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*Price Four Shillings.*

SEPTEMBER 12, 1901.

# THE NATIONAL PHYSICAL LABORATORY.

## *Report on the Observatory Department for the Year ending December 31, 1900.*

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 1900 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 connexion 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 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. =  $0^{\circ} 8'7$ .

Bifilar, January, 1900, for 1 cm.  $\delta H = 0\cdot00051$  C.G.S. unit.

Balance, January, 1900, for 1 cm.  $\delta V = 0\cdot00049$  C.G.S. unit.

The distance between the dots of light upon the vertical force cylinder having become too small for satisfactory registration, the dots were separated on June 20 by slightly altering the position of the zero mirror.

The curves have been quite free from any large fluctuations; indeed, no unusual disturbance has been registered for some time past. The principal variations that were recorded during the year took place on the following days:—

January 19th–20th; March 8th–9th and 13th; May 5th.

The hourly means and diurnal inequalities of the magnetic elements for 1900, 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.....	16° 52'·7
Mean Horizontal Force .....	0·18428 C.G.S. unit.
Mean Inclination .....	67° 11'·8
Mean Vertical Force.....	0·43831 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 IA to the present Report.

A course of magnetic instruction was given to Captain Denholm Fraser, R.E., charged with a magnetic survey of India, and facilities were afforded him for making experiments with a view to improving the instrumental outfit for the survey.

A new magnetic hut was erected early in the year by Mr. Eldridge. It is larger and better lighted than the old hut, and has proved very useful.

## 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 Council, data have been supplied to the Council of the Royal Meteorological Society, the Institute of Mining Engineers, and the editor of 'Symons' Monthly Meteorological Magazine.' On the initiative of the Meteorological Office, some special cloud observations have been made in connection with the International scheme of balloon ascents.

*Electrograph.*—This instrument worked generally in a satisfactory manner during the year.

The small glass beaker mentioned in last year's Report is still

employed, and by removing the sulphuric acid at regular periods—generally fourteen or fifteen days—the troubles previously experienced with the “setting” of the needle and with the shift of zero has been largely overcome.

No systematic use has been made of the thirty-six Clark cells mentioned in the 1898 Report, but they have been employed to check the scale values of the two portable electrometers.

Scale-value determinations of the electrograph were made on April 2, July 14, and October 25, and the potential of the battery has been tested weekly. Forty cells only have been employed during the year, giving about 30 volts.

With a view to promoting uniformity in procedure, the Superintendent, at the suggestion of the Meteorological Office, had an interview with Mr. C. T. R. Wilson, F.R.S., and Mr. W. Nash, of Greenwich Observatory, who were shown the electrograph arrangements and the means adopted for standardising the curves. The stoppage this entailed in the working of the instrument was utilised in giving it a thorough cleaning. A new bifilar suspension was also fitted to the needle, and the wire leading from the can to the electrometer was bedded in paraffin wax in hopes of improving the insulation.

*Inspections.*—In compliance with the request of the Meteorological Council, the following Observatories and Anemograph Stations have been visited and inspected:—North Shields, Glasgow, Aberdeen, Alnwick Castle, Deerness (Orkney), Falmouth, and Fort William, by Mr. Baker; and Radcliffe Observatory (Oxford), Stonyhurst, Fleetwood, Armagh, Dublin, Valencia, and Yarmouth, 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 seconds of arc of the largest movements are given in Table I, Appendix III.

The “disturbance” on January 20 was particularly noticeable.

The movement was the largest that has yet been fully recorded at the Observatory, the maximum amplitude being 15 mm., or 12·6 seconds of arc. The next largest disturbance was on October 29, with a maximum of 12 mm., or 9·5 seconds of arc.

The action of the boom was not altogether satisfactory during August and September, and on September 27 the old boom was replaced by a new one of standard pattern. The balance weights are at 117 mm. and the tie at 127 mm. from the cup end of the boom.

The point of the bearing pivot on the stand was also improved.

A detailed list of the movements recorded from January 1 to December 31, 1900, was made and sent to Professor Milne, and will be found in the ‘Report’ of the British Association for 1901, “Seismological Investigations Committee's Report.”

During October a Milne seismograph, No. 31, intended to be set up at the University Observatory, Coimbra, was fitted up in the seismograph room, at the same height and in the same N.—S. direction as the Kew Instrument, and a series of comparisons were carried out till the end of the year. Several interesting features were noticed, and the results have been embodied in a paper by the Superintendent.

#### 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 since March on 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, and these have thrown considerable light upon the action of the self-recording electrometer, especially with reference to its insulation. Some direct experiments have also been made on this point.

The reservoir holding the supply of water for the water-dropper of the self-recording electrometer is supported upon six large "Mascart" insulators, and it was thought that perhaps this system of insulating the tank could be improved upon.

A quantity of fine paraffin wax, with a high melting point, was procured from Price's Candle Company, Limited, in rectangular blocks, and a number of cylinders of sulphur were cast at the Observatory. Three similar water tanks were supported upon three wax blocks, three sulphur blocks, and three Mascart insulators respectively. Each received a similar definite charge, and the rate of loss of charge was observed.

The observations—which are to be regarded only as preliminary—extended through May, June, and July, under various hygrometric conditions. The sulphur and paraffin when new and clean gave much the best values, but after the lapse of a few weeks the rate of loss became very similar for all three species of insulator. The deterioration was apparently due to accumulation of dust, &c. The provision of a hood or cover to the sulphur and paraffin blocks would undoubtedly improve the permanency of their insulating qualities.

*Platinum Thermometry.*—The paper by the Superintendent, referred to in last year's Report, has been published in the Royal Society's 'Proceedings,' vol. 67, p. 3.

V. VERIFICATION OF INSTRUMENTS.

The subjoined is a list of the instruments examined in the year 1900, compared with a corresponding return for 1899 :—

	Number tested in the year ending December 31.	
	1899.	1900.
Air-meters .....	6	9
Anemometers .....	23	1
Aneroids .....	175	197
Artificial horizons .....	9	27
Barometers, Marine.....	92	139
„    Standard.....	85	57
„    Station .....	15	23
Binoculars .....	404	963
Compasses .....	43	51
Deflectors.....	6	1
Hydrometers .....	241	173
Inclinometers .....	9	17
Photographic Lenses .....	160	136
Magnets .....	3	1
Telescopes .....	561	1,345
Rain Gauges.....	19	4
Rain-measuring Glasses .....	44	29
Scales .....	—	1
Sextants .....	876	813
Sunshine Recorders.....	6	3
Theodolites .....	24	12
Thermometers, Avitreous or Immisch's	5	—
„    Clinical .....	16,020	20,476
„    Deep sea.....	19	83
„    High Range .....	62	40
„    Hypsometric .....	39	66
„    Low Range .....	103	33
„    Meteorological .....	2,892	2,786
„    Solar radiation .....	—	2
„    Standard .....	104	61
Unifilars .....	5	5
Vertical Force Instruments .....	1	14
Declinometers .....	—	1
<b>Total .....</b>	<b>22,051</b>	<b>27,569</b>

Duplicate copies of corrections have been supplied in 56 cases.

The number of instruments rejected in 1899 and 1900 on account of excessive error, or for other reasons, was as follows:—

	1899.	1900.
Thermometers, clinical .....	149	116
„    ordinary meteorological ...	78	79
Sextants .....	151	122
Telescopes .....	49	116
Binoculars .....	21	31
Various .....	14	28

Four Standard Thermometers have been constructed during the year.

There were at the end of the year in the Observatory, undergoing verification, 16 Barometers, 285 Thermometers, 15 Sextants, 250 Telescopes, 30 Binoculars, 2 Hydrometers, 4 Rain Measures, 2 Rain Gauges, and 4 Unifilar Magnetometers.

#### VI. RATING OF WATCHES AND CHRONOMETERS.

The number of watches sent for trial this year is slightly less than in 1899, the total entries being 403, as compared with 469 in the preceding year.

The “especially good” class A certificate was obtained by 98 movements.

