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2

Pickering ?

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Index

Index

Quartering of Fifth preliminary plate. } Add 10 to number of page.
Regular spaces of fifth plate. }
Subdivisions in the bands of fifth plate. }

Corrections to bands of subdivisions on fifth plate.

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Concerning the fifth preliminary plate.

Description of Standard Plate ruled by Prof. Rogers.

Distortion of Scale of Photograph. Preliminary

Distortion of Scale - Measurements & results.

Condition of Screw - Measurements preliminary to those on Photographs.

Plate 39 Preliminary Measures.

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3 Detail Measures upon Photographs (Ranges on Screw
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See re-measurements pages 158 et seq.

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2	"			76-33
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4	"			76-75
5		"		77-32
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5					
6		" " from p 83 and on p 85			62-00 (35)
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8		" } Examination and adjustment for			
9		" } permanence of position of plate on screen.			
180					

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Quartering Plate ruled today (the first one with
coarse-glass and bronzing and with triplet lines at intervals)

Apr 23/79 8 P.M. 1st Quartr.

1999.9
.9

6327.95
.95

.9
.9

Reference + mount base-screw

28.0
.05
.0

99.75
.8
.75

7.95
8.00
7.95

Reference + mount base-screw

.00
.05

8.15
.15

.00

8½ P.M.

Observer suspects that the fine line chosen to set upon is not reliable. The edge of a broader line will be used next time.

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Detail Measures. Setting by Prof. Rogers. J.R.E. record.

0.10	333.10	Bands-triplet	-.016	-.016
	3.20	poor line near	-.116	-.133
	3.10	thin end of plate	-.016	-.149
	2.97		+.114	-.035
	3.12		-.036	-.071
0.49	3,10	triplet	-.016	-.087
	3.03		+.054	-.033
	2.95		+.134	+.101
	3.02		+.064	+.165
	3.15		-.066	+.099
0.25	3.10	triplet	-.016	+.083
	~~3.03~~			
	3.12		-.036	+.047
	3.02 3,03		+.064	+.151
	3.08 3,05		+.014	+.125
	3,10		-.016	+.109
	3,12		-.036	+.073
0.43	3.10	triplet	-.016	+.057
	3.14		-.056	+.001
	3.12		-.036	-.035
	~~3.11~~	3,03	+.054	+.019
	~~3.03~~	3,12		
0.51	~~3.12~~	triplet ~~3.01~~	3,05	
	3.03	~~3.05~~	3,12	
	3.12	~~3,10~~	3,08	
	~~3.04~~		3,08	
			3,04	
0.37		bands triplet in middle of plate		
2.15				

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3.15 brought forward — band triplet, middle of flute.

333.14
2.93°
~~3.03~~
3.15
3.12
0.34 3.03 — triplet
3.12
3.12
3.08
3.10
0.57 3.15 — triplet
3.02
3.10
3.16
3.02
0.44 3.14 — triplet
3.12 3.12
3.10 3.12
3.05 3.02
3.03
0.36 3.06 — triplet
3.12
3.10
3.07
3.12
0.41 3.00 — band-triplet
~~2.80~~ +.28
~~4.31~~ omit
4.27
51) 4.27
0.084

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Least band of subdivision – eye-piece scale. Prof. R. obs.

	Middle Band	1st Violet Band
~~136.0~~	137.2	137.5	7.7
~~6.4~~	7.2	7.3	7.7
~~6.4~~	7.1	7.7	7.8
~~6.4~~	7.8	7.9	7.9
~~6.4~~	7.4	7.0	8.2
	7.9	7.7	8.8
	7.7	7.7	7.9
	8.0	7.9	7.8
	7.1	7.9	7.2
	5.[illegible]2 9)74.4 7.49	7.7	6.8 [illegible]
		10)76.3	10)77.8
		7.63	7.78

Summation of differences

.49	.098
.74	.074
1.17	.078
1.68	.084
2.05	.082
2.39	.080
2.96	.083
3.30	.085
3.76	.084
4.17	.083

Prof. R. has taken other settings, the mean of which will be used for the bands.

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Apr 24 1st Beam

Mean eyepiece readings of Prof. R. copied

137.67	-.04	-.04	0	Least column in terms of scale of
7.27	+.36	+.32	+2.3	ruling engine. Transferred as
7.10	+.53	+.85	+6.2	corrections to table of corrections
7.80	-.17	+.68	+4.9	previously used. (not in the
8.30	-.67	+.01	0	book, but on slip of Prof. R.)
8.53	-.90	-.90	-6.5	
7.77	-.14	-1.04	-7.3	
7.80	-.17	-1.21	-8.7	
7.20	+.43	-.78	-5.7	
6.87	+.76	-.02	0	
137.631				

From 1st " beam 137.63 eyepiece = 333.11 stage

log 333.11 = 2.52259 From middle beam makes log 333.10 = 2.52257

" 137.63 = 2.13871 " 137.65 = 2.13878

= log. 2.4420 9.38388 = log. 2.4420 9.38379

To the correct eyepiece into stage multiply by 2.42

" " " " " ruling scale " " .3 × 2.42 = .726

Prof. R. gets 1 div. eyepiece = .0000303 inch

But 1 div of stage scale = .001/8 Result .2424 subtract double

To the correct eyepiece into hundredths of ruling stage multiply by 7.26

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4.16
2.32
2) 1.83
.92

2nd Band (middle)

			0	-7
137.77	-12	-12	-0.9	-8
7.10	+55	+43	+3.1	-4
7.30	+35	+78	+5.7	-1
6.13	+48	+30	+2.2	-4
7.03	+62	+92	+6.7	0
2.33 7.63	+02	+90	+6.5	0
7.77	-12	+78	+5.7	∓1
8.30	-65	+13	+0.9	∓6
7.53	+12	+25	+1.8	∓5
7.93	-28	-03	0	-7
4.16 137.649	Last column transferred as correction to short-read in ruling (not in book)			

Last band.

Whole width of band = 332.54

Mean width of space plate = 333.08

Correction = +0.54

This corrected into spectra units is $\frac{0.54}{0.242} = 2.23$

But inspection shows that the error was made all on the last space. We therefore bring out the band by adding 2.23 to the last space, leaving the rest unchanged.

			0	0	-3
	137.30	+.238	+.24	+2	-1
	7.27	+.268	+.51	+4	+1
	7.77	-.232	+.27	+2	-1
	7.73	-.192	+.08	+1	-2
	7.27	+.268	+.35	+3	0
	7.07	+.468	+.82	+6	+3
	7.87	-.332	+.49	+4	+1
	8.10	-.562	-.08	-1	-4
	7.00	+.538	+.46	+3	0
5.77+(2.23 as above)	8.00	-.462	0 +2.23	0 +2 +16	+13
	137.538				

Last line of plate. The last space being short it will be corrected +.28 = +$\frac{8}{29}$ in hundredths of ruling again, leaving the other whole division width same correction as before.

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On the middle and 2nd end we do not like to make the connection to the end of band.

Making of bands.

2nd End

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Fifth Preliminary Plate.

The measurements made upon it and recorded on pages 24 et seq. run so evenly as regards the regular $\frac{1}{24}$ spaces that Prof. Rogers decided not to attempt further corrections before using the final plate. These lines upon the fifth plate may therefore be relied upon except for the very finest work, and excepting the last line on the plate. But the bands required correcting. So if this plate were to be used for any purpose, it would be necessary to apply corrections to the measurements made with the bands.

Zero of plate on end denoted by V sharpest scratch.
First band. Corrections to lines, necessary to reduce them to the proper positions, given in 240,000 of an inch in the last column at the head of page 28.
Of course the tenths there given are of no intrinsic value.
Middle band. Corrections (similar to above) in last column of table at head of page 29.
Last band. Corrections in last column of table near foot of page 29.
Notice the very large correction to the last line of the band.
In each of the bands the middle line is also one of the regular space-lines. Its correction (underlined in the table) is always zero.
Last space-line on the plate. Correction = + 8.
The other space lines are sensibly correct as already mentioned. J. R. E. & Prof. W. A. R. having given the extra time necessary to secure a better plate instead of using this one, Prof. R. has presented this one to J. R. E. and it is now in his possession.
The lines are filled with plumbago. The cover is cemented on with Canada balsam.

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Testing Standard Plate.

The ~~system~~ method of subdivision practiced by Prof. W. A. Rogers may be briefly outlined as; first, a system of detail measures of each of the nominally equal spaces, whereby the errors of each line could be indicated, provided the measures could be taken with sufficient accuracy; and second, a system of measures designed to eliminate the principal class of errors to which the detail measures are subject; viz; the accumulation, for any one line, of a considerable fraction of all the unavoidable errors of the measurements of the spaces intervening between that line and the nearest end.

The fundamental principle of the detail measures is that ~~the same~~ precisely the same part of the measuring screw (or its equivalent) must be applied to each space.

Suppose such a set of detail measures to be made and tabulated.

Select two reference lines, one near each end, whose distance apart shall be the unit to which the other lines are to be referred. Unless some good reason exists to the contrary use the two end lines themselves.

Subtract each measure from the mean length of the spaces between the reference-lines. This gives a column of corrections to the spaces necessary to reduce them to the mean.

Starting with zero at one reference-line, add the corrections cumulatively. This gives a column of corrections to the lines, the correction to the second reference line coming out zero. Were the measures perfect these corrections would reduce the lines to the position of perfect subdividing lines. But however small the errors of measuring each space, it will be found that the errors

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when the number of spaces is small,
of the accumulation figures are relatively ~~too~~ large, so that
it ~~will be~~ is practically better to devise a means of
correcting for the accumulated error, rather than to try to
take each space with a refinement calculated to render
the accumulated error inappreciable, even where the latter
would be ~~practicable~~ possible.

One ~~way~~ used by Prof. Rogers is to measure each third, quarter,
~~of~~ or fifth of the space between reference-lines with ~~a constant~~
one and the same part of the screw, and get a table
of corrections to these few lines by the same process
as before. Assuming these results to be sufficiently
accurate for the lines to which they apply, subtract
from each of them the corresponding correction derived
from the detail measures. The differences may
be considered as ~~ordinates~~ ordinates to a curve of
corrections for periodicity in the ~~detail measures~~.
~~to~~ results of the detail measures.

Another way used by him differs from the preceding only
in the method of obtaining the set of large subdivisions.
All the lines belonging to the system of large subdivisions adopt-
ed (together with the end lines) are measured as they
come, each on its own part of the screw. The plate
is then reversed ~~so~~ as to interchange the reference lines
with reference to the screw, and the series is measured
again. Now inasmuch as the errors of the ~~graduation~~ measuring screw
conform to a ~~symmetrical~~ periodic curve, symmetrical with
reference to a line half way between end lines, this
gives a means of ~~determining~~ eliminating them with double weight.
But the method is only to be used after due examination
of the nature of the periodic errors of ~~graduation~~ the screw.

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~~Another~~ third method, a direct outcome of the preceding, ~~but proceeding thus~~ is to take several series of measurements so planned that each space into which a given length is subdivided shall be measured over the same parts of the screw. This differs from the first method only in using more than one part of the screw for each space; while it improves upon the second in giving results independent of any assumption regarding the law of periodicity in the screw.

Notice that the second method becomes independent of the symmetry of the periodicity when applied to bisection. But that it become it thus conforms to the condition announced for the third method.

$\underline{0}$	$\underline{1}$	$\underline{2}$	$\underline{3}$
a_0	a_1	a_2	a_3
b_3	b_2	b_1	b_0
c_1	c_2	c_3	
	d_0	d_1	d_2

For the diagram, let the space $\overline{0,3}$ be trisected by 1 and 2.

Measure the four series a, b, c and d, the sub-figures denoting the part of the screw used in each case.

Now each third is measured over each of the parts $\overline{0,1}$, $\overline{1,2}$, and $\overline{2,3}$ of the screw, so that the 14 measurements give 3 determinations.

The case would be determinate were either series $\underline{a}$ or series $\underline{b}$ omitted, but the result would be reached so indirectly that it is not to be recommended.

0	1	2	3	4	5	6
a_0		a_2	a_3	a_4		a_6
b_6		b_4	b_3	b_2		b_0
	c_2	c_3	c_4		c_6	
		d_0		d_2	d_3	d_4
e_4	e_3	e_2	(e_0)			
	(f_6)		f_4	f_3	f_2	

Three or even four subdivisions is rather too small a system, however, for our plate, and the case seems to rest between five or six.

The margin shows the scheme for six, the observations in parenthesis being unnecessary, but adding largely to the

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weight of the result when compared with the extra trouble of taking them.

0 1 2 3 4 5

a_0 a_1 a_2 a_3 a_4 a_5

b_0 b_1 b_2 b_3 b_4

~~c_0 c_1 c_2 c_3~~

c_1 c_2 c_3 c_4 c_5

d_5 d_4 d_3 d_2 d_1 d_0

e_4 e_3 e_2 e_1 e_0

f_5 f_4 f_3 f_2 f_1

g_3 g_2 g_1 g_0

h_0 h_1 h_2 h_3

A better scheme for division by five than here in the margin may very likely be practicable, but it seems evident that the principle of factoring, used in the six-scheme, tends to abridgment of the work. As the six divisions are possible with one plate no further attention will be given to the five. [See page 38 however.]

0 1 2 3 4

a_0 a_1 a_2 a_4

a_4 a_2 a_1 a_0

a_2 a_1 a_0

a_0 a_1 a_2

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Description of Standard Plate.

Glass plate about 75 mm × 25 mm and something over 1 mm thick.
Diamond-ruled lines, filled with plumbago and covered dry with microscope cover-glass. Dry = no canada balsam or other cement between glass plate and cover glass over the space occupied by the scale.

Lines all about 6 mm long, except (of course) the true zero line, which crosses the length of the scale about midway the length of the lines.

Scale of 24ths of an inch, extending from −1 to +51, i.e. covering a total length of $\frac{52}{24}$ inches or 2⅙ inches.

Lines 0, 5, 10, 20 .... 45, 50 are triplets, the middle line being the one to be measured, while the lines on either side merely serve to count every fifth (6) space. The distance from the middle line of the triplet to either side line is two percent of a space, or $\frac{1}{1200}$ inch, as near as may be, with one exception:— The first line of the triplet at 50 is nearer the middle line. This is hardly considered a defect, since these side lines are not intended to measure with.

Line 49 is preceded by an extra line (ruled by mistake) at 48.99 or $\frac{1}{2400}$ inch behind the true line.

A half space on each side of lines 0, 25 and 50 is subdivided into five parts, so that at −0.5 to +0.5, 24.5 to 25.5, and 49.5 to 51.5 we have a band of the width of one space, subdivided to tenths: i.e. there are 3 such bands.

Line 49.9 was omitted in regular order of ruling (the screw having moved by it) and inserted by setting back to it after the series was finished. It is about 0.003 of a space or $\frac{1}{8000}$ inch too high on the scale.

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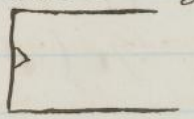
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In ruling the middle line of triplet at 45 it was remarked that possibly that line might be wrong. It therefore should not be used without checking its position.

