

RATES OF BOX AND POCKET CHRONOMETERS

ON TRIAL

FOR PURCHASE BY THE BOARD OF ADMIRALTY,

AT THE

ROYAL OBSERVATORY, GREENWICH,

FROM 1906 JUNE 16 TO 1907 JANUARY 5.

NAME OF MAKER.	No.	Whether a Self-Registering Thermometer.	(L) WEEKLY RATES															
			June 16-23	June 23-30	June 30 to July 7	July 7-14	July 14-21	July 21-28	July 28 to Aug. 4	Aug. 4-11	Aug. 11-18	Aug. 18-25	Aug. 25 to Sept. 1	Sept. 1-8	Sept. 8-15	Sept. 15-22		
Kullberg.....	7612	2	- 3-3	- 2-6	- 3-2	- 2-6	- 1-0	- 1-4	- 2-9	- 2-4	- 3-7	- 3-4	- 0-6	+ 0-2	+ 0-5	- 2-2	Kullberg.....	7612
Kullberg.....	7658	2	- 3-0	- 2-2	- 3-4	- 2-8	- 1-8	- 1-2	- 1-2	- 0-9	- 0-1	+ 0-2	+ 0-2	0-0	- 1-3	- 3-8	Kullberg.....	7658
Kullberg.....	7694	2	- 1-0	- 0-8	- 2-1	- 1-7	- 1-5	- 0-5	- 1-9	- 0-1	- 2-1	- 4-8	- 3-1	- 3-3	- 3-7	- 2-6	Kullberg.....	7694
Kullberg.....	7685	2	- 1-0	- 1-1	- 1-9	- 2-1	- 1-1	- 1-3	- 1-3	- 3-9	- 6-1	- 7-7	- 4-0	- 4-2	- 3-1	- 1-7	Kullberg.....	7685
Carley & Clemence.....	51401	2	+ 1-7	+ 5-3	+ 4-1	+ 2-8	+ 3-6	+ 4-5	+ 3-8	+ 7-8	+ 9-4	+ 9-9	+ 8-6	+ 6-4	+ 5-3	+ 2-9	Carley & Clemence.....	51401
Johannsen.....	5824	2	- 5-1	- 3-9	- 5-7	- 5-9	- 5-0	- 5-2	- 5-3	- 4-0	- 4-2	- 4-6	+ 0-8	- 0-2	- 1-9	- 1-7	Johannsen.....	5824
Kullberg.....	7538	2	- 1-9	- 3-8	- 3-0	- 2-9	- 4-3	- 3-7	- 3-4	- 0-5	- 1-3	- 0-9	- 0-7	- 2-2	- 3-8	- 4-9	Kullberg.....	7538
Johannsen.....	5736	2	- 7-2	- 5-0	- 4-4	- 4-7	- 4-9	- 4-9	- 2-7	- 6-5	- 2-9	- 0-7	- 1-3	+ 0-9	+ 2-1	- 5-9	Johannsen.....	5736
Asprey.....	1978	2	- 1-3	- 1-1	- 2-8	- 1-6	- 1-6	- 1-7	- 2-2	- 0-4	+ 1-4	+ 4-8	+ 3-9	+ 1-4	+ 0-9	- 1-1	Asprey.....	1978
H. White.....	5067	2	- 1-6	+ 1-2	+ 0-2	+ 4-2	+ 5-0	+ 6-7	+ 7-1	+ 6-1	- 0-1	- 0-1	+ 5-8	+ 9-5	+ 12-7	+ 10-2	H. White.....	5067
Carley & Clemence.....	51256	2	+ 1-8	+ 1-0	- 0-1	- 1-8	- 0-8	- 1-3	- 1-3	+ 4-4	+ 2-4	+ 1-8	+ 2-0	+ 4-7	+ 1-1	- 0-8	Carley & Clemence.....	51256
Carley & Clemence.....	51402	2	- 5-8	- 3-6	- 5-3	- 6-6	- 10-4	- 11-5	- 11-9	- 9-8	- 13-6	- 13-8	- 9-8	- 10-5	- 12-1	- 16-1	Carley & Clemence.....	51402
M. F. Dent.....	32594	2	+ 1-9	+ 3-1	+ 4-8	+ 5-6	+ 6-5	+ 9-3	+ 5-7	+ 10-5	+ 13-2	+ 13-1	+ 13-1	+ 14-0	+ 7-8	+ 9-6	M. F. Dent.....	32594
Johannsen.....	5823	2	+ 1-5	+ 1-6	- 1-7	- 0-7	- 0-4	+ 0-2	+ 0-6	- 0-8	- 1-4	- 1-4	- 0-5	+ 0-9	+ 1-9	+ 1-2	Johannsen.....	5823
Lilley & Son.....	1592	2	+ 2-3	+ 3-1	+ 0-8	+ 2-8	+ 4-2	+ 3-3	+ 7-2	+ 7-5	+ 9-7	+ 12-5	+ 12-8	+ 11-6	+ 10-8	+ 12-5	Lilley & Son.....	1592
