

**British Association for the Advancement
of Science.—Seismological Committee.**

Observations and formal business to
J. H. BURGESS,
Earthquake Observatory,
SHIDE, Isle of Wight.

Special inquiries to
Prof. H. H. TURNER,
University Observatory,
OXFORD.

Monthly Bulletin for January, 1914.

For the large Earthquakes an attempt is here made to compare the readings with theoretical values, as explained in the Nineteenth Report of the Committee to the British Association. The position of the epicentre is adopted from the Pulkovo determination, unless otherwise stated; and the tables of times for P and S are those given by Galitzin in his "Vorlesungen über Seismometrie," p. 137, or by G. W. Walker on p. 54 of his "Modern Seismology." It is shown in the above Report that these tables are sensibly erroneous; but the precise values of the corrections are under discussion and it seems better to await the definitive corrections than to introduce provisional tables. The tables are reproduced in an expanded form on page 10 of this Bulletin. The time of the earthquake at the epicentre is deduced from the Pulkovo records; and applying the tabular times for the distances in the third column (measured in degrees from a large globe specially made for the purpose), the errors O - C of the observed times are found.

Observers are requested to send a copy of their Registers to Shide *each month*, in order that this collated information may be published as early as possible.

In the Earthquake Chart the stations are arranged in the order of longitude, starting from the Azores and travelling eastward. For the large earthquakes they are arranged in the order of distance from epicentre, as shown in the 3rd column. The azimuth in the 4th column is also read from the globe.

The letters in the 2nd column stand for: A. = Alfani; Aga. = Agamennone; B. = Bosch; Bif. = Biflar; B.O. = Bosch-Omori; C. = Cartuja; Ca. = Cancani; C.O. = Cartuja-Omori; G. = Galitzin; M. = Milne; Ma. = Mainka; M.S. = Milne-Shaw; O.A. = Omori-Alfani; S. = Stiattesi; V. = Vincentini; W. = Wiechert.

Guildford and West Bromwich use a modification of the Milne. Hamburg uses machines by Wiechert and von Rebeur-Paschwitz-Hecker. Heidelberg's machine is an astatic pendulum made at the Observatory. Riverview has two Wiecherts and one Mainka.

1914. January 12.

Origin : 31N. 132E., determined by Shide.

Time at Origin : P=9h. 27m. 58s. S=9h. 27m. 59s.

Station and Component.	Machine.	Distance From Origin.	Azimuth.	P.		O-C.		PR ₁		S.		O-C.		L.		M.		Remarks.
				H.	M.	S.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.		
Osaka	W.	48	36 S.W.	9 29 28	+16	9 40 36	9 40 36	9 40 36	9 30 38	9 33 59	9 30 38	9 33 59	9 30 38	9 33 59	9 30 38	9 33 59		
Zi-ta-wai	S.	9.1	86 S.E.	9 30 4	-11	9 30 6	9 30 6	9 30 6	9 31 36	9 34 8	9 31 36	9 34 8	9 31 36	9 34 8	9 31 36	9 34 8		
Manila	W.	19.3	30 S.E.	9 32 33	+3	9 33 54	9 33 54	9 33 54	9 40 0	9 49 19	9 40 0	9 49 19	9 40 0	9 49 19	9 40 0	9 49 19		
Irkutsk	G.	29.3	54.5 S.E.	9 33 54	-25	9 38 51	9 38 51	9 38 51	9 43 0	9 52 1	9 43 0	9 52 1	9 43 0	9 52 1	9 43 0	9 52 1		29.9S. 128.7E.
Calcutta	M.	39.7	68 S.E.	9 35 22	...	9 41 11	9 41 11	9 41 11	9 48 58	9 59 0	9 48 58	9 59 0	9 48 58	9 59 0	9 48 58	9 59 0		
Batavia	W.	44.3	31 S.E.	9 37 3	-5	9 40 36	9 40 36	9 40 36	9 53 0	9 59 33	9 53 0	9 59 33	9 53 0	9 59 33	9 53 0	9 59 33		
Cashent	G.	50.5	50 S.E.	...	...	9 46 32	9 46 32	9 46 32	9 56 54	10 0 12	9 56 54	10 0 12	9 56 54	10 0 12	9 56 54	10 0 12		
Bombay	M.	54.3	64 S.E.	...	...	9 48 12	9 48 12	9 48 12	10 0 1	10 6 43	10 0 1	10 6 43	10 0 1	10 6 43	10 0 1	10 6 43		
Kodakanal	M.	54.5	59 S.E.	...	...	9 48 14	9 48 14	9 48 14	10 1 0	10 12 17	10 1 0	10 12 17	10 1 0	10 12 17	10 1 0	10 12 17		
Honolulu	M.	54.5	65.2 N.W.	...	...	9 49 24	9 49 24	9 49 24	9 58 18	10 12 24	9 58 18	10 12 24	9 58 18	10 12 24	9 58 18	10 12 24		
Trifis	G.	68	67 S.E.	9 39 2	0	9 40 45	9 40 45	9 40 45	10 4 30	10 13 6	10 4 30	10 13 6	10 4 30	10 13 6	10 4 30	10 13 6		
Pulkovo	G.	68.5	65 S.E.	9 39 9	+4	9 40 12	9 40 12	9 40 12	10 3 48?	10 15 24	10 3 48?	10 15 24	10 3 48?	10 15 24	10 3 48?	10 15 24		
Konigsberg	W.	76.1	57 S.E.	9 30 24	-29	9 40 12	9 40 12	9 40 12	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Victoria	M.	76.1	59 S.W.	9 30 58	...	9 40 12	9 40 12	9 40 12	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Yerpenitz	M.	76.3	59 S.E.	9 30 58	...	9 40 12	9 40 12	9 40 12	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Yerpenitz	M.	77.9	59 S.E.	9 40 12	+11	9 40 12	9 40 12	9 40 12	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Beirut	M.	78.1	59 S.E.	9 40 12	+11	9 40 12	9 40 12	9 40 12	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Budapest	M.	81.1	58 S.E.	9 39 3	-80	9 40 27	9 40 27	9 40 27	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Vienna	W.	82.1	55 S.E.	9 40 27	3	9 41 0	9 41 0	9 41 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Helwan, Cairo	M.	83.2	60 S.E.	9 41 0	+25	9 40 34	9 40 34	9 40 34	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
"	M.	83.2	60 S.E.	9 41 0	+25	9 40 34	9 40 34	9 40 34	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Graz	W.	83.5	53 S.E.	9 40 34	1	9 40 34	9 40 34	9 40 34	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Zagreb	W.	84	50 S.E.	9 40 37	3	9 40 37	9 40 37	9 40 37	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Zabud	W.	84.5	53 S.E.	9 40 40	1	9 40 40	9 40 40	9 40 40	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Stambul	S.	85.5	42 S.E.	9 40 40	1	9 40 40	9 40 40	9 40 40	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Edinburgh	M.	85.1	42 S.E.	9 40 40	1	9 40 40	9 40 40	9 40 40	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		
Triest	W.	85.1	53 S.E.	9 40 40	...	9 40 40	9 40 40	9 40 40	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0	10 6 0	10 16 0		

Innsbruck	Ma.	85.2	49 N.E.	—	—	—	—	—	10 14 30	10 16 30	—
Heidelberg	—	85.3	48 N.E.	9 40 0	—47	—	—	9 51 0	—21	10 10 0	—
Aachen	W.	85.3	44 N.E.	9 40 41	—6	9 44 1	—	9 51 18	—3	10 9 0	—
Pola	W.	85.6	52 N.E.	9 40 16	—33	—	—	—	—	—	—
Padova	V.	86.3	50 N.E.	9 40 30	—22	—	—	9 51 16	—16	—	—
Stonyhurst	E.	M.	86.5	41 N.E.	—	—	—	9 51 12	—22	—	—
Bidston	E.	M.	87.1	41 N.E.	—	—	—	9 51 48	+7	—	—
West Bromwich	—	M.	87.4	41 N.E.	—	—	—	—	—	—	—
Guildford	—	M.	87.8	40 N.E.	9 40 0	—61	—	9 51 5	—43	10 13 20	—
Shide	E.	M.	88	49 N.E.	—	—	—	—	—	10 11 30	—
Paris	—	—	88.4	44 N.E.	9 41 0	—5	—	9 51 41	—14	10 15 0	—
Moncalieri	S.	—	88.7	48 N.E.	9 39 34	—90	—	9 52 32	+34	10 10 27	—
Cork	E.	M.	90.2	41 N.E.	—	—	—	—	—	—	—
Toronto	E.	M.	100	26 N.W.	—	—	—	—	—	10 14 18	—
Granada	—	C.	100.2	43 N.E.	9 42 20	—11	—	9 54 59	+63	10 15 30	—
San Fernando	E.	M.	102	43 N.E.	—	—	—	—	—	10 25 30?	—
" La Paz "	N.	M.	102	43 N.E.	—	—	—	—	—	10 26 0?	—
" La Paz "	—	—	156.5	47 N.W.	9 47 19	—	—	—	—	—	—

P and S lost in microsetsms.

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1914. January 20.

Origin : 52°9N. 159°6E., determined by Pulkovo.

Time at Origin : P=12h. 0m. 13s. S=12h. 0m. 14s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Osaka	O.	23.8	33.13 N.E.	12	5	39	0	—	—	—	—	—	—	—	12	9	55	12	14	15	—
Irkutsk	G.	32.8	66.16 N.E.	12	6	52	—15	—	—	—	12	12	2	—32	12	16	0	12	17	49	32°6N. 71°7E.
Zi-ka-wei	W.	35.1	40.27 N.E.	12	7	7	—20	—	—	—	12	12	15	—55	—	—	—	12	18	43	—
Honolulu	E.	M.	45.1	35 N.W.	—	—	—	—	—	—	12	15	12	—24	12	22	0	12	30	30	—
Manila	W.	48.9	29.59 N.E.	12	9	0	—12	—	—	—	—	—	—	—	12	18	0	12	19	57	—
Ekaterinburg	G.	52.1	49.2 N.E.	12	9	29	—4	—	—	—	12	16	48	—11	12	24	0	12	34	35	50°55N. 154°14W.
Tashkent	G.	58	45.5 N.E.	12	10	14	+2	—	—	—	12	18	25	+12	12	33	0	12	36	6	46°7N. 156°8E.
Pulkovo	G.	60.2	32.33 N.E.	12	10	30	+4	—	—	—	12	18	43	+3	12	28	30	12	40	6	—
Calcutta	M.	61.1	40.7 N.E.	12	11	9	+36	—	—	—	12	26	24	+453	12	37	4	12	41	8	—
Konigsberg	E.	W.	67.1	25.24 N.E.	12	11	14	+2	—	—	12	20	1	—4	12	28	12	12	38	48	—
Baku	G.	68.8	37.32 N.E.	12	11	14	—8	—	—	—	12	20	4	—22	—	—	—	12	41	27	—
Tiflis	G.	70	35.37 N.E.	12	11	34	+4	—	—	—	12	20	36	—4	12	34	0	12	43	28	46°7N. 172°6E.
Edinburgh	E.	M.	70.3	10.55 N.E.	—	—	—	12	16	48?	—	—	—	—	—	—	—	12	47	36	—
Eskdalemuir	G.	70.9	10.53 N.E.	12	11	41	+6	—	—	—	12	20	58	+7	12	35	0	—	—	—	51N. 14°9E.
Lemberg	B.O.	71.1	26.30 N.E.	12	11	31	—6	—	—	—	12	19	47	—66	12	33	15	12	40	39	—
Czernowitz	Ma.	71.4	26.58 N.E.	12	11	43	+4	—	—	—	12	20	54	—3	12	33	0	12	47	0	—
Breslau	W.	71.4	22.45 N.E.	12	11	44	+5	—	—	—	12	20	59	+2	—	—	—	12	47	0	—
Stonyhurst	E.	M.	72.3	11.14 N.E.	—	—	—	—	—	—	—	—	—	—	—	—	—	12	51	48	—
Bidston	E.	M.	72.7	10.50 N.E.	—	—	—	—	—	—	12	22	0	+48	12	33	42?	12	48	6	—
Batavia	W.	72.9	30.2 N.E.	12	11	48	0	—	—	—	12	22	12	+57	12	33	0	12	50	0	—
Bombay	E.	M.	73.1	39.1 N.E.	12	7	12	—278	—	—	—	—	—	—	—	—	—	12	49	30	—
West Bromwich	—	M.	73.5	11.27 N.E.	12	12	0	+8	—	—	12	22	0	+38	—	—	—	12	53	0	—
Aachen	W.	73.9	16.16 N.E.	12	12	0	+6	12	17	55	12	21	39	+5	12	41	0	12	44	48	—
Budapest	W.	74.1	23.30 N.E.	12	11	50	—6	—	—	—	12	21	21	—8	12	40	30	12	46	30	—
Vienna	W.	74.2	22.3 N.E.	12	11	59	+3	—	—	—	12	21	31	+1	12	35	0	12	49	0	—
Guildford	E.	M.	74.5	12.15 N.E.	12	10	0	—18	—	—	12	20	42	—52	12	42	0	12	52	0	—
Heidelberg	—	—	74.9	17.33 N.E.	12	12	12	+11	—	—	12	21	43	+4	12	38	0	12	42	48	—
Shide	E.	M.	75.2	11.47 N.E.	12	12	0	—3	—	—	12	21	36	—6	12	43	30	12	54	30	—
" "	N.	—	75.2	11.47 N.E.	12	12	0	—3	—	—	12	21	30	—12	12	45	0	12	54	18	—
Graz	W.	75.4	21.27 N.E.	12	12	7	+3	—	—	—	12	21	47	+3	12	36	0	12	40	47	67°5N. 164°5W.

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Paris		76	14	N.E.	12 12 12	+ 4			12 21 59	+ 8	12 38 0	12 52 53	
Innsbruck		76.2	19.6	N.E.	12 12 11	+ 2			12 21 56	+ 3	12 32 30	12 44 0	
Zagreb		76.6	21.26	N.E.	12 12 11	- 1			12 21 54	+ 4	12 44 0	12 46 3	
Laibach		76.6	20.47	N.E.	12 12 13	+ 1			12 21 50	- 8	12 31 0	12 42 15	
Kodaikanal	E.	M.	77.1	37.48	N.E.	—	—	—	12 23 18	+14	12 48 0	12 51 42	
Triest		W.	77.2	20.21	N.E.	12 12 14	—	—	12 22 2	- 3	12 29 0	12 44 30	
Padova		V.	77.9	19.15	N.E.	12 12 28	+ 9	—	12 23 14	+ 1	12 38 15	12 52 20	
Moncalieri		S.	79.2	16.49	N.E.	12 12 29	+ 2	—	12 22 28	0	12 39 41	12 53 33	
Ksara	E.	Ma.	80.4	30.32	N.E.	12 12 37	+ 3	12 18 57	—	—	—	12 52 53	
Beirut	E.	M.	80.5	30.26	N.E.	—	—	—	12 30 30	+467	—	12 56 30	
Helwan, Cairo	E.	M.	85.8	28.21	N.E.	12 13 18	+13	—	—	—	—	13 0 0	
"	N.	M.	85.8	28.21	N.E.	12 13 3	- 2	—	12 23 36	- 6	—	—	
Rio Tinto "	E.	M.	88.6	8.17	N.E.	—	—	12 19 0?	—	—	—	—	
Granada	E.	C.	88.7	10.6	N.E.	12 13 24	+ 3	—	12 24 12	- 2	12 42 0	12 53 0	
San Fernando	E.	M.	89.8	8.36	N.E.	—	—	—	12 24 0	-26	—	12 55 0	
"	N.	M.	89.8	8.36	N.E.	—	—	—	12 24 0	-26	—	13 6 0	
"	E.	M.	146.6	43.29	N.E.	12 18 30	+100	—	—	—	—	13 32 30	

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1914. January 30.

Origin : 34.1S. 66W., determined by Shide (double earthquake).

Time at Origin : P=3h. 35m. 50s. S=3h. 35m. 51s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P		O-C.	P ₁		S.		O-C.	L.		M.		Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	H.	M.		S.
Pilar	E.	M.	3	35.4 S.W.	3 37 24	+17	—	—	—	—	—	3 39 42	—	—	—	—
La Paz	(N.)	—	17.7	6 S.E.	3 40 24	+21	3 40 39	—	3 43 54	+ 8	—	3 46 7	—	—	—	S. of Santiago. Felt violently in Santiago, Valparaiso, Concepcion, Mendoza, with victims in Talca.
	(E.)	—	17.7	6 S.E.	3 40 26	+23	—	—	—	—	—	—	—	—	—	
Lima	E.	M.	24.2	22.9 S.E.	3 40 42	-38	—	—	—	—	—	—	—	3 45 42	—	
Ascension	E.	M.	54	53.3 S.W.	3 46 0	+37	—	—	3 54 30	+90	—	—	—	4 10 0	—	
Cape Town	E.	M.	67.7	63 S.W.	3 48 0	+68	—	—	—	—	4 11 0?	—	—	4 29 30	—	
St. Louis		W.	76.1	20.5 S.E.	3 47 46	0	3 50 6	—	3 57 19	-10	—	4 11 6	—	4 23 40	—	
Harvard Univ.	(N.)	B.O.	76.6	4.3 S.E.	3 47 58	+ 9	—	—	—	—	—	4 13 10	—	4 16 14	—	
	(E.)	B.O.	76.6	4.3 S.E.	3 48 4	-15	—	—	3 57 40	+ 5	—	4 9 36	—	4 26 1	—	
Toronto	E.	M.	78.8	11.3 S.E.	—	—	—	—	—	—	—	3 58 18	—	4 48 0	—	
Ottawa	(N.)	B.	80	8.1 S.E.	3 48 14	+ 5	—	—	3 58 15	+ 1	—	4 13 0	—	4 25 48	—	
	(E.)	B.	80	8.1 S.E.	—	—	—	—	3 58 12	- 2	—	4 11 0	—	—	—	
Azores	E.	M.	81	32.8 S.W.	—	—	—	—	—	—	—	—	—	4 33 48	—	
San Fernando	(N.)	M.	90.1	45.7 S.W.	3 49 30	+24	—	—	—	—	—	—	—	4 34 0	—	
	(E.)	M.	90.1	45.7 S.W.	3 49 0	- 6	—	—	—	—	—	—	—	4 35 0	—	
Granada	E.	C.	91.4	47.2 S.W.	3 49 31	+18	—	—	4 2 29	+130	—	4 9 0	—	4 26 10	—	
Rio Tinto	E.	M.	92.3	45.5 S.W.	3 48 0	78	—	—	—	—	—	—	—	4 38 0	—	
Cork	E.	M.	99.8	45.1 S.W.	3 48 0	-120	—	—	—	—	—	—	—	4 38 0	—	
Guildford	E.	M.	102.8	50.5 S.W.	3 50 24	+10	—	—	4 1 12	-61	—	4 20 0	—	4 37 42	—	
Honolulu	E.	M.	103.4	58.3 S.E.	3 50 18	+ 1	—	—	4 0 36	-103	—	4 13 54	—	4 36 0	—	
Mauritius	E.	M.	104	45.1 S.W.	—	—	—	—	4 2 30	+ 6	—	—	—	4 31 48	—	
Eskdalemuir	G.		104.2	49.8 S.W.	3 50 23	+ 2	—	—	—	—	—	—	—	4 37 0	—	
Adelaide	E.	M.	107.5	21 S.E.	3 52 12	+ 97	—	—	—	—	—	—	—	4 49 24	—	
Perth	E.	M.	113.9	4.5 S.E.	3 55 0	+235	—	—	—	—	—	—	—	4 59 30	—	
Beirut	E.	M.	116.7	65.3 S.W.	3 52 0	+42	—	—	—	—	—	—	—	4 48 0	—	
Balkovo	G.		122	76.1 S.W.	3 52 32	+51	—	—	4 9 56	+ 1	—	4 30 0	—	4 47 19	—	20S. 62W.
Tiflis	G.		126.3	73.8 S.W.	3 52 13	+12	—	—	3 57 31	-465	—	—	—	5 2 8	—	
Baku	G.		129.7	75.5 S.W.	3 55 4	+168	—	—	—	—	—	—	—	4 46 43	—	
Tashkent	G.		144.3	66.5 S.W.	3 57 55	+277	—	—	4 12 18	+299	—	4 48 0	—	4 59 48	—	27S. 67W.

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British Association for the Advancement
of Science.—Seismological Committee.

Observations and formal business to
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Special inquiries to
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OXFORD.

Monthly Bulletin for February, 1914.

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Observers are requested to send a copy of their Registers to Shide *each month*, in order that this collated information may be published as early as possible.

In the Earthquake Chart the stations are arranged in the order of longitude, starting from the Azores and travelling eastward. For the large earthquakes they are arranged in the order of distance from epicentre, as shown in the 3rd column. The azimuth in the 4th column is also read from the globe.

The letters in the 2nd column stand for: A. = Alfani; Aga. = Agamennone; B. = Bosch; Bif. = Biflar; B.O. = Bosch-Omori; C. = Cartuja; Ca. = Cancani; C.O. = Cartuja-Omori; G. = Galitzin; M. = Milne; Ma. = Mainka; M.S. = Milne-Shaw; O.A. = Omori-Alfani; S. = Stiattesi; V. = Vincentini; W. = Wiechert.

Guildford and West Bromwich use a modification of the Milne. Hamburg uses machines by Wiechert and von Rebeur-Paschwitz-Hecker. Heidelberg's machine is an astatic pendulum made at the Observatory. Riverview has two Wiecherts and one Mainka.

1914. February 6.

Origin : 30N. 64E., determined by Tashkent.

Time at Origin : P = 11h. 42m. 20s. S = 11h. 42m. 23s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.		O - C.		P _h .		S.		O - C.		L.		M.		Remarks.			
				H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.		S.		
Tashkent	G.	12.1	22.4 S.W.	11	45	20	0	—	—	11	47	44	0	11	48	5	11	49	52	—	
Bombay	M.	13.7	34 N.W.	11	45	36	-12	—	—	11	46	5	-32	11	54	0	11	54	28	—	
Baku	G.	15.5	52.1 S.E.	11	45	59	-1	11	46	27.1	11	50	48	-5	11	54	0	11	53	25	26.27N. 61.10E. 26.4N. 60.46E.
Thls	G.	17.4	59 S.E.	11	46	53	0	—	—	—	—	—	—	—	—	—	—	—	—	—	
Calcutta	M.	23	65.8 N.W.	11	42	9	-328	11	50	30	—	—	—	11	47	14	11	56	23	—	
Kodakannal	M.	23.4	30.6 N.W.	11	47	40	-9	—	—	—	—	—	—	11	53	36	11	58	42	—	
Ksara	E. M.	24.1	87.3 S.E.	11	47	40	-9	—	—	—	—	—	—	11	53	36	11	58	42	—	
Berut	E. M.	24.4	89.2 S.E.	11	48	4	-13	—	—	—	—	—	—	11	55	0	12	0	30	—	
Ekaterinburg	E. M.	26.9	6.5 S.E.	11	48	4	-13	11	51	30.7	11	52	50	-12	11	55	0	12	0	30	31.34N. 71.27E.
Colombo	M.	27.6	30.6 N.W.	11	49	0	+30	—	—	—	—	—	—	—	—	—	—	—	—	—	
Helwan, Cairo	E. M.	28.2	31.9 S.E.	11	49	8	+19	—	—	—	—	—	—	—	—	—	—	—	—	—	
Helwan, Cairo	E. M.	28.2	31.9 S.E.	11	49	8	+19	—	—	—	—	—	—	—	—	—	—	—	—	—	
Czernowitz	E. M.	34.2	71.9 S.E.	11	50	27	+48	—	—	—	—	—	—	11	57	54	12	9	0	—	
Iemberg	B.O.	33.7	72.5 S.E.	11	50	27	+48	—	—	—	—	—	—	11	58	27	12	5	25	32N. 67E.	
Irkutsk	G.	36.9	68.9 S.E.	11	49	24	-25	—	—	—	—	—	—	11	56	27	12	3	0	—	
Pulkovo	G.	37.4	52.3 S.E.	11	49	55	-18	—	—	—	—	—	—	12	2	0	12	5	25	—	
Budapest	W.	38.5	79.1 S.E.	11	48	48	-14	—	—	—	—	—	—	12	0	0	12	3	49	—	
Konigsberg	W.	38.6	69.3 S.E.	11	48	48	-14	—	—	—	—	—	—	12	0	0	12	3	49	—	
Zemla	W.	39.6	84.6 S.E.	11	48	59	-19	—	—	—	—	—	—	12	4	30	12	7	36	Turkestan.	
Yennai	W.	40.5	84.6 S.E.	11	50	0	-19	—	—	—	—	—	—	12	10	0	12	12	0	—	
Beislan	W.	40.5	77.2 S.E.	11	50	1	-18	—	—	—	—	—	—	12	10	0	12	14	0	—	
Gratz	W.	40.8	83 S.E.	11	50	2	-19	—	—	—	—	—	—	12	10	0	12	14	0	—	
Pompoi	W.	41.2	88.1 S.E.	11	50	13	-12	—	—	—	—	—	—	12	10	0	12	14	0	—	
Triest	O.A.	41.2	88.1 S.E.	11	50	13	-12	—	—	—	—	—	—	12	10	0	12	14	0	—	
Iatbach	E.	41.2	84.6 S.E.	11	50	3	-22	—	—	—	—	—	—	12	3	17	12	10	34	Damped.	
Padova	G.	41.8	80.5 S.E.	11	50	9	+9	—	—	—	—	—	—	12	3	36	12	10	34	Undamped.	
Padova	W.	41.8	80.5 S.E.	11	50	9	+9	—	—	—	—	—	—	12	3	36	12	10	34	—	
Padova	V.	43.1	80.2 S.E.	11	50	21	-18	—	—	—	—	—	—	12	3	36	12	10	34	—	

Innsbruck		Ma.	43·6	85·9 S.E.	11 50 24	-19	—	11 56 54	-25	—	—	—	—
Heidelberg			45·7	86·7 S.E.	11 50 44?	-14	—	11 57 39	-8	12 19 0	—	—	—
Moncalieri		S.	46·1	88·5 N.E.	11 50 43	-18	—	11 57 28	-24	12 3 13	—	12 18 6	—
Aachen		W.	47·3	86·5 S.E.	—	—	11 53 0?	11 57 57	-11	12 2 0	—	12 10 0	—
Zi-ka-wei		W.	48·8	75·8 N.W.	11 50 44	-35	—	11 58 20	-7	—	—	—	—
Paris		—	49·7	88·5 N.E.	11 51 37	+12	—	11 58 23	-15	12 13 0	—	—	—
Guildford	E.	M.	51·5	88·1 N.E.	—	—	—	—	—	—	—	12 23 15	—
Bidston	E.	M.	53	87·3 N.E.	—	—	—	—	—	—	—	12 22 18	—
Edinburgh	E.	M.	53	88·3 N.E.	—	—	—	11 59 24	+5	—	—	12 20 54	—
Eskdalemuir		G.	53	88·3 N.E.	—	—	—	11 59 13	-6	12 10 0	—	—	—
Manila		W.	54·4	63·8 N.W.	11 51 28	-27	—	—	—	—	—	—	—
Batavia		W.	54·7	46·1 N.W.	11 52 0	+3	—	—	—	12 11 0	—	12 13 0	—
Granada		C.	55·6	76 N.E.	11 52 12	+9	—	11 59 40	-12	12 10 0	—	—	—

3

1914. February 7.

Origin : 48·6N. 159·4E., determined by Pulkovo.

Time at Origin : P=6h. 49m. 43s. S=6h. 49m. 43s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Osaka	O.	22·5	44·7 N.E.	6 52 28	—	-146	—	—	—	—	—	—	—	6 54 37	—	—	6 55 21	—	—	—	—
Zi-ka-wei	W.	33·4	47·7 N.E.	6 54 18	—	-145	—	—	6 58 15	—	-238	—	—	—	—	—	—	—	—	—	—
Irkutsk	G.	34·4	73·7 N.E.	6 55 40	—	-71	—	—	7 0 17	—	-182	—	—	—	—	—	7 5 8	—	—	—	—
Honolulu	E.	M.	43·4	40·6 N.W.	—	—	—	—	7 6 54	—	+137	—	7 13 48	—	—	—	7 21 12	—	—	—	—
Manila	W.	46·3	34·6 N.E.	6 56 24	—	-121	—	—	—	—	—	—	7 2 0	—	—	—	7 3 38	—	—	—	—
Ekaterinburg	G.	55·1	52·8 N.E.	6 58 57	—	-26	—	—	7 6 18	—	-47	—	7 13 0	—	—	—	7 19 4	—	—	—	43·8N. 146·15E.
Tashkent	G.	60·3	49·6 N.E.	6 59 4	—	-53	—	—	7 6 51	—	-79	—	7 18 0	—	—	—	7 22 24	—	—	—	40·5N. 150·7E.
Pulkovo	G.	64	34·8 N.E.	7 0 21	—	0	—	—	7 8 56	—	0	—	7 19 0	—	—	—	7 25 39	—	—	—	—
Konigsberg	W.	71	27·4 N.E.	7 1 26	—	+20	—	—	7 10 39	—	+18	—	7 25 24	—	—	—	7 36 6	—	—	—	—
Batavia	W.	71·4	33·6 N.E.	—	—	—	—	—	—	—	—	—	—	—	—	—	7 16 0	—	—	—	—
Baku	G.	71·5	41·1 N.E.	7 0 22	—	-47	—	—	7 9 38	—	-49	—	7 24 0	—	—	—	7 27 21	—	—	—	—
Tiflis	G.	72·9	39 N.E.	7 0 49	—	-29	—	—	7 10 12	—	-31	—	7 25 0	—	—	—	7 31 33	—	—	—	42·5N. 150·5E.
Edinburgh	E.	M.	74·5	11·8 N.E.	—	—	—	—	7 11 48	—	+45	—	—	—	—	—	7 35 24	—	—	—	—
Jernberg	B.O.	74·8	28·8 N.E.	—	—	—	—	—	7 11 42?	—	+35	—	7 28 53	—	—	—	7 37 23	—	—	—	—
Eskdalemuir	G.	75·1	11·8 N.E.	—	—	—	—	—	7 21 19?	—	+609	—	7 33 30	—	—	—	—	—	—	—	—
Czernowitz	E.	Ma.	75·1	29·8 N.E.	—	—	—	—	—	—	—	—	7 28 0	—	—	—	7 37 0	—	—	—	—
Breslau	W.	75·3	24·7 N.E.	7 1 32	—	-2	—	—	7 11 30	—	+18	—	7 25 0	—	—	—	—	—	—	—	—
Stonyhurst	E.	M.	76·5	12·2 N.E.	—	—	—	—	7 12 0	—	+34	—	—	—	—	—	7 39 0	—	—	—	—
Bidston	E.	M.	76·9	11·8 N.E.	—	—	—	—	7 12 30	—	+60	—	—	—	—	—	7 39 30	—	—	—	—
Aachen	W.	77·4	17·7 N.E.	—	—	—	7 8 0?	—	7 11 14?	—	-22	—	7 28 0	—	—	—	7 33 39	—	—	—	—
Budapest	W.	77·9	25·6 N.E.	7 1 43	—	-6	—	—	7 11 56	—	+14	—	7 29 30	—	—	—	7 39 55	—	—	—	—
Vienna	W.	78	24 N.E.	7 1 47	—	-3	—	—	7 11 42	—	-1	—	7 33 0	—	—	—	7 40 0	—	—	—	—
Guildford	E.	M.	78·7	13·3 N.E.	—	—	7 9 25?	—	—	—	—	—	—	—	—	—	7 38 0	—	—	—	—
Heidelberg	—	—	78·9	19·1 N.E.	7 4 5	+130	—	—	7 12 27	—	+33	—	7 32 30	—	—	—	7 39 6	—	—	—	—
Graz	W.	79·3	23·4 N.E.	7 1 53	—	-5	—	—	7 12 20	—	+22	—	7 33 0?	—	—	—	7 41 0	—	—	—	—
Shide	E.	M.	79·3	12·9 N.E.	—	—	—	—	—	—	—	—	—	—	—	—	7 45 0	—	—	—	—
Zagreb	N.	M.	79·3	12·9 N.E.	—	—	7 10 0	—	7 12 0	—	+2	—	—	—	—	—	7 44 0	—	—	—	—
Laibach	W.	80·4	23·4 N.E.	—	—	—	—	—	7 13 6?	—	+55	—	7 37 0	—	—	—	7 41 24	—	—	—	—
Paris	G.	80·5	22·7 N.E.	—	—	—	—	—	7 12 19	—	+7	—	7 33 57	—	—	—	7 41 30	—	—	—	—
Paris	G.	80·6	15·2 N.E.	—	—	—	—	—	7 12 28	—	+15	—	7 30 0	—	—	—	—	—	—	—	—

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Triest	W.	81.1	22.2 N.E.	—	...	7 12 5?	7 21 18?	+539	7 34 18	7 35 0	—
Padova	V.	81.8	21 N.E.	7 2 9	— 3	—	—	—	—	—	—
Moncalieri	S.	83.2	18.4 N.E.	7 1 36	-44	—	7 11 47	-55	7 26 48	7 42 34	—
Helwan, Cairo	E.	88.8	31.4 N.E.	—	—	—	—	—	7 38 0?	—	—
	N.	88.8	31.4 N.E.	—	—	—	—	—	7 35 0?	—	—
Granada	C.	92.9	11.2 N.E.	7 3 39?	+25	—	7 15 51?	+84	7 35 0	7 41 48	—
	N.	93.9	9.5 N.E.	—	—	—	—	—	—	7 54 0	—
San Fernando	M.	93.9	9.5 N.E.	—	—	—	—	—	—	7 53 30	—
	E.	93.9	9.5 N.E.	—	—	—	—	—	—	—	—

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1914. February 26.

Origin : 16S. 61W., determined by Pulkovo.

This and the following earthquake overlap. The Origins are only a few degrees apart. As it is impossible to separate them for all stations, both are printed in full.