Excepting these cases, the process of anticipating and eliminating errors in ruling apparatus renders it improbable that any existing in the plate will affect measurements taken to $\frac{1}{48000}$ inch. But for measurements taken to $\frac{1}{120000}$ or $\frac{1}{240000}$ the errors of the plate should be determined.

All this refers to the accuracy of subdivision.

The comparison of the whole length with standard has not (Apr. 26/79) been made.

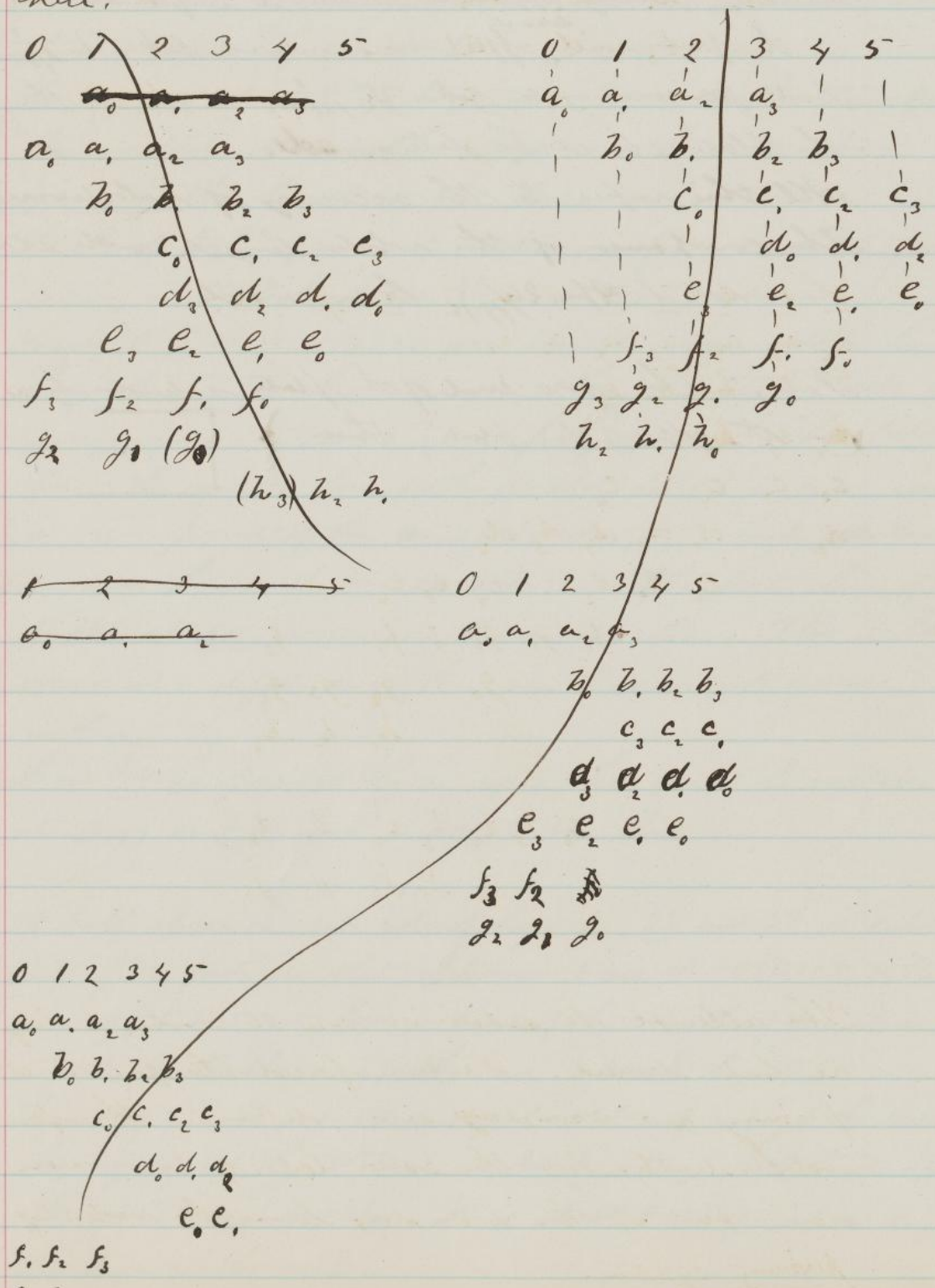
Note. The zero end of the plate is denoted by a diamond-cut V on the edge of the plate, thus 

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Subdividing – continued from page 35.

Since page 35 was written the method of treating such large prime numbers as 5 has suggested itself, and also a use for it outside this research has arisen. It is convenient to finish the matter here.



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0	1	2	3	4	5
a_2	a_3				
b_1	b_2	b_3			
c_0	c_1	c_2	c_3		
	d_0	d_1	d_2	d_3	
		e_0	e_1	e_2	e_3
			f_0	f_1	f_2
				g_0	g_1

0	1	2	3	4	5	6	7	8	9	10
a_6	a_5	a_4	a_3	a_2	a_1	a_0				
a'_4	a'_3	a'_2	a'_1	a'_0						
		~~b_6~~	~~b_5~~	~~b_4~~						
b_4	b_5	b_6								
c_2	c_3	c_4		c_6						
d_0		d_2	d_3	d_4	d_5	d_6				
		e_0	e_1	e_2		e_4	e_5	e_6		
			f_0	f_1	f_2	f_3	f_4		f_6	
				g_0		g_2	g_3	g_4		
						h_0	h_1	h_2		
			i_6	i_5	i_4	i_3	i_2	i_1	i_0	
				j_6	j_5	j_4	j_3	j_2		

The attempt to subdivide into 10 involves a long series even as last devised. We seem forced therefore to divide into primary and secondary series, determining the forms absolutely independently. For the septic loop of time necessary for doing part of the secondary lowers the value of the primary system.

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applied to all the lines of a small system (3, 4, 5, or 6)

The advantage of this system, lies in the fact that there is no process of adjustment of the results, other than the mere taking of the means, while the amount determined, compared with the number of ~~necessary~~ settings necessary to get a given weight, is considerable.

The same remark applies to its use for a primary system which is afterward to be subdivided to such an extent that the secondary measures may be given no weight in determining the primary points.

There certainly is a feeling of insecurity in applying ~~a system~~ an adjustment to combine two ~~sys~~ sets of measures bearing upon the same determinations. But is it not merely more tangible? I doubt not one feel still less secure concerning figures which are only checked by ~~a~~ consecutive measures of the same magnitudes in the same manner?

Taking this view of the case we have been led to devise a fourth method. In this method several lines are determined as before, but each determination is absolutely independent of the determination of any other line. The set of lines to be thus determined is selected by subdividing the plate into a convenient number of aliquot parts, and then independently determining all the subdividing lines except those lying next the end lines. Next each of the aliquot points is measured by the system of space measures already described as used by Prof. Rogers. Then we get three independent determinations of each line of the system selected except those next the ends, and an adjustment ~~of~~ our determination system having especial reference to the relation of a line to the ends, and the other to the relation of a line to its next neighbors.

To adjust these by a complete least-squares method will be too laborious. And any approximate method will be open to the

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objection the of uncertainty as to result. But it is supposed that each set of observation will be carried so far that we are dealing with very small quantities in the adjustment.

Looking back at the preceding system, we may regard the adjustment as made by the process of measuring one setting the result, with the advantage that each observation has a certain weight used necessarily, so that there is no room for variation, but again with the disadvantage that certain observation receive necessarily too little weight, while we are unable to control how much work shall go towards the relation of a line to each of the neighbors respectively.

On the other hand, for more than 6 aliquot parts the method under discussion is very laborious, the number of settings requiring being more than the number required to get results with all the checks desirable by more than the number required to reduce the error down to setting. (And the method loses its distinctive character when applied to 4 or less.)

Method of operation.

In general, if n and n' are the number of aliquot parts on the respective sides of the line, measure the n spaces in one over n' successive parts of the screw, and measure the n' spaces in one over n successive parts of the screw, starting at the same point for the n' as for the n spaces. The principle of "repetition" (as technically understood) will be used or discarded according to stability of apparatus, fineness of graduation &c.

With 5 aliquot parts, this amounts to determining the $\{\frac{2}{3}\}$ line by measuring the space $\{\frac{0\text{-}2}{3\text{-}5}\}$ three times and the space $\{\frac{2\text{-}5}{0\text{-}3}\}$ twice upon successive parts of the screw, three using the same length of five spaces of screw for each.

With 6 aliquot parts the 2, 3 & 4 lines are to be measured, and in each case the two segments have a common factor. Thus, the 3 line is determined by measuring the spaces

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0-3 and 3-6 upon the same part of the screw, while the $\{^{2}_{4}\}$ line is found by measuring the space $\{^{0-2}_{4-6}\}$ twice and the space $\{^{2-6}_{0-4}\}$ once. In order, however, to make the determination of equal value the 3 line is ~~measured~~ determined three times while the 2+4 lines are determined twice each. But even here the 3 line might have been determined by bisection, while the 2+4 line were independently determined by trisection. For 7 or more lines the work is greatly and the ability to check less.

Recapitulation — Selected Methods.

Bisection.

1st " Method. Measure each half upon same part of screw.

2nd " or 3rd " " all three lines on the screw and then reverse the plate so that 0+2 shall be interchanged on the screw while 1 occupies about the same place.

1st " method gives point of attainable accuracy. 2nd " gives best results for a limited number of observations.

Trisection.

1st " Method. Measure each third upon same part of screw. (Simplest.)

3rd " " 4 series of measures according to scheme on page 34. (More efficient with limited number of observations.)

4th " " Measure $\{^{0-1}_{2-3}\}$ twice and $\{^{1-3}_{0-2}\}$ once using the same part of screw in aggregate for each. This method is hardly recommended for use alone. ~~But using the 3rd " + 4th " each is a specially valuable method~~ But used with ~~that of~~ the 1st " ~~other~~ to give duplicate determinations it is specially valuable. (Adjusting 1st " + 4th " gives quarter attainable accuracy.)

4 Aliquot Parts.

1st " Method. Measure each quarter upon same part of screw. Used alone this method is weak on line 2.

3rd " " 4 series of measurements according to scheme at middle of page 35. This may be regarded as three successive bisections. ~~By the second this method~~ It is stronger for line 2

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them for lines 1 & 3. Using both methods is therefore especially good.

5 Aliquot parts.

3rd " Method. 7 series of measurements according to scheme at head of page 39.

4th " " with measurements of spaces as for 1st " method necessarily joined to it. Besides the space measurements, measure $\begin{Bmatrix} 0-2 \\ 3-5 \end{Bmatrix}$ thrice and $\begin{Bmatrix} 0-3 \\ 2-5 \end{Bmatrix}$ twice, using same part of screen in aggregate, and adjust the results.

6 Aliquot Parts.

~~Bisect either by 1st " or by 2nd " Method. } subtract one obscure quotient~~
~~Trisect by 1st " or by 4th " Method. } with measured settings~~
~~attainable accuracy, (1st " method) or best result for a limited number~~
~~of observations.~~

Bisect either by 1st " or by 2nd " Method.

Trisect by 1st " Method. ~~(3rd " Method is objectionable on account of non-independence of lines. 1st " + 4th " combined is ~~

~~by 1st " + 4th " Methods combined.~~

Measure the six spaces on same part of screen.

Adjust result of the three.

7 Aliquot Parts. Treat, by 3rd " Method, similarly to 5 parts. Details not derived.

8 " " Quarter by adjustment between results of the two methods given. Measure each space on same part of screen, but use result only for interpolating the odd lines. Use for the first time about ~~the~~ one third of aggregate system, being so little weight upon one of the systems of lines that it is not worth while adjusting for. ~~Theoretically, therefore, it is not a favorable number of parts~~

Or. Bisect by 1st " Method, ~~adjustment~~, ~~between the two methods~~ and then quarter each half independently by the 3rd " Method. Only recommended to same time. The preceding is theoretically better.

9 Aliquot Parts. Trisect by 1st " + 4th " Methods combined. Then measure each space upon same part of screen.

Or. To same time. Trisect by 1st " Method, and then trisect each third by 3rd " Method.

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Lines on plate (37) favorable for studying photographic distortion.

63.51
62.52

Dividing line of a double line about ~~1 turn~~ 100 div
behind 364.70 m.m.

85.33
85.08
.25

Fine line about 25 div. behind 375.77 m.m.

~~Line~~ Line about 98 div. beyond 369.47

73.70
72.72
.98

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Investigation of distortion of scale of photographs

Sept. 20/79

Plate 36 ~~Plate 36~~ Line -0.2 turn from ~~366~~ 361.80

Fine " -1.0 " " 363.08

× Very " " -0.09 " " a broad line

which itself is +2.02 " " 364.70

× Fine bright line -0.87 " " 364.777

The rest unfavorable for this purpose owing to overcrowding

Plate 37 Fine Line +0.94 from 364.70

Not favorable

× Fine line -0.85 " 364.77

and -0.07 from a broader

Very fine line +0.07 from a bright-

line, itself -0.70 " 364.77

Very fine " +0.80 " "

Evidently we are seeking two fine lines.

Let us rather seek broader but sharp line for setting with the Bessel pair in the eye-piece.

Plate 37 reinvestigated. [Comments on re-viewing the lines.]

Dividing line of pair	-1.00	from	364.70	Not very good
Line	+1.70	"	"	Better
Space between broad pair			366.90	(3) Fair
Bright	-0.68	"	367.77	Not very good.
" solitary	-0.87	"	368.71	Good
Rather broad	+0.33	"	"	"
Fine	+0.10 from preceding			Perhaps better (Very fine)
Not bright	+0.20 ~~(0.15)~~	"	369.47	Fair
Bright			369.63	(2) Rather broad
"	+0.70	"	"	Rather broad
Middle of triplet	+0.94	"	"	Very good

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Space betwn doublet 370.54 Fair

27/79 Lowest of group +.25 from preceding Fair

Not bright -.10. from following Good
Bright -.68 " 371.97 Rather broad
Space betwn pair (not bright) +.25 from 372.70 Good
Single +.20 from preceding Fair
Rather broad +.25 " 373.65 Rather broad
Space betwn pair +.11 " 374.30 Fair
Not bright -.25 " 375.77 "
All beyond this appear from own - appears, but after selecting lines on another plate it may be found that they can be measured on this.

Plate 38/64 Ill defined (-.98 from 373.43) = (+.20+.25 from 372.70)
Too broad
+.19 from preceding - space betwn doublet is better
or -1.30 from it - single
Fair or good
-0.29 from preceding is also fair together with several others near by.
Rather broad -0.27 from 374.82
Group (somewhat available) +0.77 " 374.95
Recall that above group is available on plate 37
Fair
Space betwn doublet - 0.14 from (Better than preceding) 375.77
Rather broad & bright 376.08
" " 376.14
Space betwn doublet +0.19 from 376.68

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Solitary, not bright +1.08 from 376.68

* * * *

Faint (one eyepiece) +0.47 from 387.74

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				Favorable for plate. Lo limits in vicinity of Harvard Lines.
	ϕ			
Plate	36 Page 60	356.46 to ~~372.68~~ 378.78	361.80 to 364.78	3
"	37 " 62	360.18 " 383.78	364.70 " 375.77	5
"	38 " 64	373.43 " 396.76	373.65 " 387.74	7
"	39 " 32	381.26 " 405.64	382.+ " 396.77	8
"	39-40 " 68	383.75 " 404.51	384.98 " 398.61	8
"	40-41 "			

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Mon. Sept 29/79 Comparisons for Photographic Scale.

