

KG  
11366  
v. 801



# Effect of adding weights to pendulum bob of Boud 394.

0	$h$	=	$d$
0		=	0.00
1		=	0.04
2		=	0.08
3		=	0.13
4		=	0.17
5		=	0.21
6		=	0.25
7		=	0.29
8		=	0.33
9		=	0.38
10		=	0.42
11		=	0.46
12		=	0.50
13		=	0.54
14		=	0.58
15		=	0.62
16		=	0.67
17		=	0.71
18		=	0.75
19		=	0.79
20		=	0.83
21		=	0.87
22		=	0.92
23		=	0.96
24		=	1.00

add	1 gramme	= +	per hour	= +	per day.
			0.27		.65
2	"	+	0.54		+1.30
3	"	+	0.81		+1.94
4	"	+	1.08		
5	"	+	1.35		
6	"	+	1.62		
7	"	+	1.89		
8	"	+	2.16		
9	"	+	2.43		
10	"	+	2.70		
20	"	+	5.40		

$\frac{1}{4}$	"	.....	.007
$\frac{1}{2}$	"	.....	.013
$\frac{3}{4}$	"	.....	.020
1.1	"	.....	.030
1 $\frac{1}{4}$	"	.....	.034
1 $\frac{1}{2}$	"	.....	.040
1 $\frac{3}{4}$	"	.....	.047
2 $\frac{1}{4}$	"	.....	.060
2 $\frac{1}{2}$	"	.....	.067
3 $\frac{1}{2}$	"	.....	.094
3.7	"	.....	.100

3.7 8



J. R. Edmonds Esq.



July 2<sup>nd</sup> 3 P.m.

Mr Edwards -

You will find the error and rate of the clocks on the last page of the Comparison Book. Please mind the Chronometer at 9 a.m. Saturday. I shall be back on Sunday morning if nothing happens.

The chronometer cannot be used as it has not been compared for several days.

Grav 1327 and Waltham = weights.

Yours - Frank Waldo

If any thing should happen to keep me away over Sunday I will telegraph you.



Clock comparisons -

Harvard College Observatory -

Time Service

May 1. 1879 to

F. W.















May 1.

$1327 + \frac{1}{2}$   
 10 40 30  
     29.0  
 10 40 01.0  
 2 36 56.98  
 8 03 04.02  
     1 19.20  
     44.82  
     60.00  
     15.18  
     15.50  
     - .32

+ 1 gr. w = 10 gr.

$1327$   
 23 7 32  
     28.8  
 23 7 3.2  
 2 36 56.98  
 20 30 06.22  
     3 21.48  
     44.74  
     60  
     15.26  
     15.50  
 - 1 gr. - .24  
 + 10 gr. for 1<sup>h</sup> + .27  
     + .03

Sig. No. Error

 $1327 (191).$ 

9 3 27  
     29.02  
 9 2 57.98  
 2 36 56.98  
 6 25 01.00  
     1 3.20  
     57.80  
     60.00  
     2.20  
     15.50  
     - 13.30

 $1327 (191).$ 

20 52 23  
     29.15  
 20 51 53.85  
 2 36 56.98  
 18 14 56.87  
     2 59.37  
     57.50  
     60.00  
     12.50  
     15.50  
 - 13.00

 $1327$ 

23 7 32  
     29.15  
 23 7 2.85  
 2 36 56.98  
 20 30 5.87  
     3 21.47  
     44.40  
     60.00  
     15.60  
     15.50  
 + .10

rim. 10 gr. - .13

previously added. - .03

- 5 gr. for  $\frac{1}{2}$  R

Sig. No. Error.



2

May 2<sup>nd</sup>

1327. -  $\frac{1}{2}$

14	28	03
		28.7
14	27	34.3
2	40	53.53
11	46	40.77
	1	55.69
		45.08
		60.00
		14.92
		15.50
		-.48

+ 2 gr.

w = 11 gr.

1327

22	32	22
		28.7
22	31	53.3
2	40	53.53
19	50	59.77
	3	15.11
		44.66
		60.00
		15.34
		15.50
		-.16
		.00
		Mean. -.08

-1 gr. Signal No Error  
weight = 10 gr.



May 3<sup>d</sup>.

1327.

11 40 31

28.5

11 40 2.5

2 44 50.09

8 55 12.4

1 27.68

44.72

60 00

15.28

15.50

- .22

May 4.

1327 +  $\frac{1}{2}$ 

9 40 07

28.0

9 39 39

2 48 46.65

6 50 52.35

1 07.38

44.97

60 00

- 1 gr. at 0<sup>h</sup>

15 03

15.50

- .47

+ 1 gr.

1327 -  $\frac{1}{3}$ 

21 59 8

28.0

21 58 40.0

2 48 46.65

19 09 53.35

3 8.30

45.05

60.00

14.95

15.50

- .55

1327 191 Error 236. + 38.12

added 10 gr. - .50 3451 39 10.15

for 1  $\frac{1}{3}$  h. - .35 mean. 38.12

+ 36 32.03

Sig. No Error. + .01 39.00

Error 1327 + 27.97

236 = 22<sup>h</sup> 34<sup>m</sup> 27.553451 = 22<sup>h</sup> 36<sup>m</sup> 25.00236 = 22<sup>h</sup> 39<sup>m</sup> 10.151327 = 22<sup>h</sup> 39<sup>m</sup> 00.00

36 25.00

2 36.07

33 48.93

34 27.05

4

May 5.

$$\begin{array}{r}
 1327 + \frac{1}{3} \\
 11 \quad 13 \quad 18 \\
 28.37 \\
 11 \quad 12 \quad 49.63 \\
 2 \quad 52 \quad 43.21 \\
 8 \quad 20 \quad 06.42 \\
 1 \quad 21.99 \\
 44.43 \\
 60.00 \\
 15.57 \\
 15.50 \\
 +.07
 \end{array}$$

$$\begin{array}{r}
 1327 (191) \\
 9 \quad 50 \quad 18 \\
 28.4 \\
 9 \quad 49 \quad 49.6 \\
 2 \quad 52 \quad 43.21 \\
 6 \quad 57 \quad 08.39 \quad 13.57 \\
 1 \quad 08.32 \quad 13.30 \\
 58.07 \quad .27 \\
 60.00 \quad 241.07 \quad 1.0029 \\
 \quad \quad \quad 48 \\
 \quad \quad \quad 220 \\
 1.93 \\
 15.50 \\
 - 13.57 (191)
 \end{array}$$

$$\begin{array}{r}
 1327 (191) \\
 20 \quad 25 \quad 02 \\
 28.56 \\
 20 \quad 24 \quad 33.44 \\
 2 \quad 52 \quad 43.21 \\
 17 \quad 31 \quad 50.23 \\
 3 \quad 52.33 \\
 57.90 \\
 60.00 \\
 2.10 \\
 15.50 \\
 - 13.40
 \end{array}$$

$$\begin{array}{r}
 1327 + \frac{1}{4} \\
 22 \quad 35 \quad 10 \\
 28.6 \\
 22 \quad 34 \quad 41.4 \\
 2 \quad 52 \quad 43.21 \\
 19 \quad 41 \quad 58.19 \\
 3 \quad 13.67 \\
 44.52 \\
 60.00 \\
 15.48 \\
 15.50 \\
 - .02
 \end{array}$$

Sig. No. Error.



May. 6.

1327 (191).

9	26	10
		28.57
9	25	41.43
2	56	39.76
6	29	01.67
	1	03.73
		57.94
		60.00
		2.06
		15.50
		- 13.44

1327

12	24	26
		28.57
12	23	57.43
2	56	39.76
9	27	17.67
	1	32.91
		44.76
		60.00
		15.24
		15.50
		- .26

add 1 gr.

w = 10 gr.

1327 +  $\frac{1}{4}$ .

23	00	10
		28.33
22	59	41.17
2	56	39.76
20	03	01.41
	3	17.05
		44.36
		60.00
		15.64
		15.50

-1 gr. w = 9. + .14

run 10 gr. - .07

for 15 m. + .07

Sig. No. Error.

1327

191

22	8	45 =	30
		28.8	
22	8	16.2	
2	56	39.76	
19	11	36.44	
	3	8.65	
		27.79	
		30.00	
		2.21	
		15.50	
		- 13.29	

6

May 7.

	1327.	191.	1327 - $\frac{1}{3}$
9	37 44 =	36	13 21 31
	28.85		28.9
9	37 15.15		13 21 02.1
3	00 36.32		3 00 36.32
6	36 38.83		10 20 25.78
	1 4.96		1 41.58
	33.87		44.20
	36.00		60.00
	2.13		15.80
	15.50		15.50
191 =	- 13.37		+ .30

	1327 - $\frac{1}{3}$
23 0 6	
	29.0
22 59 37.0	
3 00 36.32	
19 59 00.68	
3 16.38	
	44.30
	60.00
	15.70
	15.50
	+ .20

- 10 gr. - .14

for 30<sup>m</sup> +.06

Signal No Error.



May 8

	1327	191	
9	48	30 = 24	
		29.35	
9	48	00.65	
3	04	32.87	
6	43	27.78	
	1	6.11	
		21.67	
		24.00	
		2.33	
		15.50	
(191)	-	13.17	

	1327	$+\frac{1}{3}$
12	27	19
		29.4
12	26	49.6
3	04	32.87
9	22	16.73
	1	32.18
		44.55
		60.00
		15.45
		15.50
		-.05

	1327	(191)
20	27	57
		29.78
20	27	27.22
3	04	32.87
17	22	54.35
	2	50.85
17	20	03.50
		60.00

	1327	$+\frac{1}{2}$
23	17	56
		29.8
23	16	36.2
3	04	32.87
20	12	3.33
	3	18.65
		44.68
		60.00
		15.32
		15.50
		-.18
+ 3 gr. for 2 h		+.16
		-.02

Signal No Error.

8

May 9.

$1327 + \frac{1}{4}$   
 12 55 20  
     29.9  
 12 54 50.1  
 3 08 29.43  
 9 46 20.67  
     1 36.08  
     44.59  
     60.00  
     15.41  
     15.50  
     -.09

1327

22 58 59  
     30.65  
 22 58 28.35  
 3 08 29.43  
 19 49 58.92  
     3 14.92  
     44.00  
     60  
     1600  
     1530  
     1327 +.00  
     191 =+.10

Time 10 g. forth. Mean. +.30  
      $\frac{-.27}{+.03}$

Sig. No. Error.

May 10.

$1327$   
 0 39 12  
     30.70  
 0 38 41.30  
 3 12 25.98  
 21 26 15.32  
     3 30.68  
     44.64  
     60.00  
     15.36  
     15.50  
     -.14

$1327$  191  
 10 27 19 = 14  
     30.26  
 10 26 48.74  
 3 12 25.98  
 7 14 22.76  
     1 11.16  
     11.60  
     14.00  
     2.40  
     15.50  
     -13.10



May 11.

$1327 - \frac{1}{2}$   
 11 56 03  
     30.9  
 11 55 32.1  
 3 16 22.54  
 8 39 09.56  
     1 24.98  
     44.58  
     60  
     15.42  
     15.50  
     - .08

 $1327 - \frac{2}{5}$ 

21 40 39  
     31.3  
 21 40 07.7  
 3 16 22.54  
 18 23 45.16  
     3 00.75  
     44.41  
     60.00  
     15.59  
     15.50  
 $1327 + .09$   
 394 .00  
 mean. + .04

A.W.

Signal No Error.

May 12.

$1327 - \frac{1}{3}$   
 12 49 8  
     31.97 31.1  
 12 48 36.03 36.9  
 3 20 19.09 19.1  
 9 28 16.94 17.8  
     1 33.04 33.04  
     43.90 44.76  
     60.00 60.00  
     16.10 15.24  
     15.50 15.50  
     (+ .60) - .26  
 - 1 gr.

$1327 (191)$        $1327 + \frac{1}{3}$   
 13 26 27 22 33 44  
     31.12      31.35  
 13 25 55.88 22 33 12.6  
 3 20 19.09 3 20 19.09  
 10 05 36.79 19 12 53.51  
     1 39.20      3 08.92  
     3 57.57      44.59  
     60.00      60.00  
     2.43      15.41  
     15.50      15.50  
 (191) - 13.07 + 1 gr. - .09  
                          + 10 gr for  $\frac{1}{2}$  hr. + 14  
                          + 10 gr for half an hour. + 05

I left the 10 gr. weight on over the  
 time, and removed 10 } Sig. No. Error.  
 also 9 gr for half an hour.

then B-H = 13.00. This makes Bond 394  $\pm .05$

10

May 13.

13 27 (191)

11 28 03

30.58

11 27 32.42

3 24 15.65

8 03 16.77

1 19.16

57.61

60.00

2.39

15.50

(191) - 13.11

1327

12 15 58

30.6

12 15 27.4

3 24 15.65

9 51 11.75

1 36.85

44.90

60.00

15.10

15.50

- .40

wrong13 27. +  $\frac{1}{4}$ 

12 46 3

30.6

12 45 32.4

3 24 15.65

9 21 16.75

1 31.99

44.76

60.00

15.24

15.50

- .26

+ 1 gr.

1327 +  $\frac{1}{4}$ 

22 47 41

30.6

22 47 10.4

3 24 15.65

19 22 54.75

3 10.53

44.22

60.00

15.78

15.50

1327 + .28

394 .00

191 .00

mean. + .09

- 1 gr. - .07  
+ .02

Sig. No. Error



May 14.

$$1327 - 191$$

$$13 \quad 39 \quad 00 = 40$$

$$30.12$$

$$13 \quad 38 \quad 29.88$$

$$3 \quad 28 \quad 12.21$$

$$10 \quad 10 \quad 17.67$$

$$1 \quad 39.96$$

$$37.71$$

$$40 \quad 00$$

$$2.29$$

$$15.50$$

$$(191) - 13.21$$

$$1327 + \frac{1}{2}$$

$$22 \quad 41 \quad 36$$

$$29.9$$

$$22 \quad 41 \quad 06.1$$

$$3 \quad 28 \quad 12.21$$

$$19 \quad 12 \quad 53.89$$

$$3 \quad 8.95$$

$$44.94$$

$$6000$$

$$15.06$$

$$15.50$$

$$1327 - .44$$

$$191 - .2$$

$$\text{Mean} - .32$$

$$+ 5 \text{ gr. for } 2^{\text{th}} + .27$$

$$- .05$$

$$\text{Sig. No. Error.}$$

May 15.

$$1327 - \frac{1}{3}$$

$$13 \quad 1 \quad 57$$

$$29.6$$

$$13 \quad 1 \quad 27.4$$

$$3 \quad 32 \quad 08.77$$

$$9 \quad 29 \quad 18.63$$

$$1327 - \frac{1}{3}$$

$$13 \quad 1 \quad 57$$

$$30.58$$

$$13 \quad 1 \quad 26.42$$

$$3 \quad 32 \quad 08.77$$

$$9 \quad 29 \quad 17.65$$

$$1 \quad 33.21$$

$$44.44$$

$$6000$$

$$15.56$$

$$15.50$$

$$+ .06$$

$$B-H = 13.2$$

$$1327 + \frac{1}{2}$$

$$23 \quad 39 \quad 42$$

$$30.8$$

$$23 \quad 39 \quad 11.2$$

$$3 \quad 32 \quad 08.77$$

$$20 \quad 07 \quad 2.43$$

$$3 \quad 17.82$$

$$44.61$$

$$6000$$

$$15.39$$

$$15.50$$

$$1327 = - .11$$

$$394 = .00$$

$$- .05$$

Signal No Error.

12

May 16.

13 27 -  $\frac{1}{4}$ 

14 14 6

31.07

14 13 34.93

3 36 05.32

10 37 29.61

1 44.38

45.23

60.00

14.77

15.50

+2 gr.  
w=11 gr. - .73

13 27 (191)

13 44 14

31.07

13 43 42.93

3 36 05.32

10 07 37.61

18 39.53

58.08

60.00

1 92

15.50

- 13.58 (191)

13 27 -  $\frac{1}{4}$ 

23 35 38

31.37

23 35 06.63

3 36 05.32

19 59 01.31

3 16.41

44.90

60.00

15.10

15.50

13 27 - .40

191 - .20

-1 gr. Mean - .30

+5 gr. 2h  
27  
- .03

Sug No Error.



May 18.

$$\begin{array}{r} 236 \\ 1327 - \frac{1}{3} \\ \hline 13 \quad 30 \quad 49 \\ \quad \quad \quad 30.06 \\ 13 \quad 30 \quad 18.94 \\ 3 \quad 43 \quad 58.43 \\ 9 \quad 46 \quad 20.51 \\ \quad \quad 1 \quad 36.00 \\ \quad \quad \quad 44.51 \\ \quad \quad \quad 60.00 \\ \quad \quad \quad 15.49 \\ \quad \quad \quad 15.50 \\ B-H = 14.15 \quad -.01 \end{array}$$

1327 -  $\frac{1}{3}$ 

$$\begin{array}{r} 23 \quad 45 \quad 33 \\ \quad \quad \quad 33.2 \\ 23 \quad 44 \quad 59.8 \\ 3 \quad 43 \quad 58.43 \\ 20 \quad 1 \quad 01.37 \\ \quad \quad 3 \quad 16.70 \\ \quad \quad \quad 44.67 \\ \quad \quad \quad 60.00 \\ \quad \quad \quad 15.33 \\ \quad \quad \quad 15.50 \\ \quad \quad \quad -.17 \\ \quad \quad \quad .00 \quad 394 \\ \quad \quad \quad -.08 \end{array}$$

May 19.

$$\begin{array}{r} 1327 + \frac{1}{3} \\ 12 \quad 23 \quad 38 = 50 \\ \quad \quad \quad 33.6 \\ 12 \quad 23 \quad 04.4 \\ 3 \quad 47 \quad 54.99 \\ 8 \quad 35 \quad 09.41 \\ \quad \quad 1 \quad 24.46 \\ \quad \quad \quad 44.95 \\ \quad \quad \quad 60.00 \\ \quad \quad \quad 15.05 \\ \quad \quad \quad 15.50 \\ \quad \quad \quad -.45 \end{array}$$

+1 gr.

w = 11 gr.

Signal No Error.

$$\begin{array}{r} 1327 - \frac{1}{2} \\ 23 \quad 39 \quad 29.0 \\ \quad \quad \quad 34.1 \\ 23 \quad 38 \quad 54.9 \\ 3 \quad 47 \quad 54.99 \\ 19 \quad 50 \quad 59.91 \\ \quad \quad 3 \quad 15.02 \\ \quad \quad \quad 44.89 \\ \quad \quad \quad 60.00 \\ \quad \quad \quad 15.11 \\ \quad \quad \quad 15.50 \\ \quad \quad \quad -.39 \\ \quad \quad \quad -.20 \quad 191 \\ \quad \quad \quad .00 \quad 394 \\ \quad \quad \quad .54 \\ \quad \quad \quad -.20 \quad \text{mean.} \\ \quad \quad \quad +.14 \\ \quad \quad \quad -.06 \end{array}$$

-1 gr.

+10 gr. for 30<sup>m</sup>

4

May 20.

$$1327 + \frac{1}{2}$$

$$14 \quad 56 \quad 00 = 05$$

34.9

$$14 \quad 55 \quad 25.1$$

$$3 \quad 51 \quad 51.55$$

$$11 \quad 03 \quad 33.55$$

$$1 \quad 48.78$$

$$44.77$$

$$60 \quad 00$$

$$15.23$$

$$15.50$$

$$-.27$$

+ 1 gr.  
n 11 gr.

1327

$$23 \quad 52 \quad 28$$

35.4

$$23 \quad 51 \quad 52.6$$

$$3 \quad 51 \quad 51.55$$

$$20 \quad 00 \quad 01.05$$

$$3 \quad 16.59$$

$$44.46$$

$$60 \quad 00$$

$$15.54$$

$$15.50$$

$$+.04$$

- 1 gr. at noon.  
n = 10 gr.

Signal No Error

1327 191

$$13 \quad 2 \quad 56 = 00^s$$

34.8

$$13 \quad 2 \quad 21.2$$

$$3 \quad 51 \quad 51.55$$

$$9 \quad 10 \quad 29.65$$

$$1 \quad 30.18$$

$$59.47$$

$$60.00$$

$$.53$$

$$15.50$$

$$-14.97$$



May 21

1327 +  $\frac{1}{2}$   
 23  $\frac{40}{39}$  23  
 36.4  
 23 39 46.6  
 3  $\frac{5}{54}$  48.10  
 19 44 58.5  
 3 14.13  
 44.37  
 60.00  
 15.63  
 15.50

1327 + .13

~~394~~ + .00

191 - .40

mean - .27  
~~mean~~ - .64+10 gr. for  $\frac{1}{2}$  h = +.14+1 gr.  
 $w=11$  gr.

Sig. No Error .00

-1 gr. at  $6\frac{1}{2}$ 

May 22

1327 +  $\frac{1}{2}$ 

14 33 50  
 36.98  
 14 33 13.02  
 3 59 44.66  
 10 33 28.36  
 1 43.86  
 44.50  
 60.00  
 15.50  
 15.50  
 .50

1327 (191)

11 16 33.00

36.86

11 15 56.14

3 59 44.66

7 16 11.48

1 11.45

00.03

60.00

+ .03

15.50

15.53

1327

23 53 22

37.58

23 52 44.45

3 59 44.60

19 52 59.85

3 15.44

44.41

60.00

15.57

15.50

1327 + .09

394 + .00

+ .84

Sig. No Error

May 23.

$$1327. (191) \\ 14 \quad 42 \quad 04 = 00$$

$$38.55.05$$

$$14 \quad 41 \quad 25.45.95$$

$$4 \quad 03 \quad 41.22.22$$

$$10 \quad 37 \quad 44.23.73$$

$$1 \quad 44.48.48$$

$$10 \quad 35 \quad 00.25.60.25$$

$$60.00$$

$$59.75 - .25$$

$$15.50 \quad 15.50$$

$$(191) - 15.75 - 15.75$$

$$1327 \quad w. \quad 394 \\ 15 \quad 41 \quad 58$$

$$38.05$$

$$15 \quad 40 \quad 89.95$$

$$4 \quad 03 \quad 41.22$$

$$11 \quad 36 \quad 38.73$$

$$1 \quad 54.04$$

$$11 \quad 34 \quad 44.69$$

$$60.$$

$$15.31$$

$$15.50$$

$$- .19$$

+ 1 gr.

w.

$$1327 + \frac{1}{3} \\ 0 \quad 28 \quad 24$$

$$38.6$$

$$0 \quad 24 \quad 45.4$$

$$4 \quad 03 \quad 41.22$$

$$20 \quad 21 \quad 04.18$$

$$1327 \\ 0 \quad 31 \quad 25 = 00$$

$$38.6$$

$$0 \quad 30 \quad 46.4$$

$$4 \quad 03 \quad 41.22$$

$$20 \quad 27 \quad 5.18$$

$$3 \quad 21.03$$

$$20 \quad 23 \quad 44.15$$

$$60.$$

$$15.85$$

$$15.50$$

$$+ .35$$

$$+ .21$$

$$.00$$

$$56$$

$$+ .19$$

- 1 gr.

- 89. for them

$$- .21$$

$$- .02$$

Sig. No. Enrr.

$$1327.$$

$$191.$$

$$394$$

mean Enrr.



May 23

W. 1327 (191)

14 42 4 = 00

38.05

14 41 25.95

4 3 41.22

10 37 44.73

1 44.47

10 36 0.26

60.00

- 0.26

15.50

(191) - 15.75

00 3451

14 45 13.95 13 27

38.05

14 44 35.90

60.00

+ 3 24.10 Prof 3451

May 24.

$$\begin{array}{r} \text{Tr. } 1327 \text{ (394)} \\ - 75 \\ 17^h \quad 20 \quad 11. = 0.0 \end{array}$$

38.80

17 19 32.20

4 7 37.78

13 11 54.42

2 9.63

13 9 44.79

60.

15.21

15.50

-1.29

+1 gr.

1327 (191)

$$\begin{array}{r} -0 \\ 15^h \quad 18 \quad 7 = 0.0 \end{array}$$

38.80

15 17 28.20

4 7 37.78

11 9 50.42

1 49.73

11 8 0.69

60.

-0.69

15.50

-16.19

00 (3451)

15 24 13.2 (1327)

38.80

15 23 34.40

60.00

+ 3" 25.60 Error #3451.



May 25

$$\begin{array}{r}
 1327 \quad (394) \\
 - 1410 \\
 \hline
 13^h \quad 42 \quad 32 = 00 \\
 \\
 39.72 \\
 13 \quad 41 \quad 52.28 \\
 4 \quad 11 \quad 34.34 \\
 9 \quad 30 \quad 17.94 \\
 1 \quad 33.36 \\
 9 \quad 28 \quad 44.58 \\
 60. \\
 15.42 \\
 15.50 \\
 - .08 \quad \text{Error} \# 394
 \end{array}$$

$$\begin{array}{r}
 1327 \quad (191) \\
 - 1136 \\
 \hline
 13 \quad 21 \quad 45 = 00 \\
 \\
 39.72 \\
 13 \quad 21 \quad 5.28 \\
 4 \quad 11 \quad 34.34 \\
 9 \quad 9 \quad 30.94 \\
 1 \quad 30.02 \\
 9 \quad 8 \quad 0.92 \\
 60. \\
 -0.92 \\
 15.50 \\
 - 16.42 \quad \text{Error} \# 191
 \end{array}$$

$$\begin{array}{r}
 00 \quad (3451) \\
 13 \quad 28 \quad 12.2 \quad (1327) \\
 39.72 \\
 13 \quad 27 \quad 32.48 \\
 60.00 \\
 + 3 \quad 27.52 \quad \text{Error} \# 3451
 \end{array}$$

May 25

$$\begin{array}{r}
 1327 (394) \\
 + \frac{1}{3} \\
 0 \quad 34 \quad 19 = 00 \\
 40.10 \\
 0 \quad 33 \quad 38.90 \\
 4 \quad 11 \quad 34.34 \\
 20 \quad 22 \quad 4.56 \\
 3 \quad 20.81 \\
 20 \quad 18 \quad 43.75 \\
 60. \\
 16.25 \\
 15.50 \\
 +.75
 \end{array}$$

$$\begin{array}{r}
 1327 (394) \\
 0 \quad 28 \quad 18 \\
 40.10 \\
 0 \quad 27 \quad 37.90 \\
 4 \quad 11 \quad 34.34 \\
 20 \quad 16 \quad 3.56 \\
 3 \quad 19.77 \\
 20 \quad 12 \quad 43.79 \\
 60. \\
 16.21 \\
 15.50 \\
 +.71 \\
 +.73 \text{ mean.}
 \end{array}$$

$$\begin{array}{r}
 (191) - 16.42 \\
 \quad \quad \quad 7 \\
 \hline
 (\text{Computed}) - 16.49 \\
 (\text{Comparison}) - 16.40 \\
 (394) +.09 \\
 1327 +.73 \\
 \hline
 \quad \quad \quad 00 \\
 3/.82 \\
 +.27 \\
 -10 \text{ gr. for 1 hr.}
 \end{array}$$



May 26.

$$1327 (394) \\ + \frac{1}{20} \\ 16 \quad 43 \quad 58 = 00$$

$$40.93$$

$$16 \quad 43 \quad 17.07$$

$$4 \quad 15 \quad 30.89$$

$$12 \quad 27 \quad 46.18$$

$$2 \quad 2.50$$

$$10 \quad 25 \quad 43.68$$

$$60.$$

$$16.32$$

$$15.50$$

$$+ .81$$

$$1327 (394) \\ - \frac{1}{3} \\ 16 \quad 49 \quad 59$$

$$40.93$$

$$16 \quad 49 \quad 18.07$$

$$4 \quad 15 \quad 30.89$$

$$12 \quad 33 \quad 47.18$$

$$2 \quad 3.43$$

$$12 \quad 31 \quad 43.75$$

$$60.$$

$$16.25$$

$$15.50$$

$$+ .75$$

$$+ .82$$

$$+ .78 \text{ mean.}$$

$$- 5 \text{ gr. for } 6 \text{ hrs}$$

22

May 26.

$$\begin{array}{r}
 1327 \quad (394) \\
 + \frac{7}{12} \\
 23 \quad 48 \quad 8 = 00 \\
 41.24 \\
 23 \quad 47 \quad 26.76 \\
 4 \quad 15 \quad 30.89 \\
 19 \quad 31 \quad 55.84 \\
 3 \quad 12.06 \\
 19 \quad 28 \quad 43.81 \\
 60. \\
 16.19 \\
 15.50 \\
 +.69
 \end{array}$$

$$\begin{array}{r}
 1327 \quad (394) \\
 + \frac{7}{12} \\
 0 \quad 0 \quad 10 = 00 \\
 41.24 \\
 23 \quad 59 \quad 28.76 \\
 4 \quad 15 \quad 30.89 \\
 19 \quad 44 \quad 57.84 \\
 3 \quad 14.20 \\
 19 \quad 41 \quad 43.64 \\
 60. \\
 16.33 \\
 15.50 \\
 +.83 \\
 +.69 \\
 +.76 \text{ same,}
 \end{array}$$

$$\begin{array}{r}
 1327 \quad (191) \\
 + \frac{7}{12} \\
 23 \quad 39 \quad 23 \\
 41.24 \\
 23 \quad 38 \quad 41.76 \\
 4 \quad 15 \quad 30.89 \\
 19 \quad 23 \quad 10.84 \\
 3 \quad 10.59 \\
 19 \quad 20 \quad 0.28 \\
 60. \\
 -0.28 \\
 15.50 \\
 -15.78
 \end{array}$$

$$\begin{array}{r}
 191 - 16.42 \\
 - .25 \\
 \text{Comput.} - 16.67 \\
 \text{Compar.} - 16.54 \\
 (191) - .13 \\
 (1327) + .76 \\
 394 \quad .00 \\
 3 / +.63 \\
 +.21
 \end{array}$$



May 29.

1327 (394)

13 20 21. = 00

41.18

13 19 39.82

4 19 27.45

9 11 12.37

1 28.47

8 58 43.90

60.

16.10

15.50

+ .60 Error #394

1327 (394)

13 32 23 = 00

41.18

13 31 41.82

4 19 27.45

9 12 14.37

1 30.47

9 10 43.90

60.

16.10

15.50

+ .60 Error #394

1327 (191)

13 11 36 = 00

41.18

13 10 54.82

4 19 27.45

8 51 27.37

1 26.99

8 50 0.38

15.55

-15.93

Compar. (191) - 16.50 { (1327) + .60

Computed - 16.82 { (191) - 32

394 = -.32 { (394) .00

31.28

+.09

Error #394

00 (3451)

14 5 8 (1327)

41.18

14 4 26.82

60.

+ 3 33.18 Error (3451)

24

May 27.

$1327 \quad (394)$   
 $-\frac{1}{7}$   
 $0 \quad 1 \quad 6 = 0.0$   
 $40.86$   
 $0 \quad 0 \quad 25.14$   
 $4 \quad 19 \quad 27.45$   
 $19 \quad 40 \quad 57.67$   
 $3 \quad 13.45$   
 $19 \quad 37 \quad 44.24$   
 $60.$   
 $15.76$   
 $15.50$   
 $+ .26$

$1327 \quad (394)$   
 $-\frac{1}{3}$   
 $0 \quad 7 \quad 7$   
 $40.86$   
 $0 \quad 6 \quad 26.14$   
 $4 \quad 19 \quad 27.45$   
 $19 \quad 46 \quad 58.69$   
 $3 \quad 14.40$   
 $19 \quad 43 \quad 44.29$   
 $60.$   
 $15.71$   
 $15.50$   
 $+ .21$   
 $+ .26$   
 $+ .23 \text{ mean}$

$(191) \quad -16.42$   
 $- .50$   
 $\text{Comput.} \quad -16.92$   
 $\text{Compar.} \quad 16.5$   
 $394 = -42$

$191 \quad -42$   
 $1327 \quad +.23$   
 $394 \quad .00$   
 $3/- .19$   
 $-.06$   
 $+2 \text{ gr. for } 1 \text{ hr.}$   
 $\text{Signal, no error.}$

$00 \quad (3451)$   
 $23 \quad 54 \quad 7 \quad (1327)$   
 $40.86$   
 $23 \quad 53 \quad 26.14$   
 $60.$   
 $+3 \quad 33.86 \text{ Error } \#(3451)$



May 28.

$$1327_{+1/10} (394)$$

$$14 \quad 39 \quad 30 = 00$$

$$40.25$$

$$14 \quad 38 \quad 49.72$$

$$4 \quad 23 \quad 24.01$$

$$10 \quad 15 \quad 25.71$$

$$1 \quad 40.84$$

$$10 \quad 13 \quad 44.87$$

$$60.$$

$$15.13$$

$$15.50$$

$$-.37$$

$$1327_{+1/10} (394)$$

$$14 \quad 45 \quad 31 = 00$$

$$40.25$$

$$14 \quad 44 \quad 50.72$$

$$4 \quad 23 \quad 24.01$$

$$10 \quad 21 \quad 26.71$$

$$1 \quad 41.83$$

$$10 \quad 19 \quad 44.88$$

$$60.$$

$$15.12$$

$$15.50$$

$$-.38$$

$$-.37$$

$$-.38 \text{ mean.}$$

$$+ 2 \text{ gr. for yph.}$$

$$\text{Comp. } 16.6 (394)$$

$$0.0 (191)$$

$$-16.6$$

$$-.38$$

$$-16.98 \text{ Error } 191.$$

$$00 (3451)$$

$$15 \quad 37 \quad 5.6 (1327)$$

$$40.25$$

$$25.32$$

$$60.$$

$$+ 3 \quad 34.68 \text{ Error } (3451)$$

May 28.

$$\begin{array}{r}
 1327 + \frac{1}{4} (394) \\
 0 \quad 32 \quad 7 = 00 \\
 40.24 \\
 1 \quad 31 \quad 26.76 \\
 4 \quad 23 \quad 24.01 \\
 20 \quad 8 \quad 2.75 \\
 \quad 3 \quad 17.98 \\
 20 \quad 4 \quad 44.77 \\
 60. \\
 15.23 \\
 15.50 \\
 -.27
 \end{array}$$

$$\begin{array}{r}
 1327 - \frac{1}{4} (394) \\
 1 \quad 9 \quad 13 \\
 40.24 \\
 1 \quad 8 \quad 32.76 \\
 4 \quad 23 \quad 24.01 \\
 20 \quad 45 \quad 8.75 \\
 \quad 3 \quad 23.96 \\
 20 \quad 1 \quad 44.79 \\
 60. \\
 15.21 \\
 15.50 \\
 -.29 \\
 \underline{-.27} \\
 \text{Error} \# 394 = -.28
 \end{array}$$

$$\begin{array}{r}
 00 \\
 \text{Comput} (191) - 17.01 \\
 \text{Compar.} \quad -16.9 \\
 394 = -.11 \\
 -28 \\
 \underline{.00} \\
 3) - .39 \\
 \text{Mean Error} \# 394 = -.13 \\
 + 5 \text{ gr. for 1 hr.} \\
 \text{Signal, no error.}
 \end{array}$$

$$\begin{array}{r}
 00 (3451) \\
 0 \quad 10 \quad 4.8 \\
 40.24 \\
 0 \quad 9 \quad 24.56 \\
 60. \\
 + 3 \quad 35.44 \text{ Error (3451)}
 \end{array}$$



May 29.

$$\begin{array}{r}
 132\gamma \quad (394) \\
 + 14 \\
 13 \quad 52 \quad 18 = 00 \\
 40.06 \\
 13 \quad 51 \quad 37.94 \\
 4 \quad 27 \quad 20.57 \\
 9 \quad 24 \quad 17.37 \\
 1 \quad 32.49 \\
 9 \quad 22 \quad 44.88 \\
 60. \\
 15.12 \\
 15.50 \\
 - .38
 \end{array}$$

$$\begin{array}{r}
 132\gamma \quad (394) \\
 + 15 \\
 13 \quad 58 \quad 19 = 00 \\
 40.06 \\
 13 \quad 57 \quad 38.94 \\
 4 \quad 27 \quad 20.57 \\
 9 \quad 30 \quad 18.37 \\
 1 \quad 33.47 \\
 9 \quad 28 \quad 44.90 \\
 60. \\
 15.10 \\
 15.50 \\
 - .40 \\
 - .38
 \end{array}$$

- .39 Error 1327.

+ 29r.

$$\begin{array}{r}
 00 \quad (191) \\
 + 17.00 \quad (394) \\
 .39 \\
 - 17.39 = \text{Error} (191)
 \end{array}$$

May 29.

$$\begin{array}{rcl}
 132\gamma & (394) & \\
 -1/6 & & \\
 23 & 5\gamma & 5\gamma = 0.0 \\
 & & 40.16 \\
 23 & 5\gamma & 16.84 \\
 4 & 2\gamma & 20.5\gamma \\
 19 & 29 & 56.2\gamma \\
 & 3 & 11.63 \\
 & & 44.64 \\
 & & 60. \\
 & & 15.36 \\
 & & 15.50 \\
 & & -.14
 \end{array}$$

$$\begin{array}{rcl}
 132\gamma & (394) & \\
 -1/4 & & \\
 0 & 4\gamma & 5 = 0.0 \\
 & & 40.16 \\
 0 & 46 & 24.84 \\
 4 & 2\gamma & 20.5\gamma \\
 20 & 19 & 4.2\gamma \\
 & 3 & 19.68 \\
 20 & 15 & 44.59 \\
 & & 60. \\
 & & 15.41 \\
 & & 15.50 \\
 & & -.19 \\
 & & \underline{-.14}
 \end{array}$$

Error(132\gamma) - .12

+ 4 gr. for 1<sup>st</sup>

Signal, no error.

$$\begin{array}{rcl}
 132\gamma & (191) & \\
 -1/2 & & \\
 23 & \gamma & 6 = 0.0 \\
 & & 40.16 \\
 23 & 6 & 25.54 \\
 4 & 2\gamma & 20.5\gamma \\
 18 & 39 & 5.2\gamma \\
 & 3 & 3.25 \\
 18 & 36 & 2.02 \\
 & & 60. \\
 & & 2.02 \\
 & & 15.50
 \end{array}$$

-17.52 Error(191)

$$\begin{array}{rcl}
 40 & (3451) & \\
 23 & 14 & 2.3 (132\gamma) \\
 & & 40.16 \\
 23 & 13 & 22.14 \\
 & & 60. \\
 +3 & 37.86 & \text{Error}(3451)
 \end{array}$$



May 30	1327	(394)	1327	(394)
0	17	56.	0	48 1
		39.06		39.06
0	17	16.94	0	47 21.94
4	31	17.12	4	31 17.12
19	45	59.82	20	16 4.82
	3	14.30		3 19.25
19	42	45.52	20	12 45.57
		60.		60.
		14.48		14.43
		15.50		15.50
		-1.02		-1.07
				-1.02
			(394)	-1.04

Explanation.  
 I have invariably compared clocks night and morning, but as I usually worked up the results on a separate sheet first, I must have neglected to copy into this book one entry each on May 30 & 31.

Comput. (191) - 17.84  
 Compar. - 17.50

- .34

-1.04

00

3/-1.38

Error

(394)

- .46

17 gr. for 1 hr.

Signal, no error.

30

May 31.

1327 (394)		
15	29	25
		39.59
15	28	45.41
4	35	13.68
10	53	31.73
	1	47.03
10	51	44.70
		60.
		15.30
		15.50
		-.20

1327 (394)		
15	41	27
		39.59
15	40	47.41
4	35	13.68
11	5	33.73
	1	49.02
11	3	44.71
		60.
		15.29
		15.50
		-.21

$$\frac{-.20}{2}$$

mean error (1327) = -.20

1 gr. for 8 hrs.

1327 - 1/2 (191)		
12	24	13
		39.59
12	23	33.41
4	35	13.68
7	48	19.73
	1	16.63
7	47	3.10
		60.
		3.10
		15.50

Error (191) = -18.60

110 (3451)		
12	32	58.3
		39.59
12	33	18.71
		60.
+ 3	41.29	Error #3451.



June 1.

1327 (394)

4	50	36
		39.50
4	49	56.50
4	39	10.24
0	10	46.26
	0	1.71
0	10	44.55
		60.
		15.45
		15.50
		-0.05

1327 (394)

4	56	37
		39.50
4	55	57.50
4	39	10.24
0	16	47.26
	0	2.69
0	16	44.57
		60.
		15.43
		15.50
		-0.07
		<u>-0.05</u>
		-0.06

00 (191)

Compar. 18.8

Comput. 18.99

- .19 (191)

- .06 (1327)

.00 (394)

3/- .25

- .08 Error (394)

+ 1.90 for 3 hrs.

00 (3451)

12 5 56

39.38

12 5 16.62

60.

+ 3 43.38

Error #3451.

See next page.

June 1.

$132\gamma (394)$ $+1/10$		
16	30	31 = 00
		39.35
16	29	51.65
4	39	10.24
11	50	41.41
	1	56.45
11	48	44.96
		60.
		15.04
		15.50
		-46

$132\gamma (394)$ $+1/3$		
16	42	33
		39.35
16	41	53.65
4	39	10.24
12	2	43.41
	1	58.46
12	0	44.95
		60.
		15.05
		15.50
		-45
		-46

Error 394 = -46  
+ 2 gr. for 9 hrs.

$132\gamma (191)$ $-9/12$		
12	4	6 = 00
		39.38
12	3	26.62
4	39	10.24
7	24	16.38
	1	12.72
7	23	3.66
		60.
		3.66

15.50  
-19.16 Error (191)

00 (3451)		
12	5	56
		39.38
12	5	16.62
		60.
	+3	43.38
		Error #3451.



June 2.

1327 (394) +3/10			1327 (394) +1/5		
0	28	49 = 00	1	11	56 = 00
		39.29			39.29
0	28	9.71	1	11	16.71
4	39	10.24	4	39	10.24
19	48	59.47	20	32	6.47
	3	14.83		3	21.84
19	45	44.64	20	28	44.63
		60.			60.
		15.36			15.37
		15.50			15.50
		-14			-13
					-14
					<u>-14</u>
					Mean = -14

00 (191)  
 Compar. 19.2 (324)  
 Comput. 19.40  
 - .20 (by 191)  
 - 14 (" 1327)  
00 (" 394)  
 3/- .34  
 - .11 Error 394  
 + 4 gr. for 1 hr.  
 Signal, no error.

June 2.

$$1327 \begin{array}{l} (394) \\ -15 \\ 48 \end{array} \quad 48 = 00$$

40.26

$$0 \quad 48 \quad 7.74$$

$$4 \quad 43 \quad 6.80$$

$$20 \quad 5 \quad 0.94$$

$$3 \quad 17.37$$

$$20 \quad 1 \quad 43.57$$

60.

16.43

15.50

+93

$$1327 \begin{array}{l} (394) \\ -16 \\ 54 \end{array} \quad 49$$

40.26

$$0 \quad 54 \quad 8.74$$

$$4 \quad 43 \quad 6.80$$

$$20 \quad 11 \quad 1.94$$

$$3 \quad 18.36$$

$$7 \quad 43.58$$

60.

16.42

15.50

+92

+93

+92

$$\text{Comput (191)} \quad 19.95$$

20.2

$$(191) \quad +0.25$$

$$(324) \quad .00$$

$$(1327) \quad .92$$

3/1.17

+39

-10 gr. for  $1\frac{1}{3}$  hrs.

Signal, no error.



June 3.

		1327 (394)
		+5 1/2
15	39	14
		40.52
15	38	33.48
4	47	3.35
10	51	30.13
	1	46.80
10	49	43.33
		60.
		16.67
		15.50
		+ 1.17

		1327 (394)
		+1 1/2
15	45	15
		40.52
15	44	34.48
4	47	3.35
10	57	31.13
	1	47.80
10	55	43.33
		60.
		16.67
		15.50
		+ 1.17
		+ 1.17
		mean + 1.17

		1327 (191)
		+1 1/2
15	31	33
		40.52
15	30	52.48
4	47	3.35
10	43	49.13
	1	45.50
10	42	3.63
		60.
		3.63
		15.50

- 19.13 Error (191) by compar.  
with 1327.

		(191 + 394)
		Comput. (191) - 20.02
		Compar. - 20.30
		394 by (191) + 2.8
		" " (1327) + 1.17
		" " (394) .00
		3) 1.45
		+ .48
		- 2 gr. for phr.
		.. (3457)
		15 34 51
		40.52
		15 34 10.48
		60.
		Error 3457 + 3 49.58

June 3.

		1327 (394)
		$-1/10$
"	59	46
		40.71
"	59	5.29
4	47	3.35
20	12	1.94
	3	18.54
20	8	43.40
		60.
		16.60
		15.50
		+1.10

		1327 (394)
		$+1/2$
1	5	47
		40.71
1	5	6.29
4	47	3.35
20	18	2.94
	3	19.56
20	14	43.38
		60.
		16.62
		15.50
		+1.12
		<u>+1.10</u>
		+1.11

		1327 (191)
		$+1/3$
0	34	2.00
		40.71
"	33	21.29
4	47	3.35
19	46	17.94
	3	14.41
19	43	3.53
		60.
		3.53
		15.50

By compar. with S.C. -19.03

		(191) + (394)
		Comput. - 20.48
		Compar. - <u>21.14</u>
		394 by 191 - .34
		" " 1327 +1.11
		" " 394 <u>.00</u>
		3) +.77
		Error 394 = +.26
		- 10 gr. for 1 hr
		Signal, no error.



June 4.

1327 (394)		
	$+1/3$	
17	2	24.00
		40.09
17	1	43.91
4	50	59.91
12	10	44.00
	1	59.77
12	8	44.23
		60.
		15.77
		15.50
		+ .27

1327 (394)		
	$-1/3$	
17	9	25
		40.09
17	8	44.91
4	50	59.91
12	17	45.00
	2	0.81
12	15	44.19
		60.
		15.81
		15.50
		.31
		<u>.27</u>

Error 394 = +.29

- 1 gr. for  $8\frac{1}{2}$  hrs.

1327 (191)		
	$-1/3$	
14	17	17
		40.09
14	16	36.91
4	50	59.91
9	25	37.00
	1	32.61
9	24	4.39
		60.
		4.39
		15.50
		19.89 Error 191

		00 (3451)
14	21	50
		40.09
14	21	9.91
		60.
	+3	50.09
		Error 3451.

June 4

	1327	(394)
0	45 <sup>-14</sup>	40
		40.20
0	44	59.80
4	50	59.91
19	53	59.89
	3	15.56
19	50	44.33
		60.
		15.67
		15.50
		+17

	1327	(394)
0	51 <sup>-14</sup>	41
		40.20
0	51	0.80
4	50	59.91
20	0	11.89
	3	16.55
19	56	44.34
		60.
		15.66
		15.50
		+16.
		<u>+17</u>
		+16

(191) (394)  
 Comput. -20.01  
 Compar. -19.90  
 394 by 191 = - .11  
 " " 1327 = + .16  
 " " 394 = .00  
 3) +05  
 Error 394 = +.02  
 Signal, as error.



June 5.

1327 (394)  
 16 59 20  
 40.18  
 16 58 39.82  
 4 54 56.47  
 12 3 43.35  
 1 58.57  
 12 1 44.78  
 60.  
 15.22  
 15.50  
 -28

1327 (394)  
 17 5 21  
 40.18  
 17 4 40.82  
 4 54 56.47  
 12 9 44.35  
 1 59.58  
 12 7 44.77  
 60.  
 15.23  
 15.50  
 -27  
 -25

Error (394) -28  
 +1 gr. for 8 1/2 hrs.

1327 (191)  
 14 21 14  
 40.17  
 14 20 33.83  
 4 54 56.47  
 9 25 37.36  
 1 32.68  
 9 24 4.68  
 60.  
 4.68  
 15.50

Error 191 = -20.18

00 (3451)  
 14 35 46.5  
 40.17  
 14 35 6.33  
 60.  
 +3 53.67  
 Error 3451.

June 5.

		1327 (394) +1/5			1327 (394) +1/10
0	30	34	0	36	35
		40.20			40.20
"	29	53.80	"	35	54.80
4	54	56.47	4	54	56.47
19	34	57.33	19	40	58.33
	3	12.53		3	13.49
19	31	44.80	19	37	44.84
		60.			60.
		15.20			15.16
		15.50			15.50
		-.30			-.34
					-.30
					-.32

(191) (394)  
 Comput. - 20.30  
 Compar. - 19.90  
 394 by 191 - 40  
 " " 1327 - .32  
 " " 394 - .00  
 3) - .72  
 - .24  
 + 6 gr. for 1 1/2 hrs.  
 Signal, no error.



June 6.

1327 (394)

16

35

12

44.36

16

34

31.64

4

58

53.13

11

35

38.61

1

53.93

11

33

44.68

60.

15.32

15.50

-18

+1 gm. for 8 hrs.

June 6.

1327 (394) +1/12			1327 (394) +1/15		
1	33	40	1	39	41
		40.47			40.47
1	32	59.53	1	39	0.53
4	58	53.03	4	58	53.03
20	34	6.50	20	40	7.50
	3	22.19		3	23.17
20	30	44.31	20	36	44.33
		60.			60.
		15.69			15.67
		15.50			15.50
		+19			+17
					+19
					<u>+19</u>
					mean +18

191 + 394  
 Comput. 20.56  
 Compar. 20.7  
 394 by 191 +.14  
 " " 1327 +.19  
 " " 394 .00  
3/+33

Error 394 +.11

- 4 grs. for 1 hr.

also took off 1 gr. left on  
 over night.

Signal, no error.



June 7.

	1327	(394)
15	27	57
		40.51
15	27	16.49
5	2	49.59
10	24	26.90
	1	42.21
10	22	44.69
		60.
		15.31
		15.50
		-19

191 + 394

191 Comput. - 20.72

Compar. 20.9

394 by 191 = +.18

" " 1327 = -.19

" " 394 = 003/ -.01

Error 394. 00

June 8.

		1327 (394) +1/4
7	22	34
		41.34
7	21	52.66
5	6	46.15
2	15	6.51
	0	22.15
2	14	44.33
		60.
		15.67
		15.50
		+1.7

		1327 (394) +1/4
7	28	35
		41.34
7	27	53.66
5	6	46.15
2	21	7.51
	0	23.16
2	20	43.35
		60.
		15.65
		15.50
		+1.15
		+1.7

Error 394 = +1.6

-1 qu. for 6<sup>mo.</sup>

June 7.

		1327 (191)
2	13	4
		41.21
2	12	22.79
5	2	49.59
21	9	33.20
	3	27.98
21	6	5.22
		60.
		5.22
		15.50

Error 191 = -20.72

		110 (3451)
2	20	41.3
		41.21
2	20	0.09
		60.
	+3	59.91
		Error 3451.



June 8.

$1327 - \frac{1}{15} (394)$		
16	23	3
		41.50
16	22	21.50
5	6	46.15
11	15	35.35
	1	50.63
11	13	44.72
		60.
		15.28
		15.50
		-22

$1327 - \frac{1}{15} (394)$		
16	29	4
		41.50
16	28	22.50
5	6	46.15
11	21	36.35
	1	51.64
11	19	44.71
		60.
		15.29
		15.50
		-21
		<u>-22</u>

Error 394 = -21  
+ 1 gr. for 8 hrs.

$(1327) (191)$		
15	5	"
		41.45
15	4	29.55
5	6	46.15
9	57	43.40
	1	37.92
9	56	5.48
		60.
		5.48
		15.50

Error 191 = -20.98

00 (3451)		
11	47	40.7
		41.41
11	46	59.29
		60.
	+ 4	0.71
		Error 3451

June 8.

		1327 (394) -1/10			1327 (394) -1/4
0	49	26	0	55	27
		41.69			41.69
11	48	44.31	0	54	45.31
5	6	46.15	5	6	46.15
19	41	58.16	19	47	59.16
	3	13.62		3	14.58
19	38	44.54	19	44	44.58
		60.			60.
		15.46			15.42
		15.50			15.50
		-.04			-.08
					<u>-.04</u>
					mean. -.06

191 + 324

Comput. - 21.16

Compar. -21.00

394 by 191 -.16

" " 1327 -.06

" " 394 .00

3/- .22

-.07

+ 2 grs. for 1 1/2 hrs.

(1 gr. + 1 gr. left on our sight)

Signal, no error.



June 9.

1327 (394)  
 14 49 <sup>-1/10</sup> 44  
 42.11  
 14 49 2.00  
 5 10 42.70  
 9 38 19.30  
 1 34.72  
 9 36 44.58  
 60.  
 15.42  
 15.50  
 -.18

1327 (394)  
 14 55 <sup>-1/12</sup> 45  
 42.00  
 14 55 3.00  
 5 10 42.70  
 9 44 20.30  
 1 35.71  
 9 42 44.59  
 60.  
 15.41  
 15.50  
 -.19

-.18

Error 394 = -.08

1327 (191)  
 15 49 15.0  
 42.00  
 15 48 33.00  
 5 10 42.70  
 10 37 50.30  
 1 44.50  
 10 36 5.80  
 60.  
 5.80  
 15.50

Error 191 = -21.30

00 (3451)  
 15 51 38.4  
 42.00  
 15 50 56.40  
 60.  
 + 4 3.60  
 Error 3451

June 9.

		1327 (394) +1/4			1327 (394) +1/4
1	15	27	1	21	28
		42.22			42.22
1	14	44.78	1	20	45.78
5	10	42.70	5	10	42.70
20	4	2.08	20	10	3.08
	3	17.29		3	18.28
20	11	44.79	20	6	44.80
		60.			60.
		15.21			15.20
		15.50			15.50
		-.29			-.30
					<u>-.29</u>
					-.30

191 + 394

Comput. - 21.45

Compar. - 21.00

394 by 191 = -.45

" " 1327 = -.30

" " 394 = .00

3/- .75

Error 394 = -.25

+ 6 gms for 1 1/2 hrs.

Signal, no error.



June 10.

1327 (394) +3/10			1327 (394) +1/2		
14	52	41	14	58	42
		42.34			42.34
14	51	58.66	14	57	59.66
5	14	39.26	5	14	39.26
9	37	19.40	9	43	20.40
	1	34.63		1	35.65
9	35	44.77	9	41	44.75
		60.			60.
		15.23			15.25
		15.50			15.50
		-.27			-.25
					-.27
					mean: .26

191 + 394  
 Comput. - 21.61  
 Compar. -21.50  
 394 by 191 = -.11  
 " " 1327 = -.26  
 " " 394 = .00  
 3/-37  
 Error 394 = -.12

June 10.

1327 (394)  
-14  
81 22  
42.48

1 7 39.52

5 14 39.26

19 53 0.26

3 15.40

19 49 44.86

60.

15.14

15.50

-.36

1327 (394)  
-13  
14

1 23

42.48

1 13 40.52

5 14 39.26

19 59 1.26

3 16.37

19 55 44.89

60.

15.11

15.50

-.39

-.36

mean -.38

191 + 394

Comput. - 21.74

Compar. - 21.40

394 by 191 -.34

" " 1327 -.38

" " 394 .00

3/- .72

Error 394 = -.24

+ 6 gws. for 1 1/2 hrs.

Signal. no error.



June 11.

