KG
11365
508

1999phae.proj..509C

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KG-11365.508

astrophar.proj.: 509C

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mar 15. 1st pr 5

8₀	000	09	45	180	11	30	090	10	45		090	10	45	
1?	017	18	00	197	19	30	107	18	45		107	18	45	
4	032	32	15	212	34	15	122	33	15	+15	122	33	30	
3	047	43	45	227	46	15	137	45	00	+15	137	45	15	
2	049	55	15	229	57	15 tab	139	56	15	+30	139	56	45	
9₀	102	26	30	282	Sh.	M13.	192	27	45	±V. +30 N.B.	192	28	15	L.V. (RV differs)
9₁	102	33	30	282	37	00	192	35	15	+45	192	36	00	
		48	30									48	45	- 2 obs. dif = 1″
6	118	42	30	298	49	30	208	48	30	+45	208	49	15	
10	263	47	15	083	48	45	353	48	00	+1′60	353	49	00	
6	118	46	15	298	48	15	208	47	15	+1′60	208	48	15	
7₁?	336	16	00	156	17	30	066	16	45	+1″75	066	18	00	
7₀?	336	23	45	156	25	45	066	24	45	+1″15	066	26	00	
8₅	359	45	15	179	47	45	089	46	15	+1″30	089	47	45	
8₀	360	00	15	180	10	15	090	09	15	+1″30	090	10	45	

Var = −1′ 30″

2nd from 5

8₀	090	09	45	270	11	45	180	10	45		180	10	45	
1	107	18	15	287	20	30	197	19	30	−15	197	19	15	
4	122	33	15	302	36	00	212	34	45	−15	212	34	30	
3	137	46	00	317	48	45	227	47	30	−30	227	47	00	
2	139	57	00	320	short		229	58	15	−30 tV	229	57	45	L.V.
6	208	48	45	028	50	30	298	49	45	−45	298	49	00	
7₀	066	25	15	246	27	00	156	26	15	−1″00	156	25	15	
8₀	090	10	45	270	12	45	180	11	45	−1″00	180	10	45	

Var = +1″ 00

1st from 6.

10	00	00	00	180	01	45	090	00	45 R.V.
5	24	43	30	204	45	15	114	44	30
7₁	48	46	00	228	47	30	138	46	45
	48	45	30	228	48	00	~~138~~	~~46~~	~~45~~
8₀	55	31	15	235	33	~~45~~	145	32	30
3₀	89	03	45	269	06	00	179	05	00

10	090	00	00	270	03	00	180	01	45 R.V.
5	114	44	15	294	46 (?)	00	204	45	30 Av of 2 V = mean.
7₀	138	50	30	318	53	00	228	51	45
7₁	138	45	15	318	47	45	228	46	30
8₀	145	31	00	325	33	45	235	32	30
3₀	179	03	30	359	05	30	269	04	30

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2, 3, 5. Work on Closing the triangle 2, 3, 5,

2.

3₀	177	42	15
	267	45	00
		7	15
	177	43	30
5	372	34	45
at 2	194	51	15
	165	8	45

3.

	12	21	15
	12	24	
		5	15
at 3	12	22	45
at 5	2	11	30
	2	10	45
at 5	2	11	00
	12	22	45
	165	8	45
	179	42	30
Cor of 2_2	+	19	45
Cor at 5_3	−	1	00
Cor at 3_2	−	1	45
Cut 5_2		0	
	+	17	00
	179	42	30
	179	59	30

1800) 10.250 (.0057
9000
12500
126

+ 19′ 45″

1400/8 = 11,200

11200) 3,66 (.0003
3 00

13.25
10.96 | 8,00
7,13

2,3
.87
2.46

.372
2,46
2232
1488
744

1800) .9151 (.0005
1′ 45″

2,3
2,3
69
46
5.29.3

.87
609
696
7569
5.29
6.0469 (2.46
4
44) 204
176
486) 2869

.6

1,22/3
3,66

3.42
3
10.26

.5

3₀ 199 32
2p 180 11
5 192 35

1800 sin 1′

2₀ · 2p

.5
2.46
1.22
492
492
246
2.3012

.5
.67
30
20
2.46
2p
109.36
158.10
90
68.10
180
2

9600) .30012 (.00003

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KG 11865.508

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Astrophoto. proj. 5096

Journal.

July 11, 1889. R. H. Gifford

11 A.M. L. 500
View of Observatory grounds through a slit.

6.15 P.M. L. 501
Same.

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July 12, 1889

10 45 A.M. Q 502 View Near an Apple Tree.
With transverse slits

11 40 Q 503 Portrait of R. W. Gifford.

12 00 Q 504 Same. Slit Reversed

12 10 Q 505 Same. Slit Placed Obliquely.

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July 17, 1889

9:30 P.M. Q. 506 Exposures with Std. Light as follows:
1st; 1s-2s-4s-8s. Plate reversed: Expr. 16s-32s-
63s-126s. Seed 4 X 5

10 00 P.M. Q 507 Same
Seed 4 X 5

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July 18, 1889

Exposed Plates # X 1705, X 1703, X 1719 to Std. Light through a screen. Exposed as follows, using Diaphragm No 2:

1^S - 2^S 4^S 8^S on one end of plate.
16^S 32^S 63^S 126^S " the other end of "

In the case of X 1705 the exposure was 4^S where it should have been 1^S.

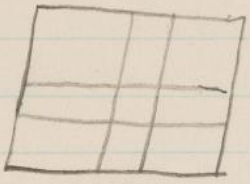
Plate 1720 was not exposed to Std. Light.

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July 22, 1889.

Q 508 Seed 4X5 placed in the printing-frame with two strips of black paper placed crosswise as in this figure.



After developing, plate was cut into four (4) parts marked A, B, C, D.

A was developed 2m
B " " 3
C " " 4
D " " 5

Exp. 1s to gas-flame.

Q 509 Same Seed 4X5

Exp. 1s Cut & Developed as Q 508, but with different times, as follows:

A developed 3m
B " 4m
C " 5m
D " 6m

Q 510 Same Carbutt 4X5

Exp. 3s Cut as above.

A was developed 2m
B " " 3
C " " 4
D " " 5

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July 29, 1889

11:50-1 Exposed plates X# to Std. Light as follows:

1S 2S 4S 8S on one end of plate
16S 32S 63S 126S " the other " " "

No screen was used. Diaphragm No. 2.

#X 1706, 1711, 1712, 1713, 1714.

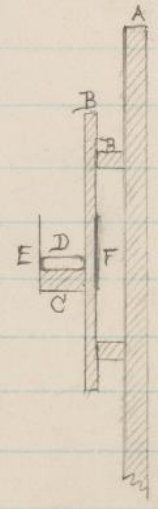
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1889phae.proj..509C

Thursday, Aug. 15, 1889.

L 511 Experiment to test absorbtion of crown glass. Two pieces of glass were marked "A" & "B" respectively. In this exposure piece "A" was used: A ~~piece~~ 4 x 5 plate-holder was placed in the tail-board of the Darlot camera; diaphragm "3" of the standard light was attached to the surface of the tail-board, next to the film. A small shelf was attached to the tail-board, and this shelf carried the second diaphragm, "4" of the standard light. The following drawing shows the apparatus; the whole apparatus was fastened to the screen of the standard light apparatus.

A = Screen of Standard Light.
B = Tail board of Darlot-camera.
C = Small shelf carrying glass.
D = Disc of glass.
E = Aperture No. 4.
F = Aperture No 3.



Side view.

Exposure:

1.st With piece of glass "A" inserted between the two diaphragms:

Exposed 1 sec.; moved plate-holder; exposed 2 secs.; reversed plate-holder ~~and removed piece of glass~~ and exposed 1 sec.

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Thursday, Aug. 15, 1889.

Q 512 Same exposures as in 511 with piece of glass "B" inserted instead of A.

Q 513 Piece "B" inserted: Exposed 8^s + 12^s + 8^s. Forgot to remove glass and plate was useless. The third exposure does not show because the opaque edge of the glass was accidentally moved before the hole of the diaphragm

Q 514 Same as 513 except for exposures Expt. 8^s, 16^s; removed glass & reversed holder & exposed 8^s

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Wednesday - Oct. 2. 1889 Ast. time

5.30 Measurments of 2 mm aperture. 1" Obj.
19.96 divs. to one mm.
1st Meas.nt No Divs = 40.
2nd " " " = 40.3+ 2 mm Hole
3rd " " " = 40.3
4th " " " = 40.2

22.00 1st Meas.nt No Divs = 12.6
2nd " " " = 12.5 } 0.632 mm Hole.
3rd " " " = 12.6 } = 12.635
4th " " " = 12.5

too small.
1st Meas.nt. Same. No Divs = 12.60
2nd " " " = 12.70 Average 12.63
3rd " " " = 12.66
4th " " " = 12.642

.2 mm Hole.
1st Meas.nt No Divs = 4.1
2nd " " " = 4. Average 4.05
3rd " " " = 4.
4th " " " = 4.1

Too Large
Pinhead is smaller.
1st Meas.nt No Divs. = 4,
2nd " " " = 3.98 (4.-)
3rd " " " = 4, Average = 4. short
4th " " " = 4, or 3.994

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1889phae.proj..509C

Oct. 3. 1889

2.40 Dividing Engine for measuring 6mm Hole

254 : 240 = x : 6.32 x = 6.69 -

1st Meas. nt 13		2nd Meas. nt	
56.724	62.253	61.791	56.234
	5.529		5.567

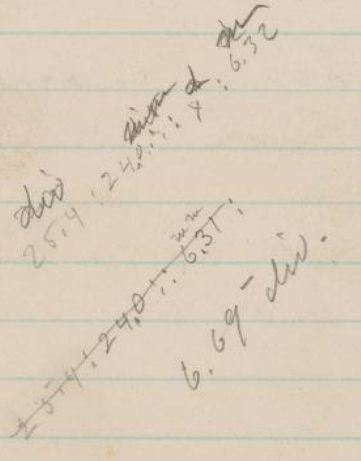
Enlarged it.

Readings again,

1st Meas	68.759	6.75	2nd Meas	69.041	
6.692	62.067	0	6.683	62.358	
		17			
		8			
		43			
3rd Meas.	68.585	4 | 68	4th Meas.	68.966	
6.675	61.91	17	6.718	62.248	
		675			

Average 6.692

22.00 Varnished diaphragms & lamp support - black.



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Oct. 4. 1889

1.00 Q.515. Set of 12 Exp.s having no effect on plate. Exs as follows - 100s, 79.s4, 63.s2, 50.1, 31.s6, 25.s2, 20, 15.s9, 12.6, 10, & 7.s94. N.B.

3.50 Q 516. Same over with $\left(D = \frac{\text{mm}}{16}\right)^{\frac{1}{10}}$ Stan. aperture One square showed.

4.50 Q 517. Stan. diaphragm. as follows:- 20s, 16.s, 12.s6, 10s, 8s, 6.s3, 5.s2, 4s. No 7 ought to have been 5.s00. Light correct at start but too low at end, corrected it.

5.+ Q 518. Same with the 12.6 Exp a little short.

Q 519 Same with the 5s Exp a little long. Light low again.

Q 520. Same. Light at end as high as possible without being too high. Drv. 2nd

Q 521. Same. Light went well, Exps good,

5.30 Drv. 3rd

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Oct 10.

Drawing of brass mask for putting centrosquares
of standard light on plates.

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Oct. 21 " 89

Measurements of distance of diaphragms on new sensitometer (of Oct. 1889) to sensitive plate.

P.M.		2nd Meas^{nt}	3rd Meas
2.40	1st. Dist. ought to be 100 m.m.		
	3 m.m. too long or + 3.	± 0	± 0
	2nd. Dist ought to be 316.2		
	4 + m.m. too long.. or + 4	+ 1.7	+ .8 m.m.

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Oct 22 89

22. Marked floor of enlarging room, in two places - 1st (nearest) at scale 1m = 5" & 2nd (furthest) 1m = 2"

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Thurs. Oct. 28 - 1889

3.. 00 to 3.. 07 Developed plates of conjunction of Venus, Saturn and Regulus. Was follows:

3.. 00 X 2368 - 1st in Dev. 4m

3.. 07 y 2367 - 2nd in Dev. 5m

3.. 18 X 2369 - 3rd in Dev. 5m

3.. 18.. 30 X 2362 1st in Dev. 4m

3.. 28.. 30 y 2363 2nd in Dev. 5m

3.. 29.. 0 X 2370. 1st in Dev. 4m

3.. 35 X 2366 3rd in Dev. 5m

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Tues. Oct. 29. 89

Subject:- Wedge photometer for dark room.

9.20 Rev'd Negs from plates - R's 1163, 1156, 1167, 1194, & 1196,
&c. Used upper wedge of 3 photographic wedges.
Reading for R 1175 - 21.8 (- 19 (= 0 point) = 2.8. See pg. 68 R series - R1218 exp. for this plate is 120s. (Thist) Other readings as follows:-

				Comp. ratio of exp's	Est'd ratio of exp's
R 1175	21.8	-19	= 2.8		
R 1163	22.6	"	= 3.6	100 sec	60 5th Short
R 1156	27.1	"	= 8.1	44s	30s
R 1167	25.3	"	= 6.3	60s	48s
R 1194	22.3	"	= 3.3	110s	60s
R 1196	21.9	"	= 2.9	120s	120s

N.B. These readings taken thro' wedge + neg + no paper - looking at gas flame, leaning against sensitometer front in dark room

The following readings taken with only paper in, near flame They are N.G. Have got those perforated paper or something of that sort. 1.7, 1.8, 1.5, 1.3, & 1.4. Rejected.

Used these Comp. Exp's as follows:-

10.00	R 1219. Rev'd Neg. fr. R 1196. 1st in Dev. 4m	120s	good
10.20	R 1220. Do fr. R 1194. 2nd in Dev. 5m.	110s.	good
10.35	R 1221. Do fr R 1167. 3rd in Dev 6m	60s	thin

N.B. Dev was cold + old - both try over with warm + fresh Dev

Same wedge as follows:- R 1156 - 26.5 - 19 = 7.5 + R 1191. 27-19 = 8.
∴ Exp for R 1191. 41s. R 1222, Rev'd Neg fr R 1191 2nd shot in Dev. Just wrong
R 1223. Do R 1191. 3rd in Dev. 3m overexp.

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Tues. Oct. 29. '89

Note. I.D. is the ($R = 1^m$) stop with Dist = 10.00 cent Dargue 5?
I.D.D. is the ($R = 1^m$ " " " = 31.62 cent Drie "
I.C.D. is the ($R = 0.316^{mm}$) " " " = " Cents "
I.M.D. is " ($R = .1^{mm}$) " " " = " Mills "

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Sat. Nov. 2 1889

12.00 to 1.30 Made Developer

Formula.

No 1	384 oz	H_2O	or	480 oz H_2O
	24	Na_2CO_3		30 Na carb
	24	Na Sulphite		30 Na Sulphite
No 2	3 oz	Salicylic acid		$3\frac{3}{4}$ oz Salicylic ac.
	$16\frac{1}{2}$	C_2H_6O		$20\frac{5}{8}$ alcohol.

Cause has been $\frac{1}{2}$ oz sheet in Sal. acid
No 2 poured into No 1 when both are dissolved

N.B. The amount of water is doubled. When filling the jars of Boyden department. As the following is used.

		for one jar	for
H_2O	48.0 oz	240	96
Na Sulphite	1.5 "	$7\frac{1}{2}$	3
Na carb	1.5 "	$7\frac{1}{2}$	3
Salicylic acid	$1\frac{7}{8}$ "	$\frac{15}{16}$	$\frac{3}{8}$
Alcohol	$1.0\frac{5}{16}$	$5\frac{2}{16}$	$2\frac{1}{16}$

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2nd Nov. 6. 1889

12. M.

Drw. I 71 + I 72 (also Q 553) as follows

I 72 onion neb. thro' perforated paper with star squares through same = (photo scale) 1st in Drw. 4m

I 71. Ditto without perforated paper or photo scale, 2nd in Drw. 5m

Q 553. Test for spectroscope. 3rd in Drw. 5m.

N.B. I 72 has standard photographic scale on its ends, thus:-

film up.

N	10		11		
N	9		12	No 1. Exp^{d} to 12.5 mds	No 7 to 63 mds
	8		13		
	7		14	" 2 " 16 "	" 8 " 50 "
	6		15		
	5		16	" 3 " 20 "	" 9 " 80 "
	4		17		
	3		18	" 4 " 25 "	" 10 " 10 cds
	2		19		
	1		20	" 5 " 31.5 "	" 11 " 12.5 "
				" 6 " 40 "	" 12 . 16 "

No 13 Exp^{d} to 20 cds. No 17 Exp^{d} to 50 cds

" 14 " 25 " 18 " 63 "

" 15 " 31,5 " 19 " 79.5 "

" 16 " 40 " 20 " 10 cds.

40.0

12

12

1'/2

8'/4

formula for Jardin Bot. Arequipa Peru

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Thurs - Nov. 7. 1889

Slit 30 9½ dds. Use of photo scale as wedge.
Slit 15, 60 ~~cdes~~ dds. great uncertainty due to change
in size of iris of eye. or pupil.

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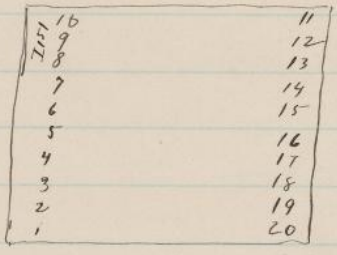
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Monday, Nov. 18, 1889

About noon. Dew.d I151 & I150 after putting on standard scale of exps through perforated brass shut.

viz:-

I151.



Exposures -

1	–	12.6 mcls	11	–	12.6 cds
2	–	16	12	–	16
3	–	20	13	–	20
4	–	25	14	–	25
5	–	31.5	15	–	31.5
6	–	40	16	–	40
7	–	50	17	–	50
8	–	63	18	–	63
9	–	79.5	19	–	79.5
10	–	10 cds	20	–	10 cds.

Dew. = 2P. KA. 1d. KBr per 2oz. ------ 10m.

Temp. of room at start 78.8 F.

" " Dew. " " 81.2

I150

1	–	4 mcls	11	–	40 mcls
2	–	5	12	–	50
3	–	6.3	13	–	63
4	–	8 Flame too high lowered it.	14	–	79.5
5	–	10	15	–	10 cds
6	–	12.6	16	–	12.6
7	–	16	17	–	16
8	–	20	18	–	20
9	–	25	19	–	25
10	–	31.5	20	–	31.5

Same Junction of Dew. 15m.

Cleaned with H_2O, H_2O_2 + HCl

Temp of room at end 83.

Dew " " 78.8 F

N.B. These temps Taken with dif. thermos.

Note - Durchspe for contrasts are Martin exposed to the standard series, for measurements.

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Sat. ~~Nov 2~~ Nov 23. 1889

Get nearly ♁ last absorption of 11ⁿᵈ. Clouded a/s & Mr attempt formed one prism gone.
Another neg. from R 1277. Little better.
Orion work on X 2419.
3.30 Collected plates into fewer boxes & increase room, + commence

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1999phac.proj.5000

Tucson. Dec. 2. 1889.

5.30 | onion plate | X 2578. | Stars measured as follows: — on Onion plate

X 2578	4	5	1 — 20 mds	5 — 12.5 cds
	3	6	2 31.5	6 20
	2	7	3 50	7. 31.5
		8	4 >9.5	8 50/or 60)?
	1			

Through perforated paper. 1st m Dec. 5m

~~X 2577~~

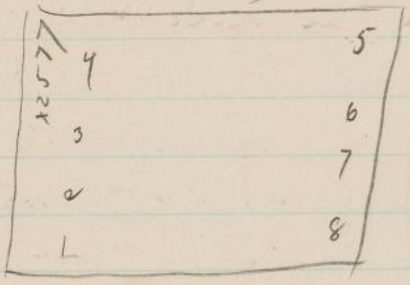
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Tues. Dec. 3, 1889

Drw. x 2578 to suit perforated paper had been used.

10.00 Orion plate x 2577 (4×5). Stan Sgs Thro' perforated paper.



4 –	79.5 mds	8 –	50 cds
3	50	7	31.5
2	31.5	6	20
1 –	20 mds	5 –	12.5 cds

10.30 Orion plate x 2567 (4×5) Stan. Sgs, Thro. perforated paper.
Spans exactly same as last.

10.50 Orion plate x 2586 (4×5) Stan. Sgs. Thro. perforated paper
Spans same as last.

Development. –
Temp of drw. – bet. 72 & 78, averging 75 to 76.
Made of 2P + 1A. Two KBr.
Time 15m rocked constantly –
Temp of room 78°.

N. B. { See note page 21. for Dev.ment of plates with stan. Series of exp.

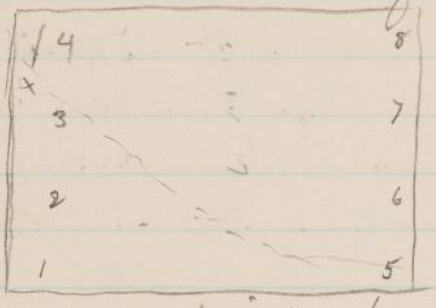
These three ought to have been developed for contrast.

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Harvard College Observatory

Thurs. Dec. 5. 1889.

1.00 to 2.50 X 2664, X 2663, & X 2662, had standard squares put on ends as follows:-



4 – 79.5 mds | 8 – 50 cds
3 – 50 | 7 – 31.5
2 – 31.5 | 6 – 20
1 – 20 | 5 – 12.5

X 2664 – 1st in Dw. for Cont. 5m

X 2663 – 1st " " " " "

X 2662 – 2nd " " " " 6m Seemed slightly flashed in lower left hand corner. See dotted lines.

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1889phae.proj..509C

Sat. Jan. 18. 1890

12. Measured focal length of combination of two 2½" lenses placed 3" apart
Focal lengths separately 15¼"
Focal length together 8¼ in
These lenses are used in new spectroscope to produce final image.
Of the two larger lenses, the larger has been found when a focus of -25".76
The focus of the smaller is -23".37

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Mon. Jan. 20. 1890.

Silvering on glass.

Formulas obtained from Alvan Clark & Sons.

Take from 5 to 10 grains, Troy, of Silver Nitrate (crystals) for each Oz. of water required to properly cover surface of mirror when placed in position in silvering dish.

Dissolve the silver in a sufficient quantity of water (exact amount not important)

Add ammonia water carefully till a precipitate forms and continue adding till this precipitate is dissolved, and no more.

Add a sufficient amount of caustic soda solution to make the weight of solid caustic soda 1/2 to 3/4 the weight of solid nitrate of silver. Another precipitate is formed.

Carefully add just enough ammonia water to dissolve precipitate, being careful to avoid an excess.

Add enough water to make the whole Amt sufficient to properly cover mirror as determined in the first steps of the process. In determining this Amt. it is well to allow for the precipitating solution to be added later. This solution should be about 1/6 of the entire bulk of the liquid [illegible] to cover the mirror.

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The bath is now ready for the addition of the precipitating solution, after which the mirror should be quickly put in place as the silver at once begins to deposit. The precipitating solution should therefore be reserved until everything is in perfect readiness, so that no time may be lost in getting the mirror into place in the bath. From 10 to 30 minutes are required for the silver to deposit properly.

