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Midt.
Summer Means.											
− ·00013	− ·00007	− ·00001	+ ·00003	+ ·00007	+ ·00007	+ ·00007	+ ·00005	+ ·00004	+ ·00003	+ ·00001	·00000
Winter Means.											
− ·00005	− ·00001	+ ·00002	+ ·00003	+ ·00003	+ ·00002	+ ·00001	·00000	·00000	− ·00001	− ·00001	·00000
Annual Means.											
− ·00009	− ·00004	·00000	+ ·00003	+ ·00005	+ ·00005	+ ·00004	+ ·00003	+ ·00002	+ ·00001	·00000	·00000

Table VII.—Hourly Means of Inclination at Falmouth Observatory, (Mean for the

Hours	Midt.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Noon
	(66° +)					Winter.							
1908.	′	′	′	′	′	′	′	′	′	′	′	′	′
January	30·9	31·0	31·0	31·0	30·9	30·7	30·7	30·7	30·6	30·7	30·8	31·0	31·2
February	31·1	31·1	31·1	31·1	30·9	30·8	30·7	30·7	30·7	31·2	31·5	31·7	31·9
March	31·6	31·6	31·6	31·6	31·6	31·5	31·4	31·5	32·0	32·5	32·9	33·2	33·0
October	32·2	32·3	32·3	32·2	32·2	32·2	32·1	32·3	32·9	33·5	34·0	34·0	33·7
November ...	31·6	31·6	31·6	31·6	31·5	31·4	31·4	31·5	31·6	32·1	32·4	32·2	31·9
December.....	31·2	31·3	31·3	31·2	31·1	30·9	30·9	30·9	31·0	31·1	31·2	31·4	31·3
Means.....	31·4	31·5	31·5	31·4	31·4	31·2	31·2	31·3	31·5	31·8	32·1	32·2	32·2
						Summer.							
1908.	′	′	′	′	′	′	′	′	′	′	′	′	′
April	30·8	30·9	30·9	30·9	31·0	31·0	30·9	31·2	31·6	32·3	32·7	32·5	32·3
May	30·7	30·6	30·7	30·8	30·8	31·0	31·3	31·7	32·0	32·3	32·4	32·2	32·0
June	30·4	30·6	30·8	30·8	30·9	30·9	31·1	31·6	32·0	32·3	32·5	32·3	31·7
July	30·4	30·4	30·5	30·6	30·7	30·8	30·9	31·3	31·8	32·1	32·2	31·9	31·7
August	30·8	31·0	30·9	30·9	31·1	31·3	31·7	32·1	32·5	32·7	33·0	32·4	31·6
September ...	31·3	31·5	31·7	31·7	31·9	32·0	32·1	32·5	32·8	33·3	33·4	33·3	32·5
Means.....	30·7	30·8	30·9	30·9	31·1	31·2	31·3	31·7	32·1	32·5	32·7	32·4	32·0

Table VIII.—Diurnal Inequality of the Falmouth

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

calculated from Tables III and V, for each month, 1908.
Year = 66° 31′·4).

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Midt.
					Winter.						
′	′	′	′	′	′	′	′	′	′	′	′
31·0	30·9	31·0	31·2	30·9	30·8	30·9	31·0	31·0	30·9	31·0	30·9
31·7	31·3	31·5	31·6	31·4	31·0	31·0	30·9	30·7	30·8	30·7	30·7
32·7	32·4	32·1	31·8	31·7	31·5	31·3	31·3	31·3	31·2	31·2	31·4
33·2	32·9	32·7	32·5	32·2	32·0	31·9	31·7	31·8	31·9	31·9	32·1
31·7	31·6	31·7	31·7	31·6	31·2	31·1	31·1	31·2	31·3	31·4	31·5
31·1	31·3	31·3	31·2	31·2	31·0	30·9	30·9	31·1	31·0	31·1	31·2
31·9	31·7	31·7	31·7	31·5	31·2	31·2	31·2	31·2	31·2	31·1	31·3
					Summer.						
′	′	′	′	′	′	′	′	′	′	′	′
31·8	31·4	31·1	30·9	30·9	30·6	30·6	30·5	30·5	30·5	30·7	30·6
31·8	31·4	31·0	30·9	30·8	30·7	30·6	30·4	30·4	30·5	30·6	30·7
31·5	31·2	31·0	30·5	30·3	30·3	30·2	30·2	30·4	30·3	30·4	30·3
31·6	31·1	30·6	30·2	30·3	30·2	30·1	30·0	29·8	29·9	29·8	30·0
31·1	30·8	30·9	30·9	31·0	30·6	30·2	30·1	30·3	30·3	30·5	30·5
32·1	31·8	31·9	31·7	31·7	31·5	31·3	31·3	31·3	31·3	31·3	31·2
31·6	31·3	31·1	30·8	30·8	30·6	30·5	30·4	30·4	30·5	30·5	30·5

Inclination, as deduced from Table VII.