$1327 \begin{smallmatrix} (394) \\ -16 \end{smallmatrix}$   
 15 46 46.  
 42.67  
 15 46 3.33  
 5 18 35.82  
 10 27 27.51  
 1 42.77  
 10 25 44.74  
 60.  
 15.26  
 15.50  
 -.24

$1327 \begin{smallmatrix} (394) \\ -15 \end{smallmatrix}$   
 15 52 47  
 42.67  
 15 52 4.33  
 5 18 35.82  
 10 33 28.51  
 1 43.74  
 10 31 44.77  
 60.  
 15.23  
 15.50  
 -.27  
 -.24  
 Mean -.26

191 + 394  
 Comput. - 21.92  
 Compar. - 21.9  
 394 by 191 -.02  
 " " 1327 -.26  
 " " 394 .00  
 3/- .28  
 Error 394 = -.09

June 11.

$1327(394)$			$1327(394)$		
	$-\frac{1}{3}$			$-\frac{5}{12}$	
1	13	19	1	19	20
		42.81			42.81
1	12	36.19	1	18	37.19
5	18	35.82	5	18	35.82
19	54	0.37	20	0	1.37
	3	15.55		3	16.52
19	50	44.82	19	56	44.85
		60.			60.
		15.18			15.15
		15.50			15.50
		-.32			-.35
					<u>-.32</u>
				Mean	-.34

$$191 + 394$$

$$\text{Comput.} - 22.05$$

$$\text{Compar.} - \underline{22.20}$$

$$394 \text{ by } 191 + .15$$

$$" " 1327 - 34$$

$$" " 394 \underline{00}$$

$$3) - .19$$

$$\text{Error } 394 = - .06$$

$$+ 2^{\text{hrs.}} \text{ for } 1\frac{1}{2} \text{ hrs.}$$

Signal, no error.



June 12.

1327 (394)		
	<sup>+1/4</sup>	
17	33	0
		44.13
17	32	15.87
5	22	32.38
12	9	43.49
	1	59.59
12	7	43.90
		60.
		16.10
		15.50
		+60

{ no stars for 3 days  
until to-night }

1327 (394)		
	<sup>+1/4</sup>	
17	39	1
		44.13
17	38	16.87
5	22	32.38
12	15	44.49
	2	0.58
12	13	43.91
		60.
		16.09
		15.50
		+59
		+60

Error 394 +.59  
- 3 yrs. for 7 1/2 hrs.

1327 (191)		
16	37	13.2 = 00
		44.06
16	36	29.14
5	22	32.38
11	13	56.76
	1	50.42
11	12	6.34
		0.00
		-6.34
		-15.50

Error 191 = -21.84

1327 (3451)		
16	45	32.9 = 00
		44.06
16	44	48.84
		60.
	+4	11.16
Error (3451)		

June 12.

1327 (394) +5/12			1327 (394) +1/2		
1	17	17	1	23	18
		44.34			44.34
1	16	32.66	1	22	33.66
5	22	32.38	5	22	32.38
19	54	0.28	21	0	1.28
	3	15.68		3	16.67
19	50	44.60	19	56	44.61
		60.			60.
		15.40			15.39
		15.50			15.50
		-1.10			-1.11
					<u>-1.10</u>
					Mean -1.10

191 + 394  
Comput. -21.91

Compar. -21.8

394 by 191 -1.1

" " 1327 -1.10

" " 394 .00

3/-21

Error 394 -1.07

+ 3 pro. for 1 hr.

Signal, no error.



June 13.

1327 (394)  
<sup>00</sup>  
 16 12 44.  
 44.81  
 16 11 59.19  
 5 26 28.94  
 10 45 30.25  
 1 45.75  
 10 43 44.50  
 60.  
 15.50  
 15.50  
 .00

1327 (394)  
<sup>+46</sup>  
 16 24 46  
 44.81  
 16 24 1.19  
 5 26 28.94  
 10 57 32.25  
 1 47.74  
 10 55 44.51  
 60.  
 15.49  
 15.50  
 -.01  
.00  
 Error 394 - .01

191 + 1327  
 10 43 12.0 = 00  
 44.65  
 10 42 27.35  
 5 26 28.94  
 5 15 58.41  
 0 51.77  
 5 15 6.64  
 0.  
 6.64  
 15.50

Error 191 - 22.14

3451 + 1327.  
 10 51 31.7  
 44.65  
 10 50 47.05  
 60.  
 +4 12.95  
 Error 3451.

June 13.

1327 (394)

1327 (394)

1

14

13

45.08

2<sup>nd</sup> comparison

1

13

27.92

with same result.

5

26

28.94

19

46

50.98

3

14.38

19

43

44.60

60.

15.40

15.50

-10

191 + 394

Comput. - 22.37

Compar. - 22.4

394 by 191 +.03

" " 1327 -.10

" " 394 .00

3/- .07

Error 394 = -.02

+ 1 gr. for 3/4 hr.

Signal. no error.



June 14.

1327 (394)  
<sup>+1/6</sup>  
 15 45 36.  
 45.70  
 15 44 50.30  
 5 30 25.50  
 10 14 24.80  
 1 40.69  
 10 12 44.11  
 60.  
 15.89  
 15.50  
 +.39

1327 (394)  
<sup>+1/6</sup>  
 15 51 37.  
 45.70  
 15 50 51.30  
 5 30 25.50  
 10 20 25.80  
 1 41.65  
 10 18 44.12  
 60.  
 15.88  
 15.50  
 +.38  
+39

Error 1327 + 38  
 - 1 gr. for 12 hrs. + - 4 gr.  
 for 1/2 hr.

1327 (191)  
 11 33 17.3 = 00  
 45.56  
 11 32 31.74  
 5 30 25.50  
 6 2 6.24  
 0 59.32  
 6 1 6.92  
 0.  
 6.92  
 15.50

Error 191 22.42

1327 (3451)  
 11 35 30.0 = 00  
 45.56  
 11 34 44.44  
 60.  
 + 4 15.56  
 Error 3451.

June 15.

$$1327 \left( \begin{smallmatrix} 394 \\ -5/12 \end{smallmatrix} \right)$$

$$5 \quad 40 \quad 54$$

$$46.19$$

$$5 \quad 40 \quad 7.81$$

$$5 \quad 34 \quad 22.05$$

$$0 \quad 5 \quad 45.76$$

$$0 \quad 0.87$$

$$0 \quad 5 \quad 44.89$$

$$60.$$

$$15.11$$

$$15.50$$

$$-.39$$

$$1327 \left( \begin{smallmatrix} 394 \\ -1/2 \end{smallmatrix} \right)$$

$$5 \quad 46 \quad 50$$

$$46.19$$

$$5 \quad 46 \quad 8.81$$

$$5 \quad 34 \quad 22.05$$

$$0 \quad 11 \quad 46.76$$

$$0 \quad 1.84$$

$$0 \quad 11 \quad 44.92$$

$$60.$$

$$15.08$$

$$15.50$$

$$-.42$$

$$-.39$$

$$\text{mean} - 40$$

$$191 + 394$$

$$\text{Comput.} - 22.65$$

$$\text{Compar.} - \underline{22.3}$$

$$394 \text{ by } 191 - .35$$

$$" \quad " \quad 1327 - .40$$

$$" \quad " \quad 394 - \underline{.00}$$

$$3/- .75$$

$$\text{Error } 394 - .25$$

$$+ 5 \text{ gro. for } 2 \text{ hrs.}$$



June 15.

$1327 \overline{) 394}$   
 $15 \quad 37 \quad 32$   
 $46.51$   
 $15 \quad 36 \quad 45.49$   
 $5 \quad 34 \quad 22.05$   
 $10 \quad 2 \quad 23.44$   
 $1 \quad 38.62$   
 $10 \quad 0 \quad 44.82$   
 $60.$   
 $15.18$   
 $15.50$   
 $-.32$

$1327 \overline{) 394}$   
 $15 \quad 43 \quad 33$   
 $46.51$   
 $15 \quad 42 \quad 46.49$   
 $5 \quad 34 \quad 22.05$   
 $10 \quad 8 \quad 24.44$   
 $1 \quad 39.59$   
 $10 \quad 6 \quad 44.85$   
 $60.$   
 $15.15$   
 $15.50$   
 $-.35$   
 $-.32$   
Mean. - .34

$191 + 394.$   
 $Comput. - 22.77$   
 $Compar. - 22.5$   
 $394 \text{ by } 191 - .27$   
 $" \quad " \quad 1327 - .34$   
 $" \quad " \quad 394 \quad .00$   
 $31 - .61$   
 $Error \quad 394 - .20$   
 $+ 1/2 \text{ for } 2 \text{ hrs.}$

June 15.

$1327(394)$ $+1/6$			$1327(394)$ $+1/12$		
1	28	9	1	34	10
		46.83			46.83
1	27	22.17	1	33	23.17
5	34	22.05	5	34	22.05
19	53	0.12	19	59	1.12
	3	15.47		3	16.57
19	49	44.65	19	55	44.55
		60.			60.
		15.35			15.45
		15.50			15.50
		-1.5			-1.5
			Mean -1.0		

 $191 + 394$ 

Comput. - 22.88

Compar. - 23.0

394 by 191 +.12

" " 1327 -.10

" " 394 .00

 $3/+0.2$ 

Error 394 +.01

Signal, as error.



June 16.

$1327(394)$   
 $17 \quad 20 \quad 46.$   
 $48.22$   
 $17 \quad 19 \quad 57.78$   
 $5 \quad 38 \quad 18.61$   
 $11 \quad 41 \quad 39.17$   
 $1 \quad 54.89$   
 $11 \quad 39 \quad 44.28$   
 $60.$   
 $15.72$   
 $15.50$   
 $+22$

$1327(394)$   
 $17 \quad 26 \quad 47.$   
 $48.22$   
 $17 \quad 25 \quad 58.78$   
 $5 \quad 38 \quad 18.61$   
 $11 \quad 47 \quad 40.17$   
 $1 \quad 55.86$   
 $11 \quad 45 \quad 44.31$   
 $60.$   
 $15.69$   
 $15.50$   
 $+19$   
 $+22$

Error 394  $+20$   
 -1 gr. for  $7\frac{1}{2}$  hrs.

$1327(191)$   
 $15 \quad 43 \quad 53.$   
 $48.12$   
 $15 \quad 43 \quad 4.88$   
 $5 \quad 38 \quad 18.61$   
 $10 \quad 4 \quad 46.27$   
 $1 \quad 39.07$   
 $10 \quad 3 \quad 7.20$   
 $0.$   
 $7.20$   
 $15.50$

Error 191  $-22.70$

$1327(3451)$   
 $15 \quad 45 \quad 27$   
 $48.12$   
 $15 \quad 44 \quad 38.88$   
 $60.$   
 $+4 \quad 21.12$   
 Error 3451.

62

June 16.

$1327 (394)$   
 $+14$   
 1      31      7  
             48.23  
 1      30      18.77  
 5      38      18.61  
 19      52      0.16  
             3      15.32  
 19      48      44.84  
             60.  
             15.16  
             15.50

Error 394 - .34

+ 11 gms. for 1/6 hrs.

Signal, no error.

$1327 (191)$   
 23      50      13  
             48.23  
 23      49      24.77  
     5      38      18.61  
 18      11      6.16  
             2      58.75  
 18      8      7.41  
             0.  
             7.41  
             15.50

Error 191 - 22.91

$1327 (3451)$   
 23      56      26.6  
             48.23  
 23      55      38.37  
             60.  
             + 4      21.63  
 Error 3451.



June 17.

1327 (394)  
 $-1/2$   
 17 10 41  
 48.64  
 17 9 52.36  
 5 42 15.17  
 11 27 37.19  
 1 52.55  
 11 25 44.64  
 60.  
 15.36  
 15.59  
 -14

1327 (394)  
 $-3/10$   
 17 16 42  
 48.64  
 17 15 53.36  
 5 42 15.17  
 11 33 38.19  
 1 53.58  
 11 31 44.61  
 60.  
 15.39  
 15.50  
 -11

-14  
 Error 394 -12  
 +120. for 7 hrs.

1327 (191)  
 15 46 50.2  
 48.64  
 15 46 1.56  
 5 42 15.17  
 10 3 46.39  
 1 38.91  
 10 2 7.48  
 0.  
 7.48  
 15.50

Error 191 -22.98

1327 (3451)  
 15 53 25.8  
 48.64  
 15 52 37.16  
 60.  
 + 4 22.84  
 Error 3451.

June 17.

$$1327 \begin{pmatrix} 394 \\ -1/3 \end{pmatrix}$$

$$1 \quad 37 \quad 4$$

$$48.87$$

$$1 \quad 36 \quad 15.13$$

$$5 \quad 42 \quad 15.17$$

$$19 \quad 53 \quad 59.96$$

$$3 \quad 15.55$$

$$19 \quad 50 \quad 44.41$$

$$60.$$

$$15.59$$

$$15.50$$

$$\text{Error } 394 = +0.9$$

$$-3^{\text{rd}} \text{ for } 1^{\text{st}} \text{ time.}$$

$$\text{Signal, no error.}$$

$$1327 \begin{pmatrix} 394 \\ -1/3 \end{pmatrix}$$

$$1 \quad 43 \quad 5$$

Same result.

$$1327 (191)$$

$$1 \quad 29 \quad 26.0$$

$$48.87$$

$$1 \quad 28 \quad 37.13$$

$$5 \quad 42 \quad 15.17$$

$$19 \quad 46 \quad 21.96$$

$$3 \quad 14.35$$

$$19 \quad 43 \quad 7.61$$

$$0.$$

$$7.61$$

$$15.50$$

$$\text{Error } 191 \quad -23.11$$

$$1327 (3451)$$

$$1 \quad 33 \quad 25.2$$

$$48.87$$

$$1 \quad 32 \quad 36.33$$

$$60.$$

$$+4 \quad 23.67$$

$$\text{Error } 3451.$$



June 18.

$$1327 \begin{pmatrix} 394 \\ -1/3 \end{pmatrix}$$

17	53	44
		49.43
17	52	54.57
5	46	11.73
12	6	42.84
	1	58.99
12	4	43.85
		60.
		16.15
		15.50
		+ .65

$$1327 \begin{pmatrix} 394 \\ -5/12 \end{pmatrix}$$

18	5	46
		49.43
18	4	56.57
5	46	11.73
12	18	44.84
	2	0.95
12	16	43.89
		60.
		16.11
		15.50
		+ .61
		<u>+ .65</u>

The normal weight of  
10<sup>gms.</sup> has been left on during  
the day but for some unknown  
cause there is 0.6 error to night.

Error 394 + .63  
- 3<sup>gms.</sup> for 8 hrs.

$$1327 (191)$$

12	35	15.4
		49.29
12	34	26.11
5	46	11.73
6	48	14.38
	1	6.88
6	47	7.50
		0.
		7.50
		15.50

Error 191 -23.00

$$1327 (3451)^*$$

12	34	24.3
		49.29
12	33	35.01
		60.
	+ 4	24.99
		Error 3451.

June 18.

1327 (394)		
	+14	
1	39	1
		49.49
1	38	11.51
5	46	11.73
19	51	59.75
	3	15.32
19	48	44.46
		60.
		15.54
		15.50

Error 394 = +.04

- 2<sup>nd</sup> for 3/4 hr.

Signal, no error.

1327 (394)		
	+13	
1	45	2

Same result.

1327 (191)		
1	20	21.0
		49.46
1	19	31.54
5	46	11.73
19	33	19.81
	3	12.21
19	29	7.60
		0.
		7.60
		15.50

Error 191 - 23.10

1327 (3451)		
1	36	23.1
		49.46
1	35	33.64
		60.
	+4	26.36
		Error 3451.



June 19.

	13 27	(394)
17	23 <sup>-46</sup>	36
		49.61
17	22	46.39
5	50	8.29
11	32	38.10
	1	53.45
11	30	44.65
		60.
		15.35
		15.50

Error 394 - .15  
 + 1 gr. for  $\frac{1}{2}$  hrs.

	13 27	(394)
17	29 <sup>-45</sup>	37

Same result.

	13 27	(191)
13	40	22.5
		49.58
13	39	32.92
5	50	8.29
7	49	24.63
	1	16.89
7	48	7.74
		0.
		7.74
		15.50

Error 191 - 23.24

	13 27	(3451)
13	40	22.3
		49.58
13	39	32.72
		60.
	+ 4	24.28

Error 3451.

June 19.

		1327 (394)
		<sup>-14</sup>
1	50	59
		49.70
1	50	9.30
5	50	8.29
20	0	1.01
	3	16.55
19	56	44.46
		60.
		15.54
		15.59
		+0.04

$$191 + 394$$

Comput. -23.38

Compar. -23.4

394 by 191 +.02

" " 1327 +.04

" " 394 .003) +0.6

Error 394 +.02

-18" for 3/4 hr.

Signal, no error.



June 20.

$$1327 (394)$$

$$18 \quad 5 \quad -14 \quad 39$$

50.12

18 4 48.85

5 54 4.85

12 10 44.03

1 59.67

12 8 44.36

60.

15.64

15.50

+ .14

-1 gr. for 6 hrs.

1327 (394)

$$18 \quad 5 \quad -14 \quad 41$$

Same result.

1327 (191)

12 27 7

50.02

12 26 16.98

5 54 4.85

6 32 12.13

1 4.25

6 31 7.88

11.

7.88

15.50

Error 191 -23.38

1327 (3451)

12 28 20.6

50.02

12 27 30.58

60.

+ 4 29.42

Error 3451

June 20.

1327 (394)  
 $-1\frac{1}{2}$   
 1 59 54  
 50.24

1 59 6.76

5 54 4.85

20 5 1.91

3 17.41

20 1 44.50

60.

15.50

15.50

.00

1327 (394)  
 $0.0$

O.C.N.

2 12 59

50.24

2 11 8.76

5 54 4.85

20 17 3.91

3 19.39

20 13 44.52

60.

15.48

15.50

-.02

.00

mean -.01

191 + 394

Comput. - 23.45

Compar. - 23.3

394 by 191 - .15

" " 1327 - .01

" " 394 .00

$\frac{3}{-} .16$

Error 394 - .05

+ 2 ppm for  $\frac{1}{12}$  hr.

Signal, no error.



June 21

$$\underline{1327} - \frac{1}{2}$$

$$15 \quad 36 \quad 11$$

$$50.5$$

$$15 \quad 35 \quad 20.5$$

$$5 \quad 58 \quad 01.40$$

$$9 \quad 37 \quad 19.10$$

$$1 \quad 34.57$$

$$44.53$$

$$60.00$$

$$15.47$$

$$\underline{15.50}$$

$$-.03$$

$$1327 \quad (191) \quad 7.71$$

$$13 \quad 31 \quad 14 = 00$$

$$50.45$$

$$13 \quad 30 \quad 23.55$$

$$5 \quad 58 \quad 01.40$$

$$7 \quad 32 \quad 22.15$$

$$1 \quad 14.09$$

$$\sim 31 \quad 08.06 \quad 31 \quad 08.06$$

$$6.03 \quad 00.00$$

$$00.00 \quad 51.94$$

$$53.97 \quad 15.50$$

$$(191) - 23.54$$

$$1327 = 3451$$

$$13 \quad 32 \quad 18.7 = 00$$

$$50.45$$

$$13 \quad 31 \quad 28.25$$

$$00.00$$

$$+ 4 \quad 31.75 \quad \text{Error } 3451$$

72

June 22

1327 -  $\frac{1}{3}$ 

15 14 4

51.15

15 13 12.85

6 01 57.96

9 11 14.89

1 30.25

44.64

60.00

15.36

15.50

-.14

1327 (191)

13 32 39 = 28

51.1

13 31 47.9

6 01 57.96

7 29 49.94

1 13.70

36.24

28.00

51.76

15.50

(191) -23.74

1327

1 51 49

51.50 .60

1 50 57.50 .40

6 01 57.96 .96

19 48 59.54 .44

3 18.80 .80

44.74 .64

60.00 .00

15.26 .36

15.50 .50

-.24 -.14

+ .10 gr. for  $\frac{1}{2}$  h  $\frac{+27}{2}$  +.14

+.03 .00

Sig. No. Error.

3451 = 00.0

1327 = 13 35 16.6

51.10

25.50

00.00

Error 3451 + 4 34.50



June 23.

$$\begin{array}{r}
 1327 + \frac{1}{8} \\
 14 \quad 44 \quad 56 \\
 \quad \quad 52.07 \\
 14 \quad 44 \quad 03.93 \\
 6 \quad 05 \quad 54.52 \\
 8 \quad 38 \quad 09.41 \\
 \quad 1 \quad 24.89 \\
 36 \quad 44.52 \\
 \quad \quad 60.00 \\
 \quad \quad 15.48 \\
 \quad \quad 15.50 \\
 \quad \quad - .02
 \end{array}$$

$$\begin{array}{r}
 1327 \quad (191) \\
 12 \quad 37 \quad 59 = 00 \\
 \quad \quad 52.02 \\
 12 \quad 37 \quad 06.98 \\
 6 \quad 05 \quad 54.52 \\
 6 \quad 32 \quad 12.46 \\
 \quad 1 \quad 4.24 \\
 \quad \quad 8.22 \\
 \quad \quad 00.00 \\
 \quad \quad 51.78 \\
 \quad \quad 15.50 \\
 \quad \quad - 23.72 \quad (191)
 \end{array}$$

$$\begin{array}{r}
 1327 - \frac{1}{2} \\
 2 \quad 0 \quad 47 \\
 \quad \quad 52.6 \\
 2 \quad 0 \quad 54.4 \\
 6 \quad 5 \quad 54.52 \\
 19 \quad 54 \quad 59.88 \\
 \quad 3 \quad 15.68 \\
 \quad \quad 44.20 \\
 \quad \quad 60.00 \\
 \quad \quad 15.80 \\
 \quad \quad 15.50 \\
 \quad \quad + .30 \\
 394 \quad .00 \\
 \text{mean} + .15
 \end{array}$$

True 10 gr. for  $\frac{1}{12}$ 

- .10

+ .05 Sig. No. Error.

$$\begin{array}{r}
 1327 \quad 3451 \\
 12 \quad 50 \quad 15.1 = 00 \\
 \quad \quad 52.02 \\
 12 \quad 49 \quad 23.08 \\
 \quad \quad 00.00 \\
 3451 = + 4 \quad 36.92
 \end{array}$$

74

June 24

1327 -  $\frac{1}{3}$

15	38	01
		52.9
15	37	08.1
6	9	51.08
9	27	17.02
	1	32.86
		44.16
		60.00
		15.84
		15.50
		+ .34

-19r.

1327 -  $\frac{1}{4}$

1	59	43	43
		52.35	53.35
1	58	50.65	49.61
6	9	51.08	51.08
19	48	59.57	58.52
	3	14.76	1
		44.80	
		60.00	
		15.20	
		15.50	
		- .30	

491 = 1.4

394 = 20.00 = 26.

191 = 24.15

1.4  
 25.55  
 26.00  
 191 = 24.15  
 394 = 20.00

- 10 gr. for 1<sup>h</sup>

1327 (191)

12	50	58 = 00
		52.85
12	50	55.15
6	9	51.08
6	40	14.07
	1	5.57
		48.50
		00.00
		51
		49.50
		15.50
		191 - 24.00

1327 = 34.51

13	40	13.3 = 00
		53.0
		20.3
		0.0
		39.7

Enf 34.51 + 4

1327 +  $\frac{1}{3}$

2	11	45
		53.4
2	10	51.6
6	9	51.08
20	1	00.52
	3	16



June 25

14	31	46
		53.5
14	30	52.5
6	13	47.64
8	17	0 4.86
	1	21.36
		43.50
		60
		16.00
		15.50
		+ 1.00

-39.00

1327	=	191
13	3	.13 = 16
		53.5
13	2	19.5
6	13	47.64
6	48	31.86
	1	6.91
		24.95
		16.00
		51.05
		15.50
191	-	24.45

1327	
2	56 49
	53.85
2	55 55.15
6	13 47.64
20	42 07.51
	3 43.47
	44.04
	60.00
	15.96
	15.50
	+ .46
	1.00
	+ 2.3

-89. for 1/3<sup>th</sup> - .28  
 (Sig. M. Enns) - .05

1327	=	3451
13	5	11.5 = 00
		53.5
		18.0
		00.0
Enns 3451	+ 4	42.00

No. Sig. today as neither line was  
 working at 10 am.

76

June 26

1327

2	7	38
		54.41
2	6	43.59
6	17	44.20
19	48	59.39
	3	14.79
		44.60
		61.00
		15.40
		<u>15.50</u>

1327 - .10

394 .00

mean - .05

Sig. No. Error.



June 27.

$1327$   
 15      41      52  
           - 54.75  
 15      40      57.25  
 6      21      40.76  
 9      19      16.49  
           1      31.63  
               44.76  
               60.00  
               15.24  
               15.50  
               - .26

+1 gr.

$1327$   
 2      51      42  
           55.10  
 2      50      46.90  
 6      21      40.76  
 20      29      06.14  
           3      31.34  
               44.80  
               60.00  
               15.20  
               15.50  
               - .30  
               394.00

Mean. - .15

+ 10 gr.  $\frac{1}{3}$  hr

+ .18

+ .03

Sig. No. Error.

78

June 29

1327-1/2

11 47 6

55.90

11 46 10.10

6 29 33.87

5 16 36.23

0 51.75

44.48

60.00

15.52

15.50

+0.2

1327-1/2

3 1 36.

56.35

3 0 39.65

6 29 33.87

20 31 05.88

3 21.52

44.36

60.00

15.64

15.50

+1.14

394 .00

Mean. +0.7

4990.

Sig. No. Error



June 30

1327.  
 15 31 39  
     54.35  
 15 30 44.65  
 6 33 30.43  
 8 57 14.22  
     1 28.00  
     46.22  
     60.00  
     13.78  
     15.50  
     - 1.72

+6gr.

1327 -  $\frac{1}{2}$   
 1 58 20  
     54.35  
 1 57 25.65  
 6 33 30.43  
 19 23 55.22  
     3 10.58  
     44.64  
     60.00  
     15.36  
     15.50

run sgr. - .16

+6gr.  $\frac{1}{2}$  = +.16

.10 Sig. No. Error.

1327 = 191  
 13 41 46 = 00  
     54.25  
 13 40 51.75  
 6 33 30.43  
 7 07 21.32  
     1 9.99  
     6 11.33  
     60.00  
     48.67  
     15.50  
     - 26.83

1327 345-1  
 13 00 00.5 = 00  
     54.25  
 59 06.25  
     00.00  
 + 4 53.75  
 Err. of 13451.

80

July 1.

1327 -  $\frac{1}{3}$ 

1 28 10

1327 191

13 35 41 = 00

54.08

1 27 15.92

6 37 26.99

18 49 48.93

3 5.00

43.93

60.00

16.03

15.50

+ .53

13 40 57.5



July 2,

1327 -1/4

16 50 41

53.60

16 49 47.40

6 41 23.55

10 08 23.85

1 39.62

44.23

60

15.77

15.50

+ .27

-1 gr.

1327

37 13 25

53.45

3 12 29.55

6 41 23.55

20 31 06.00

3 21.67

44.33

60

15.67

15.50

+1.17 -5 gr. for 1/2 h

394 +0.01

mean +0.07

Sig. 20. Error.

July 3.

$1327 + \frac{1}{3}$   
 3 47 24  
     53.7  
 3 46 30.3  
 6 45 20.10  
 21 1 10.20  
     3 26.60  
     43.60  
     60  
     16.40  
     15.50  
     +.90

-29r.

$1327 = 191$   
 1 39 32 = 00  
     53.65  
 1 38 38.35  
 6 45 20.10  
 18 53 18.25  
     3 5.65  
     50 12.60  
     60.00  
     47.60  
     15.70  
     (191) - 27.90

$1327 = 3407$   
 1 44 50.8 = 00  
     53.65  
 1 43 57.11  
     00.00  
     + 5 02.89



July 4.

1327 +  $\frac{1}{3}$ 

17 26 39

53.7

17 25 46.3

6 49 16.66

10 36 29.64

1 44.33

45.31

60.00

148.69

15.50

-81

+290

+7490

1327 +  $\frac{1}{4}$ 

0 59 52

53.7

58 58.3

6 49 16.66

18 9 41.64

2 58.54

43.10

60

16.90

15.50

rem. celia w.

+1.40

rem. log.

394 + 1.50.

for 4 h.

+1.20 mean

-1.28

-0.08

Sig. No. error.

84

July 5

$1327.$   
 3 57 19  
     54.0  
 3 56 25.0  
 6 53 13.22  
 21 0.3 11.78  
     3 26.95  
     44.83  
     60.00  
     15.17  
     15.50  
     -33

+1 gr.

$1327 = 191$   
 13 44 28  
     53.9  
 13 43 34.1  
 6 53 13.22  
 86 50 20.88  
     1 7.20  
     13.68  
     60.00  
     46.32  
     15.50  
     191 = -29.18

 $1327 = 3451$ 
 $13 50 47.7 = 00$ 

53.9

 $13 49 53.8$ 

00.0

 $3451 + 506.2$



July 6

1327-1/4

2 38 2

54.7

2 37 07.3

6 57 9.78

19 39 57.52

3 13.20

44.32

60.00

15.68

15.50

+1.18

-59.70 h

-1.14

+0.04

Signal No Error

1327

= 191

FW

13

38

24 = 00

54.5

13

37

29.5

196

57

9.78

6

40

19.72

1

5.57

14.15

60.00

45.85

15.50

191 = -29.65

1327 = 34.51

13 40 45.8 = 00

54.5

51.3

00.0

+ 5 08.6

July 7.

$1327 + \frac{1}{4}$   
 14    10    56  
           55.0  
 14    10    01.0  
 7    1    6.34  
 7    8    54.66  
       1    10.30  
           44.36  
           60.00  
           15.64  
           15.50  
           + .14

$1327$   
 2    16    55  
           55.3  
 2    15    59.7  
 7    1    6.34  
 19    14    53.36  
       3    9.18  
           44.18  
           60.00  
           15.82  
           15.50  
           +32  
           -17  
 - 5 gr. for  $\frac{1}{4}h$   
           394  
           +15  
           -100  
           +08

Signal No Error



July 8

1	56	48
		58 <sup>5</sup> .11
1	55	57.89
7	05	2.90
18	50	48 <sup>9</sup> .99
	3	5.22
		45 <sup>4</sup> .77
		60.00
		16 <sup>5</sup> .23
		15.50
		<del>7.3</del>
		- .27
+ 109.1 for 1 h		<u>+ .27</u>
		.00

Sig. No. Error.

July 9.

1327 - 1/2

2 40 52

55.70

2 39 56.30

7 8 59.45

19 30 56.85

3 11.78

45.07

60

14.93

15.17

-.57

+log for 24  $\frac{+14}{-.03}$ 

Signal No Error.



July 10.

1327  $-\frac{1}{2}$   
 15 40 00

1327  
 1 46 40  
 57.27  
 1 45 42.73  
 7 12 56.01  
 18 32 46.72  
 3 2.28  
 44.44  
 6000  
 15.56  
 15.50  
 +.06

1327  $+\frac{1}{8}^m$  191  
 5 51 52 = 09  
 57.4  
 5 50 54.60  
 7 12 56.01  
 22 37 58.09  
 3 42.51  
 16.08  
 6000  
 43.92  
 15.00  
 31.58

Signal No Error.

July 11.

$1327 - \frac{1}{4}$   
 2 55 48  
     57.9  
 2 54 50.1  
 7 16 52.57  
 19 37 57.53  
     3 12.94  
     44.59  
     60.00  
     15.41  
     15.50  
     - .09  
 + 5 gr. for  $\frac{1}{2}$  h      +  $\frac{14}{100}$   
                             + .05

$1327 + \frac{2}{5} = 191$   
 5 51 52 = 00  
     57.4  
 5 50 54.6  
 7 16 52.57  
 22 34 20.3  
     3 41.90  
     20.13  
     60.00  
     39.87  
     15.50  
 191 - 35.63



July 13

1327 - 1/4  
17 21 6

59.12

17 20 06.88

7 24 45.69

9 55 21.19

1 37.45

43.74

6000

16.26

15.50

+.76

.00

+.38

- 2gr

1327 - 1/2

2 26 26

59.50

2 25 36.50

7 24 45.69

19 00 50.81

3 6.80

44.01

6000

15.99

15.10

1327 = +.49

191 = 30

79

.40

Rem 8 gr for 1/2 - .33

+.07

Sig. No Error.

92

July 14

1327 + 1/2

17 37 6

3451

18 35 44.5

5 28.78

18 30 15.72

7 28 42.25

11 01 33.47

1 48.40

45.07

6000

44.93

15.50

+29r.

-1.57

18 40 34.75 = 3451

36 5 1327

1327 + 1/3

2 28 33

59.30

34.75

2 27 33.70

28.78

7 28 42.25

5.97

18 58 51.45

5.00

3 6.65

Enf 1327 + 59.03

44.80

6000

15.20

15.50

-1.30

+59.21r

+27

Signal No Error

-0.03



July 15

1327 - 1/4

3 6 35

59.80

3 5 35.20

7 32 38.80

19 32 56.40

3 12.11

44.29

6000

15.71

15.50

4.21

- sig. for  $\frac{1}{2}$ 

- 2

.p

Sig. No. Error.

94

July 16

$$10^{\log} 20^5 = 394$$

$$45.3 = 191$$

$$-34.7 = 191$$

$$1327 - \frac{1}{3}$$

$$17 \quad 42 \quad 59$$

$$60.0$$

$$17 \quad 41 \quad 59.0$$

$$7 \quad 36 \quad 35.56$$

$$10 \quad 05 \quad 23.64$$

$$1 \quad 39.11$$

$$44.53$$

$$6000$$

$$15.47$$

$$15.50$$

$$-0.3$$

$$1327 + \frac{1}{4}$$

$$1 \quad 45 \quad 18$$

$$1 \quad 00.2$$

$$1 \quad 44 \quad 17.8$$

$$7 \quad 36 \quad 35.36$$

$$18 \quad 07 \quad 42.84$$

$$2 \quad 58.20$$

$$44.24$$

$$44.50$$

$$-15.26$$

$$394 \quad 00$$

$$\text{Mean} \quad -13$$

$$\text{add } 10 \log \text{ for } \frac{1}{2} \text{ h} \quad +14$$

$$+0.1$$

$$\text{Sig. in mm.}$$





96

July 18

$1327 - \frac{1}{3}$   
 15      5      25  
          1      00.50  
 15      4      24.50  
       7      44      28.47  
       7      19      56.03  
          1      12.00  
              44.03  
              ~~6000~~  
              15.93  
              15.50  
              +.43

$1327$   
 3      17      25  
          1      00.95  
 3      16      24.05  
       17      44      28.47  
       19      31      55.58

$3451$   
 $+327$   
 3      27      4.5  
          5      38.49  
 3      21      26.01  
       7      44      28.47  
       19      36      57.54  
          3      12.80  
              44.74  
              ~~6000~~  
              15.26  
              15.50  
              ~~1.24~~  
              +.27  
              +.03

Sig. W. Error.



July 19.

1327  $-\frac{1}{3}$   
 17 16 42  
 1 00.40  
 17 15 41.60  
 7 48 25.03  
 9 27 16.57  
 1 32.83  
 43.74  
 60.00  
 16.26  
 15.50  
 +.76

- 2 gr.

$$B-H = 37^s$$

$$H = -36.24 \text{ Error.}$$

$$\begin{array}{r} 39.26 \\ 21.00 \\ \hline .50 \end{array}$$

+ 2 gr. at 28<sup>h</sup>

July 20

1327  $-\frac{1}{4}$   
 2 8 7  
 1 00.50  
 2 7 06.50  
 7 52 21.59  
 18 14 44.91  
 2 59.32  
 45.59  
 60.00  
 14.41  
 15.50  
 - 1.09

1327  $+\frac{1}{2}$   
 2 26 10  
 1 00.50  
 2 25 09.50  
 7 52 21.59  
 18 32 47.91  
 3 2.37  
 45.54

$$\begin{array}{r} 36.24 \\ 75 \\ \hline 37.00 \end{array}$$

$$B-H = 36.5$$

$$\begin{array}{r} 36.5 \\ 75 \\ \hline 37.25 \end{array}$$

394 is -.50 by 191  
 and this is used instead  
 of 1327, as 1327 has been  
 quite irregular.

-.50

$$+ 10 \text{ gr for } 2^h = +.54$$

$$\text{Sig. No. Error.} \quad +.04$$

98

July 21

1327  
 15 29 18.0  
 1 01.5  
 15 28 16.50  
 7 56 18.14  
 7 31 58.36  
 1 14.04  
 44.32  
 60.00  
 15.68  
 15.50  
 +.18

1327 +  $\frac{1}{3}$   
 4 26 26  
 1 01.75  
 4 25 24.25  
 7 56 18.14  
 20 29 06.11  
 3 21.40  
 44.71  
 60.00  
 15.29  
 15.50  
 -.21  
 394 .00

- .10  
 + .08  
 + 10 gr. for  $\frac{1}{3}$  h  
 Sig. No Error.

3451  
 15<sup>h</sup> 41<sup>m</sup> 34<sup>s</sup> = 100 7<sup>s</sup> 40<sup>m</sup> 00<sup>s</sup>  
 7 39 44.32

7 34 52.85  
 7 35 30 394  
 29.82  
 52.85  
 191 = - 36.97  
 36.24  
 73  
 rate 191 .37

15 41 3  
 4 43  
 15 37 20  
 29  
 08



July 22

1327

3	27	13
	1	02.25

3	26	10.75
---	----	-------

8	0	14.70
---	---	-------

19	25	56.05
----	----	-------

	3	11.05
--	---	-------

4500.

6000

15.00

15.50

- .50

- .20

$$B-H = 37.50^5$$

Mean	- .35
------	-------

+5 gr. 2 1/2	+ .34
--------------	-------

.01

Sig. No. Error.

100

July 23.

3451 + 1/4.

19 23 36.5

5 <sup>5</sup>40.4519 17 <sup>4</sup>56.05

8 4 11.26

11 13 <sup>3</sup>44.791 50. <sup>38</sup>4744. ~~48~~

60 00

15.59

15.50

+09

33. ~~45~~ = 1327

19 30 20.05 = 3451

5 50.45

19 24 29.60

33.

29.1327 + 1 03.40

1.48

+ 1.92

16

2 | 176

+ .88 rate 1327

3451 - 1/2

3 40 59

1327 + 1/2

3 38 12

1 03.80

3 37 08.20

8 4 11.26

19 32 56.94

3 12.24

44.70

60 00

15.30

15.50

- .20

+ 10 gr.  $\frac{2}{3}$  h

+ .18

- .02

Sig. No Error.



July 24

$$3451 = 394$$

$$19 \quad 23 \quad 35 = 00^s$$

$$5 \quad 52.78$$

$$19 \quad 17 \quad 42.22$$

$$8 \quad 8 \quad 7.82$$

$$11 \quad 09 \quad 34.40$$

$$1 \quad 49.68$$

$$44.72$$

$$6000$$

$$15.28$$

$$15.50$$

$$-.22$$

+ 1 gr.

2r = 10 gr.

$$1327 =$$

$$19.2$$

$$3451 = 19 \quad 30 \quad 7.5$$

$$5 \quad 52.8$$

$$14.7$$

$$19.2$$

$$1327 = + \quad 1 \quad 0 \quad 4.5$$

$$3.4$$

$$1.1$$

$$1327 - \frac{1}{4}$$

$$3 \quad 4 \quad 6 \quad 10$$

$$1 \quad 5.1$$

$$3 \quad 4 \quad 5 \quad 04.9$$

$$8 \quad 8 \quad 7.82$$

$$19 \quad 3 \quad 6 \quad 57.08$$

$$3 \quad 12.77$$

$$44.31$$

$$6000$$

$$15.69$$

$$15.50$$

$$+.19$$

$$394 \quad .00$$

$$\text{mean, } +.09$$

$$\pm 10 \text{ gr. } \frac{1}{2} \text{ hr. } -.14$$

$$-.05$$

Sig. No Error

$$30 = 19'$$

$$11 \quad 30 \quad 8.2 = 394$$

$$+.2$$

$$8.4$$

$$30.0$$

$$- 38.4 \quad \text{E. of } 191$$

$$37.05$$

$$3 \mid 1.35$$

$$.45$$

02

July 25.

1327  
3 37 5  
1 6.2

3 35 58.8

8 12 4.37

19 23 54.43

3 10.65

43.78

60.00

16.22

15.50

+ .72 (+1 gr. W = 10 gr. at 1<sup>h</sup> m. i.)

19<sup>h</sup> 20 30.05 = 394

51.0 = 191

39

30

30.05

Sum 394. +.05

3451 -1/2

3 56 58

5 56

3 51 02

8 12 4.37

19 38 57.63

3 13.05

44.58

60.00

15.42

15.50

3451 - .08

191 + .05

- .03

Sig. No. 5mm.



July 27

3451

16 1 57

5 59.30

15 55 57.70

8 19 57.48

7 36 00.22

1 14.70

45.52

60.00

14.48

15.50

- 1.02

+ 3<sup>4</sup>gr.  $\pi=13$ .3451 +  $\frac{1}{2}$ 

3 41 52

6 00.40

3 35 51.56

8 19 57.48

19 15 54.08

3 9.43

44.55

60.00

15.45

15.50

- .05

sum sig. W = 1091.

Signal No Error.

45 1327

1327-1/4

16<sup>h</sup> 08<sup>m</sup>

37.6 3451

16 13 07

5 59.30

1 06.4

38.60

16 12 00.6

45.00

8 19 57.48

1327 = + 1 06.40

7 52 03.12

4.50

1.90

32.67 rate of 1327

191 = - 39 comp.

40  
28  
67  
+17.35

Error. 191 = 40.

460  
58  
20  
41.3 100

104

July 28 <sup>7h</sup> -

3451.

2 49 41

6 2.80

2 43 38.20

8 23 54.04

18 19 44.16

3 00.15

44.01

6000

15.99

15.50

B-H = 40.8

+.49

+.10 by 191.

+.30 mean.

-.27

new 5 grs for 2 h

+.03 Sig. No Error.

1327 - 1/2

2 50 48

1 7.35

2 49 40.65

8 23 54.04

18 25 46.61

3 1.08

4, 5.53

6000

14.47

15.50

- 1.03 Not used.



July 29<sup>th</sup>

3451  
 2 18 34.5  
 6 5.0  
 2 12 29.5  
 8 27 50.60  
 17 44 38.90

2 57.44

44.46

6000

15.54

15.50

3451 +.04

H<sup>191</sup> = -.10

-.03 Meant. Signal No Error

July 30

~~3451~~ + 1/2  
 3 39 52 46.  
 6 7.37 7.37  
 3 33 44.63 38.63  
 8 31 47.16 47.16  
 19 01 57.47 51.47  
 3 7.15

44.32

6000

15.68

15.50

+.18

-.10

+.08 Signal No Error.

106

July 31

3451  $\pm 1/4$ 

17 23 2

1327

17 25

15.05

6 07.92

3451

12

17 16 54.08

7.92

4.08

8 35 43.71

15.05

+ 1 10.97

8 41 10.37

1 25.43

44.94

191 : 8 45 34.5

60 00

394:

16

34.5

16.44

15.06

sum 191 = -41.94

15.50

40.00

-1.94

- .44

rate 191 - .50

+19-

3451

4 16 50

6 08.92

4 10 41.08

8 35 43.71

19 34 57.37

3 25.51

44.86

60 00

15.14

15.50

- .34

- .25

59

Mean - .29

+109.16 + .27

- .02



Aug. 1.

3451

4 17 48  
6 11.05

4 11 36.95

8 39 40.27

19 31 56.68

3 11.98

44.70

60 00

15.30

15.50

-20

191 -10

Mean, -15

+ sample +13

-02

6 08.92

2.13

6 11.05

41.94

50

25

42.65

Aug. 2

3451

6 29 7.5

6 13.0

6 27 154.5

8 43 36.82

21 39 17.62

3 32.84

4 4.58

60 00

15.42

15.50

-08

6 35

10

13 27

11.15

3451

13.0

58.15

10.50

+ 11.85

B-H = 43.4

July Aug. 3

3451

3 57 40.5

6 14.8

3 51 25.7

8 47 33.38

19 03 52.32

3 7.36

44.96

60.00

15.24

15.50

3451 - 46

191 -.4

mean - .43

+ 5 gr. for 3<sup>rd</sup> + .42

- .01 Sig No Error.

Aug. 4.

3451

4 38 45.5

6 16.8

4 32 28.7

8 51 29.94

19 40 58.76

3 13.47

45.29

60.00

14.71

15.10

- .79

394

B-H = 43.85 Comp.

Should be 44.4.

added 10 gr. for 2<sup>nd</sup>

44.4

44.4

.0

Sig. No Error.



Aug. 5.

3451 +  $\frac{1}{4}$ 

4 28 41  
 6 18.8  
 4 22 22.2  
 8 55 26.50  
 19 26 55.7  
 3 11.22  
 44.48  
 60.00  
 15.52  
 15.50  
 +.02

Sig. No. 5000

Aug. 6.

3451

3451

20 10 16.5  
 6 19.3  
 20 3 57.2  
 8 59 23.05  
 11 04 34.15  
 1 48.90  
 45.25  
 60.00  
 14.75  
 15.50  
 - .75

+ 2 granules

4 35 39.5  
 1 19.96  
 4 34 19.54  
 8 59 23.05  
 19 34 56.49  
 3 12.39  
 44.10  
 60.00  
 15.90  
 15.50  
 +.40

not used.

40. 141  
 11 15 25.5 390  
 .75  
 26.20  
 40.00  
 - 46.20  
 43.04  
 3.16  
 13.7 -  $\frac{3}{4}$

4 45 34.  
 1 12.15  
 4 44 21.85  
 8 59 23.05  
 19 44 58.80  
 3 14.03

44.80

60.00

15.20

15.50  
 - 30 13.7  
 .00 191  
 - .15  
 + .14  
 1

110

Aug. 7.

1327			3451		
18	20	48	18	33	58
	1	12.22		6	21.05
18	19	35.78	18	27	36.95
9	3	19.61	9	3	19.61
9	16	16.17	9	24	17.34
	1	31.16		1	32.43
		45.01			44.91
		60.00			60.00
		14.99			15.09
		15.50			15.50
		-1.51			-1.41

+ 2gr.

1327 - 1/3			3451 - 1/12		
5	21	36	5	29	46
	1	12.4		6	21.95
5	20	23.6	5	23	24.05
9	3	19.61	9	3	19.61
20	17	03.99	20	20	04.44
	3	19.31		3	19.80
		44.68			44.64
		60			60.00
		15.32			15.36
		15.50			15.50
		-1.18			-1.14

47.1  
46.20  
1.5190  
1.96

Miller -16  
-1gr. + 5gr. for 1/2 hr. +1.4  
-1.02 Cig. No Error

B-H: 47.1 Comp  
B-H



Aug. 8

1327 + 1/4			3451	3451	
16	20	24	16	30	35
	1	12.30		6	22.75
16	19	11.70	16	24	12.25
9	7	16.16	9	7	16.16
7	11	55.54	7	16	56.09
	1	10.81		1	11.56
		44.73			44.53
		60.00			60.00
		15.27			15.47
		15.50			15.50
		- .23			

1327			3451		
4	38	25	4	47	36.5
	1	12.5		6	23.78
4	37	12.5	4	45	12.72
9	7	16.16	9	7	16.16
19	29	56.34	19	33	56.56
	3	11.67		3	12.30
		44.67			44.26
		60.00			60.00
		15.33			15.74
		15.50			15.50
		- .17			+ .24
					- .17
					+ .07
					+ .03

mean

Sig. 10.000

112

Aug. 9

3451  
 6 22 50  
 6 25.75  
 6 16 24.25  
 9 11 12.72  
 24 05 11.53  
 3 27.28  
 44.25  
 60.00  
 15.75  
 15.50  
 +.25  
 -1gr.

Aug. 10

20	46	13		3451 - 1/3
	6	26.95	35 1327	5 42 41.5
20	39	46.05	20 50 48.15 3451	6 27.65
9	15	9.27	26.95	5 36 13.85
11	24	36.78	21.20	9 15 9.27
	1	52.15	35.00	20 21 4.58
		44.63	1 13.8	3 20.01
		60.00		44.57
		15.37		60.00
		15.50		15.43
		-.13		15.50
				-.07

+1gr.

191 30 18.65  
 394 11 0 30.03  
 18.5 48.65  
 46.20  
 42.45  
 60



Aug. 11.

3451

19 27 57.5

5.5 3451

6 29.48

19 30 51.2 1327

19 21 28.4

9 19 5.83

5.5

10 2 22.57

29.1

1 38.62

36.4

51.2

43.95

+ 1 14.8

6000

16.05

19.5 394

19.0

15.50

10 0 30 11.294

30

49.0

+.55

-29r.

3451 -1/3

1327

3451 -1/3

4 4 9

4 4 9

4 23 26

3 6 30.0

6 29.85

3 57 39.0

4 16 56.15

9 19 5.83

9 19 5.83

18 38 33.17

18 57 50.32

3 6.32

4 4.00

6000

16.00

15.50

+.50

18.5	20.5
30	32

By 1/11 is +.30.

11 39.54 .00

2. + .15 mean

-5 gr. 1h

2.14

+.01

Dig. the front

114

Aug. 12.

1327 - 1/2

18 21 30

1 15.95

18 20 14.05

9 23 2.38

8 57 11.67

1 27.90

43.77

60

16.23

15.50

+ .73

- 2 gr.

1327 = 191 : 1327

16 53 5 = 50

1 15.98

16 51 49.02

9 23 2.38

7 28 46.64

1 13.50

+ 33.14

33.14 6000

15.50 26.86

48.64

15.50

42.36

16 50 00 = 3451

44.65.1327

1 15.98

28.67

00 00

3451 + 6 31.33

1327 - 1/2

5 4 16

1 15.80

5 3 00.2

9 23 2.38

19 39 57.82

3 13.22

44.60

60 00

15.40

+ 5 gr. for 3/4  
+ 2 gr. perm.

15 50

- .10

+ .12

+ .02

Sig. No Error.

1327 191

6 39 21

1 15.85

6 38 05.15

9 23 2.38

21 15 02.77

3 28.9

33.87

15.50

49.37

1327 3451

6 44 43.8 = 00

1 15.85

6 43 27.95

00

2451 + 6 32.05



Aug. 13

1327 + 1/2

17	32	19
	1	16.28

17	31	02.72
----	----	-------

9	27	58.94
---	----	-------

8	03	03.78
---	----	-------

	1	19.20
--	---	-------

44.58

60.00

15.42

15.50

-0.08

1327 = 191

19	18	26	= 00
	1	16.3	

19	17	09.7
----	----	------

9	27	58.94
---	----	-------

9	49	10.76
---	----	-------

	1	36.53
--	---	-------

34.23

00.00

34.23

15.50

191 - 49.73

50.2

1327 - 1/3

5	42	19
	1	16.3

5	41	02.7
---	----	------

9	27	58.94
---	----	-------

20	13	03.76
----	----	-------

	3	18.70
--	---	-------

45.06

60.00

14.96

15.50

Not used. -0.46

by 394.00

" 191.00

Error. 0.0

Sig. No. Error.

1327	= 3451
19 20	43.3 = 00

1 16.3

19 27.0

00

3451 = + 6 33.0

116

Aug. 14.

$1327 + \frac{1}{2}$   
 20 16 43  
 1 17.45  
 20 15 25.55  
 9 30 55.49  
 10 44 30.06  
 1 45.66  
 44.40  
 60.00  
 15.60  
 15.50  
 +.10

$1327 + \frac{1}{3} = 191$   
 19 8 22  
 1 17.42  
 19 7 04.58  
 9 30 55.49  
 9 36 09.09  
 1 34.43  
 34.66  
 15.50  
 191 = - 50.16  
 49.73  
 $\frac{24}{14} \frac{14}{3} \frac{14}{6}$   
 14.4  
 .43  
 1327 3457  
 18 50 42.25 = 00  
 1 17.40  
 18 49 24.85  
 00  
 35.15  
 33.00  
 2.15  
 rate.

$1327 - \frac{1}{4}$   
 5 0 9  
 1 18.0  
 4 58 51.0  
 9 30 55.49  
 19 27 55.51  
 3 11.28  
 44.23  
 60.00  
 15.77  
 15.50  
 1327 +.27  
 191 +.10  
 37

Mean +.18

rms sq for 1h -.14  
 +.04

B-H = 50.5  
 50.4

Sig. No Error



Aug 15

$$\begin{array}{r}
 + \quad 1327 + \frac{1}{4} \\
 + 9 \\
 \hline
 6 \quad 49 \quad 24 \\
 \quad \quad 1 \quad 19.20 \\
 6 \quad 48 \quad 04.80 \\
 9 \quad 34 \quad 52.05 \\
 21 \quad 13 \quad 12.75 \\
 \quad \quad 3 \quad 28.60 \\
 \quad \quad \quad 44.15 \\
 \quad \quad \quad 60.00 \\
 \quad \quad \quad 15.85 \\
 \quad \quad \quad 15.50 \\
 \quad \quad \quad \hline
 1327 \quad +.35 \\
 191 \quad \quad .00 \\
 \quad \quad \quad +.17 \\
 \text{run } 6q_{3/4}^h \quad \quad \quad \hline
 \quad \quad \quad -1.2 \\
 \quad \quad \quad +.05 \\
 \text{Sig. No. Error.} \\
 \quad \quad \quad \hline
 \quad \quad \quad \hline
 \end{array}$$

118

Aug 17.

1327 + 1/4

19 42 28

20.7

19 42 07.3

9 42 45.16

9 59 22.14

1 38.00

57 43.94

60 00

16.06

15.50

+ .56

3451 - 1/3

20 1 51.5

6 41.45

19 55 10.05

9 42 45.16

10 12 24.89

1 40.26

44.63

60 00

15.37

15.50

- .13

3451

6 31 35.5 6 31 35.5

6 42.50

6 204 53.0

9 42 45.16

20 42 07.84

3 23.45

44.39

60

15.61

15.50

3451 + .11

191 00

+ .05

Sig No Error



Aug. 18

3451 - 1/2

4	+ 2	15
	6	44.50
4	35	30.50
9	46	41.71
18	48	48.79
	3	4.82
		43.97
	60	
		16.03
		15.50
		+1.53
		<u>+2.05</u>
		.88

mean +1.44  
 Range for 2<sup>h</sup> -43

+0.1  
Signal No Error.

120

Aug. 19

$1327 +$   
 19 13 18  
     1 23.55  
 19 17 54.45  
   9 50 38.27  
   9 21 16.18  
     1 32.00  
       44.18  
       60.00  
       15.52  
       15.5  
       + 32

-195

$1327 + 1/4$   
 5 30 00  
   1 24.10  
 5 28 35.90  
   9 50 38.27  
 19 37 57.63  
   1 13.02  
       44.61  
       60.00  
       15.39  
       15.50  
       - .11

+ 5 gr for h

$+ .14$   
 $+ .03$

Lig. M. Mori

$1327 + 1/2 = 191$   
 19 11 10 = 00  
   1 23.53  
 19 9 46.47  
   9 50 38.27  
   9 19 08.20  
     1 31.68  
       36.52  
       65.50  
       - 52.02

00.245  
 19 10 37.6 = 13.7  
   1 23.55  
   9 14.05  
   00.00  
   + 6 45.95

$1327 = 191$   
 1 39 14.00  
   1 23.95  
 1 37 50.05  
   9 50 38.27  
 15 47 11.78  
   2 25.18  
       36.60  
       15.50  
       - 52.10

97 00.0 = 345  
 1 40 37.4 = 327  
   1 23.95  
   39 13.45  
   00.00  
   + 6 46.45



Aug 20

1327 +114.