The mirror should be placed face downwards in the bath, a space of ½ to ¾ inch being allowed between the face of the mirror and the bottom of the dish, for circulation.

There should be just enough of the solution to cover the face of the mirror without being enough to cover the back. A wooden block may be cemented to the back of the mirror by means of pitch, or some similar substance, to serve as a handle.

During the process, any air-bubbles adhering to the face of the mirror should be removed at the start

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1999phae.proj..5090

by tipping the dish. The bath should be thoroughly stirred with a clean glass rod after the precipitating solution has been added to insure a uniform deposit of silver.

After the silver has been deposited, the mirror should be thoroughly rinsed with distilled water and allowed to dry, after which it may be polished with fine rouge applied with a piece of chamois skin.

Distilled water should be used for all solutions employed in this process. All glasses and dishes should be carefully rinsed with the same. The presence of any dirt or animal matter is often the cause of a failure.

Much depends on the cleanliness of the mirror. All old silver should be removed with nitric acid, and the mirror rinsed with distilled water. The surface to be coated should then be cleaned with a solution of caustic soda, being gently rubbed with a tuft of soft cotton, to remove all dirt. After another rinsing it should be [illegible] with a weak solution of

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Caustic soda, face downwards, and allowed to stand while the other preparations are being made for silvering. When all is ready it should be transferred directly to the silver bath without further rinsing or rubbing.

CAUTION! After silvering, all glasses and dishes used in the process should be thoroughly washed, for if allowed to stand and dry without cleaning, a fulminate will form and an explosion would be a probable consequence. The caustic soda solution may be made for convenience with 100 grains to one ounce of water. The weight of solid caustic soda may then be determined by the no. of liquid ounces of the solution used.

—— Precipitating Solution ——

3 qts. distilled water
1680 gr. (Troy) Sugar
78 gr. " Nitric acid.
26 drams Alcohol.

This sol. improves with age. Ice melted & filtered through a cloth, may be used in place of distilled water.

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1999phae.proj..509C

Jan. 21. 1890.

Had things prepared last night for silvering this Aft. Used 8×10 porcelain dishes. To silver 4 mirrors. Waxed on backs pieces of wood with nails run through & put them through holes in sticks crossing the dish. Better tair them on separate sticks.

Preparation

This Aft. washed & put glass plates to soak in caustic soda.

Washing

Silvering bath prepared

Dissolved 96 gr. Sil. Nit. in 6 oz. H_2O. Added Ammonia, producing heavy black precip. Added more NH_4OH (mak) & redissolved precip. Added 0.6 oz caustic soda with no result for a long time when something like a silver sponge appeared on the surface & the liquid assumed a yellow tint changing to reddish brown. On adding a little more Sil. Nit. a heavy black precip. was formed, which was dissolved by adding more NH_4OH.

&

Experiments

(On adding Caus. Sod. to this in a test tube, no sediment seemed to form.) On adding reducing or precipitating fluid to this it turned dark & began to deposit silver rapidly.

The Silvering

~~Bottom~~ The glass plates were then transferred to the silvering bath - after pouring in 2.6 oz precip. sol. & stirring. The dish was rocked occasionally.

Treatment of a bad spot during silvering

Some scratches (or bubbles?) on one mirror were touched with the finger, wiped with weak Caus. Sod. Sol. on tuft of cotton & the mirror allowed to remain longer in the bath; no trace of them was left.

The glass plates were in the bath fully 45 m.

NB.

Wiped them while wet with wet camels hair brush & swept away some silver especially when they seemed

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Jan. 21. 1890

To be Bubbles.

After treatment. After silvering they were put under faucet & thoroughly washed (& rubbed with brush with bad results) & then distilled water turned over them & then left to dry.

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Fri. Jan 24, 1890.

Polished one of the mirrors by first gently rubbing on rouge with one piece of chamois skin & polishing with another and cleaner piece, then taking a fairly clean & very smooth piece and rubbing on rouge for a long time till the surface became brilliant. Then rubbed it briskly with a clean and soft chamois skin. In certain light the surface showed innumerable fine scratches,

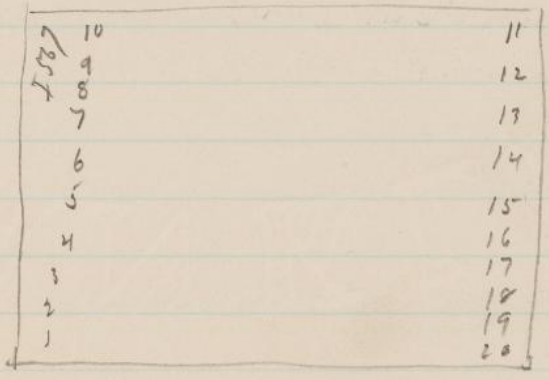
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Sat. Jan. 25. 1890

Put stan. squares on I567, same exposures as given on pg 21.

10 sq^s on each end of 8x10 plate, through perforated brass.



	1 = 12.6 mds	11 = 12.6 cds
	2 = 16.	12 = 16
	3 = 22!	13 = 20
	4 = 25	14 = 25
	5 = 31.6	15 = 31.6
	6 = 40.6!	16 = 40
	7 = 50	17 = 50
	8 = 63	18 = 63
pt D 5^m	9 = 79.5	19 = 79.5
	10. = 10 cds	20 = 10 dds.

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Mon. Feb. 10, 1890

Feb 3. Put standard squares on I638
Squares same as those on 5ff. pg. but with no mistake
Also 10 pos (pl. no) ought to be in diag of ff corner. pet D 5m

Feb 4 Put standard squares on I637
Exactly same as last. 1st D 5.

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Tues. Feb. 11. 1890

Notes

During investigation of S26 Zone Correction.

For future reference.

For black squares

Dargs	dels	cds	mds
.89	7.1	100	1580 =
1.00	8,0	112	1780
1.12	8,9	126	2000
1.26	10.0	141	22.40

For middle tints

dels	cds	cd	mds	mds
.8	12.6	11.2	200	141
.89	14.1	12.6	225	15.8
1.00	15.8	14.1	251	178
1.12	17.8	15.8	282	200

For faint tints

cds	mds	dmels.
.89	12.6	158.
1.00	14.1	178.
1.12	15.8	200.
1.26	17.8	224.

Q 741 shows how a little additional general light brings out squares that wouldn't otherwise show.

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Wed. Feb. 12. 1890

Standard squares on I646 probably an orion picture 8x10 Sq #07 (50 mcls) Red lamps high during Pat 20 sec & was runover a little being 50.6 instead of 50 mcls.

20.2 cds instead of 20, (63 cds little uncertain may be 73)?

10 dcls about 10.5

List of errors — % error

Sq				
7	50 mcls	Uncertain ~~as~~ lamps high - Exp 50.6 mcls		
13	20 cds	1%		20.2
18	63 "	might by a mistake of 10 in county		
20	10 dcls	+ 5%		10.5

Put on through perforated brass as always unless specified otherwise

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Thurs. - Feb. 13. 1890

Tests of pendulum bob marks (by 100 or more beats)

Date	Time	% error
	(.40)	
	(.50)	
	(.63)	
	(.71)	
	(.8)	
	(.89)	
	(1.00)	
Feb. 9 or 10	(1.12)	112	0.
" "	(1.26)	125.5	−0.4 %
	(1.41)		
	(1.58)		
	(2.00)	See page 42.	
	(2.50)	Marks have omitted after this.	
	(3.16)		
	(4.00)		
	(5.00)		

Measurement of Aperture R = mm .562 ½

22.7
22.6
22.7
22.6
22.7
22.7
22.7
22.7

Av - 22.675

5

.1675

$\frac{2^-}{225^-} = \frac{1}{113}$ = less than 1%.

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Thurs. Feb. 13. 1890

12,15 Put standard squares through perforated brass
& 1, on I651

Errata :-

Sq 3 & 5 25 & 31.6 mds are in each Utus plates.
12 | 16 cds may have error of ± 2%
18 | 63 cds has error of + 2%
20 | 10 dds Lad lamp slightly irregular during four seconds (±4 dds)

pt D - 5m

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Mon. Feb. 17. 1890

Measured - after making - small intermediate aperture for sensitometer ($R = 0^{mm}.178$)

i.e. $D = {}^{mm}.356$

$1^{mm} = 20.00 (-.01)$ divisions.

$\therefore .356^{mm} = 7\frac{1}{2}{}^{d}$

measurements

7.1
7.1
7.2
7.0
7.1
7.1
7.1
7.0

Error = $\frac{1}{2}$ of 1%

7 | 12

7.0875

3 | 25

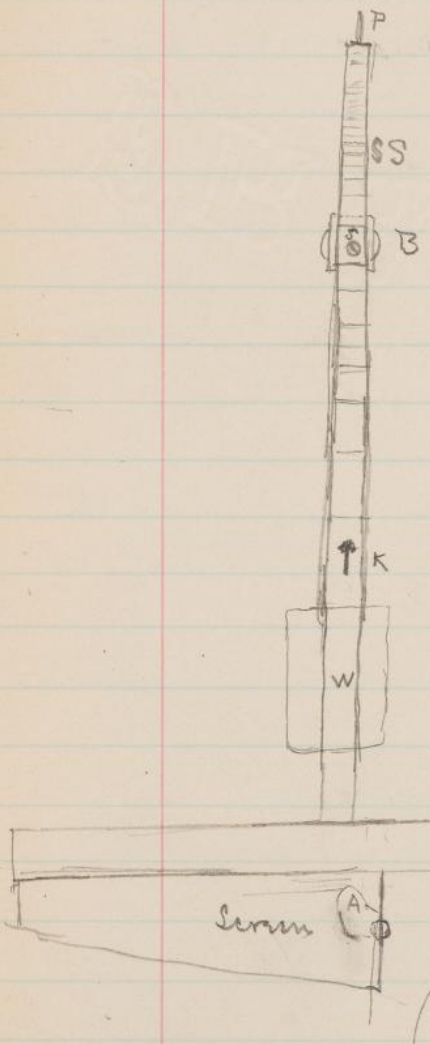
7 | 200

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Mon. Mar. 17. 1890

Notes on Metronome Pendulum for Sensitometer.



P. is brass pin in top, not at present used.
B is sliding bob for varying beat of pendulum,
K is knife edge.
W is heavy lower weight.
There is a cross pin at the bottom & a screw to swing between the flame of lamp & the aperture of sensitometer, A.
The knife edge rests on brass pins which can run transversely on a car which itself slides lengthwise on a R.R. above the sensitometer tube. The transverse motion is to easily readjust the screw point A. ⊕

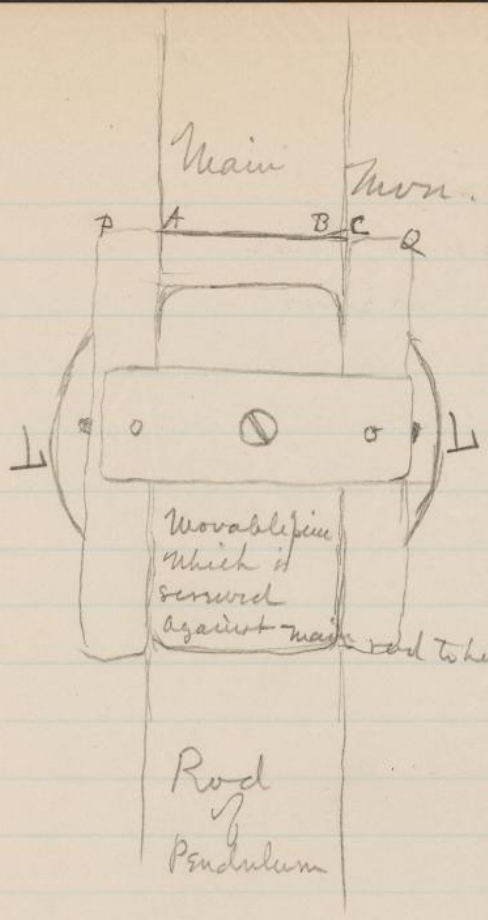
(The wood is black walnut weights of lead (W & on wooden bob) & screws of brass, knife edge of steel with copper wire plugged in above it.

The scratches SS to mark height of bob for particular periods of vibration were put on thus: The bob was moved up or down till the vibration was within 1/5 of the required time & then a knife blade was put across the main rod, & above the two side pieces of the bob thus:-

over

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Mon. Mar. 17. 1890.
The knife edge is passed along P Q making the scratch A B C which is penciled in A to B & B to C is cut deeply in the corner, so that a knife edge can be used to get bob in exact position again. ⊥ ⊥ is the lead weight on bob.

% errors in position of scratches

Correct expsure	Exp. given at mark.	% error.
0.898	0.408	+ 2½ of 1%
.447		"
.501	.500	− ⅕ "
.562		"
.631	.63	− 1/6 "
.708	.706	− 2/7 "
.794	.797	+ ½ "
.891	.889	− ¼ "
1.00	1.003	+ ⅓ "
1.12	1.121	0
1.26	1.26	0
1.41	1.415	+ ⅓
1.58	1.584	+ ¼
1.78	1.77 +	− 4/7

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Mon. Mar. 17. 1890

% Errors continued.

Comm. Eqs.	Eqs. given at Harv.	% Error.
2.00	2.00	0
2.24	2.24	0
2.57	2.496	$-\frac{1}{2}$ of 1%
2.82	2.81	$-\frac{1}{3}$ "
3.16	3.165	
3.35		
3.98	3.992	$+\frac{1}{3}$ "
4.47		
5.01		

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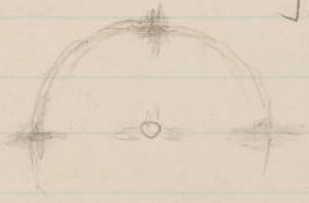
Mon. May 24, 1890

Lensboard marked R = .178 is too large giving following measurements.

8.7
8.8
8.8
8.6
8.9
9.
8.8
9.0

av. = 8.825. thought to be 9.12 See pg 40

Very good moon dogs observed in eve.



About 9.00 P.M.

S.W. Horizon

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Thurs. April. 3, 1890

Action of Standard lamps with American Pentane

Lights more quickly than with English.
When flame is ¼" high then put chimney on. — Ware be lighted by simply heating the glass body of lamp but takes longer to come to its steady state as the cylinder enclosing wick has to get heated by flame — body of [illegible] this way [illegible] the wick [illegible] to keep [illegible] lamps. [illegible] with a be[illegible] put la[illegible] match [illegible]

Bno	Pno		
763	767	×	
807	766		1691
817	771	Moulton	6186
1037	764	Cramer	4638
1244	785-791		
1252	763		
1237	769		1789
1257	784-783		
1259	762		

[illegible] rides heating
[illegible] boil &
[illegible] in trying
[illegible] turned into
[illegible] it up
[illegible] this will
[illegible] ted by a
[illegible].

It takes about [illegible] watching for the flame to become steady. If short exposures with the Met. pendulum are given first, ~~if~~ all the first 10m after lighting are not much good. Exposures during that 10m are very liable to be poor & require repetition.
As the flame comes to its steady position it becomes much more sensitive to any turn of the screw, a mere pressure on the screw causing it to jump. — also more sensitive to any shaking, heavy stepping on the floor - door slamming, also to changes in pressure, caused by opening or closing a door, wind blowing

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Thurs. April. 3, 1890

Action of standard lamp with American Pentane

Lights more quickly than with English.
When flame is ¼" high then put chimney on. — Room be lighted by simply heating the glass body of lamp but takes longer to come to its steady state as the cylinder enclosing wick has to get heated by flame — body of lamp cooled down. Besides heating this way may make the pentane boil & the wick will be turned into lamp in trying to keep flame low. If wick is turned into lamp, draw out stopper & push it up with a bent wire till it catches. This will put lamp out — it may be lighted by a match without removing chimneys.

It takes about 20m constant watching for the flame to become steady. If short exposures with the Met. pendulum are given first, ~~at~~ at the first 10m after lighting are not much good. Exposures during that 10m are very liable to be poor & require repetition.
As the flame comes to its steady position it becomes much more sensitive to any turn of the screw, — a mere pressure on the screw causing it to jump. — also more sensitive to any shaking, heavy stepping on the floor — door slamming, also to changes in pressure, caused by opening or closing a door, wind blowing

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Thurs. Apr. 3 1890

against the window, currents of air &c.
A windy day is bad for this lamp, even
though the window is closed.

If the temperature of the room is too high
wrap dampened rags about body of lamp.
Between 65° & 75° F. is a good temp.
Think lamp works much better on a dry day
than when it is damp. &c.

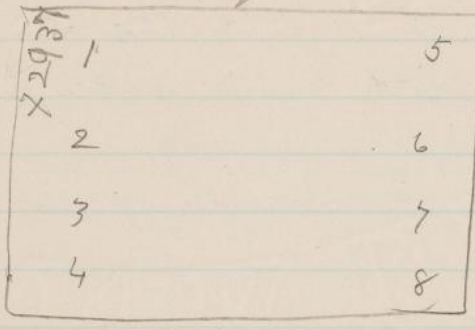
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Sat. Apr. 12, 1890

Put standard squares on an X & an O plate. To be developed for contrast.

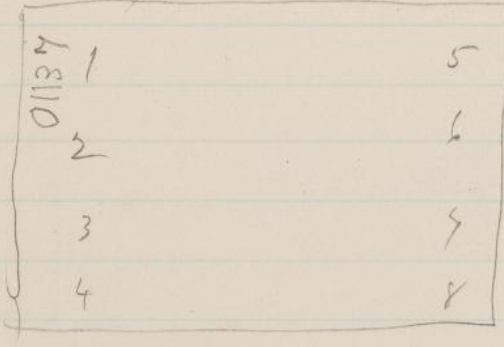
X 2937. Stan. sqs. thro'. perforated brass.



	mds	cds
Sq 1.	20.	Sq 5. 12.6
2.	31.6	6. 20.
3.	50.	7. 31.6
4.	80.	8. 50.
	R = mm .316	R = 1.mm
	D = 1.m	D = 1.m

1st D

O 1137 (not O 1137) Stan. Sqs. thro' perforated brass.



	mds.	cds
Sq 1.	20.	Sq 5. 12.6
2.	31.6	6. 20.
3.	50.	7. 31.6
4.	80.	8. 50.
	R = mm .316	R = 1.mm
	D = 1.m	D = 1.m

2nd D

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Monday Apr. 14, 1890

3.15 Put standard squares on X 2936, through perforated brass - as on page 47. Same exposures, 6 & 7 sq doubled

X 2936

(1)		(5)
20 mol		12,6 cols
31,6	(7)	31,6
50	(6)	20,
80		50
(4)		(8)

X 2938. Same exposures without doubling Sqs 6 & 7.

O 1136. Same i.e. Through perforated brass.

O 1136

(1)		(4)
mol		20 cols
50	(6)	50
79,5	(7)	80
cols		
(3) 12,6	(8)	126
(5) 31,6		

O 1138. Same in following order

O 1138

1	5	mols	
		1,	50
2	6	2	79,5
		3	12,6 cols
3	7	4	20,
4	8	5	31,6
		6	50,
		7	80,
		8	126

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Sat. Apr. 26. 1890

Description of Double D.D. form of sensitometer.

Plates – The first dif. form of sensitometer tried was
966 – 8 with a single D.D. (Ground Glass) at 10c dist from
971 – 2 plate & 2d put on it, a series of steps up to
– 3 10 mm R. was made. This would not work
– 4 as the dist rays were not sufficiently
– 5 bent up, & hence the longest step didn't
var. A get light in proportion to its size.

B 982 – 3 Then D.D.D. (Double S.S.) was tried at 11.2 mm apt
C 1004 1006 1007 & was seen to have the same defect.
Then paper as a reflecting surface
D 1018 was used but found too faint
1021. Now – Sat. apr. 26. – we are trying the D.D.D.
E 1030 at 1 M dist from plate and the lamp at
1031 about 31.6 cent from D.D.D. In the plates of to 1034
1032 the flame is at a dist. of 34 cent. and
1033. the exp in this & the standard form (71/17.8
=ing cd) differ only by ½ a div.

1070 Another form of sensitometer has double ground glass, and be-
1071 tween them and the flame, about 10 mm from glass is a
1072 lense which has its focus on the plate, a distance
1073 of about 93 or 34c from lense. This form, with the
1082
1083 small diaphams, is used in going long exposures.
etc The different forms for making abs. do not always
give like results. This cods tested several times:
952, 953, 1141, 1142, 1146, 1152/1157. It may be due to a
variation in the lamp or length of time, or some
unknown cause.

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Monday, April 28, 1890

Measurements of sensitometer.

1st- From plate to nearest aperture of exposure, (Metre tube) ~~1m 2cm 6mm~~ 1m 2cm

2nd- From plate to lamp flame of most distant exposure (Metre tube on gg.) — 140 cm. 5 mm.

3rd- From lamp flame in exposure "2nd" to first surface of glass over diapham - ~~32cm 6mm~~

4th From lamp flame in exposure "2nd" to diapham — 33 cm. 4 mm

5th From plate in exposure "2nd" to the diapham — ~~1m. 30 cm. 107 cm. 1 mm~~

L E Kazeltine

Saturday, June 14/90
Measurements continued

Dp = 12c 3mm from plate to outside of diapham
Ddgs = 34c from plate to outside of diapham
Distance from outside of diapham to centre of lamp flame is 2c 6mm. Hence,
dgs = 14c 9mm from plate to centre of flame
DDgs = 36c 6mm from plate to centre of flame.

L E Kazeltine

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Tuesday, May 27/90

Measurements of diaphams used on sensitometer in ground glass form. Measured in hundredths of a millemetre.

$R = .1^{mm\,mm} = \frac{4}{40}$

4
4
4
4) 16
4

$R = .178^{mm\,mm} = 7.125$

7.225
7.125
7.090
7.100
4) 28 540
7.135

$R = .316^{mm\,mm} = 12.625$

12.675
12.625
12.650
12.600
4) 50.550
12.637

Measured on dividers

$R = .56^{mm\,mm} = 22.5$

22.5
22.5
22.5
22.5
4) 900
22.5

$R = 2.16$

.705
.725
.72
.73
.698
.707
6) 4.317
.718+

should be .69
less than 1/2 of 1%

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Tuesday, June 3, 1890.

This day made Methyl and Alizarine Blue, as per following formulæ:

Alizarine Blue.	Water,	200 c.c.
	Alizarine,	20 Mgr.
	Ammonia,	2 c.c.
Methyl Blue.	Water,	200 c.c.
	Methyl,	20 Mgr.
	Ammonia,	2 c.c.

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Thursday, June 5/90.

Made jar of Developer.

L. E. K.

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Thurs. June 5, 1890

Notes on the slit spectroscope.

May 15. From Q 1113. Mines inclination ought to be 2/17 greater. -(2/17 signifies that for every 17 m.m. lengths, in line with focus of lines, the Camera back (Camb) ought to be turned 2 m.m. in line with motion of camera tube).

But 1st. There is a range of 2 or 3 m.m. of focus

2nd It appears that when plane of focus of sides (or simply f.s.) is at a great angle with the plane of focus of lines (or simply f.l.) definition is best except when they coincide at the Cross (Cr) point.

Hence to get best results we must strike a mean between the two

Note - in Q 1113 when the sides are in focus the lines show up well though apparently not in the best focus

For f.s. —— Inclination Reading (IR.) = -71.30?

May 27. Effect of movement of slit or Camb.