Time at Origin : P=4h. 57m. 52s. S=4h. 58m. 0s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Pilar	E. M.	16	10.1 N.E.	5	1	12	-32	—	—	—	—	—	—	—	5	3	48	5	9	36	—
Lima	E. M.	16.2	72.8 S.E.	5	0	56	-51	—	—	—	—	—	—	—	—	—	—	5	4	54	—
Ascension	E. M.	46.2	75.4 S.W.	5	3	0	-213	—	—	—	—	—	—	—	—	—	—	5	29	30	—
St. Helena	E. M.	53.1	51.1 S.W.	5	8	30	+71	—	—	—	—	—	—	—	—	—	—	5	33	48	—
Harvard Univ.	N.	59.1	11.3 S.E.	5	8	19	+21	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	E.	59.1	11.3 S.E.	5	8	17	+19	—	—	—	—	—	—	—	5	24	47	5	37	58	? Aleutian Ids.
St. Louis	N.	61.1	32.2 S.E.	5	8	9	-3	—	—	—	—	—	—	5	13	0	-217	5	14	22	—
	E.	61.1	32.2 S.E.	—	—	—	—	—	—	—	—	—	—	5	13	18	-199	5	14	0	5 14 20
Toronto	E. M.	62	20.1 S.E.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Azores	E. M.	63.1	38.5 S.W.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cape Town	E. M.	72.6	62 S.W.	5	9	18	-7	—	—	—	—	—	—	—	—	—	—	—	—	—	—
San Fernando	N.	73.7	54.9 S.W.	5	9	30	-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	E.	73.7	54.9 S.W.	5	9	30	-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rio Tinto	E. M.	74.2	54.3 S.W.	5	7	0	-155	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Granada	C.	75.8	56.6 S.W.	5	10	36	+50	—	—	—	—	—	—	5	20	40	+65	5	26	0	5 38 42
Lick	W.	77.8	58.9 S.E.	5	9	44	-14	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Berkeley	—	78.7	59.2 S.E.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Shide	E. M.	84.6	56.5 S.W.	5	11	0	+22	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Victoria	E. M.	84.8	58.7 S.E.	5	9	54	-45	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Midston	E. M.	85.2	54.8 S.W.	5	12	42	+121	—	—	—	—	—	—	—	—	—	—	—	—	—	—
West Bromwich	E. M.	85.3	55.8 S.W.	5	13	0	+139	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Guildford	E. M.	85.3	57 S.W.	5	11	9	+28	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stonyhurst	E. M.	85.7	55.3 S.W.	5	8	36	-127	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Paris	—	85.7	59.6 S.W.	5	11	13	+30	5 14 40	—	—	—	—	—	—	—	—	—	—	—	—	—
Eskdalemuir	G.	86.3	54.6 S.W.	5	11	8	+21	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Edinburgh	E. M.	86.6	54.6 S.W.	5	11	36	+47	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Moncalieri	S.	87	63.7 S.W.	5	11	37	+46	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aachen	W.	88.7	62.3 S.W.	5	11	12	+12	5 15 11	—	—	—	—	—	—	—	—	—	—	—	—	—
Heidelberg	—	89.4	64.6 S.W.	5	11	48	+44	5 15 24	—	—	—	—	—	—	—	—	—	—	—	—	—

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Times approximate.

Innsbruck	{ S.E.	Ma.	90:3	66:4 s.w.	5 11 42	+33	5 15 29?	—	—	—	5 22 0	—	—
	{ N.E.	Ma.	90:3	66:4 s.w.	5 11 45	+36	—	—	—	—	—	—	—
Triest		W.	91:2	68:1 s.w.	—	—	5 15 38	5 22 6	-20	5 38 0	5 45 0	—	—
Laiibach		G.	91:8	68:6 s.w.	5 11 12	— 6	—	5 21 33	-60	5 39 43	5 47 0	—	—
Zagreb	{ N.E.	W.	92:5	69:4 s.w.	5 15 45	+264	5 17 21	5 22 15	-25	—	—	—	—
	{ N.W.	W.	92:5	69:4 s.w.	5 15 48	+267	—	5 22 15	-25	—	5 30 6	—	—
Graz		W.	92:8	69:3 s.w.	5 11 55	+32	—	5 22 12	-31	5 40 0	5 47 12	—	—
Vienna		W.	93:8	70:1 s.w.	5 14 12	+163	5 15 56	5 22 24	-30	5 40 0	5 58 0	—	—
Breslau		W.	95:1	70:7 s.w.	5 26 6	+870	—	5 32 25	+558	—	—	—	—
Budapest		W.	95:3	72 s.w.	—	—	5 15 56?	5 22 28	-41	5 40 31	6 1 26	—	—
Konigsberg		W.	98:2	73:8 s.w.	5 12 36?	+43	—	5 23 36	-2	5 36 48	5 45 54	—	—
Czernowitz		Ma.	99:8	76:9 s.w.	—	—	5 17 5?	5 22 42	-72	5 31 0	5 44 0	—	—
Helwan, Cairo	{ E.	M.	99:8	77 s.w.	5 12 0	-2	—	5 21 18	-156	—	6 4 48	—	—
	{ N.	M.	99:8	77 s.w.	—	—	—	5 27 48	+234	—	6 6 18	—	—
Honolulu		E.	102:2	77:4 s.w.	5 12 12	-2	—	5 16 12?	—	—	5 22 48	—	—
Beirut		E.	104:1	80:9 s.w.	—	—	—	5 23 30	-64	—	6 8 30	—	—
Ksra		Ma.	104:4	80:6 s.w.	—	—	5 17 27?	5 23 13?	-84	—	5 27 10	—	—
Fulkovo		G.	104:4	81:9 s.w.	5 12 24	0	—	5 17 38?	5 24 37	0	5 44 0	5 47 9	—
Mauritius	{ N.	M.	110:0	63:5 s.w.	—	—	—	—	—	—	5 46 0	—	—
	{ E.	M.	110	63:5 s.w.	—	—	—	—	—	—	6 5 0	—	—
Tifis		G.	112:3	89 s.w.	5 13 15	+16	—	5 24 37	-71	5 43 0	6 9 30	—	—
Baku		G.	116:1	89:1 s.w.	—	—	—	—	—	5 54 0	6 14 24	—	—
Ekaterinburg		G.	120:4	71:6 N.W.	5 14 23	+47	5 17 3	—	—	—	5 55 5	—	—
Sydney		M.	121:4	36:9 s.e.	—	—	5 17 14?	—	—	—	—	—	—
Tashkent		G.	130:5	74:6 N.W.	—	—	—	5 26 58?	-66	6 4 0	6 27 16	—	—
Bombay		M.	135:9	85:4 N.W.	—	—	5 17 48?	—	—	—	6 23 42	—	—
Colombo		M.	140:6	73 s.w.	—	—	5 17 24?	—	—	—	6 26 12	—	—
Irkutsk		G.	141:9	23:3 N.W.	—	—	5 17 39?	5 27 46	-88	5 40 0	—	—	—
Calcutta		M.	150:3	82 N.E.	5 19 13	—	—	—	—	5 25 19	6 32 23	—	—
Batavia		W.	154:8	28:5 s.w.	5 18 2	—	—	—	—	5 45 0	5 57 0	—	—
Osaka		O.	156:2	42:3 N.E.	5 17 32	—	—	—	—	—	5 42 31	—	—
Zi-ra-wei		W.	164:6	8:7 N.E.	5 18 52	—	—	5 23 4	—	—	—	—	—
Manila		W.	177:7	36:7 N.E.	5 18 6	—	—	5 23 32	—	5 28 23	5 55 0	—	—

1914. February 26.

Origin: 21S. 64W., determined by Pulkovo.

See note at top of previous page.

Time at Origin: P=4h. 58m. 6s. S=4h. 58m. 8s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.		O-C.		PR ₁		S.		O-C.		L.		M.		Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.		
Pilar	E. M.	10:7	0:5 N.W.	5 1 12	+26	—	—	—	—	—	—	—	—	5 3 48	—	5 9 36	—	
Lima	E. M.	15:4	52:8 s.e.	5 0 56	-54	—	—	—	—	—	—	—	—	—	—	5 4 54	—	
Ascension	E. M.	49:6	69 s.w.	5 3 0	-250	—	—	—	—	—	—	—	—	—	—	5 29 30	—	
St. Helena	E. M.	55:2	75:3 s.w.	5 8 30	+44	—	—	5 16 30	+38	—	—	—	—	—	—	5 33 48	—	
Harvard Univ.	{ N.	B.O.	63:7	7:4 s.e.	5 8 19	-23	—	5 16 31	-46	—	—	—	—	—	—	—	—	
	{ S.	B.O.	63:7	7:4 s.e.	5 8 17	-25	—	5 16 28	-49	5 24 47	5 37 58	?	Aleutian Ids.	—	—	—	—	
St. Louis	{ N.	W.	64:5	27:2 s.e.	5 8 9	-38	—	5 13 0	-267	5 14 2	5 14 22	—	—	—	—	—	—	
	{ E.	W.	64:5	27:2 s.e.	—	—	—	5 13 18	-249	5 14 0	5 14 20	—	—	—	—	—	—	
Toronto	E. M.	66:2	15:7 s.e.	—	—	—	—	5 17 36?	-12	—	5 20 6	—	—	—	—	—	—	
Azores	E. M.	68:9	38:1 s.w.	—	—	—	—	—	—	—	5 20 6	—	—	—	—	—	—	
Cape Town	E. M.	72:5	76:1 s.w.	5 9 18	-21	—	—	—	—	—	5 18 12	—	—	—	—	—	—	
San Fernando	{ N.	M.	79:2	53:6 s.w.	5 9 30	-50	—	—	—	—	5 21 30	—	—	—	—	—	—	
	{ E.	M.	79:2	53:6 s.w.	5 9 30	-50	—	—	—	—	5 21 30	—	—	—	—	—	—	
Lick	N. W.	79:4	53:3 s.e.	5 9 44	-37	—	—	—	—	5 19 16	5 20 10	—	—	—	—	—	—	
Rio Tinto	E. M.	79:8	53:1 s.w.	5 7 0	-204	—	—	—	—	—	5 43 0	—	—	—	—	—	—	
Berkeley	—	—	53:6 s.e.	—	—	—	—	5 19 20	-75	—	5 20 25	—	—	—	—	—	—	
Granada	C.	81:3	55:2 s.w.	5 10 36	+4	—	—	5 20 42	-4	5 23 0	5 38 42	—	—	—	—	—	—	
Victoria	E. M.	87	53:5 s.w.	5 9 54	-71	—	—	—	—	5 20 0	5 29 8	—	—	—	—	—	—	
Shide	E. M.	90:3	56 s.w.	5 11 0?	-23	—	—	5 24 0?	+95	—	5 31 0	—	—	—	—	—	—	
Bidston	E. M.	91	54:7 s.w.	5 12 42	+75	—	—	5 22 0	-32	—	5 51 24	—	—	—	—	—	—	
West Bromwich	M.	91	55:5 s.w.	5 13 0	+93	—	—	5 19 30	-182	—	—	—	—	—	—	—	—	
Guildford	E. M.	91	56:6 s.w.	5 11 9	-18	—	—	5 21 45	-47	5 33 55	5 39 35	—	—	—	—	—	—	
Paris	—	—	58:9 s.w.	5 11 13	-16	5 14 40?	—	5 21 36	-60	5 47 0	5 50 51	—	—	—	—	—	—	
Stonyhurst	E. M.	91:5	55:2 s.w.	5 8 36	-174	—	—	5 18 0	-277	—	5 20 24	—	—	—	—	—	—	
Eskdalemuir	G.	92	54:6 s.w.	5 11 8	-25	—	—	5 21 33	-70	—	—	—	—	—	—	—	—	
Edinburgh	E. M.	92:4	54:6 s.w.	5 11 36	+1	—	—	—	—	—	5 24 42	—	—	—	—	—	—	
Moncalieri	S.	92:7	62:3 s.w.	5 11 37	+1	—	—	5 21 44	-66	5 30 44	5 39 5	—	—	—	—	—	—	
Aachen	W.	94:4	61:7 s.w.	5 11 12	-84	5 15 11	—	5 21 52	-76	0	5 51 0	—	—	—	—	—	—	
Heidelberg	—	95:1	63:3 s.w.	5 11 48	-2	5 15 24?	—	5 19 56	-199	5 37 0	5 50 0	—	—	—	—	—	—	

Times approximate.

Innsbruck	{ S.E.	Ma.	96	65°3 S.W.	5 11 42	-13	5 15 29?	...	...	5 22 0	...	...
	{ N.E.	Ma.	96	65°3 S.W.	5 11 45	-10	...	...	...	...	...	...
Triest	W.		96:8	66°8 S.W.	...	...	5 15 38?	5 23 55	+22	5 38 0	5 45 6	...
Lablach	G.		97:4	67°3 S.W.	5 11 12	-50	...	5 21 33	-123	5 39 43	5 47 0	...
Zagreb	{ N.E.	W.	98:1	68°1 S.W.	5 15 45	+219	5 17 21	5 22 15	-90	...	...	...
	{ N.W.	W.	98:1	68°1 S.W.	5 15 48	+222	...	5 22 15	-90	...	5 30 6	...
Vienna	W.		98:1	68°4 S.W.	5 14 12	+126	5 15 56	5 22 24	-81	5 40 0	5 58 0	...
Graz	W.		98:4	68°1 S.W.	5 11 55	-13	...	5 22 12	-86	5 40 0	5 47 12	...
Budapest	W.		100:6	76°1 S.W.	...	...	5 15 56?	5 22 28	-101	5 40 31	6 1 26	...
Breslau	W.		100:7	69°8 S.W.	5 26 6	+826	...	5 32 25	+495	...	...	...
Honolulu	E.	M.	101:1	71°6 S.E.	5 12 12	-9	5 16 12?	...	...	5 22 6	5 22 48	...
Konigsberg	W.		103:9	73°2 S.W.	5 12 36?	+1	...	5 24 49	+9	5 36 48	5 45 54	...
Helwan, Cairo	{ E.	M.	104:7	74°3 S.W.	5 12 0	-39	...	5 21 18	-209	...	6 4 48	...
	{ N.	Ma.	104:7	75°7 S.W.	...	...	5 16 36?	5 27 48	+181	...	6 6 18	...
Czernowitz	E.	M.	105:5	77° S.W.	...	...	5 16 41?	5 22 42	-133	5 31 0	5 44 0	...
Beirut	E.	M.	109:1	77°2 S.W.	...	...	5 17 27?	5 23 30	-118	...	5 27 10	...
Ksara	{ N.	Ma.	109:4	77°2 S.W.	...	...	...	...	...	...	5 46 0	...
Mauritius	{ E.	M.	109:9	57°5 S.W.	...	...	...	...	...	...	6 5 0	...
		M.	109:9	57°5 S.W.	...	...	...	...	...	...	5 47 9	...
Pulkovo	G.		110:2	82°8 S.W.	5 13 6	+2	5 17 38?	5 25 36	-2	5 44 0	6 9 30	...
Sydney	E.	M.	115:9	34°8 S.E.	...	...	5 17 30?	...	...	...	6 14 24	...
Tiflis	G.		117:6	85°9 S.W.	5 13 51	+13	...	5 24 37	-122	5 43 0	6 9 30	...
Baku	G.		121:4	89°9 S.W.	...	...	...	...	...	5 54 0	6 14 24	...
Ekaterinberg	G.		126:2	72°2 N.W.	5 14 23	+6	5 17 3?	...	...	...	5 55 5	...
Tashkent	G.		135:9	77°5 N.W.	...	...	5 17 14?	5 26 58?	-109	6 4 0	6 27 16	...
Bombay	E.	M.	139:5	79°8 N.W.	...	...	5 17 48?	...	...	...	6 23 42	...
Colombo	E.	M.	142:3	64°4 S.W.	...	...	5 17 24?	...	...	...	6 26 12	...
Irkutsk	G.		147:4	20°6 N.W.	...	...	5 17 39?	5 27 46	-126	5 40 0	...	...
Batavia	W.		151:4	18°2 S.W.	...	...	5 18 2?	...	...	5 45 0	5 57 0	...
Calcutta	E.	M.	154:2	85°7 N.W.	...	...	5 19 13?	...	...	5 25 19	6 32 23	...
Osaka	O.		158:1	56°2 N.E.	5 17 32	...	...	...	...	...	5 42 31	...
Zi-ka-wei	W.		168:7	26°6 N.E.	5 18 52	...	...	5 23 4	...	...	...	...
Manila	W.		172:2	36°8 N.E.	5 18 6	...	...	5 23 32	...	5 28 23	5 35 0	...

Pacific, not far to E. of Australia.

6

1914. February 28.

Origin : 18N. 67W., determined by Shide.

Time at Origin : P=5h. 3m. 21s. S=5h. 3m. 23s.

Station and Component.	Machine.	Distance of Origin.	Azimuth.	P.			O-C.			FR ₁			S.			O-C.			L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.		
Harvard Univ.	{ N.	B.O.	24:7	0°4 S.E.	5 8 2	-54	...	5 12 29	-51	5 21 2	...	...	...	...	...	...	...	...	...	...	...	...	...
	{ E.	B.O.	24:7	9°4 S.E.	5 8 9	-47	...	5 12 5	-75	5 15 7	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	E.	M.	27:8	26° S.E.	? 5 12 12	+163	...	...	...	5 16 42	5 17 6	...	...	...	...	...	...	...	...	...	...	...	...
Ottawa	{ N.	B.	28:3	17°7 S.E.	5 8 22	-70	...	5 13 9	-87	5 16 30	5 20 0	...	...	...	...	...	...	...	...	...	...	...	...
	{ E.	B.	28:3	17°7 S.E.	5 8 36	-56	...	5 12 52	-95	5 16 42	5 17 30	...	...	...	...	...	...	...	...	...	...	...	...
St. Louis	{ N.	W.	28:9	50°8 S.E.	5 8 9	-39	...	5 13 0	-98	5 14 2	5 14 22	...	...	...	...	...	...	...	...	...	...	...	...
	{ E.	W.	28:9	50°8 S.E.	...	...	...	5 13 18	-80	5 14 0	5 14 29	...	...	...	...	...	...	...	...	...	...	...	...
La Paz	—		34:5	2° N.E.	5 11 30	+60	...	5 19 56	+226	5 25 24	5 29 42	...	...	...	...	...	...	...	...	...	...	...	...
Pilar	E.	M.	49:8	3°9 N.W.	...	...	...	? 5 34 30	+891	...	5 37 36	...	...	...	...	...	...	...	...	...	...	...	...
Lick	W.		51:3	83°4 S.E.	...	...	...	? 5 26 43	+405	...	5 28 51	...	...	...	...	...	...	...	...	...	...	...	...
Berkeley	—		51:8	83°6 S.E.	...	...	...	? 5 27 2	+418	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Victoria	E.	M.	54:5	76°4 S.E.	...	...	...	? 5 27 0	+382	...	5 38 0	...	...	...	...	...	...	...	...	...	...	...	...
Rio Hinto	E.	M.	55:9	86°9 S.W.	...	...	...	? 5 27 0	+364	...	5 38 0	...	...	...	...	...	...	...	...	...	...	...	...
San Fernando	E.	M.	56:2	87°4 S.W.	5 8 0	-308	...	...	...	...	5 32 30	...	...	...	...	...	...	...	...	...	...	...	...
Granada	E.	M.	58:3	88°1 S.W.	5 13 52	+30	...	5 21 47	+22	5 31 0	5 32 42	...	...	...	...	...	...	...	...	...	...	...	...
Edinburgh	E.	M.	60	80°2 S.W.	...	...	...	? 5 27 48	+362	...	5 47 0	...	...	...	...	...	...	...	...	...	...	...	...
Bidston	E.	M.	60:2	79°8 S.W.	...	...	...	? 5 33 0	+674	...	5 44 42	...	...	...	...	...	...	...	...	...	...	...	...
Eskdalemuir	G.		60:4	78°9 S.W.	...	...	...	? 5 30 0	+489	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Stonyhurst	E.	M.	60:6	80°2 S.W.	...	...	...	? 5 22 42	+48	...	5 47 0	...	...	...	...	...	...	...	...	...	...	...	...
West Bromwich	M.		60:7	81°2 S.W.	...	...	...	? 5 28 0	+365	...	5 47 0	...	...	...	...	...	...	...	...	...	...	...	...
Shide	{ N.	M.	60:8	83°2 S.W.	...	...	...	5 23 0	-64	...	5 35 0	...	...	...	...	...	...	...	...	...	...	...	...
	{ E.	M-S.	60:8	83°2 S.W.	5 17 0	+201	...	...	...	5 35 0	5 45 0	...	...	...	...	...	...	...	...	...	...	...	...
Haslemere	E.	M.	61:3	83° S.W.	...	...	...	5 23 48	+105	...	5 46 12	...	...	...	...	...	...	...	...	...	...	...	...
Guildford	M.		61:4	83° S.W.	5 12 45	-57	...	5 21 48	-16	5 37 18	5 45 42	...	...	...	...	...	...	...	...	...	...	...	...
Paris	G.		63:1	87°2 S.W.	...	...	...	? 5 28 7	+42	5 32 0	...	...	...	...	...	...	...	...	...	...	...	...	...
Aachen	W.		65:5	89°2 S.W.	...	...	...	? 5 23 29	+35	5 32 0	5 42 0	...	...	...	...	...	...	...	...	...	...	...	...
Moncalieri	S.		66:7	86°9 N.W.	? 5 10 19	-238	...	5 23 50	+41	5 33 6	...	...	...	...	...	...	...	...	...	...	...	...	...
Heidelberg	—		67	88°5 N.W.	5 14 17	-2	...	? 5 23 39	+26	5 34 0	...	...	...	...	...	...	...	...	...	...	...	...	...
Graz	—		71:9	82°7 N.W.	? 5 15 12	+22	...	5 24 47	+35	5 37 0		
Zagreb	N.W.	W.	72:2	82°2 N.W.	? 5 15 16	+24	...	5 24 51	+36	5 36 0	5 55 0		

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Locality	W. or E.	N. or S.	72-3	82-6 N.W.	5 15 11	+18	5 24 18	+1	5 37 0	6 10 2	6 15 53	6 20 28	6 8 6
Vienna	W.		73-9	81-3 N.W.	5 4 49	+634	5 23 48	-48	5 39 0	6 15 53	6 20 28	6 8 6	
Konigsberg	E.O.		77-1	77-3 N.W.	5 15 29	0	5 21 17	-208	5 37 42	6 15 53	6 20 28	6 8 6	
Lemberg	G.		78-1	74-8 N.W.			5 25 24	0	5 36 30	6 15 53	6 20 28	6 8 6	
Pulkovo	M.		81-6	72-8 S.E.			5 25 0	-68	5 41 48	6 15 53	6 20 28	6 8 6	
Honolulu	E. M.		88	70-3 N.W.			5 27 0	+45	5 43 0	6 15 53	6 20 28	6 8 6	
Heiwan, Cairo	E. M.		88	70-3 N.W.			5 27 0	+45	5 43 0	6 15 53	6 20 28	6 8 6	
Thlis	G.		99-3	62-2 N.W.			5 27 11	-61	5 44 0	6 15 53	6 20 28	6 8 6	
Ekaterinburg	G.		98-4	49 N.W.			5 27 11	-61	5 44 0	6 15 53	6 20 28	6 8 6	
Baict	G.		97-3	38-8 N.W.			5 27 11	-61	5 44 0	6 15 53	6 20 28	6 8 6	
Fashent	G.		108-2	48-8 N.W.			5 27 11	-61	5 44 0	6 15 53	6 20 28	6 8 6	
Trusk	G.		109-3	8-8 N.W.			5 30 7	-38	5 57 0	6 15 53	6 20 28	6 8 6	

TABLE.

Dec. grees.	P sec.	S sec.	S - P sec.	Dec. grees.	P sec.	S sec.	S - P sec.	Dec. grees.	P sec.	S sec.	S - P sec.
1	15	28	13	51	553	991	438	101	855	1565	710
2	31	55	24	52	560	1004	444	102	860	1575	715
3	47	83	36	53	566	1016	450	103	865	1584	719
4	62	110	48	54	573	1029	456	104	870	1593	723
5	77	137	60	55	579	1041	462	105	874	1602	728
6	92	164	72	56	586	1054	468	106	879	1612	733
7	106	190	84	57	592	1066	474	107	884	1621	737
8	121	217	96	58	599	1079	480	108	888	1630	742
9	136	243	107	59	605	1091	486	109	893	1639	746
10	150	269	119	60	612	1103	491	110	897	1648	751
11	164	294	130	61	619	1116	497	111	902	1657	755
12	179	319	140	62	625	1128	503	112	907	1666	759
13	193	344	151	63	632	1141	509	113	911	1674	763
14	206	368	162	64	638	1153	515	114	916	1682	766
15	219	392	173	65	645	1165	520	115	920	1690	770
16	232	415	183	66	651	1177	526	116	925	1698	773
17	245	438	193	67	658	1190	532	117	929	1706	777
18	257	460	203	68	664	1202	538	118	934	1714	780
19	269	482	213	69	671	1214	543	119	938	1722	784
20	281	503	222	70	677	1226	549	120	942	1729	787
21	293	524	231	71	683	1238	555	121	947	1737	790
22	305	545	240	72	690	1250	560	122	952	1744	792
23	317	565	248	73	696	1262	566	123	957	1752	795
24	328	584	256	74	702	1274	572	124	961	1759	798
25	338	603	265	75	709	1286	577	125	966	1766	800
26	348	622	274	76	715	1297	582	126	970	1773	803
27	358	641	283	77	721	1309	588	127	974	1780	806
28	368	659	291	78	727	1320	593	128	978	1787	809
29	378	677	299	79	733	1332	599	129	983	1794	811
30	388	694	306	80	739	1343	604	130	988	1801	813
31	398	711	313	81	745	1355	610	131	992	1807	815
32	407	728	321	82	750	1366	616	132	996	1814	818
33	416	744	328	83	756	1377	621	133	1001	1821	820
34	425	760	335	84	762	1388	626	134	1005	1827	822
35	433	775	342	85	768	1399	631	135	1009	1833	824
36	442	790	348	86	773	1410	637	136	1014	1840	826
37	450	804	354	87	779	1421	642	137	1018	1846	828
38	458	818	360	88	785	1432	647	138	1023	1852	829
39	466	832	366	89	790	1443	653	139	1027	1858	831
40	475	847	372	90	796	1454	658	140	1031	1864	833
41	483	861	378	91	801	1464	663	141	1035	1869	834
42	491	875	384	92	807	1475	668	142	1039	1875	836
43	498	888	390	93	812	1485	673	143	1043	1881	838
44	506	902	396	94	818	1496	678	144	1047	1886	839
45	513	915	402	95	823	1506	683	145	1051	1892	841
46	520	928	408	96	829	1516	687	146	1055	1897	842
47	527	941	414	97	834	1526	692	147	1059	1902	843
48	534	954	420	98	840	1536	696	148	1063	1907	844
49	540	966	426	99	845	1546	701	149	1067	1912	845
50	547	979	432	100	851	1556	705	150	1071	1917	846

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Monthly Bulletin for March, 1914.

For the large Earthquakes an attempt is here made to compare the readings with theoretical values, as explained in the Nineteenth Report of the Committee to the British Association. The position of the epicentre is adopted from the Pulkovo determination, unless otherwise stated; and the tables of times for P and S are those given by Galitzin in his "Vorlesungen über Seismometrie," p. 137, or by G. W. Walker on p. 54 of his "Modern Seismology." It is shown in the above Report that these tables are sensibly erroneous: but the precise values of the corrections are under discussion and it seems better to await the definitive corrections than to introduce provisional tables. The tables are reproduced in an expanded form on page 16 of this Bulletin. The time of the earthquake at the epicentre is deduced from the Pulkovo records; and applying the tabular times for the distances in the third column (calculated and also measured from a large globe specially made for the purpose), the errors O - C of the observed times are found.

Observers are requested to send a copy of their Registers to Shide *each month*, in order that this collated information may be published as early as possible.

In the Earthquake Chart the stations are arranged in the order of longitude, starting from the Azores and travelling eastward. For the large earthquakes they are arranged in the order of distance from epicentre, as shown in the 3rd column. The azimuth in the 4th column is also read from the globe.

The letters in the 2nd column stand for: A. = Alfani; Aga. = Agamennone; B. = Bosch; Bif. = Bifilar; B.O. = Bosch-Omori; C. = Cartuja; Ca. = Cancani; C.O. = Cartuja-Omori; G. = Galitzin; M. = Milne; Ma. = Mainka; M.S. = Milne-Shaw; O.A. = Omori-Alfani; S. = Stiattesi; V. = Vincentini; W. = Wiechert.

Guildford and West Bromwich use a modification of the Milne. Hamburg uses machines by Wiechert and von Rebeur-Paschwitz-Hecker. Heidelberg's machine is an astatic pendulum made at the Observatory. Riverview has two Wiecherts and one Mainka.

1914. March 6.

Origin : 53N. 158E., determined by Pulkovo.

Time at Origin : P = 19h. 5m. 18s. S = 19h. 5m. 18s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.		O-C.		Ph.		S.		O-C.		L.		M.		Remarks.	
				H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.		S.
Oseka	O.	213	230	19	10	4	-45	19	19	19	17	27	4	19	21	19	29	37	
L'rusk	G.	318	291	19	12	9	+6			19	18	0	+1	19	21	19	23	59	
Zi-ka-wei	W.	342	245							19	20	24	-11	19	21	19	31	24	
Honolulu	M.	460	116							19	20	24	+8	19	28	19	36	42	
Victoria	M.	475	62				+23			19	21	55	+18	19	28	19	36	42	
Manki	W.	482	201	19	14	87				19	21	55	+18	19	28	19	36	42	
Hamburg	G.	575	207	19	15	20	+7			19	23	28	+18	19	32	19	37	56	516N. 157E. 488N. 1582E.
Pulkovo	G.	597	333	19	15	28	0			19	23	37	0	19	34	19	39	27	
Calcutta	M.	601	268							19	25	2	-1	19	40	19	42	11	
Konigsberg	W.	665	335	19	16	16	+3	19	19	30	25	2	+3	19	38	19	48	0	Kamohatka.
Baku	G.	680	369	19	16	16	-6			19	25	23	+13	19	39	19	44	41	S.R. 19h. 30m. 30s.
Tiflis	G.	693	313	19	16	33	+4			19	25	48	-113	19	31	19	45	31	556N. 1668E.
Edinburgh	M.	706	349							19	27	0	+106	19	39	19	47	0	
Heidelberg	G.	706	349							19	27	0	+106	19	39	19	47	0	
Leipzig	M.	706	349							19	27	0	+106	19	39	19	47	0	
Breslau	W.	706	349							19	25	33	-18	19	39	19	47	13	S.R. 19h. 31m. 9s.
Czernowitz	W.	709	329	19	16	41	+1			19	26	6	+12	19	39	19	47	13	
Ottawa	M.	709	329	19	16	41	+1			19	25	56	+2	19	38	19	51	5	
Toronto	S.	714	37	19	14	30	-131			19	25	36	-25	19	42	19	51	5	
Stonyhurst	E.	715	40	19	14	30	-134			19	25	33	-28	19	42	19	51	5	
Stonyhurst	E.	723	248							19	24	18	-104	19	43	19	51	5	
Boston	E.	724	348							19	20	42		19	43	19	51	5	
Batavia	W.	732	234							29	23	42		19	52	19	51	5	
Aachen	W.	735	342	19	17	22	+27			19	30	18	+215	19	52	19	51	5	
Budapest	W.	736	333	19	16	56	-2			19	26	52	+30	19	52	20	1	0	
Vienna	W.	737	334	19	16	56	-2			19	26	24	+2	19	41	19	47	0	
Guildford	M.	742	346	19	16	56	-2			19	26	35	+2	19	40	19	53	28	
Huslemere	M.	742	346	19	17	21	+23			19	26	30	+2	19	46	19	54	0	
	E.	744	346	19	17	21	+23			19	27	30	+4	19	47	19	57	21	

Heidelberg			74.4	340	19 16 15	-50			19 27 20	+43	19 30 0	20 2 7	
Shide	(E. M.		74.9	347	19 18 0	+54			19 27 0	+17		19 53 0	
	(N. M.		74.9	347					19 26 18	-25	19 32 0	19 56 0	
Graz	W.		74.9	345	19 17 5	-1			19 26 43	+2	19 46 54	19 48 18	
Harvard Univ.	B.O.		75.7	35							19 50 15		? S.R. 19h. 39m. 42s.
Innsbruck	Ma.		75.8	332	19 17 6	-6			19 27 50	+57	19 42 0	19 50 6	
Paris			76.1	344	19 17 17	+3			19 26 50	-6		19 55 0	
Laibach	G.		76.1	335	19 17 6	-8			19 27 0	+4	19 43 0	19 47 50	
Zagreb	N.W. W.		76.1	334	19 17 16	+2			19 26 56	0	19 43 0	19 48 54	
Kodaikanal	E. M.		76.2	268							19 49 0?		
Triest	W.		76.8	335	19 17 0	-18			19 27 0	-5	19 43 0	19 49 0	
Moncalieri	S.		78.8	339	19 10 58	-392			19 23 52	-216	19 44 26	19 55 7	
Helwan, Cairo	(E. M.		85.1	316					19 27 0	-98		20 4 18	
	(N. M.		85.1	316					19 29 18	-40		20 4 42	
Rio Tinto	E. M.		88.2	348							19 43 0	20 0 0	
Grenada	C.		88.4	345	19 18 3	-22			19 28 49	-35	19 46 0	19 58 13	
San Fernando	N. M.		89.5	347					19 29 0	-26		20 7 0	
Adelaide	E. M.		89.5	196					19 29 18	-8		20 5 30	

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1914. March 14.

Origin : 39.2N. 139.8E., determined by Pulkovo.

Time at Origin : P=20h. 0m. 6s. S=20h. 0m. 6s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Osaka	O.	5.8	219	20 2 3	+28									20 3 34	20 3 53						
Zi-ka-wei	W.	17.0	247	20 4 12	+1			20 5 7		20 7 37	+13	20 8 19	20 11 39								
Irkutsk	G.	27.6	310	20 5 58	-12					20 10 41	-17	20 13 30	20 15 9							38.5N. 138E.	
Manila	W.	29.6	219	20 6 22	-8					20 11 47	+14	20 16 32	20 23 35							Akita Province, Japan.	
Calcutta	M.	46.6	264	20 8 10	-40							20 14 15	20 27 29								
Tashkent	G.	52.3	297	20 9 24	-4			20 12 36		20 16 55	+1	20 26 0	20 30 40							39.8N. 141.4E.	
Ekaterinberg	G.	52.3	317	20 9 24	-5					20 16 51	-5	20 21 0	20 28 7							40.16N. 141.19E.	
Batavia	W.	54.7	222	20 9 35	-8							20 28 0	20 40 0								
Honolulu	E. M.	55.4	90	20 10 6	+18							20 18 0	20 18 48								
Bombay	E. M.	60.6	272							20 18 54	+17		20 34 54								
Kodaikanal	E. M.	62.2	260							20 19 30	+33	20 26 54	20 44 36								
Colombo	E. M.	62.5	256										20 55 0							? S.R. 20h. 24m. 54s.	
Pulkovo	G.	65.4	329	20 10 53	0					20 19 36	0	20 28 0	20 37 56								
Bulu	G.	65.8	303	20 10 46	-10			20 15 16		20 19 35	-6	20 30 0	20 47 5								
Tiflis	G.	68.5	307	20 11 13	0					20 20 17	+3	20 33 0	20 38 48							46.2N. 148.6E.	
Konigsberg	W.	72.7	328	20 11 37	-3			20 14 22		20 20 56	-8	20 31 54	20 42 36							Akita, Japan.	
Adelaide	(E. M.	74.1	181										20 39 50								
Czernowitz	(N. Ma.	74.7	321	20 11 50	-3			20 14 43		20 21 27	-1	20 35 0	20 41 0							S.R. 20h. 26m. 52s.	
	(N. Ma.	74.7	321	20 11 50	-3			20 14 45		20 21 27	-1		20 41 0								
Lemberg	B.O.	75.0	323	20 11 40	-15			20 14 20		20 21 24	-8	20 35 48	20 42 52								
Breslau	W.	76.8	327	20 12 25	+19					20 21 14	-39	20 40 0	20 46 0								
Budapest	W.	78.5	324	20 12 13	-3					20 22 13	+1	20 38 24	20 44 28								
Ksara	E. Ma.	78.6	305	20 12 23?	+6								20 37 0								
Beirut	E. M.	78.8	305					20 21 0					20 49 0								
Vienna	W.	79.2	325	20 12 16	-4					20 22 0	-20	20 36 0	20 46 30								
Edinburgh	E. M.	79.8	340	20 12 12	-12								20 47 18								
Eskdalemuir	G.	80.4	340	20 12 25	-2					20 22 23	-1	20 37 0								? S.R. 20h. 28m. 19s. 43.5N. 160E.	
Graz	W.	80.5	325	20 12 26	-2					20 22 37	+2	20 39 36	20 45 35								
Aachen	W.	81.3	333	20 12 28	-4					20 22 42	-2	20 38 0	20 43 0							Akita, Japan.	