Plate 38 - - -

Designation	Screw	Remarks
	48.072	Space bet: double preceding the next.
383.75	.189	
4.01	.610	} Bright pair
4.06	.728	
	.850	} Pair in position of prom 384.98
	.927	
387.74	55.954 fine edge	} Band more or less resolvable
	56.155 last "	
389.47	59.475	Appar: centre of overlapped band
390.48	61.406	" " " " "
392.21	64.849	" " " " "
2.73	65.896	" " " " " more or less resolvable.
393.29	66.974	K " " " K in very broad band
	67.526	Line conspicuous in comparison with other near.
	69.066	Appr: centre of overlapped band
6.07	72.689	
396.76	74.138	Approximate " " H more or less resolv[d]
6.87?	74.313	
	74.753	Appar: " " ill defined band
	.961	" " " " " "
	75.231	" " " " " "

End of photographs

0.398 - 0.071 = 0.327 on screw But (74.138 - 48.189 = 25.949) on screw = (396.76 - 383.75 = 13.01) c.m.

$\frac{13.01}{25.95} \times 0.327 = \begin{cases} 1.1142 \\ 1.4143 \\ 9.1000 \\ 9.5145 \\ \hline 9.2145 \end{cases} = 0.164$ c.m. 9.7000

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Rowland Plate 39	Difference	Mean Diff of Pairs
47.755	+0.321	+0.321
.868	+0.321	
48.308	+0.302	+0.295
.440	+0.288	
.575	.275	+0.285
.633	.294	
55.918 Brighter Line	(+0.036)	+0.071
56.048 "	(+0.107)	
59.323 Not bright .449		+(0.089)
61.401	+0.005	
64.833	+0.015	
65.843	+0.053	
66.973	+0.001	
68.997	+0.069	
72.437	+0.252	
73.785	+0.353	+0.353
~~76.960~~ 73.960	+0.353	
74.352 pair	+0.401	(+0.398)
74.569 "	+0.392	
74.831	+0.400	

i.e. Were it to be attempted to determine the position of Angstrom's line 387.74 by interpolation between his lines 383.75 and ~~396.76~~ another at about 397. from measurements on the photographs, the results of using plates 38 and 39 would differ about 1.6 m.m. while preparations have been made to get results good differentially to (say) 0.05 m.m. or 0.005 on c.m. scale.

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Lower
Tues. Oct. 7/79 Condition of Screw.

Measurements upon standard part of page 36
Height from position eye-piece, 2" objective.
Successive settings upon pair of lines in field.

		Setting on 1st line	on 2nd	Diff	Mean		
11-36 A.M.		50-00.90	03.60	2.70 ✓	5002.25	-.09	2.34
		5[illegible].96	54.68	2.72 ✓	052.32		
		60.96	63.64	2.68 ✓	062.30		
		70.94	73.64	2.70 ✓	072.29		
		81.08	83.68	2.60	082.38		
		91.12	93.80	2.68 ✓	092.46		
	≡	51-01.20	03.80	2.60	5102.50	0	2.50
		11.18	13.86	2.68 ✓	112.52		
		21.22	23.80	2.58	122.51		
		31.16	33.80	2.64°	132.48		
		41.14	43.80	2.66 ✓	142.47		
		51.32	53.88	2.56	152.60		
		52-01.32	03.90	2.58	5202.61	+.09	2.52
		3-01.42	04.06	2.64°	302.74	.19	2.53
		4-01.52	04.28	2.76 ✓	402.90	.28	.62
		5-01.60	04.30	2.70 ✓	502.95	.37	.58
	≡	6-01.78	04.44	2.66 ✓	603.11	.47	.64
		7-01.94	04.50	2.56	703.22	.56	.66
		8-02.10	04.64	2.54	803.37	.65	.72
		9-02.08	04.66	2.58	903.37	.75	.62
		60-02.26	04.94	2.68 ✓	6003.60	.44	.76
	≡	61-02.34	04.98	2.64°	103.66	.94	.72
		2.32	5.00	2.68 ✓	203.66	1.03	.63
		2.48	5.[illegible]	2.66 ✓	303.81	1.13	.68
				3.48			

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3.48

	64-02.56	05.28	2.72 ✓	6403.92	1.22	2.70
	5-02.66	5.40	2.74 ✓	504.03	1.31	.72
≡	6-02.88	5.50	2.62	604.19	1.41	.78
	2.88	5.52	2.64°	704.20	1.50	.70
	3.00	5.62	2.62	804.31	1.59	.72
	2.98	5.60	2.62	904.29	1.69	.60
	70-03.04	5.66	2.62	7004.35	1.78	.57
≡	1-03.28	5.80	2.52	104.54	1.89	.67
	3.34	5.96	2.62	204.65	1.97	.68
	3.36	6.02	2.66 ✓	304.69	2.06	.63
	3.58	6.18	2.60	404.88	2.15	.73
	75-03.60	6.20	2.60	504.90	2.25	.55
	5-53.50	56.16	2.66 ✓	554.83	2.34	
	63.56	66.22	2.66 ✓	564.89	2.43	
	73.60	76.32	2.72 ✓	574.96	2.53	
	83.54	86.26	2.72 ✓	584.90	2.62	
	93.62	96.30	2.68 ✓	594.96	2.72	
12-15 P.M. ≡	76-03.70	06.40	2.70 ✓	7605.05	2.34 2.81	.71
	13.74	16.30	2.60	615.00	2.91	
	23.76	26.38	2.62	625.07	3.00	
	33.74	36.30	2.56	635.02	3.09	
	43.70	46.30	2.60	645.00	3.19	
	53.72	56.32	2.60	655.02	3.28	
Reel-7 min.	77-04.00	06.56	2.56	7705.28	2.43 3.37	
	03.84	06.54	2.70 ✓	805.19	2.53 3.37	.66
	03.96	6.62	2.66 ✓	905.29	2.62	.67
	04.10	6.70	2.60	8005.40	2.72	.68
	81-04.20	6.74	2.54	105.47	2.81	.66
	4.24	6.86	2.62	205.55	2.91	.64
	83-04.30	6.94	2.64°	305.62	3.00	.67
			4.02	4.02/7.50		

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7.50

	84-04.40	07.00	2.60	84.05.70	3.09	2.61
	4.52	76.20	2.68✓	505.86	3.19	.67
≡	86-04.72	78.30	2.58	606.01	3.28	.73
	4.76	7.34	2.58	706.05	3.37	.68
	4.74	7.40	2.66✓	806.07	3.47	.60
	5.00	7.58	2.58	906.29	3.57	.73
	4.90	7.52	2.62	9006.21	3.65	.56
	88-05.12	7.70	2.58	106.41	3.74	.67
	5.18	7.90	2.72✓	206.54	3.84	.70
	5.26	7.90	2.56	306.58	3.93	.68
	5.32	7.96	2.56	406.64	4.02	.62
	5.30	7.94	2.54	506.62	4.12	.50
≡	96-05.80	8.16	2.66✓	606.83	4.21	.62
Rest 9 min		0				
	97-05.70	08.28	2.58	706.99	4.30	.69
	5.58	8.24	2.66✓	806.91	4.40	.51
	5.70	8.28	2.58	906.99 (see page 36)	4.49	.50
=	100-05.82	8.48	2.66✓	10007.15	4.58	.57
	55.76	58.40	2.64°	057.08		
	65.76	68.38	2.62	067.07		
	75.68	78.46	2.78✓	077.07		
	85.76	88.50	2.74✓	087.13		
	96.02	98.72	2.70✓	(097.37 (see page 36)		
≡	101-05.80	08.52	2.72✓	10107.16	4.68	.48
	15.82	18.56	2.74✓	117.19		
	25.84	28.54	2.70✓	127.19		
	35.80	38.50	2.70✓	137.15		
	45.70	48.44	2.74✓	147.07		
	55.76	58.48	2.72✓	157.12		
1-110 Mc.	102-05.86	08.46	2.60	10207.16	4.77	.39

4.30 4.30

8-3 11.80

2.64

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Sum pos. resid ^{l} = 2.40 — Mean residual of difference between
" neg " = 2.02 — two consecutive settings = 0.053
83) 4.42
.053

Or, say, probable error of a single setting is about 0.06 of one division or $\frac{1}{40,000}$ inch.
Prob. prob. err. of mean of two is about 0.04 or $\frac{1}{60,000}$ inch.

3 st. bnd. fig.^{s} of lines in band			Residuals				Mean	
1st " band	2nd " band.	3rd " band	1st " Bd.	2nd " Bd.	3rd " Bd.			
2.32	4.83	7.08	-.12	-.14	-.07 -.04	-.10	-.02 -.04 +.06	
2.30	4.89	7.07	-.14	-.08	-.08 -.05	-.09	-5 +1 +4	
2.29	4.96	7.07	-.15	-.01	-.08 -.05	-.07	-8 +6 +2	
2.38	4.90	7.13	-.06	-.07	-.02 +.01	-.04	-2 -3 +5	
2.46	4.96	(7.37) (.01)	+.02	-.01	+.22 -.05	-.01	+3 0 -4	
2.50	5.05	7.16	+.06	+.08	+.01 +.04	+.06	0 +2 -2	
2.52	5.00	7.19	+.08	+.03	+.04 +.07	+.06	+2 -3 +1	
2.51	5.07	7.19	+.07	+.10	+.04 +.07	+.08	-1 +2 -1	
2.48	5.02	7.15	+.04	+.05	0.00 +.03	+.04	0 +1 -1	
2.47	5.00	7.07	+.03	+.03	-.08 -.05	0	+3 +3 -5	
2.60	5.02	7.12	+.16	+.05	-.03 0	+.07	+9 -2 -7	
11) 4.83	11) 10.70	11) 1.60					35 27 38	
2.44	4.97	7.15					3) 100	
		11) 1.30					11) 33⅓	
		.7.12					.03.03	

Coinciding when the accordance of the 3 subdivisions of a turn of the screw into tenths, the prob. error of a single determination is about 0.03
Or the prob. error of the mean is about 0.02 or $\frac{1}{120,000}$ inch.
The actual values ~~of the mean also~~ in the column of means do not exceed .10, so that in measuring, the result of which is carried only to tenths of a division of the head the correction for fraction of a turn may be neglected. But where two series are taken it will be always better to obtain opposite points of the turn.
Then we should get $\frac{-.10+.06}{2} = -.02$ $\frac{-.07+.06}{2} = -.015$ $\frac{-.07+.08}{2} = +.005$ $\frac{-.04+.04}{2} = 0$ $\frac{-.01+0}{2} = -.005$ $\frac{+.06+.07}{2} = +.065$
but for the last a mistake is probable.

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Oct. 8

≡

57-00.90	03.52	(2.62)	00.90	03.54	(2.64)	00.92	03.48	(2.56)
57-40.96	43.52	(2.56)	40.90	43.52	(2.62)	40.98	43.52	(2.54)
57-50.96	53.58	(2.62)	50.92	53.62	(2.70)	57.00	53.62	(2.62)

Means				
5102.21	02.23	02.20	02.21
42.24	42.21	42.25	42.23
52.27	52.27	52.31	52.28

52.28 - 02.21 = 50.07

52.28 - 42.23 = 10.05

But from page 52

5152.60 - 5102.50 = 50.10

" - 5142.47 = 10.13

Evidently then the discrepancy noted at foot of page 55 is due to error of measure and not to error of standard plate, nor to persistent faulty performance of screw.

5102.44 (mean of 13 bars) - 10107.12 (mean of last bar) = -5004.68

~~4.68/5000 = .000936~~ 4.68/50 = .0936 = corr. per turn.

After the final sixth column of pages 52, 3 + 4 is a column of errors based on this the above amount. Applying corrections gives the last column, in which only the few right-hand figures are represented. The prob. error of a result is too great to use this column to show erratic variations of screw. To bring out systematic errors we will take means of figures in tithets.

Inspection of the figures on opposite page shows that if results are to be carried to sixth tenths of a division there must be a screw correction, although the error is reduced by not using below 57 nor above 88. But 0.2 division = 0.001 cm. of mean length.

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2.45	2.62
2.52	.63
2.56	.67
2.58	.69
2.61	.67
2.63	.67
.67	.63
.67	.65
.70	.64
.70	.68
.70	.67
.68	.60
.67	.58
.70	.60
.73	.61
.73	.57
.73	.53
.64	.52
.63	.48
.61	
.64	
.66	
.68	
.64	
.66	
.64	
.68	
.67	
.67	
.66	
.64	

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Fri. Oct. 10 Plate 39 Veltz with double lines

~~Identification~~ Time + Remarks	Obsrs	~~Screw~~ Identification	Screw
9-35 A.M.	7		
	3		54-69.1
	~~4~~ 5		
			70.5
	2		
			~~69~~ 7 9.7
	4		
			88.3
	3		
			92.2
	6		
	4		99.3
	6		
	4		55-04.0
	6		
			06.3
	3		
			10.5
	8		
	4		18.7
	6		
	4		28.3
	7		
	4		29.8
	6		
	4		34.4

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	7		
			53-42.8
? Double	3		
			50.7
	6		
	4		57.1
	6		
?	5?		62.5
	6		
			64.5
	3		
			68.3
	6		
~~Doubtful~~	5½		73.1
	6		
	5		77.8
	6		
			85.3
	2	387.72	
			90.6
	4		
?	3?		95.3
	4		
			99.3
	2		~~56-07.~~
			56-07.1
	6		
			11.5
	3		
			15.4

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7	56- 20.0
3	22.9
6½	26.8
3	32.0
5	35.4
3	38.9
7	41.8
3	45.0
6½	48.5
3	52.1
5	53.8
3	57.4
5	60.5
3	63.0
6	

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		56'-65.8
	2	
		69.0
	4	69.9
	~~3~~ 3½	71.7
	5	74.1
	3	76.3
	4	78.5
grading	3½	79.3
grading	(2) grading ~~to~~	(89.)
	1½ ~~2~~	(95.) ~~(89.)~~
		97.
	8	
	6	57-02.3
	8½	
very fine	6	07.4
	8	
?	6	10.9
	7½	
		13.2
	2½	
		17.2
	6	
		21.4
	3½	
		23.7
	6	
		31.0
	3	
		35.0

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6	~~3~~	
	~~57-38.6~~	57-38.6
3		
		41.7
5		
		43.7
		51.3
gradual 2		55.7
		57.5
		60.9
6		
4		65.5
5		
		68.9
2		
		73.3
76		
		88.1
65½		
		91.2
76		
		98.4
2		
		57-02.3
4		
		03.3
3		
		07.6
4		

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		58-11.1
3		
		18.1
6		
		21.4
3		
		25.4
5		
		26.5
3		
		30.2
6		
		32.8
4		
5		35.8
4		
		34.0
5		39.9
4		
		42.8
6		
		45.5
3		
		48.8
6		
		52.0
4		
		54.8
6		
		57.5

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	5	
		58 - 61.7
	6	
		66.1
	3	
		70.0
	6	
	5	76.7
	6	
		79.7
	4	
		83.8
(Rest 5 min)	6	
		86.9
	2½	
		92.2 ~~93.2~~
	7½	
		94.9
	2	
		99.5
	8½	
		5 89 - 07.1
	2	
		12.8
	8	
	5	20.0
	8	
very fine	5	24.5
	8	
		28.9

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graded.