Movement backwards & forwards of the slit changes the f.l. very rapidly & the f.s. very slowly (if at all)

Movement of the Camb is very rapid in focus of sides but slow in focus of lines.

June 5 Hence to get focus - Set slit & move Camb till the Cr is in right place. Then focus lines by moving slit.

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Thurs., June 5, 1890

Notes on slit Spectroscope - continued.

Discussion of particular plates.

Q 1176 + 1177. It appears that with moving the slit out the Cr moves towards red end of spectrum at rate of 5 mm for every 15 mm movement of slit. With slit at 15 it is at M, with slit at 31 to 32 it is between K + L. The inclination used in this plates was + 77 and this indicates a motion of 1.25 mm for every 15 mm motion of slit or a ratio of 1 to 12

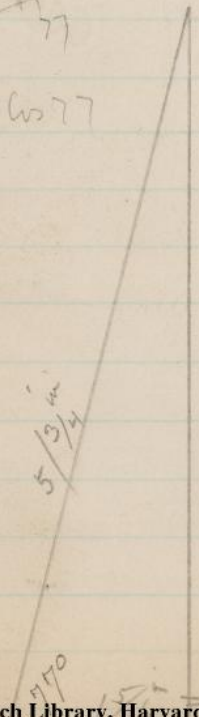
Comparison of 1176+7 with 1182 - focus of lines

	Camb	Slit at -	lines in focus		slit	
1176+7	20	22	F	D	14	Camb 25
					16	
(1176+7) - VR = +77		23	Cr		18	
1182 " = "		25	H	HK	20	
		27	M		22	

1176+7 | 1182



5 Cr's 77



Summary - Dif bet. Cambs 5 mm

" " " slits 6 on F

5 " Cr

5 " HK

5 " M

This looks as if they moved at same rates

15 = 15 mm = 1.25

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Thurs. June 5, 1890.
Slit Spectroscope. Contin'd.
Discussion of plates - Contin'd.

Q1179. V.R. = +77 Plate as follows:-

Slit - ↓	Camb	lines in f.	Cr. at.
18	20	D	M
	24	F	A?
	28	G	
24	16	D	beyond O?
	20	F	M
	24	G	" A
30	12	D	beyond O
	nothing		
	20	M!	M

This gives motion slit : Camb :: 6 : 4 to bring lines in focus

Q1180 - Same - +77

24	22	G	beyond red
	23	G to H	
	24	K to L	
25	21		A?
	22	Same	beyond red
	23		
26	20		K to L
	21	Same	F?
	22		little beyond A

This indicates equal rates of motion to bring lines in focus, but neither plate really determines movement in fs for movement of slit.

Q1185 gives about the same results. VR + 77

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Friday - June 6 1890

Slit Spectroscope - Continued.

Latest changes - Summary - &c

Two camera backs.

May 28 Plate 1186 indicated a change of 2R necessary - to about +850 (from +77) for f. This +77 is very nearly correct for f.s.

accordingly it was changed to 84.15 & 1187 was taken - also 1188, other plates & then

May 29 Eve. 2 plates (1200 + 1201) on an electric light with poor

May 30 " results - also spectra of moon, Mercury &c. The moon - as the sun in 1211 - gave (using Coll. & slit) good parallel sides though the lines were in focus. This was probably due to its illuminating so little of the Coll & Cam lens.

Bad f.s. due to This parallel sides difficulty seems to be mostly due to using the edges of the Coll & Cam lenses.

May 31 Decided on marking two Camb. one for f. & one for f.s.

(pg 31) For parallel sides (f.s.) or parallel rays through prisms)

Inc. Read. ought to be +73.50

Two Camb. For focus of lines (f.) R. ought to be +86

Inc. of Cam. Tube to to box of spectroscope : 70.30

Q 1211 was tried to get Cr but was exposed on sun and the sides came out parallel. the Camb = +74° having been used. It was in f at 18, G at 18 to 19 + Hk at 22 the slit being fixed at 22. Cam 22 seemed to be good f.s.

Q 1212 was the same thing on sky. It was made in part with each Camb & shows the dif.

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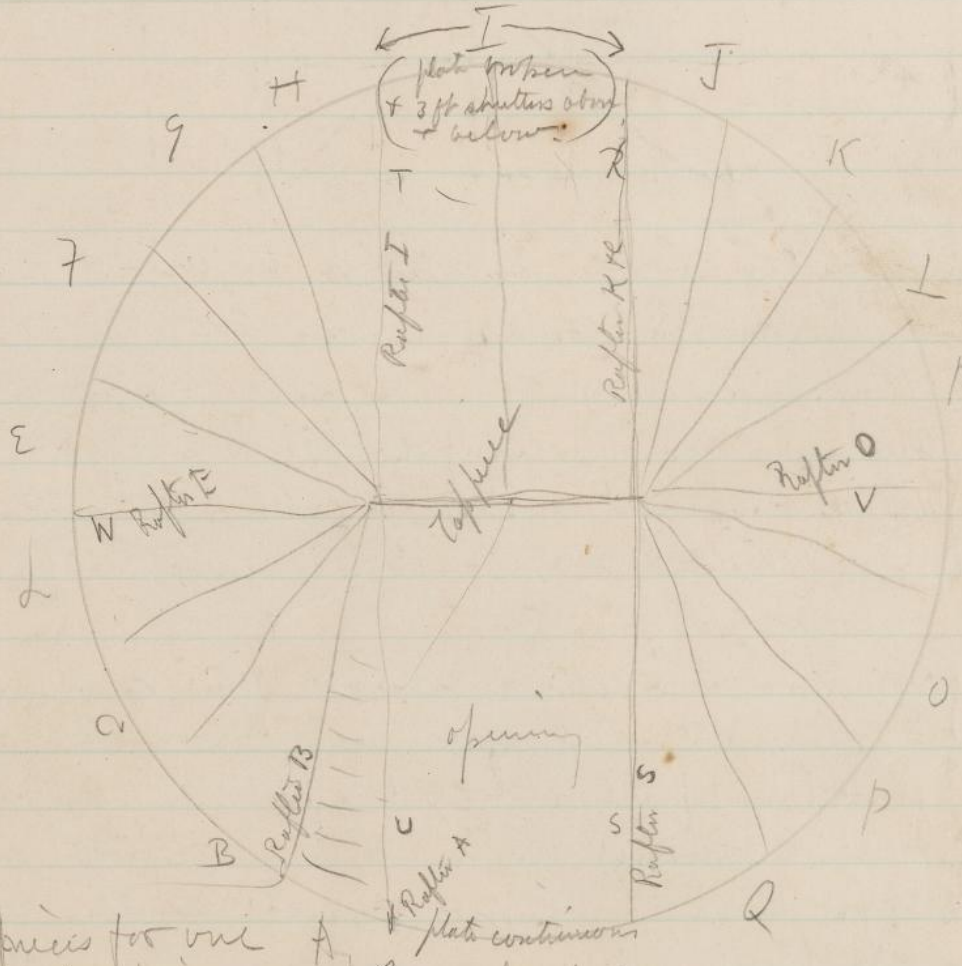
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June 23. 1890

Notes. dimensions &c of the dome for S. A.

See pg 84 —

Roof



These letters marked on centers. for brackets of shutters for roof

All pieces for one pair of slant in one bundle & marked with letter

Two short iron bands go between R & S — T & U. The long ones between V & W.

Upper Plate marked on top with letters of rafters in their positions. Put up Rafters A & I, & S & K first. Then O & E. Then rest.

Iron top piece.

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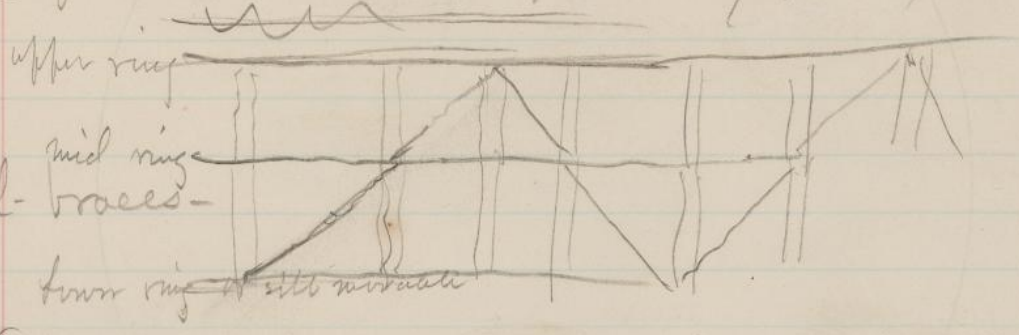
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Cylindrical Top (see bromide print)

Eaves strips — There is a bundle of strips which go round roof just under the eaves. Marked "Eaves." They go on in 2 thicknesses. Widest go inside. Must nailed on.

Inside uprights 5 in wide in bundle. Marked. 3 screws at bottom. go in any places.

Inside braces — Bundles of curved inside diagonal braces not put up in Camb. at all. (go in any place) Thus —



Wedges at foot of uprights — Bundle of wedges to put on bottom of outside uprights to hold canvas out from wheels — to go about ½ in above flat square roof.

Special uprights — Six inside & outside uprights that have to go in particular places — marked on bottoms 1 to 12 & on lower plate. sides of shutters & uprights holding cross piece with pulley near big shutter.

Tracks — There are 3 tracks. 2 lower & 1 upper. about 9 pieces in a track. Outside lower track marked on outside of curve (on top outer edge when track in laid). Inside lower track is marked on inside of curve. (top inner edge) Upper track is marked on further edge with an additional notch on opposite edge to distinguish it from other tracks. Marks are notches filed in the iron.

Begin at — Lower track begin at black paint mark on circular sill N.W. corner. Upper track at similar mark on underside of movable circular sill.

Lower side shutter 2 in longer.

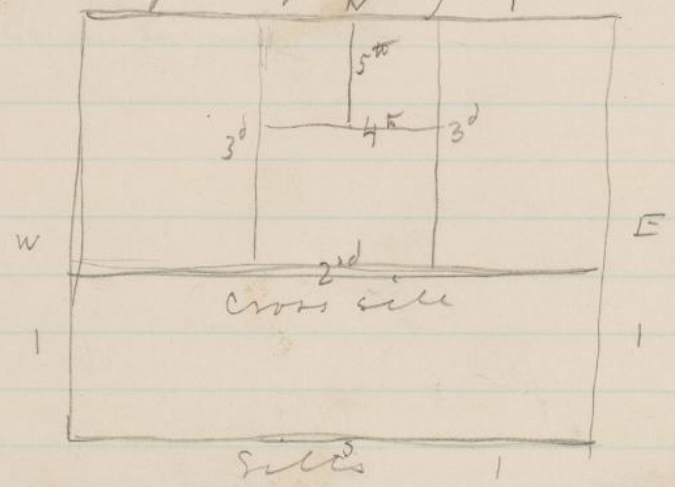
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General plan of putting up dome

1st put on sill on post. & square round form that. Then fasten together - pins &c.

2nd Long braces after getting sills bolted up & in



3d put up studding on one side (10ft 6in high) & get on straight plate. Then all round, piece by piece, & braces at corners (8) & then braces at (8 in all) all new corners.

4th Then circular sill having double track

5th Movable sill (or lower circle) having single track. Block this up till ~~other plates are on~~ Then put in trucks or rollers - this & other plates can be put together on sill. Then top one parted in 2 or 3. Lower one blocked up - track put on & trucks under. Then uprights screwed on to lower plate & all rounds raise middle to proper height & support it by others already out. Put on upper plate in same manner as middle & roof as already given.

5½in long bolts in lower plate
3½ in middle & top.

} Staging will have to be used.

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~~Struct~~ Rings

Rings — Middle ring marked on top, starts at opening & goes round same as Wallet bands, on upper half & 11 then right on lower half 12 to ~~21~~ 1 (In putting this up begin at 21 ~~Lower~~ sill & tracks. Make lower ring on sill & then raise it on blocks & put on upper track & blocks

Get #s 9 & 10 of lower ring to the south & then build middle ring with opening at this section.

1 2 3 — (3) & (4) & (9) & (10) belong to lower ring uprights &c & not to pieces of ring also all Nos on outside. These outside characters in the lower ring as they don't go near the joints but do go near the screw holes.

Lower ring marked on inside ~~=~~ top ring on outside (over)

Note Center — There is a heavy line cut in "center" of all rings - or any two lower ones. Find the piece with that cut & start it on the south side.

Lower circular (stationary) sill is marked in roman numerals I, II &c on top, begin at center

In putting up this part get each part centered before completing that part.

Ends of sills marked with point of compass. Floor timbers all alike

staging — Floor timbers may be used for staging & put in place the last thing.) If circular sill isn't level, fix it by wedges under lower square sill, find highest point by leveling with spirit level, a board supported edgewise on blocks.

Leveling Circular Sills

In this case floor was laid as soon as sills

Way to put up studding — Tenon is projection on end of stud. Put in 2 corner posts - brace down diagonally thus  . Lay plate across on tenon at one end & hold other end up while someone puts in studs. Finish one side before putting in next.

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Corner posts are marked (SE, NW & NE) & studs beginning at door (Nos 1 & 2 to 22) some Nos may be omitted in these posts (really belonging to Diag braces. Better try photos / each side.

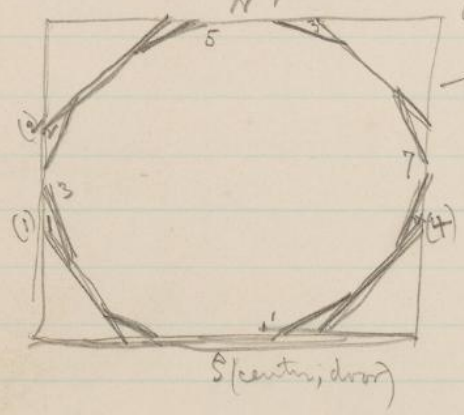
Two diagonal views: towards NE & SW July 6. 11 A.M.

(See page 86)

(See note pg 74)

Corner braces at top & above (not shown) for which there are Nos inside plates. Braces only marked on one end.

When Nos are omitted, they are on one of the four braces not on plates.



See pg 84

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Charts for Path of Mars -
During July & August. 1890.

Chart I. $15^h\,40^m$ to $16^h\,20^m$. (Standard stars marked on edge)
Chart II $16^h\,20^m$ to $17^h\,0^m$
Chart III. Same as II with standard stars marked.

Standard stars for Chart I

May. For mean date Jan 0. 1875. Argentine Gen. Cat.

π	Scorpii	15^h	5^m	18^s	25	45	8 S
δ	"	15	52	57	22	15	50
α	"	16	21	45	26	9	10
σ	"	16	13	36	25	17	28
o	"	16	13	7	23	52	0
ω_2	"	16	0	5	20	31	45
b	"	15	43	28	25	22	10
A'	"	15	46	7	24	57	
c_2	"	16	4	36	27	36	
d	"	16	10	33	28	18	
γ_1	"	15	46	30	23	36	15
γ_2	"	15	46	26	24	9	32

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– Charts for Mars –

Mag- Standard stars for Chart II + III

	α Scorpii	16^h	21^m	45^s	26°	$9'$	$10''$ S.
	ρ Ophiuchi	16	18	6	23	9	30
	τ Scorpii	16	28	6	27	57	16
	i "	16	22	37	24	50	17
	ω Ophiuchi	16	24	44	21	11	48
	(Cluster 4261 in ~~Orpha.~~ Scorpii	16	54		29	56)	
	(Cluster 4264 in Orph	16	56		26	5)	

Magnitude		Smaller stars					
5.9	A	5.9	16	49	16.	22	57
7¼	B	7¼	"	47	18	23	18
	C		"	34	2	24	13.5
	D		"	42	8	24	25
	E		"	52	30	24	47 47
	F		"	37	11	28	16 29
8½	g	8½	"	40	13	23	44 47
8½	h	8½	"	26	18	24	1 26

– Reduction Table i.e. scale –

In R.A.

$4^m = 18.^{mm}30 = 1^\circ$

$1^m = 4.60$

$10^s = .76$

$3^s = .38$

$4^s = .304$

$2^s = .152$

$1^s = .076$

In Dec.

$1^\circ = 20.^{mm}00$

&c

$1^{mm} = 13\frac{1}{3}{}^s$

$10^{mm} = 2^m\,13\frac{1}{3}{}^s$

&c

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Page for Chart I

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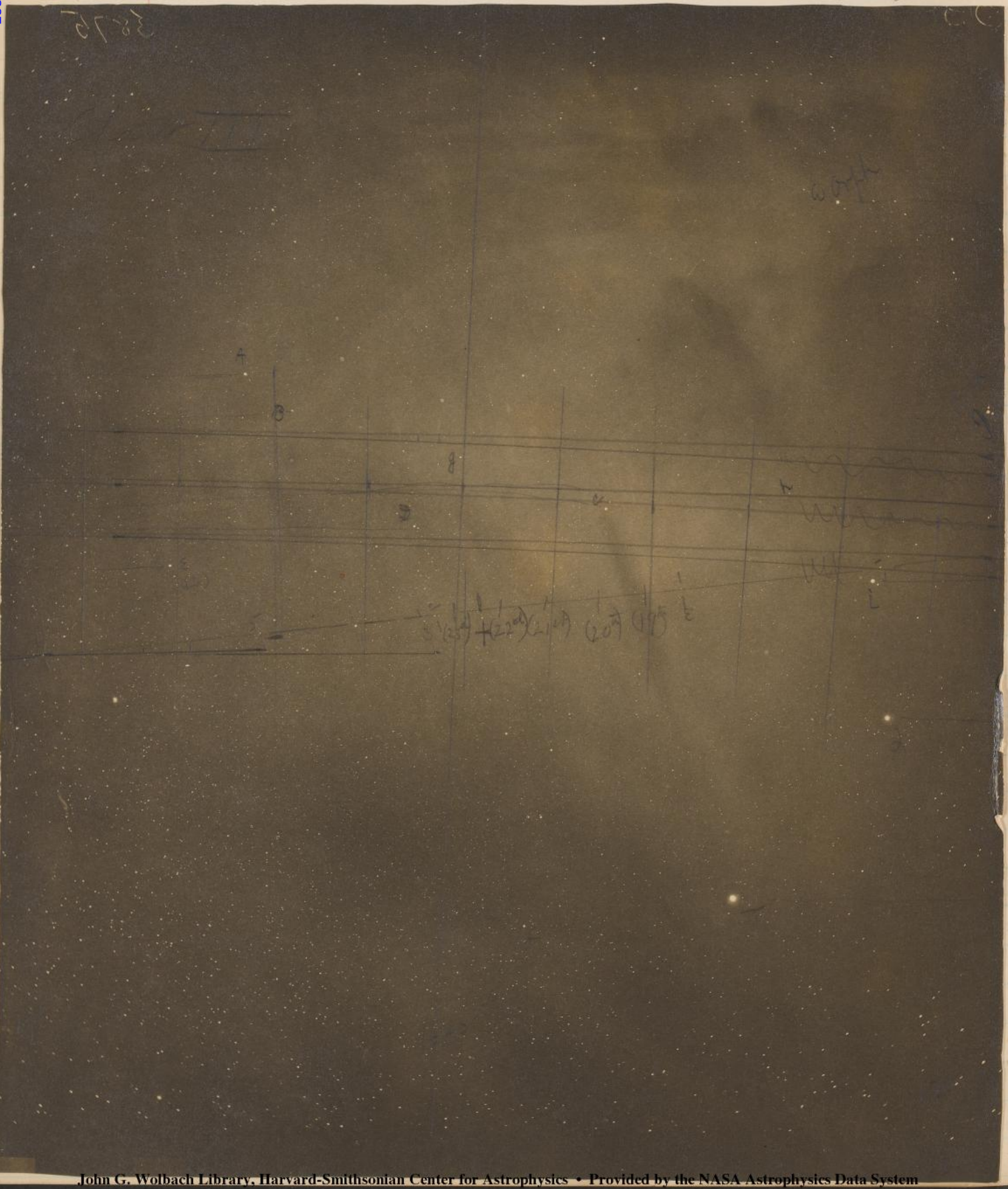
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Page for Chart II

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Chart III. same as chart II - with stars identified.



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Reduction of Mars position to mean date Jany 0.0 1875. & intervening work. Annual Precession

Date	R.A. 1890	Dec. 1890	R.A. Do to Jan 0	Dec. Do to Jan 0	Ann. R.A.	Ann. Dec
July 1	15h 40m 13s	22° 41′ 20″	15h 40 9s.3	22° 41′ 05″	3s.529	11″.44
6	39 58	45 22	39 54.3	45 7	3.53	11.51
11	41 11	52 41	41 7.3	52 26	3.532	11.43
16	43 49	23 3 10	43 45.3	23 2 55	3.54	11.23
21	47 46	16 35	47 42.2	16 21	3.55	10.95
26	52 58	32 29	52 54.2	32 15	3.565	10.56
31	59 19	50 14	59 11.3	50 2	3.587	10.09
Aug 5	16h 6 43	24 9 10	16h 6 39.2	24 8 58	3.595	9.52
10	15 04	28 37	15 00.1	28 24	3.62	8.87
15	24 18	47 58	24 14.0	47 44	3.636	8.14
20	34 22	25 6 36	34 18.0	25 6 24	3.653	7.32
25	45 11	23 51	45 7.0	23 40	3.674	6.44
30	56 40	39 03	56 36.0	38 53	3.689	5.48
Sept 4	17h 8 46	51 36	17h 8 42.0	51 27	3.704	4.45
8	18 50	59 22	18 46.0	59 14	3.714	3.59

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Date		Precession in 15 yrs. In R.A.	Precession in 15 yrs. In Dec.	Position of Mars reduced to Epoch Jan. 0. 1875 In R.A.			In Dec.	
July	1	−52ˢ.94	−172″.4	15ʰ	39ᵐ	16ˢ.4	22°	38′ 12″.6
	6	52.95	172.6		3	01.3		42 14.4
	11	52.98	171.4	Chart I	40	14.3		49 34.6
	16	53.10	168.5		42	52.2	23°	50 06.5
	21	53.25	164.2		46	48.9		13 36.2
	26	53.48	158.4		52	0.7		29 36.6
	31	53.80	151.3		58	17.5		47 30.7
Aug	5	53.93	142.8	16ʰ	5ᵐ	45.3	24	6 35.2
	10	54.30	133.1	Chart I	14	5.8		26 10.9
	15	54.60	122.0	Chart II	23	19.4		45 42.0
	20	54.80	109.9		33	23.2	25	4 34.1
	25	55.10	96.6		44	11.9		22 3.4
	30	55.34	82.2		55	40.7		37 30.8
Sept	4	55.56	66.7	17	7	46.4		50 20.3
	8	55.71	53.8		17	50.3		58 20.2

Mars goes over one of a fine double on Sept 31. Mag 8

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Mars. June 30. 1890

Estimated position of 6 stars near which Mars passes.

						Reduced position at time of conjunction
1/	15h	39m	30s	22°	46′	S
2/		52	27	23	31	
3/		56	8	23	39	over.
4/		56	52	23	42	
5/	16	6	12	24	05	7m 12.s4 8′ 35.″5
6/	16	9	20	24	15	

No 5. was found in A.G.C. to have —
RA = 16 6 14.64 Dec = 24° 6′.5

Date of conjunction of Mars with these & Mars apart Declination. No 5 was reduced from A.G.C (1875)-Stars approx.