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Heidelberg	—	73·1	339	6 28 30	—42	—	—	6 38 24	—17	6 55 24	7 7 54	—
Graz	W.	73·5	333	6 29 13	—1	—	—	6 38 51	+5	6 53 54	6 56 42	—
Shide	E. M-S.	73·6	345	—	—	—	—	—	—	7 0 0	7 8 0	—
Innsbruck	Ma.	74·3	336	6 29 10	—9	—	—	6 39 6	+10	6 55 30	7 8 30	—
Moncalieri	S.	74·4	338	6 28 29	—51	—	—	6 38 48	—9	6 50 9	7 7 55	—
Zagreb	W.	74·6	332	6 28 58?	—23	—	—	6 39 56	+57	6 53 0	7 11 30	—
Laibach	G.	74·7	333	6 29 57?	+45	—	—	6 38 57	—3	6 58 0	7 6 27	—
Paris	—	74·8	342	6 28 46?	—37	—	—	6 39 1	—1	7 1 0	7 12 0	—
Triest	N. W.	75·3	334	6 29 16	—10	—	—	6 39 8	+1	6 58 30	7 6 0	—
Ksara	Ma.	78·2	313	6 29 58	+13	—	—	6 40 55?	+75	—	7 11 55	—
Beirut	E. M.	78·3	313	—	—	—	—	—	—	7 1 0	7 15 0	—
Rio Tinto	E. M.	87·0	347	—	—	—	—	—	—	—	7 12 0	—
Granada	C.	87·1	344	6 30 24	—11	—	—	—	—	—	7 11 9	—
San Fernando	N. M.	88·2	346	—	—	6 35 30	—	6 41 4	—16	6 54 0	7 19 30	—
	E. M.	88·2	346	6 31 0	+19	—	—	—	—	—	7 19 0	—
Mauritius	N. M.	110·9	264	—	—	—	—	—	—	—	7 25 0	—
	E. M.	110·9	264	—	—	—	—	—	—	7 19 54	7 22 0	—

P and S lost in previous earthquake.

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1914. March 27.

Origin : 53·1N. 158·4E., determined by Pulkovo.

Time at Origin : P=0h. 55m. 46s. S=0h. 55m. 47s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	I.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Osaka	O.	24·6	230	1 1 26	—	+6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Irkutsk	G.	32·0	291	1 2 34	—	+1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zi-ka-wei	W.	34·5	245	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Honoulu	E. M.	45·9	117	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Victoria	E. M.	47·3	62	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ekaterinburg	G.	51·3	316	1 5 1	—	—1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tashkent	G.	57·5	297	1 5 53	—	+12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pulkovo	G.	59·7	333	1 5 56	—	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Konigsberg	W.	66·6	335	1 7 42	—	+61	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Baku	G.	68·1	309	1 6 45	—	—6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tiflis	G.	69·4	313	1 7 7	—	+8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Czernowitz	Ma.	69·7	327	1 6 30	—	—31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Edinburgh	G.	70·0	349	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fskdalemuir	E. M.	70·6	349	1 7 5	—	—1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lemberg	B.O.	70·6	330	1 8 18	—	+72	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Breslau	W.	70·9	336	1 8 10	—	+62	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Toronto	E. M.	71·2	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ottawa	E. B.	71·2	37	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	(N. B.	71·2	37	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stonyhurst	E. M.	71·9	348	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bidston	E. M.	72·4	349	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bombay	E. M.	72·4	278	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Batavia	W.	73·4	284	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aachen	W.	73·5	342	1 6 42	—	—43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Budapest	W.	73·6	353	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vienna	W.	73·7	335	1 7 27	—	+1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Heidelberg	—	74·4	340	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Shide	E. M.	74·8	347	1 6 50	—	—43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Graz	W.	75·0	335	1 7 35	—	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Harvard Univ.	N. B.O.	75·4	35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Alaska.

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Laiibach	G.	76-1	335	—	—	—	—	1 17 15	— 2	1 37 0	1 47 4	? S.R. 1h. 26m. 48s.
Zagreb	W.	76-1	334	1 7 40	— 1	—	—	1 17 27	+10	1 36 0	1 41 30	—
Paris	G.	76-1	344	—	—	1 10	—	1 17 2	— 15	1 30 0	—	—
Kodaikanal	E. M.	76-4	269	—	—	—	—	—	—	1 40 6	1 49 30	—
Triest	W.	76-8	335	—	—	—	—	1 17 29?	— 220	1 28 51	1 46 20	—
Moncalieri	S.	78-7	339	1 3 18?	— 279	—	—	1 13 0?	— 535	1 28 51	1 46 20	—
Helwan, Cairo	E. M.	84-8	316	1 7 0	— 93	—	—	—	—	—	—	—
	N. M.	84-8	316	1 10 0	+87	—	—	—	—	—	1 58 30	—
Rio Tinto	E. M.	89-2	348	—	—	—	—	—	—	1 36 0	1 51 0	—
San Fernando	E. M.	89-4	348	—	—	—	—	—	—	—	1 59 30	—
	N. M.	89-4	348	—	—	—	—	—	—	—	1 59 0	—

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1914. March 28.

Origin : 23N. 95E., determined by Pulkovo.

Time at Origin : P=10h. 44m. 31s. S=10h. 44m. 29s.

Station and Component.	Machine.	Distance ° from Origin.	° Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	s.	H.	M.	S.	H.	M.	S.	s.	H.	M.	S.	H.	M.	S.	
Calcutta	E. M.	6-3	250	10 32 23	— 824	—	—	10 46 6	— 75	10 47 38	10 50 41	—	—	—	—	—	—	—	—	—	—
Kodaikanal	M.	21-0	236	—	—	—	—	10 53 48	+35	10 57 42	11 8 24	—	—	—	—	—	—	—	—	—	—
Bombay	E. M.	21-1	263	10 50 12	+47	—	—	—	—	—	11 6 0	—	—	—	—	—	—	—	—	—	—
Zi-ka-wei	E. W.	24-8	65	10 49 47	-20	—	—	10 53 57	+89	—	10 58 49	S.R. 10h. 54m. 47s.	—	—	—	—	—	—	—	—	—
	N. W.	24-8	65	—	—	—	—	10 54 3	+95	—	10 57 45	S.R. 10h. 54m. 53s.	—	—	—	—	—	—	—	—	—
Manila	W.	25-9	104	10 49 36	-42	—	—	10 54 0	-49	10 59 8	11 0 12	—	—	—	—	—	—	—	—	—	—
Tashkent	G.	28-2	316	10 50 32	-9	10 51 8'	—	10 55 13	-19	10 59 0	11 3 16	22N. 91'E.	—	—	—	—	—	—	—	—	—
Irkutsk	G.	30-2	11	10 50 34	-27	—	—	10 55 19	-47	10 59 0	11 0 2	25-4N. 109-9E.	—	—	—	—	—	—	—	—	—
Batavia	W.	31-4	157	10 51 24	-11	—	—	—	—	—	11 4 0	? S.R. 11h. 1m. 28s.	—	—	—	—	—	—	—	—	—
Osaka	O.	37-0	62	10 53 19	+78	—	—	10 58 45	+52	11 3 36	11 6 58	—	—	—	—	—	—	—	—	—	—
Baku	G.	41-6	306	10 52 24	-15	—	—	11 1 46	+168	11 7 0?	11 15 41	—	—	—	—	—	—	—	—	—	—
Ekaterinburg	G.	42-0	332	10 52 26	-16	—	—	10 58 30	-34	11 5 0	11 10 0	—	—	—	—	—	—	—	—	—	—
Tiflis	G.	45-6	307	10 53 3	-5	—	—	10 59 51	-1	11 8 0	11 11 50	27-2N. 95-24E.	—	—	—	—	—	—	—	—	—
Ksara	N. Ma.	52-4	296	10 53 55	+2	—	—	11 1 25	+7	—	11 15 30	—	—	—	—	—	—	—	—	—	—
Mauritius	N. M.	56-3	223	—	—	—	—	11 9 30	+443	—	11 17 18	—	—	—	—	—	—	—	—	—	—
	E. M.	56-3	223	—	—	—	—	11 12 *36	+629	—	11 19 6	—	—	—	—	—	—	—	—	—	—
Helwan, Cairo	E. M.	56-7	292	10 55 0	+59	—	—	—	—	—	11 27 24	—	—	—	—	—	—	—	—	—	—
	N. M.	56-7	292	10 57 0	+179	—	—	—	—	—	11 20 0	—	—	—	—	—	—	—	—	—	—
Pulkovo	G.	57-6	327	10 54 27	0	—	—	11 2 23	0	11 11 30	11 20 53	—	—	—	—	—	—	—	—	—	—
Czernowitz	Ma.	59-3	314	10 54 43	+5	—	—	11 2 46	+2	11 12 0?	11 21 0	—	—	—	—	—	—	—	—	—	—
Lemberg	B.O.	60-6	315	10 54 0	-47	—	—	11 5 44	+164	11 14 4	—	—	—	—	—	—	—	—	—	—	—
Konigsberg	W.	62-5	321	10 55 10	+11	—	—	11 3 25	+2	11 11 42	11 21 12	—	—	—	—	—	—	—	—	—	—
Budapest	W.	63-9	313	10 55 25	+17	—	—	11 4 1	-20	—	11 24 30	—	—	—	—	—	—	—	—	—	—
Breslau	W.	64-9	317	10 55 22	+7	—	—	11 4 9	+16	11 21 0	11 23 0	—	—	—	—	—	—	—	—	—	—
Vienna	W.	65-6	314	10 55 30	+10	—	—	11 4 30	+29	11 20 0	11 25 0	—	—	—	—	—	—	—	—	—	—
Graz	W.	66-4	313	10 55 31	+6	—	—	11 4 24	+13	11 21 6	11 25 42	—	—	—	—	—	—	—	—	—	—
Zagreb	W.	66-5	312	10 55 33	+8	—	—	11 4 18	+6	11 21 48	11 29 48	—	—	—	—	—	—	—	—	—	—
Laiibach	G.	67-2	312	10 55 40?	+10	—	—	11 4 29	+8	11 20 30	11 28 2	—	—	—	—	—	—	—	—	—	—
Triest	W.	67-8	312	10 55 44	+10	—	—	11 4 32	+3	11 23 12	11 29 18	—	—	—	—	—	—	—	—	—	—
Innsbruck	Ma.	69-1	314	10 55 50	+7	—	—	11 4 46	+2	11 20 30	11 25 30	—	—	—	—	—	—	—	—	—	—

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Heidelberg	—	70.6	316	10 55 32?	-20	—	—	11 5 21	+19	11 21 30	11 25 53	—
Aachen	W.	71.7	318	—	—	—	—	11 5 17	+2	11 20 0	11 26 0	—
Moncalieri	S.	72.1	312	—	—	—	—	11 5 8	-12	11 22 31	11 30 50	? S.R. 11h. 13m. 5s.
Paris	—	74.5	317	—	—	—	—	11 5 52	+3	11 23 0	11 32 0	—
Edinburgh	E. M.	75.5	325	—	—	—	—	—	—	—	11 33 0	? S.R. 11h. 16m. 3Gs.
Guildford	E. M.	75.6	320	10 56 30	+6	—	—	11 6 9	+7	—	11 28 30	—
Eskdalemuir	E. G.	75.7	324	—	—	—	—	11 5 59	-4	11 22 0	11 28 30	—
Haslemere	E. M.	75.7	320	—	—	—	—	—	—	—	11 35 45	—
West Bromwich	E. M.	76.0	321	—	—	—	—	11 6 0	-6	—	11 33 0	—
Shide	E. M.	76.2	320	—	—	—	—	—	—	—	11 34 0	P. lost changing paper.
Bidston	E. M.	76.3	323	—	—	—	—	—	—	11 21 18	11 31 0	? S.R. 11h. 15m. 12s.
Granada	C.	82.7	308	—	—	—	—	11 7 43?	+20	11 29 0	11 34 12	—
Rio Tinto	E. M.	84.6	309	—	—	—	—	—	—	—	11 43 0	—
San Fernando	N. M.	84.8	308	—	—	—	—	11 8 0	+14	—	11 41 30	—
Honolulu	E. M.	96.2	63	—	—	—	—	11 10 30	+43	11 33 6	11 42 36	—
Ottawa	B.	111.1	353	—	—	—	—	—	—	11 38 18	—	—

13

1914. March 30.

Origin : 19N. 96W.

Time at Origin : P=0h. 41m. 11s. S=0h. 41m. 11s.

Station and Component.	Machine.	Distance ° from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Toronto	E. M.	28.3	26	0 47 12	-10	—	—	0 51 0	-75	0 55 18	1 1 21	Carribbean Sea.									
Lick	W.	28.7	314	—	—	—	—	0 52 42?	+19	0 56 52	1 3 17	—									
Berkeley	{ N. —	29.6	315	0 47 49	+14	—	—	0 53 17	+39	0 57 12	0 59 50	—									
	{ E. —	29.6	315	0 48 7	+32	—	—	0 53 10	+32	0 57 3	1 2 44	—									
Ottawa	{ N. B.	31.3	28	0 47 50	-2	0 48 49	—	0 53 25	+18	0 57 24	1 3 18	—									
	{ E. B.	31.3	28	0 47 48	-4	—	—	0 53 24	+17	0 57 24	1 3 18	—									
Harvard Univ.	{ N. B.O.	31.5	37	0 47 51	-2	—	—	0 53 18	+8	—	1 3 45	—									
	{ E. B.O.	31.5	37	0 47 45	-8	—	—	0 53 23	+13	0 59 11	1 0 35	—									
Lima	E. M.	36.2	148	0 44 33	-242	—	—	—	—	—	0 57 58	—									
Victoria	E. M.	36.8	329	0 49 6	+27	—	—	0 55 12	+40	1 3 12	1 3 36	—									
La Paz	E. M.	44.8	141	0 49 0	-43	—	—	0 55 1	-82	1 0 58	1 2 18	Felt in Lima.									
Honolulu	E. M.	57.9	283	0 51 48	+39	—	—	0 59 36	+27	1 6 54	1 15 24	—									
Pilar	E. M.	59.3	148	0 51 0	-18	—	—	0 58 18	-68	—	1 16 0	—									
Azores	E. M.	63.2	57	—	—	—	—	—	—	—	1 27 24	—									
Cork	E. M.	73.6	40	0 54 0	+69	—	—	—	—	—	1 32 0	—									
Edinburgh	E. M.	75.9	35	0 53 12	+7	—	—	—	—	—	1 39 12	—									
Eskdalemuir	E. G.	76.0	36	0 53 3	-3	0 56 20	—	1 3 2	+11	1 17 0	1 29 30	{ S.R. 1h. 8m. 20s. 11.5N. 90W.									
Bidston	E. M.	76.5	38	0 53 30	+21	—	—	1 3 48	+54	—	1 27 54	—									
Stonyhurst	E. M.	76.7	37	0 52 54	-16	—	—	1 6 24	+208	—	1 25 6	—									
San Fernando	{ N. M.	77.3	55	0 53 30	+16	—	—	1 3 30	+27	—	1 27 0	—									
	{ E. M.	77.3	55	0 54 0	+46	—	—	1 3 30	+27	—	1 25 0	—									
West Bromwich	E. M.	77.4	38	0 53 10	-4	—	—	1 3 16	+12	1 17 40	1 32 40	—									
Rio Tinto	E. M.	78.1	54	0 51 0	-133	—	—	—	—	—	1 29 0	—									
Shide	{ E. M.	78.4	40	0 53 25	+5	—	—	1 3 25	+9	1 14 0	1 26 0	—									
	{ N. M.	78.4	40	0 53 30	+10	—	—	1 3 33	+17	—	1 29 0	—									
Haslemere	E. M.	78.5	40	0 54 48	+87	—	—	1 5 0	+103	—	1 33 55	—									
Guildford	E. M.	78.6	39	0 53 23	+1	—	—	1 2 42	-36	1 18 15	1 27 27	—									
Paris	—	81.2	41	0 53 37	0	—	—	1 3 45	-3	1 19 0	1 28 29	—									

14

British Association for the Advancement of Science.—Seismological Committee.

Observations and formal business to
J. H. BURGESS,
Earthquake Observatory,
SHIDE, Isle of Wight.

Special inquiries to
Prof. H. H. TURNER,
University Observatory,
OXFORD.

Monthly Bulletin for April, 1914.

For the large Earthquakes an attempt is here made to compare the readings with theoretical values, as explained in the Nineteenth Report of the Committee to the British Association. The position of the epicentre is adopted from the Pulkovo determination, unless otherwise stated; and the tables of times for P and S are those given by Galitzin in his "Vorlesungen über Seismometrie," p. 137, or by G. W. Walker on p. 54 of his "Modern Seismology." It is shown in the above Report that these tables are sensibly erroneous: but the precise values of the corrections are under discussion and it seems better to await the definitive corrections than to introduce provisional tables. The tables are reproduced in an expanded form on page 6 of this Bulletin. The time of the earthquake at the epicentre is deduced from the Pulkovo records; and applying the tabular times for the distances in the third column (calculated and also measured from a large globe specially made for the purpose), the errors O - C of the observed times are found.

Observers are requested to send a copy of their Registers to Shide *each month*, in order that this collated information may be published as early as possible.

In the Earthquake Chart the stations are arranged in the order of longitude, starting from the Azores and travelling eastward. For the large earthquakes they are arranged in the order of distance from epicentre, as shown in the 3rd column. The azimuth in the 4th column is also read from the globe; and is the azimuth at the epicentre measured from N. towards E., in which the observing station lies.

The letters in the 2nd column stand for: A. = Alfani; Aga. = Agamennon; B. = Bosch; Bif. = Bifilar; B.O. = Bosch-Omori; C. = Cartuja; Ca. = Cancani; C.O. = Cartuja-Omori; G. = Galitzin; L. = Luckmann; M. = Milne; Ma. = Mainka; M.S. = Milne-Shaw; O.A. = Omori-Alfani; S. = Stiattesi; V. = Vincentini; W. = Wiechert.

Guildford and West Bromwich use a modification of the Milne. Hamburg uses machines by Wiechert and von Rebeur-Paschwitz-Hecker. Heidelberg's machine is an astatic pendulum made at the Observatory. Riverview has two Wiecherts and one Mainka.

1914. April 11.

Origin : 16S. 168E., determined by Pulkovo.

Time at Origin : P = 16h. 28m. 10s. S = 16h. 28m. 29s.

Station and Component.	Distance from Origin.	Azimuth.	P.		O-C.		PR ₁		S.		O-C.		L.		M.		Remarks.		
			H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.		S.	
Sydney	235	217	16	35	12	+100	—	—	16	40	18	+195	16	43	0	16	45	24	—
New	235	217	16	35	12	+180	—	—	16	39	0	+17	16	43	48	16	44	29	12° 58. 163E.
Adelaide	324	229	16	36	34	+130	—	—	16	45	30	+145	—	—	—	17	40	0	—
Perth	498	241	16	36	46	+83	—	—	16	46	54	+126	16	51	6	16	58	0	—
Honolulu	500	43	16	39	39	+133	—	—	16	46	3	+18	16	53	3	16	57	30	—
Manila	556	301	16	39	10	+77	—	—	16	47	3	+18	16	53	3	16	58	1	—
Osaka	594	329	16	35	41	+83	—	—	—	—	—	—	16	51	0	17	0	0	—
Batavia	606	271	16	40	0	+94	—	—	16	47	51	+3	16	56	19	16	58	41	S.R. 16h. 52m. 21s.
Zi-ra-wei	650	317	16	40	1	+66	—	—	16	52	32	+12	17	4	6?	17	10	55	6° 2N. 169° 2E.
Yokohama	676	321	16	42	27	+74	—	—	—	—	—	—	17	12	42	17	20	36	—
Calcutta	692	304	16	45	15	+100	—	—	16	52	42	+3	16	52	0	17	32	36	—
Kobe	692	277	16	42	19	+15	—	—	—	—	—	—	—	—	—	17	42	45	—
Kodakannal	832	280	16	41	30	+13	—	—	—	—	—	—	—	—	—	17	42	45	—
Bombay	898	267	16	53	43	+653	—	—	—	—	—	—	—	—	—	17	38	23	—
Tashkent	1069	309	16	44	10	+77	—	—	16	48	16	—	16	55	43?	17	15	30	—
Ekaterinburg	1128	325	16	44	23	+68	—	—	16	56	22	+14	17	14	0	17	18	12	—
La Paz	1197	118	16	40	58	+885	—	—	—	—	—	—	17	29	30	17	34	47	—
Toronto	1197	49	16	49	6	+826	—	—	16	50	35?	—	16	56	7?	—	—	—	—
Ottawa	1197	46	16	43	36?	+15	—	—	16	56	9?	-67	17	16	0	—	—	—	—
Belin	1316	306	16	41	9?	+162	—	—	16	50	3	+90	17	16	0	17	44	26	—
Cape Town	1316	210	16	45	15	+100	—	—	—	—	—	—	—	—	—	17	49	42	—
Harvard Univ.	1323	310	16	57	42	+813	—	—	—	—	—	—	—	—	—	17	49	42	—
Tiflis	1354	49	16	45	0	+43	—	—	16	50	28	+139	17	30	37	17	30	43	—
Pulkovo	1296	310	16	44	22?	0	—	—	17	0	15?	+139	17	19	0	17	42	5	S.R. 17h. 6m. 52s.
Ksar	1296	335	16	50	20	+327	—	—	16	50	34	6	...	17	20	0	17	49	0
Beirut	1338	302	16	50	20	+327	—	—	—	—	—	—	...	17	12	0	18	19	0
Konigsberg	1338	302	16	47	2?	+128	—	—	17	0	32?	+97	17	22	30	17	47	0	? S.R. 17h. 8m. 53s.
Czernowitz	1353	334	16	40	26	-274	—	—	16	51	29	-465	17	32	42	17	36	30	—
Lemberg	1357	327	16	41	46	-194	—	—	16	52	36	-391	17	0	46	17	44	46	S.R. 17h. 12m. 46s.

City	S.E.	M.A.	84-3	13 42 55	+23	13 53 25	+21	14 15 0	14 26 0	Notes
Florence			47	13 42 55	+4	13 53 25	+21	14 15 0	14 26 0	
Lisbon			42	13 42 40	+3	13 53 27	+21	14 15 0	14 26 0	
Tripoli			43	13 42 40	+3	13 53 27	+21	14 15 0	14 26 0	
Lahbach			44	13 42 52	+3	13 53 15	+16	14 19 0	14 27 30	Time marks failed.
Graz			42	13 42 52	+3	13 53 24	-12	14 19 0	14 23 42	? Japan.
Pompeii		O.A.	40	13 42 56	+5	13 53 46	+5	14 17 0	14 21 42	
Zagreb			44	13 42 59	+3	13 53 52	+9	14 23 0	14 32 0	
Vienna			41	13 42 57	+2	13 53 50	+9	14 23 0	14 31 0	
Breslau			38	13 42 56	+2	13 53 37	+19	14 11 0	15 24 57	
Bratislava			84	13 42 56	+2	13 53 07	+53	14 26 6	14 26 6	
Kyiv			84	13 43 27	+30	13 53 04	-53	14 9 0	14 30 4	
Budapest			83	13 43 1	-1	13 53 01	-53	14 9 0	14 31 54	
Pulkovo			84	13 43 3	-2	13 54 01	-47	14 21 01	14 40 0	S.R. 14h. 0m. 31s.
Cernowitz			84	13 43 21	-2	13 54 01	-47	14 21 01	14 40 0	
Cape Town			100-5	13 45 0	+43	13 50 07	...	14 41 0	14 41 0	
Helwan, Cairo			103-5	13 45 0	+43	13 50 07	...	14 41 0	14 41 0	
Beirut			103-5	13 45 0	+43	13 50 07	...	14 41 0	14 41 0	
Edinburgh			105-6	13 44 30	+6	13 56 45	+11	14 14 0	14 25 20	5-13N. 72-3W.
Edinburgh			105-6	13 44 30	+6	13 56 45	+11	14 14 0	14 25 20	
Tiflis			109-6	13 44 33	+9	13 59 47	+33	14 6 0	14 41 19	
Baku			112-9	13 44 33	+9	13 59 47	+33	14 6 0	14 41 19	
Irkutsk			120-0	13 44 52	+20	13 57 29	+14	14 14 0	14 33 36	
Tashkent			123-2	13 46 52	+20	13 57 29	+14	14 14 0	14 33 36	
Adelaide			133-2	13 49 11	+203	14 2 20	+187	14 23 0	14 40 28	
Mauritius			135-9	13 39 54	-400	14 2 20	+187	14 23 0	14 40 28	
Zh-Ko-wei			136-6	13 39 54	-400	14 2 20	+187	14 23 0	14 40 28	
Bombay			140-6	13 39 54	-400	14 2 20	+187	14 23 0	14 40 28	
Manila			150-2	13 49 48	...	13 51 18	...	14 41 48	14 46 12	
Kodakamal			150-8	13 49 48	...	13 51 18	...	14 41 48	14 46 12	
Perth			151-9	13 49 48	...	13 51 18	...	14 41 48	14 46 12	
Colombo			154-5	13 54 0	...	14 4 44	...	14 22 0	15 9 40	
Batavia			173-9	13 50 52	...	14 4 44	...	15 0 12	15 2 50	
			286	13 50 52	...	13 56 20	...	14 9 67	15 3 36	

TABLE.

De- grees.	P sec.	S sec.	S - P sec.	De- grees.	P sec.	S sec.	S - P sec.	De- grees.	P sec.	S sec.	S - P sec.
1	15	28	13	51	553	991	438	101	855	1565	710
2	31	55	24	52	560	1004	444	102	860	1575	715
3	47	83	36	53	566	1016	450	103	865	1584	719
4	62	110	48	54	573	1029	456	104	870	1593	723
5	77	137	60	55	579	1041	462	105	874	1602	728
6	92	164	72	56	586	1054	468	106	879	1612	733
7	106	190	84	57	592	1066	474	107	884	1621	737
8	121	217	96	58	599	1079	480	108	888	1630	742
9	136	243	107	59	605	1091	486	109	893	1639	746
10	150	269	119	60	612	1103	491	110	897	1648	751
11	164	294	130	61	619	1116	497	111	902	1657	755
12	179	319	140	62	625	1128	503	112	907	1666	759
13	193	344	151	63	632	1141	509	113	911	1674	763
14	206	368	162	64	638	1153	515	114	916	1682	766
15	219	392	173	65	645	1165	520	115	920	1690	770
16	232	415	183	66	651	1177	526	116	925	1698	773
17	245	438	193	67	658	1190	532	117	929	1706	777
18	257	460	203	68	664	1202	538	118	934	1714	780
19	269	482	213	69	671	1214	543	119	938	1722	784
20	281	503	222	70	677	1226	549	120	942	1729	787
21	293	524	231	71	683	1238	555	121	947	1737	790
22	305	545	240	72	690	1250	560	122	952	1744	792
23	317	565	248	73	696	1262	566	123	957	1752	795
24	328	584	256	74	702	1274	572	124	961	1759	798
25	338	603	265	75	709	1286	577	125	966	1766	800
26	348	622	274	76	715	1297	582	126	970	1773	803
27	358	641	283	77	721	1309	588	127	974	1780	806
28	368	659	291	78	727	1320	593	128	978	1787	809
29	378	677	299	79	733	1332	599	129	983	1794	811
30	388	694	306	80	739	1343	604	130	988	1801	813
31	398	711	313	81	745	1355	610	131	992	1807	815
32	407	728	321	82	750	1366	616	132	996	1814	818
33	416	744	328	83	756	1377	621	133	1001	1821	820
34	425	760	335	84	762	1388	626	134	1005	1827	822
35	433	775	342	85	768	1399	631	135	1009	1833	824
36	442	790	348	86	773	1410	637	136	1014	1840	826
37	450	804	354	87	779	1421	642	137	1018	1846	828
38	458	818	360	88	785	1432	647	138	1023	1852	829
39	466	832	366	89	790	1443	653	139	1027	1858	831
40	475	847	372	90	796	1454	658	140	1031	1864	833
41	483	861	378	91	801	1464	663	141	1035	1869	834
42	491	875	384	92	807	1475	668	142	1039	1875	836
43	498	888	390	93	812	1485	673	143	1043	1881	838
44	506	902	396	94	818	1496	678	144	1047	1886	839
45	513	915	402	95	823	1506	683	145	1051	1892	841
46	520	928	408	96	829	1516	687	146	1055	1897	842
47	527	941	414	97	834	1526	692	147	1059	1902	843
48	534	954	420	98	840	1536	696	148	1063	1907	844
49	540	966	426	99	845	1546	701	149	1067	1912	845
50	547	979	432	100	851	1556	705	150	1071	1917	846

Ekaterinburg	G.	35.4	42	18	9	56	+10	—	18	14	0	-61	18	19	0	—
Irkutsk	G.	60.7	45	—	—	—	—	—	18	22	30.1	—	18	33	0	18 36 11
La Paz	—	94.8	253	—	—	—	—	—	—	—	—	—	—	—	—	—

3

1914. May 18-19.

Origin : 1S. 154E., determined by Pulkovo.

Time at Origin : P = 23h. 42m. 2s. S = 23h. 42m. 0s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.	
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.		
Sydney	E. M.	32.9	184	23	53	42	+285	—	—	—	—	—	—	—	23	58	0	23	59	30	—	
Manila	W.	36.3	297	23	50	41	+75	—	—	—	—	—	—	—	0	2	11	—	—	—	—	
Adelaide	E. M.	36.8	201	23	51	0	+90	—	—	—	—	—	—	—	—	—	—	0	4	6	—	
Osaka	O.	39.8	336	23	50	9	+14	—	—	—	—	—	—	—	—	—	—	0	1	2	—	
Zi-ka-wei	W.	44.6	319	23	51	20	+48	—	—	—	—	—	—	—	—	—	—	0	9	16	—	
Perth	E. M.	47.6	225	—	—	—	—	23	55	0?	—	—	—	—	—	—	—	—	—	—	—	
Batavia	W.	47.8	260	23	51	0	+5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Honolulu	E. M.	51.9	61	23	52	0	+39	—	—	—	—	—	—	—	23	59	54	+71	0	8	46	0 14 12
Irkutsk	G.	67.6	330	23	53	27	+22	—	—	—	—	—	—	—	0	2	39	+42	0	19	0	0 19 20
Victoria	E. M.	85.9	41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5S. 153.1E.
Ekaterinburg	G.	92.7	327	23	55	35	+2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Baku	G.	101.4	311	23	59	8?	+169	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tiflis	G.	104.9	313	—	—	—	—	0	0	24?	—	—	—	—	0	6	38	-4	0	25	0	0 40 16
Pulkovo	G.	107.1	334	—	—	—	—	0	7	46	-23	—	—	—	0	7	46	-23	0	30	0	0 38 30
Konigsberg	W.	114.2	333	23	56	46	0	0	1	12	—	—	—	—	0	7	29	-72	0	31	0	0 39 7
Czernowitz	Ma.	115.1	325	—	—	—	—	0	1	54?	—	—	—	—	0	9	2	0	—	—	—	—
Lemberg	B.O.	115.7	326	23	57	54	+28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Toronto	E. M.	116.0	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ottawa	N. B.	117.8	37	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Helwan	E. M.	118.5	304	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vienna	N. M.	118.5	304	—	—	—	—	—	—	—	—	—	—	—	0	9	0?	-98	—	—	—	—
Graz	W.	120.3	329	0	1	10	+204	—	—	—	—	—	—	—	0	22	0	+682	—	—	—	—
Edinburgh	E. M.	121.5	328	—	—	—	—	—	—	—	—	—	—	—	0	13	54	+182	0	41	0	0 59 0
Eskdalemuir	W.	122.1	345	—	—	—	—	—	—	—	—	—	—	—	0	14	0	+179	0	33	0	0 44 0
Leibsch	G.	122.6	345	—	—	—	—	—	—	—	—	—	—	—	0	33	24	+1279	—	—	—	—
Triest	G.	122.6	328	—	—	—	—	0	3	11?	—	—	—	—	—	—	—	—	—	—	—	—
Aachen	W.	123.3	328	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Heidelberg	W.	123.3	336	0	1	0	+180	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pola	W.	123.8	327	0	2	37?	+276	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
				0	3	42	+340	—	—	—	—	—	—	—	0	16	0	+285	—	—	—	—
				—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

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Stonyhurst	E.	M.	54.4	316	—	—	—	8 47 0	+221	—	9 2 36	—
Edinburgh	E.	M.	54.5	319	—	—	—	8 53 12	+592	—	9 4 0	—
Eskdalemuir	G.	M.	54.6	318	—	—	—	—	—	8 52 0	—	—
Bidston	E.	M.	54.8	316	—	—	—	—	—	8 50 0	—	—
San Fernando	E.	M.	61.1	297	—	—	—	—	—	—	9 8 0	—
	N.	M.	61.1	297	—	—	—	—	—	—	9 5 30	—

7

1914. May 24.

Origin : 10°5S. 10E., determined by Shide.