This is a marked increase on the number obtained in 1899, and the general performance has been decidedly better.

The following figures show the percentage number of watches obtaining the distinction “especially good,” as compared to the total number obtaining class A certificates:—

Year .....	1895.	1896.	1897.	1898.	1899.	1900.
Percentage “especially good”	16·6	30·5	28·0	22·1	26·6	35·4

The percentage is thus higher than in any previous year.

The 403 watches received were entered for trial as below:—

For class A, 320; class B, 60; and 23 for the subsidiary trial. Of these 21 passed the subsidiary test, 55 failed from various causes to gain any certificate, 50 were awarded class B, and 277 class A certificates.

In Appendix II will be found a table giving the results of trial of the 51 watches which gained the highest number of marks during the year. The highest place was taken by Mr. A. E. Fridlander, of Coventry, with the keyless going-barrel Karrusel lever watch, No. 25,582, which obtained 90·1 marks out of a maximum of 100.

This is the first English lever watch to reach the 90 marks limit, and its performance is the best since 1892.

*Marine Chronometers.*—During the year, 53 chronometers have been

entered for the Kew A trial and 1 for the B trial. Of these 44 gained A certificates, 1 a B certificate, and 9 failed.

The mean-time chronometer Arnold 86, and the hack chronometer Molyneux 2123 have been cleaned and re-timed.

## VII. MISCELLANEOUS.

*Commissions.*—The work under this heading has been of a very varied character during the year. The following instruments have been procured, examined, and forwarded to the various Observatories on whose behalf they were purchased :—

For Lisbon and Portuguese W. Africa, a transit theodolite, a declinometer, a dip circle with two needles, a centre-seconds watch, and two chronometers.

For Mauritius, a Mason's hygrometer, an ordinary maximum and two solar maximum thermometers.

For the Central Physical Observatory, St. Petersburg, and the Baron Toll Expedition: A dip circle with six needles, two prismatic compasses, two aneroid barometers, a Robinson cup anemograph, a chronometer, and a deck watch.

For de Bilt (Utrecht), a vertical force magnet.

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

Photographic paper has also been sent in quarterly instalments to the India Office for use at Colaba (Bombay), Calcutta, and Madras.

*Anemograph and Sunshine Sheets* have also been sent to Hong Kong, Mauritius, and St. Petersburg; *Papier Saxe* to Coimbra; and *Seismograph rolls* to Mauritius.

*Pendulum Observations.*—In June, Mr. Putnam, of the U.S. Coast and Geodetic Survey, swung half-second pendulums in the wooden room in the basement.

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

19 Scientific Societies and Institutions of Great Britain and Ireland,

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

The card catalogue has been proceeded with.

*Audit, &c.*—The accounts for 1900 have been audited by Messrs. W. B. Keen and Co., chartered accountants. The balance sheet is appended.



## PERSONAL ESTABLISHMENT.

The staff employed is as follows:—

R. T. Glazebrook, Sc.D., F.R.S., Director of the Laboratory.

C. Chree, Sc.D., F.R.S., Superintendent of the Observatory  
Department.

T. W. Baker, Chief Assistant.

E. G. Constable

W. Hugo

J. Foster

T. Gunter

W. J. Boxall

G. E. Bailey

E. Boxall

G. Badderly

} Senior Assistants in the Observatory  
Department.

} Junior Assistants.

Eight other Assistants.

A Caretaker and a Housekeeper are also employed.

In addition to the above, Dr. J. A. Harker has been employed in the capacity of an Assistant in the Laboratory.

(Signed) R. T. GLAZEBROOK,  
*Director.*

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.
Executors of 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
Mr. P. Baracchi (Melbourne University).	Unifilar Magnetometer, by Jones, marked N.A.B.C., complete.....	1899
	Dip Circle, by Barrow, with one pair of Needles and Bar Magnets.....	1899
	Tripod Stand .....	1899
The Borchgrevink-Newnes Antarctic Expedition.	Dip Circle, by Barrow, No. 24, with four Needles and Bar Magnets.....	1898
C. T. R. Wilson, F.R.S.	Electrograms for 1897 .....	1899



LIABILITIES.	£	s.	d.	ASSETS.	£	s.	d.	
Brought forward . . . . .	11,941	15	1	Brought forward . . . . .	4,281	19	7	
	<hr/>			By Investments— <i>continued</i> —				
				Building Fund Account—				
				£5,006 10s. 3d. 2 $\frac{3}{4}$ per cent. Con- solidated Stock at cost . . . . .	5,064	11	0	
				Pension Fund Account—				
				£395 5s. 1d. 2 $\frac{3}{4}$ per cent. Con- solidated Stock at cost . . . . .	400	0	0	
				Cash at Bankers—				
				General Account—				
				Bank of England (Western Branch) . . . . .	1,986	15	0	
				London and County Bank Revenue Account . . . . .	110	7	1	
				London and County Bank Ex- penditure Account . . . . .	71	18	7	
				Pension Fund Account—				
				Bank of England (Western Branch) . . . . .	5	3	4	
				Cash in hands of Clerk . . . . .	21	0	6	
					<hr/>	2,195	4	6
						<hr/>	<hr/>	<hr/>
						£11,941	15	1
						<hr/>	<hr/>	<hr/>

*Income and Expenditure Account for the Year ended 31st December, 1900.*

INCOME.		EXPENDITURE.	
£	s. d.	£	s. d.
Treasury Grant for Year .. .. .	4,000 0 0	Administrative Expenditure—	
Fees for Tests .. .. .	2,661 9 1	Rents, Rates, Gas, and Insurance—	
Less—Discounts allowed .. .. .	111 10 7	Rent of Kew Observatory .. .. .	27 5 0
		Lighting and Heating .. .. .	73 19 10
		Water.. .. .	5 15 0
		Insurance .. .. .	23 9 3
Meteorological Office, Allowance .. .. .	400 0 0		
Dividends on India 3½ Per Cent. Stock, April, July, and October .. .. .	32 12 3	Salaries, Wages, and Allowances—	
Gassiot Trust Fund—		Director's Salary .. .. .	1,300 0 0
One Year's Interest .. .. .	454 4 1	Transfer to Pension Fund .. .. .	400 0 0
Rents Receivable .. .. .	10 3 0	Salaries and Wages of Staff .. .. .	2,711 11 0
Charges to Colonial and Foreign Institutions in respect of Commissions.. .. .	647 3 0	Director's Travelling Expenses .. .. .	72 1 10
Donation from Sir Andrew Noble.. .. .	200 0 0	Secretarial Services at Committee Meetings, &c. .. .. .	13 13 0
			4,497 5 10
		General Incidental Expenses—	
		General Repairs .. .. .	26 19 3
		House and Garden Expenses.. .. .	30 13 11
		Stationery, &c... .. .	44 15 1
		Printing Minutes, Reports, &c. .. .. .	31 14 6
		Miscellaneous .. .. .	77 2 3
			211 5 0
Carried forward .. .. .	£8,294 0 10	Carried forward .. .. .	£4,838 19 11

INCOME.		EXPENDITURE.	
£	s. d.	£	s. d.
Brought forward .. .. .	8,294 0 10	Brought forward .. .. .	4,838 19 11
		Observatory, Incidental Expenses—	
		Photographic Paper and Chemicals ..	42 15 5
		Repairs to Instruments, &c. .. .. .	5 9 0
		Miscellaneous .. .. .	7 19 7
		<hr/>	<hr/>
		Tests, Incidental Expenses—	56 4 0
		New Apparatus and Instruments ..	25 13 7
		Repairs to Apparatus and Instruments	3 3 0
		Printing, Books and Stationery .. ..	72 16 0
		Rent of Time Signal Wire .. .. .	21 0 0
		Materials for Tests .. .. .	21 8 9
		Miscellaneous .. .. .	50 11 3
		<hr/>	<hr/>
		Laboratory and Workshop Incidental Expenses—	194 12 7
		Materials and Sundries for Laboratory	121 18 4
		"    Workshop	36 17 9
		Miscellaneous .. .. .	22 12 5
		Repairs .. .. .	16 12 0
		<hr/>	<hr/>
		Less received from Liverpool and London and Globe Insurance Company ..	198 0 6
		<hr/>	<hr/>
		23 10 0	174 10 6
		<hr/>	<hr/>
Carried forward .. .. .	£8,294 0 10	Carried forward .. .. .	£5,264 7 0