No star.	Date of Conjunction		Declination of Mars at date.			
1	July 8d	15h 37	22	48	49.4	
2	26	7.68	23	33	32.9	
3	29	7.46	23	44	03.2	
4	29	21.37	23	46	11.	
5	Aug 5d	7.h2	24°	10′	19.″1	1′ 45
6	7	4.5(4)	24	17	38.6	

Above stars reduced approx to 1850.0 to consult Oeltzens Cat.

1/	15h	38m	10.s2	— 22	41	13
2/		51	0	22	26	36
3/		54	38		34	44
4/		55	22		37	44
5/	16	7	50	24	11	10

} None identified.

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Mean apart positions of the 5 stars from measurements on chart I & reduction to dates of transits.

Stars No	R.A.	Total Interp. Corrn.	R.A. Corrd		
1/	15h 39m 29.5	+ 56.6	15h	40m	26.1
2/	52 23.5	57.3		53	20.8
3/	56 06.0	57.5		57	3.5
4/	56 52.0	57.4			49.4
6/	16 09 17.6	57.9	16	10	15.5

In Declination.

1/	22	45	20	3′ 7″	22	48	27
2/	23	31	15	2 52	23	34	7
3/	23	39	50	2 47	23	42	37
4/	23	42	0	2 45	23	44	45
6/	24	14	0	2 41	24	16	41

Corrected positions - Summer 1890.

Nos	R A.			Dec		
1.	15h	40m	26.1	22°	48′	27″
2.		53	20.8	23	34	7
3.		57	3.5	23	42	37
4.			49.4	23	44	45
6.	16	10	15.5	24	16	41

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Tuesday July 1, 1890.

May Positions of stars along path of Mars in Chart II

8'	1/	16h	22	19,57 (sat 27.5)	X	24°	42′	04″,8 (sat. 41′
8½	2/	16	41	14.07 (" 20)	X	25	17	03.4 (" 16′
8½	3/	16	41	39.95 (" 45)	X	25	20	08.4 (" 18′ 40
7	4/	16	44	36,04 (" 43)	X	25	23	10,8 (" 22′
sel/sq 75.	5/	16	48	(41.) (" 47)	X	25	(29 10)	(" 29′ 10″
8½	6/	16	57	56.50 (" 60)	X	25	38	24,4 (" 38′ 0″

These stars have their Nos on chart III.

Reduction to date of Conjunction with Mars (Work below Aug 14)

1/ 16h 22 19.57 — 24° 42 04.8

+ 54.6 — + 2 03.3 Dif long. 14d 11.5h G.M.T.

+ 4.0 — + 14

16 23 18.2 — 24 44 22. Dec/M. 24 45 58 (S)

2/ 16 41 14.07 — 25 17 03.4

+ 55.1 — + 1 40.8 D/C. 23d 15.4h G.M.T.

my close + 4.0 — + 12.0

16 42 13.2 — 25 18 55. Dec/M 25 19 24

3/ 16 41 40.0 — 25 20 08.4

+ 55.1 — + 1 40 D/C. 23d 20.6h G.M.T.

+ 4.0 — + 12

16 42 39.1 — 25 22 0 Dec/M 25 20 3

4/ 16 44 36.04 — 25 23 10,8

Close + 55.1 — + 1 36.6 D/C 25d 4.3h G.M.T.

very close (com for Nos) + 4.0 — + 11

16 45 35.1 — 25 25 0 Dec/M 25 24 26

Nos 6/ 16 57 56.50 — 25 38 24.4

Date 26d 13.28h G.M.T. + 55.3 — + 1 19. D/C 30d 22.88h G.M.T.

Dif in Dec 20″ Mars to N + 4.0 — + 10

16 58 55.8 — 25 39 53 Dec/Mars. 25 41 40

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Tuesday July 8 1890

It is found that the actual path of Mars is some 2' to 2'.5 S of the above computed path, Hence some new stars will be investigated.

1/ RA = about $15^h\ 40^m\ 38^s.$	Dec = $22°$ 57' 36"	Date of conjunct
$+ 53^s$	+ 2' 51"	$11^d\ 22^h.84$
+ 3.7	+ 15"	— Dec of Mars
15 41 34.7	23 ° 42	22 54 26
2/ RA about $15^h\ 42^m\ 21.6$	Dec = $-22°$ 59' 42"	Do
+ 53	2 49	$15^d\ 5^h.1$
+ 3.7	15"	Do
15 " 43 " 18.3	23 " 2 " 46	23° 01' 18".7

2/ In conjunction with Mars July $15^d\ 5^h.1$ G.M.T.
Mars passes 1' 27" to the north.

Note Took 8 x 10 view of square framework of Dome for S.T. at 10.45 A.M. See Pg 63.

Star from 1878 Vol I A.G.C. RA = $15^h\ 43^m\ 26^s.85$, Dec = 22° 53' 3".5
Reduced to July 1890 :— RA = 15 44 13.1 ; Dec = 22 55 33

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Wed. July 9. "90

Observations with Ring Micrometer,

By Prof. W. H. Pickering, last evening (July 8)

Mars

Transit Mars July 8d 17h 14m 30s.81 S.T. (B236.) / 6. 12 (S.T.

7 27 ~~22.5~~ 30,

~~0h 47m~~

9 52 E ✓ ▽ Counted

5

14 52

8 49.5 watch

7 22.5

Ans. Pg 73.

27 — 19.6 7

20 — 14. 6

45 — 40 5

43 — 36 = 7

47 — (41)

60 — 56,5 — 3,5

5 (28,5

6

+ 37.

+ 13.

+ —

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Wed July 9, 1890

Observations with Ring Micrometer.

B Prof. W H Pickering.

Mars.

Transit Mars July 8d 17h 14m 30s.87 Sid. T. (Bond 236) 16..12.8 S.T.

7 22 30 — 8 49.5

9h 5 2m 0 S.S.T. (Cord) — 7h..22.5

5.

14 52 S.M.T.

Motion in α per hour .681 — Do in δ per hr 3.82

9½ h

6.152 9

6.23

15h 40m 31.70

+(− 6.23)

α = 15 40 25.47

34.38

,55

+(− 34.93)

− 22 49 21.8

δ = −22 48 46.9

2nd = 17h 14m 44.1

1st = 17 14 17.5

T = 26s.6

2 | 61.6

α = 17h 14m 30s.8

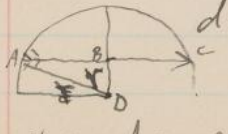
d = r Cos δ γ

log r = 2.6186

log Cos γ = 9.9526

2.5712

d = 372.6



DB = d = r Cos γ

15 T Cos δ reduces Chord AB to Equator

& evidently 2(r Sin γ) = 15 T Cos δ

$\sin\gamma = \frac{15\,T\cos\delta}{2r}$

$\log\frac{15}{2r} = 8.2565$

log T = 1.4249

log Cos δ = 9.9646

Log Sin γ = 9.6460

γ = 26°..8 16'

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Wed July 9, 1890

Ring micrometer – continued.

Double Star

2nd $17^h\ 16^m\ 1^s.5$

1st $15\ 29.0$

$T = 0^m\ 32^s.5$

$\alpha = 17^h\ 15^m\ 45^s.25$

$\log r = 2.6186$

$n \cos p = 9.9249$

2.5435

$d = 349''.5$

mean d 372.6

~~$23''.1$~~

22.1

$\log \frac{15}{2r} = 8.2565$

$\log T = 1.5119$

$\log \cos \delta = 9.9646$

$\log \sin p = 9.7330$

$p = 32°.73 (= 32° 44')$

17 15 45.25 star

17 14 30.81 mean

1 14.44

Mars further north.

Mars $\alpha_0 = 15^h\ 40^m\ 25^s.47$ $\delta_0 = -22°\ 48'\ 47''$

$1\ 14.44$ $+ 12\ \ 22.1$

Star $15\ 41\ 39.91$ $-23\ 00\ 49.1$

Star 15 41 39.9 −23 00 49.

Mars July 12 – 15 41 36.0 July $12^d\ 3^h.5$ 22 54 48.

3.9

July 12^d $3^h.5$ in conjunction.

Mars passes 6′ to the north.

Obs'd Position. $\alpha = 15^h\ 41^m\ 39.4$ $\delta = -23°\ 00'\ 49''$

Chart (I) " $\alpha = 15\ 41\ 34.7$ $\delta = -23\ \ 00\ \ 42$

Difference = Correction for Chart = $+ 05^s.2$ in R.A. $+ 07''$ in Dec

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Mad. July 9, 1890

Ring Micrometer Observations. Contd.

2nd Star 8 mag.

2nd 17h 18m 46.s

1st 17 17 45,5

T = 60.s5

2 | 151,5

α = 17 18 15,75

$\log \frac{15}{2r}$ = 8.2565

Lg T = 1.7818

9,9646

0.0029

Log r = 2,6186

Lg cos γ =

Too near middle of ring to make Dec at all accurate. Yet roughly it is 370" south of Mars, or about −22° 55'

Estimated at 20" S. of center of ring

Time of Transit

Star 17 18 15,75

Mars 17 14 30.81

3m 44,s94

2 Mars 15 40 25,47

15h 44m 10,s41

Star (8 mag) − 22° 55' 20"

Obsd position α = 15h 44m 10.s41 δ = −22° 55' 20"

A.G.C. " α = 15 44 13,1 δ = −22 55' 33"

Difference 2.s5 in RA. About 13" in Dec

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Tues. July 15. 1890.

Ring Micrometer Observations.

Star of 9th Mag.

Mars.

Mars. Transit July 14d 17h 12m Sid. Time (B236) 16 52 S.T.

7 46 — 9 06

9 26 — 7 46

5,

14d 14h 26m S.M.T.

Motion in α per h. 1.518

9½

.759

13662

− 14.421

α(15d) = 15h 43 10.45

α = 15h 42 56.03

Do in δ per h. 5".71

9½

285

5139

− 54.2

23 0 49.5

δ = − 22 59 55.3

2nd = 17h 13m 25.8

1st = 17 182 31.3

T = 54.5

117.1

58.5

α = 17h 12m 58.5

$\sin \rho = \frac{15\, T \cos \delta}{2r}$

$\log \frac{15}{2r}$ = 8.2565

log T = 1.7364

log cos δ = 9.9640

log sin ρ = 9.9569

ρ = 64° 54′ = 64.9

d = r cos ρ

log r = 2.6186

log cos ρ = 9.6276

log d = 2.2462

d = 176.3

Mars above, i.e. South of center of Ring.

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Lucs. July 15, 1890

Ring Micrometer Obs^ns of Last Evening.

Star. 9 mag

2nd	17^h	13	38.25
pt	17	13	11.00
T =			27.25
2			49.25

a = 17 13 24.63

Log r = 2.6186

" Cos γ = 9.9502

Log d = 2.5688

Mars' d = 370".5 N } from centre.

Mars. d = 176".3 S }

Mars 194".2 N = 3' 14".2 N.

Log $\frac{15}{2r}$ = 8.2565

Log T = 1.4354

" Cos δ T.9640

" Sin γ = 9.6559

γ = 26°.92

Star	17	13	24.63
Mars	17	12	58.50
			26.13

d Mars	15^h	42^m	56^s.03	δ =	−22	59 55".3
			+ 26.13		+	3 14.
Star's R.A. & Dec. d	Star	15	43	22.16	− 23	3 9.3

Star	15	43	22.16	δ	−23	3 9.3
Mars July	15	43	10.45	July 15^d 7^h.7	− 23	1 33.5
			11.71			

Mars in conjunction with this star on —

July 15^d 7^h.7 G.M.T. & passes 1' 36" to the North

Observed Position of Star	15^h	43^m	22^s.16	−23°	3'	9".3
Do estimated from Chart	15	43	18.3	−23	2	46. (See pg 74)
Correction for Chart positions			+ 3^s.9		−	23".3

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Tues. July 15, 1890

Dates of conjunction of Mars with 6 stars. 5 of them between July 26 & 31 & 2 more about Aug 3 sup 8.

Positions of stars in reference to Mars & Dates are taken direct from chart I

1st The four stars between July 26 & 31.

Measurement of positions.

τ = Length of curve for 5d. = 29.6

τ_1 = same measd. for Opp. end. = 29.45

	of from one end		2d from other end	
1/	1.9	1.85	27.7	29.6
2/	8.05	7.95	21.6	29.65
3/	15.2	15.15	14.4	29.6
4/	27.05	27.05	2.5	29.55
other end	29.6	+	29.45	29.6
		Coll. 29.5		29.45
				6)177.45

All these to the δ Mars

Average of 2 obs.

1/	0.3 m m	= 54"
2/	0.3 m m	54"
3/	0.34	61"
4/	0.20	36"

Dist for Conjunctions

	(approximate)	
1.875 m m	July 26d 8h sup	Average 5d = 29.m m 575
8.000	27d 11h	
15.175	28 16h	
27.050	30 14h	

1.88 / 5.51

2.49 / 5.71

3.96 / 5.95

3.75 / 6.28

As the movement in Dec is fairly steady, the proportionate motion in R.A. gives the days as follows

	days	m m		Day sep.	Log Stas	Diffs	Log Days
July 26.	0.0	~~1.875~~					
27	5.51	.7413	5.51	h_2 = 0.7413	.2742	.4671	$\bar{1}$.5329
28	11.22	1.0499	5.71	0.7566	.3962	.3604	$\bar{1}$.6396
29	17.17	1.2340	5.95	0.7745	.5977	.1768	$\bar{1}$.8232
30	23.30	1.3671	6.13	0.7875	~~.5749~~		
31	29.58	1.4710	6.28	0.7980	.5749	2 240	$\bar{1}$.7760

Taking separate days as if motion in each was constant does not produce an error greater than — ½

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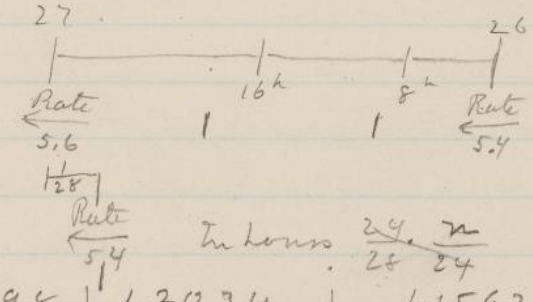
July 16, 1890

Logs of fractional parts

T.5329	+ log 24 = 0.9131, = in hours.	8.h19	July 26. (1
T.6396	1.0198	10.5	" 27 (2
T.8232	1,2034	16.0	" 28 (3
T.7760	1,1562	14.3	" 30 (4

Cor. frac'l day

T. 5329 + [log 1/28 =
T. 6396 [log 1/29 =
T. 8232 [log 1/30 =
T. 7760 [log 1/32 =



In hours. 24/28 · n/24

log n,	0.9131	1.0198	1.2034	1.1562
log 28,	1.4472	29 1.4624	30 1.4771	32 1.5057
	T.4659	T.5574	T.7263	T.6511
Cor.	~~+292~~ .3	~~+361~~ .4	.5~~23~~	.4~~446~~ additive.

Dates. 1 July 26. 8.h5 − 5. = 3.h5
2 " 27 10.9 − 5. = 5.9
3 " 28 16.5 − 5. = 11.5
4 " 30 14.7 − 5. = 9.7

G.M.T.

Standard.

– For other two stars –
Compute position of Mars for Aug 4-5-6
& plot on Coord. paper.

Mars Aug 4. 16 5 9.52 24 5 18.7
57.69 2 35.6
16 4 11.82 24 2 43.1

Aug 5. 16 6 42.96 24 9 9.6
57.77 2 34.
16 5 45.2 24 6 35.6

Aug 8. 16 8 18.70 24 13 1.8
57.84 2 32.
16 7 20 86 24 10 29.8

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July 21st 1890

Su Pg 81 - Zops. (copied from July 16th)

Path of mars aug 4-6 plotted & 3 stars pararound from chart II put in also. The middle star is No 5 of pg 71. as a corrector.

In the plate the lengths of aug 4 & 5th is 93,8 m m, of aug 5 & 6 94.6 m m As all 3 stars are near aug 5, the average of these two lengths is adopted as the day lengths & measurements are made either way from aug 5.

Star 5,	Aug.	4d	18h 24	mars passes	35" N of star
" (7)	"	5	6,78		2' 18" S " "
" 6		5	8h 25		29 N " "

Corrector. According to computation of June 30. Pg 71. The date of conjunction is 5d 7h 2 & mars passes 1' 43" S of star.

Dif in time + 24m, Cor for mars, dist N of star + 35"
This last is within pretty big limits,

Star (7) [No 5 of pg 71)

Estimated position	16	6	12,5	- 24	5	24m
True position			14,6		6	0
Cor			+ 2,1		+	36" S

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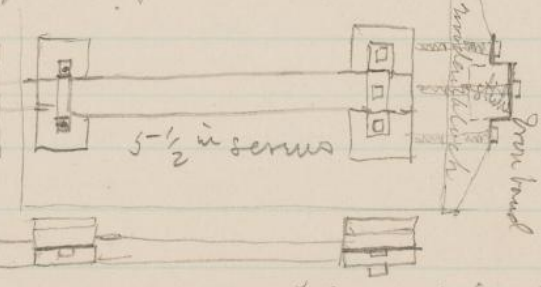
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July 9, 1890

Mem about Domes – See pgs. 59 & 63

Ladder for Dome

Ladder to mount ~~square part~~ drum stands out 4 in to prevent bars from touching canvas. Screw on the irons 2½ screws & mark holes in (outside) uprights – four iron straps to be screwed on to ladder & then into drum. One goes just to left of vertical shutter & extends up above top, drive a nail into each round after getting it together



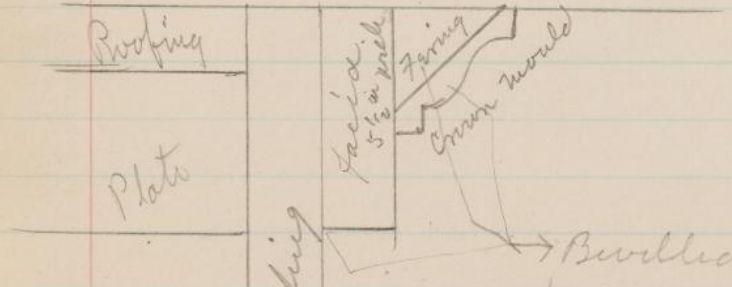
Ladder

Stick for turning dome

This end fastens to lower ring (movable sill)

This end fastens to middle ring

Moulding &c.



Bevelled & will have to be cut to proper lengths after setting the corners.

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four iron rods have been prepared for corners but may be put anywhere

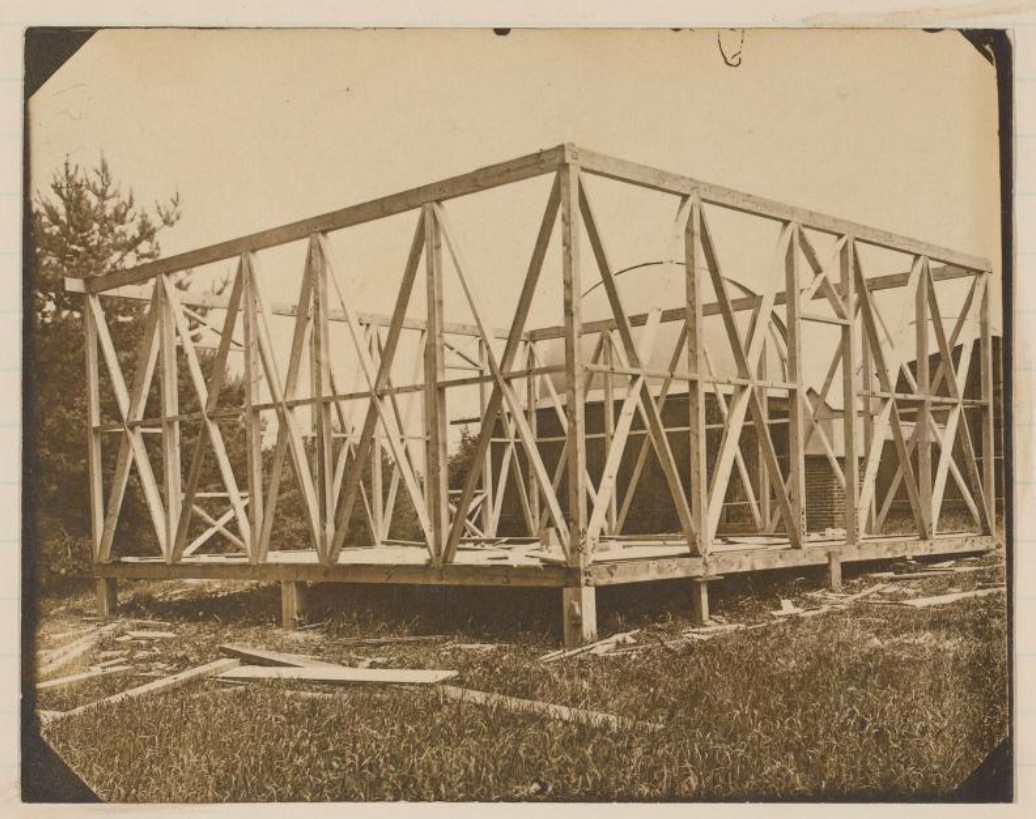
Board right over windows & possibly door & then cut out & put ~~facings~~ casements on

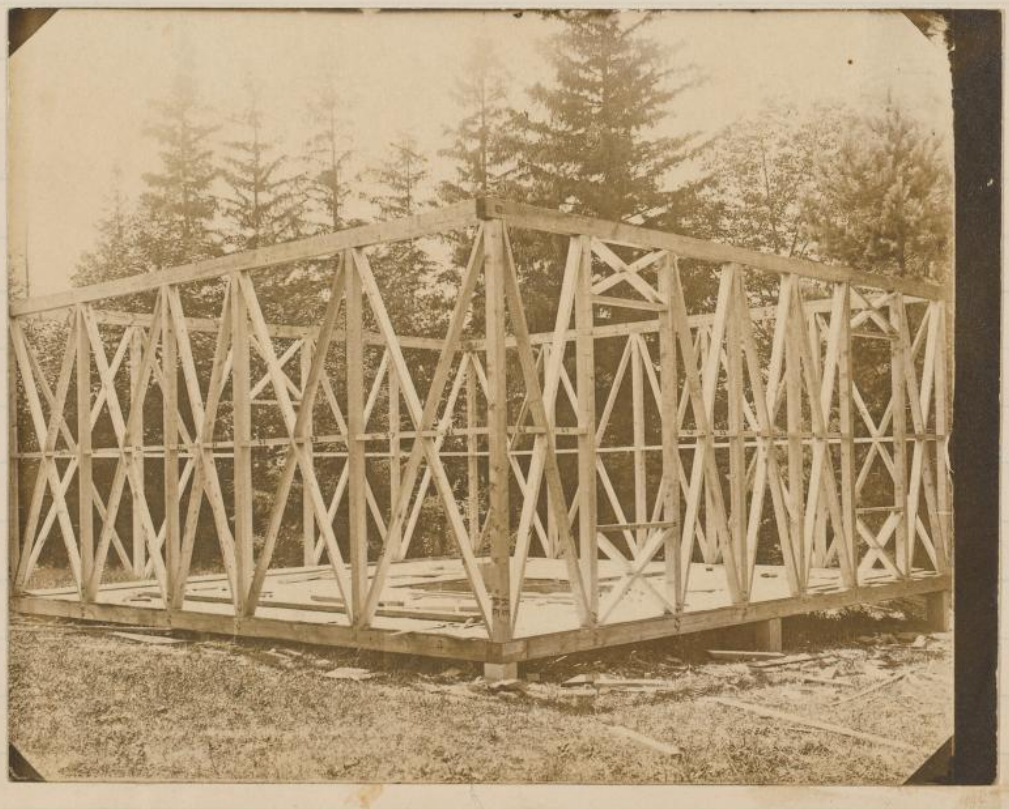
Semicircular slips groove all cracks outside and extra boards at corners, as on other domes here, Door way can be fitted together & extra ends cut off & then put right in opening in frame for it, & casings nailed on outside. (Casings are not fastened to it)

Door

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Sunday eve, Aug 3

m ½ s

1st 25 108,5 mars on wire,

28 57, star

2 6 8.5

2nd 31 60.5 mars ~~on wire~~,

34 7, star not so accurate as last

½ 66,5 very close to wire,

3d 37 2 Mars (about

39 68.5 star - little above wire,

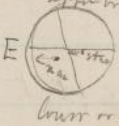
½ 66.5

19h Sid Time By Chron, B236

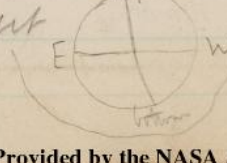
Comp with Sid Clocks 71327 gains −5m 6.s4 error

" 71327 is −52.s1

An average of these giving the second only ½ weight is 2m 33,s7 but this dif. is probably due to the fact that the cross wires are not at right angles. An observation was not made on which way the N+S wire inclines, but assuming that the upper (apf.) end inclines towards the East (or left looking at mars) thus ~~(N)~~ upper or South ~~(S)~~ as the star was above mars the observed dist. between them would be greater with Mars on the wire & equally less than the true dist with the star on the wire.