Time at Origin : P=15h. 56m. 13s. S=15h. 56m. 14s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.		O-C.	PR ₁	S.		O-C.	L.	M.		Remarks.
				H.	M.	s.	s.	H.	M.	s.	s.	H.	M.		s.
Cape Town	E. M.	24.7	163	16	5	0	+192	—	16 7 54	+103	—	16 8 42	—	
Helwan	E. M.	45.3	26	—	—	—	—	—	16 11 42	+9	—	16 22 36	—	
	N. M.	45.3	26	—	—	—	—	—	—	—	—	16 25 0	—	
Granada	C.	49.4	346	16	5	28	+12	16 10 48?	16 12 36	+11	16 24 0	16 26 6	—	
San Fernando	E. M.	49.4	343	—	—	—	—	—	—	—	—	16 29 30	—	
	N. M.	49.4	343	—	—	—	—	—	16 11 0?	-85	—	16 27 30	—	
Beirut	E. M.	50.6	28	—	—	—	—	—	—	—	—	16 20 0	—	
Kara	Ma.	50.7	28	—	—	—	—	—	—	—	—	16 27 29	—	
Barcelona	Ma.	52.3	353	—	—	—	—	—	—	—	—	16 29 50	—	
Florence	A.	54.3	1	—	—	—	—	—	16 12 36?	-26	16 23 38	16 29 50	—	
Moucalieri	S.	55.5	358	16	6	5	+10	—	—	—	—	16 28 18	—	
Triest	W.	56.2	3	16	6	0	0	—	16 13 49	+8	16 19 50	16 33 23	—	
Zagreb	W.	56.5	5	16	6	3	+1	—	16 13 50	0	16 30 30	16 34 0	—	
Laibach	C.	56.7	4	16	6	4	+1	—	16 13 56	+2	16 28 36	16 33 48	—	
Graz	W.	57.8	4	16	6	12	+1	—	16 14 3	+7	16 27 0	16 34 8	—	
Budapest	W.	58.6	7	16	6	14	-2	—	16 14 11	+1	16 28 0	16 33 12	—	
Vienna	W.	59.0	5	16	6	20	+2	—	16 14 19	-1	—	16 33 19	—	
Heidelberg	—	59.9	359	16	6	24	0	—	16 14 25	0	16 26 0	16 32 30	—	
Czernowitz	E. G.	60.4	12	16	6	31	+3	—	16 14 49	+13	16 30 0	16 35 0	—	
Tiflis	G.	61.2	29	16	6	31	-62	—	16 14 44	+2	16 25 0	16 39 0	—	
Aachen	W.	61.4	357	—	—	—	—	—	16 13 47	-65	16 24 30	16 35 30	—	
Breslau	W.	61.9	5	16	6	38	+1	—	16 14 47	-8	—	16 31 0	—	
Shide	E. M.	62.0	352	—	—	—	—	—	—	—	16 33 0	16 35 28	—	
	N. M.	62.0	352	—	—	—	—	—	—	—	—	16 36 0	—	
Kew	E. M.	62.6	353	—	—	—	—	—	16 15 45	+43	—	16 39 0	—	
Baku	G.	62.8	33	16	6	36	-8	—	—	—	—	16 34 0	—	
Bidston	E. M.	64.9	351	16	3	18	-219	—	16 14 56	-16	16 26 0	16 32 15	—	
Stonyhurst	E. M.	65.2	352	—	—	—	—	—	16 13 6	-152	—	16 38 0	—	
Konigsberg	W.	65.9	7	16	6	58	-5	—	—	—	—	16 34 0	—	
Eskdalemuir	G.	66.7	352	16	7	14	+5	—	16 15 52	+2	16 30 36	16 39 18	—	
									16 16 9	+9	—	—	—	

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12S. 3W.

Edinburgh	M.	67.3	352	—	—	—	—	—	—	—	16 42 0	—
Colombo	M.	71.7	79	—	—	—	—	—	—	—	16 36 0	—
Pulkovo	G.	72.2	11	16 7 43	— 1	16 10 20	—	—	—	—	16 41 17	S.R. 16h. 22m. 24s.
La Paz	—	75.8	255	16 8 35	+28	—	16 17 4	— 2	—	—	16 39 0	—
Ekaterinburg	G.	79.1	26	16 8 22	— 5	—	16 19 44?	+115	—	—	16 49 26	—
Irkutsk	G.	100.9	38	16 14 8	+220	—	16 18 14	— 13	—	—	16 37 0	16 45 11
							16 21 34?	+44	—	—	16 48 0	16 51 26

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1914. May 26.

Origin : 0.3S. 138.8E., determined by Pulkovo.

Time at Origin : P = 14h. 23m. 18s. S = 14h. 23m. 19s., but this seems to require correction by about -46s.

Station and Component.	Machine.	Distance ° from Origin.	Azimuth. °	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Manila	W.	23.2	311	14 27 46	— 51	—	—	14 32 0	— 48	14 37 0	14 47 21	—	—	—	—	—	—	—	—	—	—
Batavia	W.	32.5	259	14 29 0	— 69	—	—	14 34 0	— 95	—	—	—	—	—	—	—	—	—	—	—	—
Adelaide	E.	M.	34.5	180	14 31 6	+39	—	14 35 0	— 66	—	14 45 0	—	—	—	—	—	—	—	—	—	—
Osaka	O.	35.2	355	14 29 56	— 37	—	—	14 35 49	— 28	14 38 53	14 50 41	—	—	—	—	—	—	—	—	—	—
Sydney	E.	M.	35.5	162	14 29 18	— 77	—	14 39 30	+189	14 40 12	—	—	—	—	—	—	—	—	—	—	—
Zi-ka-wei	E.	W.	35.6	334	14 29 48	— 48	14 31 44	14 35 28	— 55	—	14 43 59	S.R. 14h. 27m. 24s.	—	—	—	—	—	—	—	—	—
	N.	W.	35.6	334	14 29 46	— 50	14 31 54	14 35 28	— 55	—	14 41 52	S.R. 14h. 37m. 46s.	—	—	—	—	—	—	—	—	—
Perth	E.	M.	38.4	212	14 30 18	— 41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Calcutta	E.	M.	54.1	298	14 31 28	— 84	—	—	—	14 36 33	14 47 14	—	—	—	—	—	—	—	—	—	—
Colombo	E.	M.	59.3	278	14 32 12	— 73	—	14 34 54	— 400	—	14 56 0	—	—	—	—	—	—	—	—	—	—
Irkutsk	G.	60.0	336	14 32 55	— 55	—	—	14 41 13	— 29	14 49 0	14 52 49	1.1S. 143E.	—	—	—	—	—	—	—	—	—
Kodalkanal	E.	M.	61.8	282	14 29 6	— 276	—	—	—	14 35 0	14 59 36	—	—	—	—	—	—	—	—	—	—
Honolulu	E.	M.	65.2	66	14 34 36	+32	—	14 43 48	+62	14 52 12	15 12 18	—	—	—	—	—	—	—	—	—	—
Bombay	E.	M.	67.5	291	14 33 18	— 61	—	—	—	—	15 8 6	—	—	—	—	—	—	—	—	—	—
Ekaterinberg	G.	83.9	327	14 35 18	— 41	—	—	14 45 54	— 32	14 55 0	15 14 44	1S. 141E.	—	—	—	—	—	—	—	—	—
Baku	G.	89.4	310	14 35 32	— 58	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tiflis	G.	93.2	312	14 36 0	— 51	—	—	—	—	15 3 0	15 20 15	—	—	—	—	—	—	—	—	—	—
Victoria	E.	M.	95.1	41	14 43 24	+381	—	—	—	14 49 12	—	—	—	—	—	—	—	—	—	—	—
Berkeley	E.	B.O.	97.2	52	14 40 38	+205	—	—	—	15 18 6	15 22 6	—	—	—	—	—	—	—	—	—	—
Pulkovo	G.	99.5	331	14 37 26	— 0	14 40 34	—	14 49 10	— 0	15 7 0	15 9 55	—	—	—	—	—	—	—	—	—	—
Ksara	M.	100.9	304	14 37 26	— 6	—	—	14 48 19	— 64	14 52 19	15 15 35	—	—	—	—	—	—	—	—	—	—
Beirut	E.	M.	101.2	305	14 40 0	+146	—	—	—	—	15 28 30	—	—	—	—	—	—	—	—	—	—
Czernowitz	M.	105.2	321	14 40 19	+146	—	—	14 51 13	+68	15 8 30	15 15 30	S.R. 14h. 56m. 54s.	—	—	—	—	—	—	—	—	—
Helwan	E.	M.	105.3	301	14 38 18	+25	—	14 51 0	+56	—	15 35 48	—	—	—	—	—	—	—	—	—	—
	N.	M.	105.3	301	—	—	14 40 42?	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Konigsberg	W.	106.2	328	14 36 57	— 61	14 40 52	—	14 48 33	— 100	—	15 29 54	—	—	—	—	—	—	—	—	—	—
Breslau	W.	109.5	326	14 36 42	— 91	14 41 30?	—	—	—	—	15 18 0	—	—	—	—	—	—	—	—	—	—
Budapest	W.	109.8	321	14 40 42	+148	14 41 39	—	14 50 49	+ 4	15 2 0	15 30 44	—	—	—	—	—	—	—	—	—	—
Vienna	W.	111.1	323	14 36 30	— 110	—	—	14 49 3?	— 114	15 14 0	15 24 0	—	—	—	—	—	—	—	—	—	—
Graz	W.	111.2	322	14 40 55	+154	—	—	14 51 33	+35	15 15 0	15 24 47	—	—	—	—	—	—	—	—	—	—

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Zagreb	W.	112-6	321	14 40 54	+147	14 44 39	14 51 49	+39	15 20 0	15 23 42	---	
Laibach	G.	113-2	321	14 41 45	+195	---	14 47 48	-207	---	15 4 26	---	
Triest	W.	113-9	321	14 42 7	+214	14 45 18	14 52 4	+44	15 16 30	15 19 0	S.R. 14h. 58m. 42s.	
Pola	W.	114-2	320	14 42 0	+205	---	14 53 0	+97	15 17 0	15 24 0	---	
Cape Town	E.	M.	114-5	232	---	14 43 30?	14 52 30	-65	---	15 18 36	---	
Innsbruck	Ma.	114-3	324	14 41 40	+184	---	14 52 45	-80	15 17 0	15 21 30	---	
Heidelberg	---	115-2	327	14 42 29	+230	---	14 52 35	-64	15 11 5	15 26 5	---	
Padova	V.	115-2	322	14 42 19	+220	---	14 52 43	+72	15 9 34	15 33 46	---	
Dyce, Aberdeen	Ma.	115-2	348	14 40 0	+81	---	14 54 30	+178	15 16 0	15 26 0	Machine disturbed.	
Pompeii	E.	O.A.	115-5	316	14 42 45	+245	---	---	---	15 31 0	---	
---	N.	O.A.	115-5	316	14 42 1	+201	---	---	---	15 30 0	---	
Aachen	---	115-6	329	14 38 51	+10	14 42 35	14 52 43	+69	15 20 0	15 33 12	S.R. 14h. 57m. 12s.	
Florence	A.	116-3	320	14 34 14	-270	---	14 53 14	+95	14 37 0	15 30 0	---	
Edinburgh	E.	M.	116-5	337	14 39 0	+15	---	---	---	15 37 42	---	
Eskdalemuir	G.	117-0	337	14 47 55?	+548	---	---	---	---	15 2 0	---	
Malta	E.	M.	117-4	311	14 43 0	+251	---	---	---	15 41 0	---	
Stonyhurst	E.	M.	117-7	335	14 43 18	+268	---	14 53 0	+69	15 35 36	---	
Moncalieri	---	117-9	323	14 40 49	+118	---	14 52 20?	+28	15 2 51	15 40 0	---	
Kew	N.	M.	118-3	332	14 43 12	+259	---	---	---	15 39 22	---	
West Bromwich	M.	118-4	334	14 43 6	+252	---	14 51 48	-8	---	15 29 42	---	
Guildford	E.	M.	118-6	332	14 43 16	+262	---	14 55 38	+240	15 39 22	---	
Bidston	E.	M.	119-0	335	14 42 54	+238	---	14 52 6	+5	15 27 0	---	
Shide	E.	M.	119-3	332	14 39 0	+3	14 46 0	-63	15 23 0	15 37 42	---	
---	N.	M.	119-3	332	---	---	14 45 0	14 52 30	+27	15 19 0	15 34 0	---
St. Louis	W.	121-1	44	---	---	---	---	---	---	15 30 15	15 41 46	---
Cork	E.	M.	121-6	337	---	---	---	---	---	15 51 0	15 38 14	---
Barcelona	E.	Ma.	122-9	322	14 43 24	+250	---	14 59 43	+433	15 23 28	16 20 36	---
Toronto	E.	M.	124-9	33	14 45 30	+367	---	---	---	15 29 12	---	---
Ottawa	E.	B.	125-6	29	14 42 3	+157	---	14 46 6	+403	15 1 4	---	---
---	N.	B.	125-6	29	---	---	---	14 46 7	+404	15 1 6	---	---
Granada	C.	129-4	321	14 43 4	+201	14 49 52?	14 55 52	+157	15 27 48	15 52 0	---	---
Harvard Univ.	E.	B.O.	130-1	29	14 44 17	+271	---	---	---	15 30 42	---	---
---	N.	B.O.	130-1	29	14 37 18	-148	---	14 57 46?	+235	15 29 18	---	---
Rio Tinto	E.	M.	130-8	324	14 43 0	+191	---	---	---	---	15 45 0	---
San Fernando	E.	---	131-5	322	14 41 0?	+68	---	15 1 0?	+451	---	15 42 30	---
---	N.	---	131-5	322	14 41 0?	+68	---	15 2 0?	+511	---	---	---
Azores	E.	M.	140-0	341	14 45 24	+295	---	---	---	---	15 58 6	---
St. Helena	E.	M.	141-4	244	14 41 30	+55	---	14 59 0	+270	---	15 56 30	---
Port-au-Prince	B.O.	144-4	57	14 42 36	+109	---	---	---	---	15 35 0	---	---
La Paz	---	148-5	124	14 42 45	+102	---	15 0 30	+322	15 31 45	15 51 27	---	---
Ascension	E.	M.	152-1	258	14 38 0	---	---	---	---	14 57 0	---	---

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1914. May 28.

Origin : 15°1'N. 84°8'W., determined by Pulkovo.

Time at Origin : P=3h. 23m. 51s. S=3h. 23m. 51s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	s.	s.	H.	M.	s.	H.	M.	s.	s.	H.	M.	s.	H.	M.	s.	
Port-au-Prince	B.O.	12-3	74	---	---	---	---	---	---	---	---	---	---	3 27 18	---	---	3 27 21	---	---	---	
Toronto	E.	M.	29-0	8	---	---	---	---	---	---	---	---	---	3 43 42	---	---	3 44 42	---	---	---	
Harvard Univ.	E.	B.O.	29-7	21	3 30 39	+23	---	3 31 41	---	3 36 42	+94	---	---	3 39 9	---	---	---	---	---	---	
---	N.	B.O.	29-7	21	3 30 39	+23	---	---	3 35 1	-16	---	---	---	3 40 37	---	---	---	---	---	---	
Ottawa	E.	B.	31-3	12	3 31 9	+37	---	3 32 18	---	3 36 44	+60	---	---	3 40 24	---	---	---	---	---	---	
---	N.	B.	31-3	12	3 31 22	+50	---	---	---	3 36 57	+73	---	---	3 42 30	---	---	---	---	---	---	
La Paz	---	---	35-5	152	3 30 4	-58	---	---	---	3 34 47	-126	---	---	3 38 23	---	---	3 43 0	---	---	---	
Berkeley	---	---	40-1	48	3 32 40	+54	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Victoria	E.	M.	45-9	325	---	---	---	---	---	3 41 18	+120	---	---	3 55 6	---	---	---	---	---	---	
Azores	E.	M.	56-5	55	---	---	---	---	---	3 42 18	+47	---	---	---	---	---	---	---	---	---	
Honolulu	E.	M.	69-4	288	3 36 18	+74	---	---	---	3 47 0	-170	---	4 1 12	---	---	4 9 24	---	---	---	---	
San Fernando	E.	M.	72-0	56	---	---	---	---	---	3 42 30	-131	---	---	---	---	4 8 30	---	---	---	---	
---	N.	M.	72-0	56	---	---	---	---	---	---	---	---	---	---	---	4 11 0	---	---	---	---	
Rio Tinto	E.	M.	72-3	54	3 42 0	+397	---	---	---	---	---	---	---	---	---	4 4 0	---	---	---	---	
Eskdalemuir	G.	72-9	36	3 35 27	+1	---	---	---	---	3 44 54	+2	---	3 58 30	---	---	---	---	---	---	9N. 76-5W.	
Edinburgh	E.	M.	72-9	35	---	---	---	---	---	3 45 0	+8	---	---	---	---	4 10 36	---	---	---	---	
Bidston	E.	M.	73-1	38	3 35 48	+20	---	---	---	3 45 36	+42	---	---	---	---	4 4 0	---	---	---	---	
Stonyhurst	E.	M.	73-3	38	3 35 24	-5	---	---	---	3 45 30	+33	---	---	---	---	4 4 0	---	---	---	---	
Dyce, Aberdeen	Ma.	73-4	34	3 35 30	+1	---	---	---	---	3 45 0	+2	---	3 55 0	---	---	4 5 0	---	---	---	---	
West Bromwich	M.	73-8	39	3 35 42	+10	---	---	---	---	3 45 0	-3	---	---	---	---	4 7 0	---	---	---	---	
Kew	E.	M.	73-9	40	---	---	---	---	---	3 43 30?	-274	---	---	---	---	4 9 24	---	---	---	---	
Granada	C.	74-0	55	3 35 23	-10	---	---	---	---	3 44 44	-21	---	3 55 0	---	---	4 0 15	---	---	---	---	
Shide	E.	M.	74-3	41	---	---	---	---	---	3 45 10	+1	---	---	---	---	4 6 30	---	---	---	---	
Guildford	M.	74-6	40	3 35 12	-25	---	---	---	---	---	---	---	---	---	---	4 7 48	---	---	---	---	
Barcelona	Ma.	78-3	50	3 35 41	-19	---	---	---	---	3 45 27	-27	---	3 55 9	---	---	---	---	---	---	---	
Aachen	W.	78-9	40	3 35 56	-7	---	---	---	---	3 45 58	-4	---	---	---	---	4 1 0	---	---	---	---	
Heidelberg	---	80-6	41	3 30 0	-374	---	---	---	---	3 46 5	-16	---	4 2 0	---	---	4 10 29	---	---	---	---	
Moncalieri	S.	81-1	46	3 36 11	-5	---	---	---	---	3 46 15	-11	---	3 51 15	---	---	4 10 35	---	---	---	---	
Innsbruck	Ma.	83-0	43	3 36 16	-11	---	---	---	---	3 46 31	-17	---	4 2 0	---	---	---	---	---	---	---	
Florence	A.	83-8	46	3 36 23	-9	---	---	---	---	3 46 41	-15	---	---	---	---	4 0 11	---	---	---	---	

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Padova	V.	83-8	45	3 36 22	-10	—	—	—	—	—	—	—	—	—	—	—	—
Triest	W.	85-1	44	3 36 32	-7	—	—	3 47 16	+5	3 58 54	4 12 0	—	—	—	—	—	—
Pola	W.	85-3	45	3 36 31	-10	—	—	3 46 52	-21	4 8 0	4 12 0	—	—	—	—	—	—
Laiibach	G.	85-4	43	3 36 34	-7	—	—	3 46 59	-15	4 0 0	4 0 30	—	—	—	—	—	—
Breslau	W.	85-5	38	3 36 29	-12	—	—	3 46 57	-18	4 8 0	4 14 0	—	—	—	—	—	—
Graz	W.	85-8	44	3 36 31	-12	—	—	3 46 59	-20	3 56 0	4 5 6	—	—	—	—	—	—
Vienna	W.	86-0	41	3 36 34	-10	—	—	3 47 7	-14	4 3 0	4 8 0	—	—	—	—	—	—
Konigsberg	W.	86-2	34	3 36 39	-6	—	—	3 47 13	-10	4 3 36	4 12 36	—	—	—	—	—	—
Zagreb	W.	86-3	43	3 36 41	-5	—	—	3 47 7	-17	4 6 0	4 13 0	—	—	—	—	—	—
Budapest	W.	88-0	41	3 36 43	-13	—	—	3 47 24	-19	4 1 0	4 12 38	—	—	—	—	—	—
Pulkovo	G.	88-0	27	3 37 0	0	3 40 30	—	3 47 53	0	4 3 0	4 8 38	—	—	—	—	—	—
Czernowitz	Ma.	91-9	39	3 37 0	-17	—	—	3 48 0	-25	4 7 0	4 12 0	—	—	—	—	—	—
Ekaterinburg	G.	102-5	19	3 38 3	-10	3 42 26	—	3 50 2	-8	4 7 0	4 20 54	—	—	—	—	—	—
Helwan	{ E. M.	103-3	53	—	—	—	—	3 49 0?	-82	—	4 30 0	—	—	—	—	—	—
	{ N. M.	103-8	53	—	—	—	—	3 48 0?	-142	—	—	—	—	—	—	—	—
Beirut	E. M.	105-0	48	—	—	—	—	—	—	—	4 25 0	—	—	—	—	—	—
Tifis	G.	106-6	37	3 37 10	-83	3 41 40?	—	3 51 16?	+28	3 57 0	4 17 58	—	—	—	—	—	—
Cape Town	E. M.	109-3	121	—	—	—	—	—	—	—	4 21 48	—	—	—	—	—	—
Osaka	O.	117-2	323	—	—	—	—	3 56 6?	+227	4 11 54	4 18 36	—	—	—	—	—	—
Zi-ka-wei	W.	127-3	332	3 45 37	+331	—	—	—	—	—	4 46 20	—	—	—	—	—	—
Adelaide	E. M.	136-4	235	—	—	—	—	—	—	—	4 39 42	—	—	—	—	—	—

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1914. May 28.

Origin: 39-7N. 36E., determined by Pulkovo.

Time at Origin: P=11h. 27m. 19s. S=11h. 27m. 22s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Beirut	E. M.	5-8	184	11 29 30	+42	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ksara	{ E. Ma.	5-9	181	11 28 58	+9	—	—	—	—	11 30 18	+15	11 30 58	—	11 30 58	—	—	—	11 30 0	—	—	—
	{ N. Ma.	5-9	181	11 28 58	+9	—	—	—	—	11 30 20	+17	11 30 58	—	11 30 58	—	—	—	11 32 9	—	—	—
Tifis	G.	8-9	72	11 29 13	-21	—	—	—	—	11 30 54	-22	11 31 24	—	11 31 24	—	—	—	11 31 53	—	—	—
Helwan	{ E. M.	10-5	203	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11 39 0	—	—	—
	{ N. M.	10-5	203	11 29 0	-56	—	—	—	—	—	—	—	—	—	—	—	—	11 40 0	—	—	—
Czernowitz	Ma.	11-3	324	11 30 5	-2	—	—	—	—	11 32 6	-17	11 32 30	—	11 32 30	—	—	—	11 37 0	—	—	—
Graz	W.	14-4	308	11 31 29	+30	—	—	—	—	11 34 39	+59	11 36 24	—	11 36 24	—	—	—	11 38 25	—	—	—
Budapest	W.	14-5	308	11 30 52	+1	—	—	—	—	11 33 57	+15	11 35 57	—	11 35 57	—	—	—	11 37 42	—	—	—
Zagreb	W.	16-0	299	11 31 8	-3	—	—	—	—	11 34 8	-9	11 35 56	—	11 35 56	—	—	—	11 37 24	—	—	—
Vienna	W.	16-4	308	11 31 19	+3	—	—	—	—	11 34 37	+14	11 36 48	—	11 36 48	—	—	—	11 40 0	—	—	—
Laiibach	G.	16-9	299	11 31 24	+1	—	—	—	—	11 34 33	-5	11 36 0?	—	11 36 0?	—	—	—	11 36 59	—	—	—
Pola	W.	17-2	295	11 31 6	-20	—	—	—	—	11 34 48	+4	11 36 48	—	11 36 48	—	—	—	11 37 20	—	—	—
Triest	W.	17-3	297	11 31 29	+1	—	—	—	—	11 34 53	+6	11 37 24	—	11 37 24	—	—	—	11 38 0	—	—	—
Breslau	W.	17-5	317	11 31 23	-7	—	—	—	—	11 34 52	+1	—	—	—	—	—	—	11 38 0	—	—	—
Konigsberg	W.	18-3	331	11 31 37	-3	—	—	—	—	11 35 13	+4	11 38 30	—	11 38 30	—	—	—	11 43 30	—	—	—
Padova	V.	18-6	296	11 31 49	+6	—	—	—	—	11 38 58	+223	—	—	—	—	—	—	—	—	—	—
Florence	A.	18-9	291	11 32 1	+14	—	—	—	—	11 36 0	+38	—	—	—	—	—	—	—	—	—	—
Innsbruck	S.E. Ma.	19-3	301	11 31 51	-1	—	—	—	—	11 35 35	+5	11 38 0	—	11 38 0	—	—	—	11 38 41	—	—	—
Pulkovo	G.	20-4	352	11 32 5	0	—	—	—	—	11 35 53	0	11 37 30	—	11 37 30	—	—	—	11 40 0	—	—	—
Moncalieri	S.	21-5	294	11 32 13	-5	—	—	—	—	11 35 10	-6	11 39 26	—	11 39 26	—	—	—	11 41 23	—	—	—
Heidelberg	G.	21-8	306	11 32 12	-10	—	—	—	—	11 35 12	-11	11 40 21	—	11 40 21	—	—	—	11 43 35	—	—	—
Ekaterinburg	G.	23-5	35	11 32 40	-1	—	—	—	—	11 36 52	-4	11 38 0	—	11 38 0	—	—	—	11 41 0	—	—	—
Aachen	W.	23-6	308	11 32 36?	-7	—	—	—	—	11 36 58	0	11 40 0	—	11 40 0	—	—	—	11 44 52	—	—	—
Barcelona	W.	25-1	285	11 32 40	-18	—	—	—	—	11 39 6?	+99	11 40 51	—	11 40 51	—	—	—	11 42 0	—	—	—
Kew	E. M.	27-7	309	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11 43 20	—	—	—
Guildford	M.	27-8	307	11 33 42?	-17	—	—	—	—	11 38 24?	+7	11 43 50	—	11 43 50	—	—	—	11 44 48	—	—	—
Shide	{ E. M.	28-1	305	11 33 0	-28	—	—	—	—	11 38 0	-28	—	—	—	—	—	—	11 47 0	—	—	—
	{ N. M.	28-1	305	—	—	—	—	—	—	11 38 0	-28	—	—	—	—	—	—	11 47 30	—	—	—
Bidston	E. M.	29-7	311	11 34 12	+28	—	—	—	—	11 38 18	-33	—	—	—	—	—	—	11 48 0	—	—	—

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Eskdalemuir		G.	30.2	314	—	...	—	11 38 0	-59	11 43 0	—	—
Edinburgh	E.	M.	30.3	315	—	...	—	11 38 48	-13	—	11 50 12	—
Granada		C.	30.9	279	11 34 6	+10	—	11 39 54	+43	11 43 0	11 46 34	—
San Fernando	{	M.	33.1	279	—	...	—	11 44 0	+252	—	11 48 0	—
	N.	M.	33.1	279	—	...	—	11 43 0	+192	—	11 50 0	—
Cape Town	E.	M.	75.4	195	—	...	—	—	...	—	12 9 30	—

1914. May 29.

Origin : 1N. 95°6E., determined by Pulkovo.

Time at Origin : P=4h. 47m. 20s. S=4h. 47m. 21s.

Station and Component.	Machine.	Distance from Origin.		Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
		H.	M.		S.	H.	M.		S.	H.	M.	S.	H.	M.		S.	H.	M.	S.			
Batavia	W.	13.3	123	—	4	49	58	-39	—	—	—	4	52	43	-29	—	—	—	—	—	—	—
Colombo	E.	M.	16.9	292	—	—	—	...	—	—	—	4	52	30	-127	—	—	—	5	0	0	—
Kodalkanal	E.	M.	20.1	297	4	46	0?	-362	—	—	—	—	—	—	—	—	—	—	5	1	48	—
Calcutta	E.	M.	22.6	342	4	52	40	+8	—	—	—	—	—	—	—	4	56	44	5	7	56	—
Manila	W.	M.	25.5	69	4	53	3	-30	—	—	—	4	58	0?	-29	5	3	41	5	8	36	—
Bombay	E.	M.	28.7	310	4	54	24	+59	—	—	—	—	—	—	—	—	—	—	5	6	48	—
Perth	E.	M.	38.1	152	—	—	—	...	—	—	—	5	0	0?	-65	—	—	—	5	15	0	—
Zi-ka-wei	{	W.	38.9	36	4	54	33	-32	—	—	—	5	0	33	-39	5	5	9	5	12	3	—
	N.	W.	38.9	36	4	54	35	-30	—	—	—	5	0	34	-38	5	5	9	5	11	41	—
Irkutsk	E.	G.	51.8	7	4	56	28	-11	—	—	—	5	3	49	-13	5	13	0	5	16	26	1°8N. 114°1E.
Adelaide	E.	M.	53.9	136	4	56	48	-4	—	—	—	5	4	0	-29	—	—	—	5	25	18	—
Tiflis	G.	M.	61.1	319	4	37	33	-7	—	—	—	5	6	8	+10	5	13	0	5	26	7	—
Ekaterrinburg	G.	M.	62.5	359	4	37	46	-2	—	—	—	5	6	16	+1	5	15	0	5	18	36	1°9N. 99°8E.
Sydney	E.	M.	62.9	130	4	57	42	-9	—	—	—	5	5	48	-33	5	23	18	5	26	6	—
Ksara	{	Ma.	64.6	307	4	57	59	-3	—	—	—	5	7	9	+28	—	—	—	—	—	—	—
	N.	Ma.	64.6	307	4	58	28	+26	—	—	—	5	7	9	+28	—	—	—	5	23	3	—
Beirut	E.	M.	64.9	307	4	57	30	-34	—	—	—	—	—	—	—	—	—	—	5	24	30	—
Helwan	{	M.	67.4	302	4	58	48	+28	—	—	—	5	12	12	+296	—	—	—	5	31	0	—
	N.	M.	67.4	302	4	59	24	+64	—	—	—	5	7	54	+38	—	—	—	5	41	48	—
Czernowitz	Ma.	M.	75.9	320	4	59	15	+1	—	—	—	5	9	4	+7	5	23	0	5	39	0	—
Pulkovo	G.	M.	77.0	332	4	59	21	0	5	2	14	5	9	10	0	5	24	0	5	38	43	S.R. 5h. 14m. 18s.
Florence	A.	M.	78.1	315	—	—	—	...	5	3	0?	5	10	40	+68	—	—	—	5	32	0	—
Cape Town	E.	M.	79.3	235	5	7	24?	+466	—	—	—	—	—	—	—	—	—	—	5	39	54	—
Budapest	W.	M.	80.2	318	4	59	42	+2	—	—	—	5	9	50	+4	5	23	2	5	42	4	—
Konigsberg	W.	M.	80.7	326	4	59	30	-13	—	—	—	5	9	51	-1	5	21	42	5	20	30	S.R. 5h. 15m. 41s.
Breslau	W.	M.	82.1	322	4	59	45	-6	—	—	—	5	9	57	-21	5	30	0	5	46	0	—
Vienna	W.	M.	82.1	319	4	59	49	-2	—	—	—	5	10	12	-6	5	28	0	5	42	0	—
Malta	E.	M.	82.2	306	—	—	—	...	5	8	0?	—	—	—	—	—	—	—	5	41	30	—
Zagreb	W.	M.	82.3	316	4	59	48	-4	—	—	—	5	10	8	-2	5	28	0	5	42	0	—
Graz	W.	M.	82.6	317	4	59	53	-2	—	—	—	5	10	13	-1	5	27	6	—	—	—	—

Locality	Lat. N.	Long. W.	Mag.	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time
Pompeii	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Laibach	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Onk	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Trieste	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Padova	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Innsbruck	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Heidelberg	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Monscalieri	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Aachen	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Barcelona	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Kew	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Dyce, Aberdeen	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Shide	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
West Bromwich	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Stonyhurst	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Edinburgh	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Eskdalemuir	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Bidston	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Granada	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
San Fernando	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Rio Tinto	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
St. Helena	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Honolulu	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Victoria	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Ottawa	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Harvard Univ.	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Toronto	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
La Paz	42°6'	13°11'	W.	100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

TABLE.

De-grees.	P sec.	S sec.	S - P sec.	De-grees.	P sec.	S sec.	S - P sec.	De-grees.	P sec.	S sec.	S - P sec.
1	15	28	13	51	553	991	438	101	855	1565	710
2	31	55	24	52	560	1004	444	102	860	1575	715
3	47	83	36	53	566	1016	450	103	865	1584	719
4	62	110	48	54	573	1029	456	104	870	1593	723
5	77	137	60	55	579	1041	462	105	874	1602	728
6	92	164	72	56	586	1054	468	106	879	1612	733
7	106	190	84	57	592	1066	474	107	884	1621	737
8	121	217	96	58	599	1079	480	108	888	1630	742
9	136	243	107	59	605	1091	486	109	893	1639	746
10	150	269	119	60	612	1103	491	110	897	1648	751
11	164	294	130	61	619	1116	497	111	902	1657	755
12	179	319	140	62	625	1128	503	112	907	1666	759
13	193	344	151	63	632	1141	509	113	911	1674	763
14	206	368	162	64	638	1153	515	114	916	1682	766
15	219	392	173	65	645	1165	520	115	920	1690	770
16	232	415	183	66	651	1177	526	116	925	1698	773
17	245	438	193	67	658	1190	532	117	929	1706	777
18	257	460	203	68	664	1202	538	118	934	1714	780
19	269	482	213	69	671	1214	543	119	938	1722	784
20	281	503	222	70	677	1226	549	120	942	1729	787
21	293	524	231	71	683	1238	555	121	947	1737	790
22	305	545	240	72	690	1250	560	122	952	1744	792
23	317	565	248	73	696	1262	566	123	957	1752	795
24	328	584	256	74	702	1274	572	124	961	1759	798
25	338	603	265	75	709	1286	577	125	966	1766	800
26	348	622	274	76	715	1297	582	126	970	1773	803
27	358	641	283	77	721	1309	588	127	974	1780	806
28	368	659	291	78	727	1320	593	128	978	1787	809
29	378	677	299	79	733	1332	599	129	983	1794	811
30	388	694	306	80	739	1343	604	130	988	1801	813
31	398	711	313	81	745	1355	610	131	992	1807	815
32	407	728	321	82	750	1366	616	132	996	1814	818
33	416	744	328	83	756	1377	621	133	1001	1821	820
34	425	760	335	84	762	1388	626	134	1005	1827	822
35	433	775	342	85	768	1399	631	135	1009	1833	824
36	442	790	348	86	773	1410	637	136	1014	1840	826
37	450	804	354	87	779	1421	642	137	1018	1846	828
38	458	818	360	88	785	1432	647	138	1023	1852	829
39	466	832	366	89	790	1443	653	139	1027	1858	831
40	475	847	372	90	796	1454	658	140	1031	1864	833
41	483	861	378	91	801	1464	663	141	1035	1869	834
42	491	875	384	92	807	1475	668	142	1039	1875	836
43	498	888	390	93	812	1485	673	143	1043	1881	838
44	506	902	396	94	818	1496	678	144	1047	1886	839
45	513	915	402	95	823	1506	683	145	1051	1892	841
46	520	928	408	96	829	1516	687	146	1055	1897	842
47	527	941	414	97	834	1526	692	147	1059	1902	843
48	534	954	420	98	840	1536	696	148	1063	1907	844
49	540	966	426	99	845	1546	701	149	1067	1912	845
50	547	979	432	100	851	1556	705	150	1071	1917	846

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OXFORD.