Brought forward .. .. .	£	s.	d.	£	s.	d.
				5,264	7	0
Brought forward.. .. .						
Purchase of Instruments, &c., for Colonial and Foreign Institutions on Com- mission .. .. .				614	17	11
				<hr/>		
Total Ordinary Expenditure ..				5,879	4	11
Extraordinary Expenditure—						
Building Account.. .. .				508	19	4
Director's Expenses of Removal .. .. .				150	0	0
Furnishing Director's Office .. .. .				44	18	6
Apparatus and Instruments for Laboratory .. .. .				139	5	8
Tools for Workshop .. .. .				75	18	2
				<hr/>		
				919	1	8
				<hr/>		
				6,798	6	7
Balance, being Excess of Income over Expenditure for the year.. .. .				1,495	14	3
				<hr/>		
				£8,294	0	10
				<hr/> <hr/>		
Brought forward .. .. .	£	s.	d.			
				8,294	0	10
				<hr/>		
				£8,294	0	10
				<hr/> <hr/>		

## Building Fund Account, 31st December, 1900.

		Consolidated Stock.				
		1900.				
		£	s. d.	By Balance carried down .. ..	£	s. d.
To Treasury Grant applied in purchase of £4,941 5s. 5d. 2 $\frac{3}{4}$ per cent. Consolidated Stock..		5,000	0 0		5,064	11 0
Dividends on £4,941 5s. 5d. 2 $\frac{3}{4}$ per cent. Consols, applied in purchase of £65 4s. 10d. 2 $\frac{3}{4}$ per cent. Consolidated Stock..		64	11 0			
		<u>£5,064</u>	<u>11 0</u>		<u>£5,064</u>	<u>11 0</u>
1901.		£	s. d.			
January 1. To Balance brought down .. ..		£5,064	11 0			

## Pension Fund Account, 31st December, 1900.

		Consolidated Stock.				
		1900.				
		£	s. d.	By Balance carried down .. ..	£	s. d.
£395 5s. 1d. 2 $\frac{3}{4}$ per cent. Consolidated Stock.					405	3 4
£5 3s. 4d. Balance at Bank of England, Western Branch.						
To transfer from General Revenue Account applied in purchase of £395 5s. 1d. 2 $\frac{3}{4}$ per cent. Consolidated Stock .. ..		400	0 0			
Dividends on £395 5s. 1d. 2 $\frac{3}{4}$ per cent. Consols ..		5	3 4			
		<u>£405</u>	<u>3 4</u>		<u>£405</u>	<u>3 4</u>
1901.		£	s. d.			
January 1. To Balance brought down .. ..		£405	3 4			

I have examined the above Balance Sheet and Accounts with the Books and Vouchers, and certify them to be in accordance therewith. I have also verified the Bank balances and the securities for Investments.

3, CHURCH COURT, OLD JEWRY, E.C.  
6th February, 1901.

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

APPENDIX I.

MAGNETICAL OBSERVATIONS, 1900.

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

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

The Inclination was observed with the Inclinator by Barrow, No. 33, and needles  $3\frac{1}{2}$  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 1900 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, 8, 9, 30, 31.
February.....	3, 6, 7, 13, 28.
March .....	5, 11, 21, 27, 28.
April .....	3, 8, 15, 22, 25.
May.....	9, 10, 14, 21, 28.
June .....	10, 11, 16, 20, 25.
July.....	14, 15, 18, 22, 30.
August.....	6, 9, 10, 23, 30.
September .....	2, 7, 21, 25, 26.
October .....	2, 7, 13, 19, 31.
November .....	5, 6, 11, 16, 30.
December .....	3, 6, 15, 23, 24.



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.
(16° +) West													
Winter.													
1900.													
Months.													
Jan. ..	56·7	54·1	54·1	54·4	54·5	54·4	54·3	54·2	54·0	53·6	53·8	54·4	55·7
Feb. ..	57·1	54·0	54·3	54·6	54·5	54·5	54·3	54·0	53·9	54·0	54·1	54·6	55·5
March.	57·5	53·3	53·4	53·4	53·1	52·9	52·8	52·5	51·8	50·9	50·8	52·0	54·3
Oct. ..	55·0	51·0	51·2	51·3	51·2	51·1	51·0	50·9	50·2	49·3	48·8	50·0	52·5
Nov. ..	54·2	50·6	50·9	51·1	51·1	51·1	51·0	50·7	50·4	49·9	49·9	51·3	52·8
Dec. ..	52·1	50·0	50·3	50·3	50·3	50·4	50·3	50·3	50·0	49·8	49·8	50·5	51·4
Means	55·4	52·2	52·4	52·5	52·5	52·4	52·3	52·1	51·7	51·2	51·2	52·1	53·7
Summer.													
April ..	57·0	53·0	53·0	52·8	52·8	52·4	52·2	51·6	50·6	49·8	49·9	51·5	54·5
May ..	57·1	52·4	52·5	52·2	51·9	51·6	50·5	49·4	49·0	49·4	50·1	52·3	54·8
June ..	56·1	52·4	52·3	52·1	52·0	51·6	50·8	49·9	49·4	49·5	50·2	52·1	54·9
July ..	57·0	52·2	52·3	52·1	51·8	51·2	49·8	49·4	49·3	49·4	50·0	51·0	53·4
Aug. ..	57·0	51·6	51·6	51·4	51·3	50·8	50·3	49·4	48·6	48·8	50·2	52·6	55·3
Sept. ..	57·2	51·4	51·3	51·2	51·0	50·7	50·6	50·0	49·1	48·8	49·7	52·2	54·8
Means	56·9	52·2	52·2	52·0	51·8	51·4	50·7	50·0	49·3	49·3	50·0	52·0	54·6

Table II.—Diurnal Inequality of the

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

NOTE.—When the sign is + the magnet

" " - "

selected quiet Days in 1900. (Mean for the Year = 16° 52'·7. West.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.	Succeeding noon.
Winter.													
'	'	'	'	'	'	'	'	'	'	'	'	'	'
56·8	57·3	56·2	55·6	55·4	55·5	55·0	54·3	54·0	53·9	53·9	53·9	53·9	56·7
56·9	57·5	57·2	55·6	55·0	55·0	54·7	54·4	54·4	54·1	54·1	54·1	54·2	58·0
56·7	57·7	57·6	56·2	54·5	53·5	53·4	53·7	53·8	53·7	53·5	53·5	53·3	56·5
54·8	55·6	55·1	53·7	52·5	51·9	51·8	51·7	51·5	51·2	51·2	51·2	51·0	55·0
53·6	53·5	52·6	51·7	51·4	51·3	51·2	51·1	50·8	50·8	50·7	50·8	51·0	53·5
52·0	52·1	51·6	51·0	50·6	50·4	50·1	49·8	49·8	49·6	49·5	49·7	50·1	52·9
55·1	55·6	55·0	54·0	53·2	52·9	52·7	52·5	52·4	52·2	52·1	52·2	52·2	55·4
Summer.													
'	'	'	'	'	'	'	'	'	'	'	'	'	'
57·1	58·1	57·7	56·1	54·7	53·9	53·5	53·4	53·1	53·1	53·2	52·9	52·7	57·1
56·9	57·6	56·8	55·3	53·7	52·7	52·2	52·2	52·2	52·3	52·6	52·7	52·6	56·6
57·9	58·7	58·4	57·5	56·4	54·6	53·4	52·6	52·5	52·5	52·5	52·5	52·5	57·2
56·4	58·1	57·8	56·2	54·7	53·6	52·7	52·8	52·9	52·8	52·4	52·4	52·0	56·2
57·4	57·9	56·7	55·3	53·3	52·1	51·5	51·9	51·7	51·9	51·7	51·9	51·7	58·1
57·2	57·4	55·6	53·5	52·0	51·3	51·4	51·6	51·5	51·6	51·4	51·4	51·3	56·7
57·2	58·0	57·2	55·7	54·1	53·0	52·5	52·4	52·3	52·4	52·3	52·3	52·1	57·0

Kew Declination as deduced from Table I.