On inspection this assumption is correct only the N+S wire is not perfectly straight so that the true value is nearer 2m 34,s3 than 2m 33,s3 or about 2m 33,s8



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1890

Aug 10. Sunset. Put on Ballon 103

Mon 11. A.M. Fixed batteries. Arranged connections in basement, so as to get either of mean time clocks or sid. do or sid. Chronometer on Chronograph or sound comparisons between any two.

P.M. Obs.rs in eve, found Bal 103 was nearly a second fast in eve. took off 5 gms. leaving 12, & probably touched the pendulum b.b. for during the night it lost half a minute. / Put on Bond 394 in place of Bal 103.

Tues 12 A.M. Rain for 1½h Comparisons &c. Transferred signals back to Bond 394. 1h in eve.

Wed 13 A.M. Fixed dials which were all askew. Made list of time work (daily) for Mr Powis reference if he should take my place for a day anytime.

P.M. Tested sensitiveness of some plates for Prof.

Thurs 14 A.M. Visitors. Worked up dates of conjunctions of Chart II Summary of Work

~~Fri~~ P.M. Set tracks for some mg plates & exp.d 2 in eve, Mr Powis helped me.

Fri 15. A.M. Stars. Sgs on mg plates. Dull, rain.

Sat 16. A.M. Measured Mg plates,

Sun. 17 eve. 1h on time work,

Mon 18th A.M. Fixed Mg, Eyp, Appl. Visitors

Prepared for Exp. Mg ribbon plates. (18 mm long each piece of ribbon) This latter took about 10 min; Forwarded telegram from Kiel to Bos.

Eve. Exposed 8 plates - with Mr Powis's help. Took up less than 1h

Tues. 19. A.M. Put on Stand Sgs on 8 plates.

P.M. Visitors. Had to see about when W put coal, &c

Wed 20 A.M. Fixed (or tried to) dial circuit. Examined Battery connections, switchboard, clock shunts, & back of dials Observations. R.M. & time in eve.

Went to Bost. W.H.P. at noon

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Thurs. Aug 14, 1890

Stars from chart II, Sir Page 73.

Nro	Mag	R.A.	Date of Long. Cambr. Time	Mars passes	Nos
1	8	16h 22m 19.s57	Aug 14d 6.h5	0° 1′ 36″ to the	S 1
2	8½	41 14.07	NB 23d 10.h9	Watch 0′ 29″ " "	S 2
3	8½	41 39.95	23d 15.h6	2′ 0 " "	N 3
4	7	44 36.04	Aug 24d 23.h3	Fine Watch 34 " "	N 4
5	——	46h 48-41 —	NB 26d 8.h28	Watch 20″ " "	N 5
6	8½	57 56.50	Aug 30d 17.h88	1 47 " "	S 6
Est. #2	8½	16 30¾	Aug 18		S
A1	8°	16 40 12,5	22d 12.h8	2′ 39″	N

Approx position of star A1 (between Nros 1 & 2

Same Dec as Nro 2

9.m1 less R.A. = 2m 0.s7

Corrd R.A. Nro 2 16 42 13.2 Dec = 25 16 55

— 2 0,7

16 40 12,5

46.3

12.5

5.44) 33.80 (6.2

3264

1160

16 40 46.3 = R.A. Mars on Aug 23d 0h

— 6.h2

In conjunction Aug 22d 17.h8

8.54

6.2

1708

5124

52.96

53.

Mars' Dec. Aug 23. 0 25 17 9.1

53.

" " " 22d 17.h8 = 25 16 16.1 Guess

Stars " " 25 18 55

2′ 39″

22d 12.h8 Camb. Time.

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Fri. Aug 15, 1890

Yesterday afternoon worked on Neg. plates,
Results.

Having to try, if possible plates on both ribbon and wire (50 mpr at 100 metres) found—

1st Wire could only be lighted with a bunsen burner & then would often go out,

2nd Ribbon could not be lighted with slow-match, so in use used small alcohol sponge to light it with,

On the wire kind, slow-match, match, candle and alcohol sponge

3rd of the eight pieces of ribbon set off, only one went out,

4th all had small ends (say 3 mm) left unburned,

These pieces were almost exactly same size in each

Note: The wind was blowing freshly during the operations & there was a hole in the board of the box, which better be stopped,

5th The pieces of ribbon were all 61 mm long except one which was only 60 mm. I think it safe to measure of say 63 or 64 mm. (the extra to make up for the unburned piece)

Note 2 Irregularities may be in the plates as the spaces along sides developed in prints

Note - Sensitiveness of Seed 26 ×

From plates Q 1342-46 Seed 26 × do not seem to be superior in any respect to the ordinary 526. If anything they are not quite as good, but there is very little difference between them.

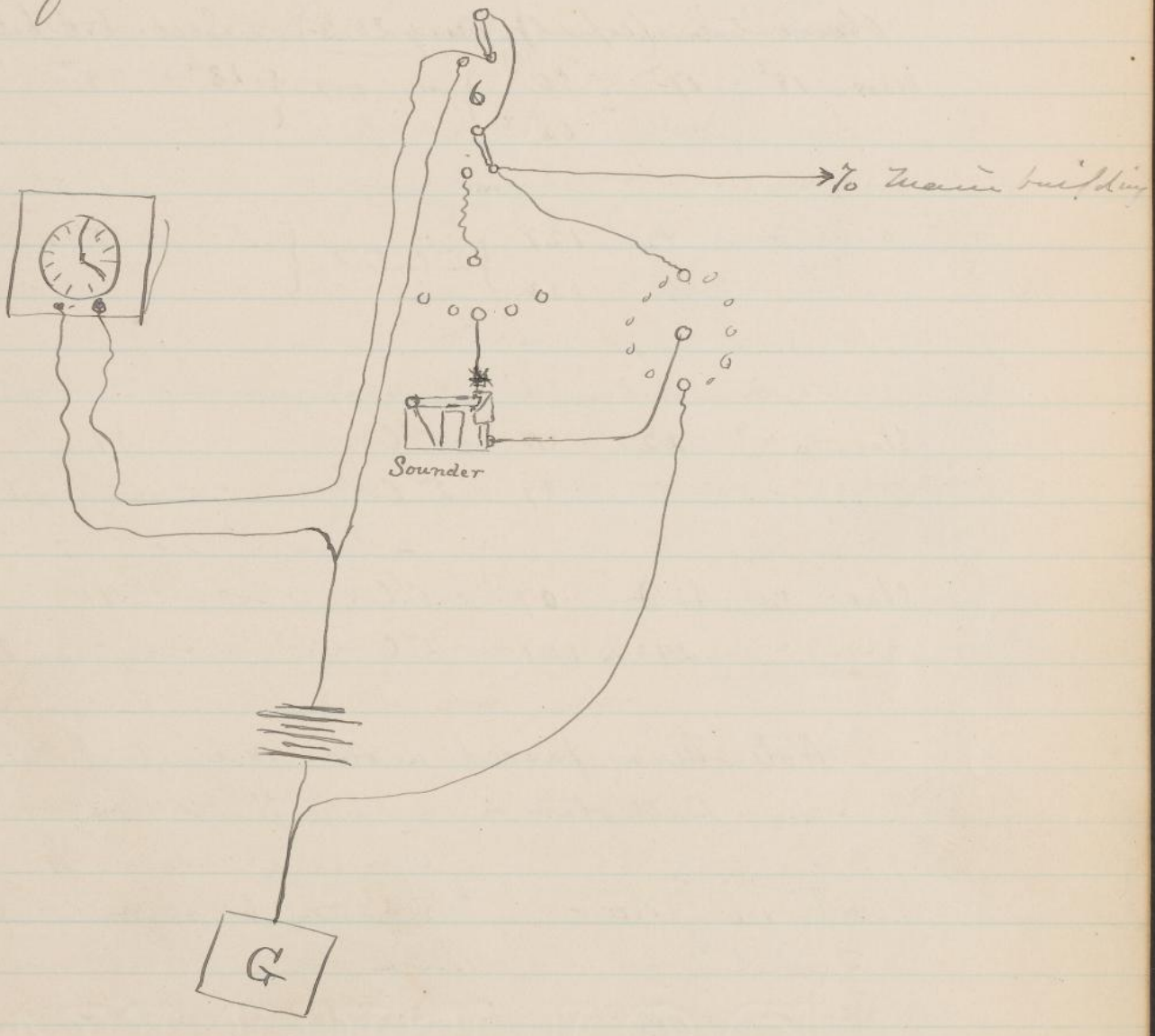
Box No 1 526 1600 1 526 special 1656. Don't know that this test is worth anything

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Lucs. Aug 19. 1890

Connections, in Mr Lemaire's room, of dials. In cottage



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Wed. Aug 20, 1890

Ring Micrometer Observations.

Chronometer B236

Observations (copied) {Aug 20.3}					Second Observation		
Mars	18^h	17^m	$56^{(1/2 S)}$	1st Contact	18^h	34^m	$86^{(1/2 S)}$
			$62^{(1/2 S)}$		"	"	91
"	"	"	127	2nd Contact.	"	35	43
			133		"	"	47
Star	"	22	$11^{1/2 S}$ — 1st C —		"	39	43
"	"	"	89 — 2nd C —		"	"	116.5
2nd Star	"	~~24~~	$07^{1/2 S}$ — 1st C —		"	41	37
"	"	24	101 — 2nd C —		"	"	129

Note. Mars passed across N limb of R.M.

Both stars " " S " " "

With 1st Star is large one between 1 & 2

2nd " " " No 2

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Thurs. Aug. 21, 1890

Ring Micrometer Computations,

Mars.

Transit. Aug. 20d 18h 19m 47s. Sid. Time (Wrtd) B236

Sid. T. Meridian 9 55 56

8 23 51 Sid. Int.

= 1 23 Corr

8h 22m 28s. EST

5

13 22 28 G. Mt.

Motion in α per hour 5s.224

13.4

20896

15672

5224

70.0016

Do in Dec 9".02

13.4

3608

2706

902

120.868

α ✱ 16 34 22.07

25° 6 35.7

α = 16 35 32.07 " δ = 25 8 36.5

2nd = 18h 17m 65s

1st 29.5

τ = 35.5

2|94.5

a 18h 17m 47s.25

Sin ρ = 15 τ Cos δ / 2r

log 15/2r = 8.2565

" τ = 1.5502

" Cos δ = 9.9568

" Sin ρ = 9.7635

ρ = 35° 27½'

d = r cos ρ

log r = 2.6186

" Cos ρ = 9.9109

" d = 2.5295

d = 338.5

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Thurs. Aug 21, 1890

R. M. Continued.

2nd Star. (of known position.

2nd 18h 24m 50s.5

1st " " 3.5

T = 47.0

54.0

$\underline{\alpha}$ = 18 24 27.0

Log $\frac{15}{2r}$ = 8.2565

" T = 1.6721

" cos δ = 9.9562

" sin γ = 9.8848

γ = 50° 5'

Log r = 2.6186

" cos γ = 9.8073

" d = 2.4259 (n)

$\underline{d}$ = − 266.6

338.5

605".1 = 10' 5".1

Mars 18 17 47.25

Star 18 24 27.00

0h 6m 39s.75

Mars. α = 16 35 32.07 δ = −25 ° 36.5

6 39.75 − 10 5.1

2nd Star, 16 42 11.8 −25 18 41.6

Conjunction. Aug. 23d 10h.7 Cambridge time.

Mars passes 42m to the S.

Mars Obsd. Position	16	42	11.8	−25	18	41.6
A.G.C. Position	16	42	13.2	−25	18	55.0
			1.4			13.4

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Thurs. Aug 21, 1890.
R. M. Continued.
1st Star.

2nd — 18 22 ~~59~~ 44.5
1st — " " ~~11~~ 5.5
T = ~~75.0~~ 39.0
~~100~~ 50
$\underline{\alpha}$ = 18h 22m ~~50~~s 25s

Log 15/25 = 8.2565
1.5911
" T = ~~1.8921~~
" Cos δ = 9.9562
" Sin p = ~~0.1048~~ 9.8038
p = 39° 32'

Log r = 2.6186
" Cos p = 9.8872
" d = 2.5058 (m)

Mars 18 17 47.25
1st Star 18 22 25.00
4m 37.75

$\underline{d}$ = -320.5
338.5
659.0 = 10' 59"

Mars 16 35 32.07
+ 4 37.75
1st Star 16 40 9.8

δ = - 25 8 36.5
- 10 59.
25 19 35.5

Conjunction, Aug. 22d 17h.3 Ghst. 3' 23" = Aug 22d 12h.3 Cambridge time
Mars passes ~~1'58~~" to the N

Stars Obsd. Position 16 40 9.8 -25 19 35.5
" Assumed " " " 12.5 18 55.
Easting 2.7 more South 40".5

Star No 3 Pq Sq.
Conjunction Aug 23d 15h.4
Mars passes 1'47" to N.

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1890

Aug 21, Thurs. Computed R.M. Obs^s. Tested 1^ms of Bal 103 by putting it on chronograph.

Eve. T.S Work. Tested all signals of Bal 103 on chronograph. 1^ms only worked once in 1^h, not all right. Wrote of it to Mr Gerrish.

Fri. 22 A.M. Bromides for paths of of Mars & Venus.

P.M. Wrote to Prof W.H.P. giving results of R.M. Obs^s. Fixed cells on T.S circuit.

Sat 23 AM Read up deflection data of night before and P.M. Lost 2 yds Mg wire to be drawn finer.

Sun 24 Eve. B 394 nearly 2^s ahead & hadn't to be let down as (1^st got stars — 17 ahead of Bal 103, comp 2^s too fast.) Took from 9 to 1.30. Evening, measured stars No 5 Ch II

Mon. 25 A.M. Bond 394 ~~slow~~ too slow & required attention visitors. Read up stars.

P.M. Got Mg wire at Shurtleff's. They couldn't draw it out

Eve. Took stars, B 394 still irregular. Wrote to Prof Pickering - forwarding copy of telegram from Kiel. re Fortey

Tues 26 A.M. 1½^h on time work. Letter from Mr Ernst about 1^ms. B 103

P.M. Mr Pickering here. B 394 irregular & needs constant watching. Tried to fix 1^ms of Bal 103 Tested signals on Began identifying stars on Charts IV & V. Bal 103 a lightened contacts

Wed. 27 A.M. T.W. B 394 slow now, & very irregular, Dials lost 26^m one night, Mr Brast of Johns Hopkins called.

Eve. T.W. Identified stars on Chart IV & part of Chart V

Thurs 28 A.M. T.W. Switch board for Chronograph circuit relay, Identified stars on Chart IV, Hon John Hicks, minister to Peru called. Also Tuttle Supt of the U.S. Coast Survey. Engaged at Jewlers Row P.W.K.P.

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Friday Aug 22.

Another star in chart III between nos 5 & 6.

	plate	Date G.C.	mens passes
Star 5.	16h 48 41.	26d 5h 28	20" to N
" 5½.	" .		
" 6.	57 56,50	30d 17h 88	1 47 to S

Est. positions 5 & 6

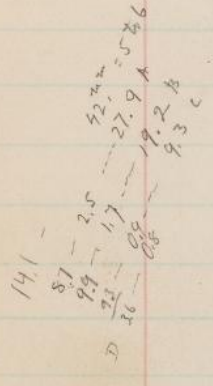
	R.A.	Dec.
5.	16 48 41	- 25 29 10
6	16 57 56.5	- 38 24.4

R. A.

Measurements backwards from No 6. Dec upwards (N.) from No 6.

A.	27.9 =	6m 6s	7' 30"
B.	19.2 =	4m 12s	5' 6"
C.	9.3 =	2m 2s	2 42
(Neg) D.	3.6 =	48s start.	(neg) 2' 24"

~~No 6~~.	R.A.		Dec		
No 6	16h	57m	56,5	- 25	38 24.4
A		57	50,5		30 54
B		53	48,5		33 18,
C		55	54,5		35 42
D		57	8,5		36' 0"



Mars does not come nearer than 1½' of arc to any of these stars. So there is no need of working them up more carefully.

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Sun am. Aug: 24, 1890

Measurements for star N°5

of Aug 26d, 8h, 3.

N°2 to N°5

1st Dec line N°2 to N°6 - through N°6.

Dec N°6 25 38 24.4

" " 2 25 17 03.4

21' 21" = 7.1m m

Dec N°4 = 25 23 10.8

" N°6 38 24.4

15 13.6 = 5.1m m

Line is .1 too low at 2 It will be .05 too low at 5

" " " .07 " " " 4

It is .2 too low at 4 or there is a rise of .13 at 4

or " " " " " .25 " 5

making .32 at 5 altogether

Height of N°5 is 4.1 Subtract .3 leaves 3.8

3.8m m = 9' + 144" = 11' 24"

Dec N°6 = 25° 38 24.4

21' 21" - 11 24 =

Dec N°5 = 25° 27 [illegible] =

Dif in R.A. 33.6m m = 7m 20s

4m = 18.3

3m = 13.8 32.2

20s 1.5 2 3 21

33.6 33.6

R.A. of N°2 (Pg 94) = 16 42 11.8 Dec 25 18 41.6

Cor = 7 20 vibes 9 57

16 49 32. 25 28 39.

4.05

37.6

33.5

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Mus. Aug 26, 1890

Measurements for N°5 again.

Measured along path of Mars $42.1^{mm} = 5+6+76+6$.

$33.9 = 4+5+7+9$

Now then, R.A. N°5 with log $\frac{33.9}{759}$. of dist between 4 & 6.

R.A. N°6 = 16 58 56

2 42 13

16 43

60

960

43

1003

log 33.9 = 1.530 20

" 1003 = 3.001 30

4,531 50

− log 759 = 1.880 24

log 448^s = 2.651 26

$448^s = 7^m 28^s$

Obsd R.A. of N°2 = 16 42 11.8

Cor 7 28

R A N°5 16 49 40.1

Estim." 48 41

Cor 1^m

Marsyas to the S of this star,

Path of Mars across charts IV & V

Date		at R.A.	
Sept 15	50	17	7
26	0	17	21
26	8 lowest	17	45
26	0	18	10

25.30 to 26.30

Let all my positions of a few from attak, rule on a line for reference & then identify a larger number in a, b, c.

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Tues. Aug 26 1890

Identifying stars on chart IV.

For Dec. lines.	Star in Atlas,	In Chart,	Mag.	R.A.			Dec.		For R.A. lines.
✓	36 (triple)	(36)	5th	17	8	10	−26°	30′	
✓	39 "	(39)	6th	17	10	55	24	8	✓
✓	57 "	(57)	5	~~17~~	~~24~~	~~10~~	23	45	✓
✓	1 (Sag.)	(1)	6	17	23 24	58,79 20	26 27	10,18 8	
✓	58 (triple)	(58)	5	17	36	40	21	35	✓
	40 "	(40)	5	~~17~~	~~14~~	0	20	50	✓

for R.A. use 40 + 58 at top 36 + 1 at bottom.

For bottom use dec + XX (hour to right of it.

d "	(d)	5	17	19	35	24	40	✓
⊕	(ΔX)	6	17	0	40	30	12	✓

Identifying stars on chart V.

Many of these may be wrong as the stars here are exceptionally hard to identify

Star in atlas	In Chart.	Mag.	R.A.			Dec.	
(Wolf Rayet marked)	J	6	17	42	40	22	35
X	X	4	17	40	0	27	50
n m	a	6	17	48	20	24	50
n m	d	6	17	47	50	27	55
n m	C	6	17	51	0	28	33
4	4	5	17	52	50	23	45
n m	G	6	17	55	50	24	20
n m	H	6	17	57		24	25
~~9~~	9	6	17	58	10	24	25
nm	9	6	18	0		21	25
nm	7	5	18	0	50	28	20
(W)	W	5	17	57	30	29	33
nm	6	6	18	4	20	23	37
11	11	4	18	6	30	21	7
15 m	15	6	18	9	0	20	35
8							

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Thurs. Aug 28, 1890

Positions of Chart IV stars from A.G.C. 1875.0

Star on chart.	Mag.	R.A.			Dec.		
36	5¾ 5¾ Double	17	7	39.66	26	25	1.0
39 (0?)	Double 6-7	17	10	23.41	24	8	49.7
40 (ξ?)	5.1	17	13	30.78	20	58	36.9
51	5.2	17	23	47.43	23	51	49.8
1	6.2	17	23	58.79	26	10	17.9
58	5.5	17	35	56.40	21	37	13.0
d	4.6	17	19	22.39	29	45*	5.4
xx (#444)							
a	7.4	17	9	53.52	26	29	20.3
b	6.9	17	10	29.17	23	55	57.8
θ in aug.	3.6	17	14	19.99	24	52	20.8
44 (δ)	4.5	17	18	44.2	24	3	29.
c	8½	17	0	10.15	25	17	23.3

Rule in every 4^m in R.A., $17^h 0^m$ to 40^m

" " ½° in Dec 24°.30, 25°.0, 25°.30

At top of chart bottom 40 58 4^m = $18^m.62$

Middle " " " 2 51 " " 18.30

bottom? " " " 36 1 " " 17.94

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Fri Aug 29, 1890

These positions of Mars will have to be reduced to 1875.0

For Sept.	1	17	1	26,28	1.44	− 25°	44	25,1	− 5.11
"	6		13	45.44	1.43	25	55	45,4	4.5
"	11		26	36,46	1.43	26	3	42.2	4,4
"	16		39	56,43	1.43	26	7	47,7	3.9

Reduction to Jan 0. 1890

Aug 14	2 Scorpii	16	22	39,75		− 26	11	14.9
				41.24				21.50
				1.49				6.6
Sept 7	θ Ophi.	17	15	15.21		− 24	53	21.4
				16,64				25.90
				1.43				4.5
Sept 24 Av.	μ Sag.	17	58	44,57		− 30	25	29.6
	Sept 23 / Sept 26			45.99				34,8
				1.48	1.43			5,2
	μ Sag	18	7	11.09		− 21	5	13.5
				12,47				15,0
				1.38				1.5
Oct 10	ρ Sag	18	48	26,66		− 26	25	57.9
		16	22	28,12				60.0
		2	26	1.46				2.1
		2½ hs						

3.3

Mean positions given in full.