Johannsen.....	5822	2	+ 3-1	- 4-4	- 9-1	- 14-2	- 13-0	- 18-6	- 19-3	- 14-1	- 12-7	- 9-0	- 0-9	- 4-4	- 11-0	- 12-6	Johannsen.....	5822
Linaker.....	1984	2	- 7-9	- 12-1	- 8-9	- 7-7	- 6-4	- 6-7	- 4-6	- 6-6	- 4-7	- 9-4	- 3-9	+ 4-0	+ 1-9	+ 1-1	Linaker.....	1984
Northern Goldsmiths Co. Kullberg.....	51045	2	- 1-2	- 10-9	- 10-1	- 10-0	- 7-3	- 9-3	- 8-3	- 10-0	- 17-7	- 15-1	- 7-4	- 1-6	- 1-1	- 6-7	Northern Goldsmiths Co. Kullberg.....	51045
Webb.....	5695	2	- 0-9	+ 1-9	- 1-0	+ 0-6	+ 1-6	+ 1-2	+ 3-7	+ 3-5	- 7-9	- 11-5	- 6-9	- 1-3	- 0-8	- 5-9	Webb.....	5695
Gardner.....	54361	2	+ 1-9	+ 2-3	- 4-1	- 5-9	- 6-0	- 6-1	- 6-7	- 0-6	- 0-6	+ 0-7	+ 0-9	+ 1-5	- 1-4	- 4-8	Gardner.....	54361
Usher & Cole.....	1990	2	- 10-0	- 7-9	- 7-0	- 5-6	- 6-7	- 4-9	- 3-1	+ 5-0	+ 13-1	+ 13-9	+ 13-1	+ 11-2	+ 7-7	+ 4-0	Usher & Cole.....	1990
Kullberg.....	7516	2	- 8-8	- 9-4	- 9-9	- 8-8	- 7-8	- 7-5	- 6-0	- 4-2	- 5-0	- 2-6	+ 1-2	- 0-5	- 3-8	- 6-6	Kullberg.....	7516
Kullberg.....	7329	2	- 5-0	- 3-9	- 5-0	- 4-8	- 5-3	- 5-1	- 7-0	- 5-4	- 0-4	+ 1-1	+ 3-0	- 0-9	- 1-2	- 4-8	Kullberg.....	7329
Webb.....	5690	2	- 2-2	- 1-9	+ 2-0	+ 0-8	+ 2-1	+ 4-3	+ 4-0	- 7-5	- 3-8	+ 6-0	+ 8-9	- 1-8	- 7-1	- 6-6	Webb.....	5690
Chronometrical Thermometer.....			- 610-1	- 894-8	- 603-7	- 778-7	- 871-8	- 943-3	- 1162-6	- 2457-4	- 3489-9	- 3716-4	- 2442-6	- 1451-9	- 771-1	- 330-3	Chronometrical Thermometer.....	
Mean Weekly Temperature.....			66-4	69-0	66-0	67-8	69-1	70-1	72-4	86-5	92-7	98-3	85-3	74-8	67-5	63-4	Mean Weekly Temperature.....	
Extremes of Temperature as shown by the Self-Registering Thermometers.....			60-6	64-1	64-1	65-3	67-0	69-3	70-3	80-2	92-2	90-8	73-6	70-8	64-8	61-8	Extremes of Temperature as shown by the Self-Registering Thermometers.....	
			72-0	72-9	69-6	70-1	72-4	72-8	74-1	92-0	102-0	105-7	98-0	80-3	72-0	65-4		
The sign + indicates that the rate is gaining. + During these weeks the Chronometers were placed in the chamber of an oven heated by jets of gas, the temperature being regulated by Kullberg's automatic governor which controls the supply of gas. The gas flames are exterior to the chamber, into which none of the ingredients produced by combustion can enter. The Chronometrical Thermometer differs from an ordinary Chronometer in the construction of the balance only, the position of the metal forming the compensating rim being reversed. By this arrangement the effect of temperature is much magnified.																		