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

points to the west of its mean position.

„ east „ „

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.													
1900. Months.													
Jan. ...	407	414	413	414	414	416	417	418	419	416	412	405	405
Feb. ...	404	414	415	415	416	416	417	419	417	415	412	408	407
March ..	408	421	421	421	421	420	421	419	419	415	408	401	399
Oct. ...	422	443	443	442	443	444	446	446	444	439	427	421	420
Nov. ...	436	441	442	441	442	443	443	443	441	437	432	430	431
Dec. ...	441	443	443	443	443	443	443	443	444	444	444	443	441
Means..	420	429	429	429	430	430	431	431	431	428	422	418	417
Summer.													
April...	405	425	425	425	425	425	424	424	424	420	412	404	402
May ...	400	422	422	419	420	418	416	412	408	404	401	404	405
June ...	421	436	435	433	434	435	435	430	427	423	415	409	409
July ...	425	446	442	441	440	440	439	436	433	427	419	415	417
Aug. ...	421	437	436	435	435	433	432	429	422	414	409	411	416
Sept. ...	428	439	438	436	436	436	434	432	427	421	416	413	416
Means..	417	434	433	432	432	431	430	427	423	418	412	409	411

Table IV.—Diurnal Inequality of the

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Summer Means.												
	+ '00006	+ '00004	+ '00003	+ '00003	+ '00003	+ '00002	- '00001	- '00005	- '00010	- '00017	- '00019	- '00018
Winter Means.												
	+ '00001	+ '00001	+ '00001	+ '00002	+ '00002	+ '00003	+ '00003	+ '00003	'00000	- '00006	- '00010	- '00011
Annual Means.												
	+ '00003	+ '00003	+ '00002	+ '00002	+ '00002	+ '00002	+ '00001	- '00001	- '00005	- '00011	- '00015	- '00014

NOTE.—When the sign is + the

for Temperature) as determined from the selected quiet Days in 1900.  
Year = 0.18428.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.	Succeeding noon.
Winter.													
407	413	415	414	414	413	414	414	415	416	416	415	416	412
407	411	413	413	413	416	416	417	418	418	417	418	417	411
405	413	418	421	422	423	424	426	427	425	425	426	426	410
423	431	436	440	441	443	444	445	445	444	445	445	445	430
433	438	440	441	441	442	443	443	443	443	442	441	441	431
440	443	442	444	445	446	445	445	444	444	443	442	442	438
419	425	427	429	429	430	431	432	432	432	431	431	431	422
Summer.													
411	418	424	428	429	427	429	430	431	430	429	429	429	410
409	412	414	414	417	422	428	431	429	429	428	428	428	407
416	424	432	435	435	438	441	441	440	439	436	435	434	410
424	431	435	440	443	442	443	446	446	446	445	444	444	430
429	435	435	437	435	434	435	439	438	439	438	439	439	427
428	434	435	435	436	436	438	442	440	439	437	440	439	437
420	426	429	431	432	433	436	438	437	437	436	436	436	420

Kew Horizontal Force as deduced from Table III.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
Summer Means.												
-0.0009	-0.0003	+0.0001	+0.0003	+0.0004	+0.0005	+0.0007	+0.0010	+0.0009	+0.0008	+0.0007	+0.0007	+0.0007
Winter Means.												
-0.0009	-0.0003	-0.0001	+0.0001	+0.0001	+0.0002	+0.0003	+0.0004	+0.0004	+0.0004	+0.0003	+0.0003	+0.0003
Annual Means.												
-0.0009	-0.0003	+0.0000	+0.0002	+0.0002	+0.0003	+0.0005	+0.0007	+0.0006	+0.0006	+0.0005	+0.0005	+0.0005

reading is above the mean.

Table V.—Hourly Means of the Kew 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.													
1900. Months.													
Jan. ...	842	845	845	845	844	844	843	843	842	841	842	842	842
Feb. ...	828	833	832	832	832	832	831	831	830	828	829	827	828
March ..	842	853	853	853	853	852	851	851	852	851	850	846	845
Oct. ...	832	846	845	845	844	844	843	843	844	845	842	840	835
Nov. ...	816	819	819	819	819	818	818	818	818	818	817	815	815
Dec. ...	801	803	803	803	803	803	803	803	802	802	800	797	799
Means	827	833	833	833	833	832	832	832	831	831	830	828	827
Summer.													
April ...	841	858	857	856	855	854	854	853	852	851	848	844	838
May ...	823	842	841	841	841	841	843	842	841	838	834	828	823
June ...	818	836	835	834	834	835	835	834	836	836	833	830	826
July ...	821	835	834	834	833	834	834	834	835	834	828	823	816
Aug. ...	777	794	794	793	792	792	794	794	793	789	784	781	775
Sept. ...	825	836	836	836	835	835	835	837	836	834	829	824	821
Means	817	834	833	832	832	832	832	832	832	830	826	822	817

Table VI.—Diurnal Inequality of the

Hours.	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Summer Means.												
	+·00003	+·00062	+·00002	+·00001	+·00001	+·00002	+·00002	+·00002	·00000	-·00004	-·00009	-·00014
Winter Means.												
	+·00001	+·00001	+·00001	+·00001	·00000	·00000	·00000	-·00001	-·00001	-·00002	-·00004	-·00005
Annual Means.												
	+·00002	+·00002	+·00001	+·00001	+·00001	+·00001	+·00001	+·00001	-·00001	-·00003	-·00006	-·00009

NOTE.—When the sign is + the

for Temperature), as determined from the selected quiet Days in 1900.  
 Year = 0.43831.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.	Succeeding noon.
Winter.													
841	844	846	846	844	844	845	845	844	844	843	843	843	840
827	829	833	835	835	835	834	833	833	832	832	831	831	823
841	842	847	852	854	855	854	854	854	853	853	852	852	839
833	837	839	844	847	847	847	847	848	847	848	847	847	833
816	818	822	822	821	820	821	822	821	820	820	819	819	814
800	803	805	806	806	805	805	805	805	805	805	804	804	802
826	829	832	834	834	834	834	834	834	833	833	833	833	825
Summer.													
838	842	847	852	855	857	859	858	857	856	856	855	854	832
819	824	831	835	840	844	843	842	842	841	840	839	839	820
823	823	829	832	836	840	842	843	843	841	841	840	839	822
818	822	825	833	838	842	842	842	841	841	840	839	838	825
775	778	783	789	792	795	795	794	794	793	792	792	791	771
821	826	832	838	841	841	839	840	839	840	839	839	837	823
817	819	824	830	834	837	837	837	836	835	835	834	833	815