For

Sept 21	17h	53	41.92		− 26	7	35.4
26	18	7	49.07		− 26	2	41.3
31	18	22	14.11		− 25	52	45.6

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Mars. Sept. 1st 1890

Reduce these four positions of Mars to 1875.0 & then plot the total correction.

Am. pos. in R.A.	1 year	15 years	to Jan 0	in Dec 1 year	15 years	to Jan 0
Sept. 1	3.692	-55.38	1.44	.06	-75.9	-5.1
6	3.710	.65	1.43	4.02	60.3	4.5
11	3.716	.74	1.43	2.91	43.6	4.4
16	3.722	.83	1.43	1.75	26.3	3.9

Total corrections in ——

	R.A.	gives for chart R.A.			Dec.			
~~Sept.~~ 1.								
Sept. 1.	-56.82	= 17h	0	29.46	-81.0	= -25°	43	04.1
" 6	57.08	=	12	48.36	64.8	=	54	40.6
" 11	57.17	=	25	39.29	48.0	= -26	2	54.2
" 16	57.26	=	38	59.17	30.2	=	7	17.5

Precessions for Chart V for pos. of Mars to 1890.

	in R.A. 1 yr	15 yrs	0 Jan 0	in Dec 1 yr.	15 years	to 1890.
Sept. 21.	3.72	55.8	1.43	0.557	8.3	3.6
" 26	3.72	55.8	1.43	0.683	10.2	3.3
" 31	3.72	55.8	1.44	1.94	29.1	2.9

Oct 24 L Sug. 19 30 0.75 -25 7 32.9

12.17

1.42

33.3

.4

Total Corrections. Rest of Sept, Chart V

Sept. 21.	-57.23	= 17	52	44.69	-11.9	= -26	7	23.5
	57.23	= 18	6	51.84	-13.5	= 26	2	27.8
	57.24	= 18	21	16.87	-32.0	= 25	52	13.6

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Incs. Sept. 2, 1890

The R.A. & Dec. of Mars with Logs. & for reduced to 1875.0

for	Sept. 1	17h	1m	26.28	-	25°	44'	25.1"
"	6,	17	13	45,44	-	25	5	45,4
"	11,	17	26	36,46	-	25	3	42 2
"	16,	17	39	56,43	-	26	7	47,7

For Identifying stars on chart V

Star in Chr.	Mag.	Position from A.G.C.					
X	6.7	17	40	38,85	26	55	41
K	6.7			12,57	22	25	46.
δ	2.8	18	12	59,45	29	52	43
m	8.		14	98,26	22	58	35,6
p	8	17	38	41,99	29	20	24

Directions for finishing chart V

Determine 4m lengths in mm. at top by K & m

" " " " " bottom " δ & p

Put in 4m marks at top & bottom & rule them in over whole chart.

By ~~these stars~~ the approp. declination of page 100 find several stars scattered along near Dec -26, & from them mark Dec lines -25,30, -26, & -26,30 as rate of 20mm = 1°

N.B. Copy their Decs accurately from A.G.C. N.B.

at top about 18,5mm will equal 4m in R.A.

" bottom " 17,5(?) " " " "

Plot in path of Mars from positions given at top of pg 103.

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Mon Sept 8 1890

Measures on Chart V

κ m = 158.m6 = 34.s262 ∴ 4ᴴ = 18.ᴴ52
1ᵐ = 4.63

∴

δ μ = 150.s0 = 34.s291 ∴ 4ᴴ = 17.ᴴ50
1ᵐ = 4.375

κ dist from 17ʰ 40ᵐ by +0.s21 = +0.ᴴ97
μ " " " " by -1,s30 = -5.69
m " " 18ʰ 12 by +2.47 = +11.47
δ " " " " by +0.99 = +4.33

Positions of stars for ruling in Parallels, Taken from a G.C.

a.S.C. 25°0	Chart	Mag.	h	m	s	°	′	″
25022	m	8	17	14	28.26	22	54	35.0
24312	a	6.6	17	47	12.50	24	51	36.1
24438	4	5.4	17	52	9.62	23	48	9.1
24587	9	6.5	17	57	30.50	24	24	9.6
24584	X,	7¾	17	57	17.21	24	41	3.6
24156	X	6.7	17	40	38,85	26	55	40.9
24987	δ	2.8	18	12	59.45	29	52	42.9
24649	F.	5.4	18	0	9.96	28	28	6.0

Dist fr 26°

	°	′	″			
m	- 3	1	23.0	= 3.024	= - 60.460	x
a	- 1	8	23.9	1.143	- 22.9	x
4	- 2	11	50.9	2.197	- 43.9	x
9	- 1	35	50.4	1.597	- 31.9	
X,	- 1	18	56.4	1.316	- 26.3	x
X	+ 0	55	40.9	0.926	+ 18.5	x
δ	+ 3	52	42.9	3.879	+ 77.6	x
F.	+ 2	28	6.0	2.468	+ 49.4	

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Tues Oct 7. 1890

Order &c of Meteorological records as observed in the Main building.

Weekly Obs^ns on Mon. 9 A.M.

Daily " " 9 A.M.

Bi " " " 9 A.M. & 3 P.M.

Record Books—

Date | Att. Ther. | Bar. | Cor^d Bar | Ext. Th. | Max. Th. | Min. | The (after) Max | Set | Min | do | Rain.

Note - a star under rain, means an unmeasurable amt.

The above is left page. Below in right page -

Time Begin obs^ns | Do Ext^r. Therm^o | Do Ext^r. Bar. | Edwy. | Observers | A.M. & P.M. interruption of Sunshine Recorder.

This is to get frequent tests of the rate of the clocks

Measured widths of Circum Polar star trails

Nr	d 0.3	d 0.5	means	
2	.5	.3	"	.020
3	.4			= mm 0.020
4	.2	.8	"	
5	.5			.025
6	.6			.030
7	.3			.015
8	.5			.025
9	.5			.025
				7 | 20

d 19.98 = 1 m

mm 0.023 = average width

or 1/40 mm

Width Polaris = mm 0.25

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Tuesday. Oct. 7. 1890

Focus 217 mm width .02 mm

$\log .02 = \bar{2}.301030$

" 217 2.336460

$\bar{5}.964570 = \log \sin_a \kappa'' - \log \frac{\gamma}{\delta}$ = $\frac{c}{g\,mm}$

$\bar{6}.685575$

1.278995

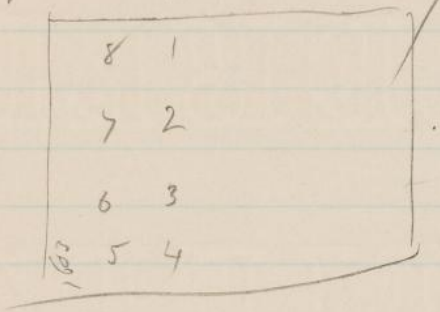
Angular width = 19".01

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Tuesday Oct 14 1890

2.30 Exposed plate in sensitometer for Mr King

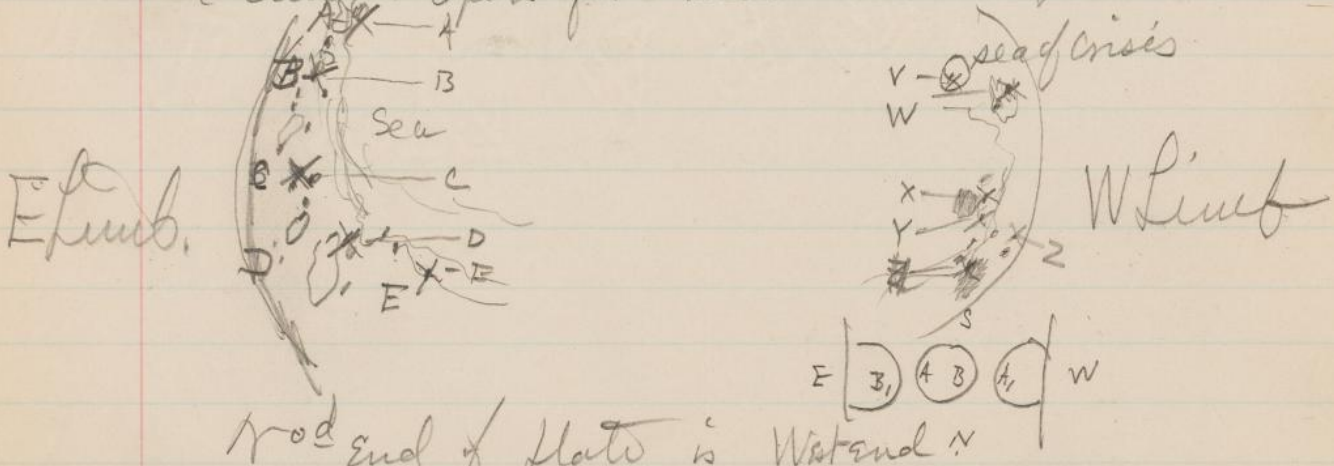


Sq 1 — 40 cds
50
63
Sq 4 80
Sq 5 100
125 cds
158
Sq 8 200

Seed 26
4×5

— To orient moon —

E limb. Spots for measurement W limb



Rod End of Plate is West end N

A	43.975	A,	89.288
B	43.335	B,	88.597
C	43.693	C,	89.008
D	45.189	D,	90.470
E	{23.33	E, =	{68.350 +.70 to one side
	{24.580 +.75 to one side		{69.821
	46.906 +0 to one side		92.32

×3.2.37

.132 906
906 414
45.226

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Tuesday, Oct 14, 1890

X3237

V	82.275	V,	36.769
W	85.351	W,	39.961
X	85.426	X,	40.128
Y	85.198	Y,	39.873
Z	83.547	Z,	38.191

— Process — on dividing engine
By revolving plate, the center is placed
under cross hairs. Place one point as A
then turn to the subpoint A_1 till it is on the
horizontal wire, revolve it to the vertical.

Scale - 42.14 to the mm

Remainders.

$A_1 - A$ =	45.313	X3237+46 Taken
B	45.262	June 16
C	45.305	
D	45.281	
E	45.226	

$V - V_1$ =	45.506	micrometer
W	45.390	
X	45.298	
Y	45.325	
Z	45.356	
	45.326 X	

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Wednesday Oct 15, 1890

To correct the moon in photos taken June 2. 1890 in Cal.

See pg 421. Nautical Almanac. $\sin C = -\sin \alpha \frac{\cos(\alpha' - \delta b)}{\cos b}$

C = angle bet. moons mer'd. & circle of Dec.

Date. 1890. June 2. $12^h\ 19^m\ 30^s$

#1 = Method found on pg 35 of Book 24. W.U.S. Constants

Lat. M.W. $\phi = 34°\ 12'\ 48''$

Long M.W. $\theta = 118°\ 4'.3 = 7^h\ 52^m\ 17^s$

G.M.T. $= 2^d$ ~~20h~~ $19^m\ 30^s$ Changed

Horiz. Parallax $p = 59'$ ~~8~~ $51''.92$ "

Moons $\alpha = 16^h\ 49^m\ 25^s.44$ C

Moons $\delta = -21°\ 31'\ 19''.8$ C

Sid. time at M.W. $= 17^h\ 14^m\ 10^s.84$ C

Hour angle Moon, $= h = +24^m\ 45.4 = 6°\ 11'\ 21''$ C

Moons long. $\lambda_1 = 253°\ 45'\ 45''.95$

Moons lat. $\beta_1 = +0°\ 55'\ 30''.4$

Obliquity ecliptic $\omega = 23°\ 27'\ 13.$

Moons corrected position, $\alpha' = 252°\ 16'\ 18''.6$

" " " $\delta' = -22\ 07\ 19.8$

" " " $\lambda = 253\ 36\ 46$

" " " $\beta = +0\ 19\ 12.4$

Mean long. moons Asc. node $\delta b = 84°\ 28'$

Sid. time G.M. noon June 2. $4^h\ 43^m\ 37^s.51$ +

$20..\ 22..\ 50.33$

Sid. time 20^h at Greenw. 25 $6\ 27.84$

Long M.W. $7\ 52\ 17.$

$17\ 14\ 10.84$

Moons α $16\ 49\ 25.44$

$24\ 45.4$

$16^h = 240°$

$49^m = 12°\ 15'$

$25^s.4 = 6'.\ 21''$

$252\ 21\ 2'$

$24^m = 6°$

$45^s.4 = 11'\ 21''$

$6°\ 11'\ 21''$

$255\ 52\ 30.4$

$248\ 37\ 58.0$

$7\ 14\ 32.4$

Cor $= 5°\ 7'\ 47.95$

$253\ 45\ 45.95$

$4^h\ 43^m\ 37^s.51$

$20\ 22$

$3\ 20.74$

$25\ 8\ 58.25$

$7\ 52\ 17$

$17\ 16\ 41.25$

$16\ 49\ 39.8$

$27^m\ \lambda_1^{15.5}$

	α		δ			β_1	
	$252°$	$21'$	$21''.0$	$-21°\ 31'$	$19''.8$	$253°\ 45'\ 46''.0$	$+0°\ 55'\ 30''.4$
Cor^{ns}		-5	2.4	$-36'$	0	-9	$-36\ 18.$
	$252°$	$16'$	$18''.6$	-21	$07\ 19.8$	$253°\ 36'\ 46.''$	$+0°\ 19'\ 12''.4$

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Wednesday Oct 15. 1890

Parallax according to Newcomb.

Let $a = \cos\phi \frac{\sin p}{\cos\delta}$

Then $\Delta\alpha = \frac{1}{\sin 1''}\left(a \sin h + \frac{a^2}{2}\sin 2h\right)$

Let $\cot b = \cos\phi \frac{\cos(h + \frac{1}{2}\Delta\alpha)}{\cos\frac{1}{2}\Delta\alpha}$

!! See page 136.

Should be cot.

$p = 59' 51.''9$

And $c = \frac{\sin\phi \frac{\sin p}{\sin b}}{}$ this sign is put in afterwards

Then $\Delta\delta = -\frac{1}{\sin 1''}\left(c \sin(b-\delta) + \frac{c^2}{2}\sin 2(b-\delta)\right)$

Log Cos ϕ	$= \bar{1}.917476$
" Sin p	$= \bar{2}.179078$
" Cos δ	$= 0.031388$
	$\bar{1}.127942$
" a	$= \bar{2}.127942$
" Sin h	$= \bar{1}.032663$
	$\bar{3}.160605$

$h = 6^h 11' 21'' \therefore 2h = 12^h 22' 42''$

Log a	$= \bar{2}.127942$
Log a^2	$= \bar{4}.255884$
Colog 2	$= \bar{1}.698970$
Log Sin $2h$	$= \bar{1}.331156$
	$\bar{5}.286010$

$.001447$
$.000019$

Log $.001466 = \bar{3}.166134$

Log Sin $1'' = \bar{6}.685575$

Log $\Delta\alpha = 2.480559$

$\Delta\alpha = 302.''4 = 5' 2.''4$

$h = 6^h 11' 21''$

$\frac{1}{2}\Delta\alpha = 2\ 31.$

$6^h 13' 52^s.4$

$\frac{1}{2}\Delta\alpha = 2' 21''$

Log Cos ϕ	$= \bar{1}.917476$
" Cos	$= \bar{1}.997427$
Colog Cos $\frac{1}{2}\Delta\alpha$	$= 0.$
Log Cot b	$= \bar{1}.914903$
b	$= 50^\circ\ 34'\ 40''$
δ	$= -21\ 31\ 20$
$(b-\delta)$	$= 72^\circ\ 6'\ 0''$

Log

Sin ϕ	$= \bar{1}.749950$
Sin p	$= \bar{2}.179078$
colog Sin b	$= 0.112109$
Log c	$=$
	Log $c = \bar{1}.041132$

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Wed. Oct. 15, 1890

Parallax according to Newcomb. Con.

$$\Delta\delta = \frac{1}{\sin 1''}\left(c \sin(b-\delta) + \frac{c^2}{2}\sin 2(b-\delta)\right)$$

$2(b-\delta) = 144°\ 12' = 54°12' + 90°$

$\log c$	$\bar{2}.355573$	$\log c$	$\bar{2}.355573$
$\log \sin(b-\delta)$	$\bar{1}.978452$	$\log c^2$	$\bar{4}.711146$
	$\bar{2}.334025$	$\operatorname{colog} 2$	$\bar{1}.698970$
	$.021579$	$\cos 54°12'$	$\bar{1}.767124$
	$.000150$		$\bar{4}.177240$
$\log .021729$	$= \bar{2}.337034$		
$\log \sin 1''$	$= \bar{6}.685575$		
	3.651459		

$\Delta\delta = 4481.''9$

$= 74'\ 41.''9 = 1°\ 14'\ 41.''9$

$\log c$	$\bar{2}.041132$	$\log c$	$\bar{2}.041132$
$\log \sin(b-\delta)$	$\bar{1}.978452$	c^2	$\bar{4}.082264$
	$\bar{2}.019584$	$\operatorname{colog} 2$	$\bar{1}.698970$
		$\cos 54°12'$	$\bar{1}.767124$
			$\bar{5}.548358$

$.010461$

$.000035$

$\log .010496 = \bar{2}.020025$

$\log \sin 1'' \quad \bar{6}.685567$

$\log \Delta\delta = 3.334458$

$\Delta\delta = 2160'' = 36'\ 0''$

Note - the error in time (taking time of exp. of pt image) reduces $\Delta\alpha$ from $5'\ 2''.4$ to $5'\ 0''.6$

It does not affect $\Delta\delta$

It will probably have almost exactly same effect on $\Delta\lambda + \beta$.

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Wed. Oct. 15, 1890

Parallax - according to Nelson. Con.

Parallax in Long. & Lat. (Pg 529)

Put $\sin p = \sin \omega \cos \alpha'$

$\tan \eta = \tan \omega \sin \alpha'$

$\tan \psi = \frac{\tan p}{\cos(\delta - \eta)}$

According to Nelson Pg 530 geocentric R.A. & Dec. (α & δ) are to be used in this calc

Then $\Delta\lambda = \frac{\cos\delta}{\cos\beta}\cos\psi\,\Delta\alpha - \frac{\sin\psi}{\cos\beta}\Delta\delta$

And $\Delta\beta = \cos\delta \sin\psi\,\Delta\alpha + \cos\psi\,\Delta\delta$

Log Sin ω = $\bar{1}.581990$

" Cos α = $\bar{1}.481592$ n

" Sin p = $\bar{1}.063582$ n

$p = -6^\circ\ 38'\ 52''$

Log Tan ω = $\bar{1}.637339$

" Sin α = $\bar{1}.979074$ n

" Tan η = $\bar{1}.616413$ n

$\delta = -21^\circ\ 31'\ 20''$

$\eta = -22\ 27\ 44$

$(\delta - \eta) = 56'\ 24''$

$\eta = -22^\circ\ 27'\ 44''$

Log Tan p = $\bar{1}.066510$ n

" Cos $(\delta-\eta)$ = $\bar{1}.999942$

" Tan ψ = $\bar{1}.066568$ n

$\psi = -6^\circ\ 38'\ 55''$

Log Sin ω = $\bar{1}.599890$

" Cos α = $\bar{1}.481592$ n

" Sin p = $\bar{1}.081482$ n

$p = -6^\circ\ 55'\ 44''$

Log Tan p = $\bar{1}.084670$

+58

" Tan ψ = $\bar{1}.084728$

$\psi = -6^\circ\ 55'\ 47''$

$\Delta\beta$

Log Cos δ = $\bar{1}.968612$ n?

" Sin ψ = $\bar{1}.063635$ n

" $\Delta\alpha$ = 2.480559

1.512806

Log Cos ψ = $\bar{1}.997070$

" $\Delta\delta$ = 3.334458

Log Cos ψ = $\bar{1}.996816$

" $\Delta\delta$ = 3.334458 n !!!

3.331274 n

Log Cos δ = $\bar{1}.968612$

" Sin ψ = $\bar{1}.081531$ n

" $\Delta\alpha$ = 2.480559 n

1.530702

-2144

$+\ 33.4$ Sign?

$-2178'' = -36'\ 18'' = \pm\Delta\beta$ Sign = ?

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Wed. Oct. 15, 1890

Parallax in Long. acc. to Newcomb.

Log cos δ = T.968612 p Log sin ψ = T.081531 n

" cos ψ = T.996816 p " Δ δ = 3.334458 n

" Δ α = 2.480559 n Co " cos β = 0.000057 p

Co " cos β = 0.000057 p Log T₂ = 2.416046 p

Log T₁ = 2.446044 n T₂ = + 260.6

T₁ = −279.3

+260.6

~~Log~~ Co − 1540" = ~~2.732394~~

− 9′ 0″ = Δ λ

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Wed. Oct 15, 1890

$\delta b = 84^\circ 28'$ (36 / 444)

$\lambda = -253\ 36\ 46$

$(\delta b - \lambda) = +190\ 51\ 15$

-180

$(\delta b - \lambda) = +10\ 51\ 15$

$(\delta b - \lambda - 180)''$

Argument $10^\circ 51' 15''$

$\Delta\lambda = -0.'3$

$\frac{1}{a} = -39$

$B = -16.7$

Thurs. Oct. 16. 1890

$B = -16.'7$

$\beta = +19.21$

$b = -35.'91$

$ab = \frac{-35.'91}{-39} = +55.''2$

June $2^d\ 20^h\ 19.^m5$

May $30\ \ 0$

$3^d\ 20^h_3$

$+\lambda = +253\ 36\ 46$

$+\Delta\lambda = \quad -\ 18$

$+ab = \quad +\ 55.2$

$\lambda' = 253\ 37\ 23.$

$D = 257\ 23\ 39$

$\lambda' - D = -3\ 46\ 16\ (= \frac{1}{4}l)$

Mean Long moon May 30. $206^\circ 42' 6''$

$3^d\ 39\ 31\ 45$

$20^h_3\ 11\ 9\ 48$

$257\ 23\ 39$

$a' = 252$ (360 / 612) $\ 16\ 19.''6$

$\delta b' = 356\ 16\ 54$

$(a' - \delta b') = 255\ 59\ 25$

$-104\ 0\ 35$

June 21

$\lambda' = 253\ 37\ 23$

$\Delta = 267\ 51\ 8$

$521\ 28\ 31$

-360

$161\ 28\ 31$

$-\delta b = -84\ 28$

$(\lambda' + \Delta - \delta b) = +77\ 0\ 31$

$i = 23^\circ\ 21'\ 12''$

$\delta' = -22\ 7\ 20$

Log sin $i = +\bar{1}.598134$

$+$ log cos $(\lambda' + \Delta - \delta b) = +\bar{1}.351805$

Colog cos $\delta' = +0.033210$

Log sin $C = +\bar{2}.983149$

$C = +5^\circ 31' 12''$

Log sin $i = \bar{1}.598134$

$+$ log cos $(a' - \delta b') = \bar{1}.383969$

Colog cos $b = 0.000024$

Log sin $C = \bar{2}.982127$

$C = +5^\circ 30' 25''$

Average $C = 5^\circ 30\ 49$

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Thurs. Oct. 16, 1890.