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

APPENDIX VI.

MAGNETIC OBSERVATIONS MADE AT THE VALENCIA OBSERVATORY CAHIRCIVEEN, 1908.

Latitude, 51° 56′ N. Longitude, 10° 15′ W.

The absolute observations of Declination, Inclination and Horizontal Force at this Observatory have been continued throughout the year. The monthly means are here given, together with the calculated values of Vertical and Total Force.

The secular change of the different elements is :—

Declination	−5′·7.
Inclination	−0′·7.
Horizontal Force	Nil
Vertical Force	−·00025 G.C.S.
Total Force	−·00024. ,,

No marked difference from last year is shown, except in the Vertical and Total Force secular changes, which have returned in sign and amount to about those of previous years.

J. E. CULLUM,

Observer.

Table I.—Declination at Valencia Observatory, Cahirciveen, 1908.

(Dover Unifilar 139.)

Date.	Declination, West.	Monthly Mean.	Remarks.
	° ′	° ′	
January 9 ...	21 5·2		
,, 22 ...	21 0·3	21 2·7	
February 7 ...	20 59·5		
,, 21 ...	20 56·6	20 58·1	
March 7 ...	20 57·2		
,, 23 ...	20 56·8	20 57·0	
April 6 ...	20 55·3		
,, 21 ...	20 54·7	20 55·0	
May 12 ...	20 57·0		
,, 20 ...	20 54·1	20 55·6	
June 9 ...	20 55·8		
,, 22 ...	20 51·8	20 53·8	
July 7 ...	20 55·8		
,, 21 ...	20 53·0	20 54·2	
August 7 ...	20 55·8		
,, 22 ...	20 54·0	20 54·9	
September 22 ...	20 54·6	20 54·6	
October 7 ...	20 53·7		
,, 21 ...	20 55·7	20 54·7	
November 11 ...	20 56·3		
,, 24 ...	20 54·9	20 55·6	
December 5 ...	20 51·4		
,, 21 ...	20 53·9	20 52·6	
Mean ...	at 10 a.m., G.M.T.	20 55·7	

Table II.—Inclination at Valencia Observatory, Cahirciveen, 1908.

(Dover Circle 118.)

Date.	Mean of two needles.	Monthly Mean.	Remarks.
	° ′	° ′	
January 9 ...	68 17·9		
,, 22 ...	68 15·3	68 16·6	
February 7 ...	68 17·6		
,, 21 ...	68 14·7	68 16·1	
March 7 ...	68 17·3		
,, 23 ...	68 15·3	68 16·3	
April 6 ...	68 17·2		
,, 21 ...	68 16·6	68 16·9	
May 12 ...	68 16·2		
,, 20 ...	68 14·4	68 15·3	
June 9 ...	68 16·4		
,, 23 ...	68 16·7	68 16·5	
July 7 ...	68 14·8		
,, 21 ...	68 15·8	68 15·3	
August 7 ...	68 16·3		
,, 22 ...	68 17·4	68 16·9	
September 22 ...	68 16·6	68 16·6	
October 7 ...	68 17·8		
,, 21 ...	68 15·3	68 16·6	
November 11 ...	68 16·6		
,, 24 ...	68 16·7	68 16·7	
December 5 ...	68 16·6		
,, 21 ...	68 14·7	68 15·6	
Mean ...	at 1 p.m., G.M.T.	68 16·3	

Table III.—Magnetic Force (C.G.S.) at Valencia Observatory, Cahirciveen, 1908. (Dover Unifilar 139, and Circle 118.)

Date.	H.F.	Mean.	V.F. H.F. × Tan. Dip.	T.F. H.F. × Sec. Dip.
January 9	0·17871			
,, 22	0·17895	0·17883	0·44885	0·48316
February 7	0·17877	0·17877	0·44908	0·48334
March 23	0·17870	0·17870	0·44802	0·48235
April 6	0·17860			
,, 21	0·17864	0·17862	0 44844	0·48270
May 12	0·17859			
,, 20	0·17882	0·17870	0·44802	0·48235
June 9	0·17873			
,, 22	0·17867	0·17870	0·44849	0·48277
July 7	0·17878			
,, 21	0·17876	0·17877	0·44820	0·48254
August 7	0·17869			
,, 22	0·17845	0·17857	0·44831	0·48257
September 22	0·17854	0·17854	0·44813	0·48238
October 7	0·17853			
,, 21	0·17883	0·17868	0·44848	0·48276
November 11	0·17863			
,, 24	0·17883	0·17873	0·44864	0·48293
December 5	0·17860			
,, 21	0·17889	0·17874	0·44824	0·48256
Mean	at Noon, G.M.T.	0·17870	0·44841	0·48270