Kew Vertical Force as deduced from Table V.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	Mid.	
Summer Means.													
- '00014	- '00011	- '00006	- '00001	+ '00003	+ '00006	+ '00006	+ '00006	+ '00006	+ '00006	+ '00005	+ '00004	+ '00004	+ '00003
Winter Means.													
- '00006	- '00003	'00000	+ '00002	+ '00003	+ '00002	+ '00002	+ '00002	+ '00002	+ '00002	+ '00002	+ '00002	+ '00001	+ '00001
Annual Means.													
- '00010	- '00007	- '00003	+ '00001	+ '00003	+ '00004	+ '00004	+ '00004	+ '00004	+ '00004	+ '00003	+ '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.													
1900.													
Months.	'	'	'	'	'	'	'	'	'	'	'	'	'
Jan....	13·5	13·1	13·2	13·1	13·1	13·0	12·9	12·8	12·7	12·9	13·2	13·6	13·6
Feb....	13·3	12·8	12·7	12·7	12·6	12·6	12·5	12·4	12·5	12·6	12·8	13·0	13·1
March..	13·4	12·9	12·9	12·9	12·9	12·9	12·8	13·0	13·0	13·2	13·7	14·0	14·1
Oct....	12·2	11·2	11·3	11·2	11·2	11·1	10·9	10·9	11·1	11·5	12·2	12·5	12·5
Nov....	10·8	10·6	10·5	10·6	10·5	10·5	10·5	10·5	10·6	10·8	11·1	11·2	11·1
Dec....	10·1	10·0	10·0	10·0	10·0	10·0	10·0	10·0	9·9	9·9	9·9	9·8	10·0
Means..	12·2	11·8	11·8	11·8	11·7	11·7	11·6	11·6	11·6	11·8	12·1	12·4	12·4
Summer.													
April...	'	'	'	'	'	'	'	'	'	'	'	'	'
April...	13·6	12·7	12·7	12·7	12·7	12·6	12·7	12·7	12·6	12·9	13·3	13·8	13·7
May....	13·4	12·5	12·5	12·7	12·6	12·7	12·9	13·2	13·4	13·6	13·7	13·3	13·1
June...	11·9	11·4	11·4	11·5	11·5	11·4	11·4	11·7	12·0	12·3	12·7	13·0	12·9
July....	11·7	10·7	11·0	11·0	11·1	11·1	11·1	11·3	11·6	11·9	12·3	12·4	12·1
Aug. ...	10·8	10·2	10·2	10·3	10·2	10·4	10·5	10·7	11·1	11·6	11·8	11·5	11·0
Sept. ...	11·6	11·2	11·3	11·4	11·4	11·4	11·5	11·7	12·0	12·3	12·6	12·6	12·3
Means..	12·2	11·5	11·5	11·6	11·6	11·6	11·7	11·9	12·1	12·4	12·7	12·8	12·5

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	-0·1	-0·2	-0·1	-0·1	+0·1	+0·4	+0·7	+1·0	+1·0	+0·8
Winter Means.												
	'	'	'	'	'	'	'	'	'	'	'	'
	0·0	-0·1	0·0	-0·1	-0·1	-0·2	-0·2	-0·2	0·0	+0·3	+0·5	+0·6
Annual Means.												
	'	'	'	'	'	'	'	'	'	'	'	'
	-0·2	-0·1	-0·1	-0·1	-0·1	-0·1	0·0	+0·1	+0·4	+0·7	+0·8	+0·7

NOTE.—When the sign is +

and Vertical Forces (Tables III and V). (The Mean for the Year = 67° 11'·8.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.	Succeeding noon.
Winter.													
'	'	'	'	'	'	'	'	'	'	'	'	'	'
13·5	13·2	13·1	13·2	13·1	13·2	13·1	13·1	13·0	13·0	12·9	13·0	12·9	13·1
13·1	12·9	12·9	12·9	12·9	12·7	12·7	12·6	12·5	12·5	12·6	12·5	12·5	12·7
13·6	13·1	12·9	12·9	12·8	12·8	12·7	12·6	12·5	12·6	12·6	12·5	12·5	13·2
12·2	11·8	11·5	11·4	11·4	11·3	11·2	11·1	11·1	11·2	11·1	11·1	11·1	11·7
11·0	10·8	10·8	10·7	10·7	10·6	10·5	10·5	10·5	10·5	10·6	10·6	10·6	11·1
10·1	10·0	10·1	10·0	10·0	9·9	9·9	9·9	10·0	10·0	10·1	10·1	10·1	10·3
12·3	12·0	11·9	11·9	11·8	11·7	11·7	11·6	11·6	11·6	11·7	11·6	11·6	12·0
Summer.													
'	'	'	'	'	'	'	'	'	'	'	'	'	'
13·1	12·8	12·5	12·4	12·4	12·6	12·5	12·4	12·3	12·4	12·4	12·4	12·4	13·0
12·7	12·7	12·7	12·8	12·8	12·6	12·1	11·9	12·0	12·0	12·1	12·0	12·0	12·9
12·5	11·8	11·5	11·4	11·5	11·4	11·2	11·3	11·3	11·4	11·6	11·6	11·6	12·7
11·7	11·3	11·2	11·1	11·0	11·2	11·1	10·9	10·9	10·9	10·9	11·0	10·9	11·5
10·2	9·8	10·0	10·0	10·2	10·4	10·3	10·0	10·1	10·0	10·0	10·0	9·9	10·2
11·5	11·3	11·4	11·5	11·6	11·6	11·4	11·1	11·2	11·3	11·4	11·2	11·2	11·0
12·0	11·6	11·6	11·5	11·6	11·6	11·4	11·3	11·3	11·3	11·4	11·4	11·3	11·9

Inclination as derived from Table VII.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
Summer Means.												
'	'	'	'	'	'	'	'	'	'	'	'	'
+0·2	-0·1	-0·2	-0·2	-0·2	-0·1	-0·3	-0·5	-0·4	-0·4	-0·3	-0·4	-0·4
Winter Means.												
'	'	'	'	'	'	'	'	'	'	'	'	'
+0·4	+0·2	+0·1	0 0	0·0	-0·1	-0·1	-0·1	-0·2	-0·2	-0·2	-0·2	-0·2
Annual Means.												
'	'	'	'	'	'	'	'	'	'	'	'	'
+0·3	0·0	-0·1	-0·1	-0·1	-0·1	-0·2	-0·3	-0·3	-0·3	-0·3	-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 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.	1898	0° 30'·3 E.	70° 39'·7 N.	·16522	·47077
Katharinenburg	56 49 N.	60 38 E.	1898	9 55·6 E.	70 40·2 N.	·17802	·50752
Kasan .....	55 47 N.	49 8 E.	1894	7 39·7 E.	68 37·5 N.	·18572	·47451
			1895	7 43·8 E.	68 35·5 N.	·18580	·47390
			1896	7 47·1 E.	68 33·7 N.	·18605	·47381
			1897	7 54·8 E.	68 34·8 N.	·18616	·47454
Copenhagen ...	55 41 N.	12 34 E.	1899	10 15·8 W.	68 40 N.	·17490	·4478
Stonyhurst ....	53 51 N.	2 28 W.	1899	18 17·7 W.	68 51·8 N.	·17273	·44677
			1900	18 10·9 W.	68 50·3 N.	·17312	·44720
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.	1899	12 31·9 W.	67 45·0 N.	·18072	·44173
Potsdam .....	52 23 N.	13 4 E.	1899	10 0·7 W.	66 33·3 N.	·18818	·43392
Irkutsk.....	52 16 N.	104 16 E.	1898	2 2·6 E.	70 13·2 N.	·20137	·55991
de Bilt(Utrecht)	52 5 N.	5 11 E.	1898	13 59·1 W.	—	·18487	—
Kew.....	51 28 N.	0 19 W.	1900	16 52·7 W.	67 11·8 N.	·18428	·43831
Greenwich.....	51 28 N.	0 0	1899	16 34·2 W.	67 10·2 N.	·18419	·43754
			1900	16 29·0 W.	67 8·5 N.	·18450	·43764
			1899	14 18·3 W.	66 13·2 N.	·18938	·42978
			1900	14 13·6 W.	66 9·8 N.	·18952	·42896
Uccle (Brussels)	50 48 N.	4 21 E.	1899	18 32·7 W.	66 48·7 N.	·18663	·43569
Falmouth .....	50 9 N.	5 5 W.	1899	9 11·9 W.	—	·19926	—
Prague .....	50 5 N.	14 25 E.	1899	—	—	—	—
St. Helier (Jersey).....	49 12 N.	2 5 W.	1900	16 59·7 W.	65 45·5 N.	—	—
Parc St. Maur (Paris).....	48 49 N.	2 29 E.	1897	14 58·6 W.	64 59 6 N.	·19717	·42270
Vienna.....	48 15 N.	16 21 E.	1898	8 24·1 W.	—	·20797	—
O'Gyalla(Pesth)	47 53 N.	18 12 E.	1900	7 28·8 W.	—	·21153	—
Odessa.....	46 26 N.	30 46 E.	1898	4 41·5 W.	62 30·5 N.	·22033	·42341
Pola*.....	44 52 N.	15 51 E.	1899	9 25·7 W.	—	·22135	·38900
Nice .....	43 43 N.	7 16 E.	1899	12 4·0 W.	60 11·7 N.	·22390	·39087
Toronto.....	43 40 N.	79 30 W.	1897	4 53·0 W.	—	·16650	—
Perpignan.....	42 42 N.	2 53 E.	1897	13 51·3 W.	60 3·5 N.	·22440	·38959
Tiflis .....	41 43 N.	44 48 E.	1897	1 59·0 E.	55 48·3 N.	·25664	·37770
Capodimonte } (Naples) .. }	40 52 N.	14 15 E.	1898	9 22·6 W.	—	—	—
			1899	9 15·8 W.	—	—	—
			1900	9 10·2 W.	—	—	—
Madrid .....	40 25 N.	3 40 W.	1897	15 56·9 W.	—	—	—
Coimbra.....	40 12 N.	8 25 W.	1899	17 24·2 W.	59 28·9 N.	·22724	·38549
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.	1900	17 18·0 W.	57 54·8 N.	·23516	·37484
Tokio.....	35 41 N.	139 45 E.	1897	4 29·9 W.	49 2·8 N.	·29816	·34356