Monthly Bulletin for June, 1914.

For the large Earthquakes an attempt is here made to compare the readings with theoretical values, as explained in the Nineteenth Report of the Committee to the British Association. The position of the epicentre is adopted from the Pulkovo determination, unless otherwise stated; and the tables of times for P and S are those given by Galitzin in his "Vorlesungen über Seismometrie," p. 137, or by G. W. Walker on p. 54 of his "Modern Seismology." It is shown in the above Report that these tables are sensibly erroneous: but the precise values of the corrections are under discussion and it seems better to await the definitive corrections than to introduce provisional tables. The tables are reproduced in an expanded form on page 10 of this Bulletin. The time of the earthquake at the epicentre is deduced from the Pulkovo records; and applying the tabular times for the distances in the third column (calculated and also measured from a large globe specially made for the purpose), the errors O - C of the observed times are found.

Observers are requested to send a copy of their Registers to Shide *each month*, in order that this collated information may be published as early as possible.

In the Earthquake Chart the stations are arranged in the order of longitude, starting from the Azores and travelling eastward. For the large earthquakes they are arranged in the order of distance from epicentre, as shown in the 3rd column. The azimuth in the 4th column is also read from the globe; and is the azimuth at the epicentre measured from N. towards E., in which the observing station lies.

The letters in the 2nd column stand for: A. = Alfani; Aga. = Agamennone; B. = Bosch; Bif. = Bifilar; B.O. = Bosch-Omori; C. = Cartuja; Ca. = Cancani; C.O. = Cartuja-Omori; G. = Galitzin; L. = Luckmann; M. = Milne; Ma. = Mainka; M.S. = Milne-Shaw; O.A. = Omori-Alfani; S. = Stiattesi; V. = Vincentini; W. = Wiechert.

Guildford and West Bromwich use a modification of the Milne. Hamburg uses machines by Wiechert and von Rebeur-Paschwitz-Hecker. Heidelberg's machine is an astatic pendulum made at the Observatory. Riverview has two Wiecherts and one Mainka.

1914. June 19.
Origin : 64.1N. 27.5W., determined by Shide.
Time at Origin : 0h. 6m. 15s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.		O - C.		PR ₁	S.		O - C.		L.		M.		Remarks.		
				H.	M.	S.	H.		M.	S.	H.	M.	S.	H.	M.	S.			
Dyce, Aberdeen	Ma.	14.1	108	0	9	44	+ 2		0	13	30	+55	0	13	30	0	15	0	44.5N. 9.3E.
Edinburgh	M.	14.5	113	0	9	56	+ 7		0	12	56	+19	0	16	0	0	16	0	
Eschalemtur.	G.	14.6	112																
Edison	M.	16.4	119																
Edinburgh	M.	16.9	118																
Shide, Hurst	M.S.	17.1	121																
Amberg	W.	22.0	121	0	11	30	0		0	15	0	+24	0	14	30	0	17	0	
Pulkovo	G.	26.5	73	0	12	10	+ 2		0	15	20	0	0	16	30	0	18	0	
Moncalieri	S.	27.3	117						0	16	46	+ 1	0	20	0	0	20	17	
Barcelona	W.	28.7	128						0	17	47	-23	0	21	27	0	23	35	
Craz	W.	28.8	105	0	12	31	0		0	17	25	-11	0	24	0	0	23	42	63.2N. 25.4W.
Leibach	G.	29.2	108						0	17	24	0	0	23	0	0	27	9	
Triest	G.	29.3	109						0	17	42	0	0	21	30	0	25	30	
Vienna	W.	29.8	110						0	17	18	-29	0	23	0	0	25	18	
Zagreb	W.	29.9	107						0	17	0	0	0	22	0				
St. Petersburg	W.	30.0	101						0	17	0	0	0	21	0				
San Fernando	M.	30.5	145	0	12	55	0		0	18	6	+ 9	0	21	48	0	25	58	
Granada	C.	32.4	95						0	20	23	-7	0	19	0				
Czernowitz	G.	40.6	57	0	14	18	- 2		0	20	23	0	0	19	0				
Ekatereburg	G.	45.8	83	0	33	24	0		0	20	23	0	0	22	0				
Tiflis	G.																		

Helwan	E.	M.	132.9	302	—	...	7 42 0?	—	...	—	9 14 0	—
	N.	M.	132.9	302	—	...	7 41 0?	—	...	—	9 7 0	—
Budapest	E.	W.	133.0	329	7 39 42	+165	7 43 20?	—	...	—	8 32 23	—
Edinburgh	E.	M.	133.3	351	—	...	7 43 0?	—	...	—	8 59 30	—
Eskdalemuir	E.	G.	133.8	351	7 39 34	+154	—	—	...	—	—	—
Graz	E.	W.	135.0	331	7 39 37	+152	—	—	...	—	—	—
Stonyhurst	E.	M.	135.2	350	7 42 36	+330	7 43 16?	7 50 0	-49	8 22 0	8 33 20	—
Bidston	E.	M.	135.6	350	7 40 0	+171	—	—	...	8 30 42	8 39 0	—
Aachen	E.	W.	135.8	341	7 39 33	+144	7 42 48	7 48 18	-155	—	8 14 42	—
Zagreb	E.	W.	135.9	330	7 39 37	+147	—	—	...	8 22 0	8 40 0	—
Laibach	E.	G.	136.2	331	7 39 35	+144	7 43 21?	7 49 22	-92	8 19 0	8 39 0	—
West Bromwich	E.	M.	136.3	349	7 38 36	+84	—	—	...	8 30 0	8 51 30	—
Innsbruck	E.	Ma.	136.8	334	7 39 47	+151	—	—	...	—	8 45 0	—
	N.	Ma.	136.8	334	—	—	—	7 51 46	+45	8 24 30	—	—
Kew	E.	M.	136.9	347	7 33 0	-254	—	—	...	—	—	—
Guildford	E.	M.	137.2	347	7 40 15	-180	—	—	...	—	—	—
Pola	E.	W.	137.4	330	—	...	7 42 51?	7 54 18	+194	8 35 45	8 43 54	—
Shide	E.	M.	137.9	347	—	...	7 44 45?	—	...	8 24 0	8 44 3	—
Padova	E.	V.	138.0	332	7 39 41	+142	—	—	...	—	8 41 0	?
Triest	E.	W.	138.2	330	7 39 36	+136	7 43 18	7 48 57	-131	—	—	S.R. 7h. 57m. 0s.
Florence	E.	A.	139.3	331	7 39 47	+142	—	7 53 24	+135	8 30 0	—	—
Monte Cassino	E.	Ca.	139.9	327	7 40 6	+153	—	—	...	8 32 0	8 36 0	—
Pompeii	N.	O.A.	140.0	325	7 39 44	-137	—	—	...	—	—	—
	E.	O.A.	140.0	325	7 39 47	+140	—	—	...	7 50 0	—	—
Moncalieri	E.	S.	140.1	335	—	...	7 43 14?	7 58 43	+442	8 26 10	8 40 47	—
Malta	E.	M.	143.1	319	—	...	—	—	...	—	—	—
Barcelona		Ma.	145.1	337	7 40 2	+135	—	—	...	8 24 44	8 59 51	—
Granada		C.	151.1	342	7 40 13	...	—	—	...	8 10 0	9 0 24	—
Rio Tinto	E.	M.	152.3	349	7 40 30	...	—	—	...	—	9 2 0	—
San Fernando	N.	M.	152.5	349	7 40 30	...	—	—	...	—	9 10 0	—
	E.	M.	152.5	349	7 42 0	...	—	—	...	—	9 9 0	—

Paper changed during quake.

1914. June 25.

Origin : 4.5S. 99E., determined by Shide.

Time at Origin : 19h. 6m. 44s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	s.	s.	H.	M.	s.	H.	M.	s.	s.	H.	M.	s.	H.	M.	s.	
Batavia	W.	7.7	89	19 8 40	0	—	Pens thrown	—	—	—	—	—	—	—	—	—	—	—	—	4.2S. 102E.	
Colombo	E.	M.	22.2	300	19 12 48	+57	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Kodakamal	E.	M.	20.0	305	19 12 42	+10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Manila	W.	M.	28.9	49	19 13 2	+1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Calcutta	E.	M.	28.9	339	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Perth	E.	M.	31.6	152	19 13 30	+3	19 15 0?	—	—	—	—	—	—	—	—	—	—	—	—	—	
Bombay	E.	M.	34.7	313	19 13 12?	-43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Zi-ka-wei	E.	W.	41.6	29	19 14 51	-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Seychelles	E.	M.	43.8	268	19 15 30	+22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Adelaide	E.	M.	47.5	135	19 15 48	+14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Osaka	O.	M.	52.1	38	19 16 19	+14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Sydney	E.	M.	56.6	128	19 16 30	-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Tiflis	G.	M.	67.5	319	19 18 25	+40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Beirut	E.	M.	71.0	308	19 19 0	+53	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Helwan	E.	M.	73.3	303	19 19 12	+50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	N.	M.	73.3	303	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Cape Town	E.	M.	79.6	236	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Czernowitz	E.	Ma.	82.3	320	19 19 47	+31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Pulkovo	G.	M.	83.4	332	19 19 51	+29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Budapest	E.	W.	80.5	318	19 20 13	+33	19 23 22	—	—	—	—	—	—	—	—	—	—	—	—	—	
Malta	E.	M.	82.2	306	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Zagreb	W.	M.	88.5	316	19 20 22	+21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Pompeii	E.	O.A.	88.7	311	19 20 25	+33	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	N.	O.A.	88.7	311	19 20 23	+31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Graz	W.	M.	88.9	317	19 20 20	+27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Monte Cassino	Ca.	M.	89.4	312	19 20 30	+34	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Pola	W.	M.	89.8	315	19 20 29	+21	19 23 49	—	—	—	—	—	—	—	—	—	—	—	—	—	
Triest	W.	M.	89.9	316	19 20 27	+28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Padova	V.	M.	91.2	315	19 20 35	+29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

S.R. 19h. 35m. 38s.

Sumatra, 2.3S. 100.3E.

Sumatra.

Sumatra.

S.R. 19h. 37m. 46s.

Florence	(E. A.)	91-5	314	19 20 43	+35	—	—	—	—	—	—	19 43 19	20 0 0	—
Innsbruck	(S. A.)	91-5	314	19 20 44	+36	—	—	19 30 19	-54	—	—	19 45 19	19 55 0	—
Moncalieri	(S. Ma.)	91-7	317	19 20 38	+28	—	—	19 31 2	-14	—	—	19 31 30	19 54 30	—
Aachen	(W.)	95-3	321	19 20 52	+23	19 24 48	—	19 31 36	-5	—	—	19 41 0	20 7 0	—
Barcelona	(Ma.)	97-6	311	19 21 7	+25	19 24 29	—	19 31 22	-31	—	—	19 40 0	19 58 0	Near Sumatra.
Kew	(M.)	99-3	322	—	—	—	—	19 31 40	-36	—	—	19 47 57	19 58 0	Sumatra.
Guildford	(E. M.)	99-5	321	19 20 23	-29	—	—	—	—	—	—	—	20 14 12	—
Dyce, Aberdeen	(E. Ma.)	99-9	327	19 21 0	+6	—	—	19 31 18	-77	—	—	19 54 0	19 59 0	—
Shide	(E. M.S.)	100-0	321	19 21 15	-20	19 25 36	—	19 31 42	-57	—	—	20 0 0	20 18 0	—
West Bromwich	(E. M.)	100-0	321	19 21 32	+37	19 25 50	—	19 32 0	-40	—	—	—	20 1 0	—
Stonyhurst	(E. M.S.)	100-3	323	19 21 17	+21	19 26 30	—	19 33 0	+20	—	—	—	20 9 30	—
Edinburgh	(E. M.)	100-4	324	19 21 30	+33	19 25 15	—	19 33 30	+50	—	—	—	20 7 30	—
Eskdalemuir	(G.)	100-6	326	19 21 15	+18	19 25 30	—	19 31 45	-58	—	—	19 55 55	20 3 0	—
Bidston	(E. M.)	100-8	324	19 23 6	+128	19 26 0	—	19 32 0	-44	—	—	—	20 13 42	—
Granada	(C.)	102-7	307	19 21 11	+4	—	—	—	—	—	—	—	20 17 18	—
St. Helena	(E. M.)	102-9	263	—	—	19 26 0	—	19 32 55	+10	—	—	—	20 2 24	18, 102E. S.R. 19h. 40m. 42s.
Honolulu	(E. M.)	103-6	69	19 21 42	+30	19 25 24	—	—	—	—	—	—	20 33 6	S.R. 19h. 36m. 31s.
Cork	(E. M.)	104-2	323	—	—	19 24 6	—	19 33 11	+6	—	—	19 41 0	20 3 7	S.R. 19h. 40m. 0s.
San Fernando	(E. M.)	104-9	307	—	—	19 27 14	—	—	—	—	—	19 57 0	20 10 0	—
Rio Tino	(E. M.)	104-9	307	—	—	19 25 48	—	19 32 42	-31	—	—	—	20 2 24	—
Azores	(E. M.)	105-1	308	19 23 0	+102	19 25 0	—	19 35 0	—	—	—	—	20 16 0	—
Cape Verde	(E. M.)	109-8	348	—	—	19 26 0	—	19 35 30	—	—	—	—	20 26 0	—
Victoria	(E. M.)	123-3	32	—	—	—	—	—	—	—	—	—	20 30 30	—
Berkeley	(E. M.)	129-8	43	19 26 34	+201	—	—	—	—	—	—	—	19 37 0	—
Ottawa	(E. B.)	138-8	354	19 26 45	+175	19 27 24	—	—	—	—	—	19 45 0	20 47 0	—
Toronto	(E. M.)	140-8	358	—	—	—	—	—	—	—	—	—	20 24 24	—
Harvard Univ.	(E. B.O.)	141-0	348	19 26 42	+163	—	—	—	—	—	—	—	20 35 39	—
St. Louis	(E. W.)	144-9	13	19 27 7	+172	—	—	—	—	—	—	—	20 10 56	—
La Paz	(E. W.)	155-1	211	19 27 23	—	—	—	—	—	—	—	—	19 48 0	—
Port-au-Prince	(B.O.)	163-5	330	19 27 27	—	—	—	—	—	—	—	—	19 49 0	—

1914. June 26.

Origin : 13.S. 166.8E., determined by Shide.

Time at Origin : 4h. 50m. 4s.

Station and Component.	Machine.	Distance from Origin.		Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
		°	'		H.	M.	S.		S.	H.	M.	S.	H.	M.		S.	H.	M.	S.	H.	M.		S.
Sydney	(E. M.)	24-8	213	4 55 30	-10	—	—	—	—	—	—	—	—	—	5 0 12	—	—	—	5 0 48	—		
Adelaide	(E. M.)	33-6	224	4 57 12	+7	—	—	—	—	—	—	5 2 30	-8	—	—	—	—	5 11 6	—			
Honolulu	(E. M.)	48-6	46	4 59 12	+10	—	—	—	—	—	—	5 6 12	+7	—	—	5 9 48	—	5 16 54	—			
Porth	(E. M.)	50-3	239	4 59 6	-7	—	—	—	—	—	—	5 6 12	-15	—	—	—	—	5 21 48	—			
Manila	(W.)	53-2	300	4 59 53	+22	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Oskia	(O.)	56-2	329	5 0 15	+24	—	—	—	—	—	—	5 9 3	+83	—	—	—	—	—	—			
Batavia	(W.)	59-4	270	5 0 29	+17	—	—	—	—	—	—	—	—	—	5 16 37	—	—	5 22 31	—			
Zi-ka-wei	(W.)	62-1	316	5 0 28	-2	—	—	—	—	—	—	5 8 50	-3	—	—	5 15 0	—	5 39 0	—			
Berkeley	(—)	83-5	49	—	—	—	—	—	—	—	—	5 12 56	-10	—	—	—	—	5 25 40	—			
Calcutta	(E. M.)	84-6	295	—	—	—	—	—	—	—	—	5 13 13	-6	—	—	—	—	5 49 51	—			
Victoria	(E. M.)	86-9	39	—	—	—	—	—	—	—	—	5 13 48	+4	—	—	5 31 42	—	5 36 18	—			
Colombo	(E. M.)	88-7	277	—	—	—	—	—	—	—	—	5 14 36	+32	—	—	—	—	5 52 0	—			
Kodaikanal	(E. M.)	91-6	280	—	—	—	—	—	—	—	—	5 14 48	+13	—	—	5 38 36	—	5 53 48	—			
Seychelles	(E. M.)	101-1	126	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5 57 0	—			
Toronto	(E. M.)	116-1	47	—	—	—	—	—	—	—	—	5 20 6	+103	—	—	—	—	—	—			
La Paz	(E. M.)	118-1	117	5 8 45?	+187	—	—	—	—	—	—	—	—	—	—	—	—	6 40 35	—			
Ottawa	(E. B.)	118-4	45	5 10 24	+284	—	—	5 10 5?	—	—	—	5 20 15	+94	—	—	5 46 0	—	—	—			
Harvard Univ.	(E. B.O.)	118-4	45	—	—	—	—	—	—	—	—	5 20 13	+92	—	—	5 27 0	—	—	—			
Tiflis	(G.)	122-4	311	5 9 17	+199	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Fulkovo	(G.)	123-4	335	5 6 1	-2	—	—	5 11 10	—	—	—	5 18 0?	-71	—	—	5 42 0	—	6 8 44	—			
Cape Town	(E. M.)	124-2	212	5 58 0	—	—	—	—	—	—	—	5 19 8	-11	—	—	5 46 0	—	6 4 49	—			
Beirut	(E. M.)	131-2	304	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6 9 24	—			
Czernowitz	(M.)	132-1	326	5 10 0	+199	—	—	—	—	—	—	—	—	—	—	—	—	6 21 30	—			
Dyce, Aberdeen	(Ma.)	135-0	353	—	—	—	—	5 12 30?	—	—	—	—	—	—	—	—	—	6 9 0	—			
Budapest	(W.)	136-2	329	5 10 35	+216	—	—	—	—	—	—	—	—	—	—	—	—	6 10 0	—			
Edinburgh	(E. M.)	136-4	352	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6 33 0	—			
Eskdalemuir	(G.)	137-0	352	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Stonyhurst	(E. M.)	138-3	351	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6 15 48	—			

S.R. 5h. 27m. 42s. 10S. 171E.

Locality	W.	E.	189-1	841	5	12	24	+313	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Aachen	M.		140-1	348	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Kew	M.		140-2	330	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Triest	W.		140-3	335	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Guilford	W.		140-4	335	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Sibir	W.		141-1	348	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Padova	M.		141-2	332	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Florence	A.		142-8	330	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Ponpei	O.A.		143-2	324	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Moncalieri	S.		143-4	335	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Malta	M.		146-2	317	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Barcelona	Mg.		148-4	337	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
St. Helena	M.		150-3	345	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Pernambuco	E.		151-5	348	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Sao Paulo	M.		154-5	348	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
Sao Fernando	E.		155-7	346	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
	K.		155-7	346	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54
	M.		155-7	346	5	10	12	...	5	13	48	5	17	44	5	20	0	5	35	0	6	2	54

TABLE.

De-grees.	P sec.	S sec.	S - P sec.	De-grees.	P sec.	S sec.	S - P sec.	De-grees.	P sec.	S sec.	S - P sec.
1	15	28	13	51	553	991	438	101	855	1565	710
2	31	55	24	52	560	1004	444	102	860	1575	715
3	47	83	36	53	566	1016	450	103	865	1584	719
4	62	110	48	54	573	1029	456	104	870	1593	723
5	77	137	60	55	579	1041	462	105	874	1602	728
6	92	164	72	56	586	1054	468	106	879	1612	733
7	106	190	84	57	592	1066	474	107	884	1621	737
8	121	217	96	58	599	1079	480	108	888	1630	742
9	136	243	107	59	605	1091	486	109	893	1639	746
10	150	269	119	60	612	1103	491	110	897	1648	751
11	164	294	130	61	619	1116	497	111	902	1657	755
12	179	319	140	62	625	1128	503	112	907	1666	759
13	193	344	151	63	632	1141	509	113	911	1674	763
14	206	368	162	64	638	1153	515	114	916	1682	766
15	219	392	173	65	645	1165	520	115	920	1690	770
16	232	415	183	66	651	1177	526	116	925	1698	773
17	245	438	193	67	658	1190	532	117	929	1706	777
18	257	460	203	68	664	1202	538	118	934	1714	780
19	269	482	213	69	671	1214	543	119	938	1722	784
20	281	503	222	70	677	1226	549	120	942	1729	787
21	293	524	231	71	683	1238	555	121	947	1737	790
22	305	545	240	72	690	1250	560	122	952	1744	792
23	317	565	248	73	696	1262	566	123	957	1752	795
24	328	584	256	74	702	1274	572	124	961	1759	798
25	338	603	265	75	709	1286	577	125	966	1766	800
26	348	622	274	76	715	1297	582	126	970	1773	803
27	358	641	283	77	721	1309	588	127	974	1780	806
28	368	659	291	78	727	1320	593	128	978	1787	809
29	378	677	299	79	733	1332	599	129	983	1794	811
30	388	694	306	80	739	1343	604	130	988	1801	813
31	398	711	313	81	745	1355	610	131	992	1807	815
32	407	728	321	82	750	1366	616	132	996	1814	818
33	416	744	328	83	756	1377	621	133	1001	1821	820
34	425	760	335	84	762	1388	626	134	1005	1827	822
35	433	775	342	85	768	1399	631	135	1009	1833	824
36	442	790	348	86	773	1410	637	136	1014	1840	826
37	450	804	354	87	779	1421	642	137	1018	1846	828
38	458	818	360	88	785	1432	647	138	1023	1852	829
39	466	832	366	89	790	1443	653	139	1027	1858	831
40	475	847	372	90	796	1454	658	140	1031	1864	833
41	483	861	378	91	801	1464	663	141	1035	1869	834
42	491	875	384	92	807	1475	668	142	1039	1875	836
43	498	888	390	93	812	1485	673	143	1043	1881	838
44	506	902	396	94	818	1496	678	144	1047	1886	839
45	513	915	402	95	823	1506	683	145	1051	1892	841
46	520	928	408	96	829	1516	687	146	1055	1897	842
47	527	941	414	97	834	1526	692	147	1059	1902	843
48	534	954	420	98	840	1536	696	148	1063	1907	844
49	540	966	426	99	845	1546	701	149	1067	1912	845
50	547	979	432	100	851	1556	705	150	1071	1917	846

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Monthly Bulletin for July, 1914.

For the large Earthquakes an attempt is here made to compare the readings with theoretical values, as explained in the Nineteenth Report of the Committee to the British Association. The position of the epicentre is adopted from the Pulkovo determination, unless otherwise stated; and the tables of times for P and S are those given by Galitzin in his "Vorlesungen über Seismometrie," p. 137, or by G. W. Walker on p. 54 of his "Modern Seismology." It is shown in the above Report that these tables are sensibly erroneous: but the precise values of the corrections are under discussion and it seems better to await the definitive corrections than to introduce provisional tables. The tables are reproduced in an expanded form on page 14 of this Bulletin. The time of the earthquake at the epicentre is deduced from the Pulkovo records; and applying the tabular times for the distances in the third column (calculated and also measured from a large globe specially made for the purpose), the errors O - C of the observed times are found.

Observers are requested to send a copy of their Registers to Shide *each month*, in order that this collated information may be published as early as possible.

In the Earthquake Chart the stations are arranged in the order of longitude, starting from the Azores and travelling eastward. For the large earthquakes they are arranged in the order of distance from epicentre, as shown in the 3rd column. The azimuth in the 4th column is also read from the globe; and is the azimuth at the epicentre measured from N. towards E., in which the observing station lies.

The letters in the 2nd column stand for: A. = Alfani; Aga. = Agamennone; B. = Bosch; Bif. = Bifilar; B.O. = Bosch-Omori; C. = Cartuja; Ca. = Cancani; C.O. = Cartuja-Omori; G. = Galitzin; L. = Luckmann; M. = Milne; Ma. = Mainka; M.S. = Milne-Shaw; O.A. = Omori-Alfani; O.E. = Omori-Ewing; S. = Stiattesi; V. = Vincentini; W. = Wiechert.

Guildford and West Bromwich use a modification of the Milne. Hamburg uses machines by Wiechert and von Rebeur-Paschwitz-Hecker. Heidelberg's machine is an astatic pendulum made at the Observatory. Riverview has two Wiecherts and one Mainka.

1914. July 4.

Double quake: Origin, 137E. 15N. T. at O., 17h. 46m. 30s.
Origin, 130E. 25N. T. at O., 17h. 48m. 16s.
137E. 15N.

There seems to be no doubt that a shock at 17h. 46m. at one epicentre was followed some 100 seconds later by another at another epicentre; but the curious thing is that the nearer stations (Mainka, Batavia, etc.) have recorded the same quake and associated shocks at the first station to be notified. Is it notified by them, how did it reach the distant stations?

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.			PR ₁			S.			O-C.			L.			M.			Remarks.
				H.	M.	S.	S.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.		
Riverview	W.	507	165	17	57	67	+85	18	7	25	+236	18	18	30	18	24	6								
Simla	O.E.	567	298	17	58	53	-20	18	7	30	-103	18	13	0	18	19	28								
Paris	C.	817	311	17	59	0	6	18	9	25	-38	18	23	0	18	30	8								36.7N. 131.6E. 19.6N. 137E.
London	M.	927	322	17	59	50	8	18	10	37	-49	18	25	0	18	36	0								
Cecorwitz	Ma.	955	303	18	0	0	-16	18	10	37	-64														
Helwan	M.	955	303	18	0	0	-16	18	10	37	-64														
	(S. W.)	988	324	18	0	28	6	18	11	55	-16	18	31	0	18	39	54								
Graz	W.	994	323	18	0	29	8	18	11	55	-15	18	37	0											
Zagreb	W.	1003	339	18	0	36	6	18	12	14	-15	18	22	0											
Dyce, Aberdeen	Ma.	1003	339	18	0	36	6	18	12	14	-15	18	22	0											
	(S. M.)	1006	323	18	0	37	8	18	10	37	-114	18	22	0											
Triest	W.	1010	323	18	0	37	8	18	11	55	-40	18	22	0											
Birmingham	N.	1018	324	18	0	42	-11	18	12	14	-114	18	22	0											
Paderne	N.	1018	324	18	0	42	-11	18	12	14	-114	18	22	0											
Estakemuir	G.	1029	339	18	0	45	-5	18	12	36	-121	18	34	0											
	(S. G.)	1029	339	18	0	45	-5	18	12	36	-121	18	34	0											
Stonyhurst	M.	1029	337	18	0	0	55	18	11	15	-100	18	35	0	18	44	0								
Forence	M.	1031	323	18	0	45	-11	18	11	50	-74	18	35	0	18	43	0								
Guildford	M.L.	1041	394	18	0	42	-18	18	11	50	-74	18	35	0	18	43	0								
Moncafort	S.	1044	326	18	0	48	-14	18	12	20	-38	18	23	38	18	40	33								
Paris	C.	1045	331	18	1	34	+12	18	12	33	-35	18	23	0	18	25	0								
Bordeaux	C.	1045	331	18	1	34	+12	18	13	30	+19	18	23	0	18	57	0								
Shide	M.	1068	323	17	58	10	+17	18	13	30	+19	18	23	0	18	57	0								
Batavia	Ma.	1068	323	17	58	10	+17	18	13	30	+19	18	23	0	18	57	0								
La Paz	---	1558	345	18	8	7	-157	18	8	20	...	18	20	0	18	27	0								

130E. 25N.

Nagasaki		7.7	0	17	49	35	-38												
Falhooku		7.7	270	17	50	7	-6												
Osaka	O.	10.7	25	17	50	23	-33					17	52	5	17	54	52		
Manila	W.	13.4	221	17	52	0	+26			17	54	52	+42	17	57	25	18	3	50
Batavia	W.	38.5	219	17	55	48	-10			18	1	45	-16				18	3	1
Colombo	M.	51.2	258							18	5	42?	+53				18	9	54
Kodaikanal	E.	M.	51.9	263	18	0	12	+157									18	10	24
Bombay	E.	M.	53.1	264	17	58	0	+17									18	5	18
Honolulu	E.	M.	65.5	77	17	59	48	+14		18	7	36	-11	18	16	36	18	26	12
Pulkovo	G.	73.3	329	18	0	2	+8			18	9	46	+24	18	23	0	18	30	8
Victoria	E.	M.	81.8	40						18	9	30?	-30				18	23	48
Bidston	E.	M.	91.6	334	18	1	42	+1		18	12	18	-29				18	23	48
Granada	G.	104.1	324	18	2	47	+1			18	13	41	-69	18	21	0	18	39	26
Rio Tinto	M.	105.2	326	18	9	0	+369												
San Fernando	E.	M.	105.9	325	18	11	0	+485									18	59	0
	N.	M.	105.9	325	18	7	0	+245									18	52	0

27.6N. 132E.
S.R. 18h. 16m. 13s.

CS

1914. July 5.

Origin : 5S. 132E., determined by Shide.

Time at Origin : P=21h. 50m. 47s.

Station and Component.	Machine.	Distance from Origin.		Azimuth.	P.			O-C.	PR ₁	S.			O-C.	L.			M.			Remarks.
		H.	M.		S.	H.	M.			S.	H.	M.		S.	H.	M.	S.			
Manila	W.	22.4	331		21	56	6?	+9					22	0	29	22	1	15		
Batavia	W.	25.1	266		21	57	36?	+70					22	10	0	22	10	46	5S. 137E.	
Riverview	W.	33.9	151		21	57	54	+3			22	3	12	-13	22	6	48	22	10	46
Sydney	M.	33.9	151								22	3	30?	+5	22	9	56	22	13	12
Zi-ka-wei	W.	37.5	345		21	58	6	-15			22	3	40	-38	22	6	24	22	9	25
Adelaide	E.	M.	41.0	172													22	10	0	
Honolulu	E.	M.	73.3	66							22	11	0?	-53	22	23	0	22	30	12
Mauritius	E.	M.	73.3	251											22	30	0?	22	38	36
Tifis	G.	91.2	312		22	4	16	+7			22	14	53	-20	22	29	0	22	53	8
Pulkovo	G.	100.1?	330		22	4	50	-9	22	8	52				22	16	8	22	40	47
Helwan	E.	M.	101.6	300							22	15	0?	-118			23	0	0	
Victoria	N.	M.	101.6	300							22	16	0?	-58						
Berkeley	E.	M.	103.4	41											22	22	18	22	46	42
Graz	W.	111.4	319		22	10	22	+271			22	21	0?	+132	22	46	0	22	45	0?
Zagreb	W.	111.7	318		22	10	24	+271			22	19	48	+78	22	48	0	22	52	0
Triest	W.	116.9	316		22	16	27	+611			22	26	38?	+441	22	45	0	22	51	0
Moncalieri	S.	117.2?	319		22	11	11	+294			22	26	21	+427	22	40	33	23	5	59
Edinburgh	E.	M.	117.9	333							22	21	0	+108				22	56	6
Eskdalemuir	G.	118.4	333		22	11	20?	+297							22	44	0	22	52	0
Stonyhurst	E.	M.	118.8	331											22	27	0?	23	2	0
Paris	G.	118.9	325								22	18	0?	-88	22	48	0	22	53	0
Kew	E.	M.	119.1	328													23	10	18	
West Bronwich	M.	119.3	330														23	6	0	
Shide	E.	M-S.	120.0	328													23	9	0	
Barcelona	Ma.	122.4	316		21	59	8	-453							22	56	12			
Granada	C.	128.4	315		22	7	30	+23							22	43	0	22	59	15
Rio Tinto	E.	M.	130.2	317													23	15	0	
San Fernando	E.	M.	130.5	315													23	12	30	
	N.	M.	130.5	315							22	17	30?	-201			23	16	30	

Times approximate.

4

Granada	C.	99-9	319	6 51 46	+12	—	7 3 28	+ 9	7 21 0	7 38 25	—
Ottawa	B.	108-8	13	—	...	7 2 20 1	7 5 24	+43	—	—	—
La Paz	—	168-1	52	6 57 38	...	7 2 30 ?	7 9 10	...	—	—	—

1914. July 14.

Origin : 4S. 103E., determined by Shide.

Time at Origin : P=3h. 10m. 23s.

The Shide, West Bromwich, and Harvard P accord closely with a shock at 73N, 83E. at 3h. 21m. 13s.; further, the error of Harvard S would be then -35s., and of Ottawa P and S -55s. and -20s., but there is no other confirmation.