The sign + indicates that the rate is gaining.

† During these weeks the Chronometers were placed in the chamber of an oven heated by jets of gas, the temperature being regulated by Kullberg's automatic governor which controls the supply of gas. The gas flames are exterior to the chamber, into which none of the injurious products of combustion can enter.

The Chronometrical Thermometer differs from an ordinary Chronometer in the construction of the balance only, the position of the metals forming the compensating rim being reversed. By this arrangement the effect of temperature is much magnified.

IN ORDER OF TIME.															NAME OF MAKER.	No.
Sept. 22-29	Sept. 29 to Oct. 6	Oct. 6-13	Oct. 13-20	Oct. 20-27	Oct. 27 to Nov. 3	Nov. 3-10	Nov. 10-17	Nov. 17-24	Nov. 24 to Dec. 1	Dec. 1-8	Dec. 8-15	Dec. 15-22	Dec. 22-29	Dec. 29 to Jan. 5		
- 3-5	- 2-4	- 2-1	- 3-4	- 3-0	- 3-9	- 2-5	+ 0-3	- 3-0	- 5-9	- 4-8	- 5-1	- 7-0	- 5-1	- 5-1	Kullberg.....	7612
- 7-0	- 6-0	- 5-5	- 7-0	- 4-2	- 4-1	- 3-0	- 3-9	- 6-4	- 10-0	- 11-1	- 10-1	- 9-2	- 10-7	- 10-7	Kullberg.....	7658
- 4-7	- 3-8	- 3-8	- 5-3	- 5-6	- 7-3	- 5-8	- 3-1	- 7-4	- 8-7	- 9-7	- 10-6	- 10-5	- 10-9	- 10-2	Kullberg.....	7694
- 2-9	+ 0-7	+ 0-3	- 0-4	- 3-0	- 4-2	- 3-8	- 1-5	+ 3-4	- 2-6	- 2-2	- 1-1	- 1-4	- 1-1	- 1-3	Kullberg.....	7685
+ 3-4	+ 6-3	+ 6-0	+ 4-5	+ 9-8	+ 13-1	+ 12-7	+ 10-7	+ 6-4	+ 6-1	+ 5-3	+ 3-5	+ 5-2	+ 3-0	+ 3-8	Carley & Clemence.....	51401
- 3-3	- 3-8	- 2-2	- 4-8	- 1-0	- 1-2	+ 0-1	+ 2-6	+ 5-8	+ 3-5	+ 6-1	+ 6-0	+ 4-1	+ 4-8	+ 3-2	Johannsen.....	5824
- 7-0	- 7-5	- 10-3	- 13-3	- 8-7	- 5-4	- 3-9	- 6-2	- 10-6	- 14-2	- 15-0	- 15-9	- 15-2	- 12-6	- 12-3	Kullberg.....	7538
- 2-1	- 0-4	- 1-0	- 4-4	- 2-1	- 2-1	+ 2-1	+ 2-7	+ 1-3	+ 1-5	+ 0-6	+ 1-5	- 0-4	- 1-6	- 2-6	Johannsen.....	5736
- 2-9	- 2-8	- 3-2	- 4-0	- 1-3	+ 1-6	+ 6-0	+ 4-1	- 2-1	- 6-5	- 6-8	- 8-5	- 8-2	- 5-7	- 7-2	Asprey.....	1978
+ 8-6	+ 10-1	+ 11-1	+ 9-1	+ 3-0	- 3-2	- 1-9	+ 6-6	+ 3-8	+ 6-9	+ 7-0	+ 6-0	+ 3-9	+ 8-1	+ 5-9	H. White.....	5067
- 5-6	- 2-5	- 5-0	- 5-9	0-0	+ 2-6	+ 4-0	+ 5-4	- 4-3	- 10-8	- 7-8	- 9-3	- 8-5	- 10-6	- 10-9	Carley & Clemence.....	51256
- 17-3	- 17-6	- 19-2	- 20-0	- 17-1	- 14-6	- 13-5	- 11-3	- 13-5	- 24-1	- 25-0	- 23-9	- 24-1	- 24-1	- 24-1	Carley & Clemence.....	51402
+ 6-9	+ 7-9	+ 9-0	+ 4-0	+ 9-9	+ 11-7	+ 10-2	+ 11-5	+ 10-2	+ 3-9	+ 3-2	- 3-1	+ 1-2	- 0-3	- 0-9	M. F. Dent.....	32594
+ 1-1	+ 2-3	+ 1-8	- 1-8	- 1-8	- 0-2	+ 0-8	- 5-0	- 2-5	+ 1-9	+ 1-9	- 9-9	- 9-4	- 10-8	- 8-2	Johannsen.....	5823
+ 10-6	+ 14-4	+ 9-8	+ 4-7	+ 6-3	+ 11-0	+ 14-2	+ 11-4	+ 3-7	- 4-4	- 7-0	- 7-3	- 6-7	- 4-5	...	Lilley & Son.....	1592
- 8-0	- 8-3	- 7-9	- 10-2	- 13-9	- 13-1	- 10-4	- 8-5	- 11-2	- 13-4	- 12-2	- 16-6	- 15-6	- 13-6	- 13-2	Johannsen.....	5822
- 1-1	- 0-6	+ 0-8	+ 0-3	- 2-0	- 6-5	- 1-0	- 10-2	+ 1-3	- 6-9	- 9-9	- 12-8	- 5-3	- 5-8	+ 1-2	Linaker.....	1984
- 7-4	- 8-9	- 10-8	- 11-2	- 7-2	- 12-0	- 8-0	+ 1-2	- 10-0	- 17-1	- 12-9	- 12-0	- 12-6	- 12-5	- 15-0	Northern Goldsmiths Co. Kullberg.....	51045
- 8-1	- 5-5	- 6-6	- 8-9	- 6-1	- 8-0	- 7-1	- 5-9	- 9-2	- 11-6	- 12-3	- 13-7	- 14-1	- 14-5	- 15-0	Webb.....	5695
+ 23-7	+ 25-0	+ 25-0	+ 27-9	+ 24-2	+ 21-2	+ 23-3	+ 22-6	+ 27-9	+ 38-3	+ 38-1	+ 39-1	+ 37-3	+ 40-3	+ 39-3	Webb.....	5695
- 7-0	- 6-2	- 5-9	- 8-0	- 3-7	+ 1-2	- 4-6	- 1-7	- 13-5	- 11-6	- 13-4	- 15-7	- 17-0	- 17-2	- 15-3	Gardner.....	54361
+ 6-3	+ 6-9	+ 9-2	+ 9-1	+ 15-8	+ 16-8	+ 17-2	+ 14-2	+ 8-3	+ 11-9	+ 14-1	+ 14-7	+ 14-7	+ 14-3	+ 13-2	Usher & Cole.....	1990
+ 10-4	- 11-4	- 14-6	- 15-9	- 10-5	- 7-4	- 5-5	- 5-3	- 15-4	- 21-7	- 22-3	- 25-1	- 25-2	- 24-4	- 24-3	Kullberg.....	7516
- 6-8	- 8-5	- 13-0	- 14-8	- 4-7	- 2-6	- 2-5	- 4-2	- 13-8	- 17-4	- 20-8	- 21-5	- 25-8	- 21-7	- 24-0	Kullberg.....	7329
- 7-3	- 2-1	- 0-5	+ 2-6	- 7-8	- 10-0	- 7-0	- 15-3	- 22-0	- 23-0	- 19-6	- 25-4	- 23-0	- 30-9	- 26-0	Webb.....	5690
- 91-6	- 302-1	- 447-5	- 45-5	- 1078-8	- 3123-1	- 3105-6	- 1461-4	+ 301-8	+ 221-0	+ 390-0	+ 518-6	+ 524-8	+ 1051-0	+ 1013-2	Chronometrical Thermometer.....	
60-7	63-4	64-9	60-4	75-1	93-2	92-9	73-9	53-6	56-7	55-1	49-1	52-9	47-6	46-2	Mean Weekly Temperature.....	
59-2	61-2	61-5	59-0	70-6	88-4	88-3	56-4	50-1	55-6	51-7	46-8	42-4	43-2	42-0	Extremes of Temperature as shown by the Self-Register- ing Thermometers.....	
61-8	66-0	65-8	62-4	84-0	98-0	98-2	82-1	67-9	68-0	67-5	58-0	59-3	55-2	53-2		
The Chronometers are placed in order of merit, their respective positions being determined by consideration of the irregularities of rate exhibited in Table III.																
Only those Chronometers have been included in this list for which 3 did not exceed 12 seconds.																

The Chronometers are placed in order of merit, their respective positions being determined by consideration of the irregularities of rate exhibited in Table III.

Only those Chronometers have been included in this list for which δ did not exceed 12 seconds.