3: fenton resolved

3		
4		54-37.4
3		
		45.4
7		
		51.2
4		
		55.0
7		
		58.6
4		
		61.5
7		
6		66.8
7		
		78.1
3	389.69	
		81.4
7		
		86.6
2	389.70	
		92.2
7		
		96.3
3	389.72	
		60-00.4
8		

11-12 A.M.

It is probable that in this first attempt the estimates are too contracted i.e. do not cover a sufficient range on the scale of opacity.

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Sat Oct 11

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Upper edge = top when held so that diamond scratched figures & letters are right-side up.

Plate 39 – Left-hand pages only

Sat. Oct 11 Settings with single field-line.
Upper edge of photograph. (This was used yesterday, but the plate was wrong side to.)

		Screw	Opacity (Plate re-examined.) Mean Position	Width
8.5	8.5	9		
10·05 A.M.		59·07.3		
2	2	1.5	10.5	6.5
		13.8		
8.5	8½	9		
indefinite		19.2		
4	4	4	20.2	(2.0)
indef.to		21.2		
8.5	8.5	9		
? 5	5	24.3	4½	
8.5	8.5	9		
		29.2		
2.5	3	2.5	31.1	3.9
? 6	6	33.1	6½	~~32.4~~ ~~6.5~~
3	3.5	3	34.4)	(2.6)
ind.to		35.7		
6	6	6		
ind.		37.9		
2.5	3	2		
? 5	5	41.5	~~6~~ 6½	42.2 (8.5)
2	2.5	1.5		
ind		46.4		
8	8	8		
		51.7		
4	4	4	53.7	3.9
		55.6		

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With diaphragm, movable to vary illumination.

Oct 24/79 Plate 39-40 Right-hand pages only. Photographs. Upper end of
10-05 A.M.

9			
2	59-58.0		
6?	58.9		
1.5		60.6	5.3
	63.3		
8,5			
4	67.5 ~~68.7~~	67.5 68.1 68.4 68.4	70.8 76.7 (7.1)
7½	69.0	~~68.8~~	∴ 7.1
4		69.9	1.8
	70.8		
8			
4	74.8		
8			
4	76.5		
8,5			
	78.7		
2		80.6	3.8
16	82,5		
3	84.0		
6			
12	88.0		
6	89.7		
21		92.4 92.0	8.1
7?	95.2		
3	96.1		
8			
	60 - 101.4		
3		03.4	4.0
	05.4		

Some left blank by mistake

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	7.5	7			7.5		
				59 - 58.3			
	3.5-	4			4	60.1	3.7
				62.0			
	7.5-	7.5			7.5-		
	5-	5		66.6	4	~~64.3~~	~~4.6~~
	8	8			8		
?	5-	5		75.2	4?		
	8	8			8		
				77.6			
	3	3	389.69		2.5-	79.7	4.2
				81.8			
	7.5-	7			~~8.5-~~		
ind				86.4			
	1.5-	2	389.70		1.5-	89.7	(6.6)
ind				93.0			
	8	8			8.5		
				96.5		~~98.8~~	~~4.6~~
	3	3	389.72		2.5-	98.8	4.6
				60 - 01.1			
	8.5	8.5			9		
?	6	6		05.4	4?		
	8.5-	8.5			9		
				09.6			
	3	3			2.5-	11.6	4.1
				13.7			
	7	6			x7		
	5-	4			4		
ind				18.1			

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7	~~60 - 05.1~~			
~~2.5~~	60 - 08.1			
2.5		10.0	3.7	
	11.8			
8				
4	16.3			
8				
½ Double 4½	21.8			
8				
4	25.9			
7				
	27.9	29.3	2.8	
2.5		30.2		
7½	30.7	29.7	4.5	
~~X 3½~~	32.4		3.6	
~~8.8~~				
3	36.8			
7½	37.5	34.5	34.9 (4.0)	6.2
1				
1½	41.5			
3	43.0			
8				
3	46.4			
7½	47.2	48.6	48.7	4.7
2				
7½	50.0			
3	57.1			
9				
½ Double 4	55.1			
9				
	60.0	61.8	3.7	
3				

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	6	5	7	6		
ind			60 - 21.7			
	2	3		2		
	1.5	2		1.5		
	1.5	2		1	(24.6)	(5.5)
	2	3		1.5		
				2		
ind			27.4			
	7.5	7.5		7.5		
	8	8		8.5		
	5	5	34.7	.4		
	6.5	6.5		9		
			38.5			
	1.5	2		1.5	40.5	4.1
			42.6			
	7	7		7.5		
ind			45.6			
	4	4		4	48.1	(5.)
ind			50.6			
	6	8		8.5		
			60.3			
	3	4		3	61.9	3.2
			63.5			
	6	7		8		
			66.4			
	2.5	3		2.5	68.3	3.8
			70.2			
	6	7		8.5		
			74.7			
	3	3.5		3.5	75.8	2.3
			77.0			

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60-63.7

9
4½ 67.8
8
4½ 69.1
7
3 72.3
6½ 73.0
1
7 77.3
4½ 79.3
9
? Double 4½ 84.5
9
88.7
1 90.7 4.0
92.7
9
4 96.1
8 97.0
4 98.2
8 99.6
4½ 61- 01.4
? false 4's 9
10.2
3 11.8 3.3
13.5
8
16.7
3
7½ 19.1
22 20.0

74.8
75.3 75.8 .3 75.5
7.0

18.4 17.9 18.2
3.3 3.4 2.9

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7	6		~~6~~ 7		
~~3~~ 4	4	60-74.9	4		
"6?" probably means 7 and ? fine 4½ 6	5		6?		
3	3	83.6	3		
6	5		6		
ind		86.0			
2	2		~~2~~ 1.5	88.6	(5.3)
ind		91.3			
6	6 5		6		
ind		93.4			
3	4		3	(94.9	(3.0)
		96.4			
8.5	8		9		
?	5	61-01.3	~~4~~ ?		
8.5	8		9		
		03.0			
2	2.5		2	07.1	4.3
		09.3			
8	8		8		
5	5	12.3	~~4~~		
? fine 5½ 8	8		9 8.5 8	2.5½	
7.5	7				
		24.9			
2.5	3		3	25.7	1.6
		26.5			
? fine 4½ 7	6		7 6.5 6	2.5½	
6	5				
3	3	34.0	2.5		
4	4		~~6~~4		
0	3		2.5		

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9
3 61-24.9 } 25.6 [1.3]
7? }
3 26.2 }
7
4 29.4
7
4 32.2
7
3 34.1
7
3 35.7
6? 36.9
1 38.6 38.8 38.7 4.9 6.1
7? 41.4
3? 41.8
7
4 43.7
7? } 44.7 [2.0]
4 45.7
9
4? 49.1
9
4 51.3
9
3 54.4
6? 55.7
2 ~~56.0~~ 57.4 (6.0)
6 59.4
4 60.4
8
4 62.6

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ind				61-38,3			
	1	2			1,5 / 1,5	40.5	(4.4)
ind				42,7			
	2	3			2 / 3		
	3						
	4	4			4 / 5		
	5	5			6 / 6		
	5	5			~~4~~ 5		
ind				46.8			
	2	3			2	48.1	(2.6)
ind				49.4			
	8.5	8			9		
	2	3		53,3	2		
	5	5		56.6	~~4~~ 5		
				57.8			
	1.5	2	390.59		1,5	59.4	3.3
				61.1			
	7	7			7,5		
				63.2			
	3	4	39060		3	64.6	2.8
				66.0			
	7	7			7,5		
	5	5		69,3	4		
	7	7			7.5		
	6	6		73,7	4		
	8	7			7,5		
				78,0			
	3	4			3	79.3	2,7
				80,7			
	7	7			7		
				83.0			

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9
4? 61- 66.1
9
4 68.2
8
4? 71.2
7
4? 73.3
72
3 75.2
7? } 76.0 [1.7]
2 76.9
7
4 78.8
7
4 81.0
7
4 83 84.4
7? } 83.9 [1.8]
4 84.8
6
4? 86.1
6?
4? 87.3
6? 88.5 } 87.7
1 } 89.8 } 90.0
6? 91.0 } 90.3 (4.8)
2 92.7
7
4? 95.9
6?
3 98.5
(7) Continues on back 176

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4	5			4	87.0	1.98
		61-84.9				
6	6			6		
		87.3				
2	3			2	88.5	2.5
		89.8				
8	8			8.5		
ined		93.6				
4	5			4	95.3	(3.3)
ind		96.8				
7	7			7		
5	5	62-01.1		4		
7	7			7		
		03.7				
3 2.5	3			2.5	05.0	2.5
		06.2				
6	6			6		
3	4			3		
		09.7				
8 7.5	8			8		
		13.7				
4	4			4		
? 6	6			6.2	15.3	3.3 Double
4	4			4		
		17.0				
8	7			8		
		22.4				
3	3			2.5	23.8	2.8
6	6	25.2		7		

10 min

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See page 176 for page of obs. for insertion here

4	62-36.8		
7½	37.9		
2		38.6	3.6
7½	39.5		
4	40.4		
4			
4½	43.0	43.35	
7½	43.7		
3		44.8	(2.8)
7½	45-8	46.15	
4½	46.5		
7			
4	49.8		
9			
3	53.2		
6½	53.7	54.6	2.8
2			
	56.0		
6			
4½	57.9		
6½		58.6	[1.4]
X 3	59.3		
9			
4	63.8		
8 X ½		64.9	[2.3]
4	66.0		
9			
4½	70.7		
6			
	71.9		
3 8		73.0	2.1
	74.0		

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Glat. time = 2.5 & 7.5
" " = 3 & 7

2.5	3		2	26.8	3.3
2	2				
		62. 28,5			
9	8,5		9		
8,5	8	~~34.4~~	~~9~~		
Rest 30 min		34.4			
	3,5		3	35.8	2.8
		37.2			
	6		6		
		39.1			
	3		2,5	40.4	2.6
		41.7			
	7		7,5		
		45,0			
	3		2,5	~~46.6~~	~~3.2~~
	6	48.2	6	Double 48.0	6.0
	4		3		
incl		57.0			
	5		6,5		
	6		7		
	7		7,5		
	5	57.0	4		
	8		8		
		62.3			
	3		3		
	6	67.6	6,5	Double 66.8	9.0
	3		3		
		71.3			
	7		8		
		74.1			

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7	
	62-75.5
2	
	78.4
8	
4½	80.1
9	
	84.1
3	
	87.2
7	
4½	88.5
6½	89.6
3	
8	91.9
4½	92.6
8	
4	94.2
6½	94.9
3	
6	98.4
4	99.7
7	
4½	63-01.2
9	
4	12.2
6½	13.4
3	
6½	15.2
4	16.2
7	
4	17.4

? five 4's

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	4				4	75.2	2.3
			62 - 76.4				
	8				8		
?	6		84.2		6?		
	8				8.5		
mid			86.4				
	3				3	88.0	3.3
			89.7				
	8				9		
Double?	4		94.0		4 7? 4		
	7				7		
			97.0				
	2	391.29			1.5	Double	
	5		63 - 00.5		6	00.4	6.7
	2				1.5		
			03.7				
	8.5				9		
	4		09.8		4		
	8 7.5				8.5		
			12.8				
	2	391.34			1.5 6? 2	Double 16.2	6.9
mid			19.7				
	8.5				9 8.5 8	5P 2-	
	8						
			31.8				
	4				4	33.1	2.6
			34.4				
	4				8		
			38.2				

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	6?	63-18.2
	~~4~~3	
		21.1
	8	
	~~4?~~	~~23.1~~
		23.4
	4	
Indiff.		26.3
? fine 4's	9	
	4?	36.3
	8	36.9
	3	
		40.0
	9	
? Double	4	43.8
	8	
	4	47.0
	6?	47.7
	2	
	6	50.4
	3	
	7	53.0
	4?	53.9
	9	
? Double	4	57.1
	9 ~~4?~~	
	4?	63.1
	6?	63.6
	1	
	6	66.6
	3	67.7

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4			3	40.0	3.7
		63 - 41.9			
7			7		
		43.9			
3			2,5-	45.7	3.7
		47.6			
8			8		
		52.4			
3			3		
6		55.5-	7	Double 55.3	5.8
3			3		
		58.2			
8			9		
		62.1			
3			2,5-	63.4	2.6
		64.7			
4.5-			9		
		70.8			
1,5-			1	72.3	3.0
		73.8			
8.5			8		
	5-	77.0	4		
	8		8		
? Double	4.5-	61.2	4		
	8,5-		8,5		
? Double	5-	66.3	4		
	8,5-		9		
		92.5			
1.5-			1,5	95.3	3.6
		97.1			

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	6	63-65.7
	4:	70.0
: fine 4's	9	
		81.5
: Resolvable	4	
		84.4
	9	
	4:	88.0
	1	
	4	89.2
	1	
	4	91.8
	1	
	4	94.1
	1:	94.8
	2	
	1	97.2
	4:	98.0
	8	
Probable		64-01.8
	4	
		04.6
	1	
		05.8
	4	
	1	08.4
	4:	09.1
	9	
	4	11.2
	7:	12.0
	3	
	1	14.4

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7		7.5-		
	99.8			
3		2	01.4	3.3
	64- 03.1			
8		9 3.5+		
	04.9			
1.5-		1	08.8	7.8
	12.7			
8.5-		9		
5-	17.7	4		
8		8.5-		
4.5-	23.8	4		
6?		7.5-		
4.5	24.6	4		
8		8		
7.5-		4 7.5-		
ind	30.2			
2		2 1.5-		
1.5-		1 1.5-	32.8	(5.3)
2		2		
	35.5-			
7		7		
	39.1			
3		3	42.0	5.9
	45.0			
7		7.5-		
	48.1			
2		2	49.4	2.6
	50.7			

2 Douce ?

Indefinite revolution

Partial 15 min observed here

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	4?	64-15.8
	9	
	4?	19.7
	7?	20.6
	1	
	7	23.8
	4	24.5
? fine 4	9	
? Double	4	30.5
	9	
	4	36.1
	9	
	4	43.0
	6?	44.2
	2	
	6?	47.0
	4?	47.8
	7	
	4?	49.9
	6?	50.4
	3	
		53.1
? fine 4	9	
	4?	57.8
	6?	59.0
	1	
	7?	62.2
	4?	62.9
	9	
	4?	66.5
	9	