Station and Component.	Machine.	Distance ° from Origin.	Azimuth. °	P.		O-C.	PR ₁		S.		O-C.	L.		M.		Remarks.
				H.	M.	S.	S.	H.	M.	S.	S.	H.	M.	S.	H.		M.	S.
Batavia	W.	4-4	121	3 11 31	0	—	—	3 12 19	- 5	—	—	3 18 0	3 18 0	Malabar Δ 510.		—
C Colombo	E. M.	25-6	295	3 21 6	+299	—	—	—	—	3 22 0	—	3 23 54	3 23 54	—		—
Manila	W.	23-8	43	3 16 7	- 2	—	—	—	—	3 30 46	—	3 36 0	3 36 0	—		—
Kodaiканал	E. M.	29-2	300	3 16 54	+193	—	—	—	—	3 22 42	—	3 30 48	3 30 48	—		—
Bombay	E. M.	37-6	309	3 20 6	+128	—	—	—	—	—	—	3 32 42	3 32 42	—		—
Zi-ka-wei	W.	39-4	25	3 18 10	+ 7	—	—	3 24 12	- 9	—	—	3 28 26	3 28 26	—		—
Simla	O.E.	42-9	327	3 18 18	-22	—	—	—	—	3 35 18	—	3 40 18	3 40 18	—		—
Alechiide	E. M.	45-2	158	3 19 12	+15	—	—	—	—	—	—	3 44 18	3 44 18	—		—
Mauritius	E. M.	46-8	246	3 24 30	+321	—	—	—	—	3 30 30	—	3 32 54	3 32 54	—		—
Osaka	O.	49-2	36	3 19 41	+17	—	—	—	—	—	—	3 45 45	3 45 45	—		—
Riverview	—	53-7	130	—	—	—	—	3 26 54	-34	—	—	3 36 42	3 36 42	—		—
Helwan	E. M.	76-2	302	3 22 0	-19	—	—	—	—	—	—	4 0 0	4 0 0	—		—
	N. M.	76-2	302	3 24 0	+101	—	—	3 33 6	+64	—	—	3 57 30	3 57 30	—		—
Padova	V.	93-6	315	3 34 38	+639	—	—	3 34 52	-23	—	—	—	—	—		—
Moncalieri	S.	96-6	315	3 23 15	-60	—	—	3 36 57	+72	—	—	3 45 40	3 45 40	—		—
Paris	—	99-9	319	—	—	—	—	3 35 0?	-78	—	—	4 11 0	4 11 0	—		—
Honolulu	E. M.	99-9	69	3 35 24	+651	—	—	—	—	—	—	3 58 0	3 58 0	—		—
Barcelona	E. M.	100-3	311	3 26 52?	+137	—	—	3 46 40	+618	—	—	4 16 46	4 16 46	—		—
Kow	E. M.	101-4	322	4 13 30	+2890	—	—	—	—	—	—	—	—	—		—
Dyce, Aberdeen	E. M.	101-5	328	3 29 0	+260	—	—	—	—	—	—	4 24 36	4 24 36	—		—
Shide	—	102-1	321	3 29 10	+267	—	—	3 35 30	-69	—	—	4 42 0	4 42 0	—		—
West Bromwich	M.S.	102-2	323	3 28 55	+251	—	—	3 35 0	-100	—	—	4 14 0	4 14 0	? Double earthquake.		—
Stonyhurst	E. M.	102-2	324	3 35 0	+616	—	—	—	—	—	—	4 14 30	4 14 30	—		—
Edinburgh	E. M.	102-3	327	3 34 0	-556	—	—	—	—	—	—	4 20 0	4 20 0	—		—
Eskdalemuir	G.	102-5	326	3 24 12	-33	—	—	—	—	—	—	—	—	—		—
Bidston	E. M.	102-7	324	3 39 30	+884	—	—	3 46 0	+556	—	—	3 49 42	3 49 42	—		—
Granada	C.	105-6	308	3 20 48	-252	—	—	—	—	3 56 0	—	4 22 12	4 22 12	—		—
San Fernando	E. M.	107-8	307	3 27 30	+140	—	—	—	—	—	—	—	—	—		—
Rio Tinto	E. M.	107-9	309	4	0	—	—	—	—	—	—	4 27 0	4 27 0	—		—
Victoria	E. M.	120-7	34	—	—	—	—	—	—	—	—	4 20 6	4 20 6	—		—

7

8

San Fernando	(E.)	M.	95-4	10	—	...	—	7 32 0	+25	—	8 11 30
Helwan	(N.)	M.	95-4	10	—	...	7 26 0?	—	—	—	8 14 0
La Paz	(E.)	M.	99-3	338	—	...	—	—	—	—	8 12 6
			112-8	90	7 27 0	+325	—	—	—	8 2 0	8 6 18

1914. July 21.
 Origin : 46N. 130W., determined by Shide.
 Time at Origin : 22h. 31m. 17s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Victoria	(E.)	M.	5-2	59	22	19	24?	...	—	—	—	—	—	—	22	31	54	22	31	30	—
Berkeley	(E.)	—	9-9	142	22	34	26	+40	—	—	22	37	6	+83	22	38	54	22	40	4	—
	(N.)	—	9-9	142	22	34	30	+44	—	—	—	—	—	—	—	—	—	22	40	14	—
Lick	(E.)	—	11-0	142	22	34	38	+38	—	—	—	—	—	—	22	37	54?	22	41	30	—
St. Louis	(E.)	W.	30-1	94	22	38	0	+14	—	—	22	44	35	+102	22	48	36	22	50	29	—
Honolulu	(E.)	M.	33-6	232	—	—	—	—	—	—	22	44	48	+57	22	46	48	22	48	42	—
Toronto	(E.)	M.	35-3	75	22	20	12?	—	—	—	—	—	—	—	22	50	12	22	52	54	—
Ottawa	(E.)	B.	37-1	71	22	38	24	-24	—	—	22	44	9	-33	22	50	0	22	51	6	—
Harvard Univ.	(E.)	B.O.	40-6	76	22	38	25	-62	—	—	22	44	28	-64	22	52	27	22	55	17	—
Dyce, Aberdeen	(E.)	Ma.	68-0	27	—	—	—	—	—	—	22	50	48	-31	—	—	—	23	5	12	—
Edinburgh	(E.)	M.	68-8	29	—	—	—	—	—	—	22	51	0?	-29	—	—	—	23	10	12	—
Eskdalemuir	(E.)	G.	69-2	29	22	42	9	-20	—	—	22	51	3	-30	23	1	0	—	—	—	—
Stonyhurst	(E.)	M.	70-7	30	—	—	—	—	—	—	22	52	0?	+8	—	—	—	23	10	0	—
Bidston	(E.)	M.	70-8	30	—	—	—	—	—	—	22	51	30	-23	—	—	—	23	12	0	—
Azores	(E.)	M.	72-3	54	—	—	—	—	—	—	—	—	—	—	—	—	—	23	6	42?	—
Pulkovo	(E.)	G.	73-0	10	22	42	33	-20	—	—	22	51	43	-36	—	—	—	—	—	—	50N. 140W.
Kew	(E.)	M.	73-3	30	—	—	—	—	—	—	—	—	—	—	23	3	0?	23	12	42	—
Shide	(E.)	M.	73-6	31	—	—	—	—	—	—	22	52	0	-26	23	6	0	23	10	30	—
	(N.)	M.	73-6	31	—	—	—	—	—	—	—	—	—	—	—	—	—	23	11	0	—
Paris	(E.)	G.	76-5	30	22	43	29	+14	—	—	22	52	31	-29	23	7	0	23	11	0	—
Moncalieri	(E.)	S.	81-6	29	22	43	34?	-11	—	—	22	53	21	-38	23	2	18	23	14	57	—
Rio Tinto	(E.)	M.	81-9	42	—	—	—	—	—	—	—	—	—	—	—	—	—	23	7	0	—
San Fernando	(E.)	M.	83-2	42	—	—	—	—	—	—	—	—	—	—	23	5	0?	23	16	30	—
	(N.)	M.	83-2	42	—	—	—	—	—	—	—	—	—	—	23	5	30?	23	16	30	—
Helwan	(E.)	M.	102-1	17	—	—	—	—	—	—	—	—	—	—	—	—	—	23	29	0	—
	(N.)	M.	102-1	17	—	—	—	—	—	—	—	—	—	—	—	—	—	23	20	0	—

Mauritius	{ E. M.	67-7	213	—	—	—	—	23 1 0	-13	23 9 30	23 23 48	—
Granada	{ N. M.	67-7	213	—	—	—	—	23 1 12	-1	23 14 6	23 20 36	—
Rio Tinto	M.	69-5	302	22 52 47	+18	—	—	23 1 58	+23	23 5 40	23 25 30	—
San Fernando	{ E. M.	71-1	304	22 48 0	-278	—	—	—	—	—	23 22 0	—
	{ N. M.	71-6	303	22 53 30	+48	—	—	—	—	—	23 29 0	—
Azores	E. M.	82-4	314	—	—	—	—	—	—	—	23 28 0	—
Victoria	E. M.	86-2	22	—	—	—	—	23 6 0	+115	—	23 37 0	—
Adelaide	E. M.	87-4	142	—	—	—	—	23 4 30	-17	23 16 18	23 35 18	—
Honolulu	E. M.	91-3	60	22 55 0	+22	—	—	23 5 0	0	—	23 48 42	—
Sydney	E. M.	93-0	134	—	—	—	—	23 5 12	-30	—	23 39 0	—
Ottawa	{ E. B.	93-1	350	22 54 40	-8	—	—	23 5 48	-12	—	23 24 12	23 46 42
	{ N. B.	93-1	350	22 54 44	-4	—	—	—	—	—	23 23 21	23 30 0
Toronto	E. M.	93-3	353	22 56 48	+108	—	—	23 5 12	-49	—	23 23 13	23 35 18
Harvard Univ.	{ E. B.O.	93-4	346	—	—	—	—	—	—	—	23 16 30	23 48 48
	{ N. B.O.	93-4	346	—	—	—	—	23 5 20	-65	—	23 23 0	23 27 26
Berkeley	—	96-0	25	—	—	—	—	23 5 23	-62	—	23 14 45	—
Santa Clara	W.	96-6	25	—	—	—	—	23 5 17	-74	—	—	—
Lick	W.	97-1	25	—	—	—	—	—	—	—	23 39 33	—
Cape Town	E. M.	99-6	233	—	—	—	—	23 6 14	-28	—	—	—
St. Louis	W.	100-8	359	—	—	—	—	—	—	—	23 45 24	—
Fiji	E. M.	100-9	107	22 59 0	+210	—	—	—	—	23 25 2	23 42 45	—
Fernando Noronha	E. M.	117-1	290	—	—	—	—	23 2 30	+289	—	23 6 0	—
La Paz	—	149-7	316	23 1 29	—	—	—	23 19 10	—	—	23 57 10	—

{ Quake recorded.
Time marks failed.

5

1914. August 6.

Origin: 4N. 115E., determined by Pulkovo.

Time at Origin: 4h. 10m. 19s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.			PR ₁			S.			O-C.			L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.		
Manila	W.	12-1	29	4 14 40	+81	—	—	—	—	—	—	4 17 52	+131	—	—	—	—	—	—	—	—	—	—	—	
Batavia	W.	13-1	219	4 13 58	+25	—	—	—	—	—	—	4 14 23	-102	—	—	—	—	—	—	—	—	—	—	—	
Zi-ka-wei	W.	27-9	12	4 17 0	+34	—	—	—	—	—	—	4 22 2	+46	—	—	—	—	—	—	—	—	—	—	—	
Calcutta	E. M.	31-8	308	—	—	—	—	—	—	—	—	? 4 21 30	+6	—	—	—	—	—	—	—	—	—	—	—	
Colombo	E. M.	35-2	277	—	—	—	—	—	—	—	—	? 4 22 30	-47	—	—	—	—	—	—	—	—	—	—	—	
Osaka	O.	36-0	29	4 17 40	-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Kodaikanal	E. M.	37-7	282	4 14 54	-181	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Perth	E. M.	37-8	179	4 18 42	+47	—	—	—	—	—	—	4 21 0	-174	—	—	—	—	—	—	—	—	—	—	—	
Bombay	E. M.	43-9	294	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Adelaide	E. M.	44-7	150	4 20 36	+106	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Sinala	O.E.	44-8	312	4 26 24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Sydney	E. M.	50-9	141	4 18 30	-61	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Mauritius	{ E. M.	61-0	244	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	{ N. M.	61-0	244	—	—	—	—	—	—	—	—	? 4 23 30	—	—	—	—	—	—	—	—	—	—	—	—	
Helwan	{ E. M.	82-5	300	4 24 0	+68	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	{ N. M.	82-5	300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Pulkovo	G.	83-9	330	4 23 0	0	—	—	—	—	—	—	4 34 0	+49	—	—	—	—	—	—	—	—	—	—	—	
Honolulu	E. M.	85-7	69	4 21 48	-83	—	—	—	—	—	—	4 33 24	-2	—	—	—	—	—	—	—	—	—	—	—	
Padova	{ V.	96-3	317	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	{ N.	96-3	317	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Cape Town	E. M.	97-7	236	—	—	—	—	—	—	—	—	4 33 32	-126	—	—	—	—	—	—	—	—	—	—	—	
Moncalieri	S.	99-2	317	—	—	—	—	—	—	—	—	4 32 48	-184	—	—	—	—	—	—	—	—	—	—	—	
Paris	G.	101-4	322	—	—	—	—	—	—	—	—	4 35 41	-26	—	—	—	—	—	—	—	—	—	—	—	
Edinburgh	E. M.	101-9	330	—	—	—	—	—	—	—	—	4 29 26	—	—	—	—	—	—	—	—	—	—	—	—	
Esikdalemuir	G.	102-4	322	—	—	—	—	—	—	—	—	4 44 28	+480	—	—	—	—	—	—	—	—	—	—	—	
Kew	E. M.	102-2	325	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Stonyhurst	E. M.	102-4	328	—	—	—	—	—	—	—	—	4 38 5	+89	—	—	—	—	—	—	—	—	—	—	—	
West Bromwich	E. M.	102-7	326	—	—	—	—	—	—	—	—	4 36 48	+12	—	—	—	—	—	—	—	—	—	—	—	
Bidston	E. M.	102-9	327	—	—	—	—	—	—	—	—	4 36 0	-38	—	—	—	—	—	—	—	—	—	—	—	

Slight local shock.

Damped.
Undamped.

6

Shide	N.	M.	103-1	324	—	...	—	4 36 16	-28	—	4 49 30	—
Newport, I.W.	E.	...	103-1	324	—	...	—	—	...	—	4 49 45	—
Barcelona	E.	Ma.	104-1	314	4 26 12	+83	—	—	?	4 42 39	—	—
Victoria	E.	M.	107-2	35	—	...	—	4 37 18	-4	4 43 24	—	—
Granada	E.	C.	109-8	312	4 28 23	+188	—	?	4 39 23	4 46 30	4 51 24	—
San Fernando	E.	M.	111-9	312	—	...	—	4 36 0	-124	—	—	—
Fernando Noronha	E.	M.	146-6	268	—	...	? 4 32 40	4 39 30	-118	—	4 53 0	—
La Paz	...	...	167-1	194	4 29 23	...	4 29 51	4 34 18	...	4 53 18	4 54 51	—

7

1914. August 8.

Origin : 21N. 106.5W., determined by Shide.

Time at Origin : 19h. 8m. 39s.

Station and Component.	Machine.	Distance ° from Origin.	Azimuth. °	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Lick	W.	20-8	324	19	13	26	-3	—	—	—	19	17	24	+5	—	—	—	19	23	25	—
Berkeley	E.	21-6	324	19	13	30	-21	—	—	—	—	—	—	—	19	17	32	19	17	46	—
St. Louis	E.	21-6	324	19	13	26	-25	—	—	—	—	—	—	—	19	17	37	19	17	44	—
Victoria	E.	22-6	35	19	14	18	+27	—	—	—	19	18	45	+49	—	—	—	19	22	33	—
Toronto	E.	22-6	35	19	14	15	+24	—	—	—	—	—	—	—	—	—	—	19	22	8	—
Ottawa	E.	30-3	338	—	—	—	...	—	—	—	—	—	—	—	19	20	12	19	26	6	—
Harvard Univ.	E.	31-9	39	19	17	2	+107	—	—	—	—	—	—	—	19	27	24	19	28	6	—
La Paz	E.	35-1	39	19	16	7	+14	—	—	—	19	21	48	+13	—	—	—	—	—	—	—
Fernando Noronha	E.	35-1	39	19	16	7	+14	—	—	—	19	21	57	+22	—	—	—	—	—	—	—
Honolulu	E.	36-5	46	19	16	9	+4	—	—	—	19	22	24	+38	—	—	—	19	29	25	—
La Paz	E.	36-5	46	19	16	9	+4	—	—	—	19	22	25	+39	—	—	—	19	29	20	—
Fernando Noronha	E.	47-8	280	19	19	48	+137	—	—	—	19	24	24	-6	—	—	—	19	32	12	—
La Paz	E.	53-1	132	19	18	17	+11	—	—	—	19	25	26	-10	—	—	—	19	40	39	—
Eskaletmir	E.	76-6	99	—	—	—	...	?	19	27	30	—	—	—	—	—	—	19	55	0	—
Dyce, Aberdeen	E.	78-1	34	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Edinburgh	E.	79-8	32	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bidston	E.	79-9	34	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stonyhurst	E.	80-9	36	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
West Bromwich	E.	81-1	35	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Shide	E.	81-8	37	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Guildford	E.	83-0	38	19	20	30	-45	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kew	E.	83-0	38	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rio Tinto	E.	83-2	37	19	20	12	-64	—	—	—	—	—	—	—	—	—	—	—	—	—	—
San Fernando	E.	84-7	51	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Paris	E.	85-2	52	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Granada	E.	86-0	39	—	—	—	...	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Granada	C.	87-1	51	19	26	48	+309	—	—	—	—	—	—	—	—	—	—	—	—	—	—

8

Barcelona		Ma.	89°2	45	19 19 50	-120	—	—	...	19 38 25	12 4 0	
Moncalieri		S.	91°0	40	19 32 33	+633	—	19 39 19	+376	19 49 14	20 5 50	
Pulkovo		G.	91°9	20	19 22 21	+16	—	19 33 8	- 5	—	20 1 30	25N. 104W.
Florence		A.	93°8	40	—	...	—	—	...	? 19 53 0	20 4 0	
Sydney		M.	111°3	240	—	...	—	19 37 6	+47	—	20 1 30	
Helwan	{	E.	114°9	40	—	...	—	19 40 0	+192	—	—	
	{	N.	114°9	40	—	...	—	19 42 0	+312	—	—	
Adelaide	{	E.	121°9	241	—	...	—	—	...	—	20 19 36	
Mauritius	{	E.	165°3	84	20 33 36	...	—	—	...	—	20 48 6	
	{	N.	165°3	84	—	...	—	—	...	—	20 48 24	

6

1914. August 22.

Origin : 125W. 43N., determined by Shide.

Time at Origin : 5h. 28m. 17s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Berkeley	{	E.	5°5	157	5 30 22	+41	—	—	—	—	—	—	—	5 32 44	5 34 0	—	—	—	—	—	
	{	N.	5°5	157	5 30 20	+39	—	—	—	—	—	—	—	5 32 50	5 34 37	—	—	—	—	—	
Victoria	E.	M.	5°5	12	—	...	—	—	—	—	—	—	?	5 28 54	5 31 42	—	—	—	—	—	
Lick	W.	M.	6°5	155	5 30 21	+25	—	—	—	—	—	—	—	5 32 59	5 35 58	—	—	—	—	—	
Toronto	E.	M.	32°8	72	—	...	—	—	?	5 40 54	+16	—	—	5 48 6	5 50 18	—	—	—	—	—	
Honolulu	E.	M.	34°9	243	5 34 42	-47	—	—	—	—	—	—	—	5 42 0	5 46 12	—	—	—	—	—	
Harvard Univ.	E.	P.O.	38°9	72	5 36 2	0	—	5 37 41	—	—	—	—	—	5 48 43	5 50 28	—	—	—	—	—	
Dyce, Aberdeen	{	E.	69°0	29	5 40 4	+36	—	—	—	—	—	—	—	—	6 10 30	—	—	—	—	—	
	{	N.	69°0	29	5 40 2	+34	—	—	—	—	—	—	—	—	6 10 45	—	—	—	—	—	
Edinburgh	E.	M.	69°6	31	—	...	—	?	5 45 30	—	—	—	—	—	6 8 18	—	—	—	—	—	
Fskdalemuir	G.	M.	70°0	31	5 39 36	0	—	—	—	—	—	—	—	6 0 0	6 7 42	—	—	—	—	—	40N. 121E.
Azores	E.	M.	71°2	56	—	...	—	—	—	—	—	—	—	+ 3	6 13 0	—	—	—	—	—	
Bidston	E.	M.	71°5	32	—	...	—	—	—	—	—	—	—	+23	6 9 0	—	—	—	—	—	
Stonyhurst	E.	M.	71°5	32	—	...	—	—	?	5 50 36	+95	—	—	—	6 9 30	—	—	—	—	—	
West Bromwich	E.	M.	72°7	32	5 38 42	-69	—	—	—	—	—	—	—	-75	6 11 30	—	—	—	—	—	
Kew	E.	M.	74°1	32	5 44 0	+249	—	—	—	—	—	—	—	—	6 13 48	—	—	—	—	—	
Guildford	E.	M.	74°2	32	5 39 20	-40	—	—	—	—	—	—	—	—	6 12 24	—	—	—	—	—	
Shide	{	E.	74°3	33	—	...	—	—	—	—	—	—	—	—	6 14 0	—	—	—	—	—	
	{	N.	74°3	33	5 40 5	+ 4	—	—	—	—	—	—	—	—	6 14 30	—	—	—	—	—	
Pulkovo	G.	M.	75°3	13	5 40 4	- 4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Paris	G.	M.	77°4	32	5 40 21	+ 1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
La Paz	—	—	79°1	125	5 40 51	+20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Rio Tinto	E.	M.	81°8	45	—	...	—	—	?	5 48 0	-61	—	—	—	6 12 0	—	—	—	—	—	
Moncalieri	S.	M.	82°5	32	—	...	—	—	—	—	—	—	—	—	6 15 44	—	—	—	—	—	
San Fernando	{	E.	83°0	45	5 40 45	- 5	—	—	—	—	—	—	—	+301	6 2 54	—	—	—	—	—	
	{	N.	83°0	45	—	...	—	—	—	—	—	—	—	—	6 13 30	—	—	—	—	—	
Barcelona	Ma.	M.	83°1	37	—	...	—	?	5 47 39	—	—	—	—	—	6 19 20	—	—	—	—	—	
Padova	V.	M.	83°7	29	5 40 54	- 3	—	—	—	—	—	—	—	—	6 4 44	—	—	—	—	—	
Granada	C.	M.	83°8	43	5 40 58	0	—	—	—	—	—	—	—	+ 1	6 18 40	—	—	—	—	—	

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1914. September 25.

Origin : 7S. 80.9W., determined by Shide.

Time at Origin : 10h. 30m. 28s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.		O-C.		Pth.		S.	O-C.		L.		M.		Remarks.
				H.	M.	S.	H.	M.	S.		H.	M.	S.	H.	M.	S.	
La Paz	E.	15-7	129	10	34	38	+22	—	—	10	37	46	+30	10	40	21	—
Fernando Noronha	E.	48-3	90	10	36	18	-200	—	—	10	44	24	-149	10	52	12	—
Terreiro	E.	27-2	1	10	39	55	-17	—	—	10	46	42	-37	10	52	12	—
Yacora	E.	66-7	323	—	—	—	—	—	—	10	54	0	+61	11	5	24	8
Honolulu	E.	80-7	313	—	—	—	—	—	—	10	53	15	+63	11	8	42	11
Grananha	E.	84-2	51	10	47	18	-6	10	44	58	2	+223	10	55	6	11	13
Brakton	E.	88-5	36	10	43	23	-14	—	—	10	54	2	+40	11	12	0	11
Eschadeunir	E.	88-8	34	10	43	23	-14	—	—	10	56	12	+102	11	11	0	11
Stonyhurst	E.	88-9	35	—	—	—	—	—	—	10	56	12	—	11	11	0	11
Shide	E.	88-9	39	—	—	—	—	—	—	10	56	12	—	11	11	0	11
Edinburgh	E.	89-0	33	—	—	—	—	—	—	10	53	47	-50	11	15	54	11
Bahreunha	E.	89-5	48	—	—	—	-43	—	—	10	53	47	-52	11	15	54	11
Paris	E.	89-5	44	10	43	23	-14	—	—	10	54	13	-68	11	17	10	11
Marsabit	E.	90-9	11	—	—	—	—	—	—	10	54	13	+100	11	17	10	11
Hohven	E.	112-7	60	—	—	—	—	—	—	10	54	13	-68	11	17	10	11
Baku	E.	124-9	60	—	—	—	—	—	—	10	54	13	-68	11	17	10	11
Mauritius	E.	131-1	45	—	—	—	—	—	—	10	54	13	-68	11	17	10	11
			125	—	—	—	—	—	—	10	54	13	+30	11	25	0	11

1914. October 3.

Origin : 16N. 64W., determined by Shide.

Time at Origin : 17h. 21m. 56s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.		O-C.		Pth.		S.	O-C.		L.		M.		Remarks.
				H.	M.	S.	H.	M.	S.		H.	M.	S.	H.	M.	S.	
Harverd Univeskyr	B.O.	27-0	348	17	27	57	+3	—	—	17	33	33	-4	17	35	10	—
Toronto	E.	30-5	338	17	30	18	+1.09	—	—	17	33	33	-4	17	35	10	—
Ottawa	E.	31-0	344	17	28	39	+5	—	—	17	33	51	+4	17	35	18	6
St. Louis	E.	32-1	320	17	29	0	+1.6	—	—	17	31	29	+33	17	37	12	17
La Paz	E.	32-8	187	17	28	51	+1	—	—	17	34	8	-9	17	38	2	17
Fernando Noronha	E.	37-0	120	17	28	40	+0	—	—	17	34	15	-65	17	46	30	17
Rio Hinto	E.	34-7	350	17	32	0	+2.7	—	—	17	38	30	-45	17	54	0	17
San Fernando	E.	34-8	348	17	32	30	+3.6	—	—	17	38	30	-45	17	52	18	17
Santa Clara	E.	34-8	302	17	31	54	+3.0	—	—	17	38	18	-57	17	52	18	17
Coik	E.	56-5	38	17	32	30	+1.3	—	—	17	38	6	—	17	53	0	17
Granada	E.	57-0	318	17	30	36	-1.3	—	—	17	38	6	-06	17	44	42	17
Ylaxoia	E.	57-9	318	17	30	36	-1.3	—	—	17	40	5	-13	17	57	42	17
Halsaton	E.	60-0	37	17	32	12	+4	—	—	17	40	5	-19	17	51	48	17
Eschadeunir	E.	60-4	35	17	32	6	+5	17	54	48	—	—	—	—	—	—	—
Stonyhurst	E.	60-5	37	17	31	6	-65	—	—	17	38	42	-103	17	48	24	17
Shide	E.	60-5	40	17	32	15	+4	—	—	17	40	30	+3	17	51	12	17
West Bromwich	E.	60-5	40	17	32	12	+4	—	—	17	40	30	+3	17	52	0	17
Kewport I W	E.	60-5	38	17	30	52	+4	—	—	17	40	20	-5	17	52	0	17
Edinburgh	E.	60-6	34	17	32	30	+1.8	—	—	17	40	7	-18	17	50	30	17
Guildford	E.	61-1	40	17	32	36	+2.0	—	—	17	40	0	—	17	56	48	17
Kew	E.	61-2	40	17	32	24	+8	—	—	17	40	13	-24	17	53	6	17
Dye, Aberdeen	E.	61-4	33	17	32	4	+1.3	—	—	17	40	14	-29	17	56	12	17
Barcelona	E.	61-4	33	17	32	4	+1.3	—	—	17	40	14	-29	17	52	4	17
Paris	E.	61-7	32	17	32	8	-11	—	—	17	40	11	-33	17	52	3	17
Krus	E.	62-6	45	17	32	18	-7	17	35	32	—	—	-25	17	49	31	17
Moschaki	S.	62-6	45	17	32	18	-7	—	—	17	40	27	-26	17	50	10	17
				17	32	18	-7	—	—	17	41	4	-43	17	50	10	17

Martinique and St. Vincent.

Florence	E. A.	68° 4'	49	17 32	58	- 5	---	17 41	33	-30	---	17 53	30	17 54	0	---
Padova	N. V.	68° 5'	47	17 32	59	+ 7	---	17 41	44	-28	---	17 50	30	17 54	52	---
Monte Cassino	E. O.A.	70° 5'	51	17 33	21	+ 5	---	17 42	20	- 8	---	17 49	13	---	---	---
Pompeii	N. O.A.	71° 0'	52	17 33	15	- 4	---	17 40	0	-154	---	17 57	0	---	---	---
Melfa	E. M.	71° 3'	37	17 28	30	-12	---	17 39	0	-214	---	17 49	0	---	---	---
Torrevere	E. M.	74° 3'	60	17 32	30	-119	---	17 40	36	- 7	---	---	---	---	---	---
Homonium	E. M.	86° 6'	60	17 32	30	-119	---	17 40	36	- 7	---	---	---	---	---	---
Cape Town	E. M.	87° 8'	282	17 32	30	+30	---	17 46	6	-24	---	17 17	24	---	---	---
Baku	E. G.	91° 9'	135	17 32	30	+22	---	17 45	50	-100	---	18 0	6	---	---	---
Shibui	E. M.	96° 8'	45	17 32	18	-31	---	17 45	0	- 31	---	18 19	0	---	---	---
Mauritius	E. O.E.	119° 9'	38	17 42	38	+298	---	---	---	---	---	18 20	18	---	---	---
Manitoba	E. M.	124° 9'	104	17 42	30	+269	---	---	---	---	---	18 20	18	---	---	---
Danbury	E. M.	124° 9'	104	17 42	30	+269	---	---	---	---	---	18 20	18	---	---	---
Zharka-wei	E. M.	125° 0'	32	17 42	57	+205	---	---	---	---	---	18 12	42	---	---	---
Galcutta	E. M.	132° 5'	354	17 41	35	+172	---	17 43	21	+269	---	18 21	42	---	---	---
Kobelemul	E. M.	132° 5'	354	17 41	35	+172	---	17 43	21	+273	---	18 21	42	---	---	---
Colombo	E. M.	133° 9'	36	17 41	43	+187	---	17 56	48	+273	---	18 38	10	---	---	---
Sydney	E. M.	137° 5'	60	17 44	21	+326	---	---	---	---	---	18 30	10	---	---	---
Riverview	E. M.	143° 7'	284	17 41	54	+152	---	---	---	---	---	18 37	42	---	---	---
Manilla	E. M.	148° 8'	234	17 40	54	+92	---	---	---	---	---	18 54	48	---	---	---
Alchilde	E. M.	149° 0'	351	17 43	0	+139	---	---	---	---	---	18 24	6	---	---	---
Doon	E. M.	152° 5'	253	17 43	0	...	---	---	---	---	---	---	---	---	---	---
Deulu	E. M.	164° 0'	170	17 43	0	...	---	---	---	---	---	---	---	---	---	---
Baurvio	E. M.	166° 6'	43	17 42	0	...	---	---	---	---	---	18 30	0	---	---	---

CT

1914. October 3.
 Origin : 37.5N. 32.5E., determined by Shide.
 Time at Origin : 22h. 6m. 34s.

Station and Component.	Machine.	Distance ° from Origin.	Azimuth. °	P.		O-C.	Pth.	S.		O-C.	L.		M.		Remarks.
				H.	M. S.			H.	M. S.		H.	M. S.	H.	M. S.	
Hetwan	E. M.	7° 7'	8	22	8	- 1	---	22 16	0	- 3	22 11	12	22 16	0	---
Baktu	E. G.	13° 8'	72	22 10	34	+37	---	---	---	---	---	---	---	---	---
Pompeii	E. O.A.	14° 3'	288	22 10	10	+ 6	---	---	---	---	22 13	17	---	---	Disjunctous quide in Asia Minor.
Katka	E. O.A.	14° 3'	288	22 10	10	+ 6	---	---	---	---	22 13	17	---	---	Disjunctous quide in Asia Minor.
Monte Cassino	E. O.A.	14° 6'	283	22 11	0	+32	---	---	---	---	22 15	52	22 21	0	---
Florance	E. O.A.	14° 9'	291	22 10	20	+ 8	---	22 13	38	+ 5	---	---	22 17	0	---
Padova	E. A.	17° 3'	298	22 10	49	+ 6	---	22 13	36	+ 5	---	---	22 16	0	---
Moncalieri	E. V.	20° 0'	300	22 11	29	+ 5	---	22 14	47	-10	---	---	22 16	0	---
Halselberg	E. S.	21° 1'	312	22 11	51	+23	---	22 15	10	+18	---	---	22 10	21	---
Bayreuth	E. G.	22° 3'	289	22 11	57	+16	---	22 16	8	- 2	---	---	22 24	3	---
Paris	E. M.	24° 3'	307	22 12	7	- 1	---	22 18	11	- 2	---	---	22 24	0	---
Kew	E. M.	24° 3'	307	22 12	7	- 1	---	22 18	11	- 2	---	---	22 24	0	---
Stalder	E. M.	24° 3'	307	22 12	7	- 1	---	22 18	11	- 2	---	---	22 24	0	---
Shide	E. M.	27° 2'	310	22 13	0	+25	---	22 17	30	+30	---	---	22 26	48	---
Newport, I.W.	E. M.	27° 2'	310	22 13	0	+25	---	22 17	30	+31	---	---	22 26	48	---
West Bromwich	E. M.	27° 2'	310	22 13	0	+25	---	22 17	30	+31	---	---	22 26	48	---
Granada	N. G.	28° 2'	313	22 12	40	- 7	---	22 18	0	-19	---	---	22 25	30	---
Bilston	E. M.	28° 5'	280	22 12	40	- 7	---	22 18	0	-19	---	---	22 25	30	---
Stonyhurst	E. M.	28° 5'	280	22 12	40	- 7	---	22 18	0	-19	---	---	22 25	30	---
Eskeaton	E. G.	29° 1'	314	22 13	1	+ 4	---	22 19	18	+25	---	---	22 27	48	---
Eskeaton	E. G.	29° 1'	314	22 13	1	+ 4	---	22 19	18	+25	---	---	22 27	48	---
Eskeaton	E. G.	29° 1'	314	22 13	1	+ 4	---	22 19	18	+25	---	---	22 27	48	---
Dunstable	E. M.	30° 1'	322	22 13	4	+ 1	---	22 17	55	-15	---	---	22 25	34	---
Pies, Aachen	E. M.	30° 1'	322	22 13	4	+ 1	---	22 17	55	-15	---	---	22 25	34	---
San Fernando	E. M.	30° 7'	280	22 13	0	- 9	---	22 18	0	-20	---	---	22 27	31	---

CT

Station and Component	Machine.	Distance ° from Origin.	° Azimuth.	P.	O-C.	Pr ₁	S.	O-C.	L.	M.	Remarks.	
			H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.		
Ris. Thilo	M.	307.0	288	22 14 0	+51	—	22 18 0	-10	—	22 22 0	22 29 0	
Cape Thilo	O.E.	317.0	320	22 14 54	+50	—	22 21 0	-10	—	22 25 6	22 28 42	
Simba	M.	37.0	80	22 15 1	+36	—	22 22 59	+14	—	22 27 18	22 28 54	
Bombay	M.	39.6	106	22 15 42	+190	—	22 22 18	...	—	22 27 57	22 29 48	
Kochabemal	E.	48.7	112	22 18 1	+185	—	22 23 14	...	—	22 28 49	22 30 48	
Calcutta	E.	49.8	113	22 17 55	+162	—	22 23 11	...	—	22 28 42	22 30 48	
Colombo	E.	52.6	118	22 17 0	+185	—	22 23 24	...	—	22 29 17	22 31 0	
Mauritius	M.	62.3	138	22 17 0	+185	—	22 23 24	...	—	22 29 17	22 31 0	
Zika-wai	W.	70.8	163	22 18 33	+37	—	22 23 38	...	—	22 29 52	22 31 0	
Cape Town	E.	72.6	192	22 18 30	+41	—	22 23 38	...	—	22 29 52	22 31 0	
Fernando Noronha	E.	72.9	251	22 18 11	+6	—	22 23 28	...	—	22 29 42	22 31 0	
Lafayette Tabv.	B.O.	74.2	312	22 18 40	+18	—	22 23 28	...	—	22 29 42	22 31 0	
Ottawa	E.	74.9	316	22 18 11	+18	—	22 23 28	...	—	22 29 42	22 31 0	
Tonono	M.	75.0	317	22 18 40	...	—	22 23 28	...	—	22 29 42	22 31 0	
Osake	K.	78.1	317	22 18 40	...	—	22 23 28	...	—	22 29 42	22 31 0	
Manila	O.	78.5	55	22 19 18	+34	—	22 23 28	...	—	22 29 42	22 31 0	
Manila	W.	80.0	79	22 19 33	+40	—	22 23 28	...	—	22 29 42	22 31 0	
Manila	W.	81.5	105	22 19 36	+34	—	22 23 28	...	—	22 29 42	22 31 0	
St. Louis	W.	87.3	319	22 19 48	+13	—	22 23 28	...	—	22 29 42	22 31 0	
Victoria	E.	81.4	344	22 19 48	...	—	22 23 28	...	—	22 29 42	22 31 0	
Veracruz	K.	101.4	514	22 25 12	+220	—	22 23 28	...	—	22 29 42	22 31 0	
Honolulu	M.	108.2	262	22 25 12	+220	—	22 23 28	...	—	22 29 42	22 31 0	
Adelphi	E.	120.4	112	22 25 12	+220	—	22 23 28	...	—	22 29 42	22 31 0	
Honolulu	E.	121.9	112	22 25 12	+220	—	22 23 28	...	—	22 29 42	22 31 0	
Adelphi	E.	130.9	105	22 25 12	+220	—	22 23 28	...	—	22 29 42	22 31 0	
Sydney	M.	131.0	105	22 16 0	-426	—	22 22 28	...	—	22 28 48	22 29 24	

57N. 30E.
57N. 25E. 30m. 12s.