(II.) WEEKLY RATES IN ORDER OF TEMPERATURE

NAME of MAKER.	No.	Weather and Day	(II.) WEEKLY RATES IN ORDER OF TEMPERATURE															
			Dec. 22-29	Dec. 29 Jan. 5	Dec. 6-15	Dec. 15-22	Dec. 1-8	Nov. 17-24	Nov. 24 Dec. 1	Oct. 13-20	Sept. 22-29	Sept. 29 Oct. 6	Sept. 16-22	Oct. 6-13	June 30 July 7	June 16-22		
Kullberg.....	7612	2	- 5.1	- 5.1	- 5.1	- 7.0	- 4.8	- 3.0	- 5.9	- 3.4	- 3.5	- 2.4	- 2.2	- 2.1	- 3.2	- 3.8		
Kullberg.....	7658	2	- 9.2	- 10.7	- 11.1	- 10.1	- 11.0	- 6.4	- 10.3	- 7.0	- 7.0	- 6.0	- 3.8	- 5.5	- 3.4	- 3.0		
Kullberg.....	7684	2	- 10.9	- 10.2	- 10.6	- 10.5	- 9.7	- 7.4	- 8.7	- 5.3	- 4.7	- 3.8	- 2.6	- 3.8	- 2.1	- 1.0		
Kullberg.....	7685	2	- 1.1	- 1.3	- 1.1	- 1.4	- 2.2	+ 2.4	- 2.6	- 0.4	- 2.9	+ 0.7	- 1.7	+ 0.3	- 1.9	- 1.0		
Carley & Clemence.....	51401	2	+ 3.0	+ 3.8	+ 3.5	+ 5.2	+ 5.3	+ 6.4	+ 6.1	+ 4.5	+ 3.4	+ 6.8	+ 2.9	+ 6.0	+ 4.1	+ 1.7		
Johannes.....	5824	2	+ 4.8	+ 3.2	+ 6.0	+ 4.1	+ 6.1	+ 5.8	+ 3.5	- 4.8	- 3.8	- 3.8	- 1.7	- 2.2	- 5.7	- 5.1		
Kullberg.....	7538	2	- 12.6	- 12.3	- 15.9	- 15.2	- 15.0	- 10.6	- 14.2	- 13.3	- 7.0	- 7.5	- 4.9	- 10.3	- 3.0	- 1.9		
Johannes.....	5786	2	- 1.6	- 2.6	+ 1.5	- 0.4	+ 1.3	- 1.5	- 4.4	- 2.1	- 0.4	- 5.9	- 1.0	- 4.4	- 7.2			
Asprey.....	1978	2	- 5.7	- 7.2	- 8.5	- 8.2	- 6.8	- 2.1	- 6.5	- 4.0	- 2.9	- 2.8	- 1.1	- 3.2	- 2.8	- 1.3		
H. White.....	5067	2	+ 8.1	+ 5.9	+ 6.0	+ 3.9	+ 7.0	+ 3.8	+ 6.9	+ 9.1	+ 8.6	+ 10.1	+ 10.2	+ 11.1	+ 0.2	- 1.6		
Carley & Clemence.....	51256	2	- 10.6	- 10.9	- 9.3	- 8.5	- 7.8	- 4.3	- 10.8	- 5.9	- 5.6	- 2.5	- 0.8	- 5.0	- 0.1	+ 1.8		
Carley & Clemence.....	51402	2	- 24.1	- 24.1	- 23.9	- 24.1	- 25.0	- 18.5	- 24.1	- 20.0	- 17.3	- 17.6	- 16.1	- 19.2	- 9.3	- 5.8		
M. F. Dent.....	32584	2	- 0.3	- 0.9	- 3.1	+ 1.2	+ 3.2	+ 10.7	+ 3.9	+ 4.0	+ 6.9	+ 7.9	+ 9.6	+ 9.0	+ 4.8	+ 1.9		
Johannes.....	5823	2	- 10.8	- 8.2	- 9.9	- 9.4	+ 1.9	- 2.5	+ 2.9	- 1.8	- 1.1	+ 2.8	+ 1.2	+ 1.8	- 1.7	+ 1.5		
Lilley & Son.....	1592	2	- 4.5	...	- 7.3	- 6.7	- 7.0	+ 3.7	- 4.4	+ 4.7	+ 10.6	+ 14.4	+ 12.5	+ 8.8	+ 0.8	+ 2.3		
Johannes.....	5822	2	- 13.8	- 13.2	- 16.6	- 15.6	- 12.2	- 11.2	- 13.4	- 10.2	- 9.0	- 8.9	- 12.6	- 7.9	- 9.1	+ 3.1		
Linsaker.....	1984	2	- 5.8	+ 1.2	- 12.8	- 3.8	- 9.9	+ 1.3	- 6.9	+ 0.3	- 1.1	- 0.6	+ 1.1	+ 0.8	- 8.9	- 7.9		
Northern Goldsmiths Co.....	51045	2	- 13.5	- 15.0	- 12.0	- 12.6	- 12.9	- 10.0	- 17.1	- 11.2	- 7.4	- 8.9	- 6.7	- 10.8	- 10.1	- 1.2		
Kullberg.....	7513	2	- 14.5	- 15.0	- 13.7	- 14.1	- 12.3	- 9.2	- 11.6	- 8.9	- 8.1	- 5.5	- 5.9	- 6.6	- 1.0	- 0.9		
Webb.....	5695	2	+ 4.0	+ 39.3	+ 39.1	+ 37.3	+ 38.1	+ 27.9	+ 38.3	+ 27.9	+ 23.7	+ 25.0	+ 24.2	+ 25.0	+ 17.0	+ 15.0		
Gardner.....	54361	2	- 17.2	- 15.3	- 15.7	- 17.0	- 13.4	- 13.5	- 11.6	- 8.0	- 7.0	- 6.2	- 4.8	- 5.9	- 4.1	+ 1.9		
Usher & Cole.....	1990	2	+ 16.4	+ 13.2	+ 14.1	+ 14.7	+ 11.9	+ 14.2	+ 8.3	+ 9.1	+ 6.3	+ 6.9	+ 4.0	+ 9.2	- 7.0	- 10.0		
Kullberg.....	7516	2	- 24.4	- 24.3	- 25.1	- 25.2	- 22.3	- 15.4	- 21.7	- 15.9	- 10.4	- 11.4	- 6.6	- 14.6	- 9.9	- 8.8		
Kullberg.....	7232	2	- 21.7	- 24.0	- 21.5	- 25.8	- 20.8	- 13.3	- 17.4	- 14.8	- 6.8	- 8.5	- 4.8	- 13.0	- 5.0	- 5.0		
Webb.....	5690	2	- 30.9	- 26.0	- 25.4	- 28.0	- 19.6	- 22.0	- 29.0	+ 2.6	- 7.3	- 2.1	- 6.6	- 0.5	+ 2.0	- 2.2		
Chronometrical Thermometer.....			+1051.0	+1013.2	+818.6	+524.8	+380.0	+351.3	+221.0	-45.5	-91.6	-305.1	-330.3	-447.5	-603.7	-610.1		
Mean Weekly Temperature.....			47.6	46.2	49.1	52.9	55.1	53.6	56.7	60.4	60.7	63.4	65.4	64.9	66.0	66.4		
Extremes of Temperature as shown by the Self-Registering Thermometers.....			43.2	42.0	46.8	42.4	51.7	50.1	55.6	59.0	59.2	61.2	61.8	61.5	64.1	60.6		
			55.2	53.2	53.0	59.3	57.5	57.9	58.0	62.4	61.8	66.0	65.4	65.8	69.6	72.0		