\* The vertical force is mean from months June to December only.

APPENDIX IA—continued.

Place.	Latitude.	Longitude.	Year.	Declination.	Inclination.	Horizontal Force. C.G.S. Units.	Vertical Force. C.G.S. Units.
Zi-ka-wei . . . . .	31 12 N.	121 26 E.	{ 1897	2 18' 5 W.	45 53' 0 N.	·32799	·33827
			{ 1898	2 19' 0 W.	45 48' 7 N.	·32778	·33720
Havana . . . . .	23 8 N.	82 25 W.	1898	3 10' 8 E.	52 30' 7 N.	·31166	40634
Hong Kong. . . . .	22 18 N.	114 10 E.	1899	0 21' 1 E.	31 29' 4 N.	·36676	·22465
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.	1897	0 31' 3 E.	20 59' 1 N.	·37463	·14369
Manila . . . . .	14 35 N.	120 58 E.	1898	0 51' 4 E.	16 28' 7 N.	·37952	·11228
Batavia . . . . .	6 11 S.	106 49 E.	1898	1 14' 9 E.	29 47' 4 S.	·36752	·21040
Dar-es-salem* . . . . .	6 49 S.	39 18 E.	{ 1896	8 41' 6 W.	36 50' 8 S.	·29004	·21735
			{ 1897	8 29' 9 W.	36 53' 3 S.	·29009	·21771
			{ 1898	8 18' 1 W.	36 56' 8 S.	·28966	·21785
Mauritius . . . . .	20 6 S.	57 33 E.	1898	9 39' 2 W.	54 22' 4 S.	·23873	·33314
Rio de Janeiro†	22 55 S.	43 11 W.	1899	7 45' 9 W.	13 16' 0 S.	·2505	·0590
Melbourne. . . . .	37 50 S.	144 58 E.	1898	8 20' 1 E.	67 22' 4 S.	·23364	·56050

\* Data for 1896 and 1897 are from absolute observations only. For 1898 use was made of the available magnetograph records.

† Data from first three and last three months of year only.

APPENDIX II.—Table I.  
 Mean Monthly Results of Temperature and Pressure. Kew Observatory.  
 1900.

Months.	Thermometer.			Absolute Extremes.			Barometer.*				Mean vapour-tension.							
	Mean.	Means of—		Max.	Date.	Min.	Date.	Absolute Extremes.										
		Max.	Min.					Max.	Date.	Min.		Date.						
1900.																		
Jan....	40.4	44.9	35.4	40.2	53.0	d. h.	24 2 P.M.	27.9	d. h.	14 8 A.M.	ins.	29.934	d. h.	3 2 P.M.	ins.	29.231	in.	.216
Feb....	38.4	43.2	33.4	38.3	56.7		26 3 "	19.0		9 8 "	30.124	29.573		19 11 "	28.526		.199	
March..	39.4	45.1	34.6	39.9	56.0		12 3 "	24.9		18 6 "	30.672	30.013		19 6 A.M.	29.215		.182	
April...	47.6	55.7	39.2	47.5	73.4		21 4 & 5 P.M.	27.9		2 5 "	30.586	29.991		4 2 "	29.244		.239	
May ...	52.0	59.6	44.2	51.9	69.3		6 5 P.M.	37.2		16 4 "	30.356	29.980		3 NOON	29.469		.279	
June ...	59.8	68.3	52.1	60.2	86.5		11 3 & 4 P.M.	46.1		5 3 "	30.258	29.937		25 11 A.M.	29.451		.366	
July ...	66.9	76.9	57.5	67.2	89.4		16 2 "	45.2		8 4 "	30.283	30.008		2 4 P.M.	29.616		434	
Aug....	61.0	69.0	53.8	61.4	81.3		18 4 "	46.3		31 5 "	30.417	29.961		6 6 "	29.240		.394	
Sept....	57.7	67.5	49.2	58.3	79.4		16 2 "	41.9		4 6 "	30.553	30.136		27 11 "	29.594		365	
Oct....	50.7	57.2	43.9	50.6	70.1		8 3 "	36.6		16 7 "	30.597	29.984		26 3 "	29.281		.307	
Nov....	46.4	50.7	41.7	46.2	59.9		1 NOON & 1 "	27.3		11 8 "	30.381	29.747		29 5 A.M.	29.119		.278	
Dec....	45.8	49.8	40.7	45.3	56.1		5 9 "	31.0		24 5 "	30.548	29.930		31 2 "	28.919		.269	
Yearly Means	50.5	57.3	43.8	50.6	..		....	..		....	..	29.933		..	..		.294	

\* Reduced to 32° at M.S.L.

This table has been compiled at the Meteorological Office from values intended for publication in the volume of "Hourly Means" for 1900.

Meteorological Observations.—Table II.  
Kew Observatory.

Months.	Mean amount of cloud (0=clear, 10=over-cast).	Rainfall.*		Weather. Number of days on which were registered						Wind.† Number of days on which it was									
		Total.	Maxi-mum.	Rain.	Snow.	Hail.	Thun-der-storms.	Clear sky.	Over-cast sky.	☁	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Cal <sup>m</sup>
1900.		ins.	ins.																
January.....	7.6	2.920	0.550	19	2	1	0	2	20	0	5	1	1	5	5	8	5	3	3
February.....	7.6	3.175	0.550	18	4	0	0	2	17	4	6	3	2	4	5	2	1	5	5
March.....	7.5	0.935	0.375	8	2	0	0	2	19	0	10	3	2	1	1	3	9	3	5
April.....	6.1	0.925	0.320	14	0	1	0	5	11	2	3	3	1	2	6	3	9	3	5
May.....	6.8	1.065	0.235	11	0	0	0	1	14	1	6	2	1	3	8	2	3	1	1
June.....	7.0	2.020	0.350	12	0	0	2	3	15	0	5	1	1	3	10	7	2	2	2
July.....	5.2	1.360	0.510	7	0	0	3	7	7	0	2	1	2	3	11	5	6	5	5
August.....	6.0	2.915	0.440	15	0	2	2	6	7	0	4	5	2	7	6	4	3	5	5
September....	5.3	0.670	0.310	7	0	0	0	6	7	0	4	2	3	2	6	9	4	9	9
October.....	6.5	1.060	0.475	16	0	0	0	1	10	0	5	2	1	2	13	7	4	5	5
November....	7.8	1.680	0.280	17	0	0	0	2	21	0	6	2	2	4	9	3	1	2	2
December....	7.9	2.540	0.580	18	0	0	0	0	19	3	2	1	1	9	14	4	..	3	3
Totals and means.	6.8	21.865	..	162	8	4	7	37	169	11	58	24	12	44	94	63	37	47	47