Double (3rd min about here

Continued on Page 177

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1879phae.proj.1150P

	7			7		
	3		64 - 52.8	3		
	7			7.5		
			56.4	7		
	3			3	~~58.4~~	~~4.1~~
modifiz. resolution	5		60.5	6	Double 60.6	8.4
	3			3	~~62.6~~	~~4.3~~
			64.8			
	8			8.5		
ind			68.2			
	4			4	69.5	(2.7)
Rest-S ind min			70.9			
	8			8		
			74.9			
	4			4	76.3	2.9
			77.8			
	8			8		
			80.9			
	3			2.5	~~88.4~~	~~(3.1)~~
ind	6		84.0	7	Double 85.0	8.3
	2			1.5		
	1.5	392.21		1	~~86.6~~	~~(5.2)~~
	2			1		
				1.5		
ind			89.2			
? fein S'r	8			8		
ind			65 - 09.7			
	4			4	10.4	(1.5)
ind			11.2			
	8			8.5		

Doppelwindung offenbar Halo, Kern doppelt, Rest einfach, Intensität der Linien

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Parent obs. on page 177 here

	65- 08.8
6	
	10.4
4 Resolvable	
8	14.1
4?	14.7
9	
4	18.1
78.2	
4	20.0
9	
4?	24.3
8	
4	27.0
8	
4?	29.3
8	
4	30.8
7?	
4	32.1
7	
4	33.8
7?	34.8
1	
7?	38.4
4	39.4
8	
4?	40.6
9	
4?	44.2
9	
4?	52.8

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Barely Resolvable in Mass. St Carlo

2			2		
		65° = 20,0			
8			8,5		
5		24,5	4?		
8			8,5		
5		26,4	4?		
8			8,5		
		30,3			
2			2,5	32,0	3,3
		33,6			
7,5			8		
5		36,7	4?		
7,5			7,5		
		38,8		~~40.6~~	~~3.7~~
2			2	40.6	3,7
		42,5			
8			9		
		45:6			
1,5			1	47.2	3.2
		48,8			
8			8,5		
		55,8			
4			4	57.2	2.8
		58,6			
1,5	7		8,5		
2	5	62,5	4?		
1,5	7		8		
2	5	66,8	4?		
1,5	7		7,5 8		
?Double 7	5	70,9	4		

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	9	
	4	65-59.0
	8:	
	4	60.4
	9	
	4:	65:5
	7:	66.4
	3	
	7	70.2
3 fin 4'2	8	
		79.7
	4	
		83.7
	8	
	4:	85:7
	8	
	4:	87.2
	7	88.5
	3 4	
Indef.		92.2
	9	
	4:	94.6
	7	95:2
	1	
	7	98.3
	4:	99.4
	9	
	4:	66-03.7
	9	
	4	05.3
	7 8:	
	4	07.8

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	7.5	7			8		
? Double		4		65 - 76.4	4		
	7.5	7			8		
		6					
See page 156				83.0	3		
	7.5	2			7		
		1.5	392.73	86.2	1.5 1		
		4 to 6		~~93.2~~	1.5		
		3			2		
	7.5	5		93.2	7		
		3			2.5		
				94.8			
	7.1	7			9		
				98.1			
		3			2.5	00.0	3.1
				66 - 01.8			
	7.1	7			8.5		
		4		05.6	4		
	7.1	7			8.5		
				08.6			
		2	392.85		2	10.4	3.6
				12.2			
	-1.5				8		
	~~-1.5~~	5			4?		
	-1.5	6			8		
?		5		19.9	4		
	-1.5	6			8		
				23.5			
		3	392.95		3	25.0	2.9
				26.4			

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~~59~~	
4?	66-10.9
8	
4?	16.2
8	
4?	19.2
8	
~~Continued from page 157~~	
4?	20.2
8	
4?	25.0
8	
4?	27.6
~~7~~ 8	
4?	30.0
7	
4	32.3
~~7~~ 8	
4?	33.8
6?	34.5
1	
6?	37.2
~~4~~	38.8
4	
6	42.7
4	
7	45.4
4?	46.1
8	
2-00 P.Mo.	46.2
~~Continued page 157~~	
4	
	51.9

Continued page 157 Test for permanency of position of this page 178

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100

	-1,5	6			8		
				66 - 31,2			
		2	392.98		1	32.9	3.4
				34,6			
	-2,	6			8		
?		4		38,5	4?		
	-2,	6			8		
?		4		41,2	4?		
	-2,	6			8		
		4		45,0	4		
	-2,	6			8		
				47,3			
		3			2,5-	48,9	3.2
				50,5			
	-2,	5-			7,5		
		3		55,7	3		
	-2,5-	4			7		
?		2,5-		64,8	4?		
	-2,5-	3			7		
?		2		76,2	4?		
	-3	2,5-			6,5-		
?		2		83,1	4?		
	-3,5-	2,5-			6,5-		
		2			2		
					1,5-		
				91,3			
		1,5-			1		
?	-4	2,5-	K 393.29	96,6	6?		
		1,5-			1		
				67 - 02,1			

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	-3,5	2,5	6
2		2	6) 06,0
		2	2 1,5
2	-3,5	3	10.8 6?
		2	2
		2,5	3 2,5
		2	2
2	-3,	3	6?
		2	20,1 2
	-2,5	3	6?
		2,5	22,0 2,5
	-2.	3	6
		2,5	33,7 2,5?
	-1,5	4	7
			40,7
		2	2
	-1,5	4	45,7 6
		2,5	3
			47,8
	-1,5	4	7
			50,5
		3	4
?	-1.	4	54,3 6?
		3	4
			56,4
	-1,	4	7
?		3,5	57,5 4?
	-1,	4	7
		3	63,5 4

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?	-1.	5		6	
		4	67 - 65;7	4	
	-1.	6		7	
			70.7		
		2,5-		2	72.1 2.9
			73.6		
	-5,	6		7	
?		5	79.3	4?	
	-5,	7		7,5-	
			83.8		
		3		3	
	-,5-	6	85;4	7	
		3		3	
			87.2		
	-,5-	7		8	
nicht			90,5-		
		2		1.5-	92.9 (4.8)
nicht Rest-5'min			95;3		
	-,5-	7		8	
?		5-	97.2	4?	
		7		8	
?		5-	68 - 02.0	4?	
		7		8	
?		5-	04.8	4?	
		7		8	
?		5-	07	4?	
		7		8	
?		5-	10.8	4?	
		7		8	

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2.	5	68 - 13,8	4:		
	7		8		
2.	5	15,3	4:		
1.5	7		8		
2.	5	20,0	4:		
	7		8		
2.	5	22,8	4:		
	7		8		
		24,5			
	4	3.5	25.7	2.5	
		27.0			
	7		8		
		30.6			
	5		4,5	31.7	2.3
		32.9			
	7		8		
	5	38.9	4.5		
	7		8		
		40.9			
	2		1.5	42.4	3.1
		44.0			
	8		8.5		
	~~2.5~~	47.7			
	2.5		2	49.5	3.1
		51.4			
	7		8		
		53.4			
	3		2,5	54.6	2.4
		55.8			

Barely twinkle visible to the naked eye

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7			8.5		
	68. 58.1				
3			2.5		
7 6		62.4	8		
x 5		63.7	~~8~~		
7			8		
5		68.2	~~8~~		
7			8		
		71.0			
2			1.5	72.8	3.0
Rest 10 min		74.3			
8			8.5		
4		78.7	4		
6			7		
4		80.9	4		
8			8.5		
end		85.6			
3			3	86.8	(2.5)
end		88.1			
6			7		
end		89.7			
3			2.5	91.2	(3.0)
end		92.7			
7			7.5		
end		95.1			
end 4			3	96.0	(1.7)
		96.8			
8			8.5		
x 3		69- 00.1	3		
5		01.7	7		

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Plate 39-40 Continue from page 167

? Double	3	
	7	69-18.9
	4	13.0
? fine 4	8	
? Double	4	17.3
	8	
	4	20.7
	7	21.3
	2	
	7?	23.9
	4?	24.8
	8	
	4	29.0
	7	
	4	30.7
	8	
		35.4
? Double	3	
		37.9
? fine 4	6	
	3	40.1
	6?	
	3	42.0
	6	
		44.0
? Double	4	
		46.7
	7	
v. fine	4	49.6
"	6	
"	4	50.5

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	2				
ind	1.5	394.31	69-04.9	1	
	2				
ind			07.3		
	6			7	
?	5		10.5	4?	
	7			8	
?	5		13.5	4?	
	8			8 ~~9~~	
			16.2		
	3			3	
	6		20.4	7	
	3			3	
			23.8		
	7			~~8~~ 7	
			26.0		
	3			3	
	6		29.1	7	
	3			3	
			31.9		
	8.5			9	
?	5		35.2	4?	
	8.5			9	
	5		38.1	~~4~~	
	8.5			9	
ind			39.3		
	4			4	4.6 (3.6)
ind			42.9		
	8.5			9	
1-50 P.M. ?	5		46.0	4?	

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1879phae.proj.1150P

6?	
82	69 - 51.6
6?	52.6
1	
6?	55.9
2	57.0
6	58.0
4?	58.6
7	
4?	60.1
8 ~~87~~	
4?	62.0
9	
	66.1
3	
	69.3
6	
	70.7
2.5 ~~2~~	
	72.4
7	
	75.6
2.5	
	78.2
6	
	79.4
3	
8	82.0
4?	82.8
9	
4?	86.1
9	

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3-12 P.M.

	8.5		9		
?	5	69 - 47.6	4:		
	8.5		9		
	5	52.5	4:		
	8.5		9		
	4	57.2	4		
	8.5		9		
ind		62.3			
	2.5		2	63.6	(8.7)
ind		65.0			
	8		8.5		
ind		70.1			
	3				
	2.5	74.0	2		
	7	75.8	8		
	2.5		2		
		79.9			
	8.5		9		
		83.3			
	2.5		2	85.0	3.5
		86.8			
	8		9		
ind	4	90.7	4		
	8.5		9		
		95.7		~~98.2~~	~~5.0~~
	2		1.5	98.2	5.0
		70 - 00.7			
	7		8		
		03.8			

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Rect-15 min		69-89.5
Double	4	
		92.9
	8	
	4?	94.7
	8	
		70-04.0
Nebulous	4	
		07.8
	9	
	4?	11.7
	7?	12.3
	2	
	7	15.7
	4	16.6
	9	
	4?	20.2
	7	
	4?	21.0
	7?	22.8
	2	
		25.3
	7	
		26.8
	3	
		29.5
	9	
		33.2
	2	
		36.1
	7	
		57.9
Nebulous	4	

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1879phae.proj.1150P

	2.5⁻		2	05.6	3.6
		70·07.4			
	8.5⁻		9		
?	5⁻	14.8	4:		
	8.5⁻		9		
?	5⁻	16.8	4:		
	8.5⁻		9		
		19.9			
	2		1.5⁻	21.4	3.0
		22.9			
	8.5⁻		9		
incl		27.7			
	3		~~2.5~~ 3	24.6	(3.9)
incl		31.6			
	8.5⁻		9		
?	5⁻	35.5⁻	4?		
	8.5⁻		9		
?	5⁻	39.0	4:		
	8.5⁻		9		
		43.3			
	2		1.5⁻	45.3	4.0
		47.3			
	8		9		
	5	56.0	4		
	8		9		
		60.0			
	3		2.5	61.5	3.1
		63.1			
	8.5⁻		9		
	5⁻	70.4	X4		

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1879phae.proj.1150p

	70-39.8
9	
	46.0
61	
6?	49.7
4	50.3
7	
4?	53.4
6?	57.3
3	
	57.2
? fin 4'2 9	
	70.2
2	
	73.4
9	
	78.2
4	
	81.6
? fin 4'2 9	
4?	90.3
8?	94.1
2	
	97.7
9	
? Double 4?	71-06.1
9	
4?	09.9
7?	10.5
4	
	13.2
9	

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1879phae.proj.1150P

8,5			9		
		70 - 73.7			
1,5			1	75.4	3.3
		76.5			
6			7.5		
		79.4			
3			21.5		
6		83.1	7		
3	395.20		21.5		
		87.2			
8,5			9		
		91.0			
4			4	92.4	2.9
		93.9			
8,5			9		
		97.3			
4			3	98.8	3.1
		71 - 00.4			
8,5			9		
5		03.7	4		
8,5			9		
5		07.2	4		
8,5			9		
		11.1			
4			4		
7		14.6	8		
4			4		
		18.0			
8.5			9		
5		21.0	43		

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3 Draco	4½	71 - 19.4
	9	
	4?	21.4
	7½	23.0
	1	
	7	27.0
	4?	27.9
	7	
		29.6
	2	
	6	33.1
	2.5	
	7?	36.5
	4?	37.2
	8~~9~~	
		40.8
	4	
	7	43.1
	4?	44.0
	4	
	4?	47.1
	7?	47.6
	3	
		50.4
	9	
	4?	53.6
	9	
	4?	56.7
	9	
	4?	60.7
	8?	61.2

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1879phae.proj.1150P

8.5			9		
5		24.3	4:		
7			5.5		
		26.1			
2			2	27.9	3.6
		29.7			
8			8		
5		34.4	5:		
8			8		
		38.9			
3			3	40.7	3.7
		42.6			
8.5			9		
		47.2			
2			1.5	49.2	4.0
		51.2			
6			7.5		
		53.7			
2			1.5	55.4	3.4
		57.1			
8.5			9		
		60.0			
2			1.5	61.5	3.0
		63.0			
8.5			9		
5		68.7	4:		
8.5			9		
		73.3			
4			4	74.3	1.9
		75.2			

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1879phae.proj.1150P

4	
	71- 63.8
8	
	64.9
4	
	67.7
9	
4?	75.4
8	76.5
2	
8	80.3
4?	80.8
9	
5?	88.8
8?	89.8
3	
	92.3
9	
4	96.6
6?	97.8
1	
6?	72- 00.5
4	01.7
7	
	03.8
1.5	
	06.5
9	
4?	09.6
7?	10,1
1	
7?	13.5
4?	14.6
9	

? fin 4's

? fin 4's

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1879phae.proj.1150P

	8		8.5		
		71 - 78.1			
	3		3	79.7	3.2
Vecalw p. 124		81.3			
	8		8.5		
		83.5			
	2		1.5	85.1	3.3
		86.8			
	8		8.5		
ined	4	90.3	4		
	8.5		89		
		93.7			
	4		4	95.3	3.2
		96.9			
3-46 P.M.	9		98.5		

Wed Oct 15 Plate disturbed

10-07 A.M. 1 69 - 04.8

***

7 16.8

3 19.4

6 21.0

3 24.1

***

3 29.6

6

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1879phae.proj.1150P

	84	22.1
	6	
	4	24.9
	9	
		28.1
	84	
		31.5
	9	
		33.9
	2	
		36.7
4? 8	8	
	4?	39.2
	8	
	4?	41.3
	9	
		44.7
	4	
		47.5
	9	
? Double	4?	54.8
	9	
v-fl: 4? double	4	66.8
	9	
		75.0
	3	
		77.8
? fine 4's	9	
		92.2
	3	
		95.6
	7	
Continued page 127	4	97.6
1-5-0 R. No.	6	98.8

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1879phae.proj.1150P

Sat. 15

10-16.4.14.