The sign + indicates that the rate is gaining.

During these weeks the Chronometers were placed in the chamber of an oven heated by jets of gas, the temperature being regulated by Kullberg's automatic governor which controls the supply of gas. The gas flames are exterior to the chamber, into which none of the injurious products of combustion can enter.

The Chronometrical Thermometer differs from an ordinary Chronometer in the construction of the balance only, the position of the metals forming the compensating rim being reversed. By this arrangement the effect of temperature is much magnified.

AS DETERMINED GENERALLY BY THE CHRONOMETRICAL THERMOMETER.

Sept. 8-15	July 7-14	June 23-30	July 14-21	July 21-28	July 28 to Aug. 4	Sept. 1-8	Nov. 10-17	Oct. 20-27	Aug. 25 to Sept. 1	Aug. 1-8	Nov. 8-15	Oct. 27 to Nov. 3	Aug. 11-18	Aug. 18-25	NAME of MAKER.	No.
+0.5	-2.6	-2.6	-1.0	-1.4	-2.9	+0.2	+0.3	-3.0	-0.6	-2.4	-2.5	-3.9	-3.7	-3.4	Kullberg.....	7612
-1.3	-2.3	-2.2	-1.8	-1.2	-1.2	0.0	-3.9	-4.2	+0.2	-0.9	-3.0	-4.1	-0.1	-0.2	Kullberg.....	7668
-3.7	-1.7	-0.8	-1.5	-0.5	-1.3	-3.3	-3.1	-5.6	-3.1	-0.1	-5.6	-7.3	-2.1	-4.8	Kullberg.....	7684
-2.1	-2.1	-1.1	-1.1	-1.3	-1.3	-4.2	-1.5	-3.0	-4.0	-3.9	-3.8	-4.2	-6.1	-7.7	Kullberg.....	7685
+5.3	+2.8	+5.3	+3.6	+4.5	+8.0	+6.4	+10.7	+9.8	+8.6	+7.8	+12.7	+13.1	+9.4	+9.9	Carley & Clemence.....	51401
-1.9	-5.9	-3.9	-5.0	-5.2	-5.3	-0.2	+2.6	-1.0	+0.9	-4.0	+0.1	-1.2	-4.2	-4.6	Johannes.....	5824
-3.8	-2.9	-3.8	-4.3	-3.7	-3.4	-2.2	-6.2	-8.7	-0.7	-0.5	-3.9	-6.4	-1.3	-0.9	Kullberg.....	7688
+2.1	-4.7	-5.0	-4.9	-4.9	-2.7	+0.9	+2.7	-2.1	-1.3	-6.5	+2.1	-1.1	-2.9	-0.7	Johannes.....	5786
+0.9	-1.6	-1.1	-1.6	-1.7	-2.2	+1.4	+4.1	-1.3	+3.9	-0.8	+6.0	+1.6	+1.4	+4.8	Asprey.....	1978
+12.7	+4.2	+1.2	+5.0	+6.7	+7.1	+5.9	+6.6	+3.0	+5.8	+6.1	-1.9	-3.2	-0.1	-0.1	H. White.....	5067
+1.1	-1.8	+1.0	-0.8	-1.3	-1.3	+4.7	+5.4	0.0	+2.0	+4.4	+4.0	+2.6	+2.4	+1.8	Carley & Clemence.....	51256
-12.4	-6.6	-3.6	-10.4	-11.5	-11.6	-10.5	-11.3	-17.1	-9.8	-9.8	-13.5	-14.6	-13.6	-13.8	Carley & Clemence.....	51402
+7.8	+5.6	+3.1	+5.5	+5.3	+5.7	+14.0	+11.5	+9.9	+18.1	+10.0	+10.2	+11.7	+18.2	+13.1	M. F. Dent.....	32584
+1.9	-0.7	+1.6	-0.4	+0.2	+0.6	+0.3	-5.0	-1.8	-0.5	-0.8	+0.8	-0.2	-1.4	-1.4	Johannes.....	5823
+10.8	+2.8	+3.1	+4.2	+5.3	+7.2	+11.6	+11.4	+6.3	+12.3	+7.5	+14.2	+11.0	+9.7	+12.5	Lilley & Son.....	1592
-11.0	-14.2	-4.4	-19.0	-18.6	-19.3	-4.4	-8.5	-13.9	-3.9	-14.1	-10.4	-13.1	-12.7	-9.0	Johannes.....	5822
+1.9	-7.7	-12.1	-6.4	-6.7	-4.6	+4.0	-10.2	-2.0	-3.9	-6.6	-1.0	-6.5	-4.7	-9.4	Linsaker.....	1984
-1.1	-10.0	-10.9	-7.3	-9.3	-3.8	-1.6	-1.2	-7.2	-7.4	-10.0	-8.0	-12.7	-15.1	-1.2	Northern Goldsmith Co.....	51045
-0.8	+0.5	+1.9	+1.6	+1.2	+3.7	-1.3	-5.9	-6.1	-6.9	+3.5	-7.1	-8.0	-7.9	-11.5	Kullberg.....	7513
+24.1	+16.6	+14.8	+16.6	+13.8	+18.5	+23.6	+24.2	+20.1	+16.5	+23.3	+21.2	+14.7	+13.6	+6.0	Webb.....	5695
-1.4	-5.9	+3.8	-6.0	-6.1	-6.7	+1.5	-1.7	-3.7	+0.9	-0.6	-4.6	+1.2	-0.6	+0.7	Gardner.....	54361
+7.7	-5.5	-7.9	-6.7	-4.9	-3.1	+11.2	+17.2	+15.8	+18.1	+5.0	+13.5	+16.8	+13.1	+19.9	Usher & Cole.....	1990
-3.3	-8.3	-9.4	-7.8	-7.5	-6.0	-0.5	-3.3	-10.5	+1.2	-4.2	-5.5	-7.4	-5.0	-2.6	Kullberg.....	7516
-1.2	-4.8	-3.9	-5.3	-5.1	-7.0	0.0	-4.2	+7.3	+3.0	-5.4	-2.5	-2.6	-0.4	+1.1	Kullberg.....	7232
-7.1	+0.8	-1.9	+2.1	+4.3	+4.0	-1.8	-15.3	-7.8	+8.9	-7.5	-7.0	-10.0	-3.8	+6.0	Webb.....	5690
-771.1	-778.7	-854.8	-871.8	-943.3	-1103.6	-1451.9	-1461.4	-1578.8	-2442.6	-2454.7	-3105.6	-3123.1	-3489.9	-3716.4	Chronometrical Thermometer.....	
67.5	67.8	69.0	69.1	70.1	72.4	74.8	75.9	75.1	85.3	86.5	92.9	93.2	97.7	98.3	Mean Weekly Temperature.....	
64.8	65.3	64.1	67.0	68.8	70.3	70.8	56.4	70.6	73.6	80.2	88.3	88.4	93.2	90.9	Extremes of Temperature as shown by the Self-Registering Thermometers.....	
72.0	70.1	72.9	72.4	72.8	74.1	80.3	82.1	84.0	93.0	92.0	96.2	98.0	102.0	105.7		