4	57	52
	1	25.55
4	56	26.45
9	54	34.82
19	01	51.63
	3	7.11
		44.52
		60.00
		15.48
		15.50
		-.02

Fig. 16. Error.

1327 = 191

4	43	42 = 00
	1	25.55
4	42	18.45
9	54	34.82
18	47	41.63
	3	4.74
		36.89
		15.50
	191	-52.39

00 34.51

4 50 36.55 = 1327

1 25.55

4 49 11.00

00.00

49.00

122

Aug 21

$$1327. = 191$$

$$19 \quad 10 \quad 5 = 00$$

$$1 \quad 26.18$$

$$19 \quad 8 \quad 38.82$$

$$9 \quad 58 \quad 31.38$$

$$9 \quad 10 \quad 07.44$$

$$1 \quad 30.12$$

$$37.32$$

$$15.50$$

$$191 - 52.82$$

$$\begin{array}{r} 52.82 \\ 52.59 \\ \hline 154.31 \\ 30 \\ \hline 184.31 \\ 120 \\ \hline 6.31 \end{array}$$

$$\begin{array}{r} 52.82 \\ 52.70 \\ \hline 53.52 \end{array}$$

1327

$$5 \quad 25 \quad 54$$

$$1 \quad 26.75$$

$$5 \quad 24 \quad 27.25$$

$$9 \quad 58 \quad 31.38$$

$$19 \quad 25 \quad 55.47$$

$$3 \quad 11.00$$

$$44.47$$

$$60.00$$

$$15.53$$

$$15.50$$

$$+ 0.3$$

Sig. no error

m. 109m

$$00.0 = 34.51$$

$$19 \quad 10 \quad 36.2 = 1327$$

$$1 \quad 26.2$$

$$9 \quad 10.0$$

$$00.0$$

$$+ 6 \quad 50.00$$



Aug 22

1327

5	15	50
	1	28.07
5	14	21.93
10	2	27.94
19	"	53.99
	3	8.68
		45.33
		60.00
		14.69
		15.50

1327

5 33 53

Comp B-H = 53.<sup>s</sup>

Jones bc 53.50

∴ B is -.50

+ 10gr 2<sup>th</sup> = +.14

+0.4

Sig. No Error

Aug 23.

1327 - 1/4

7	34	10
	1	29.15
7	32	40.85
10	6	24.50
21	26	16.35
	3	30.68
		45.67
		60
		14.33
		15.50
		-1.17

+ 3gr.

Aug. 24

1327			1327 = 191			08.341		
20	36	18	19	12	59 = 00	19	12	34.1 = 15.2
	1	30.0		1	29.95		1	29.95
20	34	48.0	19	11	29.05	19	11	04.15
10	10	21.04	10	10	21.04			00.00
10	24	26.96	9	01	08.01			55.85
	1	42.30		1	28.66			
		44.66			49.35			
		60			15.50			
		15.34			(191) - 5 4.85			
		15.00			52.82			
		<u>-.16</u>			312.03			
					-6.8 ratio (191)			

run. 2 gr.  
w = 11 gr.

1327			1327 = 191			= 34.1		
5	42	48	2	16	9	2	45	338.13 = 1
	1	30.52		1	30.40		1	30.42
5	41	47.48	2	14	38.60		44	03.38
10	10	21.04	10	10	21.04			00.00
19	30	56.44	16	4	17.56	34.1 + 6		56.62
	3	11.84		2	37.96			55.85
		44.60			39.60			71771"
		60			15.50			
		15.40			(191) - 55.10			
		15.50			54.85			
		<u>10</u>			71.25			
		.00			19.34			
		.05			13.6			
		Sig. Error			68			
					.81			

w = 11 gr.

Aug. 25

1327  $\frac{1}{2}$ 

17 15 42

1 31.38

17 14 10.62

10 14 17.60

6 29 53.02

1 8.85

44.17

6000

15.83

15.50

+ .33

-1 gr.

W=10 gr.

36  $\frac{1}{2}$   
17  $\frac{1}{4}$ 

13

65

65

78

.845

38

1 32.22

65  
24  
260  
130  
158

1327.

6 29 53

1 32.22

6 28 20.78

10 14 17.60

20 14 03.18

3 18.85

44.33

6000

10.67

15.50

-100

+ 1.17

-10 gr  $\frac{1}{2}$  h

- .14

+ .03

Sig. No. Error.



Aug. 26.

1327  
 18 17 50  
 1 32.95  
 18 16 17.05  
 10 18 14.15  
 7 58 2.90  
 1 18.30  
 44.60  
 60.00  
 15.40  
 15.50  
 .10

1327 - 1/4  
 6 1 46  
 1 33.75  
 6 0 12.25  
 10 18 14.15  
 19 41 58.10  
 3 13.60  
 44.50  
 60.00  
 15.10  
 15.50  
 .00

Sig. No. Error.

Aug. 27.

1327  
 17 51 43 B-H = 56.3  
 1 34.45 should be 56.8  
 17 50 08.55 -0.15  
 10 22 10.71  
 7 27 57.84  
 1 13.36  
 44.48  
 60.00  
 15.52  
 15.50  
 +.02  
 191 +.50  
 Mean - .48  
 Mean - .24  
 +1 gr.

1327  
 5 54 42  
 1 35.25  
 5 53 06.75  
 10 22 10.71  
 19 30 56.04  
 3 11.84  
 44.20  
 60.00  
 15.80 B-H = 56.5  
 15.50 should be 57.1  
 +.30 +.30 1327  
 -7.6 -60 191  
 Mean - .70 3451  
 -1.00

Mean = -.33  
 +10 gr 1/3 + 34  
 +1 gr. -1.01 Sig. No. Error

Aug 28.

34 47  
 20 48 36.5  
 7 04.85  
 21 41 31.65  
 10 26 7.26  
 10 15 24.89  
 1 40.82  
 43.57  
 60.00  
 16.43  
 15.50  
 +.93

-1 gr.

-3 gr.

3451  $-\frac{1}{3}$   
 6 10 10  
 7 5.77  
 6 3 04.23  
 10 26 7.26  
 19 36 56.97  
 0 12.76  
 44.21  
 60.00  
 15.79  
 15.50  
 +.29

191 = 10 30  $\frac{30}{27.4}$   
 394 -  $\frac{27.4}{26.5}$   
 $\frac{30.0}{56.0}$   
 $\frac{54.0}{11.5}$   
 1327  
 3457 21 53 28.8  
 7 04.85  
 23.95  
 00.00  
 36.05  
 29.99  
 4 16.06 1.50

1327  $+\frac{1}{6}$   
 6 8 6 8 42  
 7 36.70  
 6 7 05.30  
 10 26 7.26  
 19 40 58.04  
 3 13.50  
 44.54  
 60.00  
 15.46  
 15.50  
 -.04  
 +.29

Mean  $+\frac{1}{2}$   
 3 gr.  $-\frac{1}{8}$   
 +.3 gr.  $-\frac{1}{4}$   
 .06 Significance

128

Aug. 29.

3451  $-1/3$

5	35	2.5
	7	07.1
5	27	55.4
10	30	3.82
18	57	51.58
	3	06.36
		45.22
		60.00
		14.78
		<u>15.50</u>
		- .72
		<u>15</u>
		- .57 <i>Smf 396</i>

+20 gr forth = +.54

Aug. 31.

3451	3451 $+1/3$	327 $-1/3$
20 30 28	7 5 13	7 8 44
7 10.90	7 11.90	1 41.57
20 23 17.10	6 58 01.10	7 7 02.43
10 37 56.92	10 37 56.92	10 37 56.92
7 45 20.18	20 20 04.18	20 29 05.51
1 25.87	3 19.90	3 21.29
44.31	44.28	44.22
60.00	20 00	60.00
15.69	15.72	15.78
<u>15.50</u>	<u>15.50</u>	<u>15.50</u>
+ .19	+ .22	+ .28

Comp. B-H = 57.6

mean  $+ .25$   
 $- 10 \times 10^{-6}$   
 $- .27$   
 $- .02$   
 Sig. 76 *Smf*



Sept. 1

1327			3451		
6	11	32	6	20	3.5
	1	43.17		7	14.0
6	9	48.83	6	12	49.5
10	41	53.47	10	41	53.47
19	27	55.36	19	30	56.03
	3	11.35		3	11.84
		44.01			44.19
		6000			6000
		15.99			15.81
		15.50			15.50
		+ .49			+ .31

$$\begin{array}{r} +.49 \\ +.31 \\ \hline .80 \\ \text{mean} = +.40 \\ \text{rem 5 gr. for } 2\frac{1}{2}\text{h.} = .84 \\ +.06 \end{array}$$

Comp. B-H = 58.6

Signal No Error

Sept 2.

3451-1/3			1327-1/2			1327+1/3			3451+1/4		
18	20	3.00	18	23	32	6	22	32	6	31	4.5
	7	10.12		1	44.00		1	44.84		7	16.24
18	12	47.88	18	21	49.00	6	20	47.16	6	23	48.26
10	45	50.03	10	45	50.03	10	45	50.03	10	45	50.03
7	26	57.85	7	35	58.97	19	34	57.13	19	37	58.23
	1	13.15		1	14.62		3	12.53		3	13.01
		44.70			44.25			44.60			45.22
		6000			6000			6000			6000
		15.30			15.65			15.40			14.98
		15.50			15.50			15.50			15.50
		-.20			+ .15			-.10			-.72

$$\begin{array}{r} +.34 \\ - .06 \\ \hline +.28 \\ \text{Sig. No. Error} \end{array}$$

130

Sept. 3.

1327 - 1/2

18	1	27
	1	45.65

17	59	41.35
----	----	-------

10	49	46.59
----	----	-------

7	09	54.76
---	----	-------

	1	10.35
--	---	-------

		44.41
--	--	-------

		60.00
--	--	-------

		15.59
--	--	-------

		15.50
--	--	-------

		+0.9
--	--	------

1327 + 1/4

7	2	36
---	---	----

	1	46.55
--	---	-------

7	0	49.45
---	---	-------

10	49	46.59
----	----	-------

20	11	02.86
----	----	-------

	3	18.45
--	---	-------

		44.41
--	--	-------

		60.00
--	--	-------

		15.59
--	--	-------

		15.50
--	--	-------

		+0.9
--	--	------

		.00
--	--	-----

mean .04 Sig. No. Error.

B-H = 58.5

Sept. 4

1327

6	29	28
---	----	----

	1	48.15
--	---	-------

6	27	39.85
---	----	-------

10	53	43.14
----	----	-------

19	33	56.71
----	----	-------

	3	12.31
--	---	-------

		44.40
--	--	-------

		60.00
--	--	-------

		15.60
--	--	-------

		15.50
--	--	-------

		+ .10
--	--	-------

Sig. No. Error.

+  
rate 24.4h 2.5h m. J.

Sept. 5

1327 - 1/2

20 40 49

1 47.70

20 39 01.30

10 57 39.69

9 41 21.61

1 35.15

46.46

6000

13.54

15.50

- 1.96

+ 3 gr.

+ 7 gr.

I did not discover until this comparison that I had removed 3 grammes instead of adding it, and this accounts for the large error. F.W.

1327 + 1/3

6 28 24

1 48.30

6 26 35.70

10 57 39.69

19 28 56.01

3 11.57

44.44

6000

15.56

15.50

+ .06

sum 7 gr.

Sig. No. Error.



132

Depth 7

11

1327 + 1/2

11 13 08

1 49.20

11 11 18.80

11 5 32.79

0 05 46.00

1.00

45.00

6000

15.00

15.50

- 1.50

191

11 14 09

1 49.20

11 12 19.80

11 5 32.79

0 06 47.01

1 11

45.90

6000

14.10

15.50

- 1 1.40

08 3451

11 30 24.85 = 1327

1 49.20

35.65

0000

24.35

+ 1 gr.

1327 - 1/2

6 40 20

1 50.65

6 38 29.35

11 5 32.79

19 32 56.56

3 12.08

44.48

6000

15.52

15.50

+ 0.02

Sig. No Error

Sept 8.

1327 + 1/4

191

18 23 16  
1 51.50

17 43 11

3451

17 50 23.75 1327

18 21 24.50

11 9 29.35

7 11 55.15

1 10.80

44.35

6000

15.65

15.00

+ .15

1327

191

7 19 24

3 55 52.0

0800 3451

1 52.4

3 57 23.35 = 1327

7 18 31.6

11 9 29.35

20 09 02.25

3 18.05

44.20

6000

15.80

15.00

+ .30

-1092 for 1<sup>st</sup>

-27

+ .03

Sig. No Error

134

Sept. 9.

1327

20 19 33

1 53.13

20 17 39.87

11 13 25.90

9 04 13.97

1 29.17

44.80

6000

15.20

15.00

- .30

1327

6 39 15

1 53.70

6 37 21.30

11 13 25.90

19 23 55.80

3 10.67

144.73

6000

15.27

15.00

- .23

+ 5 gr for 2<sup>h</sup>

+ 2.1000001

+ .04

Sig 26.5000



Sept. 10

1327 -  $\frac{1}{2}$ 

20	38	33
	1	14.45
20	36	38.55
11	17	22.46
9	19	16.09
	1	31.53
		44.56
		6000
		15.44
		15.50
		-.06

1327 +  $\frac{1}{3}$ 

6	14	50	6	50	14
	1	54.88		1	54.88
6	12	55.12	6	48	19.12
11	17	22.46	11	17	22.46
	55	32.66	19	30	56.66
			3		11.89

44.77  
 6000  
 15.23  
 15.50  
 -.27

+ 1092 for 1 h.

136

Sept 11.

1327 + 1/4

6 58 12.

1 56.27

6 56 15.73

11 21 19.00

19 34 56.73

3 12.53

44.20

6000

15.80

15.30

+ .30

- 592h - .27

+ .03

Sept. 12

1327

7 7 11

1 57.6

7 5 13.4

11 25 15.56  
H 25.15

19 39 57.84

3 13.32

44.52

6000

15.48

15.50

- .02

191 - 1/2

11 32 00 :00

1 57.15

11 30 02.85

11 25 15.56

04 47.29

0.77

4 46.52

6000

13.48

15.50

- 62.02

00:34.51

11 36 20.85 = 12.7

1 57.15

0 23.40

00.00

+ 7<sup>m</sup> 36.30

Sept. 13.

1327 + 1/2

8 52 26

1 58.75

8 50 29.25

11 29 12.11

21 21 15.14

3 29.98

45.16

6000

14.84

15.52

Sept. 14.

1327

21 35 32

1 59.45

21 33 32.55

11 33 08.67

10 00 23.88

1 38.37

45.51

6000

14.50

15.50

+ 3gr.

1327

6 38 01

2 00.65

6 36 00.35

11 33 08.67

19 02 51.68

3 07.25

44.43

6000

14.57

15.50

15.50

- 3gr.



138

Sept. 15

1327 - 1/2

19 18 6

2 01.70

19 16 04.30

11 37 05.22

7 38 59.08

1 15.08

44.00

6000

15.00

15.50

+ .50

- 2 gr.

1327 + 1/2

8 02 13

2 02.55

8 00 10.45

11 37 05.22

20 23 05.23

3 20.45

44.78

6000

15.22

15.50

- .28

+ 2 gr.

+ .27

+ 10 gr. for 1<sup>st</sup>

- .01

Sept. 16.

1327-1/2

6 11 52  
 2 04.28  
 6 09 47.72  
 11 41 01.78  
 18 28 45.94  
 3 01.54  
 44.40  
 60.00  
 15.60  
 15.50  
 +.10  
 run 59 1/2 h - .07  
 +.03

Sig. No. Mor.

1327

7 13 00  
 2 06.23  
 7 10 53.77  
 11 44 58.33  
 19 25 55.44  
 3 11.02  
 44.42  
 60.00  
 15.58  
 15.50  
 +.08

Sig. No. Mor.

140

Sept. 18

1327.

8 1 6

2 08.25

7 58 57.75

11 48 54.89

20 10 02.86

3 18.22

44.64

6000

15.36

15.50

-.84

.00

-.07

Sig. No Error.

Sept. 19

1327 + 1/4

21 58 24

2 09.1

21 56 14.9

11 52 51.43

10 03 23.47

1 38.86

44.61

6000

15.39

15.50

-.11

1327.

16 41 36

00.0 3451

2 08.75

16 44 18.1 1327

16 39 27.25

11 52 51.43

4 46 35.82

0 46.93

48.89

6000

15.39

15.50

-64.41

-3.21



Sept. 20

1327  $\frac{1}{4}$ 

$$\begin{array}{r} 7 \quad 34 \quad 59 \\ 2 \quad 09.88 \end{array}$$

$$4 \quad 32 \quad 49.1^m$$

$$11 \quad 52 \quad 51.43$$

$$19 \quad 39 \quad 57.69$$

$$3 \quad 13.31$$

$$44.38$$

$$6000$$

$$15.62$$

$$15.50$$

$$+1.12$$

$$+1.00$$

$$\text{mean. } +0.06$$

$$\text{Sig. No. Mrs.}$$

$$1327 = 191$$

$$6 \quad 44 \quad 53 = 00$$

$$2 \quad 11.2$$

$$6 \quad 42 \quad 41.8$$

$$11 \quad 52 \quad 51.43$$

$$18 \quad 49 \quad 50.37$$

$$3 \quad 5.10$$

$$45.8^m$$

$$6000$$

$$14.83$$

$$00 = 3451$$

$$7 \quad 10 \quad 17.2 = 13.7$$

42

Sept. 21

1327.

12 22 44

2 11.6

12 20 32.4

12 0 44.54

19 49.86

3.25

44.61

6000

15.39

15.50

-11

1327.

8 18 1

2 12.52

8 15 48.48

12 0 44.54

20 15 3.94

3 19.12

44.82

6000

15.18

15.50

-32

.00

Mean, -.16

+ 10 gr for +14

 $\frac{1}{2}h$  -.02

Sig. No Error

Sept. 22

1327 +1/4  
 20 27 1  
 2 13.3  
 20 24 47.7  
 12 4 41.1  
 8 20 06.6  
 1 21.95  
 44.65  
 6000  
 15.35  
15.50  
 - .15

1327 +1/3

8 16 58  
 2 14.10  
 8 14 43.90  
 12 4 41.1  
 20 10 02.8  
 3 18.27  
 44.53  
 6000  
 15.47  
15.50  
 - .03

Sig. No Error.

Sept. 23

1327  
 20 0 54  
 2 15.4  
 19 58 38.6  
 12 08 37.64  
 7 50 00.96  
 1 16.96  
 44.00  
 6000  
 16.00  
15.50  
 +.50

1327

7 32 48  
 2 16.2  
 7 30 31.8  
 12 08 37.64  
 19 21 54.16  
 3 10.30  
 43.86  
 6000  
 16.14  
15.50  
 +.64

- 109.1<sup>+</sup> - 63  
 2 1/4<sup>th</sup> +.01

Sig. No Error



144

Sept.  
Jan. 24

1327 + 1/3

7	38	47
	2	17.66

7	36	29.34
---	----	-------

12	12	34.20
----	----	-------

19	23	55.14
	3	10.72
		<u>12.76</u>

		44.42
--	--	-------

		60.00
--	--	-------

		15.58
--	--	-------

		<u>15.50</u>
--	--	--------------

		+ .08
--	--	-------

Sig. No. Error.

Sept. 25.

1327.

8	9	49
	2	19.25

8	7	29.75
---	---	-------

12	16	30.75
----	----	-------

19	50	59.00
----	----	-------

	3	15.10
--	---	-------

		48.90
--	--	-------

		60.00
--	--	-------

		16.10
--	--	-------

		<u>15.10</u>
--	--	--------------

		+ .60
--	--	-------

-1090 for 2h		<u>- .54</u>
--------------	--	--------------

		+ .06
--	--	-------

Sig. No. Error.

Sept. 26.

1327.

8	16	47
	2	20.68
8	14	26.32
12	20	27.31
19	53	59.01
	3	15.60
		43.41
		60.00
		16.50

1327 - 1/2

8	23	48
	2	20.68
8	21	27.82
12	20	27.31
20	01	00.51
	3	16.50
		44.00
		60.00
		16.00

45.50

+1.00

+.50

- .02 for 1/2

- .04 gr. Sig. No. Error

+ .04 gr. permanent weight

1327 - 1/2

12	37	27
	2	21.25
12	35	05.75
12	28	20.42
	6	45.33
		1.02
		44.31
		60.00
		15.69
		15.50
		+ .11

1327

7	48	36
	2	22.00
7	44	14.00
12	28	20.42
19	15	56.58
	3	9.17
		44.41
		60.00
		15.54
		15.50
		+ .09
		.00

mean + .04

Sig. No. Error

146

Sept. 29.

9	24	39
	2	22.20
8	22	16.80
12	32	16.96
19	49	59.84
	3	14.95
		44.89
		60.00
		15.11
		<u>15.50</u>
		- .89

+1gr. +10gr for 1 1/4 h +.341  
 Penn. - .05  
 Pa. W: 10gr.

Sep. 30.

	1327	
20	54	42
	.2	22.45
20	52	19.55
12	36	13.52
8	16	6.03
	1	21.30
		44.73
		60.00
		15.26
		<u>15.50</u>
		- .24

B-H, Comp. = 1 5/8

	1327 - 1/3	
8	34	37
	2	23.00
8	32	14.00
12	36	13.52
19	56	00.48
	2	15.90
		44.58
		60.00
		15.42
		<u>15.50</u>
		- .08
	+ 2 gr for 1 1/4 h	+ .06
		- .02

Sig. W. Error.



Oct. 1.

1327 + 1/2

19	30	25
	2	23.24
19	28	01.76
12	40	10.08
6	47	51.68
	1	06.90
		44.78
		60.00
		15.22
		15.50
		- .28

1327 = 191

4. 4/1

17	26	09 = 00
	2	23.18
17	23	45.82
12	40	10.08
4	43	35.74
	0	46.45
		49.29
		60.00
		10.71
		15.50
- 1	0	4.79 = error of 21.191.

1327

8	52	37
	2	23.74
8	50	13.26
12	40	10.08
20	10	3.18
	3	18.26
		44.92
		60.00
		15.08
		15.50
		- 42
		- 241
		- .01

+ 1 1/2 h

Sig. No. Error.

Let. Howard 191 ahead 1 min.  
So now it is slow about 5 s.

148

Oct. 2

$$\begin{array}{r}
 1327 \quad 191 \quad 1327 = 191 \\
 20 \ 10 \ 28.0 = 7 \cdot 23.00 \left\{ 17 \ 50 \ 10 = 00. \right. \\
 2 \ 24.18 \quad 2 \ 24.08
 \end{array}$$

L.W.

$$\begin{array}{r}
 20 \ 8 \ 03.72 \\
 12 \ 44 \ 06.64 \\
 7 \ 23 \ 57.08 \\
 1 \ 12.72 \\
 44.36 \\
 60.00 \\
 15.64 \\
 15.50
 \end{array}$$

$$\text{Sum } 394. \quad +.14$$

$$\begin{array}{r}
 17 \ 47 \ 45.92 \\
 12 \ 44 \ 06.64 \\
 5 \ 03 \ 39.28 \\
 049.74 \\
 49.54 \\
 60.00 \\
 10.46 \\
 15.50
 \end{array}$$

$$-5.04 \text{ Error } H. 191.$$

$$\begin{array}{r}
 1327 \quad -1/2 \\
 8 \quad 9 \quad 26 \\
 2 \quad 24.65 \\
 8 \quad 7 \quad 01.35 \\
 12 \quad 44 \quad 06.64 \\
 19 \quad 22 \quad 54.71 \\
 3 \quad 10.40 \\
 44.31 \\
 60.00 \\
 15.69 \\
 15.50 \\
 +.19 \\
 -59.1^h \quad - .14 \\
 +.05
 \end{array}$$

Sig. No Error.



oct. 3<sup>d</sup>

1327

19	54	22
	2	25.08
19	51	56.92
12	48	03.19
7	03	53.73
	1	09.38
		44.35
		<u>6000</u>
		15.65
		<u>15.50</u>
		+ .15

1327.

8	34	27
	2	25.55
8	32	01.45
12	48	03.19
19	43	58.26
	3	13.95
		44.31
		<u>6000</u>
		15.69
		<u>15.50</u>
		+ .19

- 5 gr for 1/2 -.14  
+ .05

Sig. No. Error.

oct. 4<sup>th</sup>

1327 -

23	26	54
	24	26.3
23	24	27.7
12	51	59.75
10	32	27.95
	1	43.00
		44.35
		<u>6000</u>
		15.65
		<u>15.50</u>
		+ .15

1327 = 191

21	50	44.00
	2	26.27
21	48	17.73
12	51	59.75
8	56	17.98
	1	27.85
	54	50.13
		<u>6000</u>
		9.87
		<u>15.50</u>
		- .5.63

Sig. 191.



150

Oct. 5

$\underline{1327}$   
 22 15 40  
       2 27.30  
 22 13 12.70  
 12 55 56.31  
   9 17 16.39  
       1 31.39  
       45.00  
       6000  
       15.00  
       15.50  
       - .50

+1 gr.

$1327 = 191$   
 17 4501 = 00  
       2 27.42  
 17 42 33.58  
 12 55 56.31  
   4 46 37.27  
       0 46.93  
       50.34  
       6000  
       09.66  
       15.50  
       - 5.84

$\underline{1327}$   
 9 7 37  
       2 27.80  
 9 5 09.20  
 12 55 56.31  
 20 09 12.89  
       3 18.49  
       44.78  
       6000  
       15.22  
       15.50  
       - .28  
 +10 gr for  $\frac{1}{2}$  h +27  
                     - .01

Sig. No. Error.

Oct. 6.

$\overline{1327.}$   
 19 40 11  
 2 28.83  
 19 37 42.17  
 12 59 52.84  
 6 37 49.33  
 1 05.18  
 44.15  
 6000  
 15.85  
15.50  
 +.35

-1 gr.

1327  
 9 13 25  
 2 29.55  
 9 10 55.45  
 12 59 52.84  
 20 11 02.61  
 3 18.39  
 44.22  
 6000  
 15.78  
15.50  
 +.28

-10 gr. = .28

+.01 Sig. No. Error.

Oct. 7.

1327 - 1/3  
 0 24 55  
 2 30.05  
 0 22 24.95  
 13 03 49.39  
 11 18 35.56  
 1 51.10  
 44.46  
 6000  
 15.54  
15.50  
 +.04

9 7 21  
 2 30.50  
 9 4 50.50  
 13 03 49.39  
 20 01 01.11  
 3 16.75  
 44.36  
 6000  
 15.64  
15.50

avg 1327 = +.14

subtracing 394 = .00

mean = + .07

Sig. No. Error.



Oct. 8

$$\begin{array}{r}
 1327 \\
 20 \quad 10 \quad 10 \\
 2 \quad 30.9 \\
 20 \quad 07 \quad 39.1 \\
 73 \quad 07 \quad 45.95 \\
 6 \quad 59 \quad 53.15 \\
 1 \quad 08.70 \\
 44.45 \\
 6000 \\
 15.55 \\
 \hline 15.50 \\
 +.05
 \end{array}$$

$$\begin{array}{r}
 1327. - 1/3 \\
 10 \quad 3 \quad 27 \\
 2 \quad 31.48 \\
 10 \quad 00 \quad 55.52 \\
 13 \quad 07 \quad 45.95 \\
 20 \quad 53 \quad 09.57 \\
 3 \quad 25.29 \\
 44.47 \\
 44.30 \\
 6000 \\
 15.70 \\
 \hline 15.50 \\
 +.20 \\
 -10 \log \frac{2}{3} = -.18 \\
 +.02 \\
 \text{Sig. No. Em.}
 \end{array}$$

$$\begin{array}{r}
 1327 = 191 \\
 19 \quad 28 \quad 10 \\
 2 \quad 30.88 \\
 19 \quad 25 \quad 39.12 \\
 13 \quad 07 \quad 45.95 \\
 8 \quad 17 \quad 53.17 \\
 1 \quad 08.70 \\
 51.27 \\
 6000 \\
 8.73 \\
 \hline 15.50 \\
 - 6.77
 \end{array}$$

$$\begin{array}{r}
 1327 = 191 \\
 10 \quad 26 \quad 38 \\
 2 \quad 31.45 \\
 10 \quad 24 \quad 06.55 \\
 13 \quad 07 \quad 45.95 \\
 21 \quad 16 \quad 20.60 \\
 3 \quad 29.10 \\
 51.50 \\
 6000 \\
 8.50 \\
 \hline 15.50 \\
 \text{Em. } 191 = - 7.00 \\
 5.84 \\
 \sqrt{1.161} \\
 1.0 \\
 3 \overline{) 1.06} \\
 .35
 \end{array}$$



Oct. 9.

$\overline{1327.}$   
 8 47 12  
 2 32.5  
 8 44 39.5  
 13 11 42.50  
 19 32 57.06  
 3 12.16  
 44.84  
 60.00  
 15.16  
 15.50  
 — 34  
 + .10 by Howard 191  
 .00 .. Bond 394  
 .44

mean  $\frac{.15}{+.146}$  .00 Fig. No. Error.  
 + 109 for  $\frac{1}{2}k$

Oct. 10

$\overline{1327.}$        $\overline{1327.}$   
 19 24 57      10 2 21  
 2 32.98      2 33.50  
 19 22 24.18      9 59 47.50  
 13 15 39.06      13 + .15 39.06  
 6 06 45.04      20 44 08.44  
 1 00.08      3 23.84  
 44.06      44.60  
 60.00      60.00  
 15.94      15.40  
 15.50  
 + .44

154

Oct. 12

$1327$   
 22 35 22  
     2 35.4  
 22 32 46.6  
 13 23 32.16  
   9 9 14.44  
     1 30.00  
     44.44  
     6000  
     15.56  
     15.50  
     +.06

$1327 = 191$   
 $+1/4$   
 21 1 14  
     2 35.82  
 20 58 38.68  
 13 23 32.16  
   7 35 6.52  
     1 14.62  
     11.90  
     6000  
     8.10  
     15.50  
 $191 = -7.40$

$1327 + 1/2$   
 8 31 00  
     2 36.00  
 8 28 24.00  
 13 23 32.16  
 19 04 51.84  
     3 7.62  
     44.22  
     60.00  
     15.78  
     15.50  
     +.28  
 - 592th - -77  
     +.01  
 Sig. No Error

Oct. 13

1327

0 6 34  
 2 36.10  
 0 3 57.90  
 13 27 28.71  
 10 36 29.19  
 1 44 .30  
 44.89  
 6000  
 15.11  
15.50  
 - .39

+191

1327 = 191

22 9 22  
 2 36.00  
 22 6 46.00  
 13 27 28.71  
 8 39 17.29  
 1 25.10  
 52.19  
 60.00  
 10.00 7.81  
 15.50  
 191 = - 7.69

1327 - 1/2

8 55 01  
 2 36.25  
 8 52 24.75  
 13 27 28.71  
 19 2.4 56.04  
 3 10.75  
 45.29  
 6000  
 14.71  
15.50

+191 - .79

191 1 - .50  
 - .60

+159112 = +.50

- .06

Sig. No. Emr.



156

Oct. 14

1527  
 9 25 02  
     2 37.15  
 7 22 34.85  
 13 31 25.27  
 19 51 09.58  
     3 15.17  
     44.41  
     6000  
     15.59  
     15.50  
     +.09  
     .00

Mean: +04

Sig. No. Error.

1321 = 191  
 8<sup>h</sup> 4<sup>m</sup> 57<sup>s</sup>  
     2 37.10  
 8 2 20.90  
 13 31 25.27  
 18 30 55.63  
     3 2.01  
     53.62  
     6000  
     6.38  
     15.50  
 191 = - 8.12

Oct. 15

23 54 24  
     2 37.60  
 23 51 46.40  
 13 35 21.82  
 10 06 24.58  
     1 40.88  
     43.70  
     6000  
     16.30  
 something wrong, 15.50  
     +.80

1327 1/2  
 9 08 1  
     2 38.10  
 9 35 22.90  
 13 35 21.82  
 20 00 01.08  
     3 16.66  
     44.42  
     6000  
     15.58  
     15.50  
     +.08  
     .00  
     +04

Sig. No. Error.

Oct. 16

1327 + 1/2

10 21 5

2 39.10

10 18 2590

13 39 18.38

20 39 07.52

3 23.07

44.45

6000

15.55

15.50

+0.05

Sig. No. Sign.

Oct. 17

1327

9 56 58

2 40.00

9 54 17.90

13 43 14.93

20 11 2.97

3 18.40

44.57

6000

15.43

15.50

-0.07

Sig. No. Sign.

158

oct. 18.

1327

21 29 52

2 40.55

21 27 11.45

13 47 11.49

7 39 59.96

1 15.36

44.60

60.00

15.40

15.50

-1.10

oct. 19

1327-1/3

9 43 50

~~13 51 07.05~~

2 42.4

9 41 7.6

13 51 08.05

19 49 59.55

3 14.90

44.65

60.00

15.35

15.50

-1.15

.85

mean - .08

Sig. Ho Error.



Oct. 20.

1327 -  
 23 29 06  
 2 43.4<sup>15</sup>  
 23 26 22.6  
 13 55 04.61  
 9 31 17.99  
 1 23.75  
 44.24  
 6000  
 15.76  
 15.50  
 +.26  
 15  
 Sum 394 +.11  
 .00

mean 4.05

Sig. No. Error.

Oct. 21

1327  
 21 13 41  
 2 44.1  
 21 10 56.9  
 13 59 01.17  
 7 11 55.73  
 1 10.73  
 4500  
 6000  
 15.50  
 15.50  
 - 15.50

- 290.

1327 = 191

21 53 59  
 2 43.3  
 21 51 15.7  
 13 55 04.6  
 7 56 11.1  
 1 18.02  
 53.08  
 60.00  
 6.92  
 15.50  
 191 - 8.58  
 20  
 191 - 8.78

1327

14 43 46  
 2 43.82  
 14 41 02.18  
 13 59 01.17  
 0 42 01.01  
 6.88  
 54.13  
 6000  
 5.87  
 15.50  
 - 9.67

10 37 54  
 2 44.7.6  
 10 35 09.3  
 13 59 01.17  
 20 36 8.13  
 3 22.55  
 45.58  
 6000  
 14.42  
 14.52  
 15.50  
 - .98

The error of  
 394 had the  
 same sign.  
 The coming  
 comparison.

+ 40% for 50 +.90  
 -.08  
 Sig. No. Error.

160

Oct. 22

1327

21 20 39

2 45.05

21 17 53.95

14 02 57.73

7 14 56.22

1 11.30

44.92

6000

15.08

15.00

-.42

-.32

+ 1 gr.

1327

9 54 43

2 45.6

9 51 57.4

14 02 57.73

19 48 59.67

3 14.80

44.87

6000

15.13

15.50

-.37

.37

.00

74

mean = .25

+ 10 gr. for 1 h

+.27

+.02

Sig. No Error.

Oct. 23.

1327

19 45 20

2 46.40

19 42 33.60

14 06 54.29

5 35 39.31

0 55.00

44.31

6000

15.69

15.50

+.19

1327 = 191

11 58 14.00

2 47.3

11 55 26.7

14 06 54.29

21 48 32.31

3 34.36

57.95

6000

+2.05

15.50

191 - 12.45

1327

10 21 44

2 47.3

10 18 56.7

14 06 54.29

20 12 2.41

3 18.50

43.91

6000

16.09

15.50

+.59

.00

.30

.79

+.26

- 10 gr. for 1 h

-.27

Sig. No Error.



Oct. 24.

1327  
 0 41 6  
 2 48.25  
 0 38 17.75  
 14 10 50.85  
 10 27 26.90  
 1 42.80  
 44.10  
 6000  
 15.90  
 15.50  
 +.40  
 -1 gr.

1327 -1/2  
 10 3 39  
 2 48.80  
 10 0 50.20  
 14 10 50.85  
 19 49 59.35  
 3 14.85  
 44.50  
 6000  
 15.50  
 15.10  
 +1 gr.  
 Sig. No Error

Oct. 26

1327 -1/2  
 0 4 54  
 2 49.8  
 0 2 04.2  
 14 18 43.97  
 9 43 20.23  
 1 35.48  
 44.75  
 6000  
 15.25  
 15.50  
 - .25

1327 -1/2  
 10 43 39  
 2 50.35  
 40 48.65  
 18 43.97  
 20 22 04.68  
 3 20.10  
 44.58  
 6000  
 15.42  
 15.50  
 - .08

+log for 1/2 h +14  
 +.06  
 Sig. No Error



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Oct 27.

1327 + 1/2			1327 <sup>-1/4</sup> ~ 191			1327.		
2	54	29	0	45	9	10	20	32
	2	51.00		2	50.15		2	51.60
21	51	38.00	0	42	18.85	10	18	40.40
14	22	40.43	14	22	40.47	14	22	40.47
7	28	57.53	10	19	38.38	19	54	59.93
	1	13.66		1	41.43		3	15.75
		43.93			56.95			44.18
		60.00			60.00			60.00
		16.07			3.05			15.82
		15.100			15.50			15.50
		+57			12.45			4.32

- 2 grammes.

add 2 gr.

- 109 gr 1<sup>h</sup> - 27  
 - 05  
 Sig. No. 1000.

Oct. 28

1327. + 1/2		
9	41	22
	2	51.80
9	38	39.20
14	26	37.03
19	11	53.17
	3	8.96
		44.41
		60.00
		15.09
		15.00
		+0.09
		Sig. No. 1000.

oct. 29

	1327		1327 = 191	
0	54 52		22 18 38	00 23 45.1
	2 50.4		2 50.25	22 20 8 = 1327
0	52 01.6		22 15 47.75	2 50.25
14	30 33.59		14 30 33.59	17.75
10	21 28.00		7 45 14.16	00.00
	1 41.86		1 16.20	-17.75
	46.15		52.96	
	60.00		60.00	
	13.85		2.04	
	15.00		15.50	
	-1.65		-13.46	

+ 5 gr.

	1327		1327 = 191		3451 = 00 <sup>5</sup>
10	31 25		9 58 33		1327 = 9 30 7.85
	2 50.4		2 50.32		2 50.22
10	28 34.6		9 55 42.68		3451 - 17.53
14	30 33.59		14 30 33.59		
19	58 01.01		19 24 09.09		
	3 16.26		3 10.86		
	44.75		58.23		
	60.00		60.00		
	15.25		1.77		
	15.00		215.50		
	-25		13.73		
	.00				

+ 1 gr. for 2 h

- .12 Mean.

+ .06

Min. 5 gr.

- .06 Sig. Min.



Oct. 30

 $1327 + \frac{1}{3}$ 

1 17 50

2 50.32

1 14 59.68

14 34 30.15

10 40 29.53

1 44.97

44.56

6000

15.44

15.50

-06

 $1327.$ 

10 47 23

2 50.4

10 44 32.6

14 34 30.15

20 10 02.45

3 18.18

44.27

6000

16.73

15.50

+23

 $-10 \log \frac{2}{3}$ 

-18

+05

 $1327 = 191$ 

13 37 5

2 50.04

13 34 14.96

14 34 30.15

22 59 44.81

3 46.03

58.78

6000

1.22

15.50

58.78 - 14.28

 $\left\{ \begin{array}{l} 1327 = 13 40 5^3 \\ 3457 = 00^5 \end{array} \right.$ 

13 40 5

2 50.04

13 37 14.96

00.00

3457 - 14.96



Oct. 31

1327 -1/3

1327

ΦW

0 50 41

2 49.9

0 47 57.1

14 28 26.69

10 09 24.41

1 39.80

44.61

60.00

15.89

15.50

-11

$$13 \overset{h}{\sim} 40 \overset{s}{\sim} 5 = 3451$$

$$\begin{cases} 3451 = 0 \overset{s}{\sim} \\ 1327 = 13 \overset{h}{\sim} 40 \overset{s}{\sim} 5 \end{cases}$$

11 33 26

2 49.8

11 30 38.2

14 38 26.69

20 52 09.51

3 25.11

44.40

60.00

15.60

15.50

+10

It was decided that after Nov. 1<sup>st</sup> the 10 am. signal would be discontinued, as there has only been two days for over a year when any error has been sent.

Frank W. Waldo

1879.  
166

Nov. 1

1327. -  $\frac{1}{3}$ 

F.W.

1 13 40

2 49.7

1 10 50.3

14 42 23.25

10 28 27.05

1 42.85

44.20

60.00

15.80

15.50

+ 30

Nov. 2

1327 +  $\frac{1}{4}$ 

22 8 5

2 49.6

22 5 15.4

14 46 19.80

7 18 55.80

1 11.92

43.68

60.00

16.32

15.50

+ .82

1327  $\frac{1}{2}$ 

10 39 8

249.4

10 36 18.6

14 46 19.80

19 49 58.80

3 14.95

43.85

60.00

16.15

15.10comp.  
H-B=14.6 + .65

H - .40

mean + .10

\*1928 - .06

+ .04 at 22<sup>h</sup> = M.J.

Nov. 3  $\frac{f}{11}$ 

$$\begin{array}{r}
 236 \overset{+55}{=} 394 \\
 8 \quad 44 \quad 38 \\
 \quad \quad 40.55 \\
 8 \quad 43 \quad 57.45 \\
 14 \quad 50 \quad 16.36 \\
 17 \quad 53 \quad 41.09 \\
 \quad 2 \quad 55.90 \\
 \quad \quad 45.14 \\
 \quad \quad \underline{6000} \\
 \quad \quad 14.81 \\
 \quad \quad \underline{15.50} \\
 \quad \quad - .69 \\
 + 59 \text{ for } \frac{h}{4} = + .66 \\
 \quad \quad - .08 \text{ at } 22^{\text{th}} \text{ m.J.}
 \end{array}$$

$$B-H = 14.25 \text{ comp.}$$

$$H = -14.95 \text{ at } 18^{\text{th}} \text{ m.J.}$$

$$\begin{array}{r}
 95 \\
 41.25 \\
 \hline
 41.25 + .16
 \end{array}$$

Nov. 4

$$\begin{array}{r}
 1327 + \frac{1}{2} \\
 1 \quad 13 \quad 25 \\
 + 2 \quad 46.82 \\
 1 \quad 10 \quad 38.18 \\
 14 \quad 54 \quad 12.91 \\
 10 \quad 16 \quad 25.27 \\
 \quad 1 \quad 41.08 \\
 \quad \quad 44.20 \\
 \quad \quad 6000 \\
 \quad \quad 15.80 \\
 \quad \quad \underline{15.50} \\
 \quad \quad + .30
 \end{array}$$

$$\begin{array}{r}
 1327 + \frac{1}{4} \\
 10 \quad 50 \quad 09 \\
 \quad 2 \quad 46.45 \\
 10 \quad 48 \quad 12.58 \\
 14 \quad 54 \quad 12.91 \\
 19 \quad 53 \quad 59.64 \\
 \quad 3 \quad 15.60 \\
 \quad \quad 44.04 \\
 \quad \quad 6000 \\
 \quad \quad 15.96 \\
 \quad \quad \underline{15.50} \\
 \quad \quad + .46 \\
 191 \quad - .10 \\
 \quad \quad 4.17 \\
 - 59 \text{ for } \frac{h}{4} = - .10 \\
 \quad \quad \underline{+ .3}
 \end{array}$$



168

Nov. 5

$1327 + 14$   
 0 40 15  
 2 44.7  
 0 37 30.3  
 14 57 9.47  
 9 40 20.83  
 1 35.10  
 45.73  
 6000  
 14.27  
15.50  
 -1.23

+ 4 gr.

$1327$   
 10 57 55  
 2 44.25  
 10 55 10.75  
 14 57 9.47  
 19 58 01.28  
 3 16.28  
 45.00  
6000  
 15.00  
15.50  
 - .50  
.25

allanys 34  
 range + 60 ft + 27  
 + .02 at 22<sup>nd</sup> M.J.

Nov. 6

1327 + 1/2

11 12 52

2 43.10

11 10 08.90

15 2 6.02

20 8 2.88

3 18.00

44.88

60.00

15.12

15.50

-.38

.00

means -19.

+1090.  $\frac{1}{5}$ h +18-.01 at 22<sup>h</sup> m J.

Nov. 7

1327

2 11 18

2 42.2

2 8 35.8

15 6 2.58

11 2 33.22

1 48.53

44.69

60.00

15.31

15.50

-.19

1327 - 1/2

11 13 46

2 47.5

11 9 04.25

15 6 2.58

20 3 01.67

3 17.00

44.67

60.00

15.33

15.50

-.17

+1091<sup>h</sup> +14

-.03

at 22<sup>h</sup> m J.



170

Nov. 9

1327				1327 + 1/4			
0	31	50	2 42.2	11	6	34	00 = 34.51
	2	39.7	2.5		2	37.4	10 40 38.7 = 12.1
0	29	10.3	191 = 1327		3	56.6	
15	13	55.69	10 28 05.6	11	13	55.69	
9	15	14.61	15 13 55.69	19	50	00.91	
	1	30.92	19 14 09.91		3	14.95	
		43.69	3 9.10			46.00	
		60.00	00.81			60.00	
		16.31	15.50			44.00	
		15.50	191 = 16.31			15.50	
		+ .81				- 1.50	
- 2 gr.				+ 40 gr 1/4 + 1.30			
				+ 10 gr 2/5 + .18			

- .02 at 22<sup>h</sup> 14<sup>m</sup> J

Nov. 10

1327				1327			
1	9	50	11 2 5 30	10	29	37	10 34 35.30 = 27
	2	36.24	2 35.62		2	35.69	
1	7	13.76	11 22 54.38	10	25	01.8	
15	17	52.24	15 17 52.24	15	17	52.24	
9	49	21.52	20 05 02.14	19	07	09.16	
	1	36.60	3 17.41		3	7.93	
		44.92	44.73			58.77	
		60.00	60.00			61.23	
		15.08	15.27			60.00	
		15.02	15.50			- 1.23	
		- .42	- .23			15.50	
+ 1 gr.				+ 10 gr 1/4 = + 2.7			
				+ .04			
				at 22 <sup>h</sup> 14 <sup>m</sup> J.			



Nov. 11

1327

11 17 23

2 34.05

11 14 48.95

15 21 48.80

19 53 00.15

3 15.44

44.71

6000

15.29

15.50

- .21

.00

mean - .10

+59.16

+14

+0.4 at 22<sup>h</sup> m. J.

Nov. 12

1327 - 1/2

10 53 14

2 32.55

10 50 41.45

15 25 45.35

19 24 56.10

3 10.74

45.36

6000

14.64

15.50

- .86

191 - .50

13.6

mean - .68

+107.46 +63

- .05

at 22<sup>h</sup> m. J.

172

Nov. 13.

1327.

"	28	14
	2	31.12

"	25	42.88
---	----	-------

15	29	41.91
----	----	-------

19	56	00.97
----	----	-------

	3	15.99
--	---	-------

		45.00
--	--	-------

		<u>60.00</u>
--	--	--------------

		15.00
--	--	-------

		<u>15.50</u>
--	--	--------------

		-.50
--	--	------

		+ .09 <sup>h</sup> + .54
--	--	--------------------------

+ .04 at 22<sup>h</sup> M.S.

Nov. 14

"	40	10 + $\frac{1}{4}$
---	----	--------------------

	2	29.60
--	---	-------

"	37	40.40
---	----	-------

15	33	38.47
----	----	-------

20	04	01.93
----	----	-------

2	3	17.30
---	---	-------

		44.63
--	--	-------

		60.00
--	--	-------

		15.87
--	--	-------

		<u>15.10</u>
--	--	--------------

		-.13
--	--	------

		<u>.00</u>
--	--	------------

-.07 at 22<sup>h</sup> M.S.

Nov. 15

1327  
 12 57 18  
 2 28.85  
 12 54 49.65  
 15 37 35.03  
 21 17 14.62  
 3 29.30  
 45.32  
 6000  
 14.68  
 15.50  
 - .82

Nov. 16

1327 - 1/2	1327 = 191
" 35 59 2 27.0	" 35 59 2 28.10
11 33 32.0	11 33 30.90
15 41 31.58	15 41 31.58
19 52 00.42	19 51 59.32
3 15.20	3 15.20
45.22	44.12
6000	6000
14.78	15.88
15.50	15.50
mag. .72	+ .38
	-109 1/4 - .36
	+ .02 at 22 <sup>h</sup>

  

13 38 39 2 27.85	3451 = 00 1327 13 50 21.8
13 36 11.15	
15 41 31.58	
21 54 39.57	
3 35.37	
4.20	
15.50	
-19.70	
06	
(191) = -19.76	



174

Nov. 17

$1327 + \frac{1}{2}$   
 0 55 10  
 2 27.57  
 0 52 42.43  
 15 45 28.14  
 9 7 14.29  
 1 29.73  
 44.46  
 6000  
 15.54  
 15.50  
 +.04  
 $1327 = 1^h 0 20.95$   
 $3451 = \text{ov.}$

 $1327 = 191$ 

0 50 29  
 2 27.57  
 0 48 01.43  
 15 45 28.14  
 9 02 33.29  
 1 28.87  
 4.42  
 15.50  
 $(191) - 19.92$   
 19.76  
 $+21.16$   
 $= .32 \text{ daily rate } 191$

 $1327$ 

12 51 12+  
 12 57 8  
 2 27.3  
 12 54 40.8  
 15 45 28.14  
 24 9 12.66  
 3 28.00  
 27.96  
 44.66  
 6000  
 15.34  
 15.50  
 -16  
 .00  
 at 22<sup>h</sup> m. J.  
 mean - .08

Nov. 18.

$1327 + \frac{1}{3}$   
 22 38 43  
 2 27.0  
 22 36 16.0  
 15 49 24.69  
 6 46 51.31  
 1 6.70  
 44.61  
 6000  
 15.39  
 15.50  
 - .11

 $1327$ 

12 57 3  
 2 26.65  
 12 54 36.35  
 15 49 24.69  
 21 5 11.66  
 3 27.26  
 44.40  
 6000  
 15.60  
 15.50  
 +.10  
 .00  
 +.05 at 22<sup>h</sup>

Nov. 19

$1327 + \frac{1}{3}$   
 11 44 46  
     2 26.05  
 11 42 19.95  
 15 53 21.25  
 19 48 58.70  
     3 14.83  
     43.87  
     60.00  
     16.13  
     15.50

1327 + .63

191 .00

394 .00

mean .21

$-10 \log l^h$        $-27$   
                                 
                     -0.6 at 22.  $^h$

Nov. 20.

$1327 + \frac{1}{2}$   
 23 35 42  
     2 25.85  
 23 33 16.15  
 15 57 17.81  
 7 35 58.34  
     1 14.74  
     43.60  
     60.  
     16.40  
     15.50  
     + .90

Comp B-H = 21.0

Comp B-H = 20.95

B = -1.5

.00

-0.7 at 22  $^h$



176

Nov. 21.

$$236 = 394$$

$$23 \ 11 \ 35 = 7 \ 9 \ 00$$

$$25.44$$

$$23 \ 11 \ 09.56$$

$$16 \ 01 \ 14.87$$

$$7 \ 09 \ 55.19$$

$$1 \ 10.44$$

$$44.75$$

$$6000$$

$$15.25$$

$$15.50$$

$$-25$$

+ 1 gr.

$$1327$$

$$12 \ 50 \ 45$$

$$2 \ 22.20$$

$$12 \ 48 \ 22.80$$

$$16 \ 01 \ 14.37$$

$$20 \ 47 \ 08.43$$

$$3 \ 24.23$$

$$44.20$$

$$6000$$

$$15.80$$

$$15.50$$

$$\text{by } 1327 = +.30$$

$$\text{by } H.191 \quad +.10$$

$$\text{mean } +.20$$

$$-3 \text{ gr for } 10^{-11}$$

$$+.09 \text{ at } 22^{\text{h}} \text{ M.T.}$$

$$23 \ 14 \ 22.6 = 236$$

$$23 \ 16 \ 20 = 1327$$

$$57.6$$

$$55.$$

$$23 \ 16 \ 20$$

$$2 \ 22.86$$

$$23 \ 13 \ 57.14$$

$$23 \ 14 \ 22.60$$

$$236 = +25.44$$

$$\begin{array}{r} 19.92 \\ 4 \overline{) 1.23} \quad \text{ratio of } 191. \\ \underline{12} \quad 3 \end{array}$$



Nov. 23.4

L. 1327	3 <sup>h</sup>	9 <sup>m</sup>	17.5
	—	2	21.2
	3	6	55.8
	16	9	7.5
	10	57	48.3
		1	47.8
	10	56	0.5
B 394	10	56	16.0
			15.5

Nov 24. 1479

394 ran down at—  
 Mr. Astor set 394 16.1° fast at 3<sup>h</sup> 8<sup>m</sup> M.T. (Cray)

Nov. 24.

$1327 + \frac{1}{3}$			$1327 = 191$		
20	30	51	16	32	33 = 00
2	19.60		2	19.86	
20	28	31.40	16	30	13.14
16	13	04.03	16	13	04.03
4	15	27.37	0	17	09.11
0	41.90		0	2.80	
	45.47			6.31	
	61.00			15.50	
	14.53			21.81	
	15.50				
	- .97				

$1327 - \frac{1}{3}$			$1327 - \frac{1}{2}$			$1327 = 191$		
13	1	30	13	25	34	10	54	32
2	18.60		2	18.90		2	19.17	
12	59	17.40	13	23	15.10	10	52	12.83
16	13	04.03	16	13	04.03	16	13	04.03
20	46	07.37	20	10	11.07	18	39	8.80
			3	28.05		2	3.32	
				43.02			5.48	
							15.50	
							- 21.0	



Nov. 24.

1327.

394

14 18 43 = 22 00

2 19.00

14 16 24.00

16 13 04.03

20 03 19.97

3 36.90

43.07

6000

16.97

15.50

+1.47

-10gr.

I found there was something wrong with the clock 394 this morning, but did not detect until 21h 50<sup>m</sup> that Mr. Astor in setting the clock had set it 2 minutes fast. So I set the clock as it should be and after comparing it found

it was 1.47<sup>s</sup> fast as shown above.

Nov. 25

Frank Naldo

1327 = 1/2

1327 + 1<sup>m</sup> 394

20 58 49

21 9 51 = 4 50

2 18.51

2 18.51

20 56 34.49

21 7 32.49

16 17 00.59

16 17 00.59

4 39 33.90

4 50 31.90

0 47.75

44.25

60.00

15.75

15.50

+1.25

m = 9 gr.



180

D

Nov. 25

1327 - V<sub>12</sub>

13 7 27

2 16.05

13 5 10.95

16 17 00.59

20 48 10.36

3 24 48

45.98

60.00

14.12

15.10

-1.88

+10 gr for 2 h. + .54

1327

13 7 27

2 16.60

13 5 10.40

16 17 00.59

20 48 9.94

3 24.48

45.33

60.00

14.67

15.10

- .83 This comp. must have been lost.

Nov. 26.