Average dist. apart of moon images 45.326 d

254 d = 240 mm

We want $\frac{240}{254}$ 45.326.

Log 240 = 2.380211
" 45.326 = 1.656348
by 254 = $\overline{3}$.595166
1.631725

42.8273 mm

Date of photo - June 2.. 1890
G.M.T. 20h 19m 30s
Motion for 1m in
R.A. Dec
2s.5515 7".638
15
38".2725

Scale 1 mm = 42".4

E — b 38.2725 — A
a 7.638
B S

$\frac{a}{b}$ = tan A

Log 7.638 = 0.882980
" 38.273 = 1.582892
$\overline{1}$.300088

A = 11° 17' 10"

log 42.8273 = 1.631725
" sin 11° 17' 10" = $\overline{1}$.291610
0.923335

Log 45.326 = 1.656348
sin 11°+ = $\overline{1}$.291610
0.947958

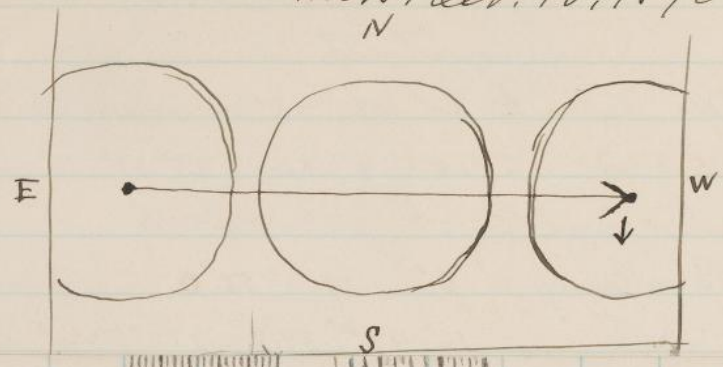
8.38 mm
dif. 8.87
11° 17' 10"

1st Turn 11°+ towards W

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Thurs. Oct. 16, 1890



for interpolating in Klein's Star atlas.

17 38 48
29 21

12.1 | 4
17.2 | 484 (2.8+
344
1400
1376 +

Motion per min. = 3975 Cos φ . 900 Sin 1" = m

$\frac{m}{R} = \frac{x}{p}$ or $\frac{p\,m}{R} = x = 900 \sin p \cos \phi \sin 1''$

Log 900	= 2.602060		log 900 = 2.954243
" Sin p	= $\bar{2}$.241253	58' 51".9	2.602060
" Cos φ	= $\bar{1}$.917478	34° 12' 48"	0.352183
" Sin 1"	= $\bar{6}$.685575		0.760791
Log Sin p	= $\bar{5}$.446366		1.112974
m	= $\bar{6}$.685575		
	0.760791		x = 12".97

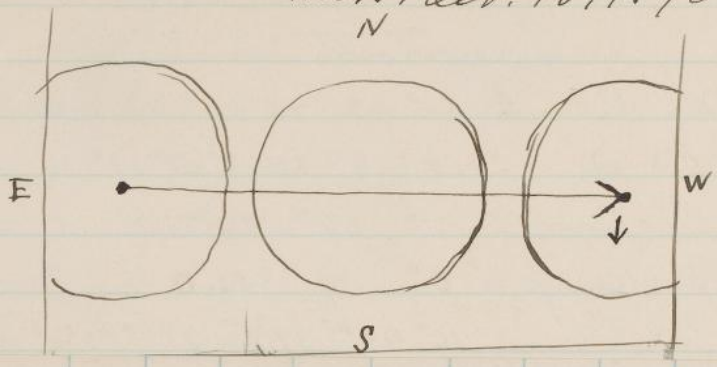
(see page 122)

x = 5".8 which is subtracted from Morris motion per minute in R.A.

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Thurs. Oct. 16, 1890



Dia C in Library	1				
" " Ch. room	1				
" " Ladies room	2				
" " cottage C	3				
Reduced to					
at	11 A.M.	11,35			
Cottage C	4h 55m	5, 31			
Ladies room	3	43	12, 47		
Ch. room	3	4	3 55		
Library	2	48	3 34	45	

Motion per min. = 3975 Cos φ . 900 Sin 1" = m

$\frac{m}{R} = \frac{x}{p}$ or $\frac{p\,m}{R} = x = 900 \sin p \cos \phi \sin 1''$

Log 900	= 2.602060		
" Sin p	= $\bar{1}$.241253	59° 51.9	
" Cos φ	= $\bar{1}$.917478	34° 12' 48"	
" Sin 1"	= $\bar{6}$.685575		
Log Sin p	= $\bar{5}$.446366		
M	= $\bar{6}$.685575		
	0.760791		

log 900 = 2.954243
2.602060
0.352183
0.760791
1.112974

x = 12".97

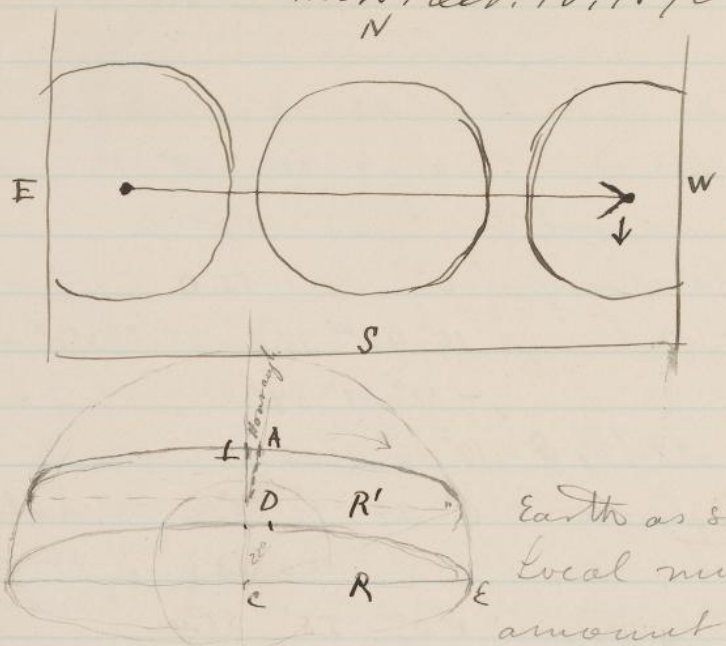
(see page 122)

x = 5".18 which is subtracted from Mercurs motion per minute in R.A.

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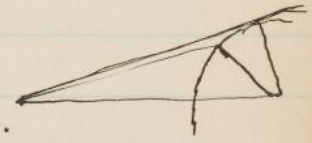
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Thurs. Oct. 16, 1890



Earth as seen from moon
Local motion in Dec. can't amount to anything

Let p = Horiz. Parallax.
R = Equa. Radius / earth
R' = " " " " at Lat 34° 12' 48"



Then $\angle R' = p \cos 34° 12' 48"$

Call equa. ~~Radius~~ / earth $3975 = R$
~~Hourly motion~~ $R' = R \cos \phi$
Motion per min. as $= 60 R' \sin 1" \times 15 = 900 R' \sin 1"$
Motion per min. $= 3975 \cos \phi \cdot 900 \sin 1" = m$

$$\frac{m}{R} = \frac{x}{p} \text{ or } \frac{pm}{R} = x = 900 \sin p \cos \phi \sin 1"$$

Log 900	= 2.602060		
" Sin p	= $\bar{2}$.241253	59' 51".9	
" Cos ϕ	= $\bar{1}$.917478	34° 12' 48"	
" Sin 1"	= $\bar{6}$.685575		
Log Sin p	= $\bar{5}$.446366		
M	= $\bar{6}$.685575		
	0.760791		

log 900 =	2.954243
	2.602060
	0.352183
	0.760791
	1.112974

$x = 12".97$

(see page 122)

$x = 5".8$ which is subtracted from Moon's motion per minute in R.A.

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Thurs. Oct 16, 1890

– Constants –

Lat M^t W. ϕ = 34° 12 48

Long. " " Θ = 118 4 18 = $7^h 52^m 17^s$

G.M.T. June = $2^d\ 20^h\ 22^m\ 0^s$

Horiz. Parallax p = 0° 59' 55."0

Moon's α = $16^h 49^m 39.^s8$ = 252° 25' 0"

" δ = −21° 31' 39"

Sid. Time at M^t W. Θ = $17^h\ 16^m\ 41.^s25$ =

Hour Angle h = $0^h\ 27^m\ 1.^s5$ = 6° 45' 23." past meridian: brings other signs right by being called minus

Moon's Long λ_1 = 253° 40 58

" Lat. β_1 = +0° 55' 55."4

Obliquity Ecliptic ω = 23° 27' 13."

Cometic Position: α' =

" δ' =

" λ =

" β =

Mean Long. Asc. M. Ω = 84° 25' 24"

	α	δ	λ	β
Real Obs. values	252° 25' 00"	−21° 31 39	253° 40 58	+0° 55' 55.4
	− 6 22	− 41 39	− 40 53	− 40 38
	252° 18' 38"	−22° 13' 18"	253° 30' 5"	+0° 15' 17"
	α_1	δ_1	λ_1	β_1

These four values to be used on page 121.

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Fri. Oct. 17. 1890

Repitition of Page 111.

Parallax in R.A. and Dec.

Log Cos φ = $\bar{1}.917478$

" Sin p = $\bar{2}.241253$

Co " Cos δ = 0.031405

" a = $\bar{1}.190136$

" Sin h = $\bar{1}.070587$ n

$\bar{3}.260723$ n

h = 6° 45′ 23″ ∴ 2h = 13° 30′ 46″

log a = $\bar{2}.190136$ / 2

" a^2 = $\bar{4}.380272$

" Sin 2h = $\bar{1}.368589$ n

Co " 2 = $\bar{1}.698970$

$\bar{5}.447831$ n

−+.001823

−+.000028

Log −+.001851 = $\bar{3}.267406$ n

Log Sin 1″ = $\bar{6}.685575$

Log Δα = 2.581831 n

~~Δα = 3818″ = 1° 3′ 38″~~

Δα = −381.″8 = −6′ 21.″8

Δα −6′ 22″ 5″.53

$\frac{1}{2}$ Δα = −0° 3′ 10.″9

h = − 6 45 23.1

$(h + \frac{1}{2}\Delta\alpha)$ = − 6° 48′ 34″

see page 136

Log Cos φ = $\bar{1}.917478$

" Cos $(h + \frac{1}{2}\Delta\alpha)$ = $\bar{1}.996926$

Co " Cos $\frac{1}{2}\Delta\alpha$ = 0.000000

" Cos b = $\bar{1}.914404$

b = 50° 36′ 36″

δ = −21 31 39

(b − δ) = 72 8 15 / 2

144 16 30

35 43 30

Log Sin φ = $\bar{1}.749950$

" Sin p = $\bar{2}.241253$

Co " Sin b = 0.111908

Log c = $\bar{2}.103111$

" Sin (b − δ) = $\bar{1}.978543$

$\bar{2}.081654$

Log c = $\bar{2}.103111$ / 2

Log c^2 = $\bar{4}.206222$

" Sin 2(b − δ) = $\bar{1}.766335$

Co " 2 = $\bar{1}.698970$

$\bar{5}.671527$

.012069

.000047

Log .012116 = $\bar{2}.083360$

" Sin 1″ = $\bar{6}.685575$

" Δδ = 3.397785

Δδ = −2499″ = −41′ 39″

49″.52

Δδ −41′ 39″

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Friday Oct. 17, 1890

Parallax in Long. & Lat.

See pencil with page 113

Those in pencil are doubtful.

Log Tan ω = $\bar{1}.637339$ — Log Sin ω = $\bar{1}.599890$

" Sin α = $\underline{\bar{1}.979220}$ n — " Cos α = $\underline{\bar{1}.480140}$ n

" Tan η = $\bar{1}.616559$ n — " Sin γ = $\bar{1}.080030$ n

η = −22 28 8 — γ = −6° 54′ 20″

δ = −21 31 39 — Log Tan γ = $\bar{1}.083186$ n

η = −22 28 8 — Co " Cos$(\delta-\eta)$ = $\underline{0.000059}$

$(\delta-\eta)$ = +56′ 29″ — " Tan ψ = $\bar{1}.083245$ n

ψ = −6° 54′ 23″

Log Cos δ = $\bar{1}.968594$ (−2970.3, +39.5) — Log Cos ψ = $\bar{1}.996837$

" Sin ψ = $\bar{1}.080079$ n (−2930.8) — " $\Delta\delta$ = 3.397785 n (47 5962)

" $\Delta\alpha$ = 2.581831 n (54 77 75) — 3.394622 n

1.630504 — 3.472799 n

1.596448 — +42″.7, −2481. — −2438″.3 = −40′ 38″. = $\Delta\beta$

$\Delta\beta$ −40′ 38″ — −48′ 50″.8 — 48′ 51″

Parallax in Longitude.

Log Cos δ = $\bar{1}.968594$ — Log Sin ψ = $\bar{1}.080079$ n

" Cos ψ = $\bar{1}.996837$ — " $\Delta\delta$ = 3.397785 n (47 5962)

" $\Delta\alpha$ = 2.581831 n (54 77 75) — Co " Cos β = 0.000058

Co " Cos β = 0.000058 — " T_2 = 2.577722

" T_1 = 2.573264 n (−326.03) — 2.558099

T_1 = −352″.6 — −(+359.83) = 685.9 = 11′ 26″

T_2 = +360.5 — 326.4, 26, 9, 688.3 = 11′ 28″

$\Delta\lambda$ −10′ 53″ — $T_1 - T_2 = \Delta\lambda$ = −65″ = −10′ 53″

11 28

49 52 — 60 — 2992 — 5 53 — 60 — 353

α = 25° 25′ − 180 = 72 25

δ = −21 31 39

$\Delta\delta$ = −49′ 52″ − log = 3.475962 n

$\Delta\alpha$ = −5 53 − log = 2.547775 n

λ	β
253 40 58	+0 55 55.4
$\Delta\lambda$ = −11 26	$\Delta\beta$ = −48 50.8
253° 29′ 32″	+ 7′ 4″.6

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Lookplace.proj.: 5000

Correct values to use below:—
$\lambda = 253\ 29\ 32$
$\beta = +\ 7'\ 5''$

Sat. Oct. 18, 1890

$\Omega = 84°\ 25'\ 24''$
$\lambda = 253\ 29\ 32$
$(\Omega - \lambda) = 190\ 55\ 52$
180
$(\Omega - \lambda - 180) = 10°\ 55'\ 52''$

Argument $(\Omega - \lambda - 180)$ (by Leg)
$(\lambda - \Omega) = 169° +$ $\Delta\lambda = -0°\ 18''$
$\frac{1}{a} = -39$
$B = -16'\ 48''$
$+7'\ 5''$
$\beta = +15'\ 17''$
$B - \beta = b = -32'\ 43''$
$-23'\ 43''$

Libration in $(\Omega - \lambda - 180)$ = $10°\ 55'\ 52''$
Lat. b $-23'\ 43''$
$\lambda = +253\ 29\ 32$
$\Delta\lambda = -18$
$ab = +37$
Sum $= \lambda' = 253\ 29\ 51$
$D = 257\ 24\ 51$ (v.d. value 3")
Long. $l = \lambda' - D = -3\ 55\ 0'' = -3°\ 55'\ 0''$
$-3°\ 55'\ 3''$

$ab = \frac{b}{\frac{1}{a}} = \frac{-32'\ 43''}{-39} = +37''$

June $2^d\ 20^h.36$ from
May $30\ 0$
$3^d\ 20^h.36$

Mean long Moon. $\mathbb{D}$ May 30 = $206°\ 42'\ 6''$
$+ 3^d = 39\ 31\ 45$
$20^h.36 = 11\ 11\ 0$
$\mathbb{D}$ June $2^d = 257\ 24\ 51$

$\lambda' = 253\ 30\ 5$
$+ \Delta = 267\ 51\ 12$
$521\ 21\ 17$
$- 360°$
$161\ 21\ 17$
$-\Omega = -84\ 25\ 24$
$(\lambda' + \Delta - \Omega) = 76\ 55\ 53$

C
$i = 23°\ 21\ 18$
$\delta' = -22\ 13\ 18$

Log sin $i = \bar{1}.598163$
" $\cos(\lambda' + \Delta - \Omega) = \bar{1}.354336$
Co" cos $\delta' = 0.033518$
" sin $c = \bar{2}.986017$
$c = +5\ 33\ 24$

Log sin $i = \bar{1}.598163$
" $\cos(\lambda' - \delta') = \bar{1}.382500$
Co" cos $b = 0.000519$
" sin $c = \bar{2}.980982$
$c = +5\ 29\ 33$

$c = 5\ 33\ 24$
$c = 5\ 29\ 33$
$3\ 51$
$\quad 54$
$5\ 31\ 29$

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Sat. Oct. 18, 1890.

Moon's motion per min. in RA. = 38.″27

Correction (x) − 12.97

Aff. motion. 25.″3

Motion in Dec. per min. = 7.″638

4 | 19.″09 = motion in 150^s

At scale of 42.″4 = 1^{mm}

log 19.09 = 1.627366 (1.280506)

" 42.4 = 1.627366

" Q^{mm} = $\bar{1}$.653440 Q = ^{mm}.45

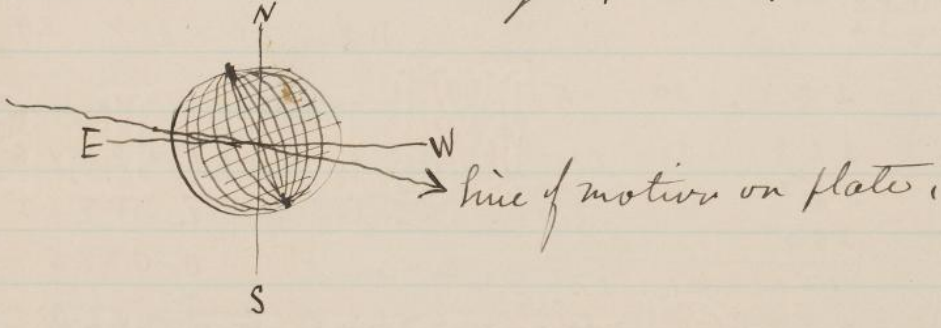
log 254 = 2.404834

colog 240 = $\bar{3}$.619789

$\bar{1}$.678063

div. 0.477

Wedge must be turned towards N $^{div.}_{0.477}$ in the $^{div.}_{45.+}$ returning images, or $^{mm}_{0.45}$



Total angle to be turned through = 6° 7.′6

$^{d}_{45.+}$ sin $^{d}_{\alpha}$ = $^{d}_{.477}$

sin α = $^{d}_{.477}$ / $^{d}_{45.+}$ log = $\bar{1}$.678063

1.656348

log sin α = $\bar{2}$.021715

α = $\bar{6}$.685547

3.336 | 48

C_1 = 5 33 24

C_2 = 5 29 33

av. 5 31 30

+ 36 8

Total 6° 7.′6

α = 2168″ = 36′ 8″

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Sat. Oct. 18. 1890.

Hair got one ~~coordinate~~ axis of ~~plate~~ dividing engine parallel to line of motion in plate X3237.

Coördinates of all 10 points - center image

A	64, 030	in R.A.	62.786 in Dec
B	64.303		64.914
C	63.924		67.618
D	62.395		68.976
E	60.721		69.717

not position A. is correctly identified.

V	25.620	58.342	(58.476)
W	22.392	64.398	(64.491)
X	22.773	67.370	(67.43)
Y	23.236	68.381	(68.478)
Z	22.306	69.715	(69.84?)

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Monday. Oct. 20, 1890.

Squares ruled on glass, put against film of moon neg. X3237.

Dist between two images = 47.8

The interval between the central image & the Western one, seems to be ~~greater~~ less than the other. That was shown in the first measurements on the dividing engine, though not taken into account.

The ~~image~~ Eastern image is 47.95 from central.

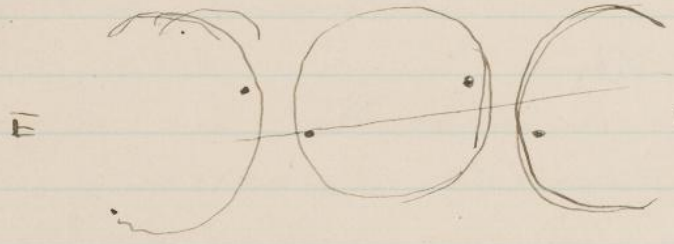
Reached Obs. after dinner.

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Tuesday. Oct. 21. 1890

Central image to East = 47.95
" " " West = 47.80



Angle of roof. = 6° 7'.6 = 6°.13

Log 47.8	= 1.6794	log 47.95	= 1.6807
" Sin 6°	= $\bar{1}$.0285		$\bar{1}$.0285
	0.7079		0.7092

5.1 W

5.12 E

Dentists in A.M. Reached Obs. about 1.

Bromides for this evening had not come so went to Cushmans 34 Brownfield St Boston. To see why.
Afterwards, called on Mr Pickering

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Thursday, Oct. 23. 1890

Yesterday A.M. Countermanded order on Eastman Co for Bromides and purchased of Codman a 10yd roll 22in Bar. B.

Mr Pickering directed me to get B if possible, smallest quantity of largest size. They had as follows:- 20x24 A - $9.00
10yd. x 22in B - 12.40
22x27in C - 11.25

On being told me that Br paper cost by the square inch & ~~suggesting~~ that the paper not used could be cut into smaller sizes without any loss except bother of cutting, I decided to take the roll without specially inquiring of Mr Pickering.

Got back to the Obs about noon.

Fastened ruled glass plate to moon neg with beeswax and got the two in right relation with a magnifying glass. Got the proper enl. on it as there was a good sun, tried a single enl. which would developed there as I had to leave. at 3.50.

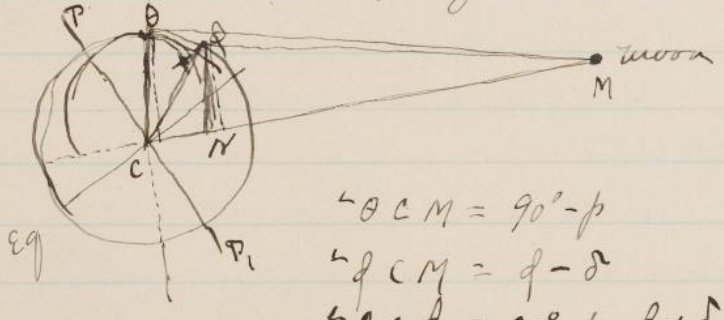
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Thursday. Oct 23. 1890.

Just before taking the print, the calculation in the preceding pages was examined to see if an error in Neison's formulas for $\Delta\delta$ would make much diff. in angle C. It didn't appear that it would but a little more careful investigation better be made.

Rough method.