The Chronometers are placed in order of merit, their respective positions being determined by consideration of the irregularities of rate exhibited in Table III.

Only those Chronometers have been included in this list for which δ did not exceed 12 seconds.

NAME OF MAKER.	No.	Warrant No. & Date.	ADDRESS OF MAKER.	Construction of Escapement, Balance, and Spring, from the Description furnished by the Maker.	(III.) ABSTRACT OF	
					Least Weekly Sum.	Extremes of Temperature.
Kullberg.....	7612	2	105, Liverpool Road, London, N.	Kullberg's auxiliary balance; palladium spring.	- 7.0	42.4 - 59.3
Kullberg.....	7658	2	105, Liverpool Road, London, N.	Kullberg's auxiliary balance; palladium spring.	- 11.1	46.8 - 53.0
Kullberg.....	7684	2	105, Liverpool Road, London, N.	Kullberg's auxiliary balance; palladium spring.	- 10.9	43.2 - 55.2
Kullberg.....	7685	2	105, Liverpool Road, London, N.	Kullberg's auxiliary balance; palladium spring.	- 7.7	50.2 - 105.7
Carley & Clemence.....	51401	2	30, Ely Place, Holborn, W.C.	Invar balance; steel spring.	+ 1.7	60.6 - 72.0
Johannsen.....	5824	2	149, Minories, London, E.	Auxiliary to balance acting in heat; palladium spring.	- 5.9	65.3 - 70.1
Kullberg.....	7388	2	105, Liverpool Road, London, N.	Kullberg's auxiliary balance; palladium spring.	- 15.9	46.8 - 53.0
Johannsen.....	5786	2	149, Minories, London, E.	Auxiliary to balance acting in heat; palladium spring.	- 7.2	60.6 - 72.0
Asprey.....	1978	2	165, 166, New Bond Street, London, W.	Auxiliary to balance acting in cold; palladium spring.	- 8.5	46.8 - 53.0
H. White.....	5067	2	63, Chesapeake, London, E.C.	Auxiliary balance; palladium spring.	- 3.2	88.4 - 98.0
Carley & Clemence.....	51256	2	30, Ely Place, Holborn, W.C.	Auxiliary balance; palladium spring.	- 10.9	42.0 - 53.2
Carley & Clemence.....	51402	2	30, Ely Place, Holborn, W.C.	Auxiliary balance; palladium spring.	- 25.0	51.7 - 57.5
M. F. Dent.....	32564	2	33, Cockspur Street, London, S.W.	Auxiliary to balance acting in heat; palladium spring.	- 3.1	46.8 - 53.0
Johannsen.....	5823	2	149, Minories, London, E.	Auxiliary to balance acting in heat; palladium spring.	- 10.8	43.2 - 55.2
Lilley & Son.....	1592	2	10, London Street, Fenchurch Street, E.C.	Auxiliary compensations; palladium spring.	- 7.8	46.8 - 53.0
Johannsen.....	5822	2	149, Minories, London, E.	Auxiliary to balance acting in heat; palladium spring.	- 19.8	70.8 - 74.1
Linaaker.....	1984	2	c/o. Pike, 26, King Street, Manchester.	Auxiliary to balance acting in cold; palladium spring.	- 12.8	46.8 - 53.0
Northern Goldsmiths Co. Kullberg.....	51045	2	Blackett Street, Newcastle-on-Tyne.	Auxiliary balance; palladium spring.	- 17.7	93.2 - 102.0
Webb.....	5695	2	105, Liverpool Road, London, N.	Kullberg's auxiliary balance; palladium spring.	- 15.0	42.0 - 53.2
Webb.....	5695	2	69, Charlton Road, Blackheath, S.E.	Auxiliary compensations; steel spring.	+ 14.7	93.2 - 102.0
Gardner.....	5/4361	2	20, Lloyd's Square, London, W.C.	Auxiliary balance; palladium spring.	- 17.2	43.2 - 55.2
Usher & Cole.....	1990	2	339, St. John Street, London, E.C.	Auxiliary to balance acting in cold; palladium spring.	- 10.0	60.6 - 72.0
Kullberg.....	7516	2	105, Liverpool Road, London, N.	Kullberg's auxiliary balance; palladium spring.	- 25.2	42.4 - 59.3
Kullberg.....	7329	2	105, Liverpool Road, London, N.	Kullberg's auxiliary balance; palladium spring.	- 25.8	42.4 - 59.3
Webb.....	5690	2	69, Charlton Road, Blackheath, S.E.	Auxiliary compensations; steel spring.	- 30.9	43.2 - 55.2

The sign + indicates that the rate is gaining.