1327  
 20 27 38  
 2 16.30  
 20 25 21.70  
 16 20 57.15  
 4 04 24.55  
 0 40.00  
 44.55  
 60.00  
 15.45  
 15.50  
 .05

1327  
 13 48 26  
 2 14.48  
 13 46 11.52  
 16 20 57.15  
 21 25 44.37  
 3 30.52  
 43.85  
 60.00  
 16.15  
 15.50  
 + .65  
 - 1 gr.

Nov. 27

1327  
 13 9 13  
 2 12.33  
 13 7 00.67  
 16 24 53.71  
 20 42 06.96  
 3 23.40  
 43.56  
 60.00  
 16.44  
 15.50  
 + .94  
 00  
 mean: 47  
 - 27 for 2<sup>h</sup> - .54  
 -.07 at 22<sup>3</sup>/<sub>4</sub>

Nov. 28

1327.  
 21 57 39  
     2 11.52  
 21 55 27.48  
 16 28 50.26  
   5 26 37.22  
       53.57  
      43.65  
      60.00  
      16.35  
      15.50  
      +.85  
 for snuff rate - .70  
                  +.15

1327  
 12 29 00  
     2 9.33  
 12 26 50.67  
 16 28 50.26  
 19 58 00.41  
     3 16.20  
      44.21  
      60.00  
      15.79  
      15.50  
      +.29  
      394 .00  
      mean +.14  
       $\frac{+109}{-109} \frac{1}{12}$   $\frac{-.14}{.00}$  at 22<sup>h</sup>

1327  
 12 29 00  
     2 10.02  
 12 26 49.98  
 16 28 50.26  
 19 57 59.72  
     Wong. 3 16.20  
              43.52  
              60.00  
              16.48  
              15.50

14  
10.3  
 412  
103  
 1442  
 6  
1.50  
 10.83  
 +2 09.33



Mr. 29.

1327  
13 - 29 3  
2 06.60

13 26 56.40

16 32 46.82

20 54 09.58

3 25.40

44.18

~~6000~~

15.82

15.50

+.32

rem. 195.10 = 9 gr.

1327.

12 31 47  
2 04.09

12 29 42.81

00 = 3451

12 0 56.75 = 1327.

2 06.70

11 58 50.05

1327.

12 31 47  
2 03.74

12 29 43.26

16 36 43.38

19 52 59.88

3 15.40

44.48

~~6000~~

15.52

15.50

+.02 at 22

+ 1 gr.

Dr = 10 gr.



Dec. 3

1327  
 21 59 04  
 1 55.85  
 21 57 08.15  
 16 48 33.05  
 5 08 35.10  
 0 50.58  
 44.52  
 6000  
 15.48  
 15.10  
 -0.02

1327  
 13 46 38  
 1 53.71 54.42  
 13 44 44.29  $\frac{71}{718}$   
 16 48 33.05  
 20 56 11.24  
 3 25.85  
 45.39  
 6000  
 14.61  
 15.50  
 - .89  
 + 71 Enclav.  
 - .18  
 + 591<sup>h</sup> + .14  
 - .04 at 22<sup>h</sup>

Dec. 4.

1327  
 1 27 31  
 1 53.12  
 1 25 37.88  
 16 52 29.61  
 8 33 8.27  
 1 24.00  
 44.27  
 6000  
 15.73  
 15.00  
 +.23

1327 - 1/2  
 12 48 21  
 1 51.67  
 12 46 29.33  
 16 52 29.61  
 19 53 59.72  
 3 15.00  
 44.22  
 6000  
 15.78  
 15.50  
 +.28



186

Dec. 5

1327-1/2

23 11 2

1 50.44

23 09 11.56

16 56 26.17

6 12 45.39

1 00.94

44.45

6000

15.55

15.50

+1.05

1327

13 55 25

1 48.75

13 53 36.25

16 56 26.17

20 57 10.08

3 25.92

44.16

6000

15.84

15.50

+1.34

+1.00

mean +1.17  
-10gr 32h -1.21

-0.4 at 22h

Dec. 7

1327-1/2

17 11 50

1 45.17

17 10 04.83

17 4 19.29

5 45.54

85

44.69

6000

15.31

15.50

-1.19

+1.9 at 5h 30m J.

1327.

13 10 4

1 42.71

13 8 21.29

17 4 19.29

20 4 02.00

3 17.28

44.72

6000

15.28

15.50

-1.22

+1.00

-1.1

Dec. 8

1327.

13	6	57
	1	39.60
13	5	17.40
17	8	15.84
19	57	01.56
	3	16.20
		45.36

0000

14.64

15.50

- .86

+ 14 gr.  $\frac{+78}{-08}$  abn. h. m. J.

Dec. 9

1327

0	43	49
	1	38.15
0	42	10.85
17	12	12.40
7	29	58.45
	1	13.68

44.77

60 00

15.23

15.50

- .27

+ 1 gr.

1327.

14	1	58
	1	36.60
14	0	21.40
17	12	12.40
20	48	09.00
	3	24.37

44.63

60 20

15.39

15.50

- .11

.00

Mean = - .05 abn. h.



Dec. 10.

1327  
 12 52 40  
 1 33.75  
 12 51 06.25  
 17 16 8.96  
 19 34 57.29  
 3 12.56  
 44.73  
 60.00  
 15.27

0. But the cl. is evidently fast a little bit.

Dec. 11

1327 -  $\frac{1}{2}$   
 2 0 48  
 1 31.09 .61  
 1 59 16.01  
 17 20 5.52  
 8 39 10.49  
 1 24.99  
 45.50  
 60.00  
 14.50  
 52  
 15.02  
 15.50  
 -48

1327  
 14 13 49  
 1 30.05  
 14 12 16.95  
 17 20 5.52  
 20 52 11.43  
 2 25.15  
 46.28  
 60.00  
 13.72  
 15.50

13  
 12  
 11  
 10  
 9  
 8  
 7  
 6  
 5  
 4  
 3  
 2  
 1

The rate of 1327 has  
 evidently changed.

added 10 gr for 1<sup>th</sup>  
 and 1 gr for —  
 added 4 gr at 24<sup>th</sup>



Dec. 12.

1327

0 24 30  
 1 29.92  
 0 53 00.08  
 17 24 2.07  
 7 28 58.01  
 1 13.65  
 44.41  
 60.00  
 15.59  
 15.50  
 +.09

rem 5 gr.

or 10 gr.

1327 -

H.W.

13 31 33  
 1 28.50  
 13 30 04.50  
 17 24 2.07  
 20 6 02.43  
 3 17.55  
 44.88  
 60.00  
 15.12  
 15.50  
 -.38  
 -.00  
 -.19

+10 gr.  $\frac{1}{4}$  + .27  
 +.08 at 22<sup>h</sup>.

Dec. 14.

1327

1 38 23  
 1 24.50  
 1 36 58.40  
 17 31 55.19  
 8 5 03.31  
 1 19.35  
 43.86  
 60.00  
 16.04  
 15.50  
 +.54

rem 1 gr.

1327.

13 23 17  
 1 23.17  
 13 21 53.83  
 17 31 55.19  
 19 49 58.64  
 3 14.90  
 43.74  
 60.00  
 16.26  
 15.50  
 +.76  
 +.38

-100 gr for  $\frac{1}{4}$  h. = -.04  
 +.04 at 22<sup>h</sup>.

90

Dec. 15.

1327  
 2 2 20  
 1 20.75  
 2 0 59.25  
 17 35 51.75  
 8 25 07.50  
 1 22.70  
 44.80  
 60 00  
 15.20  
15.50  
 -.30

+1 gr.

1327  
~~+ 19 17~~  
 13 49 14  
 1 19.17  
 13 47 54.83  
 17 35 51.75  
 20 12 03.08  
 3 18.40  
 44.58  
 60 00  
 15.42  
15.50  
 -.08 ab. 2<sup>h</sup>

Dec. 16

1327 +  
 3 8 23  
 1 16.85  
 3 7 06.15  
 17 39 48.31  
 9 27 17.84  
 1 32.96  
 44.88  
 60 00  
 15.12  
15.50  
 -.38

n=11 gr.

1327  
 14 30 13  
 1 15.08  
 14 28 57.92  
 17 39 48.31  
 20 49 09.61  
 3 24.66  
 44.95  
 60 00  
 15.05  
15.50  
 -.45 n=11 gr.  
 depends on 394 n=11 gr.  
 subtraction 1327



Dec. 17.

	1327	
0	54	54
	1	13.85
0	53	40.15
17	43	44.87
7	9	55.28
	1	10.31
		44.97
		60.00
		15.03
		15.50
		-.47

+2 gr.

m=12 gr.

1327

F.W.

14	40	7
	1	12.07
14	38	54.93
17	43	44.87
20	55	10.06
	3	25.55
		44.51
		60.00
		15.49
		15.50
		-.01 at 22 <sup>h</sup>

-1 gr.

m=11 gr.

Dec. 18.

	1327 + 1/4	
4	8	17
	1	9.87
4	7	7.13
17	47	41.42
10	19	25.71
	1	41.48
		44.23
		60.00
		15.77
		15.50
		+.27

-1 gr.

1327

14	52	1
	1	8.17
14	50	52.83
17	47	41.42
21	3	11.41
	3	26.91
		44.50
		60.00
		15.50
		15.50
		.00 at 22 <sup>h</sup>

put in 1 gr.

m=11 gr.



Dec. 19

1327 + 1/3

13 56 44

1 4.50

13 55 39.50

17 51 37.98

20 4 01.52

3 17.30

44.22

60.00

15.78

15.50

$\begin{array}{r}
 +.28 \\
 - .27 \\
 \hline
 .01 \text{ at } 22^{\text{h}} \\
 +.18
 \end{array}$

Dec. 21

1327

18 52 26

1 01.90

18 51 24.10

17 59 31.10

0 51 53.00

8.52

44.48

60.00

15.52

15.50

+.02

1327 + 2/3

14 0 32

59.53

13 59 32.47

17 59 31.10

20 00 01.37

3 16.70

44.67

60.00

15.33

15.50

-.17

.06-.08 at 22<sup>h</sup> m J.

Dec. 22.

1327

13	57	25	
		59.60	57.60
13	56	28.40	27.40
18	3	27.66	27.60
19	53	09.74	59.80
	33		15.50

44.30

60.00

15.70

15.50

+ 20

-12 -109.74<sup>h</sup> - 27. ...  
-07

Dec. 23.

1327+

1	24	17	
		57.90	
1	23	19.10	
18	07	24.22	
7	15	54.88	
	1	11.42	
		43.46	
		60.00	
		16.54	
		<u>15.00</u>	
		+ 1.04	
		- .06	
		+ .98	

- 3

n=7

1327

14	16	23 - 1/2	
		56.80	
14	15	26.20	
18	07	24.22	
20	8	01.98	
	3	17.80	
		44.18	
		60.00	
		15.82	
		<u>15.50</u>	
		+ .32	
		+ .00	
		+ .16	
		-109.74 <sup>h</sup> - 14	
		.02	

194

Dec. 24

1327

15 11 27

54.70

15 10 32.30

18 11 20.77

20 59 11.53

3 26.35

45.18

60.00

14.82

15.50

- .68

+ 1 gr.

Dec. 25

1327

13 52 8

53.13

13 51 14.87

18 15 17.33

19 35 57.54

3 12.65

44.89

60.00

15.11

15.50

- .39

+ 107.14 = 34

- .25 at 25th



Dec. 26

1327

4	39	32
		51.45
4	38	40.55
18	19	13.89
10	19	26.66
	1	41.45
		45.21
		6000
		14.39
		15.50
		-1.11 <i>wrong</i>

1327 -  $\frac{1}{2}$

14	19	6
		51.00
14	18	15.00
18	19	13.89
19	59	01.11
	3	16.35
		44.76
		6000
		15.24
		15.50
		-26

Dec. 27

1327 -  $\frac{1}{2}$

1	38	56
		49.65
1	38	06.35
18	23	10.45
7	14	55.90
	3	11.18
		44.72
		6000
		15.28
		15.50
		-22

w = 11 gr

+1091  $\frac{1}{2}$   
w = 11 gr

196

Dec. 28

1327 +

13 54 48

46.05

13 54 01.95

18 27 07.01

19 26 54.94

3 11.20

43.74

6000

16.26

15.50

+ .76

+ .38

 $-10 \log f_{\text{bol}} \frac{1}{3}^h = -3.6$ + .02  $\Delta z_{\text{rel}}^h$ 

Dec. 29

1327 +  $\frac{1}{2}$ 

6 42 31

42.44

6 41 48.56

18 31 3.57

12 10 45.00

1 59.78

45.22

6000

14.78

15.50

- .72

+ 3 gr.

1327

15 20 54

41.18

15 20 12.82

18 31 3.57

20 49 9.25

3 54.88

44.57

6000

15.43

15.50

+ .07

rem. 3 gr.

14.22  $\Delta z_{\text{rel}}^h$

Dec. 30

1327

1327 + 1/2

1 43 34

3 22 50

38.90

1 42 54.10

18 35 00.22

7 7 54.88

1 10.10

44.78

60.00

15.22

15.50

-28

 $n = 119$ 

14 35 38

36.88

14 35 01.12

18 35 00.22

20 00 00.90

3 16.55

44.35

60.00

15.65

15.50

+ 15



198

Dec 31.

1327  
 14 4832  
 32.90  
 14 47 59.10  
 18 38 56.68  
 20 09 2.42  
 3 18.06  
 44.36  
 6000  
 15.64  
 15.50  
 +.14  
 $-109 \frac{3}{4}^h$   $- \frac{21}{-07 \text{ at } 22^h}$

Jan. 1. 1880

1327  
 4 18 43  
 30.95  
 4 18 12.05  
 18 42 53.24  
 9 35 19.81  
 1 24.28  
 44.53  
 6000  
 15.47  
 15.50  
 +.03

1327 -  $\frac{1}{2}$   
 15 30 31  
 29.09  
 15 30 01.91  
 18 42 53.24  
 20 47 8.67  
 3 24.20  
 43 44.47  
 6000  
 15.53  
 15.50  
 +.03  
 at 22 $\frac{1}{2}^h$

1880.

199

Jan. 2.

$$\begin{array}{r}
 1327 - \frac{1}{3} = 394 \\
 6 \quad 24 \quad 55 = 00 \\
 \quad - 25.90 \\
 6 \quad 24 \quad 29.10 \\
 18 \quad 46 \quad 49.80 \\
 11 \quad 37 \quad 39.30 \\
 \quad 1 \quad 54.26 \\
 \quad \quad 45.04 \\
 \quad \quad 60.00 \\
 \quad \quad 14.96 \\
 \quad \quad \underline{15.50} \\
 \quad \quad - .54
 \end{array}$$

$$\begin{array}{r}
 1327 - ' \\
 14 \quad 49 \quad 16 \\
 \quad \quad \quad 24.78 \\
 14 \quad 48 \quad 51.22 \\
 18 \quad 46 \quad 49.80 \\
 20 \quad 02 \quad 01.42 \\
 \quad \quad 3 \quad 16.91 \\
 \quad \quad \quad 44.51 \\
 \quad \quad \quad 60.00 \\
 \quad \quad \quad 15.49 \\
 \quad \quad \quad \underline{15.50} \\
 \quad \quad \quad +.01 \text{ at } 22^h
 \end{array}$$

Jan. 4

$$\begin{array}{r}
 1327 \\
 19 \quad 17 \quad 51 \\
 \quad \quad \quad 20.14 \\
 19 \quad 17 \quad 30.86 \\
 18 \quad 54 \quad 42.92 \\
 0 \quad 22 \quad 47.94 \\
 \quad \quad 0 \quad 3.70 \\
 \quad \quad \quad 44.24 \\
 \quad \quad \quad 60.00 \\
 \quad \quad \quad 15.76 \\
 \quad \quad \quad \underline{15.52} \\
 \quad \quad \quad +.26
 \end{array}$$

$$\begin{array}{r}
 1327 - \frac{1}{2} \\
 14 \quad 59 \quad 01 \\
 \quad \quad \quad 46.94 \\
 14 \quad 58 \quad 44.06 \\
 18 \quad 54 \quad 42.92 \\
 20 \quad 03 \quad 61.14 \\
 \quad \quad 3 \quad 17 \quad 14 \\
 \quad \quad \quad 44.00 \\
 \quad \quad \quad 60.00 \\
 \quad \quad \quad 16.00 \\
 \quad \quad \quad \underline{15.50} \\
 \quad \quad \quad +.50 \\
 \quad \quad \quad \underline{.00} \\
 \quad \quad \quad +.25 \\
 -10.1^h \quad -27 \\
 \quad \quad \quad \underline{.00}
 \end{array}$$



200

Jan. 5

1327 - 1/2

5	28	21
		13.90
5	28	07.10
18	58	39.48
10	29	27.62
	1	43.04
		44.58
		60.00
		15.42
		15.50
		-0.8

1327 + 1/3

15	58	2
		12.20 12.00
15	57	49.80 50.00
18	58	39.48 39.48
20	59	10.32 10.52
	3	26.30 .30
		44.02 44.22
		60.00 60.00
		15.98 15.78
		15.50 15.50
		min. 1.48 1.28
		mean .00
		1.14
		-59.14 -1.4
		.00

Jan. 6

1327

15	8	45
		7.6
15	8	37.4
19	02	36.04
20	06	04.36
	3	17.40
		43.96
		60.00
		16.04
		15.50
		+54
		-log r <sub>2</sub> <sup>h</sup> -54
		.00



Jan. y.

1327 +  
 ✓ 39 ✓  
     5.0  
 5 39 0.0  
 19 06 32.60  
 10 32 27.40  
     1 43.65  
     43.75  
     6000  
     16.25  
15.50  
     +.75

1327  
 6 17 11  
     5.0  
 6 17 6.0  
 19 6 32.60  
 11 10 33.40  
     1 49.70  
     43.70  
     6000  
     16.30  
15.50  
     +.80  
 -3 gr.

1327  
 15 22 39  
     3.4  
 15 22 35.6  
 19 6 32.6  
 20 16 03.0  
     3 19.10  
     43.90  
     6000  
     16.10  
15.50  
     +.60  
     .00  
     +.50  
 -10 gr. 1/2  
-.27  
     +.03

202

Jan. 8

137+

2	45	29.
		00.87
2	45	28.13
19	10	29.16
7	34	58.97
	1	14.60
		44.37
		6000
		15.63
		<u>15.50</u>
		+ .13

1327+

15	13	29
		- 2.00
15	13	31.
19	10	29.16
20	3	01.84
	3	19.04
		44.80
		6000
		15.20
		<u>15.50</u>
		- .30
		<u>00</u>
		- .15
		<u>+ .15</u>
		00

109 1/2 h.

Jan. 9.

	(1324)		(394)
16	33	45.29	16 11

5.24

16 33 50.24

19 14 25.72

21 19 24.52

3 29.60

21 15 54.92

15.50

21 16 10.42

11.00

Error. 394 = +.58

-10 gms. for 2 hrs.



204

D.C.W.

Jan. 11. (1327) (394)  
 6 17 38 = 10 53 58

+ 10.30

6 17 48.30

19 22 18.84

10 55 29.46

1 47.39

10 53 42.07

15.50

57.57

58.00

Error 394 = +.43

- 2 grs. for 8 hrs.

Jan. 11. (1327) (394)  
 15 25 36 = 8 0 27

12.50

15 25 48.50

19 22 18.84

20 3 29.66

3 17.16

20 0 12.50

15.50

28.00

27.00

Error 394 by 1327 - 1.00

" " " 394 0.00

" 394 - 0.50

+ 18 grs. for 1/2 hr.

A duplicate comparison  
 of 394 with 1327 differs from  
 this by only 0.01

It is probable that the  
 apparent error of 1.° in 394 by 1327  
 is due to another change  
 of rate in 1327.  
 We start this morning.

Jan. 12

1327

2 40 58 = 00

13.

2 41 11.0

19 26 15.40

7 14 55.6.0

1 11.26

44.3 4

6000

15.64

15.50

+ .14

1327

16 24 11

14.80

16 24 25.8

19 26 15.40

20 58 10.4

3 26.1

44.3

6000

15.7

15.5

+ 20

-10g<sup>1/2</sup> - .14+ .06 at 22<sup>h</sup>.

Jan. 13.

1327

15 35 56

18.0 18.0

15 35 38 36 14.0

19 30 11.96 30 11.96

20 25 26.04 6 02.04

3 17 50 17.50

8.54 44.54

6000

15.44

15.50

- .06



206

Jan. 14.

1327 -  $\frac{1}{2}$

0	29	24
		18.32
0	39	42.32
19	34	8.52
5	05	33.80
	0	49.96
		43.94
		6000
		16.04
		<u>15.50</u>
		+1.54

-1 gr.

1327 -

16	29	58
		20.27
16	30	18.27
19	34	8.52
20	56	9.75
	3	25.75
		44.00
		6000
		16.00
		<u>15.50</u>
		+1.50
		<u>.00</u>
		+1.25

-10 gr  $\frac{1}{2}$ .

Jan. 15

1327 -

16	24	51	16	24	51
		23.20			23.20
16	24	27.80	16	25	14.20
19	38	05.08	19	38	5.08
20	56	22.72	20	47	9.12
	3	25.76		3	24.28
		.96			44.84
					6000
					15.16
					<u>15.50</u>
					-34
					<u>.00</u>
					-1.17
					<u>+1.4</u>
					-0.3 dr 22 $\frac{1}{2}$

10 gr  $\frac{1}{2}$



Jan. 16.

$1327 + \frac{1}{2}$   
 4 12 46  
     23.75  
 4 13 09.75  
 19 42 1.62  
 8 31 08.13  
     1 23.80  
     44.33  
     6000  
     15.67  
     15.50  
     + .17

1327

16 33 46  
     25.1  
 16 34 10.1  
 19 42 1.62  
 20 52 9.48  
     3 25.06  
     44.42  
     6000

Jan. 18

$1327 +$   
 15 44 58  
     3.91  
 15 44 54.09  
 19 49 54.74  
 19 54 59.35  
     8 15.77  
     43.58  
     6000  
     16.48  
     15.50  
     + .98  
     -109.35  
     .03

20.20	5
6.85	

20.20	5

208

Jan. 19

1327-

1 23 34

5.5

1 23 28.5

19 53 51.28

5 29 37.22

0 53.89

43.33

6000

16.67

15.50

+1.17

1327

6 43 27

6.20

6 43 20.80

19 53 51.28

10 49 29.52

1 46.32

43.20

6000

16.80

15.50

+1.30

-3 gr.

1327<sup>-1/2</sup>

16 12 2

7.61

16 11 54.39

19 53 51.28

20 18 03.11

3 19.49

43.74

6000

16.29

15.50

+1.79

Spring night  
304 +5.2

-109 gr 2

-1.24  
-0.02den  
nw = 9 grms

Jan. 20

1327

3	15	53
		9.25
3	15	43.75
19	57	47.84
7	17	55.91
	1	11.75
		44.16
		6000
		15.84
		15.50
		<u>          </u>
		+ .34

1327-1/2

14	58	50
		11.25
14	58	38.75
19	57	47.84
19	00	50.91
	3	6.84
		44.07
		6000
		15.93
		15.50
		<u>          </u>
		+ .43
		- .34

-109.14<sup>h</sup> ✓ +09 <sup>h</sup> 22<sup>m</sup> 22<sup>s</sup>

1327

16	3	00
		15.00
16	2	45.00
20	1	44.40
20	1	00.60
	3	16.70
		43.90
		6000
		16.10
		15.50
		<u>          </u>
		+ .60
		.00
		<u>          </u>
		.30
		<u>          </u>
		.27
		<u>          </u>
		+ .03

-109.14<sup>h</sup> ✓



210

Jan. 23.4

1880

AT  
Error at 6<sup>h</sup> 54<sup>m</sup>  
i. e. mean of time

1327

J. R. E.

6<sup>h</sup> 15<sup>m</sup> 42<sup>s</sup> $\bar{x} 20.60$ 15<sup>m</sup> 21.40

20 09 37.51

Sidereal Interval

10 05 43.89

- 1 39.115

- .119

Solar

10 04 04.66

394

10 04 20.

15.34

15.50

0.16

J. R. E.

6 33 36

20.6

33 15.4

9 37.51

10 23 37.89

- 1 42.064

- .104

10 21 55.72

10 22 11.

15.28

15.50

0.22

O. G. W.

7 21 45

20.6

21 24.4

9 37.51

11 11 46.89

- 1 49.922

- .128

10 22 56.84

11 10 12.

15.16

15.50

0.34

O. G. W.

7 27 58

20.6

27 37.4

9 37.51

11 19 59.89

- 1 51.041

- .107

10 16 08.82

11 16 24.

15.02

15.50

0.32

At 6<sup>h</sup> 24.6 = -0.19At 7<sup>h</sup> 24.9 = -0.33

Diff = 0.14 in 1 h. or according to already obtained ratio of 133

Mean error of 394 = 0.26 at 6<sup>h</sup> 54<sup>m</sup>1 Gamma added at ~~15~~ 22<sup>h</sup> 44.5<sup>m</sup> (solar) and taken off at 21<sup>h</sup>

J. R. E.

~~15 48 (Gamma added)~~

15 48 24

21.95

02.05

20 13 34.07

4 25 32.02

- 0 43.414

- .087

4 24 48.52

394

19 35 27.

24 00 15.52

15.50

Error of 394 .02

Clock right

J. R. E.

15 54 24

21.95

02.05

13 34.07

19 32.02

- 42.431

- .087

18 49.50

41 26.

15.50

15.50

.00

J. R. E.

16 00 30

21.95

08.05

13 34.07

13 26.02

- 41.448

- .071

12 44.50

47 31.

15.50

15.50

.00

At 6.9	1327
20.60	
15.9	1.35
9.0	
0.15	21.95
1.35	

Jan 23.8

1327

Error at 15.9

Next mean noon

Cambridge Boston



Jan 24<sup>5</sup>.2 1880

1327

23.11  
+ .02  
1523.11  
+ .17  
26

1 03 06.

- 23.11<sup>15</sup>03 42.96<sup>82</sup>

20 13 34.07

4 49 08.75

- 47.346

- .024

4 48 21.38

4 48 37.

15.62

15.50

Error of 394 = +0.12

1 51 24.

- 23.28

51 00.72

13 34.07

5 37 26.65

- 55.380 - 55.209

- .473 - .073

5 36 41.20 31.37

5 36 47. 47.

5.80 15.63

15.5

+0.13 at (29) 1<sup>h</sup> 27<sup>m</sup>

Holdest 1 gr. at 25<sup>d</sup> 0<sup>h</sup>.5 Discerning that it should have been taken off instead,  
 Subtractor 2 " " 7.5 Thus leaving pendulum as if 1 gramme was subtracted.  
 If clock gains 0.12 from 23<sup>h</sup>.8 to 24<sup>h</sup>.2, it would have gained 0.51 at 25<sup>h</sup>.5 by  
 its own rate. To this add 0.09 for the 3<sup>h</sup>.5 that the gramme was on, over and above  
 what it was off and another minus off.  $\frac{0.51}{0.60}$  So the clock may reasonably be  
 0.6 fast at 11<sup>h</sup>. (N.B. This is on Sunday P.M.)

Jan 25<sup>h</sup>.5

1880

1327

8 21 54

26.88 + (5.8 x .15) = 27.85

26.15

20 17 30.63

12 03 55.52

- 1 58.61

+ .01

12 01 56.92

12 02 13.

16.08

15.50

0.47

Error of clock = 0.58

at 5

Subtractor 2 gr. at 13<sup>h</sup>.No have it right at 20<sup>h</sup> we must subtract (at 13<sup>h</sup>) $\frac{580}{27 \times 24} = 3.1$  to make up its error. $\frac{300}{27 \times 24} = 0.5$  " compensate its ascendant rate,  
 1 gramme of which, however, has been  
 already subtracted.No have it right at 21<sup>h</sup> subtract (because  
 the 1 gramme already off. $\frac{580}{27 \times 24} = \frac{2.7}{0.5}$ 

3.2

1.0

2.2



212

Jan 25.8

1327

15.8 1.5 14.3 1.5 17.3 2.145	26.88 2.14 29.02	15 49 30 29.02 00.98 27.19	16 11 00 29.08 30.92 27.19
	Next noon	20 21 27.19 4 32 26.21 44.561 0.98 4 31 41.55 19 28 34.	20 21 27.19 4 09 56.24 40.793 1.25 4 09 55.89 19 52
		24 00 15.55 15.50 0.05	16 13 30 29.08 00.92 20 21 27.19 4 08 26.27 40.629 0.074 4 07 45.57 19 52 30. 24 00 15.57 15.50 0.07

394

Clock error = + 0.06 at 19.7

Replaced 2.25 grammes at 17.21<sup>h</sup> 21<sup>h</sup> right.  
 Added 0.2 " " 20.5 when clock showed 19.7  
 The pendulum now carries 0.55 gramme less

than before it was disturbed yesterday noon.

Temperatures { Present 62.6 62.6 } in clock case.  
 { Max & Min. 61.5 66.8 }

Jan 26.2

1880

1327

24  
15  
120  
24  
360  
26.88  
30.48

394

1 30 24 30.48	1 42 42 30.51
20 21 27.19	20 21 27.19
5 08 26.33 50.458 0.072	5 20 44.30 52.424 0.122
5 07 38.80 57. 15.20 15.50	5 19 57.75 20 07. 15.25 15.50 -0.25

Error of 394 = -0.30

Considering this as a rate since 21<sup>h</sup> 25<sup>h</sup> 21<sup>h</sup>, it is  $-\frac{0.275}{8.2} = -0.034$  per hr.

It would require  $\frac{0.034}{0.027} = 1.2$  grammes (about) to correct this rate.

It is therefore hardly to be consistent a permanent change of rate

1 gr. added 5<sup>3</sup>/<sub>4</sub> hr. See note next page.

Subsequently obtained error of 1327 at 1<sup>h</sup> 30<sup>m</sup> = 30.48, a difference of 0.04 grammes

∴ error at 1<sup>h</sup> 30<sup>m</sup> = 30.44 instead of 30.48, a difference of 0.04 grammes  
 ∴ the error of 394 was really only (0.28 - 0.14) = 0.14 at 1<sup>h</sup> 30<sup>m</sup>  
 i.e. 1327 did not maintain the rate of .15 per hr.



~~Jan 26.5~~  
~~1327~~

<del>9</del>	<del>19</del>	<del>36.</del>
<del>9</del>		<del>31.47</del>
		<del>04.53</del>
<del>20</del>	<del>21</del>	<del>27.19</del>
<del>12</del>	<del>57</del>	<del>37.33</del>
	<del>2</del>	<del>7.293</del>
		<del>.103</del>
	<del>55</del>	<del>29.44</del>
<del>12</del>	<del>55</del>	<del>45.</del>
		<del>15.06</del>
		<del>15.50</del>

Error of 394 =  $-0.44$  at  $9^h 13^m$

~~9.35~~  
~~1.25~~  
~~8.1~~

<del>9</del>	<del>25</del>	<del>42.</del>
		<del>31.48</del>
		<del>10.52</del>
<del>20</del>	<del>21</del>	<del>27.19</del>
<del>13</del>	<del>03</del>	<del>43.38</del>
	<del>2</del>	<del>8.276</del>
		<del>.118</del>
	<del>01</del>	<del>34.94</del>
<del>13</del>	<del>01</del>	<del>50.</del>
		<del>15.06</del>

~~30.30~~  
~~1.17~~  
~~31.47~~

~~30.40~~  
~~1.20~~  
~~31.60~~

~~.148~~  
~~81~~  
~~148~~  
~~1184~~  
~~1.20~~

Jan 26.5  
1327

9	19	36.
		31.60
		4.40
		27.19
		37.21
		7.293
		.103
	<del>55</del>	29.82
12	55	45.
		15.18
		15.50

394

9	25	42.
13	01	50.

Error of 394 =  $-0.32$  at  $13^h$

Hence we have established the true rate for the present.  
To compensate accumulated error by morning, added 2 gr. at  $14\frac{1}{4}^h$

Note. There was some uncertainty about the facts of changing the weights yesterday A.M. by which it was known to be possible that 1 gram less was on the pendulum than stated. The fact that the addition of 1 gram in the afternoon established the right rate was given color to the idea.



214

Jan 26.8

1327

15	46	12.	15.77
		32.55	1.25
	45	39.45	14.52
			.148
			11616
20	25	23.74	5808
			1452
4	39	44.29	2.148
		45.07	30.40
		.121	32.55

394

19	21	17.
24	00	15.46
		15.50

Clock Error -0.04

15	58	18
		32.56
	57	45.44
20	25	23.74
4	27	38.30
		43.742
		.065

26 54.49

19	33	21.
24	00	15.49
		15.50
		-0.01

The extra 2 grams put on last night early this morning is taken off at 20<sup>h</sup>

Jan. 27.4

28.61	30.40
1.25	4.05
27.36	34.45
.148	
21888	
10944	
2736	
4.049	

1327

4	36	36
		34.45
		01.55
20	25	23.74
8	10	37.81
	1	20.275
		.104

8 9 17.43

8 9 33.

15.57

15.50

+0.07

394

Error

Removed 0.25 grams at 8<sup>h</sup> when clock should be right

Jan. 27.8

Error at 26<sup>h</sup> 1.25 = +30.40 Rate taken .1481327

Handy Rate +0.148

(Home since 26 <sup>h</sup> 1.25)	Time of coincidence	15	55	42.	16	19	48.
(Error at 26 <sup>h</sup> 1.25)	Error at 26 <sup>h</sup> 1.25			+30.40			30.40
	Correction for rate	(38.38)		+5.68	(39.1)		5.79
	Next noon	2.		05.92			11.81
	Next noon	20	29	20.30		29	20.30
	Sidereal Interval	4	34	14.38		10	08.49
				44.888			40.956
				.039			24
				33		09	27.51
				19		50	48.
				24			15.51
							15.50
							+0.01

394

Clock right.



Jan 28.4

1327Hours x Rate  
Lines 3.35

Coincidence

$4.09 \times 0.15$

7	20	24	7	32	30
		$\begin{cases} +37.90 \\ -10.61 \end{cases}$			$37.90$
					$.64$
	19	45.49		31	51.46
20	29	20.30	20	29	20.30
10	50	25.15	11	02	31.16
	1	<del>48.453</del>		1	<del>48.453</del>
		46.487			.085
		.068			
10	48	38.63	10	00	42.62
10	48	54.	10	59	58.
		15.37			15.38
		15.50			15.50
		$-0.13$			$-0.12$

394

Error of 394

Jan 28.8

1327Added 0.25 grams at  $-11\frac{1}{4}^h$ 

(24 hours)	Coincidence	15	52	12	16	10	18.
(Antenna x rate)	Error	(3.35)		37.90			37.90
		(12.61 x .150)		1.89	(12.94 x .150)		1.94
		15	57	32.21	16	09	38.16
		20	33	16.85	20	33	16.85
		4	41	44.64	4	23	38.69
				46.035			43.086
				.122			.106
		4	40	58.48	4	22	55.50
		19	37	20.	19.	19	7.
				15.50			15.48
				15.50			15.50
				0.00			$-0.02$

39420-20<sup>h</sup>

Error of 394 Right

Remove the 0.25 added last night



216

Jan 29.2

1327At 0.05  
2.05 X .145

2	11	42.
		40.92
		.30
2	11	60.78
20	33	16.85
5	37	43.93
		55.209
		.120
5	36	48.60
5	37	04.
		15.40
		15.50
		- .10

394

Clock error

Added 0.25 gm. at 6 $\frac{1}{4}$ <sup>h</sup>

2	29	48
		40.92
		.36
2	29	06.72
20	33	16.85
5	55	49.87
		58.158
		.137
5	54	51.58
5	55	07.
		00
		15.42
		15.50
		- .12

Jan 29.75

1327At 0.05  
14.3 X .147

Sept in on

14	20	30.
		40.92
		2.10
14	19	46.98
20	37	13.41
6	17	26.43
		1.762
		.072
6	16	24.60
17	43	51.
24	00	15.60
		15.50
		+0.10

394~~394~~

Clock error.

14	38	36.
		40.92
		2.15
14	37	52.93
20	37	13.41
5	59	20.48
		58.813
		.056
5	58	21.61
18	01	54.
24	00	15.61
		15.50
		+ .11

Remove the 0.25 g added last night. } at 6 $\frac{1}{4}$  / 8 $\frac{1}{4}$ <sup>h</sup>  
 Remove 1 gr. additional.

(per P. B. W.)  
 At 22<sup>h</sup> replaced the 1 gram added a few hours before.  
 Clock should then be right.



Jan 30.3

1327

$$\begin{array}{r}
 4 \quad 23 \quad 18. \\
 \text{At } 0.05 \quad 40.92 \\
 28.3 \times .147 \quad 4.16 \\
 \hline
 4 \quad 22 \quad 32.92 \\
 20 \quad 37 \quad 13.41 \\
 \hline
 7 \quad 45 \quad 19.51 \\
 \quad \quad 1 \quad 16.179 \\
 \quad \quad \quad .054 \\
 \hline
 7 \quad 44 \quad 03.28 \\
 7 \quad 44 \quad 19 \\
 \hline
 15.72 \\
 15.50 \\
 \hline
 \text{Error of 394} \quad + 0.22
 \end{array}$$

394

$$\begin{array}{r}
 4 \quad 35 \quad 12. \\
 \quad \quad 40.92 \\
 28.5 \times .147 \quad 4.19 \\
 \hline
 4 \quad 34 \quad 26.89 \\
 20 \quad 37 \quad 13.41 \\
 \hline
 7 \quad 57 \quad 13.48 \\
 \quad \quad 1 \quad 18.145 \\
 \quad \quad \quad .036 \\
 \hline
 7 \quad 55 \quad 55.30 \\
 7 \quad 56 \quad 11. \\
 \hline
 15.70 \\
 15.50 \\
 \hline
 + 0.20
 \end{array}$$

N.B. Possibly the rate of 1327 was taken  $\pm .0025$  out of the way.

leaving only momentarily in clock error  $\pm .07$

Rate of gain since morning = 11.4.16, nearly .02 per hour.

At  $9\frac{3}{4}$  removed  $\frac{3}{4}$  grammm.

Jan 30.8

1327

$$\begin{array}{r}
 4 \quad 23 \\
 15 \quad 55 \quad 06. \\
 \quad \quad 40.92 \\
 39.9 \times .147 \quad 05.87 \\
 \hline
 54 \quad 19.21 \\
 \text{Next} \quad 20 \quad 41 \quad 09.97 \\
 \hline
 4 \quad 46 \quad 50.76 \\
 \quad \quad 416.854 \\
 \quad \quad \quad .139 \\
 \hline
 46 \quad 03.77 \\
 19 \quad 14 \quad 12. \\
 \hline
 24 \quad 00 \quad 15.77 \\
 \quad \quad \quad 15.50 \\
 \hline
 \text{Clock error} \quad +.27
 \end{array}$$

394

$$\begin{array}{r}
 16 \quad 12 \quad 54. \\
 \quad \quad 40.92 \\
 40.2 \times .147 \quad 05.87 \\
 \hline
 12 \quad 07.17 \\
 20 \quad 41 \quad 09.97 \\
 \hline
 4 \quad 29 \quad 02.80 \\
 \quad \quad 44.069 \\
 \quad \quad \quad .008 \\
 \hline
 28 \quad 18.72 \\
 19 \quad 31 \quad 57. \\
 \hline
 15.72 \\
 15.50 \\
 \hline
 +.22
 \end{array}$$

Removed 5 grammm. at  $19\frac{3}{4}$  Replaced it at  $22\frac{3}{4}$   $21\frac{3}{4}$   
 when clock should be right. B. removed 0.2 grammm.



Jan. 30.95

True Lateral Time

Tid. Time by Polar clock 394

Cambr. Sid. T. of Boston At in Nov

20 36 57.87

Observed By 1327 19 42 12.

By 394 23 00 40.

Correction At 0<sup>h</sup>.05 -40.9223<sup>h</sup>.00 into Tid. 3 46.699

43.7 @ 0.147 -6.42

40<sup>s</sup> " " .110

19 41 24.66

19 41 24.68

Error of 394 by this comparison = +.02

Jan. 31. 4

20 40 54.43

1327 7 44 18.

394 11 00 46.

At 2<sup>h</sup> -47.68

1. 48.42

5.7 @ 0.135 - .77

.126

7 43 29.55

7 43 28.98

Error of 394 = -0.56

" reasonably due to change of rate of 1327 since previous observation of  
 stars =  $55 \times (0.147 - 0.135) = -0.66$

W. for change of rate of 1327 =  $+ \frac{.012}{.027} = +0.44$

" " diff (0.566 - 0.66) into 2<sup>h</sup> =  $-\frac{.100}{12 \times .027} = -0.30$

" " error +  $\frac{0.56}{10 \times .027}$  to be correct in 10<sup>4</sup> =  $+2.08$

~~1.82~~  
 3.22

Added  $\frac{2}{1}$  75 gm. at 11 1/2<sup>h</sup>

~~Feb.~~ Jan 31.9

<u>1327</u>	19	05	24.	<u>394</u>	20	40	54.43
At 2 <sup>h</sup>			-47.68		22	19	59.
17.41 @ 0.135			- 2.31			3	39.964
							.162
	19	04	34.01		19	04	33.56

Error of 394 = -0.45

Added 10 gm. at 22<sup>h</sup> 25<sup>m</sup>

<u>1327</u>	20	07	12.	<u>394</u>	20	40	54.43
			-47.68		23	21	37.
18.4			- 2.44			3	50.149
							.101
	20	06	21.88		20	06	21.68

Error of 394 = -0.20

Removed 10 gm. at 23<sup>h</sup> 25<sup>m</sup>

<u>1327</u>	20	38	12.	<u>394</u>	20	40	54.43
			-47.68		23	52	32.
18.65			- 2.52			3	55.241
							.088
	20	37	21.80		20	37	21.76

Error of 394 = -.04



Feb. 1.4 (Sunday P.M.)

$$\begin{array}{r}
 1327 \\
 16-2^h \\
 5.3 \times .15 \\
 \hline
 7 \quad 21 \quad 31. \\
 - 51.26 \\
 - .80 \\
 \hline
 7 \quad 20 \quad 37.94
 \end{array}$$

Error of 394 = +.21

$$\begin{array}{r}
 20 \quad 44 \quad 50.99 \\
 10 \quad 34 \quad 03. \\
 1 \quad 44.150. \\
 \hline
 .008 \\
 7 \quad 20 \quad 38.15
 \end{array}$$

$$\begin{array}{r}
 10^h 34^m \\
 28 \quad 53 \\
 10 \quad 41 \\
 \hline
 10.7 \quad 25 \\
 .021
 \end{array}$$

Rate of gain since

At noon the alleged error was  $-.04$ , but this depended upon 18.65 in which 1327 gained .015 per hour less than was alleged.

$\therefore$  Actual error was  $-(.04 + 18.68 \times .015) = -(.04 + .28) = -.32$

$$\begin{array}{r}
 10^h 34^m \quad +.521 \\
 23 \quad 53 \quad - .32 \\
 10 \quad 41 \quad 10.7 \quad .53 \\
 \hline
 .049
 \end{array}$$

$\therefore$  394 has gained at <sup>hourly</sup> rate of .049 implying 1.8 gram too much on pendulum.

To correct the accumulator +.21 in 8<sup>h</sup> will require  $\frac{.21}{8 \times .027} = 1$  gram removed also.

$\therefore$  2.75 grams removed at 11<sup>h</sup>

Feb. 1.8

$$\begin{array}{r}
 1327 \\
 16-2^h \\
 14^h @ .15 \\
 \hline
 16 \quad 03 \quad 18. \\
 - 51.26 \\
 - 2.10 \\
 \hline
 16 \quad 02 \quad 24.64
 \end{array}$$

$$\begin{array}{r}
 20 \quad 44 \quad 50.99 \\
 19 \quad 14 \quad 24. \\
 3 \quad 9.573 \\
 \hline
 .066 \\
 16 \quad 02 \quad 24.63
 \end{array}$$

Check 394 right.

Added 1 gram at 19<sup>h</sup>.5

Temp in clock case	{	Before winding	65.0	64.8
		After winding	61.6	67.8
		After winding	65.2	65.0
		After winding	65.2	65.0

[<sup>Leaf</sup>Page taken out by J. R. E. and non-defaced contents copied by him.]

223

Feb. 2.45

$  \begin{array}{r}  1327 \quad 7 \quad 47 \quad 24. \\  \hline  \text{At } 2^{\text{h}} \quad -54.19 \\  5^{\text{h}} @ .122 \quad - .17 \\  \hline  7 \quad 46 \quad 29.10  \end{array}  $	$  \begin{array}{r}  20 \quad 48 \quad 47.54 \\  394 \quad 10 \quad 55 \quad 53. \\  \quad \quad \quad 1 \quad 47.600 \\  \hline  \quad \quad \quad .145 \\  7 \quad 46 \quad 28.28  \end{array}  $
-0.82	

$  \begin{array}{r}  1327 \quad 8 \quad 05 \quad 24. \\  \hline  -54.19 \\  6.1 @ .122 \quad - .74 \\  \hline  8 \quad 04 \quad 29.07  \end{array}  $	$  \begin{array}{r}  20 \quad 48 \quad 47.54 \\  394 \quad 11 \quad 13 \quad 50. \\  \quad \quad \quad 1 \quad 50.557 \\  \hline  \quad \quad \quad .137 \\  8 \quad 04 \quad 28.23  \end{array}  $
-0.84	Mean -0.83

When the weights were arranged this morning it was supposed that 1327 was running at an hourly rate of  $+^{\circ}150$ . But it has run for the last 24<sup>h</sup> at a rate of  $+^{\circ}122$ .

If this change is due to temperature, barometer, or any cause which could affect each clock, we ought to expect to find the error of 394 somewhere near  $-[30^{\text{h}} \times (.150 - .122)] = -.84$  or surprisingly near the fact.

The error this morning in the statement of the error of 1327 at 19<sup>h</sup> 5 (mean time) must have arisen from the fact that the change of rate had not been discovered.

To compensate the rate, will require about 0.75 grams.

" " " error in 7 1/4 <sup>h</sup> mill " "	4.25
	5.00

Added 5 grammes at 11 3/4 hours mean time.



224

Feb. 28

Removed 4.5 gm. at  $19\frac{1}{4}^h$ 

1327	16 24 48.	394	20 48 47.54
At $2^h$	-54.19	19 31 52.	
14.4 @ .122	-1.75	3 12.366	
			.142
	16 23 52.06	16 23 52.05	

From this the clock 394 would appear to be right; but, is it safe to assume the exceptional rate .122?  
 Is it not better to take the mean rate .135, having accepted the determination of the error 54.19?

This would give since  $2^h$ ,  $14.4 @ .135 = 1.94$   
 longitudinal error of 394  $1.94 - 1.75 = +.2$

Removed ~~4~~ <sup>4</sup> grams at  $20^h$

		20 48 47.54
	17 54 36.	21 01 25.
	-54.19	3 27.15
15.9 @ .135	-2.15	.07
	17 53 39.66	17 53 39.76

Error +.1 But removed  $3\frac{3}{4}$  gm. under influence of a false determination.

Feb. 3

The clock, therefore was right at about  $21\frac{1}{2}^h$  to  $22^h$   
 Failed to restore weights till afternoon.

At noon the clock must have been nearly  $0.5^{+0.5}$  slow.  
 No comparison taken then.

When disconnected, added weights without stopping to make comparison. The director had recently advised that it is better to avoid ~~rapid~~ <sup>during business hours</sup> changes of rate, even at the expense of a longer continuance of the error. So a rapid restoration was not attempted.

For test in afternoon see next page.

Feb. 3.15

<u>1327</u>	0	28	19	<del>394</del> <del>7327</del>	20	52	44.10
			-54.19		3	34	02.
22.5 @ .135			-3.04				35.155
	0	27	21.77				.005
			-57		24	27	21.26
				Amount of weight removed not recorded.			
					20	52	44.10
					8	32	06.
						1	24.109
							.016
	5	26	14.11		29	26	14.22
			+ .11				

Feb. 3.3

1327	5	27	12.		20	52	44.10
			-54.19		8	32	06.
27.4 @ .135			-3.70				1 24.109
	5	26	14.11				.016
			+ .11		29	26	14.22

Remove weight, the amount not being subject to exact calculation. Do not expect the best result early <sup>the coming</sup> morning.  
There has been some confusion about the weights today.  
But let us try again

Feb. 3.4

	6	45	24.		20	52	44.10
			-54.19		9	50	05.
			-3.88			1	36.92
	6	44	<sup>5.9</sup> 26.23				.01
			+ .10		30	44	26.03

$$\text{Rate} = \frac{.11}{6.45 - 5.27} = \frac{.11}{1.3} = .085$$

Rate nearly right.

Nothing should have been removed.



seconds of  
 Let  $e =$  error of clock at  $t$  ~~hours~~ last determination  
 "  $e_0 =$  " " " "  $t_0$  ~~hours~~ before, an earlier determination.  
 "  $t_2 =$  a number of hours after last determination, at which  
 the error is to be zero.

Rate  $= \frac{e - e_0}{t_0}$  to be corrected. Call corresponding tabular weight "for rate".  
 Rate of compensation of error  $= \frac{e}{t_2}$  " " " " " error".  
 The weight for error to be removed at end of time  $t_2$  while  
 that for rate remains.

Suppose a weight corresponding to a rate  $r$  had been added  $t_r$  hours  
 before the last determination.

Let  $\varphi$  be the rate before the addition. Then  $\varphi + r =$  that after.

$$\begin{aligned} \text{Then } (t_0 - t_r)\varphi + t_r(\varphi + r) &= \frac{e - e_0}{t_0} = t_0\varphi + t_r r \\ \varphi &= \frac{e - e_0}{t_0} + \frac{t_r r}{t_0} \quad \varphi = \frac{e - e_0}{t_0} + \frac{t_r r}{t_0} \quad \varphi = \frac{(e - e_0) + t_r r}{t_0} \\ \varphi + r &= \frac{e - e_0}{t_0} + (1 + \frac{t_r}{t_0})r \\ \varphi + r &= \frac{(e - e_0) + r(t_0 - t_r)}{t_0} \end{aligned}$$

Or, letting  $t_0$  as before be the time from determination  $e_0$  to that of  $e$ ,  
 let  $t_r$  be the time from determination of  $e_0$  to adding of weight correspond-  
 ing to rate  $r$ . Then rate after the addition  $= \frac{e - e_0 + r t_r}{t_0}$   
 For example see foot of next page.

Feb. 3.8 1880

$$\begin{array}{r}
 15 \quad 26 \quad 06. \\
 - 54.19 \\
 \hline
 37.43 @ .135 \quad - 5.05 \\
 \hline
 15 \quad 25 \quad 06.76 \\
 + .58 \\
 \hline
 20 \quad 52 \quad 44.10 \\
 18 \quad 29 \quad 21. \\
 3 \quad 2.181 \\
 \hline
 .057 \\
 39 \quad 25 \quad 07.34
 \end{array}$$

$$\begin{array}{r}
 15 \quad 38 \quad 06. \\
 - 54.19 \\
 \hline
 37.63 @ .135 \quad - 5.08 \\
 \hline
 15 \quad 37 \quad 06.73 \\
 + .64 \\
 \hline
 20 \quad 52 \quad 44.10 \\
 18 \quad 41 \quad 19.70 \\
 3 \quad 4.153 \\
 \hline
 .120 \\
 39 \quad 37 \quad 07.38
 \end{array}$$

While not very accurate, it will suit present purpose to take  $\frac{.58 + .64}{2} = .61$

$$e = +.61 \quad l_0 = 18^h 35^m - 6^h 45^m = 11^h 50 = 11.8$$

$$l_0 = .0 \quad \frac{.61}{11.8} = .051 = \text{rate. Require 2 gm. removed,}$$

.64 in 2<sup>h</sup> requires 11 gm. removed.

Removed 13 gm. at 19<sup>h</sup>, then taking all from pendulum.

Replaced 5 " " 20<sup>h</sup> 1/4 since the time is approaching at which it is desirable not to have sudden changes.

Replaced 4 gm. at 21<sup>h</sup> for same reason.

$$\begin{array}{r}
 18 \quad 11 \quad 42. \\
 - 54.19 \\
 \hline
 40.2 @ .135 \quad - 5.43 \\
 \hline
 18 \quad 10 \quad 42.38 \\
 \hline
 20 \quad 52 \quad 44.10 \\
 21 \quad 14 \quad 29 \\
 21 \quad 14 \quad 3 \\
 \hline
 29.286 \\
 .079 \\
 42 \quad 10 \quad 42.46
 \end{array}$$

Error = +.08 Provided our estimate of the rate of 1327 be right.

$$e = +.08 \quad r = \text{rate for } 5 \text{ gm. added to } .135 \quad l_1 = 0.75 \quad l_0 = 2.55$$

$$e_0 = +.64 \quad \text{Rate } \frac{.64}{2} = .32 \quad \text{Rate } \frac{.64}{2} = .32 \quad \text{Rate } \frac{.64}{2} = .32$$

$$e - e_0 = -.56 \quad \text{added just before continuation} = \frac{-.56 + (.135 \times 0.75)}{2.55} = -0.16$$

corresponding to 6 gm. (of which 4 have already been added).



In view of the addition of the 4 gm. the present rate is  $-.16 + .11 = -.05$  about, which agrees with previous opinion, since the weight and the rate now coincide with that of the interval during the night.

Replaced (added) 1 gm. at  $21\frac{3}{4}^h$

Feb. 3.9

1880

From star observations just taken it appears that the mean rate of 1327 since  $2^d 2^h$  has been  $+0.156$  instead of  $+0.135$ . Hence at noon  $19\frac{1}{2}$  hours yesterday the true clock instead of being  $+0.2$  fast was  $0.2 + [14.4 \times (.156 - .135)] = +0.2 + (14.4 \times .021) = +0.5$

This  $0.5$  was all due to not predicting the right the then undetermined rate.

At noon therefore it was not far from right.

At  $3\frac{3}{4}$  Feb. 3 it was  $-0.51 + (22.5 \times .021) = +.47 = -.04$

So that the actual error of considerable size commenced when we had approximate the time to what our assumed rate called for. And it must have been very much out of the way <sup>early this morning</sup> ~~during the evening~~ when it got ahead of what we desired.

To avoid possibility of mistake of sign, let us repeat the last calculation of error, with true rate.

18 11 42.  
At 18<sup>h</sup> 40 -60.52

$-0.5 @ (22.5) + .02$   $+ .01$   
10 41.49  
42.46

Error =  $+0.97$

18 11 42.

-54.19

-6.27

18 10 41.54

Error =  $+0.92$

.92 - .08 = .84 } Check.

$40.2 \times .021 = .84$

20 5.2 44.10

21 14 29.

3 29.286

.079

42 10 42.46

Removed 4 gm. at  $22\frac{3}{4}^h$  at which time we calculated the error to be  $+0.92 - .03 = +.89$  At noon we shall have  $+0.89 - .14 = .75$







230

Feb. 4.8

1327	16	28	45	394	19	27	49.	20	56	40.65
		- 1	01.50			3	11.708			
14.5@.14			- 2.06				.134			
	16	27	<del>45</del> 41.44		40	27	41.49			

Error of 394 = +0.05

Rate +  $\frac{.14 + .05}{16.5 - 6.4} = +.019$  No be compensated by  $-\frac{3}{4}$  gm.Error to be compensated is  $1\frac{3}{4}$  by  $-\frac{1}{2}$ Remove  $2\frac{3}{4}$  gm. at  $19^h 40^m$ Added  $\frac{3}{4}$  gm. at  $21^h$  when the clock should be right.