7

69- 15.9

3

6

3

Disturbance

10-20

68- 40.8

2

43.8

***

70.9

2

74.1

***

Disturbance

10-47

68- 40.8

2

44.0

42.4 42.45 0.05

***

70.9

2

74.4

72.65 72.8 0.15

***

3 99.7 99.7 100.1 0.4

***

6 69- 20.4 20.4 20.4 0.0

***

2 5 46.4 46.4 46.0 0.4

4) 0.6

0.15

Vibration setting to secure continuity of reading with Sat. A.M.

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1879phae.proj.1150P

Belongs with left-hand page.

When counting

	* * *			
	~~2.5~~	69 - 61.8		
	2.5		~~66~~ 63.5-5	63.65 0.0
		65.3		
	* * *			
		70 - 19.9		
	2		21.5-5	21.4 -0.15
		23.2		
	* * *			
		43.6		
	2		45.65	45.3 -0.35
		47.7		
	* * *			
	5	70.7	70.7	70.4 -0.3
	* * *			
	7	70 - 14.6	14.6	14.6 0.0
	* * *			
		60.1		
	2		61.85	61.5 -0.35
		63.6		

6 / ~~-0.41.5~~
~~-0.9.19~~
~~+0.21.5~~
0.34

From above it appears that readings of today are one or two tenths less than those of Sol. A. M. on odd lines, that readings of today are about two tenths more than readings of Sol. P. M., and that readings of Sol. P. M. are about three tenths less than those of Sol. A. M.

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1879phae.proj.1150P

Col. 15 Plate 39 continued

N-17 A.C.

	4	Copies from p. 120		4		
			(75.2)			
	8,5-	8.5		~~8~~ 8.5		
		78.1	78.6			
	3	3		3	80.0	2.7
		81.3	81.3			
	8	8.5-		8,5-		
		83.5	83.7			
	2	1.5-		1,5-	85.1	2.9
		86.8	86.6			
	7,5-	8.5-		8,5-		
	5-	4 90.3	90.8	4		
	8	9		9		
		93.7	94.2			
	4	4		4	95.7	3.1
		96.9	97.3			
	8	8.5-		8.5-		
?	5-		72-01.0	4:		
	8			8.5-		
? Double	5-		04.9	4		
	7.5-			8		
? Double	5-		09.6	4		
	8			8.5-		
? Double	4		17.9	4		
	8			8.5		
?	5-		21.8	4?		
	8			8,5-		
			25.1			
	3			3	26.7	3.2
			28.3			

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	8			8.5		
?	5		72 - 32.0	4?		
	7.5			8		
?	5		36.7	4?		
	7			7.5		
?	5		39.5	4?		
	6			7		
			42.7			
	3			2.5	44.1	2.9
			45.6			
	6			7		
	4		48.6	5-4		
	5		49.2	6		
	1.5	396.07		1		
	5		53.2	6		
	4		53.3	~~4~~ 3.5		
	5-6			6.5		
?	4		56.7	4		
?	6			7		
	4		59.2	4		
	7			7.5		
			62.3			
	3			3	63.5	2.4
			64.7			
	7			7.5		
			67.0			
	3			3	68.1	2.3
			69.3			
	6			6		
	5-		73.7	~~4~~		

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1879phae.proj.1150P

Plate 39-40 Continued from Page 121
Test of permanence of twists of Plate Page 178

Oct 23-9:49 M.T.	1	72-99.8
	6?	73-00.5
	1	01.5
	6?	02.3
	3?	03.1 / 02.9
	7	
? Double	3?	06.2
	8	
		10.8
	3	
		14.3
	7	
	6?	15.7
	6?	16.2
		15.6
	3	
		18.9
	8	
	4	
		22.7
	8	
		25.7
Nebulous	4	
		28.2
	8	
	4?	29.9
	6?	30.6
	2	
	6?	33.8
Red 8 min.	4?	34.4
	8 8	

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	7			7.5		
			72 - 75.6			
Perhaps Zone	4			4	77.1	3.0
			78.6			
	8			8.5		
			81.4			
	2			1.5	83.0	3.3
			84.7			
	8			8.5		
Perhaps Zone	4		87.1	4		
	8			8.5		
			92.5			
	2.5			2	94.0	3.1
			95.6			
-.5	8			8		
	5		99.1	4		
-.5	8			8		
	5		99.9	4		
-.5	8			8		
			73 - 03.6			
	2.5			2.5	05.2	3.2
			06.8			
-.5	7			7.5		
			09.4			
	2.5			2.5	10.7	2.7
See also page 168			12.1			
-.1	7			8		
	5		16.4	4:		
-.1	7			8		
	5		19.4	4:		

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v fine	4	36-37.5
	7	
" "	4	38.9
	8	
		41.3
	3	
		44.6
	8	
v fine	4	47.6
	7	
	4	48.9
	8	
	4?	52.1
	6	52.9
	3	
	6	55.9
	4?	56.7
	7	
		58.2
	3	
	6	61.6
	4?	62.2
?. fine 4?	8 ~~X X~~	
? Double	4	74.0
	~~X~~ 8	
		77.9
? Double	4	
		81.1
	7	
	4?	83.3 ~~36~~
	7	
Continue in 171	4?	84.5

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-.1	6			7.5		
Perhaps Double	4 5-		23-24.2	4		
-.1	5-6			7.5		
inc			28.8			
	4			3	30.0	2.3
inc			31.1			
-1.	6			7.5		
Perhaps Double	4		34.8	4		
-1.	5-			7		
inc			39.9			
	3			2,5-	41.4	3.0
			42.9			
-1.	7			8.5-		
Shaded			49.8			
	2,5-			2	51.7	3.9
			53.7			
-1.5-	6			7		
	3		58.4	3		
-1.5-	5-			5-7		
	3		68.5-	3		
-2.	5-			7		
	3		72.5-	3		
-2.	5-			7		
			80.0			
Perhaps Double	2			1.5-	82.1	4.2
			84.2			
-2.5-	5-			7		
			88.0			
	2	396.76 = H		1.5		
-2.5 ?	6		90.6	7?		

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		2		1,5-	92.0	2.9
			93.5-			
	-2.	6		7.5-		
			97.5-			
		3		2,5-	98.5	2.1
			99.6			
	-1.5-	6		7.5-		
			04.4			
		2	396.87	1.5-	04.4	4.1
			06.5			
	-1.5-	7		7.5-		
?		5-	10.3	4?		
	-1.	7		7.5-		
incl		x3	13.8	2,5-		
in	-1.	6	14.5-	7		
in		3	15.4	2.5-		
in	-0.5	6		7		
in		4	19.7	3		
	-0.5	6		7		
			25.6			
		3		x3		
?	-0.5-	5-	27.0	6?		
		3		x3		
			?			
?	-0.5-	6	29.8	7		
?	?	4	30.9	4		
	-0.5	6		7		
		4	40.2	4		
	-.5	6	40.8	7		
		4	41.6	4		

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Rest - 30 min.

Boundary between different kinds of water

-.5°				
	7		7.5-8	
		74-44.6		
2.5°			2	45.9 2.6
		47.2		
	8		8	
	5°	51.8	4	
			8	
	5°	52.2	4	
		53.3	8	
	5°	58.1	4	
			8	
		61.4		
2.5°			2	62.0 3.1
		64.5°		
	7		7.5°	
		68.2		
2.5°			2	~~69.3~~ ~~2.2~~
	6	70.4	7	
2.5°		71.0	2	
	7		7.5°	
		75.5°		
	3.5°		4	76.8 2.6
		78.1		
	6		7	
		80.2		
	3		3	82.0 3.6
		83.8		
7.5°			8	
5°		85.4	4	

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Block 39-40 Continued from page 173

4?	25-09.7
6	10.3
2	
	13.5
8	
4?	15.3
8	
	~~16.2~~
3	
7	15.9
3	
7	18.4
4	19.7
7	
4?	21.3
7	
4?	22.8
7	
4	25.0
6	
4	26.4
6	
	28.9
4	
7	32.6
4?	34.1
8	
4?	37.3
7	38.3
2	
	42.4
7	

Duplex.

~~Duplex~~

? Double

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8.5		8.5		
	74-89.4			
2		1.5	91.0	3.3
	92.7	8		
7				
	96.0			
4		4	97.3	2.6
	98.6			
8		8		
	99-01.1			
4		4	02.1	2.0
	03.1			
8		8		
	05.8			
2.5		2	07.5	3.5
	09.3			
6		7		
	11.5			
2.5		2	13.7	4.4
	15.9			
8		8.5		
? 5	19.2	4?		
8		8.5		
	?			
4	23.4	4		
	?			
8		8		
? 5	27.8	4?		
8		8		
? 5	31.7	4?		

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1879phae.proj.1150P

	4	75- 45.1
	6:	
	4	46.9
	8	
		50.3
? Double	4	
		52.3
	8	
	4:	55.0
	6:	55.6
	8	
	6:	57.7
	4:	58.2
	6	
		~~60.6~~
~~? Double~~	~~2~~	
Rel 20 min		~~64.5~~
	4:	60.0
	6:	60.8
	2	
	6:	64.1
	4:	65.1
	8	
	4:	67.9
	8	7
Bad.		70.5
Poor resolution ? Double	34	
Bad.		74.0
? Just 4' R	8	
		82.9
	47	
		886.1

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8	~~75 34.3~~	8.5		
	75 34.3			
3		3	35.5	2.5
	36.8			
7		8		
	39.5			
3		3	40.8	2.6
	42.1			
8		8.5		
	45.0			
4		4	46.2	2.4
	47.4			
8		8		
	49.2			
1.5		1.5	40.9	3.4
	52.6			
7		7.5		
	55.0			
4		4	56.3	2.6
	57.6			
8		8.5		
5	61.9	5		
8.5		9		
5	64.3	4		
8	68.1	8.5		
5	~~66.1~~ 62.2	4		
8.5	~~71~~	9		
	71.8			
2		2	73.4	3.3
	75.1			

ine

ine

Perhaps Double

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1879phae.proj.1150p

	7	
		75-87.9
	4	
		91.0
	8	
Pnd		93.7
? Double	4	
Pnd		96.7
	8	
	4?	98.0
	7?	98.5
	1	
	6?	76-01.6
	4?	02.6
	7	
Pndef.		03.8
	4	
	6?	06.4
	4?	06.9
	9	
	4?	09.5
	9	
	4?	11.7
	9	
	4?	16.7
	9	
	4?	18.3
	9	
	4?	20.3
	7?	20.8
	2	
		24.0
	9	
? Double	4?	29.4

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1879phae.proj.1150P

	8		8,5		
?	5	75-77.8	4:		
	8,5		9		
	5	80.6	4		
	8	81,5	8,5		
	5	82.8	4		
	8		8,5		
		85.2			
	3		3	86.6	2.8
		88,0			
	6		7		
		90.3			
	3		3	91.9	3.2
		93,5			
	8		8,5		
	5	96.3	4		
	8,5		9		
Outburst Comet	5	76-02.2	4		
	8,5		9		
	5	06.8	4		
?	6	07.8	6:		
	3		3	(09.6)	
	7	11.5	8		
	5	12.4	4		
	8		8,5		
4	5	19.0	4		
	8,5		8,5		
?	5	24.9	4:		
	8,5		9		
		29.2			

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1879phae.proj.1150P

	887	
		76. 34.4
	3	
		37.2
	7	
	4?	38.8
	7	39.7
	3	
	7?	42.4
	4?	43.3
	8	
	4?	44.7
	8	
? Double	4	50.0
	8	
	4?	55.9
	6?	56.9
	3	
	6	60.7
	4	61.6
	8	
	4	68.0
	8	
	4?	72.9
	8	
	4?	78.0
	6?	78.7
? Double	4	
		82.0
	8	
	4?	86.0
Observation Revolution	7	
	4?	87.7
	7	
	4	89.1

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1879phae.proj.1150P

4		4	30.9	3.4
	76 - 32.6			
8, 5-		9		
	2			
3, 5-	39.3	3, 5-		
4		4	40.7	
3	42.2	3		
	44.4			
8		8, 5-		
5-	47.2	4		
7		8		
5-	49.9	4		
8		8, 5-		
	51.9			
2 2, 5-		2	53.6	3.4
	55.3			
7		8		
	57.0			
3		3	58.3	2.7
	59.7			
8		8, 5-		
5-	62.9	4		
6, 5-		9		
5-	66.0	4		
6	67.0	6		
3		3	(6).3)	
6	68.7	6		
3		3		
	71.6			

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1879phae.proj.1150P

6?	
4	76-91.7
6	
4?	93.5
8	
4	97.7
8	
4?	99-00.5
6?	01.2
2	
	04.3
7	
	05.2
2.5	
	05.8
8	
4?	~~15.3~~ 11.5
8	
4?	15.3
6?	15.9
2	
6?	18.0
2	
8	20.7
4?	21.4
8	
4?	24.9
6?	25.6
3	
	28.0
7	
	29.9

½ Double

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1879phae.proj.1150P

8,5		9		
	76-75.1			
3		3,5	77.1	4.1
	79.2			
7		8		
	81.0			
3		3,5	82.2	2.5
	83.5			
8		8,5		
5	86.8	4?		
8		8,5		
5	89.0	4		
7		8		
5	90.6	4		
8,5		9		
	95.1			
2		1,5	96.5	2.9
	98.0			
7		8		
	77-00.4			
3 4		2,5	01.3	1.8
	02.2			
7		8		
	04.3			
3 4		2,5	05.4	2.2
	06.5			
8,5		9		
	09.6			
4		3.5	11.5	3.8
	13.4			

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	3	
	7	77 - 32.3
	4?	33.1
3 in 4	7	
	4	37.9
	~~7~~	
	4	39.5
	8	
	3	44.7
	6?	45.1
	~~1~~	
	6?	46.6
	3	47.2
	7	
		49.3
See page 178, 9	4	
		51.1
	7	
	4	53.5
Poor light -	6?	54.4
12-50 Pitts.	4	55.2
Test of pressure of plate page 178		
Oct 25 -	8	
10-15 A.M.	4?	58.5
	6	59.0
	4	~~57~~
	6?	61.1
	4?	61.8
	7	
	4?	64.4
	6?	64.9

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	8			8		
			22 - 15;8			
	4			3,5	17.0	2.3
			18.1			
	8,5			8,5		
?	5		22,2	4:		
	6		22,9	7		
	3			2,5		
			26,8			
	8			8,5		
?	5		31,2	4:		
	8,5			9		
?	5		37,1	4:		
	8,5			9		
			40,3			
	3			3	42.0	3.4
			43,7			
	8			9		
?	5		47,1	4:		
	8			9		
			51,6			
	2	398.59		1,5	53.3	3.5
			55;1			
	6			8		
			57,9			
	2	398.65		2	59.5	3.2
			61,1			
	8			8,5		
?	5		66,2	4:		