THE PRINCIPAL CHANGES OF RATE DURING THE 29 WEEKS.

Mean Temperature.	Greatest Weekly Sum.	Extremes of Temperature.	Mean Temperature.	Difference between the Greatest and Least. (a)	Greatest Difference between one Week and the next. (b)	Mean Temperature for these two Weeks.	Trial No. a + 2b.	NAME OF MAKER.	No.
52.9	+ 0.5	64.8 - 72.0	67.5	7.5	3.8	73.9 - 53.6	14.1	Kullberg.....	7612
49.1	+ 0.2	90.8 - 105.7 73.6 - 93.0	88.3	11.3	3.9	53.6 - 56.7	19.1	Kullberg.....	7658
47.6	- 0.1	80.2 - 92.0	86.5	10.8	4.3	53.6 - 53.6	19.4	Kullberg.....	7684
98.3	+ 2.4	50.1 - 57.9	53.6	10.1	5.0	53.6 - 56.7	20.1	Kullberg.....	7685
66.4	+ 13.1	88.4 - 98.0	93.2	11.4	5.3	60.4 - 75.1	22.0	Carley & Clemence.....	51401
67.8	+ 6.1	51.7 - 57.5	55.1	12.0	5.4	98.3 - 85.3	22.8	Johannsen.....	5824
49.1	- 0.5	80.2 - 92.0	86.5	15.4	4.6	60.4 - 75.1	24.6	Kullberg.....	7388
66.4	+ 2.7	56.4 - 82.1	73.9	9.9	8.0	67.5 - 63.4	25.9	Johannsen.....	5786
49.1	+ 5.0	88.3 - 93.2	92.9	14.5	6.2	73.9 - 53.6	26.9	Asprey.....	1978
93.2	+ 12.7	64.8 - 72.0	67.5	15.9	8.5	92.9 - 73.9	32.9	H. White.....	5067
46.2	+ 5.4	56.4 - 82.1	73.9	16.3	9.7	73.9 - 53.6	35.7	Carley & Clemence.....	51256
55.1	- 3.6	64.1 - 73.9	69.0	21.4	7.2	73.9 - 53.6	35.8	Carley & Clemence.....	51402
49.1	+ 18.2	93.2 - 102.0	97.7	21.3	7.7	86.5 - 97.7	36.7	M. F. Dent.....	32564
47.6	+ 2.9	55.6 - 58.0	56.7	13.7	11.8	55.1 - 49.1	37.3	Johannsen.....	5823
49.1	+ 14.4	61.2 - 66.0	63.4	21.7	8.1	53.6 - 56.7	37.9	Lilley & Son.....	1592
72.4	+ 3.1	60.6 - 72.0	66.4	22.4	8.1	98.3 - 85.3	38.6	Johannsen.....	5822
49.1	+ 4.0	70.8 - 80.3	74.8	16.8	11.5	73.9 - 53.6	39.8	Linaaker.....	1984
49.1	+ 1.2	56.4 - 82.1	73.9	18.9	11.2	73.9 - 53.6	41.3	Northern Goldsmiths Co.	51045
46.2	+ 3.7	70.8 - 74.1	72.4	18.7	11.4	86.5 - 97.7	41.5	Kullberg.....	7513
97.7	+ 40.3	43.2 - 55.2	47.6	25.6	8.4	53.6 - 56.7	42.4	Webb.....	5695
47.6	+ 2.3	64.1 - 72.9	69.0	19.5	11.8	73.9 - 53.6	43.1	Gardner.....	5/4361
66.4	+ 19.9	90.3 - 105.7	98.3	29.9	8.1	72.4 - 86.5 86.5 - 97.7	45.1	Usher & Cole.....	1990
52.9	+ 1.2	73.6 - 93.0	85.3	26.4	10.1	73.9 - 53.6	46.6	Kullberg.....	7516
52.9	+ 3.0	73.6 - 93.0	85.3	28.8	10.1	60.4 - 75.1	49.0	Kullberg.....	7329
47.6	+ 8.9	73.6 - 93.0	85.3	39.8	11.5	72.4 - 86.5	62.8	Webb.....	5690

The Chronometers are placed in order of merit, their respective positions being determined by consideration of the irregularities of rate exhibited in the Table above. The Trial No. a + 2b is taken as a measure of the irregularities of rate.

Only those Chronometers have been included in this list for which b did not exceed 12 seconds.

(1) WEEKLY RATES IN ORDER OF TIME.