\* 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 35 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 <i>in vacuo</i> .)		Minimum temperature on the ground.			Horizontal movement of the air.*				
	Total number of hours recorded.	Mean percentage of possible sunshine.	Greatest daily record.	Date.	Mean.	Highest.	Date. †	Mean.	Lowest.	Date. †	Average hourly velocity.	Greatest hourly velocity.	Date.
	h. m.		h. m.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	miles.	miles.	
1900.													
January	46 12	18	5 36	66	29	86	17	29	14	13	11.4	34	28
February	54 18	20	8 24	72	21	99	18	28	6	8	12.6	41	13
March	81 24	22	9 18	84	20	107	20	27	10	18	10.4	30	23
April	173 0	42	12 12	106	18	125	22	29	14	2	10.5	37	13
May	175 0	36	12 42	113	2	130	{ 5	36	22	16	11.1	35	3
June	181 36	37	15 6	124	10	139	11	46	36	27	11.0	26	{ 4
July	291 6	59	15 0	134	11	153	16	49	33	8	8.5	31	{ 10
August	186 0	41	13 36	118	13	136	19	48	38	5	10.3	35	3
September	178 6	47	10 54	118	11	128	{ 9	39	31	6	7.3	28	27
October	134 18	40	9 54	99	8	121	2	37	25	{ 16	10.0	32	6
November	46 36	18	7 24	75	10	101	1	35	19	11	10.5	32	15
December	36 48	15	6 0	65	21	83	{ 4	35	21	22	13.5	45	28
Totals and Means	1584 24	33	..	98	..	..	..	..	36	..	10.6	..	..

\* 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.

## APPENDIX III.—Table I.

Register of principal Seismograph Disturbances. 1900.

No. in Kew register.	Date.	Commence- ment of P.T.'s.*	Duration of P.T.'s.*	First maximum.	Second maximum.	Maximum amplitude.		Total duration of disturb- ance.
						mm.	Secs. of arc.	
		h. m.	m.	h. m.	h. m.			h. m.
200	Jan. 5	19 21·6	40·2	20 7·9	20 11·5	1·0	0·85	1 42
207	" 17	6 37·0	8·2	6 48·8	6 50·6	0·6	0·50	0 31
209	" 20	6 46·2	10·3	7 24·6	7 29·5	15·0	12·60	3 12
226	May 11	17 35·3	9·9	18 20·6	—	0·6	0·53	1 36
230	" 16	20 23·7	10·6	21 1·8	21 3·8	1·2	0·92	1 58
237	June 21	20 47·3	26·3	21 40·9	21 45·4	2·5	1·73	3 48
244	July 29	7 18·5	13·5	8 37·2	8 39·3	0·9	0·63	3 13
247	Aug. 28	11 8·0	5·2	11 13·8	11 20·2	1·3	0·92	0 44
253	Oct. 7	21 31·2	29·4	22 10·0	22 12·0	1·4	1·05	2 25
254	" 9	12 34·7	13·5	13 8·4	13 18·6	8·0	6·00	4 0
256	" 29	9 21·5	8·7	9 43·2	9 44·1	12·6	9·45	6 30
257	Nov. 5	8 13·2	19·2	8 40·0	—	0·9	0·68	1 13
258	" 9	16 30·2	23·0	16 55·0	17 0·8	1·2	0·90	1 8
259	" 9	18 38·5	9·0	18 53·1	—	0·7	0·52	0 52
262	" 24	8 8·7	9·6	8 47·8	—	2·5	1·87	2 0
265	Dec. 18	23 37·0	21·8	24 7·7	—	1·5	0·87	1 8
266	" 25	5 16·4	9·8	5 27·4	{ 5 55·1 } { 6 6·7 }	3·5	2·03	3 7

\* P.T.'s = preliminary tremors. The times recorded are G.M.T.; midnight = 0 or 24 hours.

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

APPENDIX IV.—Table I.

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

Watch deposited by	Number of watch.	Escapement, balance spring, &c.	Mean daily rate.				Dial up.	Dial down.	Mean variation of daily rate. $\pm$	Mean change of rate for 10 F.	Difference between extreme gaining and losing rates.	Marks awarded for			Total Marks.
			Pendant up.	Pendant left.	Pendant right.	Daily variation of rate.						Change of rate with change of position.	Temperature compensation.		
Fridlander, Coventry	25582	S.F., g. b., s. o., "Karrusel"	+3.8	+3.5	+3.4	+4.6	+3.4	0.2	0.06	3.5	35.8	38.4	15.9	90.1	
"	25594	S.F., g. b., s. o., "Karrusel"	+1.8	+1.4	+2.3	+1.8	+3.0	0.4	0.01	3.5	32.0	38.0	19.3	89.3	
Baumé & Co., London	103081	G. b., s. o., "Tourbillon" chronometer	-1.6	-1.8	-1.0	+0.4	-1.4	0.3	0.03	4.5	33.4	37.5	17.8	88.7	
H. Goley, London	155	S.F., g. b., s. o., "Karrusel"	-2.8	-1.5	-2.2	+2.0	-1.2	0.4	0.03	3.5	32.1	38.1	18.0	88.2	
W. Matthews, Coventry	97835	S.F., g. b., s. o., "Karrusel"	+1.3	+1.3	+1.5	+0.6	+2.9	0.3	0.07	6.0	34.8	37.7	15.1	87.6	
H. Goley, London	156	S.F., g. b., s. o., "Karrusel"	-1.5	-1.0	-2.1	+0.5	-1.0	0.4	0.04	4.5	31.7	38.1	17.5	87.3	
S. Yeomans, Coventry	76686	S.F., g. b., s. o., "Karrusel"	+0.0	+0.1	+0.5	+0.7	+0.5	0.3	0.09	5.5	33.7	39.0	14.3	87.0	
Fridlander, Coventry	25564	S.F., g. b., s. o., "Karrusel"	-0.4	-1.3	+0.5	+0.3	+2.8	0.3	0.07	5.0	33.8	37.9	15.2	86.9	
J. White & Son, Coventry	26643	S.F., g. b., s. o., "Karrusel"	+3.8	+2.5	+1.5	+2.5	+2.0	0.3	0.05	4.2	32.1	37.3	16.4	86.8	
Fridlander, Coventry	25391	S.F., g. b., s. o., "Karrusel"	+0.5	+0.8	+0.6	-2.0	+2.0	0.3	0.06	4.0	33.1	36.2	16.3	86.6	
Chas. Frodsham & Co., London	08753	D.R., fusee, s. o., "Tourbillon" lever	+3.2	+3.0	+2.8	+0.5	+1.8	0.3	0.05	5.2	33.3	30.4	16.4	86.1	
Fridlander, Coventry	25584	S.F., g. b., s. o., "Karrusel"	-0.2	+0.5	+0.2	+0.1	+1.6	0.4	0.07	4.5	32.3	38.1	15.6	86.0	
Elwhardt, Ltd., Birmingham	272902	S.F., g. b., s. o., "Karrusel"	+0.5	+1.8	+1.2	+1.4	+3.6	0.5	0.03	4.7	30.9	36.8	18.1	85.8	
W. Matthews, Coventry	37459	S.F., g. b., s. o., "Karrusel"	-0.1	-0.1	+2.1	+2.1	+2.2	0.4	0.03	4.3	31.5	35.8	18.3	85.6	
G. E. Sims, London	04823	S.F., g. b., s. o., "Karrusel"	+0.3	-0.1	+0.4	+1.3	+2.1	0.3	0.06	5.2	33.1	36.5	15.9	85.5	
S. Yeomans, Coventry	76648	S.F., g. b., s. o., "Karrusel"	-1.7	-1.3	-1.1	-0.7	+0.3	0.4	0.07	5.2	32.7	37.8	15.0	85.5	
H. Goley, London	150	S.F., g. b., s. o., "Karrusel"	-0.4	+0.4	+1.6	+0.2	-0.9	0.3	0.06	5.5	31.5	37.7	16.3	85.5	
S. Yeomans, Coventry	76680	S.F., g. b., s. o., "Karrusel"	-0.6	-0.3	+0.1	+3.4	-0.9	0.3	0.05	5.5	33.6	35.0	16.8	85.4	
Fridlander, Coventry	25595	S.F., g. b., s. o., "Karrusel"	-4.4	-3.9	-3.9	+0.8	+1.4	0.4	0.05	6.5	32.6	36.0	16.8	85.4	
Matthews, Coventry	97761	S.F., g. b., s. o., "Karrusel"	-0.5	-0.6	+0.2	+0.8	+1.4	0.4	0.05	3.7	32.2	36.9	16.3	85.4	
H. Goley, London	167	S.F., g. b., s. o., "Karrusel"	-1.5	-1.1	-1.7	+0.3	-0.6	0.4	0.05	3.8	31.3	37.4	16.7	85.4	
Fridlander, Coventry	25602	S.F., g. b., s. o., "Karrusel"	+0.6	+1.1	+2.3	-0.1	+3.1	0.4	0.03	6.2	32.0	33.1	18.2	85.3	
Chas. Frodsham, London	0647	D.R., fusee, s. o., "Tourbillon" lever	+2.5	+2.7	+2.3	+4.5	+3.1	0.4	0.06	3.7	31.7	37.5	16.0	84.8	
Wright & Craighhead, London	3208	S.F., g. b., s. o., "Karrusel"	+4.8	+4.5	+4.4	+5.9	+4.6	0.4	0.08	4.7	31.7	38.3	14.6	84.6	
J. White & Son, Coventry	36395	D.R., g. b., s. o., "Karrusel"	+4.8	+5.2	+4.8	+3.7	+3.7	0.4	0.06	6.7	31.2	37.6	15.7	84.5	
Montandon-Robert, Geneva	1096	D.R., g. b., s. o., minute repeater	-2.1	-4.6	-1.5	-0.6	-2.0	0.4	0.07	5.5	33.2	36.1	15.1	84.4	