1914. October 6.
Origin : 30S. 179.5W., determined by Slide.
Time at Origin : 19h. 15m. 50s.

Station and Component	Machine.	Distance ° from Origin.	° Azimuth.	P.	O-C.	Pr ₁	S.	O-C.	L.	M.	Remarks.	
			H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.		
Adelphi	M.	35.1	252	19 23 12	+8	—	19 31 0	...	—	19 35 0	19 42	
Yorba	M.	34.6	250	19 23 12	...	—	19 31 0	...	—	19 35 0	19 42	
Hionobin	M.	53.4	286	19 27 43	+20	—	19 31 48	+92	—	19 40 48	19 53 48	
Manila	M.	73.4	289	19 27 12	-12	—	19 31 23	-23	—	19 32 30	19 42 30	
Hatavia	W.	72.7	272	19 29 8	+7.5	—	19 38 23	...	—	19 52 0	19 56 0	
Osake	W.	77.3	323	19 29 30	+4	—	19 38 36	-11	—	19 42 14	19 49 14	
Zika-wai	O.	83.0	312	19 29 42	-15	—	19 38 16	...	—	19 42 14	19 49 14	
La Paz	W.	89.3	315	19 29 42	...	—	19 38 16	...	—	19 42 14	19 49 14	
Solomon	M.	103.0	252	19 29 42	...	—	19 38 16	...	—	19 42 14	19 49 14	
Veracruz	K.	105.4	252	19 29 42	...	—	19 38 16	...	—	19 42 14	19 49 14	
Veracruz	K.	105.4	252	19 29 42	...	—	19 38 16	...	—	19 42 14	19 49 14	
Kochabemal	E.	106.4	252	19 29 42	...	—	19 38 16	...	—	19 42 14	19 49 14	
Fernando Noronha	E.	114.3	219	19 29 42	...	—	19 38 16	...	—	19 42 14	19 49 14	
Heilvan	E.	133.8	131	19 29 42	+389	—	19 30 15	...	—	19 33 30	19 33 30	
Schabunth	E.	133.1	284	19 35 0	...	—	19 30 15	...	—	19 33 30	19 33 30	
Eschabunth	E.	134.0	355	19 35 45	...	—	19 30 15	...	—	19 33 30	19 33 30	
Brisson	E.	154.5	355	19 35 45	...	—	19 30 15	...	—	19 33 30	19 33 30	
Kew	M.	156.5	355	19 46 42	...	—	19 30 15	...	—	19 33 30	19 33 30	
Shildeford	M.	158.3	1	19 45 30	...	—	19 30 15	...	—	19 33 30	19 33 30	
Shildehurst	M.	158.3	2	19 45 30	...	—	19 30 15	...	—	19 33 30	19 33 30	
Paris	K.	159.6	352	19 45 30	...	—	19 30 15	...	—	19 33 30	19 33 30	
Kochabemal	K.	161.2	352	19 45 30	...	—	19 30 15	...	—	19 33 30	19 33 30	
Kochabemal	G.	163.9	341	19 36 14	...	—	19 30 15	...	—	19 33 30	19 33 30	
Pompeii	S.	164.5	317	19 36 14	...	—	19 30 15	...	—	19 33 30	19 33 30	
Bancona	N.	164.5	317	19 36 14	...	—	19 30 15	...	—	19 33 30	19 33 30	
Hio Thilo	O.A.	168.5	9	19 47 50	...	—	19 30 15	...	—	19 33 30	19 33 30	
Hio Thilo	M.	170.0	34	20 39 30	...	—	19 30 15	...	—	19 33 30	19 33 30	
Sau Fernando	E.	171.5	35	20 39 30	...	—	19 30 15	...	—	19 33 30	19 33 30	
Geranda	E.	171.5	35	20 39 30	...	—	19 30 15	...	—	19 33 30	19 33 30	
Geranda	N.	172.1	24	19 53 35	...	—	19 30 15	...	—	19 33 30	19 33 30	

1914. October 17.

Origin : 38N. 24E., determined by Slide.

Time at Origin : 10h. 42m. 0s.

Station and Component.	Machine.	Distance ° from Origin.	Azimuth °	P.		O-C.		PR ₁		S.		O-C.		L.		M.		Remarks.
				H.	M. S.	S.	H.	M. S.	H.	M. S.	H.	M. S.	H.	M. S.	H.	M. S.		
Pompeii	O.A.	7.8	293	10 45	0	+82	—	—	10 47	0	+88	10 54	10	—	—	—	—	—
Holwan	O.A.	7.8	293	10 45	0	+88	—	—	10 47	0	+88	10 54	10	—	—	—	—	—
Farafra	M.	10.1	141	—	—	—	—	—	10 48	0	+88	10 54	10	—	—	—	—	—
Farafra	A.	11.2	305	—	—	—	—	—	10 46	53	-6	10 48	3	—	—	—	—	—
Marsa Matruh	V.	11.8	314	10 45	45	+49	—	—	10 46	53	+61	10 50	19	—	—	—	—	—
Marsa Matruh	S.	14.9	305	10 46	15	+49	—	—	10 48	47	+39	10 52	19	10 53	37	—	—	—
Dergha	M.	17.6	295	—	—	—	—	—	10 49	56	+8	—	—	—	—	—	—	—
Dergha	M.	17.6	295	10 46	32	—	—	—	10 50	31	+8	10 52	0	10 54	44	—	—	—
Bahari	C.	20.0	77	—	—	—	—	—	10 50	31	+8	10 52	12	10 55	0	—	—	—
Kew	E.	21.7	316	10 46	37	-4	—	—	10 50	31	+8	10 52	12	10 55	0	—	—	—
Kew	E.	21.8	313	—	—	—	—	—	10 49	13	-106	10 54	26	—	—	—	—	—
Graulford	M.	21.9	313	10 45	10	+10	—	—	10 52	12	+16	10 54	26	10 56	0±	—	—	—
Shide	E.	21.9	313	10 46	54±	+10	—	—	10 52	12	+16	10 54	26	10 56	0±	—	—	—
Graulford	C.	21.9	278	10 47	7	+3	—	—	10 51	24±	+21	10 55	12	—	—	—	—	—
Phelovo	O.	22.1	8	—	—	—	—	—	10 50	46	-17	—	—	—	—	—	—	—
Phelovo	C.	22.1	8	—	—	—	—	—	10 51	0	-59	—	—	—	—	—	—	—
West-Bromwich	M.	23.2	317	—	—	—	—	—	10 51	0	-168	—	—	—	—	—	—	—
San Fernando	M.	24.0	276	—	—	—	—	—	10 54	30	+16	—	—	—	—	—	—	—
San Fernando	M.	24.0	276	—	—	—	—	—	10 52	30	+16	—	—	—	—	—	—	—
Islaston	E.	24.2	319	—	—	—	—	—	10 52	30	+16	10 55	0	10 58	30	—	—	—
Islaston	M.	25.2	322	—	—	—	—	—	10 53	49	+42	10 53	42	11	1	4	—	—
Edinburgh	G.	25.2	322	—	—	—	—	—	10 53	49	+42	10 53	42	11	1	4	—	—
Edinburgh	M.	25.5	323	10 47	28	—	—	—	10 53	49	+47	—	—	—	—	—	—	—

1914. October 17.

Origin : 38N. 23.5E., determined by Slide.

Time at Origin : 6h. 22m. 26s.

Station and Component.	Machine.	Distance ° from Origin.	Azimuth °	P.		O-C.		PR ₁		S.		O-C.		L.		M.		Remarks.
				H.	M. S.	S.	H.	M. S.	H.	M. S.	H.	M. S.	H.	M. S.	H.	M. S.		
Pompeii	O.A.	7.4	293	6 24	19	+1	—	—	6 25	28	-47	6 27	0	6 29	30	—	—	? Tomo.
Malta Cassino	O.A.	7.4	293	6 24	18	0	—	—	6 25	28	-19	6 26	28	6 28	0	—	—	—
Malta Cassino	M.	8.2	260	—	—	—	—	—	6 27	0	+73	—	—	6 33	0	—	—	—
Holwan	A.Ga.	8.2	260	6 24	44	+13	—	—	6 27	6	+58	—	—	6 33	0	—	—	—
Holwan	M.	10.4	159	6 25	30	+28	—	—	6 28	0	+48	—	—	6 33	0	—	—	—
Farafra	E.	10.9	306	6 25	23	+15	—	—	6 28	0	+48	—	—	6 33	0	—	—	—
Farafra	A.	10.9	306	6 25	23	+15	—	—	6 28	0	+48	—	—	6 33	0	—	—	—
Farafra	V.	11.3	314	6 24	50	+24	—	—	6 28	36	+69	—	—	6 30	19	—	—	—
Phelovo	S.	13.7	306	6 25	48	0	—	—	6 28	25	+2	—	—	6 30	19	—	—	—
Phelovo	S.	15.8	293	6 26	22	-6	—	—	6 28	36	+69	—	—	6 30	19	—	—	—
Phelovo	M.	18.5	312	6 26	49	-6	—	—	6 30	21	+4	—	—	6 31	15	—	—	—
Marconia	G.	20.5	312	—	—	—	—	—	6 31	18	+2	—	—	6 33	18	—	—	—
Marconia	C.	21.3	273	6 27	23	—	—	—	6 31	18	+2	—	—	6 33	18	—	—	—
Bahari	M.	21.4	316	6 27	22	-2	—	—	6 31	6	-12	—	—	6 37	0	—	—	Beginning lost.
Geranda	M.	21.4	316	6 27	22	-18	—	—	6 31	6	-12	—	—	6 37	0	—	—	F. In Greece.
Geranda	M.	21.4	316	6 27	22	-18	—	—	6 31	6	-12	—	—	6 37	0	—	—	—
Kew	E.	21.4	316	6 27	22	-18	—	—	6 31	6	-12	—	—	6 37	0	—	—	—
Kew	E.	21.4	316	6 27	22	-18	—	—	6 31	6	-12	—	—	6 37	0	—	—	—
Graulford	E.	21.6	314	6 27	30±	+4	—	—	6 31	0±	+7	6 34	3	6 36	48	—	—	—
Graulford	E.	21.6	314	6 27	30±	+4	—	—	6 31	0±	+7	6 34	3	6 36	48	—	—	—
Shide	N.	21.6	314	—	—	—	—	—	6 31	0±	-23	—	—	6 36	30±	—	—	—
Keyport, I.V.	G.	21.9	314	6 27	50	+24	—	—	6 31	26	+7	—	—	6 36	30	—	—	S. lost in traffic.
Keyport, I.V.	G.	22.4	317	6 27	51	-9	—	—	6 31	40	-7	—	—	6 35	30	—	—	S. lost in traffic.
Yule	M.	23.4	317	6 27	51	-9	—	—	6 31	40	-7	—	—	6 35	30	—	—	—
Yule	M.	23.4	317	6 27	51	-9	—	—	6 31	40	-7	—	—	6 35	30	—	—	—
San Fernando	E.	23.6	276	6 28	36	+50	—	—	6 31	40	-7	—	—	6 35	30	—	—	—
San Fernando	E.	23.6	276	6 28	36	+50	—	—	6 31	40	-7	—	—	6 35	30	—	—	—
Stonyhurst	E.	23.7	276	6 28	0	-100	—	—	6 32	30	+23	—	—	6 37	0	—	—	—
Stonyhurst	E.	23.9	319	6 28	13	+23	—	—	6 31	42	-20	6 34	42	6 38	48	—	—	—
Islaston	E.	24.9	323	6 27	58	-10	—	—	6 32	15	-12	6 34	0	6 39	48	—	—	38.5N. 23.5E.
Islaston	E.	25.2	324	6 28	0	-6	—	—	6 32	15	-12	6 34	0	6 37	36	—	—	—
Edinburgh	E.	25.6	327	6 28	0	-10	—	—	6 32	30	-10	6 36	50	6 37	36	—	—	—
Dyce, Aberdeen	E.	25.6	327	6 28	0	-10	—	—	6 32	30	-10	6 36	50	6 37	36	—	—	—

Geok.	P.	O-C.	PRs	S.	O-C.	L.	M.	Remarks.
Acores	312	...	? 6 31 0	---	...	---	? 6 38 30	---
Bombay	285	---	---	---	---	---	6 46 24	---
Fernando Noronha	100	---	---	6 43 30	+21	---	6 32 10	---
Cape Town	184	...	---	---	...	---	7 2 48	---
Lisbon	312	...	---	---	...	---	7 14 54	---
Toronto	389	...	---	---	...	---	7 24 0	---
Victoria	389	...	---	---	...	---	7 24 0	---
La Paz	258	...	---	---	...	---	7 33 48	---
London	328	...	---	---	...	---	7 40 42	---

1914. October 23.
 Origin : 6N. 132.5E., determined by Shide.
 Time at Origin : 6h. 18m. 34s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.		P.	O-C.	PRs	S.	O-C.	L.	M.	Remarks.
			H. M. S.	S.								
Mantle	W.	11.2	6 51 50	-13	---	---	6 21 38	-9	6 28 0	6 36 20	Mindanao Is.	
Thames	O.	21.7	6 23 31	+15	---	---	6 27 29	-4	6 30 15	6 33 15		
Zeilerei	W.	27.2	6 24 29	5	6 21 46	6 24 49	6 29 5	-14	6 30 15	6 33 3	S.R. 6h. 20m. 38s.	
Bombay	W.	28.4	6 23 52	-54	?	6 24 19	---	...	6 30 24	6 34 41		
Oosaka	O.	28.7	6 24 51	+5	---	---	---	...	---	6 38 30		
Cocos	E.	30.8	6 27 0	+33	---	---	6 34 0	+64	---	6 41 30		
Perth	E.	41.1	6 26 0	-38	---	---	---	...	---	6 42 54		
Adelaide	E.	41.4	6 27 24	+44	---	---	---	-18	6 43 36	6 47 30		
Sydney	M.	43.6	6 27 24	...	?	6 27 33	6 33 12	+1	6 43 36	6 47 30		
Reveriew	E.	43.6	6 27 24	...	?	6 27 33	6 33 31	-1	6 43 36	6 47 30		
Catania	M.	43.6	6 27 24	...	?	6 27 33	6 33 31	...	6 43 36	6 47 30		
Calcutta	M.	43.6	6 27 24	...	?	6 27 33	6 33 31	...	6 43 36	6 47 30		
Colombo	M.	43.6	6 27 24	...	?	6 27 33	6 33 31	...	6 43 36	6 47 30		
T. Okhkanal	H.	54.6	6 28 18	+7	---	---	---	...	6 31 20	6 34 36		
Simla	M.	57.4	6 28 18	-47	---	---	6 33 12	-73	6 34 42	6 42 48		
Bombay	E.	59.4	6 28 40	+2	---	---	6 35 12	-30	6 41 18	6 45 48		
Honolulu	E.	68.7	6 31 6	+83	---	---	6 36 20	+82	6 50 6	6 55 41		
Hakai	G.	80.5	6 30 32	-24	---	---	6 40 31	-32	---	---		
Pulkovo	G.	80.9	6 31 43	-12	---	---	6 42 34	-23	---	---	SN. 191E.	
Victoria	M.	94.7	6 31 43	...	---	---	6 43 18	...	7 3 48	7 10 18		
Helwan	E.	94.7	6 31 43	...	---	---	6 43 18	...	7 3 48	7 10 18		
Padova	E.	94.7	6 31 43	...	---	---	6 43 18	...	7 3 48	7 10 18		
Prague	N.	106.3	6 33 24	+9	---	---	6 43 44	-105	7 3 33	7 11 30	Dempeled.	
Dyest, Aberdeen	O.	106.3	6 33 24	...	?	6 37 37	6 43 4	+289	7 15 30	7 15 30	Dempeled.	
Florence	E.	106.9	6 36 52	...	---	---	6 43 47	-107	7 15 0	7 22 36		
Edinburgh	E.	107.4	6 36 52	+212	---	---	6 44 52	+88	7 10 23	7 15 30		
Eschdeammur	A.	107.4	6 36 52	-23	---	---	6 44 52	-47	7 10 23	7 15 30		
Eschdeammur	M.	108.2	6 33 23	...	---	---	6 45 16	...	7 12 30	7 16 18		
Eschdeammur	G.	108.6	6 33 23	...	---	---	6 45 16	...	7 12 30	7 16 18		

Station and Component.	Machine.	Distance from Origin.	azimuth.	P.	O-C.	PR ₁	S.	O-C.	I.	M.	Remarks.
				H. M. S.	S.	H. M. S.	H. M. S.	S.	H. M. S.	H. M. S.	
Monckhert	S.	109° 1	332	6 33 16	-11	6 38 30	6 45 10	-14	7 2 55	7 32 33	
Stonyhurst	E. M.	109-3	334	6 33 12	...	6 46 30	6 46 30	+34	7 17 0	7 24 30	
Idleston	E. M.	109-8	331	6 35 36	+126	6 37 47	6 45 53	...	7 17 30	7 17 30	
Kew	E. M.	109-8	331	6 35 36	+126	6 37 47	6 45 53	...	7 17 30	7 17 30	
West Bromwich	M.	109-9	333	6 34 30	+59	6 37 49	6 45 30	-32	7 10 0	7 21 0	
Paris	M.	110-0	335	6 33 42	+10	6 37 49	6 45 30	-32	7 10 0	7 16 0	
Redford	M.	110-1	331	6 33 42	+10	6 37 49	6 45 30	-32	7 10 0	7 16 0	
Shide	M.	110-1	331	6 33 42	+10	6 37 49	6 45 30	-32	7 10 0	7 16 0	
Newport, I. W.	N. M.	110-8	331	6 33 30±	...	6 37 30±	6 43 13	-50	7 13 25	7 27 31	
Cape Town	E. M.	110-8	331	6 33 30±	...	6 37 30±	6 43 13	-50	7 13 25	7 27 31	
Barrowda	E. M.	113-3	326	...	...	6 38 40	...	...	...	...
Oranuda	E. M.	113-4	321	...	...	6 38 8	6 44 18	-132	7 11 10	7 25 0	
Hio Ythio	E. M.	120-5	330	6 33 57	-22	6 37 53	6 45 30	-117	7 0 0	7 19 0	
Sua Fernando	E. M.	122-0	322	6 37 0	+134	6 37 53	6 45 30	-117	7 0 0	7 24 30	2.7N. 101.2E.
Toronto	N. M.	122-5	321	...	...	6 39 0	6 49 0	+78	7 29 0	7 33 0	
Oranuda	E. M.	122-5	321	...	...	6 39 0	6 49 0	+78	7 29 0	7 33 0	
Keewau	E. M.	122-5	321	...	...	6 39 0	6 49 0	+78	7 29 0	7 33 0	
Lea Puz	N. E. O.	122-5	321	6 37 57	+208	6 39 0	6 45 40	-113	6 31 0	6 37 0	
Fernando Noronha	E. M.	157-2	112	6 38 55	+148	6 40 18	6 44 47	-207	6 37 11	6 43 15	
		164-9	266	6 40 0	...	6 51 40	6 51 40	...	7 18 15	7 27 10	

1914. October 26.
 Origin : 44.1N. 9E., determined by Shide.
 Time at Origin : 3h. 43m. 19s.

Station and Component.	Machine.	Distance from Origin.	azimuth.	P.	O-C.	PR ₁	S.	O-C.	I.	M.	Remarks.
				H. M. S.	S.	H. M. S.	H. M. S.	S.	H. M. S.	H. M. S.	
Monckhert	S.	1-1	303	3 43 22	-14	...	...	...	...	...
Plymoue	E. A.	1-8	118	3 44 29	+42	...	...	...	...	3 43 29	
Padova	N. V.	2-3	180	3 44 23	+42	...	...	...	...	3 45 52	
Monte Cassino	N. V.	2-3	180	3 44 13	+42	...	...	...	...	3 45 51	
Rompeit	O. A.	4-7	132	3 46 0	+25	...	...	...	...	...
Parabona	M. R.	6-2	312	3 44 38	-16	...	...	...	...	...
Shide	M. R.	6-2	312	3 44 38	-16	...	...	...	...	...
Newport, I. W.	E. M.	9-3	315	3 45 30±	-9	...	...	...	...	...
Guildford	E. M.	9-3	315	3 44 39	-60	...	...	...	...	...
Kew	E. M.	9-3	321	...	...	...	...	...	...	...
West Bromwich	E. M.	10-9	322	...	...	...	...	...	...	...
Idleston	E. M.	11-9	323	...	...	...	...	...	...	...
Stonyhurst	E. M.	11-9	323	...	...	...	...	...	...	...
Granada	E. O.	12-0	326	3 47 22	+64	...	...	...	...	...
Edinburgh	G. M.	13-4	329	...	...	...	...	...	...	...
Edinburgh	E. M.	13-5	330	...	...	...	...	...	...	...
San Fernando	E. M.	14-1	240	...	...	...	...	...	...	...
Dyce, Aberdeen	E. M.	14-1	240	3 48 5	+72	...	...	...	...	...
Padova	E. M.	14-6	335	3 47 56	-3	...	...	...	...	...
Hilwen	E. M.	19-9	32	...	...	...	...	...	...	...
Baku	E. M.	23-0	123	...	...	...	...	...	...	...
		30-3	81	...	...	...	...	...	...	...

P. in Laguna, Piedmont, and Steoy.

1914. October 27.

Origin : 46N. 9E.

Time at Origin : 9h. 22m. 19s.

Station and Component	Machine.	Distance ° from Origin.	° Azimuth.	P.		O-C.		TR ₁		S.		O-C.		L.		M.		Remarks.
				H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.		S.
Monahelt	S. V.	1.4	221	9 23	6	+25	---	---	9 23	26	+28	9 23	33	9 23	51	---	---	
Pelovne	V. A.	2.1	104	9 22	47	-25	---	---	9 23	10	-7	---	---	---	---	---	---	
Pelovne	M. A.	2.7	164	9 22	36	+23	---	---	9 25	25	+14	---	---	---	---	---	---	
Paris	Atom.	5.2	385	9 22	18	-24	---	---	9 23	45	-70	---	---	---	---	---	---	
Paris Casino	M. A.	6.4	302	9 25	4	---	---	---	9 24	9	-70	---	---	---	---	---	---	
Kow	E. O.A.	6.6	182	9 25	28	-31	---	---	9 24	14	-65	---	---	---	---	---	---	
Pompidi	M. A.	6.7	192	9 24	4	+3	---	---	9 25	19	-2	---	---	---	---	---	---	
Barcelona	M. A.	8.2	313	9 25	22	+99	---	---	9 27	18	+77	---	---	---	---	---	---	
Grandfont	M. A.	9.7	316	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
West Bromwich	M. A.	12.1	321	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Zschalamm	G.	12.9	321	9 25	30	---	---	---	9 28	3	+2	---	---	---	---	---	---	
Oranada	G.	12.9	321	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
San Fernando	M. A.	14.9	285	9 27	45	+63	---	---	9 30	48	---	---	---	---	---	---	---	
Paluro	M. A.	18.7	35	9 26	43	+1	---	---	9 30	22	---	---	---	---	---	---	---	
Baku	G.	30.0	86	9 28	12	-35	---	---	9 33	49	-64	---	---	---	---	---	---	48N. HE.

1914. October 28.

Origin : 39S. 180, determined by Riverview.

Time at Origin : 0h. 16m. 14s.

Station and Component	Machine.	Distance ° from Origin.	° Azimuth.	P.		O-C.		PR ₁		S.		O-C.		L.		M.		Remarks.
				H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.	S.	H.	M.		S.
Stancy	M.	28.7	276	0 21	30	-8	---	---	0 25	48	-4	0 27	48	0 30	0	---	---	
Riverview	M.	28.7	275	0 21	30	---	---	---	0 25	48	-4	0 27	30	0 37	6	---	---	39S. 180.
Adelaide	M.	33.1	263	0 26	12	+10	---	---	---	---	---	---	---	---	---	---	---	
Terri	M.	51.7	257	0 28	15	+13	---	---	---	---	---	---	---	---	---	---	---	
Honolulu	M.	63.8	258	0 28	15	+13	---	---	---	---	---	---	---	---	---	---	---	
Honolulu	M.	75.9	255	0 28	15	+13	---	---	---	---	---	---	---	---	---	---	---	
Honolulu	M.	75.9	255	0 28	15	+13	---	---	---	---	---	---	---	---	---	---	---	
Palokan	W.	84.1	309	0 30	23	+22	---	---	---	---	---	---	---	---	---	---	---	
La Paz	O.	85.5	117	0 30	23	+22	---	---	---	---	---	---	---	---	---	---	---	
Mauritius	M.	99.8	284	---	---	---	---	---	0 40	57	-29	---	---	---	---	---	---	
Victoria	M.	100.8	84	---	---	---	---	---	0 52	54	+637	---	---	---	---	---	---	
Calombo	M.	102.2	272	---	---	---	---	---	0 51	6	+344	---	---	---	---	---	---	
Samba	O.D.	118.2	289	---	---	---	---	---	0 51	6	+344	---	---	---	---	---	---	
Toronto	M.	122.5	57	---	---	---	---	---	0 49	3	+93	---	---	---	---	---	---	
Terranito	M.	122.5	57	---	---	---	---	---	0 49	3	+93	---	---	---	---	---	---	
Novorika	M.	137.6	137	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Dakin	M.	137.6	137	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Belknap	G.	142.3	289	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Belknap	M.	142.3	289	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Belknap	M.	162.9	6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Belknap	G.	163.5	6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Stonyhurst	M.	165.0	7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Belknap	M.	165.4	7	---	---	---	---	---	0 55	0	---	---	---	---	---	---	---	
Belknap	M.	167.6	4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Grifford	M.	167.6	4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Kew	M.	168.2	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Slide	M.	168.2	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Erbs	M.	170.0	10	---	---	---	---	---	1 3	24	---	---	---	---	---	---	---	
Pelovne	A.	170.0	305	0 50	48	---	---	---	---	---	---	---	---	---	---	---	---	
Novobentri	M.	174.2	329	0 40	30	---	---	---	1 3	24	---	---	---	---	---	---	---	
San Fernando	M.	174.5	115	0 40	30	---	---	---	---	---	---	---	---	---	---	---	---	
Granada	M.	174.5	115	0 40	30	---	---	---	---	---	---	---	---	---	---	---	---	
Granada	G.	175.6	122	0 38	5	---	---	---	0 49	25	---	---	---	---	---	---	---	

1	15	28	13	51	553	991	438	101	855	1565	710
2	31	55	24	52	560	1004	444	102	860	1575	715
3	47	83	36	53	566	1016	450	103	865	1584	719
4	62	110	48	54	573	1029	456	104	870	1593	723
5	77	137	60	55	579	1041	462	105	874	1602	728
6	92	164	72	56	586	1054	468	106	879	1612	733
7	106	190	84	57	592	1066	474	107	884	1621	737
8	121	217	96	58	599	1079	480	108	888	1630	742
9	136	243	107	59	605	1091	486	109	893	1639	746
10	150	269	119	60	612	1103	497	110	897	1648	751
11	164	294	130	61	619	1116	497	111	902	1657	755
12	179	319	140	62	625	1128	503	112	907	1666	759
13	193	344	151	63	632	1141	509	113	911	1674	763
14	206	368	162	64	638	1153	515	114	916	1682	768
15	219	392	173	65	645	1165	520	115	920	1690	770
16	232	415	183	66	651	1177	526	116	925	1698	773
17	245	438	193	67	658	1190	532	117	929	1706	777
18	257	460	203	68	664	1202	538	118	934	1714	780
19	269	482	213	69	671	1214	543	119	938	1722	784
20	281	503	222	70	677	1226	549	120	942	1729	787
21	293	524	231	71	683	1238	555	121	947	1737	790
22	305	545	240	72	689	1250	560	122	952	1744	792
23	317	565	248	73	696	1262	566	123	957	1752	795
24	328	584	256	74	702	1274	572	124	961	1759	798
25	338	603	265	75	709	1286	577	125	966	1766	800
26	348	622	274	76	715	1297	582	126	970	1773	803
27	358	641	283	77	721	1309	588	127	974	1780	806
28	368	659	291	78	727	1320	593	128	978	1787	809
29	378	677	299	79	733	1332	599	129	983	1794	811
30	388	694	306	80	739	1343	604	130	988	1801	813
31	398	711	313	81	745	1355	610	131	992	1807	815
32	407	728	321	82	750	1366	616	132	996	1814	818
33	416	744	328	83	756	1377	621	133	1001	1821	820
34	425	760	335	84	762	1388	626	134	1005	1827	822
35	433	775	342	85	768	1399	631	135	1009	1833	824
36	442	790	348	86	773	1410	637	136	1014	1840	826
37	450	804	354	87	779	1421	642	137	1018	1846	828
38	458	818	360	88	785	1432	647	138	1023	1852	829
39	466	832	366	89	790	1443	653	139	1027	1858	831
40	475	847	372	90	796	1454	658	140	1031	1864	833
41	483	861	378	91	801	1464	663	141	1035	1869	834
42	491	875	384	92	807	1475	668	142	1039	1875	836
43	498	888	390	93	812	1485	673	143	1043	1881	838
44	506	902	396	94	818	1496	678	144	1047	1886	839
45	513	915	402	95	823	1506	683	145	1051	1892	841
46	520	928	408	96	829	1516	687	146	1055	1897	842
47	527	941	414	97	834	1526	692	147	1059	1902	843
48	534	954	420	98	840	1536	696	148	1063	1907	844
49	540	966	426	99	845	1546	701	149	1067	1912	845
50	547	979	432	100	851	1556	705	150	1071	1917	846

TABLE.

1	15	28	13	51	553	991	438	101	855	1565	710
2	31	55	24	52	560	1004	444	102	860	1575	715
3	47	83	36	53	566	1016	450	103	865	1584	719
4	62	110	48	54	573	1029	456	104	870	1593	723
5	77	137	60	55	579	1041	462	105	874	1602	728
6	92	164	72	56	586	1054	468	106	879	1612	733
7	106	190	84	57	592	1066	474	107	884	1621	737
8	121	217	96	58	599	1079	480	108	888	1630	742
9	136	243	107	59	605	1091	486	109	893	1639	746
10	150	269	119	60	612	1103	497	110	897	1648	751
11	164	294	130	61	619	1116	497	111	902	1657	755
12	179	319	140	62	625	1128	503	112	907	1666	759
13	193	344	151	63	632	1141	509	113	911	1674	763
14	206	368	162	64	638	1153	515	114	916	1682	768
15	219	392	173	65	645	1165	520	115	920	1690	770
16	232	415	183	66	651	1177	526	116	925	1698	773
17	245	438	193	67	658	1190	532	117	929	1706	777
18	257	460	203	68	664	1202	538	118	934	1714	780
19	269	482	213	69	671	1214	543	119	938	1722	784
20	281	503	222	70	677	1226	549	120	942	1729	787
21	293	524	231	71	683	1238	555	121	947	1737	790
22	305	545	240	72	689	1250	560	122	952	1744	792
23	317	565	248	73	696	1262	566	123	957	1752	795
24	328	584	256	74	702	1274	572	124	961	1759	798
25	338	603	265	75	709	1286	577	125	966	1766	800
26	348	622	274	76	715	1297	582	126	970	1773	803
27	358	641	283	77	721	1309	588	127	974	1780	806
28	368	659	291	78	727	1320	593	128	978	1787	809
29	378	677	299	79	733	1332	599	129	983	1794	811
30	388	694	306	80	739	1343	604	130	988	1801	813
31	398	711	313	81	745	1355	610	131	992	1807	815
32	407	728	321	82	750	1366	616	132	996	1814	818
33	416	744	328	83	756	1377	621	133	1001	1821	820
34	425	760	335	84	762	1388	626	134	1005	1827	822
35	433	775	342	85	768	1399	631	135	1009	1833	824
36	442	790	348	86	773	1410	637	136	1014	1840	826
37	450	804	354	87	779	1421	642	137	1018	1846	828
38	458	818	360	88	785	1432	647	138	1023	1852	829
39	466	832	366	89	790	1443	653	139	1027	1858	831
40	475	847	372	90	796	1454	658	140	1031	1864	833
41	483	861	378	91	801	1464	663	141	1035	1869	834
42	491	875	384	92	807	1475	668	142	1039	1875	836
43	498	888	390	93	812	1485	673	143	1043	1881	838
44	506	902	396	94	818	1496	678	144	1047	1886	839
45	513	915	402	95	823	1506	683	145	1051	1892	841
46	520	928	408	96	829	1516	687	146	1055	1897	842
47	527	941	414	97	834	1526	692	147	1059	1902	843
48	534	954	420	98	840	1536	696	148	1063	1907	844
49	540	966	426	99	845	1546	701	149	1067	1912	845
50	547	979	432	100	851	1556	705	150	1071	1917	846

British Association for the Advancement of Science.—Seismological Committee.

Observations and formal business to Special Invitations to
 J. II. BURGESS, Prof. H. H. PRINER,
 Earthquake Observatory, University Observatory,
 SHIPDE, Isle of Wight. OXFORD.