The pendulum now carries 10 grammes.

(Must be some mistake touching the ans. of right carried. See following results.)

Feb. 5.2

	21	00	37.21
2 21 41	5	19	06.
At 1 <sup>h</sup> 46 <sup>m</sup> -1 04.82			52.404
0.6@.14 <sup>8</sup> - .08			.016
<hr/> 2 20 36.10	<hr/> 26	20	35.63

Bolt

by

Chronograph.

Error -.47

	2	33	47.	21	00	37.21
		- 1	04.82	5	31	10.
						54.375
0.8 @ .14			- 0.11			.027
	2	32	42.07	26	33	41.61

Error -.46

Feb 5.5

	8	39	24	21	00	37.21
		-1	04.82	11	35	46.
		-	.83		1	54.171
6.9 @ .14						.126
	8	38	18.35	32	38	17.51

Error -.84

Rate -  $\frac{.47}{8} = .06$  And -  $\frac{.84 - 47}{6} = .06$ 

Requires 2.1 gm. to compensate rate. And 4 gm. to compensate error in less than 8 hrs.



Temperature in clock case { After wiring 64.2 64. F  
Max taken 61.6 64.0

231

Noting that the complete independent checks of determination giving the same  
percentage rate would force the acceptance of this.

Notice however that at  $21^h$ ,  $1\frac{1}{2}$  grams should have been added.

So that we have to account for unaccounted for only  $2 - (1\frac{1}{2} - \frac{3}{4}) = 1\frac{1}{4}$  gm.

Added 6 gm. at  $23^h 55^m$   ~~$23^h 55^m$~~   $23^h 55^m$   $11^h 55^m$

Feb. 8<sup>5</sup>

	21	00	37.21
15	40	35	
	18	35	48.
-1			04.83
		3	3.166
13.9 @ .14 =			1.95
			.131

15 39 28.23

39 39 28.51

Error + .28 Rate  $\frac{.28 + .84}{7} = \frac{1.12}{7} = .16$  Requires 6 grammes.

Remove 5<sup>half half</sup> Hence, the change in error yesterday was of a temporary  
and comparatively violent nature. The clock was <sup>not</sup> wound till  
after the chronograph test. So it could not have been that.  
And yesterday morning's compensation gave just what was expected - a check  
on that also.

To correct .28 in  $2^h$  must require 5 grams.

So removed 10 grammes at  $18^h \frac{3}{4}$ .

But to avoid mistake take another comp.

	21	00	37.21
15	59	00	
	18	54	10.
-1			04.82
		3	6.287
14.2 @ .14			1.99
			.027
	15	57	53.19
		39	57 53.52

Error = + .33 Close enough for present purpose.

Added 4 gm. at  $21^h \frac{1}{4}$

	21	00	37.21
18	28	17	
	21	23	02.
-1			04.82
		3	30.764
15.7 @ .14			2.20
			.005
	18	27	09.98
		42	27 09.98

Clock right.

the amt. just added.

$\frac{.28}{2.5} = .11$  corresponding to 4 gm. nearly, i.e.  
The fraction now carries 12 gm.



Feb. 6. 2

St-1, 41m

 $\frac{1}{4}^k @ .14$ 

Bolt

Even + 0.60

by

*L. honazoth.* .35' @ .14

Error + 0.62

$$6.7 @ 1.35^4 =$$

Error + 1.03

56 25

1. 08.18

03

1 55 16.79

2 02 34

- 1 08.18

- .05

2 01 25.77

$$\frac{.62}{7.6} \times .081 \text{ per hour, the equiv. of 3 grams.}$$

8 24 45-

- 1 08.18

0.94

8 23 ~~35.68~~

25. 9 8

$$\frac{1.03}{14} = .073$$

21 04 33.76

4 49 56.

47.475-

153

25 55 17.89

21 04 33.76

4 56 04,

48.625

005-

26 01 36.39

21 04 33.76

11 17 12.

57.214

033

32 23 37.01

For comparison 1.03 in 7<sup>th</sup> or  $\frac{.147}{.13}$  per lb. require  $5\frac{1}{2}$  grs.

"	"	"	"	8 <sup>9</sup>	"	13	"	"	"	"	ready	5-	"
"	"	"	"	9 <sup>1</sup> / <sub>2</sub>	"	786	"	"	"	"	"	"	"
"	"	"	"	9 <sup>1</sup> / <sub>2</sub>	"	104	"	"	"	"	"	4X	"

It is suspected that the change of such large quantities of weight itself induces the irregularities. See first of page.

7 grammes removed at  $-11\frac{1}{2}^{\circ}$  leaving 5 grammes on pedestal.

Where such large changes are to be compensated it will be necessary to <sup>summed</sup> <sup>home</sup> ~~test~~, before the desired <sup>time</sup> hour, but it would be a mistake to change weight to make it compensate at the earlier hour. This mistake was made last night and made it necessary to use extreme measure this morning.

It is suspected as an alternative that the rate of change of momentum per gramme may be greater than tabulated.

Feb. 6. 8

	15	50	08.	21	04	33.76
		- 1	08.18	18	41	20.
					3	4.152
14.1 @ .14			- 1.97			.055
	15	48	57.85	39	48	57.97
Error +.12	<i>Not a good comparison see below.</i>					

	16	01	50.	21	04	33.76
		- 1	08.18	18	53	00.
					3	6.123
14.3 @ .14			- 2.00			0.
	16	0	39.82	40	00	39.88
Error +.06						

	16	13	42.	21	04	33.76
Estimate for an interval of no heat,		- 1	08.18	19	04	50.
				21	04	33.76
14.5 @ .14			- 2.03		3	7.930
	16	12	31.79			.137
Error +.04				40	12	31.83

The clock is compensating about .501 in 4<sup>m</sup>. So the last two agree perfectly. At this rate the clock should compensate in about  $\frac{1}{4}$  from the last comp.

Time	Error	Rate	Grams changed	Change in grams
6d 29 <sup>h</sup> 04 <sup>m</sup>	+1.06			
6 11 17	+1.03			
7.8	.97	.124		

5 grams added at 19<sup>h</sup> 25<sup>m</sup> Giving 10 on perpendicular.

We replace 5 instead of 4 grams, since we suspect that a gram makes more change of rate than is later stated.



At  $6^d 23^h$  the error was  $+1.03$

For  $0.2^h$  the addition of rate add  $.03$   
 At  $11.5$   $+1.06$

At  $6^d 19^h$   $+ .05$

~~Corrected by~~  $17^h$  with

$-1.01$

Change in  $7.5^h$  with 5 gm. error

At  $6^d 11\frac{1}{2}^h$  the error was  $+1.06$

"  $5^d 21.4$  " " "  $0$

$+1.06$  Change in  $9.9$  with 12 gm. "

The change in rate  $= g(w - w_0)$  the change in error  $\frac{S}{h} = g(w - w_0)h$   
 where  $g$  = change in gram per h.  $w$  = weight carried.  $w_0$  = normal weight  
 for rate zero.

$$S_1 = g(w_1 - w_0)h_1$$

$$\frac{S_1}{h_1} - \frac{S_2}{h_2} = g(w_1 - w_2)$$

$$S_2 = g(w_2 - w_0)h_2$$

$$S_1 = -1.04 \quad h_1 = 7.7 \quad \frac{S_1}{h_1} = -0.13 - 0.131$$

$$g = \frac{\frac{S_1}{h_1} - \frac{S_2}{h_2}}{w_1 - w_2}$$

$$S_2 = +1.06 \quad h_2 = 9.9 \quad \frac{S_2}{h_2} = +0.107$$

$$\frac{S_1}{h_1} - \frac{S_2}{h_2} =$$

$$\frac{S_1}{h_1} - \frac{S_2}{h_2} = 2.38$$

$$w_1 = 5 \text{ gm.} \quad w_2 = 12 \quad w_1 - w_2 = -7 \quad g = +0.34 \quad \text{But see further}$$

$$w = g w_0 - \frac{S}{h} \quad g w_1 = \frac{1.75}{.131} \quad w = w_0 - \frac{S}{h}$$

$$w_1 = 5$$

$$w_2 = 12$$

$$\frac{S_1}{h_1} =$$

$$-3.85$$

$$\frac{S_2}{h_2} =$$

$$3.15$$

$$w = 8.85$$

$$w = 8.85$$

$$g$$

$$w = 8.85$$

$$\text{foundly wrong}$$

At  $5^d 18.9$  the error was  $+1.33$

At  $5^d 18^h$   $\left\{ \begin{array}{l} 36^m \\ 45^m \end{array} \right\}$  the error was  $+ \left\{ \begin{array}{l} .28 \\ .33 \\ .30 \end{array} \right\}$  } the pendulum  
 At  $5^d 5^h$   $\left\{ \begin{array}{l} 31^m \\ 36^m \end{array} \right\}$  " " "  $- \left\{ \begin{array}{l} .72 \\ .46 \end{array} \right\}$  } carrying 18 gms.

At  $4^d 23^h 36^m$  " " "  $- .84$

For  $0.3$  add to negative error

At  $23^h 9$   $- .88$

At  $4^d 5^h 24^m$  the error was  $-4.6$

In substitution  $S_1 = .30 + .88 = +1.18$   $w_1 = 18.8$   $w_2 = 18$   
 using  $S_2$ ,  $h_2$  &  $w_2$  as before

$$\frac{S_1}{h_1} = +.063$$

$$-.131$$

At $5^d 18^h 45^m$	the error was $+1.30$	} The problem carrying 18 gms.
" " $11^h 36^m$	" $-1.84$	
" " " $55$	For $0.7$	
	$\frac{2}{-1.84} = -1.16$	
	$+1.16$	

To take  $S_2$  as before.

At $S_2 = +1.16$	$h_2 = 6^h 8^m 5^s$	$w_2 = 18$	$\frac{S_2}{h_2} = +.170$
$w_1 - w_2 = -13$	$g = .023$		$-.131$
$w_1$	$5$	$w_2$	$18$
$\frac{S_1}{h_1} \div 2$	$\frac{5.7}{10.7}$		$\frac{7.4}{10.6}$
			$-.303$

For mean values we have  $n \left\{ \begin{array}{l} 8.85 \\ 10.75 \\ 9.8 \end{array} \right\} g \left\{ \begin{array}{l} .034 \\ .023 \\ .028 \end{array} \right\}$   
 Giving no reason to change, but from the established figures, and  
 at any rate showing that we have not here the means for a  
 complete determination. Perhaps the addition or subtraction  
 of a large weight is the disturbance which has troubled us.  
 It is to be hoped that the necessity of large changes will be  
 infrequent in future.



Feb. 7. 2

~~2 (42) 137~~

43

~~5- (32)~~

~~32 35~~

21 08 30.32

2 42 37

35

5- (32)

32 35

- 1 08.18

54. 54

- 3.50

10

2 42 00,32

26 41 59.96

Билл - .36

Note  $\frac{.36}{14.1} = .027$  corresponding to  $\frac{1}{\text{gpm}}$ .

*Pondus undictus*.  
~~Added 19 grains at 6~~

N.B. The error of 1327 is but approx. stated. But even if the  
~~agram is not~~<sup>all</sup> ~~required for rate correction it will~~ ~~be a~~  
~~error compensation for a few houses.~~

Feb. 7. 3

21 08 30.32

6 32 25

9 21 10.

By chronograph.

At-

- 1.11.89

1 32.15-8

 $2.8 @ .143$ 

- .40

.027

6 31 12.71

30 31 12.50

Error = 0.21 Based on star determination & therefore replacing entire  
the determination of Feb 7.2

Rate -  $\frac{.21}{12} = .0175$  corresponding to  $\frac{2}{3}$  gramme.

Sold  $\frac{3}{4}$  grammer at  $10\frac{1}{2}^h$

The pendulum now carries  $10\frac{3}{4}$  gm.

Feb. 7.9

Hrs. min. + approx<sup>to</sup> sec. of 1327  $\rightarrow 19^h 14^m 22^s$  Hrs + min of 394  $22^h (01^m)$   
 Interval to coincidence  $2\ 04.$  Observed coincidence  $03\ 04.$   
 Error of 1327 at  $3^h 44^m$   $\rightarrow 7^s\ 11.89$  Reduction  $3\ 37.375$   
 $\rightarrow 15.8$   
 $\rightarrow 17.2 @ .143$   $2.22$   $.011$   
 $19^h 15^m 49.65$  Noon  $21\ 08\ 30.32$   
 $11.89$   
 $11.66$   
 Error of 394  $- .23$   $43^h 15^m 11.66$

N.B. Chance for change of rate of 1327 in 15 hours.

~~Removed  $\frac{1}{4}$  gramme~~ Added 5 grammes at  $22^h 20^m$  Removed at  $0^h 10^m$

The pendulum now carries  $10\frac{3}{4}$  gm.

Feb 8.2

Did not wind chronometers & watches till  $7\frac{1}{2}^h$

Richard watch had stopped.

Walther \$10 had stopped. Wound and started it.

B.7  
 Chronograph. At  $2^h 37^m$   $4\ 49\ 45.$   $21\ 12\ 26.87$   
 $2.2 @ .135$   $-74.74$   $7\ 34\ 48.$   
 $- .30$   $1\ 14.581$   
 $4\ 48\ 29.96$   $28\ 48\ 29.58$   
 $.131$

Error  $-.38$  <sup>partly</sup> Due to fact that at noon when we last regulated, we counted upon a faster rate of 1327 than the stars now show it to have had.

Added  $\frac{1}{2}$  gramme at  $9^h$   $12\frac{1}{4}$  gm. now on pendulum.



Monday

21 12 26.87

19 19 24.

$$AC 2^{\wedge} 37^{\wedge} - 1 \quad 14.74$$

3 10.394

$$14^2 @ .135 \quad - 1.89$$

166

16 35 ~~28~~ 37

30 35 61.33

01.37

Corr of 394 := - .04

Removed  $1\frac{1}{4}$  gm. at 19<sup>h</sup> 40<sup>m</sup>

Purd. non cornis 11 grs.

Wood chronometer & watches  $19 \times 3\frac{1}{4}$  except Richard watch which has not been started.

Wound clock (394, 312, 1327) at 7 19<sup>h</sup> 50<sup>m</sup>

Temp in clock <sup>case</sup> ~~room~~ 64.8 64.6 }  
Max. + Min 63.4 66.6 } I.

Feb 9.2

21 16 23.43

3 15-40  
at 34 - 78.17

3 15 40.

5 57 00.

Al-  $2^{h58m}$  - 78.23

58, 646

$0.3 @ .135$  -.04

0

3 14 21.73

27 14 22.08

Error of 394 = +.35

Removed 1 gramme at 8<sup>h</sup>

Pend. non carrier 10 gms.

Feb. 9. 8

21      16      23, 43

17 07 58

19 (47)

1 10

48 10.

- 1 18.23

3 15, 15-8

14.1 @ .135 - 1.90

. 027

17 07 48<sup>7</sup>.87

41. 07 48.62

Enor = .25

Added 6 gm. at (8 A.M.) 20<sup>h</sup>

 $2 + .75$ 

Remond 5 gm. at

 $2\frac{1}{4}^h$

Wound chronometer (Yves.) at 20<sup>h</sup>

Feb 10.3

	5 <del>4</del>	48	04.	21	20	19.98
				8	(25)	
		2	02.		27	02.
25 <sup>d</sup> 2 <sup>h</sup> 02 <sup>m</sup> @ 3 <sup>o</sup>	-1	+5.25 <sup>88</sup>	15.74		1	23.287
From residual curve		-5.94	5.88			.005
	5	4.8	44.8 <sup>88</sup>	29	48	45.37

Error of 394 +0.94 +0.89

This is based upon error of 1327 =  $75.73 + 5.94 = 81.67$  by graphical prediction.

The old method would give  $74.74 + (27.2 \times .135) =$

$78.23 + (26.8 \times .135) = 78.23 + 3.67 = 81.90$  A difference of 0.29

Although a higher rate might have been estimated with still greater discrepancy.

	6	1 <sup>88</sup>	09.	21	20	19.98
		2	08.	8	(55)	
From error		-81.67			57	08.
1/2 hr @ .14		- .07			1	28.215
	6	18	55.22			.022
					18	56.22

Error +0.94 +0.90

Removed 3 grams at 9<sup>1/4</sup><sup>h</sup> Pendulum now carries 8 gms.

Feb 10.8

	16	42	53.	21	20	19.98
				19	18	
			44.			44.
25 <sup>d</sup> 16 <sup>h</sup> 43 <sup>m</sup>	-1	17.09			3	10.23
Residual		-5.97				.12
	16	42	13.94		40	42
						14.38

Error +.37

Remove 3 grams at 19<sup>1/2</sup><sup>h</sup>

Wound chronometer & watches at 19<sup>3/4</sup><sup>h</sup>

Replaced 4 gms. at 21<sup>1/4</sup><sup>h</sup> Pend now carries 9 gms.



	19	52	25.		21	20	19.98
		1	40.		22	(27)	
						28	40.
At 17 <sup>h</sup> 39 <sup>m</sup>	-1		23.30			3	41.442
2.2 @ .135			- .30				.11
	19	52	41.40		53	52	41.53

Error = +0.13

Added 1<sup>1</sup>/<sub>2</sub> gm. at 22<sup>h</sup> Pendulum carries 10<sup>1</sup>/<sub>2</sub> gm.

Feb. 11.4

	9	1	36		21	24	16.54
		1	02. <del>02</del>		11	(34)	
						35	02.
At 2 <sup>h</sup> 31	-18		24.47			1	54.171
6.5 @ .13			- .85				.005
			- 8.52				
	9	01	12.68		33	01	72.78
			05.01				

Clock error = +.04

Added 1/4 gm Pendulum unchanged.

Feb. 11.8

	17	27			21	24	16.53
			40.		19	(58)	
						58	40.
At 2 <sup>h</sup> 31	-1		24.47			3	16.801
14.5 @ .131							.110
15.5 @ .13			- 1.96				
	17	26	13.57		41	26	13.45

Error -.12

Added 5<sup>1</sup>/<sub>4</sub> gm. at 20<sup>h</sup> Pendulum carriesWound chronometer & watches 8<sup>h</sup> 5 to 10<sup>m</sup>Remained 5 gm. at 21<sup>1</sup>/<sub>4</sub><sup>h</sup>

Feb. 12.4

			21	28	13.09
	9	54 44.	12	23	
		42.			42.
At 6 <sup>h</sup> 17 <sup>m</sup>	- 1	28.62		2	2.056
3.6 @ .14		-.50			.115
	9	53 56.88	33	53	57.26

Error +.38

Remove 2 gms. at 12<sup>h</sup> 1/2<sup>m</sup> Pendulum now carries 8<sup>3</sup>/<sub>4</sub> gmWound clock in clockcase at 12<sup>h</sup> 1/2<sup>m</sup> M.S.

Temp. after winding 67.0 66.8

Minimum &amp; Maximum 63.4 66.8

Feb. 12.8 Friday A.M.

			21	28	13.09
	16	35 51	19	03	
		36.			36.
	- 1	28.62		3	7.776
10.3 @ .14		- 1.44			.099
	16	34 56.94	40	34	56.96

Error of 394 = +.02 or clock right at 19<sup>h</sup> 25<sup>m</sup>Added 2 gms. at 19<sup>h</sup> 1/2<sup>m</sup> Pendulum now carries 10<sup>3</sup>/<sub>4</sub> gm.

Feb. 13.3

1327	Behind amount 16.5	86.55	6	55	14	9	20	42.
384		5.26			42			
14.4 @ .137		91.91			56		1	31.99
		88.46		- 1	31.81			.12
		91.81	6	54	27.54	30	54	23.76
					24.19			

Error = -.43

With the present experience with the graphical method of prediction, J.R.E. is afraid that error in prediction may have increased the negative error. The apparent discrepancy between this and morning is directly due, <sup>largely</sup> to different modes of predicting.

There 88.62 - 80.0 88.62 + 1.44 + 14.3 @ .14 = 92.06 inches of 91.81

Added 1 gm. at 10<sup>h</sup> 3 3/4<sup>m</sup> Load now = 11<sup>3</sup>/<sub>4</sub> gm.



242

Feb 13.8

(Sat. A. M.)

Peterson at 6<sup>55</sup> 91.81  
 10.2 @ .137 1.40  
93.21

17	40	01.	21	32	09.65
		30.	20	03	
				30.	
	- 1	33.21		3	17.622
17	38	57.79			.082
		57.35			
Error		- .44	41	38	57.35

The fact that  $11\frac{3}{4}$  grams has been carried by Peterson makes it improbable that the error has not reduced since last night. It is more probable that the rate of 1327 is greater than predicted. Attempt to get stars this A. M. failed. Perseus undisturbed.

Wound chronometer & watches at  $22\frac{1}{2}^h$

Feb 14.2

2 31 41.  
 At 3<sup>h</sup> 08<sup>m</sup> - 1 15.15  
 - 0.6 @ .14 + .08  
 05.93  
 04.34  
 Error = +.57

Provisional at 2<sup>h</sup> 59<sup>m</sup>

- 0.5 at .14

2 31 41.  
 - 1 35.17  
 + .07  
 2 30 05.90

21 36 06.20  
 4 53 12.  
 0 48.132  
 .033  
 26 30 06.86

Provisional error of 394 = +0.46

394 has had 1 gm. more weight than name. If it has then being .027 below, then at 2<sup>h</sup> 03<sup>m</sup> or 8.8 ago its error would have been about 0.46 - 0.24 or say +0.2. At 9<sup>h</sup> 20 or 19.5 ago its error would have been 0.46 - .53 = -.07 which is more in accord with what was expected than the error actually found, but depending upon the rate prediction for 1327.

Removed 1 3/4 gm. at 6 1/4<sup>m</sup> 10 gm. more on pendulum.

Feb. 14.9

Sunday A. M.

Wound chronometer & watches at 21 3/4<sup>m</sup>

1.2967  
 2.1614  
 2.1353  
 0.4581

At 3<sup>h</sup> 08<sup>m</sup>

19.8 @ .145

Error = +0.79

21 36 06.20  
 20 39 30. 22 (58) 12.  
 1 12. 59 12.  
 - 1 35.15 3 46.535  
 - 2.87 .033  
 20 39 03.98 44 39 04.77

21 36 06.20  
 20 51 32 23 (10)  
 1 10 11 10.  
 - 1 35.15 3 48.506  
 - 2.90 .027  
 20 51 03.95 44 51 04.73

Error = +0.78



Removal 10 gm. at  $-23\frac{1}{4}^h$  0 gm. now on fusel.

The comparisons at  $-4^h 53$  and  $22^h 59$  give a rate

$\frac{.78 - .46}{18.1} = +.018$  with 10 gm load. This seems hardly reasonable. Probably the <sup>rate</sup> has been wrongly calculated for 1327

Replaced 9 gm. at  $0^h \frac{1}{4}$

Feb 15.3

$$\begin{array}{r} 1.4609 \\ 7.4757 \\ 9.1114 \\ 0.6322 \\ \hline 0.6283 \end{array} \quad \begin{array}{r} 1.4458 \\ 9.1614 \\ 0.6070 \end{array}$$

At  $3^h 08^m$   
~~2~~  $2^h 27.9$  at .145 Provisional

$$\begin{array}{r} 87 \quad 01 \quad 14. \\ -1 \quad 20. \\ \hline 35.15 \\ +4.94 \\ \hline -4.05 \end{array}$$

21 40 02.76

9 18

30.

1 31.665

.055

$$\begin{array}{r} 56 \quad 59 \quad 54.57 \\ 54.80 \\ \hline \end{array}$$

30 59 54.48

Provisional Error  $-0.03$  or block right.  
 $= .32$

Refining the former of page 226

$$\text{Rate} = \frac{e - e_0 + vt}{t} = \frac{-0.03 - 0.78 + (.243 \times 1^h)}{8.8} = \frac{-0.57}{8.8} = -.065$$

$$= \frac{-0.32 - .78 + (.243 \times 1^h)}{7.8} = \frac{-.86}{7.8} = -.11 \quad \text{with 9 grammes.}$$

Hardly reasonable.

21 40 02.76

7 57 20.

9 57

06.

06.

-1 35.15

1 37.579

-4.18

.016

28.8 at .145 Provisional

$$\begin{array}{r} 7 \quad 55 \quad 46.67 \\ 31 \quad 55 \quad 46.35 \end{array}$$

Error (Provisional) =  $-0.32$

Having checked this, the inference is that the removal and replacing of a large weight make more loss than the simple rate for that weight removed for

$$\begin{array}{r} 1.4594 \\ 9.1614 \\ 0.6208 \end{array}$$

the time would indicate. This is in accordance with the inference from pages 232 & 235.

Had we chosen a rate of .141 for 1327 we should have

$$\begin{array}{r} 1.4594 \\ 9.1492 \\ 0.6086 \\ \hline 1.4594 \\ 9.6128 \\ \hline 1.0722 \end{array}$$

28.8 @ .141

$$\begin{array}{r} 7 \quad 57 \quad 26 \\ -1 \quad 35.15 \\ \hline \end{array}$$

-4.06

$$\begin{array}{r} 7 \quad 55 \quad 46.79 \\ 46.35 \\ \hline \end{array}$$

Provisional Error - .44

Let us assume the normal weight <sup>for</sup> of the specimen to be about 10. Although the comparisons of 14.9 seem to amply check, let us imagine a mistake of 15, so that the error would read +.21 instead of -.21 instead of +.79

The rate would then have been  $\frac{-21 - .46}{18.1} = \frac{-.67}{18.1} = -.037$  with 10 gm. which would correspond to a normal weight of  $10 + \frac{3}{8} = 10\frac{3}{8}$  gm.

Then last rate would be  $\frac{-.32 + .21 + .24}{7.8} = \frac{+.13}{7.8} = +.017$  corresponding to a normal weight of  $9 - \frac{3}{8} = 8\frac{5}{8}$ . This does not better the matter. It is quite unsatisfactory.

Now the normal weight  $10\frac{3}{8}$  gm. and the  $-.44$  error to be compared in  $10^h$ , we should have  $10\frac{3}{4} + 1\frac{1}{2} = 12\frac{1}{4}$

Added 3 gm. at  $10\frac{3}{4}^h$  Load = 12 gm.

Feb 15.8

Monday A.M.

$$\begin{array}{r} 1.5922 \\ 9.1492 \\ 0.7414 \end{array}$$

$$\begin{array}{r} 1 \quad 35.15 + 39.1 @ .145 \text{ Provisional} \\ 5.51 \\ \hline 40.66 \end{array}$$

$$\begin{array}{r} -1 \quad 40.66 \\ \hline \end{array}$$

$$\begin{array}{r} 16 \quad 13 \quad 59.34 \\ \hline \end{array}$$

Provisional Error = -.09

But see next page.

$$\begin{array}{r} 21 \quad 40 \quad 02.76 \\ \hline \end{array}$$

$$\begin{array}{r} 16 \quad 14 \quad 46. \\ \hline \end{array}$$

$$\begin{array}{r} 18 \quad 30 \quad 54. \\ \hline \end{array}$$

$$54.$$

$$3 \quad 2.345$$

$$.148$$

$$\begin{array}{r} 40 \quad 13 \quad 59.25 \\ \hline \end{array}$$



A single star taken this morning gives for 1327 Error =  $+1^m 40.68$   
 One previous at  $16^h 40^m$

Error at time of comparison would be

$$\begin{array}{r} 1^m 40.68 \\ - 0.4 @ .19 \\ \hline 1^m 40.62 \\ 1 \quad 40.66 \\ \hline \text{Correction} \quad .04 \end{array}$$

This being an algebraic increase in the error of 1327  
 would be an algebraic increase in the error of 394

$\therefore$  Error at last comparison =  $-.09 + .04 = -.05$

The rate of 394 was about  $\frac{+.44 - .09}{8.3} = +.042$  with 12 gm.

This corresponds to normal weight  $12 - 1.7 = 10.3$ .

Removed  $1\frac{3}{4}$  gm. at  $19^h 40^m$  Load =  $10\frac{1}{4}$  gm.

Wound clocks at  $19^h 3\frac{1}{4}^m$

~~shown~~ Temp in case before winding 62.2 62.  
 Min. & Max. 61.8 67.2

Wound regulator & chronometer at  $19^h 55^m$

Feb. 16.2

			21	43	59.31
3	16	28	5	2.9	52.
	-1	42.03		0	54.036
		+ .01			.142
<hr/>					
3	14	45.98	27	14	45.50

Error =  $-0.48$

Rate about  $\frac{.43}{10} = .043$  corresponding to normal wt.  $10\frac{1}{4} + 1\frac{1}{2} = 11\frac{3}{4}$

Correction by adding  $1\frac{1}{2}$  gm. Load at  $10\frac{1}{4}^h$

Load =  $11\frac{3}{4}$  gm.

Feb. 16.5      Tues. 4. 16.

$$\begin{array}{r} .143 \\ 13 \\ \hline 429 \\ 143 \\ \hline 1.859 \end{array}$$
At 3<sup>h</sup> 3813<sup>h</sup> @ .143

16 36 49

1 08

- 1 42.03

- 1.86

16 36 13.11

21 43 59.31

18 (48)

49 08.

3 5.466

.022

40 36 12.80

Error of 394 = -.31

Added 5 gm. at 19<sup>h</sup>Load = 16  $\frac{3}{4}$ 

The preceding rate corresponds to normal load 17  $\frac{3}{4}$  -  $\frac{3}{4}$  = 11 gm.  
 Wound chronometer & watched at 20  $\frac{3}{4}$ <sup>h</sup>

Removed 5  $\frac{3}{4}$  gm. at 22<sup>h</sup> 21<sup>h</sup> Load 11 gm.

$$\begin{array}{r} 19 \quad 03 \quad 13. \\ \quad \quad 1 \quad 26. \\ \hline \text{At } 17^{\text{h}} 54 - 1 \quad 43.91 \\ 1.1 @ .14 \quad - .16 \\ \hline 02 \quad 54.93 \\ \quad \quad 54.93 \\ \hline 1.1875 \\ 9.1553 \\ \hline 0.3428 \end{array}$$

Error = -.10

15<sup>h</sup> 4 @ .143

19 03 13.

1 26.

- 1 42.03

- 2.20

19 02 54.77

21 43 59.31

21 (14)

15 26.

3 29.45

.07

43 02 54.83

Error = +.06

Feb. 17.2

(Worked out at 17.4)

21 47 55.87

1 18 11.

3 27 56.

By chronograph

32<sup>h</sup> 1<sup>h</sup> 18<sup>h</sup> @ 3<sup>s</sup> - 1 36.16

... 34.005

Residual - 8.81

.153

1 16 26.03

25 16 26.03

Clock right.

But see foot of next page.



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Feb 17.5

			21	47	55.87
9	43	39.	11	52	
		48.		48.	
<del>32d</del> 9 <sup>h</sup> 43 <sup>m</sup>	1	37.21	1	56.964	
Adjusted At 1 <sup>h</sup> 18	-1	44.97		131	
8.4 @ .14		-1.18	33	42	40.96
	9	42			40.85

Block Error = +.11

0.11 parts in 8.4 =

0.11 in 8.4 = .013 or too much to attribute to wrong rate of 1327 <sup>Defect of base.</sup>Removed 3/4 gm. at 12<sup>h</sup> 10

Load = 10 1/4

Feb 17.8

Wed. A. 14.

			21	47	55.87
17	19	55.	19	(27)	
	1	36.		28	36.
	-1	44.97		3	11.873
16 <sup>h</sup> @ .14		-2.24			.099
	17	19	41	19	43.84

Block 0.05 parts Error = +.05

Block comparison of Feb 17.2 (from chronograph)

			21	47	55.87
	1	48	3	58	14.
At 1 <sup>h</sup> 18	-1	44.97			39.097
0.5 @ <del>14</del> .14		- .07			.038
	1	46	25	46	49.005

Error = +.04 or +.05

In view of the discrepancy between this and the figures on last preceding page, it will be well to duplicate chronograph comparisons next time. This last figure is in accord with what we should have <sup>estimated</sup> predicted for the other comparisons.

Pendulum undisturbed.

Wound watch + chronometer at  $-20^h$

Feb. 18.5

			21	51	52.42
9	9	33.	11	(14)	
	1	08.		15	08.
33 <sup>d</sup> 9 <sup>h</sup> 9 <sup>m</sup> @ 3.	-1	40.14		1	50.885
Predicted residual		-9.10			.022
9	8	51.76	43	08	51.33

Error =  $\frac{1}{2} - .43$

Rate  ~~$\frac{1}{4}$~~   $\frac{47}{15.8} = .030$  with a Normal load =  $10\frac{1}{4} + 1 = 11\frac{1}{4}$   
 A compromise call normal load =  $10\frac{3}{4}$  estimate.

To compensate in 9<sup>h</sup> would require  $\frac{1\frac{3}{4}}{12\frac{1}{2}}$  grams.

Added 2 gm. at  $-11\frac{1}{2}^h$  Load =  $12\frac{1}{4}$  gm.

Feb. 19.2

Thurs. A. M.

17	06	52.	21	51	52.42
		38.		55	48.98
17	05	39.44	19	10	
		39.40			38.
33 <sup>d</sup> 17 <sup>h</sup> 7 <sup>m</sup>	-1	41.14		3	08.916
Provisional Residual		-9.14			.104
17	05	39.72	40	05	39.44

Provisional Error = .28

Added 6 gm. at  $19\frac{3}{4}^h$

Two stars  
 Stars just taken give Error of 1327 =  $+1^m$  50.554 at  $17^h$

The provision used above

$$\begin{array}{r} 1 \quad 50.56 \\ 1 \quad 50.28 \\ \hline .28 \end{array}$$

$\therefore$  Error of 394 at  $19^h 10^m$  N.Y. = 0 The effect of the net.  
 just added gives a compromise toward where the



"smooth curve" of 1327 will probably lie.

Remove 7 gm. at  $20^h 4^m$  Load =  $11\frac{1}{4}$

Wound watches & chronometer at  $20^h 20^m$

Thurs. See next morning for clock winding.

Feb. 19.3

	21	55	48.98
6 11 02.	8	12	00.
At $5^h 03^m$	-1	52.27	1 20.82
1.1 @ .14		- .15	
	6 09 09.58	20 09 09.80	

Error = +.22

Remove  $1\frac{1}{4}$  gm. at  $12^h$

Load =  $10\frac{1}{4}$

Feb. 19.8

Fri. A.M.

	21	55	48.98
17 05 51.	19	(05)	
At $5^h 03^m$	+1 08	06	08.
- - - - -	-1.52.27	3	08.26
12 <sup>h</sup> @ .14		- 1.68	.02
	17 05 05.05	41 05 05.26	

Error = +.21

Remove  $4\frac{1}{4}$  gm. at  $19^h 25^m$

Load =  $6\frac{1}{4}$  gm.

Wound clocks at  $19^h 25^m$

Temp before winding  $65.6$   $65.4$

Mo in & Max  $61.8$   $65.4$

Wound watches & cronom. at  $19^h 40^m$

2 Stars just taken give at  $17^h 05^m$  Error of 1327 =  $154.05$   
 Above in used  $153.95$   
 .10

Error of  $294$   
 block at this  $19^h 06^m$  M.T. =  $.21 - .10 = .11$

Added  $4\frac{1}{2}$  gm. at  $20^h 55^m$  Load =  $10\frac{1}{2}$  gm.  
 The clock has probably <sup>lost</sup> ~~gained~~ about .18 in the hour & a half.  
 So that it is about .07 slow.

Wound and started Richard watch in afternoon.

Feb. 20.2

	38	25	10.	21	59	45.52
				5	22	36.
At $3^h 42$	- 1	55.36				52.896
- 0.3 @ .14		+ 0.04				.099
	3	23	14.68	27	23	14.51

Error = -.17

Rate =  $\frac{.10}{8.4} = .012$  roughly. This, acting  $2\frac{1}{4}^h$  more, would make error about -.20

To correct rate requires  $\frac{1}{2}$  gm. To compensate  $13^h$  requires  $\frac{1}{2}$  gm. about:

Added  $\frac{3}{4}$  gm. at  $7\frac{3}{4}^h$  Load =  $11\frac{1}{4}$  gm.

Feb. 20.8 Sat. A.M.

	3	25	10.	21	59	45.52
				5	22	36.
	- 1	55.36		21	59	45.52
	16	45	47.	18	41	
		1.8.				18.
	- 1	55.36				
		- 1.86		3	4.15	
					.05	
	16	44	07.78	40	44	07.72

Error = -.06

Rate +  $\frac{.20-.06}{11} = +.013$  roughly. In  $2\frac{1}{4}^h$  more, the error would reduce.  
 to  $-(.06-.03) = -.03$  Or in  $4\frac{1}{2}^h$  to zero. In view of uncertainty  
 of 1327 the pendulum is not disturbed.

Wound chronometer & watch at  $19^h$

Removed  $\frac{1}{2}$  gm. at  $21\frac{3}{4}^h$  Load =  $10\frac{3}{4}$  gm.

1.1155  
 9.1430  
 0.2585



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Feb. 21.2

B<sub>3</sub>  
chronograph.At 3 44  
0.4 @ .14

4	6	16.
-1		58.74
		- .06
		<hr/> 17.20

22	03	42.08
5	59	
6	17	36.
	0	58.975
	1	0.946
		<hr/> .099
28	16	19.12
28	04	18.15

Error ~~to~~ - .05

Pendulum undisturbed.

Feb. 21.9 Sunday L.H.

21	25	32.
2		00.
-1		58.74
		- 2.48
		<hr/> 21 25 31.78

17.7 @ .14

22	03	42.08
23	(16)	
		18 00.
		3.49.66
		<hr/> 0.
45	25	31.74

Clock error = -.04 or practically right.

Rate correct.

Pendulum undisturbed.

Wound chronometer &amp; watches 22 1/2 h

Feb. 22.2

At 3<sup>h</sup> 33  
4.1 @ .14

7	<sup>40</sup> <del>39</del>	15.
	1	12.
		- 2 02.13
		- .57
		<hr/> 7 39 24.30

22	07	38.63
9	(29)	
		30 12.
		1 33.637
		<hr/> .033
31	39	24.30

Error zero.

The clock has gained .05 in 27.7, or rate is as near  
to right as one can hope to run it. Pendulum undisturbed.

Feb. 22.8 Mon. A.M.

17	34	54.	22	07	38.63
2	02.		19	(22)	
-2	02.13		24	02.	
			3	11.316	
14 <sup>h</sup> @.14	-1.96				.005
17	34	51.91	41	34	51.85

Error +.06

Removed  $\frac{3}{4}$  gm. at  $19\frac{1}{2}^h$  Load = 10 gm.

Wound clocks at  $19\frac{1}{2}^h$  Temp 63.8 62.4  
 Min + Max 63.8 66.2

Wound chronometer & watch at  $19\frac{3}{4}^h$ Added  $\frac{1}{2}$  gm.  $22\frac{1}{2}^h$  Load =  $10\frac{1}{2}$  gm

Feb. 23.4

By  
chronometer

7	19	17	22	11	35.19
At 7 <sup>h</sup> 31 (Provisional)	-2	06.50	9	04	06.
-2@.14		+ .03	1	29.365	
	7	17	10.53	31	17
				10.57	

Error = +.04 (Provisional)\* Pendulum undisturbed.

\* I have no stars be obtained in the morning, more of these taken this morning will be calculated.

\*  
 7 19 17.  
 At 7<sup>h</sup> 08} -2 06.49  
 +0.2@.14 - .03  
 7 17 10.58  
 10.57  
 Error = -.01



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Feb. 23.8 Yucc. A. 16.

By can.

18 34 38  
 At 18'05" - 2 08.13  
 .5@.14 - .07  
 39.80  
 29.93  
 Error = +.13

18	34	38	22	11	35.19
	- 2	06.50	19	57	38.
		- 1.50		3	16.64
					.10
18	12	30.00	42	12	29.93

Error = -.07 (Provisional)

Time stars of this A. 16. taken too late for work up -  
 Trouble with chronograph caused delay.

Pendulum not disturbed.

Wound chronometer at 20<sup>h</sup> Watch at 20<sup>h</sup> 14<sup>m</sup>

Feb 24.2

By chronograph

3 09 47  
 At 3<sup>h</sup> 36 - 2 09.39  
 -.5@.14 + .07  
 37.78  
 37.59  
 Error = -.19

At 3<sup>h</sup> 37

-.5@.14.

3	09	47.	22	15	31.74
	- 2	09.33	4	51	18.
		+ 00.07			47.804
					.049
3	07	37.74	27	07	37.59

Error = -.15

Rate =  $\frac{.75 + .04}{(27^h 07.6) - (27^h 07.6)}$  -  $\frac{.75 + .04}{(29^h 09.8) - (7^h 19.3)}$  =  $-\frac{.19}{19.8}$  = -.010 per hr.

Requires  $\frac{3}{4}$  gm. for rate.Added  $\frac{3}{4}$  gm. at 8<sup>h</sup> 12<sup>m</sup>Load = 11<sup>h</sup> 14 gm.

Feb. 24.8 Wed. B.M.

			22	15	31.74
17	35	53.	19	(15)	
2	08.		17	08.	
- 2	09.33		3	10.066	
14 <sup>h</sup> @ .14		- 7.96			.022
	17	35	49.71	41	35 49.83

Error (dependent upon hourly prediction rating of 1327) = +.12

Error expected =  $-.15 + (0\frac{1}{2} \times \frac{2}{8} \text{ of } .027) = -.15 + .11 = -.04$ Difference (.16) corresponds to a rate of ~~the~~ a trifle over .01 in rate for 14<sup>h</sup>. (But see page 256)Removed  $\frac{3}{4}$  gm. at 19 $\frac{1}{2}$ <sup>h</sup> Load = 10 $\frac{1}{2}$  gm.

			22	15	31.74
18	00	57.	19	(40)	
1	10.		41	10.	
- 2	09.33		3	14.01	
14.4 @ .14		- 2.02			.03
	17	59	55.85	41	59 55.78

Error = +.13 which checks with the above.

Mean of Prediction &amp; Expected errors = +.04

As the discrepancy seems to be purely a difference in the previous comparison rates of the clocks over what previous days had led to expect, give weight to each. But as prediction of 394 was disturbed give (say) double wt. to 1327. Then mean = +.07

Removed 2 gm. at 20<sup>h</sup> Load = 8 $\frac{1}{2}$  gm.  
 Wound chronometer at 19<sup>h</sup> 55<sup>m</sup> Watch at 20<sup>h</sup> 05<sup>m</sup>

Added 2 gm. at 21 $\frac{1}{2}$ <sup>h</sup> Load = 10 $\frac{1}{2}$  gm.



Feb. 25, 8 Thurs. A. U.

	15	34		22	19	28.30
	<del>17</del>	<del>10</del>	32.	17	10	
At 3 <sup>h</sup> 39		56.				56.
At 3 <sup>h</sup> 37	-2	09.33			2	49.203
Approximate 36 <sup>h</sup> @ .14		- 5.04			3	39.964
						.153
	15	33	13.63	39	33	4.42
						13.66

Approximate error = +.03

Working up star back stars for a better prediction of rate of 1327 shows the rate to <sup>have been</sup> actually about .15 instead of .14 from Feb 22.2 to 23.8, and then to have fallen to about .14 from 23.8 to 24.2, or less than .13 from 23.8 to 24.2. This low rate would account for the discrepancy of page 255.

Had we used a rate of .13 in the above comparison, it would have made the clock 1327 394 appear .36 slow, or error = -.33

In view of above, and while making a graphical prediction for 1327

Remained ~~2~~ gm. from <sup>at 18<sup>h</sup> 1/2</sup> ~~prediction~~. Load = 8 1/2 gm.

Added 3 gm. (by removing 2 + adding 3) Load = 13 1/2 gm.

40<sup>h</sup> 15<sup>h</sup> 34<sup>h</sup> @ 3<sup>s</sup> = 2<sup>m</sup> 01.95

Predicted Residual + 12.55

" Error = 2 14.50

Above approx. (2 14.37)

Diff .13

15 34 32.

56.

- 2 14.50

15 33 18.50

39 33 13.66

+ .16

The prediction makes that 394 was .16 fast at 17<sup>h</sup> 11

The difference is due to the fact that the smooth curve does not justify the rate .13 but confirms the .14, which it ~~affairs~~ passes a point at the last star observation which would call for a greater positive error of 1327 than the result which indicated the slow rate.

The 3 grams added have given about .08 in the hour.

Remove 5 grams at  $19\frac{1}{2}^h$  Load =  $8\frac{1}{2}$  gm.  
At  $21^h$  this should bring <sup>error</sup> it to where it was before the 3 gm. were added.  
Wound chronometer & watch at  $19\frac{3}{4}^h$ .

Feb. 26

After Added 2 gm. at  $21\frac{1}{2}^h$  Load =  
Winding clocks in P.M. neglected. Gals next morning.

Feb. 26.8

Wound clocks Fri. A.M.  
At Wound clocks at  $19^h 10^m$  } Before winding  $64.6$   $64.2$   
and Added 5 gm. Load = } At 11 + 10  $67.8$   $65$

Provisional error of 1327 from  $E + \pi$  Huculi =  $+2^m 17.79$  at  $17^h 08^m$  sid.  
Corresponding " " 394 =  $-0.25$  at  $18^h 41^m$  m.t.

See "Pocket-Record of clock comparisons etc. etc."

Wound chronometer  $19\frac{3}{4}^h$

" watch  $20\frac{1}{4}^h$

Adding a Huculi to the two above give error of 1327 at  $17^h 08^m$  sid.  
=  $+2^m 17.83$  or .04 more than before.

So the above error of 394 reduces to  $-(0.25 - .04) = -.21$

Remove 5 gm. at  $20\frac{3}{4}^h$  Load =  $10\frac{1}{2}$  gm.

Feb. 27.2

Running Error of 1327 at  $2^h 47^m_{sid} = 2^m 19.10_{sid}$  from direct observation, Error of 394 of sid.  
Error of 394 at  $4^h 17^m$  m.t. =  $-.27$

" " " " "  $2^m 19.17_{sid}$  from smoothing of curve,  
Error of 394 at  $4^h 17^m$  m.t. =  $-.20$

Feb. 27.8

" " " " "  $10^h 16^m_{sid} = 2^m 20.08$  from graphical prediction,  
Error of 394 at  $11^h 47^m = -.35$

Merits to add so large a weight as a calculation for compensation would call for.

Added  $1\frac{1}{2}$  gm. at  $12^h$  Load =  $12$  gm.



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Feb. 27.8 Lat. A. K.

Error of 1327 at  $16^h 57^m$  Sid. =  $2^m 20.93$  At  $16^h 49^m$ , Error =  $2^m 20.91$ Comparing error of <sup>394</sup>1327 (at last named time of 1327) =  $\bar{x}.13$  at  $18^h 18^m$  m. t.

$$\text{Rate } \frac{+.13 + .35}{6.3} = \frac{.91.98}{.71.05332} = .076$$

Normal load =  $12 \text{ gm.} - 2\frac{3}{4} = 9\frac{1}{4} - \text{uncertain}$ 

$$\text{Rate } \frac{.35 - .13}{6.3} = \frac{.71.22}{.71.02446} = .035$$

Normal load =  $12 - 1\frac{1}{4} = 10\frac{3}{4} \text{ gm.}$ Since at  $21^h$  the error would be  $-.13 + (4.2 \times .035) = -.13 + .14 = 0$ Wound watches & chronometer at  $20\frac{1}{4}^h$ Removed  $1\frac{1}{4} \text{ gm.}$  at  $21\frac{1}{2}^h$  Load =  $10\frac{3}{4} \text{ gm.}$

Sat: Feb. 28, 1880 (Sunday) etc. etc.

Lengthening of Pendulum of Fideur clock #327  
to const-rate.

Working record, <sup>to be formed,</sup> in Pocket-Record of Clock Comparisons etc. etc.

General

Day rate of chronometer 3451

Corresponding		Corresponding		Interval	Interval	Error		
3451	1327			between	x	3451		
1327	2451		Error	two times	0.14	first time		
1327	1327-3451	1327	1327	of 1327		of 1327	1 <sup>st</sup> diff.	Rate of
								3451
								per hour
27 <sup>d</sup> 3 <sup>h</sup> 2	77.7	<del>1<sup>st</sup> 59.96</del> 2 <sup>nd</sup> 08.04	3 <sup>h</sup> 1	+2 <sup>m</sup> 19.06	+0.1	+0.01	11.03	
24 <sup>d</sup> 3 <sup>h</sup> 5	70.5	<del>1<sup>st</sup> 59.20</del> 2 <sup>nd</sup> 00.30	3 <sup>h</sup> 6	2 09.29	-0.1	-0.01	08.98	2.05
21 4.0		<del>2<sup>nd</sup> 08.54</del> 2 51.54	3 <sup>h</sup> 7	1 58.74	+0.3	+0.04	07.24	+7.54
							09.68	+1.24
								+0.24
								+1.270

(after lengthening pendulum)

Graphical construction upon the second sheet shows that  
1327 lost 0<sup>s</sup>.25 relating to 3451 in 1<sup>h</sup>.6 or 0.156 per h.  
∴ Rate of 1327 = +.026 - 0.156 = -0.13

Graphical construction upon the third sheet shows that after  
adding 3 ten-gramme weights to the pendulum of 1327 it  
gained 0<sup>s</sup>.438 relating to 3451 in 1<sup>h</sup>.3 or 0<sup>s</sup>.337 per h.

Then effect of weight = 0.156 + 0.337 = .493 or 0.164 per 10 gm.

To change its rate 0.13 would require about  $\frac{.13}{.164} = 7.9$  gm.

But since the centre of gravity of a 10 gm. wt. is higher above  
the base of the weight than in the case 5, 2, or 1 gramme  
weights, it will ~~therefore~~ probably take more than 7.9 gm. if  
made up of small weights.



260

and  $\alpha$ 

Error and Ratio of 3451 Estimation of Value of preceding page.

27th

Fraction of  
day counting  
to 1<sup>st</sup> Jan of 1327

27 17.1	13.9	2 09.05	17.0	2 20.93	+0.1	+0.01	11.89	0.86	.71
27 3.2		2 08.04	3.1	2 19.06	+0.1	+0.01	11.03		.13
26 18.1	09.1	2 06.95	17.1	2 17.83	+1.0	+0.01	10.89	0.14	.75
24 17.1	49.8	2 01. X						1.91	
24 3.5	13.6	2 00.30	3.6	2 09.29	-0.1	-0.01	08.98		.15
23 18.0	09.5							.25	
23 6.9	11.1	1 57.73	7.1	2 06.49	-0.2	-0.03	8.73		.25
22 3.2	27.7	1 54.33	3.5	2 02.13	-0.3	-0.04	7.76	0.97	.13
21 4.0	23.2	2 51.54	3.7	1 56.74	+0.3	+0.04	7.24	0.52	.17

Studying the above graphically and necessarily rather hastily given a prediction; -

At 28th 28.4 of incl. , Error of 3451 = about  $\pm 12.7$ 

$\times 2^4$			22	31	17.96
8	57	48.	22	11	36.
-		12.7		3	38.65
					.10
			44	46	33.71
		35.3			

$12^4$			22	31	17.96
8	11	24.13	23	36	00.
		- 12.7 (3451)		3	52.61
			46	11	10.57
20	11	11.3			

Rough estimate of error = -.83

Feb. 29

upon the 4<sup>th</sup> sheet -  
 Graphical construction shows that after removing the  
 3<sup>rd</sup> ten-gramme note, and adding a five and ten time (5+2=9),  
 1327 gained <sup>1.08</sup> 0.08 in 10<sup>h</sup> or ~~0.108~~ <sup>relating to 3451</sup> 0.108 per hour.  
 But rate of 3451 = +0.027 roughly.  
 Hence rate of 1327 = 0.08 per h.  
 1327 ~~gained~~ lost 0.92 relating to 3451 in 10<sup>h</sup> or 0.092 <sup>hourly</sup> ~~per hour~~.  
 But rate of or hourly rate of 1327 = -0.088 relating.  
 But rate of 3451 roughly = +0.027  
 Rate of <sup>1327</sup> ~~3451~~ = -0.065  
 Then 9 grammes changed the rate from -.13 to -.065 or reduce  
 it ~~to~~ <sup>to</sup> half but little over half.

After changing the weight to 14 gm. it was found by  
 graphical construction that 1327 <sup>gained</sup> lost 0.30 relating to 3451 in  
 4<sup>h</sup> or +0.067 per h.

But + 27 " " = approx rate of 3451  
 $\therefore +.094$  = rate of 1327 as near as may be.

	22	35	14.52
9	18	27.	10 42 34.
With 1 stone At 6 <sup>h</sup> 30.7		+ 7.64	1 45.464
At 2 <sup>h</sup> 8 @ .094		- .26	.093
	9	18	34.38
	33	14 <sup>8</sup>	33.78

Error = ~~0.6~~ 0.6 Using 2 stones subsequently 7.64 becomes <sup>7.49</sup> 7.5 and -.6 becomes <sup>-1.45</sup> -1.45  
 Rate corresponds to about  $\frac{1}{2}$  grammes.  
 Change  $\frac{1}{4}$  gramme for rate, and  $2\frac{3}{4}$  for compensation. Hence  
 Added 3 grammes at 11 $\frac{3}{4}$ <sup>h</sup> to pendulum of 394  
 Decided to make it up rapidly. Added 10 gm. at 12 $\frac{1}{2}$ <sup>h</sup>  
 Removed 12 $\frac{3}{4}$  gm. at 13<sup>h</sup> 40<sup>m</sup> Load = 11 gm.



$$\begin{array}{r}
 12 \quad 49 \quad 52. \\
 + 7.64 \\
 - .57 \\
 \hline
 59.07
 \end{array}
 \quad
 \begin{array}{r}
 22 \quad 35 \quad 14.52 \\
 14 \quad 12 \quad 23. \\
 2 \quad 19.96 \\
 \hline
 36 \quad 49 \quad 57.54
 \end{array}$$

6.1 @ .094

Feb. 29.6

$$\begin{array}{r}
 12 \quad 57 \quad 52. \\
 + 7.49 \\
 - .58 \\
 \hline
 12 \quad 57 \quad 59.06 \\
 58.91
 \end{array}
 \quad
 \begin{array}{r}
 22 \quad 35 \quad 14.52 \\
 14 \quad 20 \quad 23. \\
 2 \quad 21.28 \\
 \hline
 36 \quad 57 \quad 58.86
 \end{array}$$

Error = -.05

It is not probable however that in this unusual emergency (stopping the standard astronomical clock, with bad weather following without stars) we know our time within much less than .03

\*

Feb. 29.9

Went watch, chronometer + clocks at 22<sup>h</sup>. Temp 68.0 67.8  
 Wm. Wagner. Min + Max 67.8 68.3

Mar. 1 1880

Mer. 6 in. leveled by Thos. R.  $b = +.24$   
 $b \sec \phi = +.32$  (1 div. of level =  $0.84 = 0.056$ )

Mar. 1.2

Error of 394<sub>1</sub> at 22<sup>h</sup> dependent upon one star = +.06 Pendulum indicator.