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 P.	Difference between extreme gaining and losing rates.	Marks awarded for			Total Marks.	
			Pendant up.		Pendant left.		Dial up.					Dial down.		Daily variation of rate with change of position.		Temperature compensation.
			secs.	secs.	secs.	secs.	secs.	secs.				secs.	secs.			
Fridlander, Coventry	25592	S.R., g.b., s.o., "Karrusel"	-0.2	-0.1	+0.7	+1.7	-0.2	0.3	0.11	0.0	34.3	37.3	12.8	84.3		
Ehrhardt, Ltd., Birmingham	264560	S.R., g.b., s.o.	+1.2	+0.8	+4.5	+0.2	+3.4	0.4	0.06	7.1	31.5	36.6	10.2	84.3		
Montandon-Robert, Geneva	1111	D.R., g.b., s.o., "Karrusel"	-2.6	-1.4	-4.7	-2.3	-3.8	0.5	0.03	4.7	30.8	30.3	17.0	84.3		
Smith & Son, London	191-277	S.R., g.b., s.o., "Karrusel"	-0.9	+0.5	+0.7	+2.3	+0.6	0.5	0.05	4.5	30.4	37.2	16.5	84.1		
S. Yeomans, Coventry	76684	S.R., g.b., s.o., "Karrusel"	+0.2	+0.7	+0.7	+3.0	+0.9	0.4	0.09	5.7	32.9	37.0	14.1	84.0		
T. J. Jackson, Coventry	83882	S.R., g.b., s.o.	+5.1	+4.1	+1.6	+5.4	+7.2	0.4	0.02	7.2	31.2	34.1	18.6	83.9		
Strauffer & Co., London	181318	D.R., g.b., s.o., chronograph	-0.8	-4.3	-3.2	-0.2	-2.3	0.5	0.03	5.7	31.0	34.6	18.3	83.9		
Fridlander, Coventry	25987	S.R., g.b., s.o., "Karrusel"	+2.3	+1.8	+1.8	+1.8	+0.9	0.4	0.06	7.5	32.3	35.3	16.1	83.7		
W. Matthews, Coventry	97261	S.R., g.b., s.o., "Karrusel"	+1.9	+3.7	+4.3	+2.1	+2.9	0.5	0.03	6.5	29.1	36.5	17.9	83.5		
Smith & Son, London	172-351	S.R., g.b., s.o.	+5.0	+3.2	+4.1	+1.5	+0.1	0.4	0.03	8.5	31.9	33.6	17.9	83.4		
Fridlander, Coventry	52764	D.R., g.b., s.o.	-1.0	-0.1	-1.6	-0.4	-2.8	0.4	0.08	5.2	32.1	36.6	14.5	83.2		
J. White & Son, Coventry	35103	S.R., g.b., s.o.	+1.4	+3.6	+1.4	+3.5	+6.0	0.4	0.03	5.8	31.2	34.2	17.8	83.2		
Mathews, Coventry	97766	S.R., g.b., s.o., "Karrusel"	+2.0	+4.4	+5.0	+2.4	+3.1	0.4	0.08	7.5	32.6	33.8	14.7	83.1		
Usher & Cole, London	29854	S.R., g.b., s.o., "Karrusel"	+0.6	+0.3	+0.7	+1.4	+2.1	0.4	0.10	5.7	32.1	37.7	13.3	83.1		
J. White & Son, Coventry	36906	D.R., g.b., s.o.	+1.5	+0.1	+2.0	-1.4	+3.2	0.5	0.03	7.7	30.9	34.5	17.7	83.1		
S. Yeomans, Coventry	76664	S.R., g.b., s.o., "Karrusel"	+1.3	+1.7	+1.5	+0.4	+2.2	0.5	0.09	7.0	30.5	38.1	14.4	83.0		
Baume & Co., London	12386	S.R., g.b., s.o., "Karrusel"	-2.1	-2.2	-2.2	-0.4	+1.1	0.5	0.05	5.7	30.9	35.0	17.0	82.9		
J. White & Son, Coventry	34929	D.R., g.b., s.o.	+1.3	+5.5	+2.7	+1.3	+3.6	0.5	0.04	7.2	30.7	34.6	17.6	82.9		
R. Milne, Sate	1263	S.R., g.b., s.o., "Karrusel"	-0.5	-0.4	+0.2	-1.0	-2.4	0.5	0.07	5.5	30.2	37.1	15.4	82.7		
Williamson, Ltd., London	56019	S.R., g.b., s.o., "Karrusel"	+2.6	+1.9	+2.6	+2.7	+4.6	0.5	0.06	6.8	29.5	37.2	16.0	82.7		
H. Goley, London	157	S.R., g.b., s.o., "Karrusel"	-0.0	+0.3	-0.1	+2.8	+3.0	0.4	0.06	4.5	31.9	34.5	16.1	82.5		
Ehrhardt, Ltd., Birmingham	272886	S.R., g.b., s.o., "Karrusel"	-3.5	-2.6	-2.7	-0.1	-1.8	0.4	0.07	5.0	31.1	36.1	15.3	82.5		
R. Gardner, London	272897	S.R., g.b., s.o.	+2.5	+1.8	+1.3	+1.1	-2.0	0.5	0.01	7.7	30.2	33.2	19.1	82.5		
	52009	S.R., g.b., s.o., "Karrusel"	+5.4	+2.0	+2.5	+1.3	+1.2	0.6	0.02	7.0	28.2	35.3	18.7	82.2		
			-0.2	-1.1	-1.2	+0.9	-1.4	0.6	0.03	4.5	27.2	37.0	18.0	82.2		

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—continued.

Description of watch.	Number.	Deposited by	Marks awarded for			Total marks.
			Varia- tion.	Position.	Tempera- ture.	
			0-40	0-40	0-20	
"Non-magnetic" .....	190-364	S. Smith and Son, London....	29·8	36·6	14·1	80·5
" .....	25581	" .....	31·8	34·8	13·9	80·5
" .....	191-231	" .....	26·0	35·3	16·3	77·6
" .....	191-228	" .....	30·5	32·7	12·8	76·0
" .....	191-373	" .....				
" .....	25590	" .....				