Bulletin for November and December, 1914.

For the large Earthquakes an attempt is here made to compare the readings with theoretical values, as explained in the Ninteenth Report of the Committee to the British Association. The position of the epicentre is adopted from the Pulkovo determination, unless otherwise stated; and the tables of times for P and S are those given by Galtzau in his "Vorlesungen über Seismometrie," p. 137, or by G. W. Walker on p. 54 of his "Modern Seismology." It is shown in the above Report that these tables are sensibly erroneous; but the precise values of the corrections are under discussion and it seems better to await the definitive corrections than to introduce provisional tables. The tables are reproduced in an expanded form on page 14 of this Bulletin. The time of the earthquake at the epicentre is deduced from the Pulkovo records; and applying the tabular times for the distances in the third column (calculated and also measured from a large globe specially made for the purpose), the errors O — C of the observed times are found.

Observers are requested to send a copy of their Registers to Slide *each month*, in order that this collated information may be published as early as possible.

In the Earthquake Chart the stations are arranged in the order of longitude, starting from the Azores and travelling eastward. For the large earthquakes they are arranged in the order of distance from epicentre, as shown in the 3rd column. The azimuth in the 4th column is also read from the globe; and is the azimuth at the epicentre measured from N. towards E., in which the observing station lies.

The letters in the 2nd column stand for: A. = Altkani; Agra. = Agamemore; B. = Bosc; Bif. = Biflar; B. O. = Bosc-Omori; C. = Cartuja; Ca. = Cancani; C. O. = Cartuja-Omori; G. = Galtzau; L. = Luckmann; M. = Milne; Ma. = Mainka; M. B. = Milne-Burgess; M. S. = Milne-Shaw; O. A. = Omori-Altkani; O. E. = Omori-Ewing; S. = Stattesi; V. = Vincenini; W. = Wiechert.

Guldford and West Bromwich use a modification of the Milne-Hamburg uses machines by Wiechert and von Rebeur-Paschwitz-Hecker. Heidelberg's machine is an astatic pendulum made at the Observatory. Riverview has two Wiecherts and one Mainka.

1914. November 4.

Origin : 30°5N. 69°E., determined by Shide.

Time at Origin : 11h. 6m. 48s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O—C.	PR ₁			S.			O—C.	L.			M.			Remarks.
				H.	M.	s.	s.	H.	M.	s.	H.	M.	s.	s.	H.	M.	s.	H.	M.	s.	
Sinla	O.E.	7.1	81	11	8	36	0	—	—	—	11	9	42	-19	—	—	—	11	11	42	—
Bombay	M.	12.4	163	11	14	15	+267	—	—	—	—	—	-19	—	—	—	11	16	10	—	
Baku	G.	18.4	308	11	10	54	-16	—	—	—	11	14	18	—	11	18	0	11	20	7	—
Calcutta	E.	19.0	110	11	13	32	+135	—	—	—	—	—	—	—	11	18	5	11	17	36	—
Kodaikanal	E.	21.8	157	11	1	0	-651	—	—	—	—	—	—	—	11	16	54	11	22	48	—
Colombo	M.	25.7	155	11	20	0	+447	—	—	—	11	22	0	-296	11	22	48	11	24	12	—
Helwan	E.	32.4	278	11	15	0	+81	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pulkovo	G.	39.0	330	11	14	8	-26	—	—	—	11	20	8	—	—	—	—	—	—	—	—
Moncalieri	G.	49.3	305	? 11	22	37	+407	—	—	—	11	28	1	-303	11	32	17	11	42	10	—
Paris	M.	52.5	310	—	—	—	—	—	—	—	—	—	—	—	11	41	0	11	45	0	—
Kew	M.	54.0	314	11	42	18	+1557	—	—	—	—	—	—	—	—	—	—	11	45	24	—
Shide	M. B.	54.7	313	11	16	0	-25	—	—	—	11	23	30	—	—	—	—	11	42	30	—
	M.	54.7	313	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11	42	30	—
	M.	54.7	313	—	—	—	—	—	—	—	—	—	—	—	11	27	30	11	44	0	—
Dyce, Aberdeen	M.	54.8	321	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11	45	0	—
West Bromwich	M.	55.0	315	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11	45	0	—
Stonyhurst	M.	55.1	317	11	25	30	+542	—	—	—	—	—	—	—	—	—	—	11	48	30	—
Edinburgh	E.	55.3	320	11	24	0	+451	—	—	—	—	—	—	—	—	—	—	11	45	42	—
Eskdalemuir	G.	55.4	319	? 11	16	30	0	—	—	—	? 11	24	6	—	11	36	0	—	—	—	—
Bidston	E.	55.5	316	—	—	—	—	—	—	—	11	35	42	-686	—	—	—	11	46	30	—
Granada	M.	59.2	298	—	—	—	—	—	—	—	—	—	—	—	11	37	0	11	51	24	—
San Fernando	M.	61.3	298	11	38	0	+1251	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fernando Noronha	M.	101.8	267	—	—	—	—	—	—	—	—	—	—	—	11	46	45	—	—	—	—
La Paz	M.	138.2	281	11	45	9	+1276	—	—	—	? 11	47	37	+594	11	48	35	11	48	45	—

1914. November 18.

Origin : 1°8N. 86°W., determined by Shide.

Time at Origin : 9h. 37m. 37s.

Station and Component.	Machine.	Distance ° from Origin.	° Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Toronto	E. M.	42.3	7	9 48 18	+148	—	—	—	—	—	—	—	—	—	9 58 48	10 1 12	—	—	—	—	
Harvard Univ.	E. B.O.	42.7	16	—	—	—	—	—	—	—	9 52 27	+6	—	—	9 59 22	—	—	—	—	—	
Ottawa	E. B.O.	42.7	16	9 46 11	+18	9 47 43	—	—	—	—	9 52 7	-14	—	—	9 59 49	—	—	—	—	—	
	N. B.	44.5	10	—	—	—	—	—	—	—	9 52 58	+13	—	—	9 56 30	—	—	—	—	—	
Lick	E. B.	44.5	10	9 46 14	+8	—	—	—	—	—	—	—	—	—	9 56 12	—	—	—	—	—	
	N. W.	48.1	321	9 47 30	+58	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Berkeley	—	49.0	322	—	—	—	—	—	—	—	9 55 3	+80	—	—	—	—	—	—	—	—	
Fernando Noronha	E. M.	53.8	95	9 46 36	-33	—	—	—	—	—	9 54 0	-43	—	—	9 58 15	10 7 45	—	—	—	—	
Victoria	E. M.	56.8	331	9 56 18	+531	—	—	—	—	—	10 0 48	+330	—	—	10 8 18	10 14 48	—	—	—	—	
Azores	E. M.	65.8	49	9 58 36	+699	—	—	—	—	—	—	—	—	—	—	9 59 42	—	—	—	—	
Honolulu	E. M.	72.6	292	10 0 12	+661	—	—	—	—	—	—	—	—	—	10 15 36	10 19 12	—	—	—	—	
Rio Tinto	E. M.	80.5	52	9 57 0	+421	—	—	—	—	—	—	—	—	—	—	10 28 0	—	—	—	—	
San Fernando	E. M.	80.7	53	9 51 0	+60	—	—	—	—	—	10 0 0	-8	—	—	—	10 31 0	—	—	—	—	
	N. M.	80.7	53	9 50 0	0	—	—	—	—	—	10 0 0	-8	—	—	—	10 29 0	—	—	—	—	
Granada	C.	82.8	53	9 50 12	0	—	—	—	—	—	10 0 33	+1	—	—	10 12 30	10 18 6	—	—	—	1°-1N. 85°-6W.	
Eskdalemuir	G.	84.4	35	9 50 28	+7	—	—	—	—	—	10 0 43	-6	—	—	10 14 0	10 24 30	—	—	—	6°N. 88°W. or 2°N. 84°W.	
Edinburgh	E. M.	84.5	34	9 51 0	+38	—	—	—	—	—	—	—	—	—	—	10 31 42	—	—	—	—	
Stonyhurst	E. M.	84.7	36	9 52 0	+97	—	—	—	—	—	—	—	—	—	—	10 29 30	—	—	—	—	
Shide	E. M.	85.3	39	—	—	—	—	—	—	—	—	—	—	—	—	10 26 0	—	—	—	Machine disturbed by changing paper.	
Guildford	E. M.	85.7	39	—	—	—	—	—	—	—	—	—	—	—	—	10 32 24	—	—	—	—	
Kew	E. M.	85.9	38	—	—	—	—	—	—	—	—	—	—	—	—	10 32 12	—	—	—	—	
Barcelona	E. Ma.	87.4	49	—	—	—	—	—	—	—	—	—	—	—	10 19 29	—	—	—	—	—	
Paris	—	87.7	41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Moncalieri	S.	91.3	45	9 50 54	-6	—	—	—	—	—	10 1 0	-25	—	—	—	—	—	—	—	—	—
Pulkovo	G.	101.3	37	9 51 49	-4	—	—	—	—	—	10 1 46	-18	—	—	10 20 42	10 34 0	—	—	—	—	—
Cape Town	E. M.	102.3	125	10 22 36	+1762	—	—	—	—	—	10 3 17	-28	—	—	—	—	—	—	—	—	—
Helwan	E. M.	112.5	56	9 57 6	+260	—	—	—	—	—	10 34 54	+1859	—	—	—	10 39 0	—	—	—	—	—

Sydney	E.	M.	117-9	232	10	8	12	+902	—	—	—	—	10	38	30	—		
Riverview			117-9	232	10	18	30	+1520	—	—	—	—	10	39	47	—		
Baku	G.		121-8	39	9	53	50	+22	—	10	7	54	10	31	0	—		
Adelaide	E.	M.	127-0	226	10	9	18	+927	—	—	—	—	—	—	10	51	55	
Zi-ka-wei		W.	138-0	324	—	—	—	—	—	—	—	—	—	—	10	56	12	
Mauritius	E.	M.	140-3	120	10	0	12	+323	? 10	1	48	—	—	—	—	—	—	
	N.	M.	140-3	120	10	39	48	+2699	—	—	—	—	10	49	30	10	52	6
Simla		O.E.	143-4	25	—	—	—	—	—	—	—	—	10	49	0	10	52	30
Bombay	E.	M.	150-6	44	10	57	4	—	—	—	—	—	—	—	—	—	—	—
Kodaikanal	E.	M.	159-6	53	10	41	48	—	—	—	—	—	11	8	30	11	20	30
Colombo	E.	M.	163-4	58	11	3	42	—	—	11	9	0	—	—	—	11	17	24
Batavia		W.	166-5	251	9	59	0	—	—	—	—	—	11	2	0	11	28	0

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1914. November 24.

Origin : 24°N. 141°E.

Time at Origin : 11h. 53m. 15s.

It is believed that the times given for S. at Dyce, Eskdalemuir, Bidston, Padova, Paris, Moncalieri, and Barcelona really apply to a continually reflected P. wave, travelling at an approximately constant rate of 1° in 14.9s. See the Report for 1915.

Station and Component.	Machine.	Distance ° from Origin.	Azimuth. °	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	s.	s.	H.	M.	s.	H.	M.	s.	s.	H.	M.	s.	H.	M.	s.	
Osaka	O.	11-7	337	11	56	50	+41	—	—	—	—	—	—	11	59	24	11	59	36	—	
Nagasaki		13-0	314	11	57	5	+37	—	—	—	—	—	—	—	—	—	—	—	—	—	
Tahoku	O.	17-7	276	11	57	56	+28	—	—	—	—	—	—	12	1	26	12	1	43	—	
Zi-ka-wei	E.	W.	18-7	297	11	58	2	+22	11	58	21	12	1	38	+35	—	12	4	32	—	
	N.	W.	18-7	297	11	58	2	+22	11	58	22	12	1	36	+33	—	12	5	47	—	
Manila	E.	W.	21-1	247	—	—	—	—	—	—	—	12	2	56	+56	12	6	6	12	9	6
	N.	W.	21-1	247	11	58	14	+6	—	—	—	12	2	48	+48	12	6	28	12	9	6
Batavia		W.	45-0	232	12	1	30	-18	—	—	—	12	7	48	-42	—	—	—	12	8	28
Calcutta	E.	M.	48-1	279	11	58	5	-245	—	—	—	—	—	12	9	17	12	41	49	—	
Honolulu	E.	M.	55-9	79	12	2	48	-12	—	—	—	—	—	12	9	54	12	10	12	—	
Simla	O.E.	56-3	293	12	3	0	-3	—	—	—	—	12	10	48	-5	12	18	0	12	24	42
Riverview		58-6	170	12	2	54	-24	—	—	—	—	12	10	30	-51	12	16	24	12	18	9
Sydney	E.	M.	58-7	170	12	3	0	-18	—	—	—	12	10	18	-64	12	14	18	12	19	24
Adelaide	E.	M.	59-0	182	12	3	0	-20	—	—	—	—	—	—	—	12	10	36	12	20	24
Perth	N.	M.	60-9	204	12	3	12	-21	—	—	—	12	11	30	-20	—	—	—	12	28	0
Colombo	E.	M.	61-0	264	12	3	6	-28	—	—	—	—	—	—	—	—	—	—	12	30	30
Kodaikanal	F.	M.	61-8	268	—	—	—	—	—	—	—	—	—	—	—	12	4	12	12	32	18
Bombay	S.	M.	63-1	280	12	3	43	-5	—	—	—	—	—	—	—	—	—	—	12	27	13
Baku	G.	75-5	308	12	5	0	-6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Victoria	E.	M.	75-9	43	12	4	48	-20	—	—	—	12	13	18	-93	12	13	48	12	14	18
Pulkovo	G.	79-1	331	12	5	28	-1	—	—	—	—	12	15	17	-11	—	—	—	—	—	—
Berkeley	N.	—	80-5	53	12	5	25	-12	—	—	—	—	—	—	—	12	15	8	12	15	10
Lick	N.	W.	81-3	53	12	5	23	-18	—	—	—	—	—	—	—	12	15	15	12	15	29
Mauritius	E.	M.	92-1	249	12	6	0	-42	—	—	—	—	—	—	—	12	18	6	12	20	36
	N.	M.	93-1	249	12	5	30	-72	—	—	—	—	—	—	—	12	16	12	12	18	30
Dyce, Aberdeen	N.	M.	93-1	341	12	6	24	-12	—	—	—	12	16	31	-90	12	40	49	12	43	49
Helwan	E.	M.	93-6	305	12	6	54	+3	—	—	—	—	—	—	—	—	—	—	12	24	12
Edinburgh	E.	M.	94-5	340	12	6	48	-7	—	—	—	—	—	—	—	—	—	—	12	47	30
Eskdalemuir	G.	95-0	340	12	6	43	-15	12	10	54	12	16	56	-85	12	40	0	12	43	0	34 N. 129 E.

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Stonyhurst	E.	M.	96.0	339	12 5 18	-106	—	—	12 16 24	-127	—	—	12 55 0	—
Bidston	E.	M.	96.5	339	12 6 52	-14	12 11 0	—	12 17 6	-90	—	—	—	—
Padova	V.	V.	96.6	327	12 6 51	-16	—	—	12 17 5	-92	12 33 25	12 53 36	Damped.	
			96.6	327	12 6 51	-16	—	—	12 17 5	-92	12 33 39	12 53 44	Undamped.	
Warley, Birmingham	E.	—	97.0	338	12 6 0	-69	—	—	12 16 18	-143	—	12 45 0	—	
West Bromwich	E.	M.	97.0	338	12 7 0	-9	12 11 15	—	12 17 15	-86	—	12 53 0	—	
Kew	E.	M.	97.2	337	12 6 42	-29	—	—	—	—	—	12 53 42	—	
Guildford	E.	M.	97.5	337	12 4 47	-145	—	—	12 14 42	-244	12 40 19	12 43 21	—	
					12 9 17	+125	—	—	12 19 20	+54	12 44 27	12 46 39	—	
Shide	E.	M.	98.2	337	12 6 50±	-26	12 11 15±	—	12 19 0±	+7	—	12 56 30±	—	
	N.	M.	98.2	337	12 6 50±	-26	12 11 0±	—	12 19 35±	+42	—	—	—	
Newport, I.W.	—	—	98.2	337	12 6 40±	-36	12 12 40±	—	12 18 40±	-13	12 42 40±	12 53 40±	S.R. 12h. 26m. 30s. ±	
Monte Cassino	Aga.	—	98.2	323	12 7 1	-15	—	—	12 19 45	+52	—	—	—	
Paris	—	—	98.3	334	12 6 59	-17	12 11 10	—	12 17 14	-100	12 40 0	12 47 0	S.R. 12h. 25m. 10s.	
Pompeii	O.A.	—	98.4	322	12 8 30	+73	—	—	12 19 0	+5	12 45 0	—	—	
Moncalieri	S.	—	99.0	329	12 7 3	-17	—	—	12 17 15	-106	12 40 22	12 53 42	—	
Cork	E.	M.	99.5	341	12 3 0	-263	—	—	—	—	—	12 20 30	—	
St. Louis	W.	—	101.2	38	—	—	—	—	12 11 6	-496	12 17 14	—	S.R. 12h. 14m. 45s.	
Malta	E.	M.	101.6	318	11 45 0	-1353	—	—	—	—	—	12 25 0	—	
Toronto	E.	M.	102.8	29	12 4 6	-213	—	—	—	—	—	—	—	
					12 9 18	+99	—	—	—	—	12 20 24	12 26 36	—	
Ottawa	B.	—	102.9	25	12 11 37	+238	—	—	12 17 26	-132	12 21 18	—	SR 12h. 20m. 19s.	
Barcelona	M.A.	—	104.3	329	12 11 50	+244	—	—	12 19 2	-49	—	12 50 54	—	
Harvard Univ.	E.	B.O.	107.3	24	12 12 24	+264	—	—	12 17 45	-154	—	—	—	
	N.	B.O.	107.3	24	12 11 58	+238	—	—	12 17 39	-160	12 21 54	12 23 45	—	
Granada	G.	—	110.3	331	12 7 59	-14	—	—	12 19 41	-65	—	12 49 53	—	
San Fernando	E.	M.	112.1	332	12 12 0	+218	—	—	12 19 30	-92	12 31 0	—	28.7N. 126.6E.	
	N.	M.	112.1	332	12 12 30	+248	—	—	12 20 0	-62	—	12 59 0	—	
Azores	E.	M.	117.0	348	12 21 42	+778	—	—	—	—	—	12 22 0	—	
Cape Town	E.	M.	129.4	245	12 15 18	+580	—	—	—	—	—	12 16 42	—	
La Paz	—	—	151.7	81	12 13 11	—	—	—	12 27 21	—	12 53 43	13 28 0	Clock error ± 5 secs.	
Fernando Noronha	E.	M.	158.9	341	12 12 15	—	—	—	12 25 30	—	12 32 0	12 37 10	—	

1914. November 27.

Origin : 38°3N. 20°E., determined by Granada.

Time at Origin : 14h. 39m. 42s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O--C.	PR ₁			S.			O--C.	L.			M.			Remarks.
				H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	S.	H.	M.	S.	H.	M.	S.	
Pompeii	E.	O.A.	4.8	302	14 40 2	-54	—	—	14 41 2	-52	14 41 40	14 42 10	? Ionian Islands.								
	N.	O.A.	4.8	302	14 40 2	-54	—	—	14 41 0	-54	14 41 35	14 42 0	—								
Malta	E.	M.	5.0	243	14 34 0	-419	—	—	—	—	—	14 45 0	Masked by tremors.								
Monte Cassino	—	Ca.	5.7	305	14 41 20	+10	—	—	14 43 11	+53	—	14 43 46	Ionian Islands.								
Padova	—	V.	9.3	322	14 41 56	-6	—	—	14 43 21	+32	14 45 31	14 48 42	Ionian Islands.								
Moncalieri	—	S.	11.3	310	14 42 34	+23	—	—	14 45 5	+21	14 46 16	14 48 30	—								
Helwan	E.	M.	12.6	129	14 43 42	+53	—	—	14 52 12	+116	—	14 54 6	—								
Barcelona	—	Ma.	14.0	294	14 43 2	-6	—	—	—	—	14 46 27	14 49 50	—								
Paris	—	G.	16.4	315	14 43 37	-2	—	—	14 46 49	+3	14 49 0	14 50 0	—								
Granada	—	G.	18.6	371	14 44 7	+1	—	—	14 47 37	+2	14 49 18	14 53 24	38°3N. 20°E.								
Guildford	E.	M.	19.3	271	14 42 49	-86	—	—	14 46 21	-89	14 48 38	14 53 0	—								
Kew	E.	M.	19.3	318	14 44 54	+39	—	—	—	—	—	14 55 30	—								
Shide	E.	M.	19.4	319	—	—	—	—	14 47 30±	-22	—	14 52 0±	—								
	N.	M.	19.4	319	14 44 0±	-16	—	—	14 47 45±	-7	—	14 53 0±	—								
Newport, I.W.	—	—	19.4	319	—	—	—	—	—	—	14 47 30	14 50 0	—								
West Bromwich	—	M.	20.8	316	—	—	—	—	14 48 16	-6	—	14 51 36	—								
Warley, Birmingham	—	—	20.8	320	14 26 0	-1113	—	—	14 38 0	-622	—	14 54 36	—								
San Fernando	E.	M.	20.8	272	—	—	—	—	14 49 30	+68	—	14 55 30	—								
	N.	M.	20.8	272	—	—	—	—	14 48 30	+8	—	14 55 0	—								
Rio Tinto	E.	M.	20.9	277	14 42 0	-154	—	—	—	—	—	14 53 0	—								
Bidston	E.	M.	21.8	321	14 44 54	+9	—	—	14 48 54	+12	—	14 52 18	—								
Stonyhurst	E.	M.	21.8	323	14 44 6	-39	—	—	14 48 0	-42	14 51 30	14 53 36	—								
Esksdalemuir	—	—	23.0	325	—	—	—	—	14 48 57	-10	14 52 0	14 54 0	—								
Baku	—	G.	23.1	75	14 44 36	-24	—	—	14 48 24	-45	—	—	—								
Edinburgh	E.	M.	23.4	326	14 49 12	+249	—	—	—	—	—	14 55 0	—								
Dyce, Aberdeen	N.	Ma.	23.9	330	14 45 0	-9	—	—	14 49 12	-12	14 53 0	14 59 0	—								
Azores	E.	M.	35.6	283	15 0 0	+780	—	—	—	—	—	—	—								
Simla	—	O.E.	46.8	81	—	—	—	—	—	—	14 57 48	—	—								
Kodaikanal	E.	M.	58.3	103	15 14 30	+1487	—	—	—	—	—	—	—								

Guildford	E.	M.	88-4	337	10 57 30	-69	---	11 7 47	-101	11 31 15	11 42 30	---
Pompeii	N.	O.A.	88-4	318	10 59 0	+21	---	---	---	---	11 9 0	---
Paris	---	---	89-0	329	10 58 32	-10	---	---	---	---	11 45 0	---
Shide	{ E.	M.	89-2	332	---	---	---	11 8 50	-47	11 34 0	11 44 30	---
	{ N.	M.	89-2	332	---	---	---	11 9 5	-32	11 36 0	11 45 50	---
Newport, I.W.	E.	---	89-2	332	---	---	---	---	---	---	11 36 40	---
Moncalieri	S.	---	89-3	324	? 10 58 12	-32	---	11 9 12	-26	11 29 11	11 34 40	---
Barcelona	Ma.	---	94-6	324	---	---	---	---	---	11 35 17	11 41 50	---
San Fernando	{ E.	M.	99-6	327	11 41 30	+2509	---	11 46 0	+2076	---	11 50 0	---
	{ N.	M.	99-6	327	11 39 0	+2359	---	11 44 30	+1986	---	11 53 0	---
Granada	C.	---	100-7	325	10 59 34	-12	---	11 11 17	-20	11 38 0	11 46 48	---
Toronto	E.	M.	101-0	22	11 28 36	+1729	---	---	---	11 50 54	---	---
Rio Tinto	E.	M.	101-7	327	11 6 0	+370	---	---	---	---	11 51 0	---
Harvard University	E.	B.O.	104-6	17	---	---	---	---	---	11 48 45	---	---
Fernando Noronha	E.	M.	149-7	327	11 0 0	-202	---	11 15 0	-148	---	11 30 0	---
La Paz	---	---	157-3	57	11 5 40	---	---	---	---	12 2 10	12 16 50	---

11

1914. December 20.

Origin : 17°S. 168°W., determined by Shide.

Time at Origin : 14h. 8m. 27s.

Station and Component.	Machine.	Distance from Origin.	Azimuth.	P.			O-C.	PR ₁			S.			O-C.	L.			M.			Remarks.
				H.	M.	S.		H.	M.	S.	H.	M.	S.		H.	M.	S.	H.	M.	S.	
Honolulu	E.	M.	39-5	15	14 17 24	+67	---	---	---	14 23 6	+40	14 29 0	14 30 42	---	---	---	14 29 0	14 30 42	---	---	
Riverview	E.	M.	40-2	237	14 16 0	-24	---	14 17 46	---	14 21 41	-56	14 24 36	14 25 6	---	---	---	14 24 36	14 25 6	---	18°-5S. 173°W.	
Sydney	E.	M.	40-2	237	14 14 36	-108	---	---	---	14 21 42	-55	14 24 42	14 27 30	---	---	---	14 24 42	14 27 30	---	---	
Adelaide	E.	M.	50-7	238	---	---	---	---	---	---	---	---	14 37 6	---	---	---	---	14 37 6	---	---	
Lick	N.	W.	69-4	38	14 20 24	+44	---	---	---	14 29 46	+60	? 14 39 6	14 44 56	---	---	---	14 39 6	14 44 56	---	---	
Perth	E.	M.	69-6	241	14 20 12	+30	---	---	---	14 28 24	-24	14 46 6	15 0 0	---	---	---	14 46 6	15 0 0	---	---	
Berkeley	E.	---	69-6	37	14 20 23	+41	---	---	---	14 28 43	+55	14 38 52	14 43 44	---	---	---	14 38 52	14 43 44	---	---	
Osaka	E.	O.	74-5	315	14 20 19	+7	---	---	---	14 29 57	+10	14 38 43	14 44 18	---	---	---	14 38 43	14 44 18	---	---	
Victoria	E.	M.	76-5	29	14 30 24	+600	---	---	---	14 31 30	+80	14 45 18	14 48 42	---	---	---	14 45 18	14 48 42	---	---	
Manila	W.	---	76-9	290	14 20 25	-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Zi-ka-wei	W.	---	82-7	306	14 20 58	-3	---	---	---	14 30 54	-27	---	14 46 48	---	---	---	---	14 46 48	---	---	
Batavia	W.	---	85-6	266	? 14 20 59	-8	---	---	---	14 30 51	-30	14 48 0	14 50 0	---	---	---	14 51 0	14 50 0	---	---	
La Paz	---	---	94-2	109	14 22 48	+42	---	---	---	14 33 27	+2	14 51 0	14 57 20	---	---	---	14 51 0	14 57 20	---	---	
Toronto	E.	M.	100-6	47	14 34 6	+686	---	---	---	---	---	14 51 24	15 10 48	---	---	---	---	15 10 48	---	---	
Ottawa	{ E.	B.	103-5	46	14 28 8	+314	---	---	---	? 14 38 4	+189	15 6 0	---	---	---	---	15 6 0	---	---	Times interpolated.	
	{ N.	B.	103-5	46	---	---	---	---	---	? 14 38 48	+233	14 54 0	---	---	---	---	---	---	---	Times interpolated.	
Harvard Univ.	{ E.	B.O.	106-3	50	---	---	---	? 14 27 54	---	14 34 32	-50	14 43 51	---	---	---	---	14 43 51	---	---	T. at O. 14h. 18m. 6s.	
	{ N.	B.O.	106-3	50	---	---	---	---	---	14 33 45	-97	14 43 42	---	---	---	---	---	14 43 42	---	---	---
Colombo	E.	M.	113-2	270	14 28 0	+261	---	---	---	---	---	15 20 12	15 23 0	---	---	---	15 20 12	15 23 0	---	---	
Kodakanal	E.	M.	116-3	273	14 34 24	+631	---	---	---	---	---	14 38 0	14 38 54	---	---	---	14 38 0	14 38 54	---	---	
Simla	O.E.	---	119-6	297	(e) 14 33 48	+581	---	---	---	---	---	---	15 28 0	---	---	---	---	15 28 0	---	---	
Mauritius	{ E.	M.	121-7	232	---	---	---	---	---	---	---	15 4 48	15 9 36	---	---	---	---	15 4 48	15 9 36	---	---
	{ N.	M.	121-7	232	14 34 24	+607	---	---	---	---	---	---	15 7 18	---	---	---	---	15 7 18	---	---	---
Cape Town	E.	M.	128-7	187	14 45 0	+1212	---	---	---	---	---	---	14 49 12	---	---	---	---	14 49 12	---	---	---
Dyce, Aberdeen	N.	Ma.	138-4	12	---	---	---	---	---	---	---	---	15 28 0	---	---	---	---	15 28 0	---	---	---
Edinburgh	E.	M.	139-4	13	14 24 0	-96	---	---	---	---	---	---	14 50 18	---	---	---	---	14 50 18	---	---	---
Baku	G.	---	139-8	314	? 14 28 4	+147	---	---	---	---	---	15 7 0	15 18 5	---	---	---	---	15 7 0	15 18 5	---	---
Eskdalemuir	G.	---	140-0	13	(e) 14 31 22	+344	---	---	---	(i) 14 49 54	+623	---	---	---	---	---	---	---	---	---	---
Azores	E.	M.	141-0	50	14 42 48	+1026	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

12

Locality	E.	M.	141°5'	14	30	30	0	+286	14	51	12	+693	15	24	30	15	29	18
Stonyhurst	E.	M.	141°5'	14	30	30	0	+286	14	51	12	+693	15	24	30	15	29	18
Bidston	E.	M.	141°7'	14	29	0	+195	14	34	12	-328	14	34	12	0	15	28	24
West Bronwich	E.	M.	142°8'	14	33	54	+479	14	56	0	+973	15	27	0	15	28	24	0
Kew	E.	M.	144°2'	14	33	54	+479	14	56	0	+973	15	27	0	15	28	24	0
Guildford	E.	M.	144°3'	14	33	54	+479	14	56	0	+973	15	27	0	15	28	24	0
Stunde	E.	M.B.	144°6'	14	32	0	+364	14	52	54	+779	15	33	48	14	50	25	15
Newport, I. W.			147°9'	14	32	0	+154	14	52	54	+779	15	33	48	14	50	25	15
Padova	V.		151°6'	14	38	41	+154	14	30	7	...	15	31	0	15	38	0	15
Monahiet	S.	M.	151°8'	14	38	47	...	14	46	41	...	15	31	0	15	38	0	15
Rio Tinto	S.	M.	153°6'	14	39	8	...	14	46	41	...	15	31	0	15	38	0	15
Barecelona	M.a.	M.	154°1'	14	31	0	...	14	41	0	...	15	31	0	15	38	0	15
San Fernando	{ E. M.	M.	154°7'	14	30	30	...	14	41	0	...	15	31	0	15	38	0	15
Granada	{ S. C.	M.	155°5'	14	40	30	...	14	40	28	...	15	34	0	15	34	0	15
Hawaii	E.	M.	158°1'	14	29	41	...	14	40	28	...	15	34	0	15	34	0	15
				14	28	0	...	14	40	28	...	15	34	0	15	34	0	15

TABLE.

De-grees.	P sec.	S sec.	S - P sec.	De-grees.	P sec.	S sec.	S - P sec.	De-grees.	P sec.	S sec.	S - P sec.
1	15	28	13	51	553	991	438	101	855	1565	710
2	31	55	24	52	560	1004	444	102	860	1575	715
3	47	83	36	53	566	1016	450	103	865	1584	719
4	62	110	48	54	573	1029	456	104	870	1593	723
5	77	137	60	55	579	1041	462	105	874	1602	728
6	92	164	72	56	586	1054	468	106	879	1612	733
7	106	190	84	57	592	1066	474	107	884	1621	737
8	121	217	96	58	599	1079	480	108	888	1630	742
9	136	243	107	59	605	1091	486	109	893	1639	746
10	150	269	119	60	612	1103	491	110	897	1648	751
11	164	294	130	61	619	1116	497	111	902	1657	755
12	179	319	140	62	625	1128	503	112	907	1666	759
13	193	344	151	63	632	1141	509	113	911	1674	763
14	206	368	162	64	638	1153	515	114	916	1682	766
15	219	392	173	65	645	1165	520	115	920	1690	770
16	232	415	183	66	651	1177	526	116	925	1698	773
17	245	438	193	67	658	1190	532	117	929	1706	777
18	257	460	203	68	664	1202	538	118	934	1714	780
19	269	482	213	69	671	1214	543	119	938	1722	784
20	281	503	222	70	677	1226	549	120	942	1729	787
21	293	524	231	71	683	1238	555	121	947	1737	790
22	305	545	240	72	690	1250	560	122	952	1744	792
23	317	565	248	73	696	1262	566	123	957	1752	795
24	328	584	256	74	702	1274	572	124	961	1759	798
25	338	603	265	75	709	1286	577	125	966	1766	800
26	348	622	274	76	715	1297	582	126	970	1773	803
27	358	641	283	77	721	1309	588	127	974	1780	806
28	368	659	291	78	727	1320	593	128	978	1787	809
29	378	677	299	79	733	1332	599	129	983	1794	811
30	388	694	306	80	739	1343	604	130	988	1801	813
31	398	711	313	81	745	1355	610	131	992	1807	815
32	407	728	321	82	750	1366	616	132	996	1814	818
33	416	744	328	83	756	1377	621	133	1001	1821	820
34	425	760	335	84	762	1388	626	134	1005	1827	822
35	433	775	342	85	768	1399	631	135	1009	1833	824
36	442	790	348	86	773	1410	637	136	1014	1840	826
37	450	804	354	87	779	1421	642	137	1018	1846	828
38	458	818	360	88	785	1432	647	138	1023	1852	829
39	466	832	366	89	790	1443	653	139	1027	1858	831
40	475	847	372	90	796	1454	658	140	1031	1864	833
41	483	861	378	91	801	1464	663	141	1035	1869	834
42	491	875	384	92	807	1475	668	142	1039	1875	836
43	498	888	390	93	812	1485	673	143	1043	1881	838
44	506	902	396	94	818	1496	678	144	1047	1886	839
45	513	915	402	95	823	1506	683	145	1051	1892	841
46	520	928	408	96	829	1516	687	146	1055	1897	842
47	527	941	414	97	834	1526	692	147	1059	1902	843
48	534	954	420	98	840	1536	696	148	1063	1907	844
49	540	966	426	99	845	1546	701	149	1067	1912	845
50	547	979	432	100	851	1556	705	150	1071	1917	846

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