Mar. 1.6

Error of 394 at 15.2 = +.33  
 This assumes error of 1327 at 14.9 = 14<sup>h</sup> 52.5 =  $\begin{cases} -4.82 \text{ at } 13^{\text{h}} 45. \\ .07 = 1.1 @ .87 \end{cases}$

Removed 2 gm. at 17<sup>h</sup> 1/2 m. b.

Replaced " " " 22<sup>h</sup> 3/4 " "

\* Load on pendulum of 1327 reduced to 12 gm. at 24<sup>h</sup> 13<sup>h</sup> 1/4 (about) See pocket record.

Mar. 2.2

Error of 394 at  $26\frac{1}{2}^h = \text{about } +.39$ 

Mar. 2.8 Wed. A. M.

Error of 394 at  $17^h 48 = +.42 \pm .25$ 5 gm. off pendulum from  $18\frac{3}{4}^h$  to  $21\frac{1}{4}^h$ 

Mar. 3.8 Thurs. A. M.

Error of 394 at  $21^h 09 = +.22$ , of which there should be .06, leaving a real error of +.16  
 Dependent upon <sup>correcting</sup> error of 1327 at  $21^h 09 = -.49$   
 $-0.70 = -0.90 = \begin{cases} \text{at last-transmit} - 0.70 \\ 2.65 @ 0.8 \quad .21 \end{cases}$

Note.  $2^s .058 = \text{space between lines of Mer. Cir.}$ 

(given by Prof. Rogers) To be multiplied by sec 5 for use.

Note. The above +.06, referred to as an error which "should be", is a rough approximation to the <sup>armature</sup> relay time of the <sup>relay</sup> magnet which transmits the signals of 394 to the telegraph line. The determination has been subject to <sup>a</sup> difference of this sort since the clock 1327 was moved down stairs. See pocket record Mar. 3.

Mar. 4.5 Wound clocks at  $12^h$  Added 1 gm. to pend. Load = 11 gm.

Temp in clock case 65- 64.8

Min. &amp; max. 63.4 68.2

Mar. 4.8 Error of 394 =  $-.57$  at  $19^h 2$  dependent upon an uncertain standard, the rate of 1327 not being well determined.Added 10 gm. at  $19^h 20$  Removed  $10\frac{1}{2}$  gm. at  $20\frac{3}{4}^h$ 

Mar. 5.0 Error of 394 =  $+0.8$  dependent upon  $\begin{cases} \text{Error of 1327} - 1.99 \text{ at } 3^h 33^m \\ \text{Rate} \quad +.08 \text{ hour (about)} \end{cases}$   
 at  $2\frac{1}{2}^h 4^h$



Sat. A. M.

Mon. 5:8

Error = -.06 at  $19^h$ Added  $\frac{1}{4}$  gm. at  $19\frac{1}{2}^h$ Load =  $10\frac{3}{4}$  gm.

J. R. E. obs.

Wound watch & chronometer at  $19\frac{1}{2}^h$ 

Mon. 6:9

Sun. A. M.

Wound chronometer & watch at  $20\frac{3}{4}^h$ 

Error at  $21^h = \begin{cases} -.03 \\ +.03 \\ .00 \end{cases}$  Per column undisturbed.  
 But depends upon a single star.  
 Altered rate of 13.27 by removing weights.

Mon. 7:8

Mon. A. M.

A pendulum of 394 has run undisturbed for two days  
 we may with moderate safety count upon its rate.  
 i. e. Error this A. M. will be not far from +.06,  
 the appropriate relay time.

Wound chronometer & watch at  $20\frac{1}{4}^h$

Mar. 8.

J. F. W. Obs.

March 8. 1880.

F. W. resumes the gas of the clocks after an absence of six weeks.

During the past few days from Feb. 26 - March 8 the clock comparisons were made in a small pocket book - hereafter they will be made in this book.

$$1327^{-1/3} = 394.$$

23	33	57	=	0	27	00.
		5.57		6.00	6.30	6.30

$$23 \quad 33 \quad 51.48 \quad 51.00$$

$$23 \quad 7 \quad 2.48 \quad 2.48$$

$$26 \quad 49.00 \quad 48.52$$

$$4.28 \quad 4.28$$

$$26 \quad 44.72 \quad 44.24$$

$$27 \quad 00.00 \quad 00.00$$

$$15.28 \quad 15.96$$

$$15.50 \quad 15.50 \quad -9 \text{ at this time.}$$

$$-.22$$

$$+2.6 \text{ by am.}$$

$$+.56 \text{ running back rate from midnight obs.}$$

$$1327^{-1/2}$$

$$19 \quad 47 \quad 16$$

$$6.40$$

$$19 \quad 47 \quad 9.60$$

$$23 \quad 7 \quad 2.48$$

$$20 \quad 40 \quad 7.12$$

$$3 \quad 23.06$$

$$44.06$$

$$6.00$$

$$15.94$$

$$15.50$$

$$.44$$

$$.44$$

$$.28$$

$$+.72$$

The greatest error

.44 in. by 100 ft.

+28 of 394.

removed 1 gr.

the 1 gr.

to be replaced at 7 P.M. today.



266

Mar. 9.

	1327	
6	38 23	03
	6.9	<del>6.6</del> 6.87
6	37 56.1	56.13
23	10 59.03	59.03
7	26 57.07	57.10
	1 13.23	13.23
	43.84	43.87
	6000	6000
	16.76	16.13
	15.50	15.50
	+ .66	+ .63 at night.
giving $394\frac{1}{3}$ in hours + .44		

Ma. 10

1327 -  $\frac{1}{3}$ 

3 55 33 33

6.47 6.95

3 55 26.53 26.05

23 14 55.59 55.59

4 40 30.94 30.46

0 45.90 45.90

45.04 44.56

6000 6000

14.96 15.44

15.50 15.50

-0.54 2001327

+

1327

8 54 22

7.33

8 54 14.63

23 14 55.59

9 39 19.04

1 34.88

44.16

6000

15.84

15.50

+34

1327

20 34 17

7.40

20 34 09.60

23 14 55.59

21 19 14.01

3 29.56

44.45

6000

15.55

15.50

+0.5



Mar. 11

1327 + 1/2

5 47 48

7.66

5 47 40.34

23 18 52.14

6 28 48.20

1 3.94

44.26

60 00

15.74

15.50

+ .24

- 190.

1327 <sup>not used.</sup>

Waltham.

1327

23 20 40.00

21

2

18

7.72

7.91

23 20 32.28

21

2

10.09

23 18 52.14

23

18

52.14

21

43

17.95

3

33.46

44.49

60 00

15.51

15.50

+ .01

Mar. 12.

1327. <sup>not used.</sup> + 1/2

2 55 16

7.80

2 55 08.20

23 22 48.70

3 32 19.50

0 34.86

44.64

60 00

15.36

15.50

- .14

1327. Waltham

23 26 41

7.72

23 26 33.28

23 22 48.70

3 44.58

62

43.96

60 00

16.04

15.50

+ .54 Snaf Waltham.

Mar. 12.4

1327

1327

Lid. 7. of 4. moon

394

23 22

33.16

9 49 24.

10<sup>h</sup> (25)

1 16.

Coincidence 26<sup>m</sup> 16.<sup>s</sup>Bar. at 9<sup>h</sup> 14

-7.48

Reduction 1 42.836

0.6 @ (eq) .013

- .08

.044

9 50 32.7633 50 32.04Error = ~~-42~~ -5.47

23 22 33.16

10 44 33.

11 20

58.

58.

-7.48

1 51.707

1.5 @ (eq) .02

- .03

.159

10 45 23.4934 45 22.97

Error = -46

Added 1 gm. at 11<sup>h</sup> 1/2

1327

19 19 47

7.92

19 19 49.08

23 22 48.70

19 57 00.38

3 16.08

44.30

Good

15.70

15.50

+ .20

- .20

.00

rem. the 1 gr. added.

also,

5 gr for 1 1/2 h

at 21<sup>h</sup> 30<sup>m</sup>



270

Mar. 13.

1327 - 1/2

20 16 2

8.16

20 15 53.84

23 26 45.24

20 49 08.60

3 24.53

44.07

6000

15.93

15.50

+.43

.00

+.22

rem. 1 gr.

Mar. 14.

1327 + 1/3

18 52 45

8.36

+ 8.16 = fuel m. at this time.

18 52 36.64

23 30 41.80

19 21 54.84

3 10.42

44.42

6000

15.58

15.50

+.08

assume 394 lbs. - .10

put on 1 gr. and

+.14

5 gr. for 1 hr.

+.04 at 22<sup>h</sup>







Monday Evening Mar. 15<sup>th</sup>

J. R. E. takes charge of tire service during F. W.'s absence on account of health.

Note. Longitude of base  $N. H. C_1 = 73^\circ 27' 27''$  west of Paris M<sub>2</sub>2.

$$\begin{array}{r}
 73^{\circ} 27' 37'' \\
 60) 27.61\% \\
 \hline
 360) 73.46 \text{ (204)} \\
 \underline{72} \\
 146 \quad \frac{24}{260} \quad 73.46 = 73\frac{46}{260} \\
 \underline{144} \\
 2
 \end{array}$$

Cor. for long.  
in taking ac-  
stan place  
from  
or  
L'omniscience des  
Temps. "

Whence. I'm taking a star place from the  
Comnaissance des Temps  
add  $4.9^{\text{h}}$  <sup>or 5-6</sup> to our sidereal time, or (what is <sup>probably</sup> the same  
thing) to the sidereal time of meridian passage tabulated  
right ascensions. With this as argument interpolate in  
table.

low. for long.  
in taking out  
star place from  
"539 Sternin"

Long of N. L. C. =  $7^h 9^m 31.06 - 0^h 23^m 49.54 = 49.52$   $45^m 49.52 = 6.8$   
west of Pulhova.

Whence, in taking a star place from the German Ephemeris, add  $6^{\text{h}} 8^{\text{m}} 27^{\text{s}}$  <sup>or  $7^{\text{h}}$</sup>  to our sidereal time, or (what is <sup>practically</sup> the same thing) to the tabulated right ascension. With this as argument - instead in the table.

*M. W. Brown*

Interpolation  
in Ephraim

When the <sup>of train stain</sup> phenomenon is given for every 20 days, obtain the difference for 10 days by 2<sup>nd</sup> differences, and multiply then by the interval expressed as a decimal of 10 days.

To tenth of a day is finer than is needed for time scale.  
But only to single days is too coarse. So say to 0.1



①  
from  
"American  
Ephemeris"

For taking out the Sun from the Amer. Ephemeris, notice that Cambridge is  $\frac{1}{60}$  of a day east of Washington (within  $18^{\circ}5'$ ).

∴ In the daily tabulation of Sun's right-ascension at noon, take the  $1^{\text{st}}$  difference expressed in minutes (and decimal of minutes) and call it seconds. "Look out for sign" is a constant precaution so constantly necessary as hardly to need mentioning. For time by the sun of course the apparent noon is what is wanted.

If, however, the greatest refinement is wanted, so that one finds and applies a correction to the ephemeris place of the sun, we must also subtract from the above sixtyeth of a day correction  $\frac{1}{60}$  of itself.

Reduction	Wire (factor +)	Wire (factor -)	Factor (numerical values)	
to Middle	$A$	$A$	0	
Wire of	4	6	12	
Mention	3	7	23	
Line for	2	8	34	
a broken transit.	1	9	45	
	$A_{+1}$	$A_{-1}$		
	5	1	6	
	4	2	7	
	3	3	8	
	2	4	9	
	1	5	10	

For a broken transit take the algebraic sum <sup>respectively</sup> of the factors corresponding to the wires used, divide by the number of wires used (including the middle wire if used), and multiply <sup>see §</sup> by 2.058 (see page 263). The result, with its proper sign, is the correction to the mean of the wires for reduction to middle.

Or, omit dividing by number of wires, and apply as a correction to the sum of the readings.

### Diurnal Aberration for Latitude of Cambridge.

Diurnal Aberration for True Stars.	$\delta$	$0.021 \cos \delta \sec \delta$	Declination	Aberration
	$0^\circ$	0.015	$0^\circ$ to $51^\circ.7$	.02
	$30^\circ$	0.017	$51^\circ.7$ to $63^\circ.7$	.03
	$40^\circ$	0.020	$63^\circ.7$ to $69^\circ.8$	.04
	$50^\circ$	0.024	$69^\circ.8$ to $73^\circ.6$	.05

Considered as a correction to the right ascension, the aberration has the same sign as the declination, and the same numerical value whether the declination be + or -.



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Selected  
Table of <sup>1</sup> Values of  $n$  (Declination Constant) for  
Meridian Circle.

Date	Value	Pole Star.	Division.	<u>Culm<sup>tan</sup></u>	(Not necessarily the value adopted for time.)
1880 Mar. 10	(-0.99)	0 Ursa Maj. <u>Lo.</u>	1.66	U.	

<u>Date</u>	<u>Value of <math>n</math></u>	<u>Pole Star</u>	<u>Division</u>	<u>Culm<sup>tan</sup></u>
1880 Mar. 15	-0.97	5 Ursa Min.	17.1	U.
18	-1.20	Polaris <u>Lo.</u>	43.5	Lo.
18	-1.08	"	43.3	U.
21	-1.11	51 H. Cephin	21.2	U.
25	-1.15	Polaris <u>Lo.</u>	43.0	Lo.
28	-1.09	8 Ursa Min.	16.9	U.

Apr

Apr. 4	-1.09	{ 8 Ursa Min. 51 H. Cephin <u>Lo.</u>	37.5	<u>Culm<sup>tan</sup></u>	<u>Division</u>
--------	-------	--	------	---------------------------	-----------------

Apr. 7	-1.34?	Polaris	L. L.	43.5
" 10	-1.22	"	Lo. L.	43.3
" 11	-1.16	51 H. Cephin	Lo. L.	20.8
" 12	-1.18	Polaris		43.2
" 12	-1.24	"	Lo. L.	43.0
" 20	-1.34	"	L. L.	43.3
" 21	-1.27	"		42.9
" 27	-1.39	"		42.9
May 3	-1.52	"	Lo. L.	43.3
May 4	-1.44	"		42.8
" 8	-1.46	"	Lo. L.	42.3
" 16	-1.54	"	L. L.	43.3
" 22	-1.61	"	Lo. L.	43.3
" 23	-1.62	"	L. L.	43.3





## Table of Errors of Standard Sidereal Clock 1327

Date.	Time (Sid.). (Mean of the several adjacent times).	Obs. Provisional Error.	Adopted Constant used.		Num. of Stars.	Mean Coefficient of m.	Subsequent Previous Error.	Previous Error.
			Base.	m.				
1880 Mar. 15	5 <sup>h</sup> 46 <sup>m</sup>	R.	+8.34	+0.32	-1.1	III	+70	
" 17	5 25	Between 0 <sup>h</sup> + 5 <sup>h</sup> 25 <sup>m</sup> the clock lost 2 <sup>s</sup> discontinuously.						
" 17	5 25	R.	+6.90	+0.32	-1.1	II	+93	
"	7 37	"	+6.90	"	"	II	+60	
"	9 55	"	+7.06	"	"	II	+46	
"	13 01	"	+7.07	"	"	III	+88	
"	20 25	"	+6.93	"	"	II	+64	
" 18	5 02	"	+6.76	"	"	I	+1.00	
"	19 45	"	+6.45	"	"	I	+76	
" 19	19 45	E.	+6.69	"	"	I	+76	
" 20	8 06	Wk.	+7.20	"	"	IV	+0.005	
" 21	7 30	R.	+7.23	"	"	III	+65	
" "	18 21	R.	+7.40	"	"	IV	+42	
" 22	7 30	R.	+7.26	"	"	III	+65	
" "	18 31	"	+7.07	"	"	II	+1.18	
" 23	19 28	"	+7.11	"	"	III	+83	
" 24	19 42	"	+7.77	"	"	II	+1.75	
" 25	7 30	"	+7.92	"	"	IV	+1.58	
" "	11 25	"	+8.08	"	"	II	+78	
" "	19 47	"	+7.96	"	"	II	+78	
" 26	6 06	E. }	+8.12	"	"	{ III IV	{ +1.27 +1.54	
" 28	7 33	R.	+9.17	"	1 1/8	I	+82	

Mar 29	19 <sup>h</sup> 45 <sup>m</sup>	R.	+9.70 <sup>368</sup>	+5.32	-1.1	III	+1.77
" 30	6 <sup>h</sup> 42	"	+9.86	"	-1.1	V	+1.63
" "	19 34	"	+10.04	"	"	III	+1.63
" 31	9 48	"	+10.34	"	"	IV	+1.67
Apr 1	9 57	"	+10.72	"	"	III	+1.54
" 1	19 32	"	+11.00	"	"	V	+1.74
" 2	9 24	Mrk	+11.19	"	"	III	+1.37
" 4	0 56	R	+11.63	Appx 62	"	⊙	+1.91
" 4	19 23	"	+12.15	"	"	V	+1.73
<i>Block disturbed</i>							
<del>" 5</del>	<del>9 56</del>	<del>"</del>	<del>-15.89</del>	<del>"</del>	<del>"</del>	<del>III</del>	<del>+1.54</del>
" 5	10 31	"	-15.91	"	"	V	+1.56
" 6	19 45	"	-17.77	"	"	IV	+1.72
" 7	10 15	"	-18.50	"	"	III	+1.54
" 8	5 41	"	-19.89	"	"	IV	+1.83
" 9	5 25	"	-21.34	"	"	III	+1.75
" 10	12 09	"	-22.87	"	-1.2	IV	+1.65
" 11	19 49	"	-24.80	"	"	IV	+1.81
" 12	6 00	"	-25.40	"	"	IV	+1.94
" "	12 30	"	-25.55	"	"	IV	+1.77
" 13	9 21	"	-26.51	"	"	IV	+1.50
" 14	5 58	"	-26.91	"	"	IV	+1.62
" 15	1 37	"	-27.34	Appx	"	⊙	+1.73
" 18	5 47	"	-28.43	"	"	III	+1.55
" 20	11 08	"	-28.26	"	-1.3	III	+1.77
" 20	21 2 <sup>3</sup>	"	-28.2 <sup>3</sup>	"	"	<del>III</del>	<del>+1.82</del>
" 21	1 59	"	-28.21	Appx	"	⊙	+1.70
" 21	<del>21 35</del>	"	<del>-28.31</del>	"	"	III	+1.80
" 21	21 35	"	-28.24	"	"	IV	+1.82

Began another calculation book.



280

1880

Apr	22	6 <sup>h</sup>	11	R	-28.35	+ <sup>s</sup> .32	-1.3	III	+ <sup>s</sup> .64
"	"	22	07	R	-28.26	"	"	III	+ <sup>s</sup> .87
"	23	5 <sup>h</sup>	11	R	-28.25	"	"	III	+ <sup>s</sup> .59
"	24	12	40	R	-28.35	"	"	II & III	+1.14
"	"	23	05	R	-28.50	"	"	IV	+0.28
"	26	11	25	R	-28.43	"	"	II	+0.58
"	"	21	39	R	-28.35	"	"	IV	+0.12
"	27	21	48	R	-28.21	"	-1.4	VI	+0.19
"	28	20	20	R	-28.11	"	"	III	+0.31
"	30	6	44	R	-27.88	"	"	III	+0.47
May	2	12 <sup>h</sup>		R	-27.4	mean <sub>2</sub>			
May	3				-28.6	327.6		①	
"	3	12			-28.3	327.3			
"	4				-27.4			①	
"	4	21	31	R	-27.31		1.4	IV	+0.23
"	5				-27.3			①	
"	5	21	21	R	-27.15		1.4	III & IV	+0.13
"	6	7	26	R	-27.10		"	III	+0.62
"	"						1.4		
"	8	12	46	R	-26.15		1.4	III	+0.35
"	9	8	44	R	-26.06		"	III & IV	+0.23
"	10	12	28	R	-26. <sup>67</sup>		1.46	III & IV	+0.31
"	11	12	about	R	-25.4	about			
"	11	21	57	R	-25.33		-1.5	III	-0.12
"	12	21	20	R	-24.95		-1.5	III	+0.12
"	13	0	02	R	-24.32	about		I	
"	14	22	46	W.G.W	-24.17		-1.5	III	+0.42
"	15	12	41	R	-24.38		-1.5	III	+0.17
"	16	12	21	R	-24.32		-1.5	II	+0.60

May 17	11 <sup>h</sup>	5 <sup>m</sup> 4	M.G.M.	-24.22	+0.32	-1.5	IV	+0.34
" 20	11	5 <sup>m</sup> 5	R	-23.41	"	-1.5	II	-0.35
" 21	12	44	M.	-23.48	"	-1.5	III	+0.35
" 22	13	43	R	-24.00	"	-1.6	IV	+0.28
" 23	11	35	R	-24.24	"	-1.6	III	+0.05









## Table of Errors of Sid. Chronometer 3451

Date,	Time	Seconds of 1327	Seconds of 3451	Error of 3451	Revised Values,	Coincidences	
						Waltham, 1327	Comp. 1327 Tab. Error
						Waltham, 3451	Tab. Error
						$\text{Diff.} - (\text{Diff.}) = \text{Diff. Error 3451}$ <del>reduced Error</del>	
1880 Mar. 17	10 <sup>h</sup> .5	0.	+12.32	19.38		11 <sup>h</sup> 40 <sup>m</sup> 26 <sup>s</sup> 58 <sup>ms</sup>	+7.06 +19.40
		+7.06 = Error		+5.26		46 37 18	-1.648 +5.28
						10 06 - 10 30 =	+14.00
"	20.3	0.	+13.77	19.70			
		+6.93		+5.04			
18	5.6	0.	+13.25	20.02		50 <sup>s</sup> 58 <sup>ms</sup> +6.77	
	+2.3			+6.48		46 37 18 -0.628	+19.99
		+6.77				16 <sup>h</sup> 56 17 <sup>h</sup> 12 <sup>s</sup> 10 <sup>s</sup>	+6.45
		Seconds of Companion Clock	Seconds of Companion Clock	Error of 3451	Error of 3451	Coincidences would better be worked out in another place, look and only month tabulation When companion clock is solar, its seconds must be reduced to sidereal. Figure found below that to be reduced.	
						Revised. Seconds of Error of Comp. Cl. 1327	

39.57

40  
28

39  
25

31

26



## Waltham Mean Time block. Comparisons with 1327

Date

Caml. M. 2. of Boston Mean Time

Time of error

h, m, &amp; s. of 1327

Correction of 1327

Natural x rate.

Correction for rate

Algebraic Sum.

h, m, & s. of Waltham & Boston  
Corr. for reducing L & M to eidl.  
to + m. reduced to

Corr. for reducing S to eidl.

Algebraic Sum.

Mar. 17

23 42 15.91

9 54 31.

10 10 28.

Other indications  
suggest completely  
wrong with error of  
1327. This  
point in same direction9<sup>h</sup> 55-

- 7.06

1 40.21

.07

9 54 23.94

33 54 24.19.

Error = +.25 per chronograph (Waltham view relay)

Horn + min. of Waltham derived from analogy with 394

23 42 15.91

12 34 09.

12 49 40.

13<sup>h</sup> 01

- 7.07

2 6.33

1/2 @ ? rate (quite correct)

.11

12 34 01.93

36 34 02.35

Error = +.42

23 42 15.91

20

19 53 19.

20 07 36.  
19 53 17.20<sup>h</sup> 25

- 6.93

3 18.28

1/2<sup>h</sup>.

.10

19 53 10.07

43 53 10.45

10.29

Error = +.22

Mar. 18

5<sup>h</sup> 02

4 56 56.  
- 6.76

---

4 56 49.24

Error = +.12

19<sup>h</sup> 45<sup>m</sup>

20 01 06.  
- 6.45

---

20 00 59.55

Error = -.06

23 46 12.47

5 09 46.

50.76

.13

---

28 56 49.86

23 46 12.47

20 12' 28.

3 15.94  
19.40

.08

---

44 00 59.65

Mar 21

7<sup>h</sup> 30

7 48 23.  
- 7.23

---

7 48 15.77

Error = -.61

23 58 02.12  
54 05.58

7 48 58.

1 16.88

.16

---

31 44 10.62  
48 15.16

18<sup>h</sup> 21

-1.1 @ (avg)

17 39 58.  
- 7.40  
+ .02

---

17 39 50.62

Error = -.55

23 58 02.12

17 38 54.

2 53.80

.15

---

41 39 50.07

18<sup>h</sup> 21

19 23 33.  
- 7.40  
(avg) - .02

---

25.58

23 58 02.12

19 23' 12.

3 10.89  
2 11.05

.03

---

43 24 25.20

23 25.04



288

Mar 22.

		01 58.68
7 <sup>h</sup> 30	7 22 55.	7 19 36.
Correct for 1327:	- 7.26	1 12.12
		.10
	7 22 47.74	7 22 46.90

Error = -.84

Again

		01 58.68
7 <sup>h</sup> 30	7 22 49.	7 19 36.
	- 7.26	1 12.12
		.08
	7 22 41.74	7 22 40.88

Error = -.86

At 18.

		01 58.68
At 18 31	18 04 08.	17 59 04.
	- 7.07	2 57.25
		.01
	18 04 00.93	18 03 59.94

Error = -.99

Mar 23.

		5 55.23
At 19 <sup>h</sup> 28	19 29 50.	19 20 36.
	- 7.11	3 10.56
		.10
	19 29 42.89	19 29 41.89

Error = -1.00

Mar. 24.

		9 51.79
At 19 42	18 43 49.	18 30 46.
	- 7.77	- 3 2.34
		.13
	41.23	18 43 40.26

Error = -0.97

Mean 25.

$$\begin{array}{r}
 7 \quad 54 \quad 59. \\
 \text{At } 7^h 30 \quad \quad \quad -7.92 \\
 \hline
 7 \quad 54 \quad 51.08 \\
 \text{Error} = -1.21
 \end{array}$$

$$\begin{array}{r}
 13 \quad 48.34 \\
 7 \quad 39 \quad 46. \\
 1 \quad 15.40 \\
 \hline
 13 \\
 7 \quad 54 \quad 49.87
 \end{array}$$

$$\begin{array}{r}
 11 \quad 57. \quad 55. \\
 \text{At } 11^h 25 \quad \quad \quad -8.08 \\
 \hline
 46.92 \\
 \text{Error} = -1.25
 \end{array}$$

$$\begin{array}{r}
 13 \quad 48.34 \\
 11 \quad 42 \quad 02. \\
 1 \quad 55.32 \\
 \hline
 .01 \\
 11 \quad 57 \quad 45.69
 \end{array}$$

$$\begin{array}{r}
 20 \quad 23 \quad 46. \\
 \text{At } 19 \quad 47 \quad \quad \quad -7.96 \\
 \hline
 38.04 \\
 \text{Error} = +1.50
 \end{array}$$

$$\begin{array}{r}
 13 \quad 48.34 \\
 20 \quad 06 \quad 30. \\
 3 \quad 18.115 \\
 \hline
 .082 \\
 20 \quad 23 \quad 36.54
 \end{array}$$

Mean 26.

$$\begin{array}{r}
 6 \quad 45 \quad 38. \\
 \text{At } 6^h 06 \quad \quad \quad (-8.12) \\
 0.7 @ .02 \quad \quad \quad - .01 \\
 \hline
 6 \quad 45 \quad 29.87 \\
 \text{Error} = (-1.45)
 \end{array}$$

$$\begin{array}{r}
 17 \quad 44.90 \\
 6 \quad 26 \quad 40. \\
 1 \quad 3.41 \\
 \hline
 .11 \\
 6 \quad 45 \quad 28.42
 \end{array}$$

Mean 28.

$$\begin{array}{r}
 7 \quad 52 \quad 22. \\
 \text{At } 7^h 33 \quad \quad \quad -9.17 \\
 \hline
 7 \quad 52 \quad 12.83 \\
 \text{Error} = -1.67
 \end{array}$$

$$\begin{array}{r}
 25 \quad 38.00 \\
 7 \quad 28 \quad 20. \\
 1 \quad 12.192 \\
 \hline
 12.774 \\
 .055 \\
 7 \quad 52 \quad 11.16
 \end{array}$$



290

Mean 29

$$\begin{array}{r} \text{At } 19^h 45^m \\ - \frac{1}{2} @ +.02 \\ \hline \text{At } 19^h 45^m \end{array}$$

$$\begin{array}{r} 19 \ 18 \ 09. \\ -9.70 \\ +.01 \\ \hline 19 \ 17 \ 59.31 \end{array}$$

Error = -1.90

$$\begin{array}{r} 29 \ 34.55 \\ 18 \ 45 \ 18. \\ 3 \ 4.81 \\ \hline 19 \ 17 \ 57.41 \end{array}$$

Mean 30

$$\begin{array}{r} \text{At } 6^h 42^m \\ - .6 @ .02 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \ 3 \ 49. \\ -9.86 \\ +.01 \\ \hline 6 \ 3 \ 39.15 \end{array}$$

Error = -1.95

$$\begin{array}{r} 33 \ 31.11 \\ 5 \ 29 \ 12. \\ \hline 6 \ 03 \ 37.20 \end{array}$$

$$\begin{array}{r} \text{At } 19^h 34^m \\ 0.2 \\ \hline \end{array}$$

$$\begin{array}{r} 19 \ 15 \ 55. \\ -10.04 \\ \hline 19 \ 15 \ 44.96 \end{array}$$

Error = -2.01

$$\begin{array}{r} 33 \ 31.11 \\ 18 \ 39 \ 08. \\ 3 \ 03.82 \\ \hline 19 \ 15 \ 42.95 \end{array}$$

Mean 31

$$\begin{array}{r} \text{At } 9^h 48^m \\ \hline \end{array}$$

$$\begin{array}{r} 9 \ 33 \ 34. \\ -10.34 \\ \hline 9 \ 33 \ 23.66 \end{array}$$

Error = -2.22

$$\begin{array}{r} 37 \ 27.65 \\ 8 \ 54 \ 26. \\ 37 \ 27.65 \\ 1 \ 27.723 \\ \hline 9 \ 33 \ 21.44 \end{array}$$

Apr

Apr. 1

$$\begin{array}{r}
 8 \quad 35 \quad 33. \\
 \text{At } 9^h 57 \quad -10.72 \\
 -1.4 @ .017 \quad - .02 \\
 \hline
 8 \quad 35 \quad 22.26 \\
 \text{Error} = -2.41
 \end{array}$$

$$\begin{array}{r}
 41 \quad 24.21 \\
 87 \quad 52 \quad 38. \\
 \quad \quad 17.535 \\
 \quad \quad 1 \quad 27.394 \\
 \hline
 \quad \quad .104 \\
 .5 \quad 29.71 \\
 8 \quad 35 \quad 19.85
 \end{array}$$

$$\begin{array}{r}
 19 \quad 20 \quad 59. \\
 \text{At } 19^h 32 \quad -11.00 \\
 \hline
 19 \quad 20 \quad 48.00 \\
 \text{Error} = -2.41
 \end{array}$$

$$\begin{array}{r}
 41 \quad 24.21 \\
 18 \quad 36 \quad 18. \\
 \quad \quad 3.330 \\
 \quad \quad 3 \quad 43.187 \\
 \hline
 \quad \quad .149 \\
 19 \quad 20 \quad 45.59
 \end{array}$$

Apr. 2

$$\text{At } 9^h 24 \quad -11.19 (\text{mk.})$$

Apr. 4

$$\text{At } 0^h 56 \quad -11.63 \text{ approx.}$$

Apr. 4

$$\begin{array}{r}
 19 \quad 06 \quad 52. \\
 \text{At } 19^h 23 \quad 12.15 \\
 .3 \quad - .01 \\
 \hline
 19 \quad 06 \quad 39.84 \\
 \text{Error} = -2.85 - 2.85
 \end{array}$$

$$\begin{array}{r}
 53 \quad 13.87 \\
 18 \quad 10 \quad 24. \\
 20 \quad 2 \quad 59.059 \\
 \quad \quad 3 \quad 18.773 \\
 \hline
 \quad \quad .066 \\
 .46 \quad 56.71 \\
 19 \quad 06 \quad 36.99
 \end{array}$$



Apr. 5

$$\begin{array}{r}
 10 \ 33 \ 24. \\
 \text{At } 10^h 31 \quad +15.91 \\
 \hline
 10 \ 33 \ 39.91
 \end{array}$$

$$\begin{array}{r}
 57 \ 10.43 \\
 9 \ 35 \ 02. \\
 1 \ 34.858 \\
 \hline
 .005 \\
 10 \ 33 \ 46.89
 \end{array}$$

Apr. 6

At

$$\begin{array}{r}
 19 \ 37 \ 49. \\
 \text{At } 19^h 45 \quad +17.77 \\
 \hline
 19 \ 37 \ 06.77
 \end{array}$$

$$\begin{array}{r}
 1 \ 01 \ 06.97 \\
 18 \ 3 \ 56. \\
 \quad \quad 2.838 \\
 \quad \quad 3 \ 3.48 \\
 \hline
 .153 \\
 19 \ 48 \ 07.60 \\
 \quad \quad 37 \ 05.96
 \end{array}$$

Apr. 7

At 10<sup>h</sup> 15<sup>m</sup>

+18.50

$$1 \ 05 \ 03.53$$

Apr. 8

At 5<sup>h</sup> 41<sup>m</sup>

+19.89

$$1 \ 09 \ 00.08$$

Apr. 9 At

At 5<sup>h</sup> 25<sup>m</sup>

+21.34

$$1 \ 12 \ 56.64$$

Apr 10

1 16 53.19

At-12 09

+22.87

Apr 11

1 20 49.75

At-19 49

+24.80

Apr 12 At-6 02

+25.40

1 24 46.29

At-6 00

+25.40

Apr 12

1 24 46.29

11 55 27.50

10 29 20.

At-12 30

+25.55

± 1 43.33

0.6 @ .04

+.02

.05

11 55 53.07

11 55 49.67

 $E_{\text{err}} = -3.40$ 

Apr 13

1 28 42.85

9 23 54.

x7 54 16.

At-9 21

+26.51

1 17.860

9 24 20.51

.044

10 24 26.45  
16.76 $E_{\text{err}} = -3.75$



Apr. 14

How Waltham Cl.

M-5<sup>h</sup> 58

6 00 20.  
+26.91  
6 00 46.91

1 32 39.40  
4 ~~27~~ 20.  
27 43.86  
06  
54.06  
6 00 57.39  
43.32

Cm = 3.59

Apr. 15

2 05 11.

1 36 35.96  
54.48

At 1 37 Approximate +27.34

April.

20<sup>th</sup>21<sup>st</sup>22<sup>nd</sup>23<sup>d</sup>

11 27 28.  
28.26  
11 27 56.26  
1 56 34.27  
9 31 21.99  
1 33.60  
48.39  
-3.89

1 418 48  
28.21  
1 42 13.21  
2 0 30.83  
23 41 48.38  
3 53.92  
48.46  
-3.96

2k 43 01  
28.26  
2k 43 29.26  
2 4 27.38  
19 39 01.88  
3 13.35  
58.56  
48.73  
-4.23

5 33 18  
28.25  
5 33 46.25  
2 8 23.93  
3 25 22.32  
0 33.63  
48.69  
-04.19

24<sup>th</sup>26<sup>th</sup>27<sup>th</sup>28<sup>th</sup>

12 17 20  
28.35  
12 17 48.35  
2 12 20.48  
10 05 27.87  
1 39.17  
48.68  
-4.16

22 43 55  
28.35  
22 44 23.35  
2 20 13.59  
20 24 09.76  
3 20.14  
49.22  
-4.72

20 23 28  
28.21  
20 24 56.21  
2 24 10.15  
18 00 46.06  
2 57.04  
49.02  
-4.52

18 50 09  
28.11  
18 50 37.11  
2 28 6.70  
16 22 30.41  
2 40.95  
49.46  
-4.96

30<sup>th</sup> x

6 6 52

6 7 27.88  
19.88  
2 35 59.81  
3 31 20.07  
0 34.61  
45.46  
4  
49.46  
-4.96

May.

Waltham clock.

3 <sup>rd</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	5 <sup>th</sup>	6 <sup>th</sup>
12 13 45 27.3	11 27 41 27.6	11 25 37 27.3	20 17 02 27.15	7 51 50 27.10
12 14 12.3	11 28 08.6	11 26 04.3	20 14 29.15	7 52 17.10
2 47 49.48	2 43 52.92	2 47 49.48	2 55 42.59	2 59 39.14
9 26 22.82	8 44 15.68	8 38 10.95	17 58 46.56	4 52 37.96
1 32.77	1 25.88	1 24.88	2 56.72	0 47.97
50.05	49.80	46.07	49.84	50.04
-5.55	-5.30		-5.34	-5.54

8 <sup>th</sup>	9 <sup>th</sup>	10 <sup>th</sup>	11 <sup>th</sup>
12 43 30.4 26.15	7 41 37.2 26.06	11 42 13 25.67	11 41 09 25.4
12 43 56.55	7 42 03.26	11 42 38.67	11 42 34.4
3 7 32.26	3 11 28.82	3 15 25.37	3 19 21.93
9 36 24.29	4 30 34.44	8 27 13.30	8 23 12.47
1 34.44	0 44.31	1 23.09	1 22.43
49.85	50.13	50.21	50.04
-5.35	-5.63	-5.71	-5.54

12 <sup>th</sup> x 45	15 <sup>th</sup> x	16 <sup>th</sup>	17 <sup>th</sup>
21 48 24.95	12 42 04 24.4	12 28 18 24.32	12 44 57 24.22
21 48 49.95	12 42 28.4	12 29 22.32	12 45 21.22
3 23 18.48	3 38 08.15	3 39 4.71	3 43 01.27
18 25 31.47	9 04 20.25	8 50 17.61	9 02 19.95
3 1.16	1 29.18	1 26.87	1 28.54
30.37	51.07	50.74	51.11
50.34	46.57	46.24	46.61
-5.84			

21	20 <sup>th</sup>	21 <sup>st</sup>	22 <sup>nd</sup>	23 <sup>rd</sup>
12 9 35.3 23.48	11 29 33 23.41	9 35 03 23.48	13 30 44.5 24.0	11 20 19 24.24
12 9 58.78	11 29 56.41	9 35 26.48	13 31 08.5	11 20 43.24
3 18 47.49	3 54 50.93	3 58 47.49	4 02 44.05	4 06 40.61
8 11 11.29	7 35 05.48	5 36 38.99	9 28 24.45	7 14 02.63
1 20.47	1 14.56	0 55.14	1 33.12	1 11.11
50.82	50.92	43.85	51.83	51.52
-6.32	-6.42		-6.83	-7.02





HARVARD COLLEGE  
OBSERVATORY.

Cambridge, Dec. 6, 1880.

Sir,

The publication entitled  
Sixty-ninth Annual Catalogue,  
Harvard

Am. 30

At 6 44

27.88

Androm  
12.8  
7  
7  
21.51  
0771  
0.927  
22.2  
28.56 28 81  
81.9 97 7  
20.25 11 22  
20.00  
2 81 2 2  
21-12 1221

May 2

12 14 17  
11 39 54  
12 14 17

At 12

27.4 mean

2 43 32.38

8 55 28

1 27.887

.022

11 40 18.4

11 40 13.29

Error = -5.1 mean



3 repeats  
12 30 32  
-0 47

59.8 9 9 8 8  
- 3

3.9 89 01

Apr. 30

At-6 44

27.88

John Woodbury.

May 2

~~12 14 17~~  
~~11 39 54~~  
~~12 14 17~~

At 12"

27.4 mag

2 43 32.38

8 55 32.8

1 27.887

.022

11 40 18.4

11 40 13.29

Err = -5.1 mag

May 3

At 2<sup>h</sup> 44<sup>m</sup> 2 53 31.  
12 14 17.At 2<sup>h</sup> 44<sup>m</sup> 27.6 mag.

2 53 58.6

Error = -5.6 mag

2 47 33.94  
30 0 6 18.  
32.  
0.986  
20.863

.049

4 53 42.85  
52.98

May 3

At 12<sup>h</sup> 12 14 17.5At 12<sup>h</sup> 27.38

12 14 44.38

Error = -5.54

2 47 33.94  
9 25 32.  
1 32.815  
.088

12 14 38.84

May 4

At

At

At 2<sup>h</sup> 48<sup>m</sup> 27.4 mag

2 51 20.49

May 4

At 21<sup>h</sup> 31 27.31

2 51 30.49

May 5

At 2<sup>h</sup> 52 27.3 mag

2 55 27.05



May 5

$\begin{array}{r} 21 \ 24 \ 01. \\ 21 \ 21^{\circ} \ 21 \end{array}$

---

21 24 28.19

Error = -5.42

$\begin{array}{r} 2 \ 55 \ 27.05 \\ 18 \ 25 \ 54. \\ 3 \ 01.523 \end{array}$

---

21 24 22.72

May 6

$\begin{array}{r} 7 \ 51 \ 52. \\ 26 \ 7^{\circ} \ 26 \end{array}$

---

7 52 19.03

Error = -5.46

$\begin{array}{r} 2 \ 59 \ 23.60 \\ 4 \ 52 \ 02. \\ 47.968 \\ .005 \end{array}$

---

7 52 13.57

Table of Errors of Mean Time Block 394,  
taken at times near to the observation of stars, and before  
any change based upon the <sup>a</sup> knowledge of the result of these observa-  
tions had been effected.

1880	Time.	Error.	<sup>+Hour</sup> <del>Mean</del> <del>Time</del> <del>Obs. 3. 24</del>	Number of Hours	Observation of Transits
Jan 23	6 <sup>h</sup> 54	+ .26			
Feb. 1	2 <sup>h</sup> 00 <sup>m</sup>	+ .21	5.3	III	A.P.
2	11 04	- .83	5.8	IV	A.P.
3	<del>20</del> <del>12</del>	+ .97	0.5	II	A.P.
4	5 44	- .20	0.7	IV	A.P.
5	5 19	- .47	0.6	IV	A.P.
6	4 50	+ .62	0.3	III	A.P.
7	9 21	- .21	2.8	III	A.P.
8	7 35	- .38	2.2	III	A.P.
9	5 57	+ .29	0.3	IV	A.P.
10	19 18	+ .37	1.6	II	J.R.E.
11	11 35	+ .04	6.5	IV	S.
12	12 24	+ .38	3.6	IV	S.
14	4 54	+ .57	0.6	{ III II	E. S.
15	18 31	- .05	0.4	I	E.
16	3 30	- .48	0.	III	E.
"	21 15	- .10	1.1	III	E.
17	1 18	+ .04	0.5	IV	E.
18	19 10	0.00	0.1	II	E.



6:21

Feb. 19	8 <sup>h</sup>	12 <sup>m</sup>	+ .22	1.7	V	E.
"	19	06	+ .11	0.0	II	E.
20	5	23	- .17	0.3	III	E.
21	6	00	- .05	0.4	IV	E.
22	9	30	.00	4.1	III	E.
23	9	04	- .01	0.2	IV	E.
24	4	51	- .19	0.5	V	E.
23	19	57	+ .13	0.5	III	E.
26	18	41	- .21	0.5	III	E.
27	4	17	- .27	0.3	III	E.
"	18	18	- .13	0.1	III	E.
Pendulum of 1327 changed.						
29	10	41	- .45	2.8	II	<del>W.R.</del>
Mar. 1	5	39	+ .06	0.1	I	R.
"	15	13	+ .33	1.1	<del>III</del> II	R.
2	6	30	+ .39	0.5	III	R.
<del>3</del>	<del>19</del> <del>20</del>	<del>04</del> <del>09</del>	<del>+ .34</del> <del>+ .22</del>	<del>1.6</del> <del>2.6</del>	<del>II</del>	<del>R.</del>
5	3	32	+ .09	1.	IV	E.
6	21 <sup>h</sup>		.00	4.4	I	R.
Pend. of 1327 changed.						

35) 9.02  
 .26







## Error of Mean Time Block 394 by Star Transit.

Table similar to page 300. Scope extended.

Date	Time	Error	$\pm$ Interval Actual Transit Time	Number of Stars	Obs. Time	Left Error	Right Time	Local Error	Actual Local	Mean Local	Normal Local
Mar. 17	8 <sup>h</sup> 45 <sup>m</sup>	+0.16	0.9	II	W.R.						
"	20 44	+0.07	0.5	II	R.						
18	4 50	-0.08	0.6	I	R.						
"	19 57	-0.31	0.	I	R.						
19	18 42	+0.02	1.	I	E.						
20	10 05	+0.28	1.9	IV	W.C.V.						
21	7 23	+0.13	0.0	IV	R.						
"	19 3/4	+0.49	1.5	IV	R.						
22	8 01	+0.05	0.5	III	R.						
"	19 00	+0.02	0.5	II	R.						
23	19 09	+0.16	0.2	III	R.						
24	19 04	+0.65	0.8	II	R.						
25	7 56	+0.88	0.7	IV	R.						
"	11 08	+0.17	0.8	II	R.						
"	19 57	+0.03	0.5	II	R.						
26	7 30	+0.04	1.7	III	E.						
28	18 40	+0.39	11.5	I	R.						
29	18 57	+0.01	0.4	III	R.	0.00			10 <sup>3</sup> / <sub>4</sub>		10.75
30	19 15	+0.01	0.5	III	R.	-0.08	14.6	+0.20	10 <sup>3</sup> / <sub>4</sub>		10.95
31	9 50	+0.07	0.6	IV	R.	-0.02	(1 <sup>h</sup> 10)		10 <sup>3</sup> / <sub>4</sub>	10.97	11.00
31	11 00						26.1 (24 <sup>h</sup> 58)	+0.03	11		
Apr. 1	11 58	-0.09	2.7			+0.19	06.2	-0.88	11	7	10.15
"	1 20 10	+0.10	1.3			+0.10	12.2	-0.30	11		10.70
"	2 8 21	+0.20	0.3						11		
"	8 35								9		
"	9 39	+0.07							9		
"	10 18								10 <sup>1</sup> / <sub>2</sub>		

Copies / kept over.





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## Performance of Mean Time Block 394

1871

Date  
1880

Time

No. of  
Transits

Obs.  
Time

Interval  
between  
transits  
&  
comparison

Seconds Grammer

Error

Diff.  
Error

Diff.  
Time

Local  
Error

Active  
Load

Mean  
Load

Normal  
Load

Apr. 1

Wound

1

2

2

2

2

2

2

4

5

5

6

7

7

7

8

9

9

9

10

10

10

11

11

11

11

11<sup>h</sup> 58

20 10

8 21

8 35

9 39

10 18

10 28

18 49

8 9<sup>h</sup> 03 25

11 00

18 52

9 45

19 40

20 45

4 50

4 28

6 16

21 25

6 29

11 19

22 35

11 45

10 16

19 52

III

V

III

V

~~III~~ V

IV

III

II

III

IV

IV

R

R

Wk.

R

R

R

R

R

R

R

R

2.7

1.3

0.3

1.0

1.8

.3

~~1.0~~

1.4

0.2

0.6

0.3

0.4

0.5

22

11

10

0.8

-.09

+.10

+.20

(+.07)

(+.05)

.00

~~1.0~~ ±.05

(+.10)

+.10

+.19

-.14

-.66

-.09

-.19

+.19

+.10

-.05

+.09

8.2

12.2

32.2

14.9

-.85

-.30

+.05

11

11

11

11

9

9

10 1/2

10 1/2

10 1/2

10 1/2

10 1/2

10 1/2

10 1/2

10

10 1/2

10 1/4

10 1/4

10 1/4

12 1/4

11 1/4

10 3/4

10 3/4

10 3/4

11 1/2

10 3/4

10 3/4

20 3/4

11.00

10.15

10.70

10.55

10.55 ± 1/10

10.50 ± 1/10

10.28

1.68



Date	Time	Number of Stars	Obs. of Stars	Interval between transits & comparison	Error	Diff Sun	Diff Moon	Local Cor.	Actual Local	Mean Local	None Local
1880					1.68						
Apr. 11	19 <sup>h</sup> 52								20 <sup>3</sup> / <sub>4</sub>		
" 11	20 59								10 <sup>3</sup> / <sub>4</sub>		
" 11	22 34								11		
" 12	4 53	IV	R	0.3	$\frac{+.01}{-2.540}$				11		
" "	11 30	IV	R	0.6	+ .21				11		
" "	13 14								10 <sup>3</sup> / <sub>4</sub>		
13	8 47	IV	R	0.6	- .18				10 <sup>3</sup> / <sub>4</sub>		
"	10 03								11		
14	0 20								10 <sup>1</sup> / <sub>2</sub>		
"	7 17	IV	R	2.9	+ .27						
"	8 30 about								10		
15	<del>8</del> 00 <sup>06</sup> 8 33								10 <sup>1</sup> / <sub>2</sub>		
"	8 33								10 <sup>3</sup> / <sub>4</sub>		
"	20 30								10 <sup>1</sup> / <sub>4</sub>		
16	19 45								10 <sup>1</sup> / <sub>2</sub>		
17	10 <sup>h</sup> roughly								10 <sup>3</sup> / <sub>4</sub>		
18	0 0								10 <sup>1</sup> / <sub>2</sub>		
Commenced Pocket-Record No 2									10 <sup>1</sup> / <sub>2</sub>		
"	4 01	III	R	0.0	+ .83				10 <sup>1</sup> / <sub>2</sub>		
"	6 16								5 <sup>1</sup> / <sub>2</sub>		
"	10 59								10 <sup>1</sup> / <sub>2</sub>		
"	11 53								10		
"	18 57								10 <sup>1</sup> / <sub>2</sub>		
19	9 38								10 <sup>3</sup> / <sub>4</sub>		
20	4 42								10 <sup>1</sup> / <sub>2</sub>		
"	9 01	III	R	0.0	+ .47				10 <sup>1</sup> / <sub>2</sub>		
"	10 07								9 <sup>1</sup> / <sub>2</sub>		9 <sup>3</sup> / <sub>4</sub> !!
"	19 40	<del>III</del>			+ .47				9 <sup>1</sup> / <sub>2</sub>		
"	23 08								0		
"	23 53								9		

Date	Time	Number of Flare Observed	Observed of Flare	Interval for which ratio is hypothesized	Error for test- of perform- ance.	Error not too enter test- of perform- ance.	Actual Load	Normal Load grams
1880					4.05		9 9 1/2	
Apr. 20 <sup>1</sup>	3 <sup>h</sup> 30							
" 21	7 <sup>3</sup> / <sub>4</sub>	II	R.	0.0	+0.3			9.9
" "	20 04	IV	R.	0.5	-1.4			
" "	21 47					9 1/2 10		10.7
" 22	4 41	III	R	0.5	-0.34			
" "	6 03					10 11		10.5
" "	20 07	"	"	0.1	-0.07			
" 23	2 56	III	"	0.1	+0.06			10 1/4
" "	9 55					11 1/4		
" 24	10 43	II & III	"	0.2	(+0.30) +0.30			10.2
" "	12 02					10 1/4 9 3/4		
" "	21 52	IV	"	1.0	-0.01			10.32
" "	23 30					9 3/4 10 1/4 10 1/2 10 1/4		
" 25	23 08							10.20
" 26	9 59	II		0.9	+0.13			
" "	20 31	IV		1.2	+0.01			10.20
" 27	4 55					10 1/4 10 1/2		
" "	19 39	VI	"	0.3	+0.10			10.20
" 28	4 39					10 1/2 10 1/4		
" "	20 51	III	"	3.	+0.33			10.20
" "	21 53					10 1/4 10.0		
" 30	4 17				-0.08			10.0 10 1/4
" "	4 48							

Mountain error.

27 55.4

.49

30 5.62

.187



May									
May									
May	1	5 <sup>h</sup> 08						10 <sup>1</sup> / <sub>4</sub> 10 <sup>3</sup> / <sub>4</sub>	
"	"	22 42						10 <sup>3</sup> / <sub>4</sub> 10 <sup>1</sup> / <sub>2</sub>	
"	"								
"	2	10 45	R		+1.0				Error overlooked at time.
"	3	12	R		+ <del>-0.4</del>				Error in adjusting collima- tion of Mer. Cir. masked the actual error of clock.
"	"	21 19						{ 10 <sup>1</sup> / <sub>2</sub> 10 <sup>3</sup> / <sub>4</sub>	
"	4	11 47						{ 10 <sup>3</sup> / <sub>4</sub> 10 <sup>1</sup> / <sub>2</sub>	
"	4	20 23	R		+1.67				Result reached promptly, but existence of inconsis- tent error in adjusting collimation May 3 caused great delay in satisfactory by checking the result.
"	5	Stopped signals at 0 <sup>h</sup> 51 <sup>m</sup> — Notified Stearns & George.							
"	5	Started signals at 20 <sup>h</sup> 25							
"	5	21 24	R	3 <sup>h</sup>	-0.11	11 <sup>m</sup>			
"	6	5 13	R	III	0.7	-1.03			
"	"	5 49						11 10 <sup>1</sup> / <sub>2</sub>	
"	"	21 03						10 <sup>1</sup> / <sub>2</sub> 9 <sup>1</sup> / <sub>2</sub>	
"	7	5 38						9 <sup>1</sup> / <sub>2</sub> 10 <sup>3</sup> / <sub>4</sub>	} 9.9
"	"	22 16						10 <sup>3</sup> / <sub>4</sub> 9 <sup>1</sup> / <sub>2</sub>	
"	8	10 14	R	III	0.6	+0.41			
"	"	10 55						{ 9 <sup>1</sup> / <sub>2</sub> 8 <sup>1</sup> / <sub>2</sub>	
"	9	0 47						{ 8 <sup>1</sup> / <sub>2</sub> 9 <sup>1</sup> / <sub>2</sub>	

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Time by obs<sup>n</sup> of Sun.

Apr. 2<sup>d</sup> 9<sup>h</sup> 24<sup>m</sup> Error of 1327 = +11.19

" 4 19<sup>h</sup> 23<sup>m</sup> " " " = +12.15

~~48<sup>h</sup>~~ + 10<sup>h</sup>

58) 96 (.0162

58  
360  
348  
120

.96

4<sup>d</sup> 19<sup>h</sup> 23<sup>m</sup>

4<sup>d</sup> 0<sup>h</sup> 56<sup>m</sup>

18<sup>h</sup> 27

Hourly rate = +.0162

8.2095

1.2660

9.4755

18.75

0.299

+12.15

- .30

Calculated error of 1327 = +12 + 11.55  
at time of taking Sun Apr. 4

Error by Line, neglecting correction to ephemeris +11.63<sup>56</sup>

Reduced approximate correction to Line's place - .22<sup>29</sup>

Test of accuracy of sign

Ephemeris place for Washington<sup>Washington</sup> ~~Greenwich~~ 0<sup>h</sup> 56<sup>m</sup> 23.09

Correction for Long. ~~Greenwich~~ - 3.61<sup>5</sup>

Diurnal Aberration +.02

Correction to place, deduced above - .22<sup>29</sup>

19.29<sup>11</sup>

Mean time of transit from chronograph 0<sup>h</sup> 56<sup>m</sup> 29.82

+10.53<sup>65</sup>

2<sup>nd</sup> +

3<sup>rd</sup> "

time of transit

As above +11.85

{ +.32  
+ .50  
+ .08



























May 23.

137 = Waltham.