Order of Merit.	Pocket Chronometer Horizontal. Dial up.																							
	June 16-23	June 30-30	June 30 to July 7	July 7-14	July 14-21	July 21-28	July 28 to Aug. 4	Aug. 4-11	Aug. 11-18	Aug. 18-25	Aug. 25-30	Sept. 1-8	Sept. 8-15	Sept. 15-22	Sept. 22-29	Sept. 29 to Oct. 6	Oct. 6-13	Oct. 13-20	Oct. 20-27	Oct. 27-31	Oct. 31 to Nov. 3	Nov. 3-6	Nov. 6-10	
	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Chas. Verinal Pendul. up.	Chas. Verinal Pendul. right.	Chas. Verinal Pendul. left.	Chas. Verinal Pendul. up.	
1	64	46	78	79	54	44	65	57	140	222	186	93	15.9	21.7	21.4	17.7	17.8	245	229	42.2	40.4	41.1	42.2	
2	85	56	141	81	69	56	97	24	10	13	91	108	74	24	0.1	0.2	0.8	26	122	128	31.0	29.6	44	
3	282	238	162	147	51	65	55	190	201	185	51	50	163	106	102	98	138	137	201	247	328	401	187	
4	+101	+76	+93	+87	+211	+261	+268	+182	+47	-118	+9	+253	+286	+321	+321	+181	+251	+357	+326	+112	+175	+175	+221	
5	+179	+186	+148	+51	+33	+180	+186	06	-185	-132	-71	-41	+69	+75	+130	+112	+10	+169	+249	+110	+126	+16	+182	
6	-20	-37	-14	+18	+32	+49	+53	-80	-229	-250	-51	+13	+32	-98	-144	-187	+34	+30	+222	-53	-79	-12	-28	
7	+48	+189	+207	+365	+348	+296	+314	+371	+378	+460	+434	+230	+346	+323	+299	+380	+411	+439	+290	+667	+208	+268	+674	
8	+206	+228	+254	+282	+258	+320	+247	+172	+116	+150	+238	+363	+435	+462	+460	+388	+368	+462	+283	-39	0.2	0.5	4.6	
9	+184	+166	+200	+156	+136	+177	+135	-155	-50	+01	+102	+213	+244	+245	+230	+129	+77	+165	+43	-33	-75	44	+26	
10	+48	+10	+12	+42	+206	+177	+174	+04	-14	+12	+57	+222	+255	+256	+320	+246	+264	+218	+165	-945	-838	-1227	-989	
11	+107	+86	+84	+81	+65	-38	+62	+111	+244	+290	+287	+158	+75	+180	-25	-78	-140	-226	+27	-21	+42	+205	+70	
12	-287	-258	-224	-221	-216	-213	-253	-429	-429	-474	-326	-356	-239	-475	-388	-470	-420	-437	-1489	-1243	-1300	-1274		
	664	650	660	678	681	701	724	865	977	963	853	728	675	634	657	634	649	604	878	877		879		
	606	641	641	653	670	683	703	802	902	903	736	708	648	618	592	612	615	590	844		816		888	
	720	729	696	701	724	728	741	920	1020	1057	980	803	720	654	618	660	658	624	900		900		891	

† The weekly rates have been computed from the rates for four days.

* The weekly rates have been computed from the rates for three days.

During the period Aug. 4 to Sept. 1 and Oct. 20 to Nov. 17, the Pocket Chronometers were placed in the chamber of an oven heated by jets of gas, the temperature being regulated by Kullberg's automatic governor which controls the supply of gas. The gas flames are anterior to the chamber, into which none of the injurious products of combustion can enter.

(2) ABSTRACT OF PRINCIPAL CHANGES OF RATE.

								(3) ABSTRACT OF PRINCIPAL CHANGES OF RATE.											
Nov. 10-17	Nov. 17-24	Nov.24 to Dec. 1	Dec. 1-8	Dec. 8-15	Dec. 15-22	Dec.22-29	Dec.29 to Jan. 5	Differences between greatest and least Weekly Rate, on any day at the next one week's trial.	Difference of Weekly Rates.				Trial Number.	NAME OF MAKER.	No.	ADDRESS OF MAKER.			
									Dial up.	Dial up.	Dial up.	Dial up.							
																	Product up - Dial up.	Product right - Dial up.	Product left - Dial up.
Pocket Chronometer. Horizontal. Dial up.																			
a.	b.	c.	d.	e.															
-251	-216	-227	-274	-291	-178	-322	-304	278	144	-182	-164	-171	713	J. Player & Son.	33498	Butts Lane, Coventry.			
+107	-74	-111	-140	-212	-164	-268	-250	385	181	-73	+195	-411	885	Lindqvist.....	1110	13 Alderney Street, Fimlico, W.			
-88	-184	-211	-214	-247	-225	-257	-213	347	245	-72	-378	-256	979	L. Hall.....	17986	17 Mercer Row, Louth, Lincolnshire.			
+201	+152	+127	+171	+79	+129	+74	+162	475	244	-127	-119	-119	1067	Kullberg.....	74228	105 Liverpool Road, London, N.			
+239	+26	+65	+62	+51	+57	+73	+49	434	274	-128	-148	-258	1114	Kullberg.....	74507	105 Liverpool Road, London, N.			
+181	+160	+303	+212	+130	+214	+06	+119	558	221	-243	-281	-214	1205	J. White & Sons.	37553	Karlston, Coventry.			
+390	+380	+414	+432	+441	+468	+568	+449	515	204	+346	-117	-593	1214	Newsome & Co.	152381	The Butts, Coventry.			
+183	+396	+643	+498	+586	+540	+575	+542	527	247	-276	-235	-228	1236	Newsome & Co.	150708	The Butts, Coventry.			
-138	+313	+328	+242	+298	+249	+308	+266	468	446	+41	-80	+01	1386	J. Player & Son.	33495	Butts Lane, Coventry.			
+270	+149	+144	+225	+248	+305	+254	+194	334	170	-1185	-1051	-12945	1666	Wates & McCulloch.	38395	20 Lodge Hill, London, E.C.			
+02	-392	-508	-522	-511	-486	-482	-552	842	394	+10	+27	+190	1671	Lindqvist.....	1099	13 Alderney Street, Fimlico, W.			
-424	-561	-569	-713	-722	-730	-853	-869	685	176	-946	-807	-864	1789	Thorneloe.....	570468	13-17 Stanton Street, Coventry.			
869	536	527	551	481	529	476	462	Mean Weekly Temperature.											
840	501	556	517	468	424	432	420	Extremes of Temperature as shown by the Self-Registering Thermometers.									The sign + indicates a gaining rate.		
888	579	580	575	530	593	552	532												

The quantities a, b, c, d, e, in the formula $a + 2b + \frac{1}{2}(c + \frac{d+e}{2})$ are taken numerically without regard to sign.

The sign + indicates a gaining rate.