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4	
6?	77-66.7
4?	67.3
8	
4?	70.8
6	71.8
2	
	76.2
9	
4?	
8	79.6
4?	
9	
4?	
8	85.0
4?	
9	
4?	88.7
6	89.1
2	
6	91.7
4?	92.5
8	
4?	99.7
6	8-00.8
1	
6?	03.5
4?	04.6
7	
4?	06.2
6?	06.9
2	
6	10.0
4?	10.8
8	

Rest 8 min

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1879phae.proj.1150P

	8.5-		8.5		
		77. 68.8			
	4		3	70.2	2.8
		71.6			
	8.5-		9		
	5-	76.3	4		
?	6		6?		
	5-	78.6	4		
	8		8.5		
		86.6			
	4		3	88.2	3.3
		89.8			
	8.5-		9		
?	5-	94.4	4?		
	8		8.5-		
		96.9			
	3		2.5-	98.8	3.9
		78- 00.8			
	8.5-		9 ~~5.8~~		
		11.9			
	1.5-		1	14.1	4.5
		16.4			
	8		8.5		
?	5-	17.9	~~4? 5.8~~		
	8		8.5		
?	5-	21.1	4?		
	8		8.5		
		23.7			
	3		2.5-	25.3	3.3
		27.0			

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? Double	4?	18-14.0
	8	
		17.6
	~~3~~	
? Double		20.3
	9	
	4	25.3
	8	
	4	27.3
	9	
Fund.		35.5
	4	
Fund.		38.9
	9	
Fund		45.5
	2	
Fund		50.2
	9	
	4?	60.3
	6	61.4
	1	
	6	64.7
	4?	65.4
	8	
(Fund)		72.6
(Fund) (Fund) = rather indefinite	3	
		75.8
	9	
? Double	4?	78.4
	9	
	4?	84.3
	9	
(Fund)		87.5
	3	
(Fund)		91.1

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	8		8.5		
	5	28-29.5	5		
?	6		7?		
	5	31.0	4		
	8.5		8.5		
?	5	35.3	4?		
	8.5		8.5		
		38.7			
	3		2.5	40.4	3.5
		42.2			
	8		8.5		
		45.6			
	4		4	47.0	2.9
		48.5			
	7		8		
		50.7			
	3		2	51.7	2.1
		52.8			
	8		8.5		
?	5	56.2	4?		
	8.5		9		
		60.9			
	4		4		
?	6	65.2	7?		
	4	66.5	4	(65.8)	
	7		8		
?	5	69.8	4?		
	7		8		
		73.1			

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1879phae.proj.1150P

	8	
* Ind		78 - 94.3
? Double	4	
* Ind		96.8
	7	
(Ind)		99.4
	3	
(Ind)		99 - 02.1
	8	
Ind		09.7
	4	
~~D - Ind~~	6?	14.5
Ind	4?	15.5
? fuz 4	~~8~~	
		22.0
	3	
		24.9
	7	
		27.8
	3	
		30.4
	8	
? Double	4?	33.5
	9	
	4?	39.4
	8	
	4?	41.3
	8	
Ind		45.0
	3	
	6?	47.6
	3	
Ind		50.7

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8	3		3	74.4	2.7
		78 - 75.8			
	7		8		
		78.7			
	3		3	80.0	2.6
		81.3			
	8		8,5		
?	5-	86.8	4?		
	8 7		8		
?	5-	92.2	4?		
	7		8		
	4	96.6	4 3		
?	6	97.9	7?		
	3		3		
		99 - 01.6			
	8		9		
		07.1			
	3		3		
	6	10.2	7		
	3		3		
		12.2			
	8,5-		9		
		21.8			
	2		1,5-	23.7	3.8
		25.6			
	8		9		
	5-	32.8	5-		
	7		8		
		36.9			

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	9	
(Bud)		79- 55;3
	3	
(Bud)		58,3
	6	
(Bud)		59.8
	3	
(Bud)		62.6
? fine 4's	9	
	4?	70,2
	6?	70,8
	1	
	6?	75,0
	9?	75,7
	9	
Bud. ? Double	4	81.3
	9	
		85,2
	3	
		88.8
	8	
Bud		91.1
	4	
Bud		94.0
	8	
	4?	98,2
	8	
	4?	80-02,5
	8	
	4?	04.8
Bud.	7?	05.6

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	3		3	38.1	2.4
		39.3			
	7		8		
		42.1			
	4		4	43.5	2.8
		44.9			
	8		9		
?	5-	49.0	4?		
	7/6		7		
Pseudofinite		56.0			
Probably Double	4		4	(58.5)	(5.0)
Pseudofinite		61.0			
Overexposed	7		8		
		64.5			
	2		1.5	66.4	3.9
		68.4			
	8.5-		9		
Pseudofinite		75.3			
Probable Double	2.5-		2		
Pseudofinite		80.7			
	8.5-		8.5-		
?	5-	86.8	4?		
	8		8.5-		
		89.8			
	2.5-		2		
2-00 P.M.		92.8			

N. B. Disregard the scratched out readings estimates of opacity. The columns following the screw-reading were made Oct 16 after the experience of the earlier attempts.

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1879phae.proj.1150P

	4	
Band	7	80-08.9
	4?	09.7
	9	
	4?	13.3
	6?	13.9
	1	
	6?	17.1
	4?	17.7
	9	
	4?	23.7
	6?	24.4
	2	
	6	27.2
	2	
	6?	29.9
	4?	30.7
3 fine 4's	9	
	4?	37.8
	6?	38.4
	2	
	6?	41.5
11-58 A.16.	4?	42.3
	9	

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1879phae.proj.1150P

156 Plate 39

Oct-17 Re-measurement of position under feeble illumination

4-07 P.M.

	Preceding edge, from p. 94						
	Plate	Screw		This time only.	Mean of both times		
4	3	83.0	65-83.0		83.0		
8	7		85.4				
1	1	86.2		86.5	2.3	86.4	
			87.6				
6	1.5		89.0				
3	2		91.2				
7	7	93.2	93.5		93.4		
3	2.5	94.8	94.9		(204) 94.8		
*** 9	9						
9	* * *						
		08.6	66-09.3		~~09.0~~		
2.5	2				10.7	3.6	
		12.5	12.5		~~12.5~~		
7	8						
4.2	4.2		14.7				
7.5	8						
4	4	19.9	19.8		19.8		
7							
4.2			24.2				
8	8						
		23.5	24.1				
4	4				25.2	2.9	
		26.4	27.0				
7	8						
4.2			28.8				
7							
4.2			30.7				
		31.2					
6			32.0				

Effect of larger aperture, but otherwise same as in reverse to Oc.

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1879phae.proj.1150P

Plate 39-40 continue from page 99 Oct-22

~~9-5 A.M.~~ ~~4~~ 66-(4 ~~5.2~~ 5.5)

(4)

9-57 A.M. 6?

49.2

4

7?

51.5

4

52.2

8

4

53.3

7

4

54.7

8

4

57.6

7?

58.3

4

61.2

Ill-defined 4 lines 7

Indefinite

72.9

Probably Double 4

75.1

7

76.8

4?

77.6

7

4?

79.9

7?

80.7

1

6?

82.8

1

6?

84.9

4?

85.5

7

4?

88.3

7

4?

90.1

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		~~31.2~~	~~(33.0)~~				
1	1						
		34.6	66 - 34.9				
4?	8						
5?			36.1				
4							
5?	7		38.0				
8?	4?	38.5		? Double 38.5	0.9	38.5	If not on the Obse written ?
5?			38.9				
4	8						
5?	4?	41.2	41.4			41.3	
8	8						
4	4	45.0	44.8			44.9	
8	8	47.3					
4			48.0				
6			48.8				
2.5	2.5						
		50.5	50.7				
7.5	7.5						
			54.3				
3	3	55.7		55.3	2.1	55.5	
			56.4				
7.5	7						
4?			60.7				
7							
4	4?	64.8	65.3			65.0	Perhaps Double
7	7						
4?			69.1				
7							
4?			74.2				

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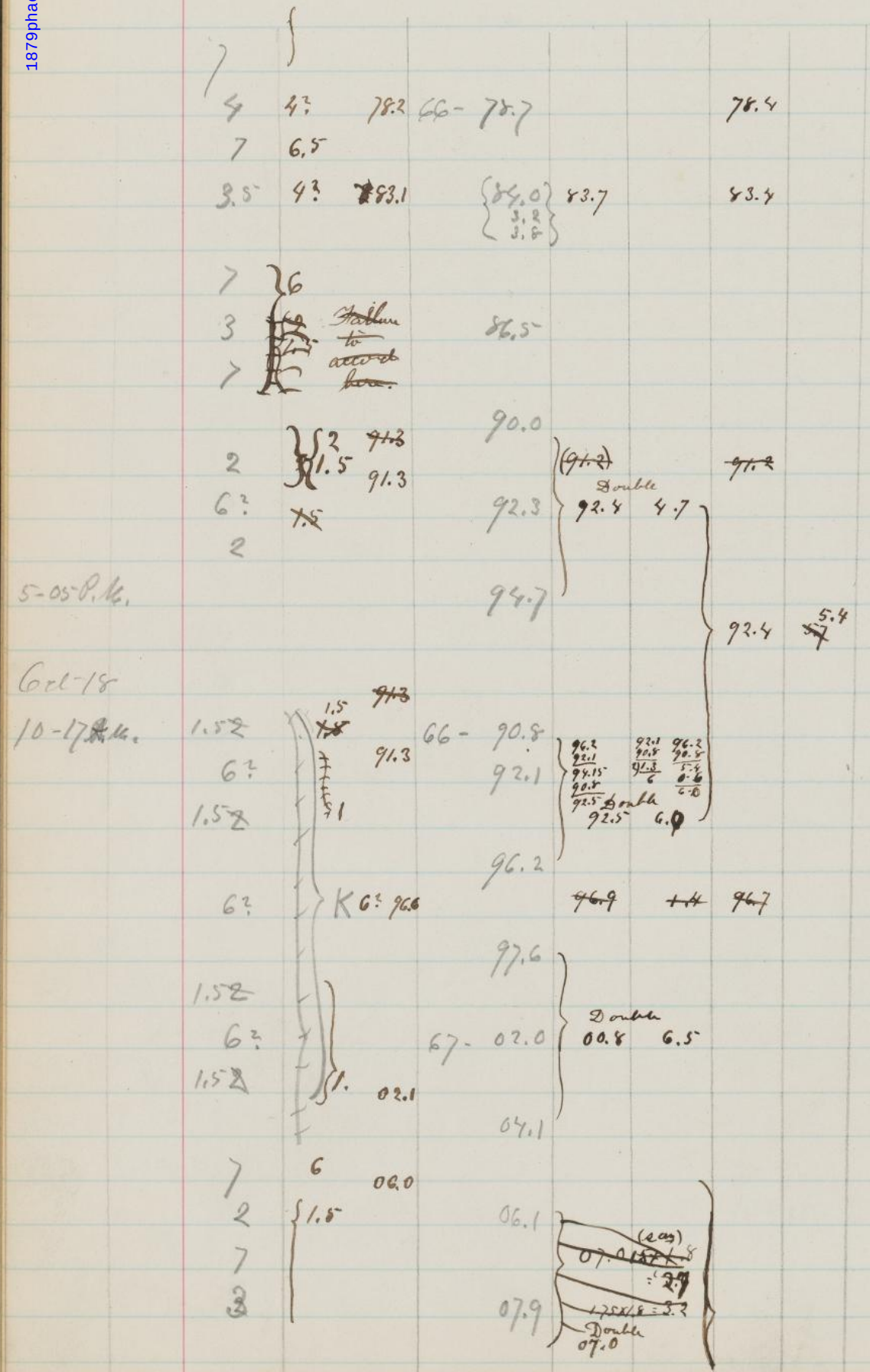
1879phae.proj.1150p

	7	
	4?	94.5
	7	
	4?	~~95.7~~ 97.6
	6?	98.1
	2	
	6?	67- 00.1
	4?	01.1
	6	
	4?	02.1
	6	
v-faint	~~4?~~	~~04.8~~ 03.3
	6?	
v-fl.	4	05.7
	6	
	4?	13.7
	6	
	4?	~~15.6~~ 16.5
	6	
	4?	20.0
	6	
	4?	21.0
	6	
	4?	28.2
	6	
	4?	32.3
	6	
	4?	34.6
	6	
	4?	37.0
	6	

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Note when seen on line of a double, use this diff. for the width of ½ line. Add 50 percent for width of "3 line" and 100 percent for width of "5 line."



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1870phae.proj.1150p

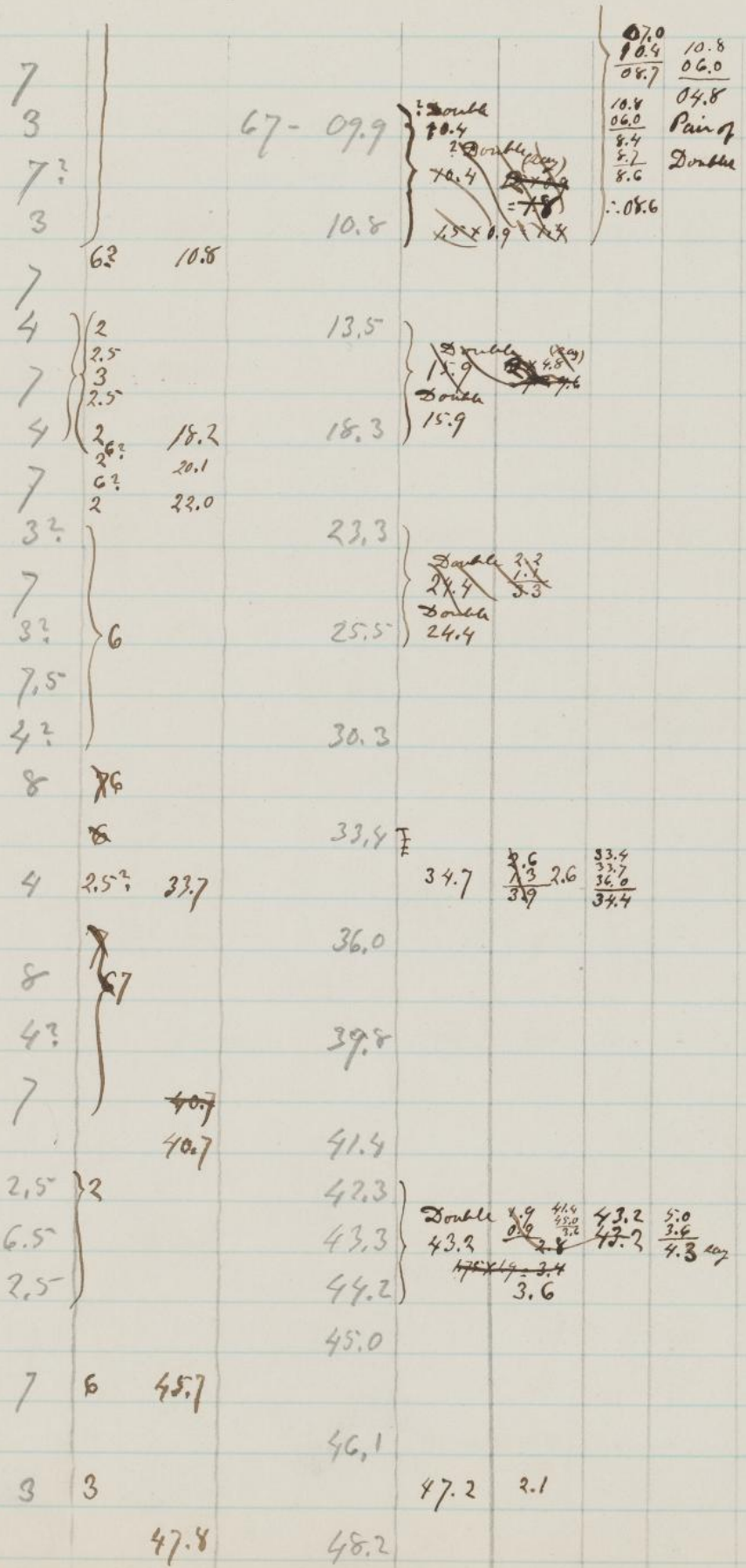
The general lowering of the opacity corresponding to any given value of the estimate is left for future investigation both for the H and the K varieties.