0	34	29 = 00
		24.2
0	34	53.2
4	6	40.61
20	28	12.59
	3	21.20
		51.39
		6000
		8.61
		<u>15.50</u>
		6.89

326

May 24

$$\begin{array}{r}
 1327 + \frac{3}{4} \\
 11 \quad 30 \quad 10 = \\
 24.57 \\
 11 \quad 30 \quad 34.57 \\
 4 \quad 10 \quad 37.16 \\
 7 \quad 19 \quad 57.41 \\
 1 \quad 12.18 \\
 45.23 \\
 6000 \\
 14.77 \\
 15.50 \\
 - .73
 \end{array}$$

$$\begin{array}{r}
 1327 + \frac{1}{2} \\
 11 \quad 55 \quad 14 = \\
 24.60 \\
 11 \quad 55 \quad 38.60 \\
 4 \quad 10 \quad 37.16 \\
 7 \quad 45 \quad 01.44 \\
 1 \quad 16.22 \\
 45.22 \\
 6000 \\
 14.78 \\
 15.50 \\
 - .72
 \end{array}$$

added 20 astromake 12 yrs.

$$\begin{array}{r}
 1327 \\
 22 \quad 41 \quad 59 \\
 - 24.58 \\
 34.42 \\
 22 \quad 42 \quad 23.58 \\
 4 \quad 10 \quad 37.16 \\
 18 \quad 31 \quad 46.42 \\
 3 \quad 2.16 \\
 44.26 \\
 6000 \\
 15.74 \\
 15.50 \\
 + .24
 \end{array}$$

$$\begin{array}{r}
 - 5 \text{ g. for } 2^h \\
 - 3 \text{ g. for } 2^h \\
 - .27 \\
 - .03
 \end{array}$$



May 25/

1327 -  $\frac{2}{3}$ 

10	00	50
		- 24.7
10	01	14.7
4	14	33.72
5	46	40.98
		56.68
		44.30
		6000
		15.70
		15.50
		+ .20

1327 +  $\frac{1}{2}$ 

22	56	57
		- 24.7
22	57	21.7
4	14	33.72
18	42	47.98
	3	4.00
		43.98
		6000
		16.02
		15.50
		+ .52

-97.20

May 26.

1327 +  $\frac{1}{3}$ 

10	12	48
		25.00
10	13	13
4	18	30.27
5	55	42.73
	0	58.32
		44.41
		6000
		15.59
		15.50
		+ .09

1327

23	8	55
		25.00
23	9	20.00
4	18	30.27
18	50	49.73
	3	5.26
		44.47
		6000
		15.53
		15.50
		+ .03

1327 = waetham

23	00	01 = 00
		25.0
23	00	26.0
4	18	30.27
18	41	55.73
	3	3.81
		51.92
		6000
		8.08
		15.50
		- 7.42

328

May 27.

1327  
 23 20 53  
 - 25.20  
 23 21 18.20  
 4 22 26.83  
 18 58 51.137  
 3 6.55  
 44.82  
 6000  
 15.18  
15.50  
 - .32  
 + 59. for 2 h  
+ .27  
 - .05

+0.3  
 - .32  
 35.6  
 19.2  
 15.3

May 28.

1327 + 1/2  
 13 36 13  
 - 25.10  
 13 36 38.40  
 4 26 23.39  
 9 10 14.71  
 1 30.22  
 44.49  
 6000  
 15.51  
15.50  
 + .01

+ .20 @ 1/2  
 + .10 @ 5/2

1327 Waltham.

0 40 01-48  
 24.9  
 0 40 25.9  
 4 22 26.83  
 20 17 59.07  
 3 19.54  
 39.53 = 48  
 12  
 54.53  
 60.00  
 8.47  
15.50  
 - 8.43  
 7.03

1327.  
 23 28 50  
 24.9  
 23 29 14.9  
 4 26 23.39  
 19 2 51.51  
 3 7.21  
 44.30  
 6000  
 15.40  
15.50  
 + .20



May 29.

13 27

1 30 6

24.8

1 30 30.8

4 30 19.95

21 00 10.85

3 26.42

44.43

6000

15.157

15.10

+ .07

$$\begin{array}{r} -30 \\ 15.10 \\ \hline 15.10 \end{array}$$

May 30.

13 27 - 1/3

23 34 46

25.0

23 35 08.0

4 34 16.50

19 00 51.50

3 06.68

44.82

6000

15.18

15.50

- .32

330

May 31.

1327  
13 23 59  
25.25

13 24 24.75

4 38 13.06

8 46 11.19

1 26.20

44.99

6000

15.01

15.50

- .49

+ 2 gr.

15.00  
15.50  
15.01  
15.50  
- .49

1327 + 1/4

23 52 41

25.4

23 53 06.8

4 38 13.06

19 14 53.34

3 9.24

44.63

6000

15.87

15.50

+ .87

15.50

- .09

+ .09

- 29.1/2

June 1st

1327 - 1/2

10 27 25

25.3

10 27 50.3

4 42 9.62

5 45 40.68

0 56.56

44.12

6000

15.88

15.50

+ .38

1327

0 33 43

25.3

24.8

0 34 08.3

04.8

4 42 9.62

9.62

19 51 58.68

58.68

6

15.28

15.28

43.40

2.50

6000

16.60



June 2<sup>nd</sup>

1327  
 23 18 27  
 25.00  
 23 18 52.00  
 4 46 6.18  
 18 32 45.82  
 3 2.22  
 43.60  
 60.00  
 16.40  
 15.50

+1.90  
 +.40  
 +.50  
 +.15  
 +.74

total of payments - .60  
 30  
 .00  
 +.15

June 3<sup>rd</sup>

1327  
 9 30 08  
 25.0  
 9 30 33  
 4 50 2.73  
 4 40 30.27  
 0 45.96  
 44.31  
 60.00  
 15.69  
 15.50  
 +.19

+1.5  
 +.40  
 +.10

1327  
 23 27 26  
 25.0  
 23 27 21  
 4 50 2.73  
 18 37 48.27  
 3 03.20  
 45.07  
 60.00  
 14.93  
 15.50  
 - .47

+ 10 grt/2 =

332

June 4.

1327  
 1 2 35 35  
 24.4  
 12 35 59.64  
 4 53 59.29  
 7 42 00.11  
 1 15.57  
 44.54  
 6000  
 15.46  
 15.50  
 -7.04

-34

1327

0 2 28  
 24.6  
 0 2 52.16  
 4 53 59.29  
 19 08 53.31  
 3 08.23  
 45.08  
 6000  
 14.92  
 15.50  
 -7.42

+ 826.2

+ 27  
 -15  
 10  
 -07

June 5.

1327  
 2 4 45  
 24.5  
 2 5 09.5  
 4 57 55.85  
 21 07 13.65  
 3 27.65  
 46.00  
 6000  
 14.00



June 6<sup>th</sup>

1327

14 16 44

24.4

14 17 08.4

✓ 1 52.41

9 15 15.99

1 30.99

45.00

60.00

15.00

18.50

-1.50

B.394 is -.1 by Waltham.

1327

0 0 20

24.4

0 0 44.4

✓ 1 52.41

18 58 51.89

3 06.50

45.49

60.00

14.51

15.50

-1.99

B.394 is -.4 by Waltham.

June 7

394 is + 8.9 of Waltham This is what it should be.

June 8.

1327

✓ 57 14

24.00

✓ 57 38

✓ 9 45.52

47 52.48

0 7.86

44.62

60.00

107.38

107.50

-1.12

$$\begin{array}{r} 3451 = 00 \\ 1327 = 6 \end{array} \quad 1455.4$$

24 div. rate 2451 = +.5

$$-19.4 = 3451.$$

This should be -19.6 by computation.

Comp. at 19<sup>h</sup> m. J.

394 is +9.4 of Waltham

" should be +9. " "

rem. 79 for 2<sup>h</sup>

9.4

-1.4

9.0

7.1

-1.1 = 394

-77  
6  
13  
1.53

334

June 9.

1327-12

Walsham

14 57 38

12 19 22

22.91

23.0

14 58 00.91

12 19 45.0

5 13 42.07

5 13 42.07

9 44 18.84

7 6 02.93

1 35.54

1 9.79

43.30

53.14

60.00

44.50

16.70

-8.64

15.50

+1.15

-50g

B 394 by Walsham +.4  
 sum nights. +.2  
 +.2  
 sum 394 +.1

June 10

1327

1327

13 9 17

0 30 9

22.9

22.60

13 9 39.9

0 20 31.60

5 17 38.62

5 17 38.63

7 52 01.27

19 12 52.97

1 17.32

3 8.87

43.95

44.10

60.00

60.00

16.5

15.90

15.50

15.50

+1.55

+1.40

nt. 79

-14g. 14

-1.20

+1.20

+1.0

perm.  $\overline{v} = 89$



June 11

1327+12

12 40 9  
 $\sim 2.95$   
 12 40 31.95  
 5 21 35.20  
 7 18 56.55  
 1 11.96  
 44.59  
 6000  
 15.41  
 15.50  
 -11

1327

1 18 13  
 $22.55$   
 1 18 35.55  
 5 21 35.20  
 19 57 00.35  
 3 6.27  
 44.08  
 6000  
 15.92  
 15.50  
 $+42$   
 $\frac{1.00}{+1.20}$   
 $-5 \text{ gr} \quad \frac{-1.5}{+0.5}$

June 12

1327

2 20 19  
 $22.50$   
 2 20 46.50  
 5 25 31.76  
 20 55 09.74  
 3 25.64  
 44.10  
 6000  
 16.90  
 15.50  
 $+40$   
 $-2 \text{ gr.}$

336

June 13.

1327  
 0 51 1  
 -22.25  
 0 51 23.25  
 5 29 28.31  
 19 21 54.94  
 3 10.36  
 44.58  
 6000  
 15.42  
 15.00  
 W=89.1 - .08

June 14

1327	1327 + 1/2
13 42 07	1 36 4
-22.20	22.00
13 42 29.20	1 36 26.00
5 33 24.86	5 33 24.86
8 09 04.34	21 03 01.14
1 20.11	3 17.18
44.23	43.96
60 00	6000
15.77	1600
15.50	15.00
+ .27	+ .54
-19.1	-89.1 - .50
	+ .04



June 15

13-7-

1	✓	55	
			21.60 + 10

1	6	16.60	
---	---	-------	--

✓	37	21.43	
---	----	-------	--

19	28	55.17	
----	----	-------	--

	3	11.34	
--	---	-------	--

43.83

6000

16.17

15.50

+ 67

- 10

+ 57

+ 53

+ 04

run 8 gr. for  $2\frac{1}{2}$  hr

June 16.

13-7

1	42	58	
---	----	----	--

21.40

1	43	19.40	
---	----	-------	--

✓	41	17.99	
---	----	-------	--

20	02	01.41	
----	----	-------	--

	3	16.92	
--	---	-------	--

44.49

6000

15.50

15.50

+ 01

By Waltham + 00

Mean . 00

338

June 17.

1327 = Waltham.			1327		
0	15	49	1	12	49
		21.50			21.50
0	17	10.50			21.50
✓	41	14.54	1	13	10.50
18	35	55.96	✓	41	14.54
	3	2.83	19	31	55.96
		53.13		3	11.90
		44.50			44.06
		-8.63			6000
		$\frac{50}{-9.13}$			15.94

15.50

+ .44

- .40

+ .04

July 18.

1327			Reminights.		
1	16	46	1327	= Waltham	
		21.40	2	6	3.00
1	17	07.40			21.5
✓	49	11.10	2	6	24.5
19	27	56.30	5	49	11.10
	3	11.40	20	17	13.40
		44.90		3	19.40
		6000			54.00
		15.10			44.50
		15.50			-9.00
		- .40			

Reminights  
add
$$\begin{array}{r} .00 \\ - .20 \\ + .10 \\ \hline -.10 \end{array}$$



June 19.9

 $w = 7$ 

$$B - w = 10.2$$

$$\underline{9.9}$$

$$\text{Sun } B_{374} + .3$$

Sun 19.

June 20.

.327

1 18 37

21.9

15.19

1 18 58.9

5 57 4.82 .32

19 21 54.08 .58

3 10.35 .35

43.75 44.23

60.00 60.00

16.925

15.77

15.50

15.50

1.75

1.27

mean +.75

mean +.21

Sun. mag. 16

-20  
+1

340

June 21

1327  
 1 15 33  
     21.5  
 1 15 54.5  
 6 01 0.78  
 19 14 53.72  
     3 9.15  
     44.57  
     66.00  
     15.43  
     15.50  
     - .07

1327 = waltham-  
 15 41 09  
     21.5  
 15 41 30.5  
 6 01 0.78  
 9 40 29.72  
     1 35.09  
     54.63  
     44.50  
     -10.13

1327 = waltham

1 25 45  
     21.15  
 1 26 06.15  
 6 01 0.78  
 19 25 5.37  
     3 10.87  
     54.50  
     44.50  
     -10.00

over 60 = 345-1  
 1 30 37.75 = 1027



June 22

1327			1327		
14	19	42	2	22	41
		20.95			20.70
14	20	0 2.95	2	23	01.70
6	04	57.34	6	04	57.34
8	15	0 5.61	20	18	0 4.36
	1	21.09		3	19.58
		44.52			44.78
		<del>60.00</del>			<del>60.00</del>
		15.48			15.22
		<u>15.50</u>			<u>15.50</u>
		-0.02			-0.28
					+5gr <sup>h</sup> +.27
					-0.01

June 23

1327		
1	26	28
		20.40
1	26	48.40
6	08	53.89
19	17	54.51
	3	9.68
		44.83
		<del>60.00</del>
		15.17
		<u>15.50</u>
		-0.33
		+5gr <sup>h</sup> 1/2 +.30
		-0.03

342

June 24.

1327  
 2 45 37  
 20.25  
 2 45 57.25  
 6 12 50.45  
 20 23 06.80  
 3 21.98  
 44.82  
 6000  
 15.18  
 15.50  
 - .32  
 + 109 ft/h + .27  
 - .05

1327 = Maethan

~~0 23~~  
 2 3 40 = 00  
 20.3  
 2 4 00.3  
 6 12 50.45  
 19 51 9.85  
 3 15.12  
 44.73  
 44.50

Maethan = - 10.23

June 25

1327  
 1 32 21  
 - 20.05  
 1 32 41.05  
 6 16 47.01  
 19 15 54.04  
 3 09.35  
 44.69  
 6000  
 15.31  
 15.50  
 - .19  
 + 59 ft/h + .20  
 + .01

B-H-98



June 26.

B 394 is  $-.9$  by Waltham.

added 10 gr for 3 h.

permanent weight = 8 gr.

" " changed to 9 gr.

June 27.

1327.

15	35	34
		21.2
15	35	55.2
6	24	40.12
9	11	15.08
	1	30.28
		44.80
		6000
		15.20
		15.50
		-.30

add 1 gr.

w = 9 gr.

1327 = Waltham.

14	4	29
		21.11
14	4	50.11
6	24	40.12
7	40	10.00
	1	15.38
		54.62
		44.50
		-10.12

1327.

2	29	21 =
		21.4
2	29	42.4
6	24	40.12
20	5	02.28
	3	17.40
		44.88
		6000
		15.12
		15.50
		-.38

- .30 by Waltham

-.29 mean.

+10 gr. 1 h + 27

- .32 at 21<sup>h</sup>.

1327 = Waltham + 1/2

1	53	25.20
		21.36
1	53	46.36
6	24	40.12
19	29	06.24
	3	11.52
		54.72
		44.50
		-10.22

344

June 28

1327  
 2 4 12  
 22.21  
 2 4 34.21  
 6 28 36.68  
 19 35 57.53  
 3 12.65  
 44.88  
 60.00  
 15.12  
 15.50  
 6 38  
 +10 gr. 7.57  
 -1.11

June 29

1327  
 2 5 7  
 - 22.86  
 2 5 29.86  
 6 32 33.24  
 19 32 56.62  
 3 12.20  
 44.42  
 60.00  
 15.58  
 15.50  
 +.08  
 m = 9 gr.

1327.

2 6 22  
 21.90  
 2 6 43.90  
 6 28 36.68  
 19 38 07.82  
 3 12.98  
 54.24  
 44.50  
 -9.74 *Eng Maltham.*

1327.

13 44 16  
 22.49  
 13 44 38.49  
 6 32 33.24  
 7 12 05.25  
 1 10.78  
 54.47  
 44.50  
 -9.97 *Eng Maltham.*



June 30

1327			1327-Waltham.			1327.			1327=Waltham.		
2	39	17	2	39	17	2	39	17	2	39	17
14	37	10	24.3	2	8	2	8	2	13	51	12
		23.6	2	39	41.3			24.3			23.43
14	37	33.6	6	36	29.8	2	8	26.3	13	51	35.43
6	36	29.8	20	03	11.5	6	36	29.8	6	36	29.80
8	01	03.8	3	17.08	19	31	56.5	7	15	05.63	
	1	18.9		54.42		3	12.00		1	11.26	
	4	14.9		44.50			44.50			54.37	
	6	00		Waltham -9.92			60.00			44.50	
	13.2			-9.72			15.00			-9.87	
	15.50						15.50			Em. of	
	15.10						.00			Waltham.	
	15.50										
	-40										

rem. 1 gr.  
or = 9 gr.

W = 9 gr.  
+ 1 gr.

July 1<sup>st</sup>

1327		
2	46	2
		25.0 .4
2	46	27.0
6	40	26.36
20	06	00.64
	13	17.50
		43.14
		60.00
		16.86
		11.50
		1.36
		.40
		+ .96 1327
		+ .80 Waltham
		17.6
		+ .88 mean.
		rem 9 gr for 3
		- .10

permanent weight = 8 gr.

Err of Maltham. June 30<sup>d</sup>.8 = -9.72. daily rate = +.10<sup>s</sup>

Err of Sid. Cl. 1327 June 30<sup>d</sup>.8 = -24.11. hourly rate = -.05<sup>s</sup>  
(Sid. time 2<sup>h</sup>30<sup>m</sup>)

Permanent weight on 394 = 8 gr.

-9.72

+30

-9.42

.24  
3

-9.72 by

-.06 by M.

-.72 by 1327

.78

-.39 mean





1327 = waltham.  
July 4.3.

13 35 47

29.6

13 36 16.6

6 52 16.03

6 44 00.57

1 6.18

54.39

44.50

-9.89



July 4.

1327 +  $\frac{1}{3}$

7	19	37
		28.66
7	20	05.66
6	52	16.03
0	27	49.63
	0	4.63
		45.00
		<del>60.00</del>
		15.00
		15.50
		-.50

July 3.8  
1327 = Waltham.

2	7	55
		28.36
2	8	23.36
6	52	16.03
19	16	07.33
	3	9.38
		<del>57.92</del>
2	8	23.36
6	48	19.47
19	20	03.89
	3	10.03
		53.86
		44.50
		-9.36

1327

1	30	34
	21	29.74
1	32	03.74
6	52	16.03
18	49	47.71
	8	1.84
		5.87
	3	3.45
		44.26
		<del>60.00</del>
		15.74
		15.50
		+2.24
		.00
		+1.12

July 4.8  
1327 = Waltham

2	40	55
		30.4
2	41	25.4
6	52	16.03
19	49	09.37
	3	14.78
		54.59
		44.50
		-10.09

350

July 5

$1327, -1/2$   
 2 14 35  
 $01.20$   
 $29.82$   
 2 15 08.20  
 6 56 12.59  
 19 18 53.61  
 3 9.75  
 $43.86$   
 $6000$   
 $16.14$   
 $15.50$   
 $+ .64$   
 mean. 8 gr.  $3^h - .62$   
 $+ .08$

July 6.

$1327$   
 16 31 55  
 mean. 34.20  
 16 32 29.80  
 7 0 9.15  
 9 32 20.05  
 1 33.87  
 $46.18$

~~June~~  $1327 - 1/3$  Waethen  
 7 12 34  
 $31.74$   
 7 13 02.26  
 $05.74$   
 7 0 9.15  
 8 12 56.59  
 $2.13$   
 $54.46$   
 $44.5$   
 $9.96$

$1327$   
 16 31 55  
 $32.20$   
 16 32 27.20  
 7 0 9.15  
 9 32 18.05  
 1 33.74  
 $44.31$   
 $6000$   
 $15.69$   
 $15.50$   
 $+ .19$





352

July 8.

1327  
 2 15 19  
 36.7  
 2 15 55.7  
 7 8 2.26  
 19 7 53.44  
 3 8.12  
 45.32  
 60.00  
 14.68  
 15.50  
 - 9.2  
 .35  
 -1.57

1327  $\frac{1}{4}$  waetham  
 16 14 51  
 35.51  
 16 15 26.5  
 7 8 2.26  
 9 07 23.54  
 1 29.61  
 53.63  
 44.50  
 9.43  
 Sum. 9.23  
 comp. 9.8  
 + .57  
 Sum. 9.28  
 +.29

July 9<sup>th</sup>

1327 = waetham  
 7 35 21  
 36.36  
 7 35 57.36  
 7 11 58.82  
 23 58.54  
 3.93  
 54.61  
 44.50  
 Sum waetham - 10.11

1327 =  
 14 54 23  
 36.76  
 14 54 59.76  
 7 11 58.82  
 7 43 00.94  
 1 15.85  
 45.09  
 15.50  
 60.00  
 15.34  
 15.50  
 -1.16  
 +.09  
 -0.07

1327  
 2 46 19  
 36.9  
 2 46 55.9  
 7 11 58.82  
 19 34 57.08  
 3 12.42  
 44.66  
 60.00  
 15.34  
 15.50  
 -1.16  
 +.09  
 -0.07



July 9

 $1327^{+11}_{-3}$  Waltham  
 2 5 22

36.85

2 5 58.85

7 11 58.82

18 54 00.03

3 5.81

54.22

44.50

9.72

July 11.

 $1327$   
 7 42 2  
 38.00

7 42 40.50

7 19 51.93

22 48.57

0 3.76

44.81

6000

15.19

15.50

- .31

 $1327$   
 2 30 6  
 39.46 37.46  
 38.70

2 30 45.46 .76

7 19 51.93

19 10 53.53

3 8.50

45.03

6000

14.97

15.50

- .253

+ 20

.00

3.73

B-W=10.2

by W.

W=89.

mean

+ .20 + .11

 76  
 53  
 + .23 Error  
 134

354

July 12.

1327<sup>-</sup>  
 4 1 16  
 39.70  
 4 1 15.70  
 7 23 48.49  
 20 38 07.21  
 3 22.77  
 44.44  
 6000  
 15.56  
 15.50

$\eta = 89^\circ$  +.06

B-W = 10.4

July 13.

1327			1327 - weather		
15	48	12	16	49	32
		39.3			39.3
15	48	51.3	16	50	11.3
7	27	45.05	7	27	45.05
8	21	06.25	9	22	26.25
	1	22.10		1	32.13
		44.15			54.12
		6000			44.50
		15.85			9.62
		15.50			
		+ .35			

$\eta = 79^\circ$



July 14

1327

15 49 09  
39.65

15 49 48.65

7 31 46.61

8 18 06.04

7 21.74

45.30

60.00

14.70

15.50

- .80

$\eta = 7$  gr.

added .3 gr.

1327

14 49 8  
39.65

14 49 47.65

7 31 41.61

7 18 06.04

1 11.80

54.24

44.50

9.74

~~8.18~~

15.14.13  
15.49.09  
25.4

1327, waltham.

2 20 01

39.73

2 20 40.73

7 31 41.61

18 48 59.12

3 4.96

54.16

44.50

- 9.66

$m = 2$  gr.

at 21<sup>st</sup> B =  $\pm .1$  by Waltham.

$m = 8$  gr.

356

July 15

1327  
 3 2 24  
 39.9  
 3 3 33.9  
 7 35 38.16  
 19 27 55.74  
 3 11.30  
 44.44  
 6000  
 15.16  
 15.50  
 +.26  
 B-w = 9.5      .00  
 +.03

m = 8 gr.

July 16.

1327 = Waltham.  
 16 44 18  
 40.5  
 16 44 58.5  
 7 39 34.72  
 9 05 23.78  
 1 29.33  
 54.45  
 44.50  
 - 9.95

1327      1327      1327  
 17 48 19      3 10 51  
 40.5      40.7  
 17 48 59.5      3 11 31.7  
 7 39 34.72      7 39 34.72  
 10 09 24.78      19 31 56.98  
 1 39.82      3 12.04  
 44.96      44.94  
 6000      6000  
 15.04      15.06  
 15.50      15.50  
 -.46      -.44  
 +1 gr.      +10 2 1/4 gr.  
 m = 9 gr.      m = 1 gr.  
 m = 8 gr.      m = 8 gr.



July 17

1327 = Maethan

$$\begin{array}{r} -1/3 \\ 5 \ 37 \ 20 \end{array}$$

40.80

5 38 00.80

7 43 31.28

21 54 29.52

3 35.30

54.22

44.50

- 9.72

B-m = 97.

July 18

$$\begin{array}{r} 1327 \\ 2 \ 52 \ 39 \end{array}$$

40.96

2 53 19.96

7 47 27.84

19 05 52.12

3 07.68

44.44

60.00

15.56

15.50

+0.6

358

July 19

1327

3 17 39

41.20

3 18 20.20

7 51 24.39

19 26 55.81

3 11.20

44.61

60.20

15.39

15.50

- .11

n = 89r

.00

- .06

1327 - waetham.

15 54 57

40.9

15 55 37.9

7 51 24.4

8 04 13.5

1 19.3

54.241.50

- 9.70

July 20

1327

4 26 46

41.0

4 27 27.0

7 55 20.95

20 32 06.05

3 21.80

44.25

60.20

15.05

15.20

+ .25

+ .20

+ .22

.00

+ .11

- .18

- .07

n = 89r

n = 89r 3/6



July 21

1327 - waethan

8 43 38

41.3

8 44 19.3

7 59 17.50

0 45 01.80

0 7.37

54.43.

44.50

- 9.93

B - W = 9.6

B = -.3

+ 1 gr.

W = 9 gr.

1327

3 27 32

41.45

3 28 13.45

7 59 17.50

19 28 55.95

5 11.51

44.44

60.00

15.56

15.50

+ .06

B - W = 9.9 + .00

+ .03

new 1 gr. W = 8 gr.

360

July 22

1327  
 5 3 43  
 41.75  
 5 4 24.75  
 8 3 14.06  
 21 1 10.69  
 3 26.55  
 44.14  
 6000  
 15.88  
 15.50  
 +.36  
 394 .00  
 B-W = 10.00. W 00  
 +.12  
 rem 5 gills -.14  
 -.02

July 23

B-W = 9.9  
at 8h

1327.  
 4 23 32  
 41.95  
 4 24 13.95  
 8 7 10.62  
 20 17 03.33  
 3 19.30  
 44.03  
 6000  
 15.97  
 15.50  
 +.47  
 B-W = 9.9  
 100  
 11.89  
 8.31  
 4.00  
 +.23 mean.

4 50 13.60 = 7227  
 41.95  
 55.15  
 60.00  
 4.85  
 4.24  
 .60



July 24.

1327 = Waltham

14	16	19
		42.36
14	17	01.36
8	11	7.18
6	05	54.18
	0	59.88
		54.30
		<u>44.50</u>
		- 9.80

at 21<sup>h</sup> 8-w = 9.9

1327

✓	14	36
		42.55
✓	15	18.55
8	11	7.18
21	04	11.37
	3	27.07
		<u>44.30</u>
		60.00
		15.70
		<u>15.50</u>
11-892.		+1.20

July 25

1327.

4	21	23
		42.85
4	22	05.85
8	15	3.73
20	07	02.12
	3	17.73
		<u>44.89</u>
		60.00
		15.61
		<u>15.50</u>
		+1.11
		<u>.00</u>
3-w = 9.9		+0.6

362

July 26

1327  
 14 20 01  
 - 43.06  
 14 20 44.06  
 8 19 00.29  
 6 01 43.77  
 0 19.27  
 44.50  
 6000  
 15.50  
 15.50  
 .00

W = 8 gr.

July 27

1327  
 4 45 19  
 - 43.30  
 4 46 02.30  
 8 22 56.84  
 20 23 05.46  
 3 20.39  
 45.07  
 64.00  
 14.93  
 15.50  
 W = 8 gr. - .57  
 + 20 gr. 1<sup>h</sup> + .50  
 - .03

+ 1 gr. permanent.  
 W = 9 gr.

1327

4 47 23  
 43.22  
 4 48 06.22  
 8 19 00.29  
 20 29 05.93  
 3 21.30  
 44.63  
 6000  
 15.37  
 15.50  
 .13  
 .00  
 .06  
 W = 8 gr.

1327 - waltham.

✓ 0 31  
 43.30  
 5 1 14.30  
 8 22 56.84  
 20 23 17.46  
 3 22.81  
 44.65  
 64.00  
 10.15 = End of Waltham



July 28

13 27<sup>+</sup>  
 4 11 9  
 43.0  
 4 11 52.0  
 8 26 53.40  
 19 44 58.60  
 3 14.20  
 44.40  
 6000  
 15.60  
 15.50  
 -10  
 00  
 -05  
 m=9

1327 = wall Hann.

5 30 32  
 43.0  
 5 31 15.0  
 8 26 53.40  
 21 04 21.60  
 3 27.12  
 54.48  
 44.50  
 -9.98

July 29

1327  
 4 8 4  
 43.96  
 4 8 47.96  
 8 30 49.96  
 29 37 58.00  
 13 13.00  
 55.00  
 6000  
 15.00  
 15.50  
 -50  
 many value of  
 ΔT in account of  
 collim.

1327 -1/3  
 1 42 51  
 43.9  
 1 43 34.9  
 8 30 49.96  
 17 12 44.94  
 2 49.13  
 55.81  
 44.50  
 11.31

$$B-r = \frac{9.5}{110.5}$$

rem. 8 gr. 1 $\frac{1}{2}$ .

rem. 2 gr. until July 29.3, then put back

1 gr.  $r = 8$  gr.

364

July 30

1327			1327		
✓	2	16	14	4	53
		42.00			42.10
✓	2	52	14	5	35.10
8	34	46.52	8	34	46.52
20	28	05.48	5	30	48.58
<del>3</del>	<del>2</del> + 3	21.18		0	54.12
		44.30			54.46
		60.00			44.50
		15.70			-9.96
		15.00			
m=8 gr.		<u>+ .20</u>			
m=5 gr. 1 1/2 h		- .21			
		- .01			

m=78 gr.

July 31

1327 = Waltham.		
2	10	49
		41.41
✓	11	30.41
8	38	43.07
17	32	47.34
	2	52.47
		54.87
		44.50
		-10.37

+1 gr.

m=8 gr.

B 394 is - .4 by Waltham

+ 59 for 30 h  
 394  
 + .4  
 .0



Aug. 1

	1327 <sup>-</sup>	1327=wal.	1327=Waeltham. F.W.
4	18 56	16 36 11	3 16 56
	41.30	41.4	- 41.3
4	19 37.30	16 36 52.40	3 17 37.3
8	42 39.63	8 42 39.63	8 42 39.63
19	36 54.67	7 54 12.77	18 34 57.67
	3 12.78	1 17.68	3 2.67
	44.89	55.09	55.00.
	6000	44.50	44.50
	15.11	- 10.59	- 10.50
	15.50		
	- 39		
	+ 50		

Aug. 2.

	1327	1327=wal.	1327
16	25 55	9 - 4-53	4 40 55
	41.0	41.21	(40.8) 41.2
16	26 36.0	9 5 34.21	4 41 35.8
8	46 36.18	8 46 36.18	8 46 36.18
7	39 59.82	0 18 58.03	19 54 59.62
	1 15.32	0 3.06	3 15.74
	44.50	54.97	43.88
	6000	5.48	6000
	15.50	44.50	16.12
	15.50	- 10.47	15.50
	00		
B - W = 10.4			+ .62 +.62
			- .50
			613.7 +.12
			" Waltham - .20
			- .05
			mean - .04

W = 8 gr.

366

Aug. 3.

1327 = waalsten.

9 7 49  
11.64

9 8 30.64

8 10 32.74

0 17 57.90

0 2.94

54.96

44.50

— 10.46

10.56

~~2~~ + 1 gr. to Bat 3<sup>h</sup> met.  
~~9 gr.~~

at  $\frac{1}{19}$  30<sup>h</sup>

B-W = 10.5

thus  $\therefore B = \pm 0.$

Aug. 4

1327

16 8 42  
41.75

16 9 23.75

8 54 29.29

7 14 54.46

1 11.26

43.20

.25  
43.45

16 27 45  
42.0

16 28 27.0

8 54 29.29

7 33 57.71

1 14.31

43.40

64.50

16.60

15.50

+1.10

B-W = 11.0

rem. 2 gr.



Aug. 4

1327. -

x	27	42					
		42.20					0.00 = 3457
4	28	24.20	4	40			48.5 - 1327
							42.20
8	54	29.29					30.70
19	38	54.91					
	3	12.20					00.
		42.71					2 29.12
		For					30.88
		17.29					48.5
		15.50					- 42.88
		+1.79					

B-m = 10.7

Sum 6 gr. additional

Aug. 5

1327 = malthan

8	45	35
		43.90
8	46	18.90
8	54	29.29
23 <sup>h</sup>	51	49.66
	3	54.60
		55.01
		44.50
		-10.51

B-m = 10.15

∴ B = -35

I put on the pens 8 gr. permanent and 5 gr. for ~~the~~

368

Aug. 5

at 6 Pm, B-m =  $9.9$ .

rem 8 gr.

w = 7 gr.

1527 -  
4 38 38

45.0

4 39 23.0

8 58 25.85

19 40 57.15

3 16.20

43.95

6000

16.05

15.50

+ .55

run 7 gr  
8 gr off for 4.48

+ .07 at 21.40.

Aug. 6

at 8 Pm rem.

1 gr.

w = 7 gr.

1327 +

5 13 37

46.50

5 14 25.50

9 2 22.40

20 12 03.10

3 18.66

44.44

6000

15.56

15.50

+ .06



Aug. 7.

	1327	236 - Waltham.
8 <sup>3</sup>	17 44	17 13 08 + $\frac{1}{4}$
	47.89	34.25
6	18 1.89	17 12 33.75
9	6 18.96	9 6 18.96
21	12 12.93	8 6 14.79
	3 28.38	1 19.69
	44.55	58.10
	<del>6.00</del>	44.50
	15.45	-10.60
	15.50	
	-1.05	

Transgr

rem. 1 gr at 8<sup>th</sup> m.t.  
m - 7 gr.

Aug. 8

	1327	
5	26 31	
	48.75	
5	27 19.75	
9	10 15.52	
20	17 04.23	
	3 19.38	
	44.85	
	<del>6.00</del>	
	48.85	
	15.50	
	-1.35	
	.00	
	-1.8	
+ 1 gr. m = 8 gr.		
+ 10 gr $\frac{3}{4}$ h		
	+21	
	+0.3	

370

Aug. 9.

1327

4	20	15	17	12	20	
		49.60				
4	21	04.60	1327 = Waltham.			
9	14	18.08	17	12	20	4
19	06	48.52				30
	3	7.86	17	13	09.14	31
		44.66	19	14	12.08	
		6000	7	58	57.06	
n = 89r.		15.34	1	18.47		
		15.50		38.53		
		- .06		6000		
		- .08		21.47		
4	41	18		15.57		
				+5.97		

00.00 - 2401  
38.75 21327  
49.14  
22.89  
00.00  
137.11  
23.00  
4.11  
00.00 = 3451  
32.25 = 1327  
49.60  
21.85  
00.00  
38.15

Aug. 10.

1327

5	7	17	18	17	24
		51.20			50.60
5	8	08.20	18	18	14.60
9	18	08.62	9	18	08.63
19	49	59.57	9	09	05.97
	3	14.95		1	28.43
		44.62			37.44
		6000			00.00
		15.38			22.56
		- .12			15.50
		.07			+7.06 Waltham.
n = 89r		- .06			



Aug. 11

1327 = Waltham.

18	1	15
		51.34
18	2	06.34
9	22	51.19
8	40	01.15
	1	25.19
		135.96
		65.00
		35.46
		<u>46.50</u>
		+8.54
		24.04
		15.00
		+8.54

1.5  
1.1  
1.6  
+1.3 daily gain of Waltham.

1327

5	46	18
		51.75
5	47	09.75
9	22	51.19
20	25	04.56
	3	20.60
		43.96
		65.00
		16.04
		<u>15.50</u>
		.54
		<u>.00</u>
		+ .27
		<u>-.28</u>
		+ .04

11-8 gr.

run 8 gr. h

Aug. 12

1327 - 44

4	46	3
		52.27
4	46	55.27
9	26	11.75
19	20	53.52
	3	10.02
		43.50
		65.00
		16.50
		<u>15.50</u>
		+1.00

run 8 gr. 2 h  
and 2 gr. 6 min  
run 6 gr.

372

Aug 13.

1327  
 18  $\sqrt{1}$  22  
 $\sqrt{2.60}$   
 18  $\sqrt{2}$  14.60  
 9 29  $\sqrt{8.31}$   
 9 22 16.29  
 1 32.12  
 $\sqrt{44.17}$   
 $\sqrt{600}$   
 $\sqrt{15.83}$   
 $\sqrt{15.12}$   
 $n=6gr.$  +.33

1327  
 $\sqrt{1}$   $\sqrt{0}$  10  
 $\sqrt{2.90}$   
 $\sqrt{02.90}$   
 9 29  $\sqrt{8.31}$   
 20 21 04.59  
 3 19.95  
 $\sqrt{44.54}$   
 $\sqrt{6000}$   
 $\sqrt{15.46}$   
 $\sqrt{15.50}$   
 $n=6gr.$  - 04  
 $+2gr. n=8gr.$

Aug 14.

1327  
 7 3 17  
 $\sqrt{3.00}$   
 7 4 10.50  
 9 33  $\sqrt{4.85}$   
 21 30 15.65  
 3 31.33  
 $\sqrt{44.32}$   
 $\sqrt{6000}$   
 $\sqrt{15.68}$   
 $\sqrt{15.00}$   
 +.18



Aug. 15

1327-  
 18 22 7  
 . 53.70  
 18 23 00.70  
 9 37 51.41  
 8 45 09.29  
 1 25.94  
 40,35.

18 47 11  
 . 53.70  
 18 48 04.70  
 9 37 51.41  
 9 10 13.29

m 39. m 59.

1327 = Walstham 1327 = Walstham

17	15	54	2	15	21	5	21	54
		53.70			54.77			54.77
17	16	47.70	2	16	15.77	5	22	48.77
9	37	51.41	9	37	51.41	9	37	51.41
7	38	56.29	16	38	24.36	19	44	57.36
	1	15.19	2	43.62			3	14.06
		41.10			40.74			30
		44.50			44.50			
		+ 13.40			+ 3.76			
					- B + m			3.00
								B = .76

H 89.10

374

Aug. 16.

1327 - waetham.

17 48 52

56.21

added 2. gr. at  $B_{\text{r}}^h$ .

17 49 48.21

 $w = 7 \text{ gr.}$ 

9 41 47.95

8 08 00.26

1 19.96

40.30

44.50

+ 4.20

 $-B + w = 4.5 \text{ at } 20^{\circ} 1/2$  $w = + 4.5$  $\therefore B = .0$ 

Aug. 17

1327

4 34 34

59.8

4 34 33.8

9 45 44.71

17 48 49.09

3 14.79

44.36

60.00

15.70

15.50

+ .20

.00

+ .10

- .10

- .04

 $w = 2 \text{ gr.}$  $\rightarrow \text{Sept. 1}$



Aug. 18

1327 +

1327 = Walther.

1327 = Wal.

✓ 27 38

15 26 14

4 17 19

61.44

60.52

61.44

✓ 28 39.24

15 27 14.52

4 18 20.24

9 49 41.06

9 49 41.06

9 49 41.06

19 38 58.18

5 37 33.46

18 28 39.18

3 13.20

0 55.29

3 1.61

44.98

38.17

37.57

60.00

44.50

44.50

15.02

+6.33

+6.93

15.50

+ 10 gr. <sup>2h</sup>

-48

+54

+06

+60  
1.20  
6.93  
8.136.  
6.93  
1.20  
8.13

Aug 19

1327 +

✓ 15 31

62.8

added 1 gr at 5 P.M.

✓ 16 33.8

w = 8 gr.

9 ✓ 3 37.62

7.2 = 34.1  
10 12.7

19 22 56.18

62.9

3 10.51

12.9

45.67

7.2

60.00

2 54.3

14.33

15.00

-1.17 = 1327

-B + w = 8.5

0.00 = Walther.

0.00

3 | -1.17

-40

+22

+10 gr. <sup>2h</sup>

Aug. 20

$$-B + r = 9.2^{\text{u}} - 8.1^{\text{u}} + .7$$

+ 2 gr. to B.  $n = 10 \text{ gr.}$   
is 9.2  
shme to 8.7  $\therefore n =$   
 $\frac{8.7}{10} \cdot 10 = 8.7$

	1327	
5	33	28
		64,10
5	34	32,10
9	57	34,17
19	36	57.923
	3	12084
		45.09
		6000
		14.91
		<u>11.50</u>
		-11.59

W-B: 9.5 ~ .20  
shirts 9.3 .81  
1.40  
~~1.40~~  
- .20  
+ .27



Aug 21

7	40	40
		68.1
7	41	48.1
10	1	30.73
21	40	17.07
	3	32.97
		44.40
		<del>60.00</del>
		15.60
		<u>15.50</u>
		+1.0

Aug. 22

5	30	11
		71.6
5	31	22.6
10	5	27.28
19	25	55.22
	3	11.02
		44.30
		<del>60.00</del>
		15.70
		<u>15.50</u>
		+1.20

$71.6 - 97 = 11.6$   
 $11.6 \times 1/4 = 2.9$

1327 = total. +

4	14	48
		71.5
4	15	59.5
10	5	27.28
18	10	32.22
	2	18.69
		38.53
		44.50
		+ 10.99 = 55.49 total.

378

Aug 23

1327 -  
 4 59 19  
 1 14.1  
 5 01 13.1  
 10 9 23.84  
 18 51 49.26  
 3 05.30  
 43.96  
 60.00  
 16.04  
 15.53

$m = 9 \text{ gr.} + .124$   
 $- 8 \text{ gr. } 1/2^h = -.36$   
 $- 1 \text{ gr.} + .18$

Aug 24.

1327 + 1/2  
 18 35 11  
 1 15.45  
 18 36 26.45  
 10 13 20.39  
 8 23 06.06  
 1 22.40  
 43.56  
 60.00  
 15.44

- 2 gr.  
 $- B + m = 12.1$

1327 - waethan.

3 24 32  
 73.95  
 3 25 45.95  
 10 9 23.84  
 17 16 22.11  
 2 49.77  
 132.34  
 44.00

+ 12.14  $\Sigma$  gr.  
 $\frac{6.93}{5 \sqrt{.2121.04}}$

at 19.2

$- B + m = 12.8$   
 at 13.2  
 $+ .4$   
 $- 8 \text{ gr. } 1/2^h = -.36$   
 $+ .04$

- 1 gr.  
 $m = 7 \text{ gr.}$



Aug 25 at 19<sup>h</sup> W-B = 13.6

+ 14.2

14.2

+ .6

13 27

✓ 2 44

1 22.0

✓ 4 06.0

10 17 16.95

18 46 49.05

3 04.63

44.42

6000

15.58

15.50

+ .8

+ .60

+ .08

+ .08

.76

+ .25 Σ 394.

- 7 gr. 11<sup>h</sup> - 28 = - .03

1.0 = 1327

5 30 30.8 = 3451

3 07.8

27 28.0

1.0

+ 1 22.0

Σ of 13 = 7 by 3451

Aug 26

1327

1327 = Wal.

1327 -

20

24 14

20 12 16.80

5

27 39

1 24.10

1 24.12

1 25.50

20

25 36.0

10 14 20.92

5

27 04.50

10

21

15.50

10

21

13.50

10

21

13.50

10

04

22.50

9

53

07.42

19

05

51.00

1

38.80

+

1

37.15

3

7.58

43.70

30.27

43.42

6000

44.50

6000

16.30

+ 14.37

16.58

45.50

15.50

+ .80

+ 1.08

run. w. B = +.8

- 3 + w = 13.5

14.5

+ 1.0

380

Aug. 27

1327  
 17 52 40  
     1 26.85  
 17 54 06.85  
 10 25 10.06  
 7 28 56.79  
     1 13.56

17 43 24.70  
     1 26.85  
 17 44 51.55  
 10 25 10.06  
 7 19 41.49  
     1 12.02  
 29.47  
 44.50

- 5 gr.  $2\frac{1}{2} \frac{h}{m} + 15.03$   
 14.50  
 at  $24^h B = +.6$

Aug. 28.

1327.  
 6 20 35  
     1 31.7  
 6 22 06.7  
 10 29 6.61  
 19 53 00.9  
     3 15.44  
 44.65  
 60.00  
 15.35  
 15.50  
 - 15

$w = 5 \text{ gr.}$   
 $+ 2 \text{ gr.}$   
 $w = 8 \text{ gr.}$



Aug. 29

1327  
 19 33 43  
     1 33.51  
 19 35 16.51  
 10 33 3.17  
   9 02 13.24  
      1 28.79  
      44.45  
      6000  
      15.55  
      15.50  
      +0.05  
      w=8 gr.  
      -1 gr.  
      w=7 gr.

Aug 30.

1327 +  
 20 6 42  
     1 36.70  
 20 8 18.70  
 10 36 59.71  
   9 31 18.99  
      1 33.70  
      45.29  
      6000  
      14.70  
      15.50  
      -80  
      w  
      -160  
      +3 gr.  
      w=10 gr.

1327  
 5 51 16  
     1 37.90  
   5 53 53.90  
 10 36 59.71  
 19 16 54.19  
     3 9.54  
     44.65  
     6000  
     15.35  
     15.50  
     -1.15  
     -0.07  
     rem. 2 gr.  
     w=8 gr.

382

Aug 31

1327  
 6 5 11  
 1 39.7  
 6 6 50.7  
 10 40 56.27  
 19 25 54.43  
 3 11.02  
 43.41  
 16.59  
 15.50  
 4/3 m. + 1.09  
 39 4 1/3 m. + .70

- 8 gr. 2<sup>h</sup> rem. 2 gr.  
 m = 6 gr.

Sept. 1

	1327	+	1327 - Meltham.	1327
20	45	34	18 53 58.25	7 5 15
	1	41.0	1 40.85	1 42.55
20	47	15.0	18 55 39.10	7 6 57.35
10	44	52.82	10 44 52.82	10 44 52.82
10	02	22.18	8 10 46.28	20 22 04.53
	1	38.62	1 20.40	3 20.19
		43.56	25.88	44.24
		6000	44.50	6000
		16.44	+ 18.62	15.76
		15.50		15.50
		+ .94		1.26
		17		.00
		+ .77		+ .13
	m = 6 gr.			- 2 gr. 2 <sup>h</sup>
	- 1 gr. m = 5 gr.			put back m.
				m = 7 gr.



THERM.

383

Sept. 2.

1327  
 17 59 0' 43.48  
 18 00 44.48  
 10 48 49.38  
 7 11 55.10  
 1 10 77  
 44.33  
 6000  
 15.67  
 15.10  
 m=7.  
 +.17

1327=15.

5 52 37.70  
 1 44.61  
 5 54 22.31  
 10 48 49.38  
 19 05 32.93  
 3 7.68  
 25.39  
 44.100  
 +19.20  
 18.62  
 .58

1327

7 20 11  
 1 44.8  
 7 21 55.8  
 10 48 49.38  
 20 33 06.42  
 3 22.05  
 44.37  
 6000  
 15.63  
 15.10  
 +.13  
 m=7.  
 +.06

Sept. 3.

1327 -  
 18 16 57 46.01  
 18 18 43.00  
 10 52 45.93  
 7 25 57.07  
 1 12.92  
 44.15  
 6000  
 15.85  
 15.10  
 +.35

-1 gr.  
 m=6 gr

1327=25

16 53 24.80  
 1 45.75  
 16 55 10.55  
 10 52 45.93  
 6 02 24.62  
 0 59.37  
 25.25  
 44.100  
 +19.25

1327

7 17 03  
 1 47.40  
 7 18 50.40  
 10 52 45.93  
 20 26 04.47  
 -B+w=19.4  
 slide to 19.4  
 ∴ 394 = ±.0

+1 gr.  
 m=7 gr

384

Sept. 4.

1327.

2	10	3	+ .05
	1	52.4	
8	11	55.4	
10	56	42.49	
21	15	12.91	
21	15	12.96	+ .05
	3	28.86	
		44.10	
		60.00	
		15.90	
		15.50	
		+ .40	

- 2 gr.  
 m = 5 gr.

Sept. 5

1327 - W.

7	25	5	52	11.10	7	25	47		
at 7 P.m. + 2 gr.				1	57.00	1	57.10		
m = 7 gr.				5	54	08.15	7	27	44.10
		11	00	39.03	11	02	39.03		
		18	58	29.12	20	25	05.07		
		3	15.49	3	20.64				
			13.62		44.43				
			39.3		60.00				
		3	05.70		15.57				
			23.42		15.00				
			23.32		+ .07				
			44.00						
		Sum	20.18						
			19.20						
			1.93						

25 11.93 1.77  
 123 180  
 25 1.93 1.37  
 25 1.93 1.37  
 21.18  
 1.20  
 22.43



Sept. 6

1327 -  
 19 54 47  
 1 59.70  
 19 56 46.70  
 11 04 35.59  
 8 52 11.11  
 1 27.07  
 44.04  
 6000  
 15.96  
 15.50  
 +.46

- 2 gr.  
 $w = 5 \text{ gr.}$

at 20<sup>th</sup> added 2 gr.  
 $w = 7 \text{ gr.}$

Sept. 7

1327

at 10<sup>h</sup> 30<sup>m</sup>.

$$-B + w = 23.0$$

$$\text{shd be } 22.5$$

$$\therefore B = -.5$$

$$w = 7 \text{ gr. } -2.5$$

at 20<sup>th</sup>

$$-B + w = 23.2$$

$$\text{shd be } 22.9$$

$$-0.30$$

$$+ 5 \text{ gr } 1/2 \text{ h. } +.20$$

$$-10$$

$$w = 7 \text{ gr.}$$

386

Sept. 8.

at 20<sup>h</sup> m.y.

$$-B + W = 22.0$$

$$\text{shd be } \underline{23.6}$$

$$\therefore B = + 1.6 \text{ by } W.$$

$$\begin{array}{r} 1.6 \\ 0.0 \\ \hline 3.2 \end{array}$$

$$\therefore B \text{ giving } \frac{1}{3} \text{ to } B = + 1.1$$

$$-7 \text{ gr. for } 4^{\text{th}}$$

$$+ 4 \text{ gr. } W = 4 \text{ gr.}$$

$$64.7$$

$$65.0$$

$$65.0$$

$$64.7$$

$$70.3$$

Sept. 9

at 7<sup>1/2</sup> h. made no change.at 20<sup>h</sup>.

$$-B + W = 23.6$$

$$\text{shd be } \underline{24.2}$$

$$+ 0.6$$

giving weight to  
394, and taking into account  
the weights for yesterday, we have,

$$B = + 0.2$$

$$+ 2 \text{ gr. } W = 6 \text{ gr.}$$



Sept. 10

1327 -

6 36 ✓6

2 19.8

6 39 15.8

11 20 21.81

19 18 54.0

3 9.80

44.20

6000

15.80

15.50

+1.30

- 6 gr for 2<sup>h</sup> - .36

m = 6 gr. - .06

Sept. 11

1327

8 35 8

2 23.60

8 38 31.60

11 24 18.35

74 14 13.25

3 28.80

44.45

6000

15.55

15.50

m = 6 gr. + .05

388

Sept. 12.

7 6 47

2 26.45

7 8 13.45

11 28 14.91

19 40 58.54

3 13.45

45.09

60.00

14.91

15.00

- .59

.00

- .30

+10 gr 1 $\frac{1}{2}$ .

+ .27

+1 gr.  
w=7 gr.

- .03

Sept. 13

1327

7 4 4 46

2 29.57  $\frac{57}{13}$ 

7 47 15.57

11 32 11.45

20 15 04.12

3 19.04

45.08

61.01

14.92

15.50

- .58

+ .44 Correction

- .14

.02

w=7 gr - .07

Set 1327 ahead 3<sup>m</sup>



Sept. 14

1327  
 8 0 40  
~~11 36 28.00~~  
~~08.01~~  
 8 0 12.00  
 11 36 08.01  
 20 24 08.99  
 3 20.46  
 43.58  
 6000  
 16.02  
 15.50  
 +.52

Sept. 15.

1327  
 21 47 53  
 23.40  
 21 47 29.60  
 11 40 04.56  
 10 07 25.04  
 1 39.61  
 44.43  
 6000  
 14.57  
 15.50  
 - 11

+ 4 gr.  
 m = 10 gr.

max.  
 60.3 64.7  
 60.3 60.7

1327  
 6 47 19  
 21.0  
 6 46 58.0  
 11 40 04.56  
 19 06 53.44  
 3 07.92  
 45.52  
 6000  
 14.48  
 15.50  
 - 1.02

+ 10 gr.  
 for 2 1/2  
 m = 10 gr.

390

Sept. 16.

$$\begin{array}{r}
 + \\
 21 \quad 12 \quad 37 \\
 18.70 \\
 21 \quad 12 \quad 18.80 \\
 11 \quad 44 \quad 1.11 \\
 9 \quad 28 \quad 17.19 \\
 1 \quad 33.05 \\
 44.14 \\
 6000 \\
 15.86 \\
 \hline
 15.50 \\
 +.36
 \end{array}$$

- 3 gr.  
 m = 6 gr.

$$\begin{array}{r}
 9 \quad 3 \quad 32 \\
 17.0 \\
 9 \quad 3 \quad 15.0 \\
 11 \quad 44 \quad 1.11 \\
 21 \quad 19 \quad 13.89 \\
 3 \quad 29.49 \\
 44.40 \\
 6000 \\
 \hline
 15.60 \\
 \hline
 15.50 \\
 +.10 \\
 \hline
 \text{or} \\
 +.05
 \end{array}$$

m = 6 gr.

Sept. 17

$$\begin{array}{r}
 1327. \\
 8 \quad 219 \quad 23 \\
 12.70 \\
 8 \quad 19 \quad 10.30 \\
 11 \quad 47 \quad 57.67 \\
 20 \quad 31 \quad 12.63
 \end{array}$$

$$\begin{array}{r}
 1327 \\
 8 \quad 23 \quad 19 \\
 12.70 \\
 8 \quad 23 \quad 06.30 \\
 11 \quad 47 \quad 57.67 \\
 20 \quad 35 \quad 08.63 \\
 3 \quad 22.32 \\
 46.31 \\
 6000 \\
 13.69 \\
 \hline
 15.50 \\
 - 1.81 \\
 \hline
 13.69 \\
 \hline
 13.69
 \end{array}$$

+ 20 gr. 1/16 lb.  
 + 4 gr. 1/10 gr.



sept. 18.

1327.  
 9 8 18  
 9.96  
 9 8 8.04  
 11 11 14.23  
 21 16 43.81  
 3 29.12  
 44.68  
 6000  
 15.52  
 15.50  
 n=7 gr. - 18

at 9<sup>h</sup> m. t. I removed 3 gr. $\therefore W = 7$  gr.