	67 - 40.5		Absolutely to attempt
6½		42.8	Utmost of reserve.
8 2		43.2	
6½			
8 2		45.7	
6½			
2		47.8	
6½			
2	50.7		
			Akabone
2	67 - 40.0		40.5
6½			
2		42.7	
6			
2 1		46.3	
6½			
1		48.7	
6			
See page 163 4½		55.1	
6½			
4½		56.7	
7			
4½		67.5	
6			
4½		69.0	
7			
		83.6	
Prob. Double 4			
		84.9	
7 3			
3		91.7	

Even this is obtained by deciding into what part of the space between the reversed and unlikely measurements which will stand on safe with the conclusion of that assumption.

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	4?	67-55.1
	6?	
	4?	56.7
	7	
	4	67.5
	6	
	4	69.0
	7	
		83.6
Probably Double	4	
		84.9
	7	
	8?	91.7
	X6	
	2	93.0
	6	
		94.5
Prob. Double	3	
		96.4
	7	
	4?	99.6
	6	
	4?	68-01.3
	7	
? Double	4?	05.3
	7	
	4?	13.4
	6	
	4?	16.0
	7	
	4	18.4

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1879phae.proj.1150P

8	7	58.5					
4? 4 7 4?	4		57-	57.3	? Double 52.4	52.4	(3.8)
				52.2			
				~~57.9~~			
				53.5			
8	6?	54.3					
4	4	56.4		56.3			
8	7 4?	57.5					
4 6? 4	7			61.6	? Double 62.2		
		63.5		62.8			
8	6						
4	4	65.7		65.6		65.6	
6 4? 8 4? 8.5	7			66.2			
				68.7			
		70.7			~~2 Double~~		
3 6? 3	2	~~70.7~~		71.0	2 Double 72.4	72.3	(2.9)
				71.7			
		73.6		73.8		73.7	
7.8 8.4 8 4 7	7			75.0			
				76.1			
4	4?	79.3		79.7			
8	7.5						
2.5	3			85.2	Double 86.0	Single(?) 85.7	
7 4.5	7 3	85.4		86.0			
				86.9			

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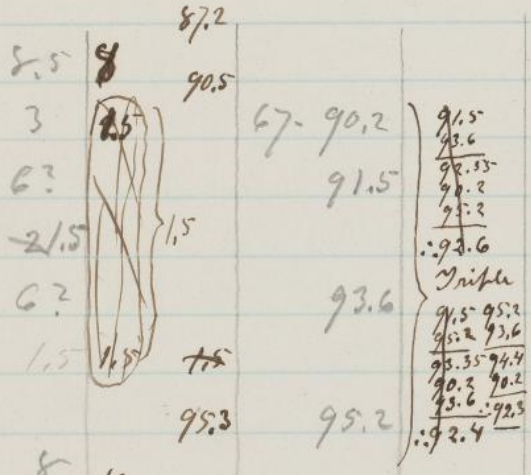
1879phae.proj.11500

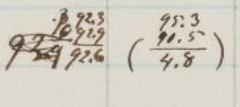
	7	
	2	68-20.8
	6	21.9
	2	
	7	22.3
	4?	24.6
	7~~8~~	
Pointing seen but position unmeasurable*	4	~~27.7~~
	6	
	4	
?. fine 4	7~~8~~	
	4	34.1
	7	
	4	36.3
	8	
	4?	39.6
	6?	40.3
	1	
	7~~8~~	45.5
	4	46.7
?. fine 4's	7~~8~~	
	4?	53.3
	8	
?. Double	4?	57.8
	8	
	4?	62.7
	8	
	4?	65.1

* Seen clearly seen in part of field not occupied by "spider-line". But broken up in part occupied by "spider-line".

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8	8			
4	4?	97.2	97.2	97.2
8.5	8			
4?	4?	02.0	68-01.9	02.0
8.5	8			
4?	4?	04.8	04.4	04.6
8.5	8			
4?	4?	08.7	08.4	08.6
8	8			
4?	4?	10.9	11.3	11.1
8.5	8			
4	4?	13.8	13.5	13.6
8.5	8			
4	4?	15.3	15.9	15.6
8.5	8			
4?	4?	20.0	18.7	
8.5	8			
4?	4?	22.8	22.3	22.6
9	8			
		24.5	25.1	24.8
3	3.5			
		27.0	27.2	27.1
	8			

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1879phae.proj.1150P

3 fine 4's

8	74
	68-74.3
3	
7	76.9
4:	77.3
8	
4	80.5
6:	
4	82.4
8	
4	87.0
9	
4:	90.6
1:	91.1
2	
7	93.4
4:	94.0
9	
4:	96.3
8	97.6
2	
6:	69-00.5
4	01.2
8	
4:	02.6
6:	03.5
3	
1:	05.6
4:	06.4
8	
4:	07.8
6:	08.4

See page 109

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1879phae.proj.1150P

9	8	30.6			
4	4.5		6δ – 31.1	? Double 32.0	(2.3)
8?					
4		32.9	32.8		
9	8				
4?			36.9		
8?					
4	4.5	38.9	38.6		
9	8				
4		~~40.9~~ 40.9	40.6		
7? ~~6?~~			41.5		
2	1.5				
7?		44.0	43.8		
4?	8.5		44.4		
9					
4			46.4		
8					
		47.7	48.3		
2	2				
✳	✳	✳	✳ ✳		
2					
8	8				
4?	4?	16.4	3–15.8		
✳7.	8				
4?	4?	19.4	18.1		
8	7.5				
4?	marked		23.6		
7?	4?	24.2			
4?	"nebula double"		28.0		

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8 7.5
4?
7?
3 3 ~~3~~ 31.1
7?
4
7 7.5
4 4 34.8 34.5
7 35.4
? 4 36.4
7 7
39.9 40.6
3 2.5
6?
3 42.9 43.7
8 8.5
4?
7.5 46.3
49.8
3 50.8
6 52.4
3 2 53.8
7 7
4? 55.2
7 7
4 8 58.4 59.0
7 7
4 61.3
Rest-15 min 7
4 67.2
7?

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Plate 39-40 Continue from p. 129

	7	
	2	73-89.8
	6	90.7
	2	91.7
? fine 4's	8	
	4?	95.1
	8	
	4?	?
	7	
	3	99.7
	6	74-01.8
	2+5	02.5
	7	
? Double	4	07.4
	7	
	4	16.3
	6	
	4	18.1
	6	
		28.6
	1	
	6?	
	1	
		32.3
H	6	
		36.3
	1	
	6?	
	1	
		42.4
~~fine~~ ft.	6	

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4 3 68.5 73-68.8
7 7
4 3 72.5 71.7
7 7
2½ 74.3
7
4½ 77.5
7
4½ 79.4
7 80.0
3½ 81.0
7 1.5
23 83.1
84.2
6 84.4
23 85.3
6
3½ 87.4
6 7
2 H 88.0
1.5 89.4
6 7½ 90.0 90.6
2 1.5 91.4
6½ 2.2 91.9
2 92.9
93.5
1 7.5 97.5
4½ 97.7
7 2.5
4½ 99.5
99.6
7 7.5
02.4
3 1.5 74-02.5
7

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fl.	4	74-46.2
	6	
	4?	49.4
	~~6~~	
~~o~~ fine	4	57.4
	6?	52.2
	2	
		55.4
? fine 4'2	7	
	4	62.3
	6	
	4	63.9
	7	
	4	68.7
	6	
	4	69.8
	7	
	4?	71.6
	7	
		73.5
? Resolvable	4	
		77.2
? fine 4'2	7	
? Double	4	88.7
	7	
	2	93.7
	6?	
	2	95.5
	6	
	4?	96.7
? fine 4'2	8	
Continued	page 135	

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23			74-04.0
6½	1.5		
2		06.5	06.0
8			
4½			9 14.7
4½	7.5		
4½	4½	10.3	10.7
8	7.5		
3	2.5	13.8	13.6
8	7	14.5	14.5
3	2.5	15.4	15.5
7.5	7		
4	3	19.7	19.8
7½			
4			20.4
7.5	7		
4½			22.7
7.5		25.6	
3½	3		25.7
6½	6½	27.0	26.5
3½	3		27.4
	shaded		
7½	7	29.8	
3½	4	30.9	30.3
8	7		
4½			33.7
8			
4½			34.8
8			
4½	4	40.2	34.6
7	7	40.8	
4½	4	41.6	40.9

12-45-P.M.

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Continued to page 133

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Continued from page 83 – Page need here to prevent over-running there.

(7)

4½	62-00.3		
9		01.6	
4½	02.9		
9			
3	05.1		
6 7	06.3		
		6.8	
3	07.2		
6½	08.0		
1		09.4	(5.2)
7½	11.2		
3	12.0		
9			
3 ~~4~~3	13.8		
7½		14.7	[1.9]
3 ~~4~~3	15.7		
9			
4	19.6		
9			
4	24.4		
9			
	28.0		
3 7½		29.4	(2.9)
7½	30.6		
		30.9	
4½	31.2		
8			
4	33.0		
7½		33.9	[1.8]
4	34.8		
8			

Continue on page 85

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continue from page 93

V. fl:	4	64-71.1
	9	
	4?	74.6
	9	
	4?	78.6
	7	
	4	81.0
	7?	81.7
	1	
	7	85.3
	4	86.1
	7	
	4?	87.5
	7	
	4	89.2
	7	90.2
	4	
	7	92.4
	4	94.7
		95.8
	8	
	4?	97.3
	6?	98.1
	3	
	7	65-01.0
	4	02.2
	7	
	4?	07.2
	7?	07.7
	3	

Continue on page 95

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Plate 39-40

Oct 22 9-45 A. M. Test of fidelity of plate over night

	New.	Yesterday page 99	
4	66 - 32.3	32.3	Hence we conclude that
×××			
7	45.3	45.4	plate is undisturbed.
×××			
4	46.1	46.1	

Oct 24

	New	Previous page 121	Diff	
4	72 - 22.8	23.1	+ .3	Hence that
×××				
4	24.8	24.9	+ .1	plate is
×××				
8				undisturbed
4?	37.9			
8				
4?	37.2	39.2	.0	
8				
4?	40.7	41.3 evidently not identical	~~.6~~	
9				
××4				
4	97.8	97.6	- .2	
6	98.8	98.8	.0	

Better not try to give the resolution of this pair.

Oct 25

page 145

4	77 - 37.7	37.9	.2	
×××				
4	39.3	39.5	.2	Plate now under .25 or .3
×××				
3	44.4	44.7	.3	less than formerly.
×××				
3	46.9	47.2	.3	See page 179
×××		49.3		
3 4	49.4	(49.95) (50.2)	.25	
6?				
3 4	50.3			
		51.1		
×××				
3 4	53.3	53.5	.2	
6?	54.0	54.4	.4	
3 4	54.9	55.2	.3	

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Continue from page 178

Plate distortion

4	77 - 37.9	37.9	.0	From this we may conclude that the plate has been probably re-adjusted.
×44 4	39.4	39.5	+.1	
×××				
Better illumination than previously ×3	49.6			
6?				
×3	50.7			
×44				
×3	53.6	53.5	-.1	
6?	54.6	54.4	-.2	
×3	53.2	53.2	0	

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Rutherfurd Plates

May 10/79	Indexing records and other matter allied – at Obs.	3 hr.
May ?	With Jamin and at Obs. concerning micrometer. (About)	2 "
"	Describing apparatus &c. concerning committee circular (About)	2 "
		7 "

July 17	11 to 1¼ & 3 to ~~6~~ 5¾	(Clerical, arranging mss. & 2 hr. obs.)	5 "

~~July~~	In New Hampshire	5 hr. Refraction (clerical)	5
Sept. 10 to 17	In New Hampshire	3 hr. Refraction (clerical)	
Sept 18/79	~~8 hours Refraction~~	8 hours Refraction	
19	~~8 " "~~	8 " "	
20	5 " Rutherfurd		
24 7	5½ " "		
29	6 " "		
	16½		
Oct 2	4 " "		
" 7	6 " "		
" 8	2 " "		
	~~1 " Refract~~	1 " "	
9	5 Rutherfurd		
10	2 " "		
11	6 " "		
15	4 " "		
16	3¾ " "		
17	2½ " "		
18	6 " "		
20			
~~19~~	4½ " "		
21	4¼ " "		
22	4¼ " "		
	54¼		

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		57 1/4		
Oct	24	5 3/4 hours	Rutherfurd	
"	25	7 "	"	
~~" 26 to 31~~				
"	27	Other work		
"	28	(Headache) 3 hrs. on	"	
"	29			2 hr. Spectrum
"	30	Other work		
"	31	4 hr.	"	
		74	"	

Nov.	4	~~1 1/4~~ 2 3/4 hr. Spectrum
	5	4 3/4 " "
	6	2 3/4 " "
	7	3 " "
	8	4 1/2 " "
	10	4 1/2 " "
	11	3 3/4 " "
	13	3 1/2 " "
	14	3 " "
	15	4 3/4 " "
	21	4 1/2 " "
	22	3 " "
	24	4 1/2 " "
	25	3 " "
	26	5 " "
		59 1/4

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Dec. 1	Spectrometer		3¾ hr.
" 2	"		4 "
" 3	"		4½ "
" 4	"		3¾ "
" 5	"		2 "
" 9	"		5¼ "
" 16	"		4 "
" 17	"		4½ "
" ?	"		3¼ "
			36 "

Jan. 7/80	"		2½ "	
" 8	"		3¾ "	
" 10	"		4¼ "	
" ?	"		3 "	
" 19	"	A.M.	4 "	
" "		P.M.	2 "	relative to spectrometer.
" ?	"	about	3 "	
" ?	"	"	4 "	
			26½ "	

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