1327 = waltham

19 4 45.0  
 11.78  
 19 4 33.22  
 11 11 14.23  
 7 12 38.99  
 1 10.86  
 28.13  
 6000  
 31.87  
 15.50  
 + 16.37

at 9 PM.

Sept. 19

1327 +  
 8 5 1  
 6.95  
 8 4 54.05  
 11 11 50.78  
 20 09 08.27  
 3 18.20  
 45.07  
 6000  
 14.93  
 15.10  
 - .57  
 .00  
 - .28  
 + .27  
 .00

n=8 gr.  
 10 gr. 1/2

at 9 PM + 1 gr.  
 n=8 gr.

392

Sept. 20.

$$\begin{array}{r}
 1327 \\
 20 \quad 47 \quad 3 \\
 \quad \quad 5.70 \\
 20 \quad 46 \quad 57.30 \\
 11 \quad 59 \quad 47.34 \\
 8 \quad 47 \quad 09.96 \\
 \quad 1 \quad 26.30 \\
 \quad \quad 43.66 \\
 \quad \quad 6000 \\
 \quad \quad 16.34 \\
 \quad \quad \underline{15.50} \\
 \quad \quad +.84
 \end{array}$$

Rem. 3 gr.  $n = 5$  gr.

$$\begin{array}{r}
 \text{at } 20^{\text{h}} 30^{\text{m}} \\
 n - B = 14.8 \\
 n - B \text{ at } 14.8 \\
 \therefore 394 = \underline{+1.0}
 \end{array}$$

$$\begin{array}{r}
 +2 \text{ gr.} \\
 n = 7 \text{ gr.}
 \end{array}$$

$$\begin{array}{r}
 1327 = \text{waethan} \\
 \begin{array}{r}
 12 \quad 03 \quad 24 \\
 11 \quad 57 \quad 23 = 00 \\
 \quad \quad 6.80 \\
 12 \quad 03 \quad 17.20 \\
 11 \quad 57 \quad 16.20 \\
 11 \quad 59 \quad 47.34 \\
 \quad 3 \quad 29.86 \\
 \quad \quad 0.58 \\
 \quad \quad 29.28 \\
 \quad \quad 6000 \\
 \quad \quad 30.72 \\
 \quad \quad \underline{15.50} \\
 n = +15.22 \\
 \quad \quad \underline{16.37} \\
 \quad \quad 411.1 \sqrt{L.021} \\
 \quad \quad \quad 8 \quad 2 \\
 \quad \quad \quad 3 \quad 3
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 1327 + \frac{1}{2} \\
 8 \quad 43 \quad 59
 \end{array}$$



Sept 21

1327 +  
 20 13 50  
 .50  
 20 13 49.50  
 12 3 43.88  
 8 10 04.62  
 1 20.40  
 45.22  
 60.00  
 14.78  
 15.50  
 - .72  
 + 2 gr.  
 n = 99

1327 = wall than

17 1 4.40  
 73  
 17 1 13.67  
 12 3 43.88  
 4 57 19.79  
 0 48.70  
 31.09  
 60.00  
 28.91  
 15.50  
 13.41  
 16.37  
 12.96 L .04 hour rate

1327  
 7 50 42  
 1.62  
 7 53 43.62  
 12 3 43.88  
 49 49 59.74  
 3 14.95  
 44.79  
 60.00  
 15.21  
 15.50  
 - .29  
 2 gr for 4<sup>h</sup> +.20  
 - .09

n = 2 gr.  
 w = 2 gr.

394

Sept. 22

1327 +  
 7 36 31  
     5.90  
 7 36 36.90  
 12 7 40.44  
 19 28 56.46  
     3 11.60  
     44.86  
     6000  
     15.14  
     15.50  
     - .36

min	max
60.6	63.8
60.6	60.3

+ 10<sup>gr</sup> + .27  
 - .09

Sept. 22

1327  
 7 50 26  
     8.70  
 7 50 34.70  
 12 11 36.99  
 20 38 57.71  
     3 13.15  
     44.56  
     6000  
     15.44  
     15.50  
     - .06

M = 7.9r

1327 = Wal.  
 6 49 04.6  
     8.86  
 6 49 13.46  
 12 11 36.99  
 18 37 36.47  
     3 3.07  
     30.40  
     6000  
     29.60  
     15.50  
     14.10  
     +3.4  
     +7



Sept. 24

1327  
 7 26 16 7 26 16  
 12 12  
 7 26 28 7 26 28  
 12 " 36.99 12 15 33.55  
 19 14 51.01 19 10 54.45  
 3 8.60  
 45.75  
 6000  
 14.25  
 151.50  
 - 1.25  
 - .62  
 + 3 gr.  
 W = 10 gr.

Sept. 25

1327  
 19 44 15 1327 = waltham 1327  
 13.16 20 49 15.40 10 5 34  
 19 44 28.16 13.28 14.90  
 12 19 30.09 20 49 28.68 10 5 48.90  
 7 24 58.07 12 19 30.09 12 19 30.09  
 1 12.90 8 29 59.59 21 46 18.81  
 45.17 1 23.55 3 34.00  
 6000 34.04 44.81  
 14.83 6000  
 151.50 25.96 15.19  
 - .67 15.50 15.10  
 - .31  
 + 10.46 gr.  
 14.10  
 36 13.6 41.101  
 36.40  
 - 1 gr.  
 W = 9 gr.  
 W = 9 gr.

396

Sept. 26.

at 9 1/2 hr. run. 1 gr.  
 $\pi = 8 \text{ gr.}$

1327 - waltham  
 16 41 29.45

15.57

16 41 45.02

12 23 26.65

4 18 18.37

0 42.32

36.05

6000

23.95

15.50

8.45  $\Sigma$  r. l. only  
 10.46  
 20 2.00  $\Sigma$  10

1327  
 8 44 14  
 17.40

8 44 31.40

12 23 26.65

20 21 04.75

3 20.05

44.70

6000

15.30

15.50

- .20

.00

- .10

+2902h =  $\frac{+12}{+02}$

Sept. 27

1327

1327

9 2 7

17.74

9 2 28.94

12 27 23.20

20 35 05.74

3 22.25

43.49

6000

16.51

15.50

+ 1.01

80

+ .50

.46

-8gr2h =  $\frac{+04}{+02}$



1327

8 14 53

- 25.80

8 15 18.80

12 31 19.76

19 43 59.04

3 14.02

45.02

6500

14.98

15.50

- .52

- .00

- .26

+10gr 1/4 - 1.27

m = 79r. +.01

28.6

31.0

33.5

35.9

38.2

17.2

33.44 29gr.

7 26

+32.09

sept. 29

9

9

12

20

8 14 53

m = -1.41

+10gr 3/4

1327

8 14 53

- 25.80

8 15 18.80

12 31 19.76

19 43 59.04

3 14.02

45.02

6000

14.98

15.50

- .52

.00

- 26

+10gr  $\frac{1}{h}$  +27

m = 79r. +.01

sept. 29

1327

9 7 55

- 28.80

9 8 23.80

12 35 16.30

20 33 07.50

3 22.06

45.44

6000

14.56

15150

- .94

.00

.47

m = 89r.

+10gr  $\frac{1}{3} \frac{h}{a}$ +1gr. at 1 Pm.  
m = 89r.

58.0	63.0
61.3	60.9



398

sept. 30

1327<sup>c</sup>

8	22	41
		29.92
8	23	10.92
12	39	12.86
19	43	58.06
	3	13.92
		44.14
		6000
		15.86
		<u>15.50</u>
$n = 99r$		+1.36
$-1gr. n = 89r$		- .27
$-10gr 1h$		+0.9

at  $9\frac{1}{2}h + 1gr.$   
 $n = 99r.$

oct. 1.

1327

9	22	46
		30.70
9	23	16.70
12	43	09.41
20	40	07.29
	3	23.10
		44.19
		6000
		15.81
		<u>15.50</u>
		+1.31
		<u>1.00</u>
		+1.15
$-5gr \frac{1}{2}h$		- .13
		+ .02

Oct. 2.

$\overline{1327.}$   
 20 57 40  
     30.90  
 20 58 10.90  
 12 47 05.97  
 8 11 04.93  
     1 20.40  
     44.53  
     6000  
     15.47  
     15.50  
 W = 8 gr. - .03

Oct. 3.

$\overline{1327}$   
 17 47 4  
     31.85  
 17 47 35.85  
 12 51 2.51  
 4 56 33.34  
     0 48.60  
     44.74  
     6000  
     15.26  
     15.50  
     - .24  
 W = 8 gr.

$\overline{1327}$   
 13 31 18.8  
     31.7  
 13 31 50.5  
 12 51 2.51  
 40 47.99  
     0 6.68  
     41.31  
     6000  
     18.69  
     15.50  
     + 3.19

1327 = Maetham.

13 31 18.8  
     31.7

13 31 50.5  
 12 51 2.51

40 47.99  
     0 6.68

13 31 50.5  
     6000

13 31 18.8  
     18.69

13 31 50.5  
     15.50

13 31 50.5  
     + 3.19

1327 -

8 15 25  
     32.40

8 15 57.40

12 51 2.51

19 24 54.89

3 10.74

44.15

6000

15.85

15.50

15.50  
 + .35

15.85

W = 8 gr.

15.85



400

Oct. 4.

1327  
 19 7 11  
 33.20  
 19 7 44.20  
 12 54 59.07  
 6 12.45.13  
 1.1 1.00  
 44.13  
 6000  
 15.87  
15.50  
 $m=8\text{ gr}$  +.37  
 $=1\text{ gr}$   
 $m=7\text{ gr}$

1327  
 9 45 33  
 33.76  
 9 46 06.76  
 12 54 59.07  
 20 51 07.69  
 3 24.83  
 42.86

1327 = waltham  
 19 12 9.60  
 33.20  
 19 12 42.80  
 12 54 59.07  
 6 17 43.78  
 1 01.88  
 41.85  
 6000  
 18.15  
15.50

$\frac{18}{180}$   
 $\frac{18}{180}$   
 $\frac{27}{270}$   
 $\frac{64}{640}$   
 $\frac{2.38}{2.38}$   
 $\text{at } 2\text{ph } B+m=1.7$   
 $\text{sh's } 2.4$   
 $\therefore B \text{ is } +.7 \text{ by } m.$

$m=$  + 2.65  
3.19  
 $30 \sqrt{.541018}$   
 $30$   
 $240$   
 $240$

Oct. 5

1327  
 21 33 28  
 36.30  
 21 34 04.30  
 12 58 55.62  
 8 35 08.68  
 1 24.37  
 44.31  
 6000  
 15.69  
15.50  
 $m=7\text{ gr}$  +19

1327  
 9 23 23  
 37.71  
 9 24 00.71  
 12 58 55.62  
 20 25 05.09  
 3 20.68  
 44.41  
 6000  
 15.59  
15.50  
 $+ .09$   
 $\frac{104}{104}$   
 $m=7\text{ gr}$

oct. 6

1327 +  
 8 36 10  
 - 39.80  
 8 36 49.80  
 13 2 52.18  
 19 33 59.62  
 3 12.43  
 45.19  
 6000  
 14.81  
 15.50  
 - .69

62.4 62.2  
 58.6 65.9

+ 109r,

oct. 7

9 8 8  
 42.35  
 9 8 50.35  
 13 6 48.73  
 20 2 01.62  
 3 16.85  
 44.77  
 6000  
 15.23  
 15.50  
 - .27  
 + 109r,<sup>h</sup>  
 + .03

1327 - waltham.

7 57 55.7  
 42.2  
 7 58 37.9  
 13 6 48.73  
 18 51 49.17  
 3 5.42  
 43.75  
 6000  
 16.25  
 15.50  
 + .75 sum f.m.  
 2.65  
 3.51 9.01 .54  
 17.5 .75  
 1.50 .21  
 1.40



402

oct. 8

1327

9 37 2

44.7

9 37 46.7

13 10 45.29

20 27 01.41

Evidently ratio of 1327 changed.

B is +0.4 by Malham

$$\begin{array}{r}
 0 \\
 +0.2 \\
 -57^{th} \quad -0.14 \\
 \hline
 +0.6
 \end{array}$$

n=792

oct. 9

1327-

10 9 56

55.70

10 10 51.70

13 14 41.83

20 56 09.87

3 25.67

44.20

6000

15.80

$$\begin{array}{r}
 15.00 \\
 \hline
 +.30
 \end{array}$$

Oct. 10

1327 = Maltham

18 51 20.70

57.75

18 52 18.45

13 18 38.39

5 33 40.06

0 54.65

45.41

6000

14.59

15.50

Maltham. - .91

+ .75

2.5 | 1.66 | .56

150  
160
$$\begin{array}{r}
 24 | 66 | .028 \text{ rate. knuz} \\
 48 \quad 17 \\
 180 \quad 186 \\
 \quad 28 \\
 \quad 476 \\
 \quad 91 \\
 \quad 1.38
 \end{array}$$

- 1.38 = Surf Maltham at 20 1/2 M.T.

- 1.60

+ .22 = " of Bond 394 at 20 1/2.

$$\begin{array}{r}
 .00 \\
 + .11 \\
 - .14 \\
 \hline
 -.03 \text{ at } 21 \frac{1}{2}
 \end{array}$$

Oct. 11

 at 5<sup>h</sup> M.T. + 1 gr.  
 M = 7 gr.

1327 = Wad.

11 25 46

- 11.35

11 26 57.35

13 22 34.94

22 04 22.41

3 36.96

45.45

6000

14.55

15.50

- .95

40

- 1.35

30

= 1.65

$$\begin{array}{r}
 1.35 \\
 91 \\
 \hline
 44
 \end{array}$$



404

oct. 12.

1327 = waltman

8 54 6.4

1 22.

8 55 28.4

13 26 31.50

19 28 56.90

3 11.51

45.40

6000

14.60

15.50

den. 1 gramme.

394 by  $\pi$  is +1.2

-1.

The man at the factory changed the weight with out notifying me, and consequently I used the old rate and was led to change the weight of Bond 394.

oct. 13.

1327 = 394.

<sup>21</sup>  
9

1 06

1 20.0

<sup>21</sup>  
~~9~~

2 26.0

13

30 28.05

7

31 57.95

1

13.96

43.99

6000

16.01

15.50

+ .51

 $\pi = 6 \text{ gr.}$ 

1327

8 58 6

1 18.10

8 59 24.10

13 30 28.05

19 28 56.05

3 11.51

44.54

6000

15.46

15.50

- .04

Oct. 14.

1327 at 3<sup>h</sup> 40<sup>m</sup> 4.  
 - 7 gr. from 1327.  
 9 10 18  
 1 33.65  
 9 11 31.65  
 13 34 24.61  
 20 37 07.04  
~~3 22 22.65~~  
 44.39  
 6000  
 15.61  
 $\frac{15.50}{+11}$   
 $\frac{-08}{-08}$   
 w = 7 gr.  $\rightarrow 6$

1327 = W.

7 24 17.4  
 1 13.9

+ 1 gr. at 3<sup>h</sup> 40<sup>m</sup> 4.  
 w = 7 gr.

7 56 11.3  
 13 34 24.61  
 18 21 46.69  
 3 0 24  
 46.19  
 6000  
 13.81  
 $\frac{15.50}{-1.69}$

Oct. 15

at 2<sup>h</sup> 00<sup>m</sup> 40<sup>s</sup> N.Y.

Could not get measurements.  
 and could not rely on value  
 of 1327.

$\therefore$  new! gr. w = 6 gr.

3<sup>h</sup> 10<sup>m</sup> N.Y. removed 7  
 grammes from 1327.



406

Oct. 16.

1327 -

10 22 14

1 11.13

10 23 25.13

13 42 17.71

20 41 07.42

3 23.24

44.18

6000

15.82

15.50 $n = 6 \text{ gr}$ 

+ 32

Oct. 17

1327

10 12 9

1 11.46

10 13 20.46

13 46 14.26

20 27 06.20

3 21.13

45.07

6000

14.93

15.50

$$\begin{array}{r}
 + 20 \text{ gr. l.} \\
 + 1 \text{ gr. m. } 7 \text{ gr} \\
 \hline
 - 57 \\
 + 14 \\
 \hline
 - 63
 \end{array}$$

Oct. 18.

1327 + 1  
 10 14 6  
 1 11.79  
 10 15 17.79  
 13 50 10.82  
 20 25 06.97  
 3 20.85  
 46.12  
 65

13.88

15.50

- 1.62

+ 1.29

- .33.00- .17+ .14- .03 $\Sigma \text{ref } 1327$ 

+ 5 gr. 1 h =

could not get Waltham.

3.89  
 7 15 24 48.13  
 3 7  
 53.13  
 23 38  
 23 36 30.0 - Waltham  
 23 36 51.30 - 3413

Oct. 19.

1327  
 10 24 4  
 9.75  
 10 24 13.75  
 13 54 07.37  
 20 30 06.38  
 3 21.55  
 44.83  
 65

15.17

15.50

W. 7 gr.

+ 10 gr. 1 h =

- .33.00- .17+ .14

+ 10 gr. 1 h = 8 gr. 1 h =



Oct. 20.

P. W. Lee.

$\begin{array}{r} 1307 \\ \underline{\phantom{00}} \end{array}$

9      27      51

$* - 9.25$

9    28    00.25

13   58    3.93

20   29   56.32

$\begin{array}{r} 3 \\ \times \\ \hline 3 \end{array}$

$\begin{array}{r} 11.67 \\ \hline 21.50 \end{array}$

~~4.82~~

44.65

6000

15.35

15.15

$n = 89.$

$\begin{array}{r} n \\ 15.15 \\ \hline 03 \\ \hline 708 \end{array}$

65.8      65.5  
60.6      70.8

oct 21.

	13	27	+
	10	46	00
			8.82
	10	46	8.82
new 1 gr.	14	2	0.47
at 7 <sup>th</sup> m of	20	44	8.35
w = 7 gr		3	23.84
			44.51
			Gross
			15.49
			15.50
			<hr/>
			+0.1
w = 7 gr.			

oct. 22

1327 +

10 23  $\sqrt{3}$ 

8.34

10 24 01.34

14 5  $\sqrt{7.03}$ 

20 18 04.31

3 19.61

44.70

6000

15.30

15.50

- .20

$$\begin{array}{r} n=78r. \\ + 1gr. \\ n=89r. \end{array} \quad \begin{array}{r} .00 \\ - .10 \\ \hline \end{array}$$

$$\begin{array}{r} n=78r. \\ + 1gr. \\ n=89r. \end{array}$$

oct. 23

1327

11 05  $\sqrt{6}$ 

7.95

11 06 03.95

14 9  $\sqrt{3.58}$ 

20 56 10.37

3 25.76

44.61

6000

15.39

15.50

$$\begin{array}{r} n=89r. \\ - .11 \end{array}$$

- .11



410

Oct. 24

~~78~~ 27  
 10 37 48  
~~7.70~~<sup>50</sup>  
 10 37 50.70  
 14 13 50.14  
 20 24 05.56  
 21 24 05.36  
 3 20.55  
 44.81  
 6000  
 15.19  
15.10  
 - .31  
 m = 8 gr.  
 + 10 gr. 1<sup>h</sup> + .27  
 - .04

Oct. 25

1327  
 10 45 45  
 7.60  
 10 45 52.60  
 14 17 46.69  
 20 28 05.91  
 3 21.17  
 44.74  
 6000  
 15.26  
15.10  
 - .24  
 + 10 gr. 1<sup>h</sup> = + .27  
 m = 8 gr. + .03

Oct. 26

~~Oct~~ 1327.

11 10 44

7.95

11 10 51.95

14 21 43.25

20 49 08.70

3 24.55

44.15

6000

15.85

15.50

+ .35

$$-8 \text{ gr. } 1\frac{1}{4} = \frac{-29}{+0.6}$$

1327 - Waltham.

9 22 32.6

- 7.98

9 22 40.58

14 21 43.25

19 00 57.33

3 6.92

50.41

6000

9 59

15.50

5.91

Oct. 27.

1327

10 57 37

8.20

10 47 45.20

14 25 39.80

20 32 05.40

3 21.70

43.70

6000

16.30

15.50

+ .80

+ .50 by Waltham.

+ 2 gr.

- 8 gr. 1/4 lb.

- 2 gr. till 9 P.m. of Oct. 28. Then + 1 gr.

69.4	68.9
64.8	69.2



412

oct. 28

$$\begin{array}{r}
 1327 - \\
 11 \quad 20 \quad 37 \\
 \quad \quad \sqrt{2.0} \\
 11 \quad 19 \quad 45.0 \\
 14 \quad 29 \quad 36.86 \\
 20 \quad 50 \quad 08.64 \\
 \quad \quad 3 \quad 24.64 \\
 \quad \quad 47 \quad 44.00 \\
 \quad \quad \text{brrrr} \\
 \quad \quad 16.00 \\
 \quad \quad \underline{15.50} \\
 \quad \quad +.50 \\
 \quad \quad \quad .00 \\
 n = 79r. \quad \quad \quad .00 \\
 \quad \quad \quad +.25 \\
 - 109 \text{ for } 1^{\text{st}} - 27 \\
 \quad \quad \quad \underline{-12}
 \end{array}$$

oct. 30

$$\begin{array}{l}
 1327. \\
 1 \text{ P.m. } n. J. \\
 B-m = 4.4
 \end{array}$$

1327 = walking

$$\begin{array}{r}
 9 \quad 11 \quad 21.3 \\
 \quad \quad \sqrt{1.7} \\
 9 \quad 10 \quad 29.6 \\
 14 \quad 29 \quad 36.36 \\
 18 \quad 40 \quad 53.24 \\
 \quad \quad 3 \quad 3.60 \\
 \quad \quad 49.64 \\
 \quad \quad \text{brrrr} \\
 \quad \quad 10.36 \\
 \quad \quad \underline{15.50} \\
 n = \quad - \sqrt{.14}
 \end{array}$$

$$n = 79r.$$

oct. 31

1327  
 10 59 22  
 51.86  
 11 00 13.86  
 14 41 26.02  
 20 18 47.84  
 3 19.70

11 7 23  
 51.86  
 11 8 14.86  
 14 41 26.02  
 20 26 48.84

1327 - Walther  
 9 38 12.3  
 51.86  
 9 37 20.44  
 14 41 26.02  
 18 55 54.42  
 3 6.10  
 48.32  
 6000  
 11.68  
 15.50  
 Walther - 3.82

$N = 29r.$

1327  
 11 7 23  
 51.86  
 11 6 31.14  
 14 41 26.02  
 20 25 05.12  
 3 20.65  
 44.47  
 6000  
 15.53  
 15.50  
 $N = 29r.$   
 +03



414

Nov. 1

1327

11	52	27	1327 - waltham
		$\sqrt{1.86}$	9 12 3.6
		86	$\sqrt{0.40}$
11	51	35.14	9 17 13.00
14	45	22.58	14 45 22.58
21	06	12.56	18 25 50.62
	3	27.40	3 1.19
		45.16	49.43
		6000	6000
		14.84	10.57
		15.50	15.50
		- .66	- 4.93
		$\frac{1.02}{- .33}$	
		$\frac{+10gr}{+1gr}$	
		$\frac{+ .27}{- .06}$	
		$w = 188$	

Nov. 2

10	01	04	1327 +
		$\sqrt{0.20}$	10 01 04
		20	$\sqrt{0.20}$
10	01	54.20	10 00 13.80
14	49	19.13	14 49 19.07
19	12	35.07	19 10 54.73
	3	8.89	3 8.66
		6.18	46.07
			6000
			13.93
			15.50
			- 1.57

+ 20gr. 2  $\frac{h}{v}$

+ 2 gr.

$w = 10gr$

Nov. 3.

1327  
 10 18 00  
 49.50  
 10 17 10.50  
 14 53 15.69  
 19 23 54.81  
 3 10.69  
 44.12  
 6000  
 15.88  
 15.00  
 +.38

$$-10 \log \frac{1}{2} = \frac{-41}{-0.3}$$

72.3 71.9  
 68.9 72.6

1327 = Wal.

22 29 9.35  
 49.71  
 22 28 19.64  
 14 53 15.69  
 7 35 03.95  
 1 14.54  
 49.41  
 6000  
 10.59  
 15.00  
 -4.91

Nov. 4.

1327.  
 9 51 53  
 49.00  
 9 51 04.00  
 14 57 12.25  
 18 53 51.75  
 3 05.80  
 45.95  
 6000

$$B - M = +4.2^s$$

$$+10 \log \frac{1}{2} = +1.5$$

$$+1 \log +4.7 = B - W.$$

$$M = 9.7.$$



416

Nov. 5

$$B - m = 4.9$$

= 19 yr. 4.9 should be B - m

$$m = 8 \text{ yr. } \overline{1.0}$$

Nov 6.

$$\begin{array}{r}
 1327 \\
 12 \quad 18 \quad 06 \\
 48.00 \\
 12 \quad 17 \quad 18.00 \\
 15 \quad 5 \quad 5.35 \\
 21 \quad 12 \quad 12.65 \\
 3 \quad 28.36 \\
 44.29 \\
 60.00 \\
 15.71 \\
 15.50 \\
 \hline
 + .21
 \end{array}$$

$$m = 8 \text{ yr.}$$

Nov. 7

1327 -

10 7 27  
 34.75  
 10 6 52.25  
 15 9 1.91  
 18 57 50.34  
 3 6.33  
 44.01  
 6000  
 15.99  
 15.50  
 + .49  
 - .06  
 + .43  
 $-89^{\circ} 2' = -.40$   
 +.03

waetham.

10 23 34.75  
 34.75  
 10 23 00.00  
 15 9 1.91  
 19 13 58.09  
 3 9.38  
 49.04  
 12 48.71  
 6000  
 11.29  
 15.50  
 10.96  
 15.50  
 + 4.56  
 Sum waetham.

Nov. 8

1327 = waetham.

23 08 40  
 34.54  
 23 08 05.46  
 15 13 58.46  
 7 54 07.00  
 1 17.66  
 49.34  
 6000  
 10.66  
 15.50  
 4.84  
 B-w- 4.7  
 +.14  
 +.07  
 $7r = 89r$



418

Nov. 9.

1327. - waltham.

10 0 22.1

34.11

9 59 47.89

15 16 55.02

18 42 52.97

3 3.97

49.00

6000

16.00

15.50

B-m = 4.50

1327 -

10 19 20

34.11

10 18 45.89

15 16 55.02

19 01 50.77

3 6.95

43.82

6000

16.18

15.50

$$\frac{2}{3} + .68$$

$$\sum B_{394} + .46$$

$$- 89.2^h - .44$$

$$n = 89. + .02$$

Nov. 10

B-m = 4.6

Should be  $4.6 \pm$  $\therefore 394 \pm .0$ 

n = 89.

70.9 70.3

69.8 73.9

Nov. 11

1327  
10 13 11  
33.50  
10 12 37.50  
15 24 48.53  
18 47 48.97  
3 4.75  
44.22  
6000  
15.78  
15.50  
+.28  
- 8 gr. / ml  $\frac{1}{4}$  - 28  
100

134 = Walther

23	36	33.60
23	35	56.40
15	24	48.53
8	11	07.87
	1	20.45
		47.42
		6000
		12.58
		15.50
		<u>2.92</u>
		<u>1</u>
		- 3.92
23h	36	5000 = 3
		51.30 = 13

Nov. 12.

$$B - m = 3.8$$

$$\text{Should be } \underline{3.65}$$

$$\therefore B \text{ is } +.15$$

$$-5\% \text{ or } 1/2\% = \underline{-14}$$

$$+01$$



420

Nov. 13

3451  
+3 = Waltham.

10 38 22

44.66

10 37 37.34

15 32 41.24

19 04 56.10

3 7.58

48.52

6000

11.48

B-m = 3.3

15.50

 $\therefore m = -7.2$ 

half Waltham + 4.02

m = 8.4 + 59.6 or 4

penn m = 8.4

Nov. 14

1327 = Waltham

0 51 42

45.2

0 50 56.8

15 36 37.79

9 14 49.01

1 30.80

48.21

6000

11.79

15.50

m = -3.71

Nov. 15 1327, - waltham.

9 38 51.85

32.87

9 38 18.98

15 40 34.35

17 57 44.68

2 56.57

48.06

6000

11.94

15.50

 $\pi = -3.56$   $B-\pi = 3.5$  $\pi = 89^\circ$   $B = \pm 0$ 

Nov. 16 1327 - waltham.

23 11 4.75

32.91

23 10 31.84

15 44 30.90

7 26 00.94

1 13.07

47.87

6000

12.13

15.50

 $\pi = -3.37$  $B-\pi = 3.4$  $\therefore B = \pm 0$  $\pi = 89^\circ$



422

Nov. 17.

1327  
 12 39 09  
 32.9  
 12 38 36.1  
 15 48 27.46  
 20 50 08.64  
 3 24.70  
 43.94  
 6000  
 16.06  
 15.50  
 +.56  
 - .16  
 +.46

$$\begin{aligned}
 2/3 W B &= +.30 \\
 - 89 1/4 &= -.30 \\
 B &= +.00
 \end{aligned}$$

Nov. 18 ~~18~~perm.  $\pi = 89^\circ$ 

1327-  
 11 2 49  
 32.8  
 11 2 16.2  
 15 52 23.02  
 19 09 52.18  
 3 08.28  
 43.90  
 6000  
 16.10  
 15.50  
 +.60  
 $- 89 1/2 = -.60$   
 +.00

Nov. 19

1327

11 14 47

$$\begin{array}{r} 32.9 \\ 3.89 \\ \hline 1544 \quad 30.9^{\circ} \end{array}$$

11

15

19

39

14

5

7

23

11

4.75

6 0 3 5

Nov. 21

31

3.89

15 48 29.46

30.9

187

Cambridge

HARVARD COLLEGE OBSERVATORY  
TIME SERVICE.for 3<sup>rd</sup>  
m. 18 gr.  
m. 10 gr.  
m. 8 gr.





Nov. 19

1327

11 14 47  
     32.9  
 11 14 14.20  
 15 56 19.58  
 19 17 54.62  
     3 9.75  
     44.85  
     6000  
     15.15  
     15.55  
 m=7gr. - .35  
 + 5gr. + 27  
     - .08

+ 1gr.  
 m=8gr.

m=8gr.

- 1gr at 9th m. J.

m=7gr.

Nov. 21

1327

16 24 33  
     31.8  
 16 24 01.2  
 16 04 12.70  
 0 19 48.50  
     0 3.30  
     45.20  
     6000  
     14.80  
     15.55  
     - .70

+ 10 gr. + .81  
 at 2 1/2 sec. + .11  
 for 3 m=18gr.  
 m=10gr.  
 m=8gr.

1327

11 01 35  
     31.55  
 11 01 03.45  
 16 04 12.70  
 18 56 50.75  
     3 06.23  
     44.52  
     6000  
     15.168  
     15.50  
     - .02

perm. m=8gr.



424

Nov. 22<sup>nd</sup>

1327

12	42	47
		31.00

12	42	18.00
----	----	-------

16	08	09.26
----	----	-------

20	133	06.74
----	-----	-------

3		22.04
---	--	-------

		44.70
--	--	-------

		6000
--	--	------

		15.30
--	--	-------

		15.50
--	--	-------

		<u>- .20</u>
--	--	--------------

+ log <sub>r</sub> $\frac{2}{3}$		+ .18
		<u>- .02</u>

Nov. 23.

1327

12	54	44
----	----	----

		30.40
--	--	-------

12	54	13.60
----	----	-------

16	12	05.82
----	----	-------

20	42	07.78
----	----	-------

3		23.53
---	--	-------

		44.25
--	--	-------

		6000
--	--	------

		15.75
--	--	-------

		15.50
--	--	-------

		+ .25
--	--	-------

		<u>- .00</u>
--	--	--------------

		+ .12
--	--	-------

-2 log <sub>r</sub> $\frac{2}{3}$		- .12
-----------------------------------	--	-------

		+ .00
--	--	-------

F. W.

Nov. 24.

1327  
 13 42 47  
 30.00  
 13 42 17.00  
 16 16 03.36  
 21 26 13.64  
 3 30.55  
 43.09  
 60.00  
 16.91  
 15.50  
 + 1.41

- 5 gr. at  
 $\frac{1}{7}$  21.50 m. 1/2.

at 9h<sup>m.i.</sup> + 5 gr.  
 7r = 8 gr.

Nov. 25

1327 -  
 13 05 38  
 29.75  
 13 05 08.25  
 16 19 59.92  
 20 45 08.33  
 3 23.90  
 44.43  
 60.00  
 15.57  
 15.50  
 + .07

7r = 8 gr.



426

Nov. 26.

1327  
 13 9 34  
 29.80  
 13 9 04.20  
 16 23 26.47  
 20 45 07.73  
 3 23.90  
 43.83  
 60.00  
 16.17  
 15.50  
 +.67  
 .00  
 +.34  
 -.36  
 -.02

$w = 8 \text{ gr.}$   
 $\frac{3}{2} \text{ lb.}$   
 $- 8 \text{ gr.} + \frac{3}{2}$

Nov. 27.

1327  
 13 35 34  
 29.40  
 13 35 04.60  
 16 27 23.03  
 21 07 11.57  
 3 27.50  
 44.07  
 60.00  
 15.93  
 15.50  
 +.43

$w = 8 \text{ gr.}$   
 $- 2 \text{ gr.}$

137 = Waltham,

23 28 19.80  
 29.55  
 23 27 50.25  
 16 27 23.03  
 7 29 57.22  
 1 13.72  
 43.50  
 60.00  
 16.50  
 15.50  
 +1.00

 $w =$

Nov. 28 <sup>7</sup>/<sub>11</sub>

1327  
 13 06 26  
 29.00  
 13 ~~06~~  $\sqrt{700}$   
 16 31 49.58  
 20 04 07.42  
 3 22.25

45.17  
 6000

14.83

1/2 m = 6 gr.

15.50

+ 2 gr.

- .67

m = 8 gr.

2/3 of -.67 = -.42

+ 20 gr. h

+ .54  
 + .12

Nov. 29 <sup>12</sup>/<sub>11</sub>

1327  
 13 26 24  
 28.85  
 13 25 25.12  
 16 35 46.14  
 20 50 09.01  
 3 24.78  
 44.23  
 6000

15.77

15.50

+ .27

- 8 gr. h

- .24

+ .03



428

Nov. 30 <sup>1880</sup>

1327 = Maltham

23 59 06.4

28.30

23 58 38.10

16 39 42.70

7 18 55.40

1 11.92

43.48

~~60.00~~

16.52

15.50

+1.02

 $n = 89r.$  $B - n = -1.$  $\therefore B \pm .0$ 

Dec. 1

1327

13 37 17

27.70

13 36 49.30

16 43 39.26

20 53 10.04

3 25.27

44.77

~~60.00~~

15.23

15.50

- .27

- .02

- .14

+ .14

.00

 $n = 89r.$ 

+ 59r.

 $n = 89r.$ 

64.0	63.6
62.0	69.2

Dec. 2

1327

13 48 14

27.30

13 47 46.70

16 47 35.81

21 00 10.89

3 26.50

44.39

6000

15.61

15.50

 $B-M = -.5$ 

+ .11

shift - 1.

+ .50

 $\therefore B + .5$ 

2/ + 60

W = 8 gr

+ .30

- 8 gr  $1\frac{1}{2}$  h

- .34

- .04

Dec. 3

1327

13 32 07

26.90

13 31 40.10

16 51 32.37

20 40 07.73

3 23.14

44.59

6000

15.41

15.50

W = 10 gr.

- .09

 $B-M = .5$ 

1327 = Waltham

16 50 39.25

28.00  
28.00

16 50 11.25

16 51 32.37

23 58 38.88

3 55.60

48.23

6000

16.77

15.50

+ 1.27

Dec. 4.

20 h. W. J. S

B is + 1.

rem vgr for 3<sup>h</sup>. and 2 gr. permanently



430

Dec. 5.

1327

13  $\sqrt{6}$  04

27.70

13  $\sqrt{5}$  36.3016  $\sqrt{9}$  25.4920  $\sqrt{6}$  10.41

3 25.80

44.61

6220

15.39

15.00

+29' - .11

 $n=89^\circ$   $B-n=-1.5$   $ch\delta h=1.2$  $\therefore B = -1.20$ 

$$+109m \frac{2h}{5} = \frac{+18}{-5.02}$$

Nov. 6.

 $B-n = -1.4$  at  $4\frac{1}{2}$  PM. $\therefore B = \pm .0$

Nov. 7.

1880  
1327 = waltham.  
17 10 30.05

27.20

17 10 02.35

17 07 18.60

2 43.75

00.49

43.26

6000

16.74

15.40

waltham. +1.24

 $B-m = -1.4$ at 21<sup>h</sup>  $B-m = -1.4$   $\therefore B = \pm .1$ 

Nov. 8.

1327  
13 54 00

27.38

13 54 22.62

17 11 15.16

20 43 07.46

3 23.58

43.88

6000

16.12

15.52

+6.2



432

1880

unc. 9

1327 = Waltham

2 21  $\sqrt{1.9}$   
 26.80  
 2 21  $\sqrt{1.10}$   
 17 15 11.72  
 9 06  $\sqrt{1.38}$   
 1 29.46  
 44.92  
 6000  
~~15.72~~  
 16.08  
 15.50

 $n = 8g. + .58$ 
 $B.W. = -.8 \quad \therefore B \approx +.2$ 
 $-8g, h = -.3$ 
 $\therefore B = \pm .0$ 
 $\text{perm. } n = 8gr$ 
Dec. 10<sup>th</sup>

1327

14 03 43  
 26.40  
 14 03 16.60  
 17 19 08.27  
 20 44 08.33  
 3 23.80  
 44.53  
 6000  
 15.47  
15.50  
 - .03

1327

14 20 20  
 26.80  
 14 20 23.20  
 17 15 11.72  
 21 05 11.48  
 3 27.20  
 44.28  
 6000  
 15.72  
15.50  
 + .22

PW

Dec. 11.

1327  
 14 31 43  
 26.10  
 14 31 16.90  
 17 23 04.83  
 21 08 12.07  
 3 27.70  
 44.37  
 6000  
 15.63  
15.50  
 +.13

w=8 gr.

1327  
 14 13 35  
 25.60  
 14 13 09.40  
 17 27 01.39  
 20 46 08.01  
 3 24.05  
 43.96  
 6000  
 16.04  
15.50  
 +.54

w=8 gr.  
 -8 gr 1 h  
 and 2 gr. 2 h .54  
 +.00

w=8 gr.

60.0	59.6
59.6	65.5



434

Nov. 13.

1327  
 14 32 34  
 24.70  
 14 32 09.30  
 17 30 57.95  
 21 01 11.35  
 3 26.60  
 44.75  
 6000  
 15.25  
 15.50  
 $r = 89$   
 $\begin{array}{r} - .25 \\ 1.00 \\ \hline 1.12 \end{array}$

1327 = Waltham.

10 51 58.20  
 24.80  
 10 51 38.10  
 17 30 57.95  
 17 20 35.45  
 2 50.46  
 44.99  
 6000  
 14.01  
 15.50  
 $\begin{array}{r} 71 \pm \\ - 0.49 \\ \hline + 1.00 \end{array}$   
 $r = +.50$

Dec. 14

$B - r = 0$   
 " - " Sh's to - r  
 $- 89.1^h - 49.4^h$   
 $w = 89$

Dec. 14<sup>th</sup>

13 27  
14 18 23  
24.93  
14 17 58.07  
17 38 51.07  
20 39 07.00  
3 22.95.

44.05  
6000

15.95

15.50

+1.45

-1.0

B = +1.35

$$-8 \text{ gr } 1/4^{\text{th}} = \frac{-32}{+0.3}$$

W = 8 gm

13 27  
14 32 21  
24.40  
14 31 56.60  
17 42 47.62  
20 49 08.98  
3 24.68  
44.30  
6000  
15.70

15.50

+1.20

-1.22

-0.02

W = 8 gm

-8 gr 1/4<sup>th</sup>

W = 8 gm

68.5 68.1  
61.8 68.5

13 27 = waetham.

0 14 00  
24.45  
0 13 35.55  
17 42 47.62  
6 30 47.93  
1 03.97  
43.96  
6000  
16.04  
15.50

waetham = +1.54

daily rate = +1

Dec. 16<sup>th</sup>



436

Dec. 17

20 h 30 m. W.D.

$$B - W = -.3$$

$$\Delta S_{Bz} = -.6$$

$$\therefore B_{is} = +.3$$

$$W = 88$$

rem. 2 gr.

$$W = 68 + 1\frac{1}{2} \text{ gr.}$$

$$W = 47\frac{1}{2} \text{ gr.}$$

Dec. 18

1327 = Waltham

$$12 \quad 04 \quad 46.95$$

$$23.11$$

$$12 \quad 04 \quad 23.84$$

$$17 \quad 50 \quad 40.74$$

$$18 \quad 13 \quad 43.10$$

$$3 \quad 59.22$$

$$43.88$$

$$6000$$

$$16.12$$

$$15.50$$

$$+ .62$$

Prof Waltham

Dec. 19

1327

$$19 \quad 55 \quad 04$$

$$23.00$$

$$19 \quad 54 \quad 41.00$$

$$17 \quad 54 \quad 37.30$$

$$2 \quad 00 \quad 03.70$$

$$0 \quad 19.60$$

$$44.10$$

$$6000$$

$$15.90$$

$$15.50$$

$$+ .40$$

$$- 1 \text{ gr.}$$

1327 = Waltham

$$11 \quad 34 \quad 37.40$$

$$22.68$$

$$11 \quad 34 \quad 14.72$$

$$17 \quad 54 \quad 37.30$$

$$17 \quad 39 \quad 37.42$$

$$2 \quad 53.57$$

$$43.85$$

$$6000$$

$$16.15$$

$$15.50$$

$$\left. \begin{array}{l} \text{Waltham} \\ \text{= } +.65 \end{array} \right\}$$

$$W = 7\frac{1}{2} \text{ gr.}$$

$$B - W = -.6$$

$$\therefore B = \pm .0$$

wre. 20.

1327.

14 53 06

22.20

14 52 43.80

17 58 33.86

20 54 09.94

3 25.40

44.54

6000

15.46

15.50 $w = 7\frac{1}{2} \text{ gr.}$ 

- .04

 $\frac{B}{w} = \pm .0$  $\therefore B = - .02$  $B - 20 = - .6$  $\therefore B = \pm .0$ 

wre. 21.

1327

14 48 01

22.50

14 47 38.50

18 02 30.42

20 45 08.08

3 23.95

44.13

6000

15.83

15.50 $w = 7\frac{1}{2}$ 

+ .33

 $\frac{gr}{-7 \text{ for } 1\frac{1}{2} \text{ hr}} =$ 

- .30

+ .03 $w = 7\frac{1}{2} \text{ gr.}$ 

1327 - waltham.

12 46 40.55

22.54

12 46 18.00

18 02 30.42

18 43 47.58

3 04.10

43.48

6000

16.52

15.50 $\frac{waltham}{+1.02}$ 

+ .10

+ 1.00

 $waltham = + .92$



438

Dec. 22.

1327 594  
 15 08 00 = 00  
 22.25

15 07 37.75

18 06 26.97

21 01 10.78

3 26.58

44.20

6000

15.80

15.50

$w = 7\frac{1}{2} + .30$

$20 - 7\frac{1}{2} = - .30$

Bnd. + .0

1327 = Waltham

11 52 27.4

22.30

11 52 05.10

18 06 26.97

17 45 38.13

2 54.55

43.58

6000

16.42

15.50

Waltham +.92

60.2 59.9  
 59.5 69.0

Dec. 23

1327 -  $\frac{1}{2}$

4 58 16

21.70

4 57 54.30

18 10 23.53

10 47 30.77

1 45.99

44.78

6000

15.22

15.50

$\Phi = - .28$

Dec. 23.4 Mr. F. Waldo decided to leave the weights unchanged (computed error of clock<sup>394</sup> =  $-0.28$ ) at 7 gm. + two lead pieces. J.R. Edmunds.

" 23.8 Took charge in Mr. W.'s temporary absence.

Error of <sup>\*</sup>1327 at 2<sup>h</sup> sid. t. =  $+21.75$ . Rate =  $-0.02$  per h. (From F. W.)

14<sup>h</sup> 37<sup>m</sup> 57<sup>s</sup> of <sup>\*</sup>1327 = 20<sup>h</sup> 24<sup>m</sup> 00<sup>s</sup> of <sup>\*</sup>394 }  $\therefore$  <sup>\*</sup>394 = 0.46 slow.  
14 49 59 " = 20 36 06. " } if error of <sup>\*</sup>1327 =  $-21.75 + (\frac{13}{24.5} \times 0.02)$

Added 11 gm. at 8<sup>h</sup> 43<sup>m</sup> m.t.

Wound <sup>\*</sup>3457 and Richard at 9 A.M. Found back cover (inner and metal outer) of case of latter unfastened. Left them so.

Removed 10 gm. at 21<sup>h</sup> 58 Load = 8 gm. + 2 lead pieces.

17<sup>h</sup> 00 34 of <sup>\*</sup>1327 = 22<sup>h</sup> 46 20. of <sup>\*</sup>394  $\therefore$  394 = 0.26 slow. { If error of <sup>\*</sup>1327 }  
=  $-21.75 + (22.5 \times 0.02)$

Dec. 24.4 3<sup>h</sup> 50 15.77 of <sup>\*</sup>1327 = 9<sup>h</sup> 34 34 of <sup>\*</sup>394

If <sup>\*</sup>1327's error =  $-21.75 + (26 \times 0.02)$  then Error <sup>\*</sup>394 =  $+0.16$  (= fast)

Again 3<sup>h</sup> 56 29 = 9<sup>h</sup> 40 28 or Error <sup>\*</sup>394 =  $+0.14$  Mean =  $+0.15$

But rate of 1327 is very uncertain, it having suddenly changed between the last two sets of stars. Waltham line "slow".

Removed 1 gm. at 9<sup>h</sup> 46 Load = 7 gm + 2 lead pieces.

Dec. 24, 25, 26, 27 No stars till Dec. 27.8, except one star marked doubtful and at declination of nearly 60°, taken Dec 27.3

Date.	Coincidence		Relation Error.	Relative error minus	
	<sup>*</sup> 1327	<sup>*</sup> 394		Actual error of <sup>*</sup> 394	Actual error of <sup>*</sup> 1327
December.					<u>minus computed relative error.</u>
24.7	14 <sup>h</sup> 26 <sup>m</sup> 02 <sup>s</sup>	20 <sup>h</sup> 08 <sup>m</sup> 18 <sup>s</sup>	-20.96	Load = 7 gm. + 2 lead pieces.	
25.1	22 00 00. 22 06 13.	3 41 02. 3 47 14.	-20.58 } -20.56 }	Wound <sup>*</sup> 3457 at 25 <sup>h</sup> 3 <sup>m</sup> 40 <sup>s</sup> m.t.	
25.4	4 13 11.	9 53 12.	-20.34	" " " 25 <sup>h</sup> 21 <sup>m</sup>	
26.2	23 15 06.	4 52 00.			
26.0	18 46 22.	0 23 60	-20.38		
26.6	9 18 11.	14 53 26.	-20.57	Wound clocks and <sup>*</sup> 3457 at 26 <sup>h</sup> 21 <sup>m</sup> . (Temp. 62.2 62.0)	
26 <sup>10</sup> / <sub>10</sub>	18 08 26.	23 42 14.	-20.70	Removed 1 gm. Load = 6 gm. + 2 lead pieces. at 22 <sup>h</sup> 38	
27.3	2 01 56. 3 02 30.	7 34 20. 8 34 50.	-21.14 } -21.20 }	Single, doubtful obs., high declination stars give <sup>*</sup> 1327 = -20.3	
27.8	13 43 27. 13 49 36.	19 14 02. 19 20 10.	-21.30 } -21.19 }	Added 2 gm. at 8 <sup>h</sup> 42 Load = 8 gm + 2 leads.	
				Actual error <sup>*</sup> 1327 (by 2 reliable stars) = -20.66	
				" " <sup>*</sup> 394 = -0.53	



<u>Date.</u>	<u>Coincidence</u>	<u>Relative</u>	<u>Estimated</u> <u>Actual</u> <u>Error</u>	<u>Estimated</u> <u>Actual</u> <u>Error</u>	
Dec.	1327	394	<u>Error.</u>	1327	394
27.8	(Sun preceding haze.)	-21.29	20.66	-0.53	Wound 3451 at -21° 18'
28.3	1 <sup>h</sup> 29 42.	6 <sup>h</sup> 58 22.	-20.49		
28.4	4 20 54.	9 49 06.	-20.44	-20.60	+0.16
28.8	15 56 50.	21 20 16.	-12.42		
	16 09 02.	21 35 26.	-12.41		
29.2	6 48 21.	6 10 20.	-12.33		
29.8	15 13 25.	20 36 02.	-12.61	-12.51	-0.10
30.2	22 50 22.	4 11 44.	-12.75		
30.5	5 57 58.	11 18 10.7	-12.69	-12.57	-0.18
	6 04 05.	11 24 16.5			
30.8	13 30 30.	18 49 48.	-12.55	-12.50	-0.05
"	15 08 18.	20 27 00.	-12.54	"	-0.04
"	16 09 18.	21 27 50.	-12.54	"	-0.04
30.9	18 42 05.	24 00 12.	-12.51	"	-0.01

Several days  
of wind.Load = 7 gm. + 2 lead pieces.  
1327 dropped & records.

Wound 3451 at -21° 45'

Wound 3451 at -21° 18'

Added 1 gm at -21° 05'

Removed 1 gm. at 30° 14' 32"

Added 1 gm. at 3° 25'

Load = 8 gm. + 2 lead pieces.

(Solar Eclipse)

Wound 3451 at 21° 19'

Calculated normal load for pendulum of 394 = 7.5 gm. + the two lead pieces.  
Original obs. in Time Service, Pocket Record No. 2.

J. Rayner Edmunds.

Dec. 30<sup>th</sup>

1327 - Walther.

15 44 22.2

12.45

15 44 09.75

18 37 59.44

21 06 10.31

3 27.40

42.91

6000

17.09

15.50

Emf. Walther + 1.59



442

Dec. 31, 1880.

1327 = Waltheim.

0 5 44.2

12.20

0 5 32.00

18 41 56.00

5 23 36.00

0 53.00

43.00

60.00

17.00

15.50

Waltheim. +1.50

~~B-W =~~B-W = <sup>5</sup>-1.50.  $\therefore B = \pm 0$ rem.  $\frac{1}{3}$  gr. w = 8 gr.

1327.

15 44 19

at 20  $\frac{1}{2}$  h. M.T.

B-W = -1.5.

 $\therefore B = \pm 0$











1879.  
446

d May

1.33	- .32	+ 1 gr.
1.85	+ .10	- 1 gr. - 5 g. $\frac{1}{2}$ h.
2.49	- .48	+ 2 gr.
2.82	- .08	- 1 gr.
3.38	- .22	
4.28	- .47	- 1 gr. at 0 <sup>h</sup> + 1 gr.
4.80	- .35	+ 10 gr. for $1\frac{1}{3}$ hours.
5.34	+ .07	
5.82	- .02	
6.40	- .26	+ 1 gr.
6.83	+ .14	
7.43	+ .30	
7.83	+ .20	- 9 gr. $\frac{1}{2}$ h. - 1 gr.
8.39	- .05	
8.84	- .18	
9.41	- .09	
9.82	+ .30	
10.89	- .14	
11.35	- .08	
11.77	+ .04	
12.40	- .26	
12.80	- .09	
13.39	- .26	+ 1 gr.
13.80	+ .09	- 1 gr.
<del>14.43</del>		
14.80	- .32	
15.40	+ .06	
15.83	- .05	
16.44	- .73	
16.83	- .30	
18.41	- .01	
18.83	- .08	
19.35	- .45	+ 1 gr.
19.82	- .20	- 1 gr. + 10 gr. for $\frac{1}{2}$ h.
20.46	- .27	
2		
21.35	- .03	
22.34	- .14	
22.82	- .14	
23.32	- .02	
23.83	+ .15	
24.40	+ .34	

*Signal No Error.*



8  $\phi 75$  moment  
 Dec. 18.8 + 44.2

19.8 + 45.0

22.8 + 43.8 -17 Comp.

22.8 + 42.5 -16 Comp.

23.8 + 42.8 -14 Comp.

24.8 + 42.2 -12.5

26.8 + 41.5 -9.5

27.8 41.4 -8.2

28.8 39.5  $\frac{1.9}{2.1}$  -5.

29.8 40.2  $\frac{1.5}{1.1}$  -5.9.

30.8 39.7 +3

31.8 38.40 +5  $\frac{1}{2}$

Jan. 1.8 38.3 +9  $\frac{6}{4}$

2.8 38.1 +13  $\frac{1}{2}$

3.8 +37.3 +17

4.8 +36.7 20.5

5.8 +37.3 25.2

6.8 +30.5

16.8 +39.0 +64.0  
 $\frac{2.1}{5.9}$

1679  $\phi 12$  moment.  
 Dec. 25.8 -17  $\frac{1}{2}$  Fr. +36.0

26.8 -15 +36.0

27.8 -13 +36.6

28.8 -8  $\frac{3}{4}$  +36.8

29.8 -4 +36.2

30.8 0 +36.7

31.8 +3  $\frac{1}{2}$  +36.4

Jan. 1.8 +7  $\frac{1}{4}$  +36.3

2.8 +12  $\frac{1}{3}$  +36.9

3.8 +15 +35.3

4.8 +20.5 +36.7

5.8 +24.0 +36.1

6.8 27.8

8.8 +37

13.0 +49.5 +34.0

16.0 +53 +27.9  
 $\frac{2.1}{2.9}$

Jan.

HARVARD COLLEGE OBSERVATORY

87

11 34 37.40  
Nathan

9 0 31.22



8  $\phi 75$  moment  
 Dec. 18.8 + 44.2

19.8 + 45.0

22.8 + 43.8

22.8 + 42.5

23.8 + 42.8

24.8 + 42.2

26.8 + 41.5

27.8 41.4

28.8 39.5

29.8 40.2

30.8 39.7

31.8 38.40

Jan. 1.8 38.3

2.8 38.1

3.8 + 37.3

4.8 + 36.7

5.8 + 37.3

6.8 + 30.5

16.8 + 39.0

-17 Comp.

-16 Comp.

-14 comp

-12.5

-9.5

-8.2

-5.

~~1.1~~

+3

+5  $\frac{1}{2}$

+9  $\frac{6}{7}$

+13  $\frac{1}{2}$

+17

20.5

25.2

+64.0

2.5  
5.9

1679  
 Dec. 25.8

26.8

27.8

28.8

29.8

30.8

31.8

Jan 1.8

2.8

3.8

4.8

5.8

6.8

8.8

13.0

16.0

Jan 1.

Comp.

-17

-15

-13

-8  $\frac{3}{4}$

-4

0

+3  $\frac{1}{2}$

+7  $\frac{1}{4}$

+12  $\frac{1}{3}$

+15

+20.5

+24.0

27.8

+37

+49.5

+53

2.5  
5.9

$\phi 12$  moment.

Er.

+36.0

+36.0

+36.6

+36.8

+36.2

+36.4

+36.3

+36.9

+35.3

+36.7

+36.1

+34.0

+27.9

45.5

5

40.0

HARVARD COLLEGE OBSERVATORY

TIME SERVICE.

*Cambridge,*

*187*