$p = 59' 55''$

$\phi = 34\ 12\ 48$

$\delta = 22\ 31\ 39$

$90 - 56\ 44\ 22$

$\angle\theta C M = 90° - p$

$\angle\phi C M = \phi - \delta$

$\angle\theta C\phi = 90° - p - \phi + \delta = 33\ 15\ 49$

∴ Dist of ⊙ plane of $C\odot = R \sin 33°\,+ = d$

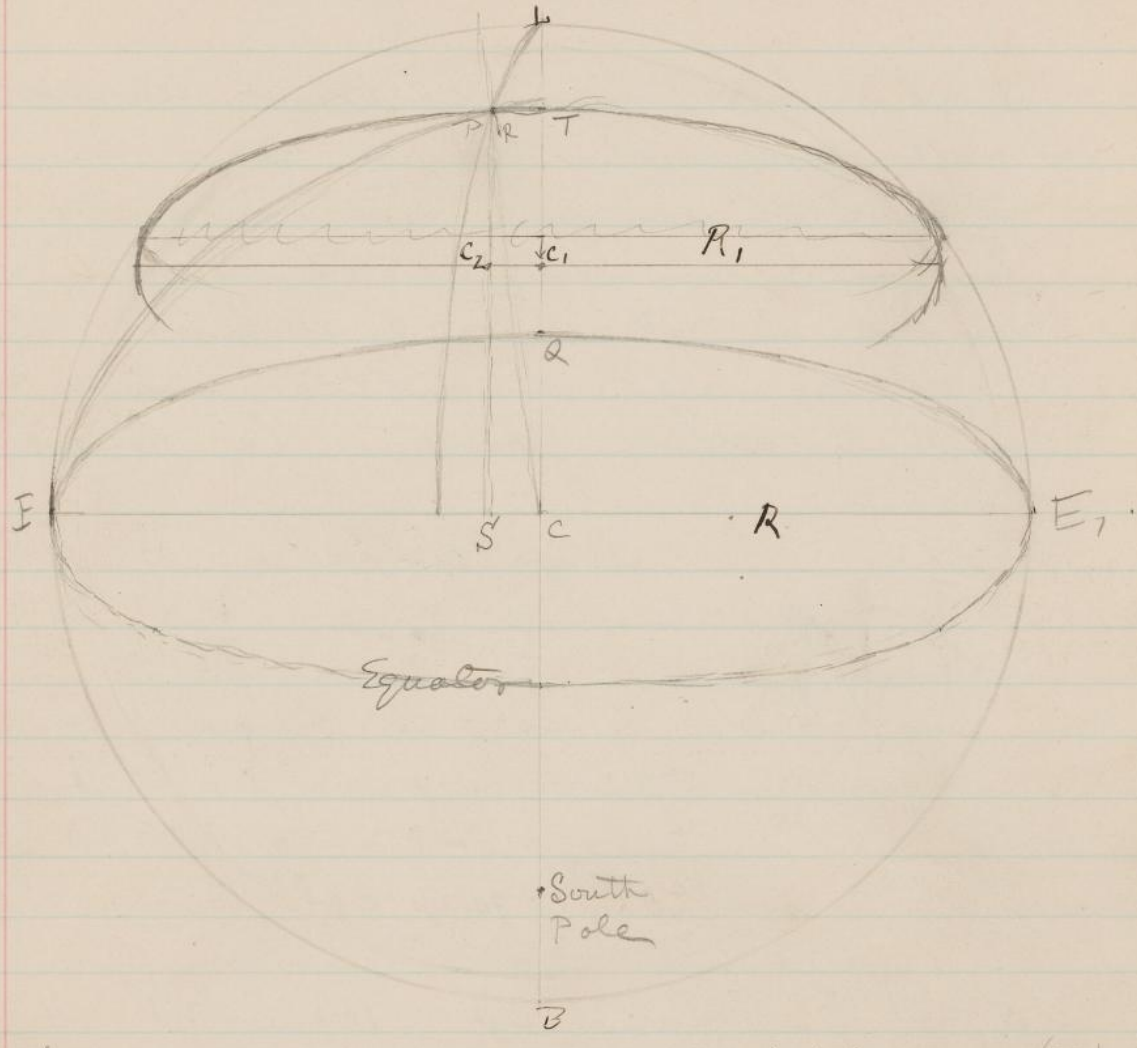
⊙ of N $(= R \sin(\phi - \delta))$ must be multiplied by $\frac{D}{D-d}$

∴ for point ϕ. $p_\delta' = p \frac{D R \sin(\phi - \delta)}{D - R \sin 33°+}$

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Thurs. Oct 23. 1890



ϕ = +34° 12′ 44″ = + 34°.21
δ = −21 31 39 = −21°.53
p = 59′ 55″ = 1.°
h = 6° 45 23 = 6°.76
R = $\frac{40}{16}$ in
$\phi - \delta$ = 55°.74

To plot in place (P) of obs.
$PT = R \sin h \cos \phi$
~~log R = 1.6021~~
" sin h = $\bar{1}.0708$
" cos ϕ = $\bar{1}.9175$
log sin h cos ϕ = $\bar{2}.9883$ ← N.B.
log R = 1.6021
3.694 0.5904

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Thurs. Oct 23, 1890.

First we want the coordinates of P. i.e. PT & PS & then the dist. from P to the moon.

The last will be found as follows:-

$\sin p = \frac{R}{D}$ or $D = \frac{R}{\sin p}$ then D_1 (P to moon) will equal $D - d$ (d = P to plane $E_1 E_1 B$.

In short we want the coordinates of P in terms of R (= 1) first of all.

PT $\quad \log PT = \bar{2}.9883 = \log R \sin L \cos \phi$ $\quad \bar{2}.9883$ / $\bar{2}$ / $\bar{3}.9766$

$\log TC = \log \sin (\phi - \delta) = \bar{1}.9172$ $\quad .009476$

$TC = .8265$ $\quad .8265$

$CC_1 = .5621$ $\quad CC_1 = .5228$

$TC_1 = .2644$ $\quad TC_1 .3037$

Angle at which $C_1 T$ is inclined $= \delta = 21^\circ 31' 40''$

Now $PC_2 = R_1 \cos h \sin \delta$ & $R_1 = R \cos \phi$

$PC_2 = R \sin \delta \cos \phi \cos h$. $\quad R = 1$.

$\log \sin \delta = \bar{1}.5647$

" $\cos \phi = \bar{1}.9175$ $\quad CC_1 = C_2 3 = R \sin \phi \cos \delta$

" $\cos h = \bar{1}.9969$ $\quad TC_1 = R \cos \phi \sin \delta$

" $PC_2 = \bar{1}.4791$

$PC_2 = .3013$ $\quad .3013$

$C_1 C = .5621$ $\quad C_1 C = .5228$

PS $\quad PS = .8634$ $\quad .8241$ $\quad \log \bar{1}.9160$ / $\bar{2}$ / $\bar{1}.8320$

$PR = \sqrt{1 - (\overline{PS}^2 + \overline{PT}^2)}$

$.0094\,76$

$.6792$ $\quad 1101 \overline{)8800}$ $\quad +864$

$1 - .6887$

$.3113$ $\quad \log .3113 = \bar{1}.4933$

RP $\quad 105 \overline{)613}$ $\quad 525$ $\quad 88$

$\bar{1}.7466$

$.5581$

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Thurs. Oct. 23, 1890

$\sin p = \frac{R}{D}$ put $R = 1$, $d = \frac{1}{\sin p}$

Log D = Colog Sin p.

log Sin p = $\bar{2}.241253$

Co " " " = 1.758747 = Log D

D D = 57.3783

R P = .558

D_1 = 56.820 Log = 1.754501

$\Delta\alpha = \frac{PT}{D_1}$ × $\Delta\delta = \frac{PS}{D_1}$

Log PT	$\bar{2}.9883$	Log PS	$\bar{1}.9160$
" D_1	1.7545	" D_1	1.7545
Log Sin $\Delta\alpha$	$\bar{3}.2338$	Log Sin $\Delta\delta$	$\bar{2}.1615$
Subtct	$\bar{6}.6856$		$\bar{6}.6856$
	2.5482		3.4759
	353".4		2992."
$\Delta\alpha$ =	5' 53"	$\Delta\delta$	49' 52"

Conclusion. These values being carried through the previous calculation only reduce angle C by 11" and $\Delta\alpha$ or $\Delta\lambda$ affect C more than the Δ^s in Dec or Lat.

Lastly, the previous calculation Pg 127 Et seq. seems to show that Nelson's formulas are doubtful.

The day has been too dark for photographing so I have kept on at this work.

Developed 30 taken yesterday aft. Too little contrast some lines do not show in important places

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Friday Oct. 24. 1890.

Note, By considering that Log $\frac{PT}{D_1}$ = Log Sin $\Delta\alpha$ &c

we assume the moon directly over P. But as the moon is directly over C using the tangent in each case will give a more exact value

thus! –

Log Tan $\Delta\alpha$ = $\bar{3}.2338$ Log tan $\Delta\delta$ = $\bar{2}.1615$

It comes out just the same as the diff. between sin & tan unit large enough.

	$\Delta\alpha$	$\Delta\delta$
Values by Nelson	– 6 22	41 39
" " Rough Method	– 5′ 53″	49′ 52″

Sign of h.

Nelson – Pg 622, states that a fast-meridian hour angle is neg.

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Saturday Oct. 25, 1890

The following stars from Bond's catalogue, are to be looked over.

296. ~~418.~~ on plate 2312

418 on all "

675 ~~on~~ under S or n on 2917?

949 } Look up & see if they can be separated.
954 }

296. Shows on 2312, 2925. & 2917, but not on the broken plate.

Its position on the chart is thus:-

.226 Image estimated at 15m.

.296

.278

.266

.348

	2312.	2325.	2917.	2925
418.	—	—	o	o

Note. It is slightly in the neb. in the first two, but would show if it were there. That is ~~probably~~ the case with those marked — or n

? When they are marked S or n, they are in the neb. but the star images so indeterminate that it is impossible to tell whether they overlap or not.

675. is about 20" from 685. Star image flatter in R. on scale of 42".4 to the mm. i.e. = 15" in R.

So 675 should be marked n in 2917 & 2925. In the others it should be n because even 685 is

949.54. Bond gives them 8" apart. 9.8 & 8.4 mag. respec. So they obscure each other & should both be marked S on all 4 plates.?

See X2759 shows the two stars.

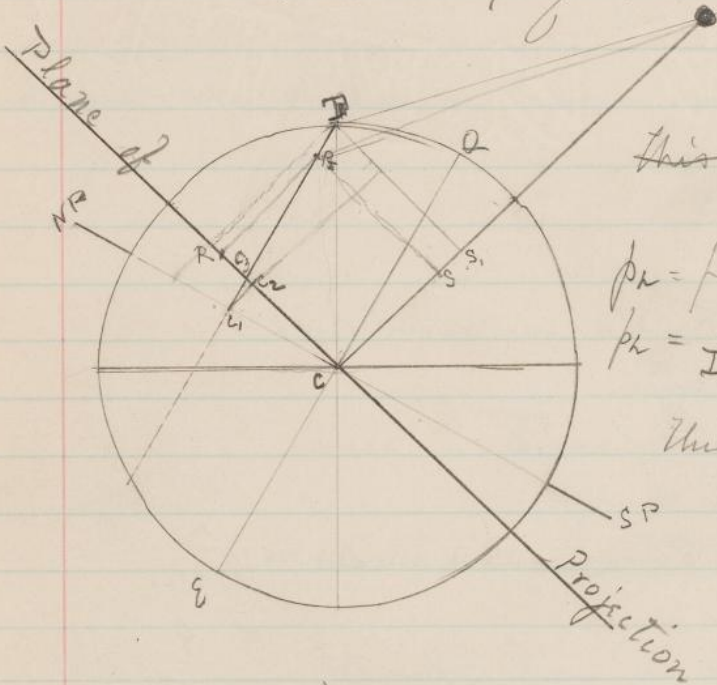
Pa Outlig. DOS 715 47-20 They are marked a Tapelitto marking at 15th Mag Star

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Sat. Oct. 25, 1890

Parallax of moon when on horizon.



~~This disregards the hour angle~~

p_h = parallax when moon sets or rises

$p_h = \frac{\sin p}{D_1 \cos \delta}$ or nearly $\sin p \frac{\sin q}{\cos \delta}$

This needs a reg correction
L. found thus $\sin c = \frac{\cos p}{\cos \delta}$

Newcomb's formula

$$\Delta \alpha = \frac{1}{\sin 1''}\left(\frac{\cos q \sin p \sin t}{\cos \delta\ !!} + \frac{\cos^2 q \sin^2 p/2}{\cos^2 \delta} \sin 2t + \text{etc}\right.$$

seems to me it should not have the term δ in at all, as the parallax in R.A. is not affected by δ

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Monday, Oct. 27, 1890

Did some studying on preceding formulas yesterday and day before.

The one I am using may be formulated as follows:—

Let $R = 1$,

Put $X = \cos\phi \sin h$

" $Y = \sin\phi \cos\delta - \cos\phi \sin\delta \cos h$

" $Z_1 = \sqrt{1 - x^2 - y^2}$

" D = dist center of earth to moon

$\log D$ = a.c. $\log \sin p$

Then $\tan \Delta\alpha = \frac{X}{D - Z_1}$

" $\tan \Delta\delta = \frac{Y}{D - Z_1}$

For Pickering's formula for $\Delta\alpha$ is

$$\tan \Delta\alpha = \frac{\cos\phi \sin h \sin[p \sin(\phi - \delta)]}{\sin(\phi - \delta)}$$

By using the term $p \sin(\phi - \delta)$ for the local parallax two errors are made to counteract each other. Angles are made proportional to their sines, which produces a pos. error, and the distance dif. on sphere is neglected which causes a neg error.

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Mon. Oct. 27, 1890

$\phi = 34^\circ\ 12'\ 48''$

$\delta = -21\ \ 31\ \ 39$

$\phi - \delta = 55^\circ\ 44'\ 27''$

$p = 59'\ 55'' = 3595''$ Log = 3.555699 other method

$h = 6^h\ 45^m\ 23^s.1$ + sin $(\phi - \delta)$ = $\bar{1}.917243$ (i.e. mine)

3.472942

2971" = 49' 31" ≒ 49 52

~~Log sin 49' +~~ =

Log 2971" = 3.472942

$\bar{6}.685560$

Log Sin 49' + = $\bar{2}.158502$

' Log Sin h = $\bar{1}.070587$ m

" Log ϕ = $\bar{1}.917478$

Co " Sin $(\phi - \delta)$ = 0.082757

$\bar{3}.229324$

$\bar{6}.685585$

2.543739

$-349.''7$

$-5'\ 49''$ ≒ $-5'\ 53''$

Comparison of Formulas - results.

	$\Delta\alpha$	$\Delta\delta$
Watson's.		49' 53"
Mr Pickering's	5 49	49' 31"
A.E.D's	5' 53"	49' 52"

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Tuesday. Oct. 28.

Discovered last evening that Nelson's formula for $\Delta\delta$ in Mr Pickering's book had a Cos ϕ or Ctn ϕ. We will see what diff. that makes.

Let $\cot b = \cot\phi \dfrac{\cos(\alpha + \frac{1}{2}\Delta\alpha_2)}{\cos\frac{1}{2}\Delta\alpha}$

$c = \sin\phi \dfrac{\sin p}{\sin b}$ $\qquad \Delta\delta = \dfrac{1}{\sin 1''}\left[c\sin(b-\delta) + \dfrac{c^2}{2}\sin 2(b-\delta)\right]$

See page 119.

Log Cot. ϕ	= 0.167530
" Cos $(\alpha + \frac{1}{2}\Delta\alpha)$	= $\bar{1}$.996826
Co " " $\frac{1}{2}\Delta\alpha$	= 0
" Cot b	= 0.164456
b	= 34 24 8
δ	= −21 31 39
$b-\delta$	= 55 55 47
	2
$\sin 2(b-\delta) = \sin$	111 51 34
(")	= sin 68 8 26

Log Sin ϕ	= $\bar{1}$.749950
" " p	= $\bar{2}$.241253
Co " " b	= 0.247952
" c	= $\bar{2}$.239155
" c^2	= $\bar{4}$.478310
Co " 2	= $\bar{1}$.698970
" $\frac{c^2}{2}$	= $\bar{4}$.177280
" Sin $2(b-\delta)$	= $\bar{1}$.967595
	$\bar{4}$.144875
Log c	= $\bar{2}$.239155
" Sin $(b-\delta)$	= $\bar{1}$.918215
Co " " 1"	= 5.314440
	3.471810

4.144875
5.314440
1.459315

2964
29
2993" = 49′ 53"

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Wed. Oct 29. 1890

Identification of 3 Mtns on moon.

Mtn	Long.	Lat	X	Y
Manilius	+8° 46' 56"	+14°26'54"	+.14824	+.24949
Mösting A	-5 13 23	-3 10 55	-.09089	-.05551

These two will determine position of center pretty well. We want one on limb to test orientation. It will be best to get one in same lat as one of those above.

Bessarion E
Eratosthenes.
Flamsteed.
Grimaldi.
Picard - my good.

Picard	+53° 52'8" by +14° 27'44"	+.78208	+.24974

Manilius is in Map II
Mösting A " " " XIII
Picard " " " I

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Wed. Oct 29, 1890

General plan for reducing given position of nebs to app. position.
The coörd. are x & y. These are the series of coörd. angles.
Coörd. dec. in long. is decreased by Lib. in Long. Same for lat.
If we consider a lib. in Long. alone we will have $\sin X' =$



$$\left[x - \sqrt{\cos^2\phi - x^2}\ \tan L\right] \cos \text{lib. long.} = x_1$$

In which $R = \cos b$

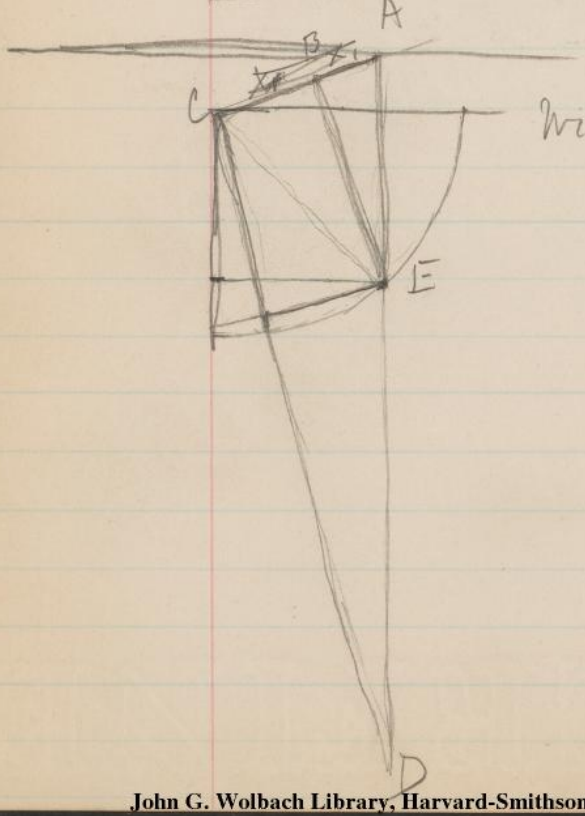
or $x \cos L - (\sin L)\sqrt{\cos^2\phi - x^2} = x_1$

and in Lat. alone

$$\left[y - \sqrt{\cos^2 L - y^2}\ \tan b\right] \cos b$$

or $y \cos b - (\sin b)\sqrt{\cos^2 X - y^2} = y_1$

$$\sqrt{1 - y^2 - \cos^2\phi \sin^2 A}$$



Within AC : AB :: CD : BE

$x_R : x_G :: E : z$

$x_R : x_R - x_C :: E : E - z$

x_R = reqd x = AC

x_C = Correction for x AB

x_G = given x = BC

$x_R : x_G :: E : E - z$

(x_1) $x_1 = \dfrac{Ex}{E - z}$

$y_1 = \dfrac{Ey}{}$

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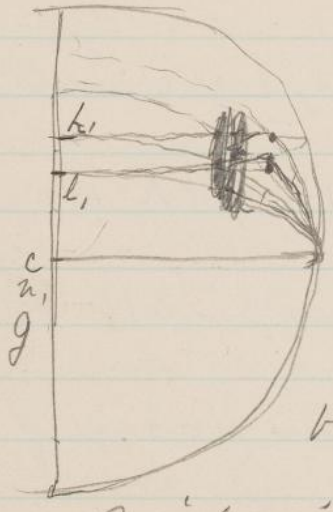
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Wed. Oct 29, 1890

On looking over Mr Pickerings method Pgs. 20 & 21 Book 24,

His way of getting x is far better than mine.

In the figure bottom of Pg 21, the sphere is revolved about the moon axis. It should be:-



Now if b, c = y when the object is in luna axis ~~then a general value of y with b~~

He avoid complications by bringing in this slight error.

Mr Pickerings Equations,

$x = R \cos\phi \sin(\lambda - l)$ λ = long. l = lib. in long

$y = R[\sin(\phi - b) + \cos\phi \sin b[1 - \cos(\lambda - l)$

ϕ = Lat. & b = Lib in Lat.

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i.e. the true center appears to the W of app. center.

N.B. libration in long. when ☾ goes in direction of +X
X is plus towards W. Y towards N

Wed. Oct. 29, 1890

To reduce true Long & Lat on moon to apparent place.

My formulas -

$$x_1 = \qquad y_1 = x\cos l \mp \sin l \sqrt{\cos^2 b - x^2}\,]\,R$$

$$y_1 = y\cos b - \sin b \sqrt{1 - y^2 - \cos^2\phi \sin^2\lambda}\,]\,R$$

Mr Pieberings are better

$$x_1 = R\cos\phi\sin(\lambda - l) \qquad \lambda = \text{long.}, \; l = \text{lib in long.}$$

$$y_1 = R\left[\sin(\phi - b) + \cos\phi \sin b\,[1 - \cos(\lambda - l)]\right]$$

followed by correction for size of moon.

$$x_2 = \frac{E x_1}{E - z} \qquad Z = \sqrt{R^2 - x^2 - y^2}$$

$$y_2 = \frac{E y_1}{E - z}$$

x_2 & y_2 will finally be the required coördinates.

	Manilius	Mösting A	Picard.
λ	+8° 46 56	−5° 13 23	+53° 52 8
l	−3 5 5.3	−3 5 5.3	−3 5 5.3

N.B. The signs of l are given here according to the Calc. from the nautical almanac. The coördinates of Mb^ns have signs from Neison's moon plus towards N^e W. How does the lib. increase towards E with the long. or towards west?

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Thurs. Oct. 30, 1890

Took some of these large 22×27 Br Enlargements of moon.

1. Exposed 66 sec. S.F. sunlight. (Over exposed)
Development - 2 full bottles.
1 Bottle = ½ from Jar. (= ½ A) } = ¼ A.
+ ½ water
+ 16 Pyro spoonfuls.
+ 4 drops Br.
This latter Br had no effect.

2 & 3d Exposed 20s Still showed little contrast. There isn't much in original development - 2nd

* Same as above
Old Dev. added to draw out contrast if possible, but without success.

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Friday Oct 31, 1890,

SIGNS of Librations.

Libration in Long. l = + x° ν means = lib W
you can see around W circle of moon.

Lib. in Lat β is equiv. to lib. north & means
you can see over N pole of moon

Exposed 2 4×5 Br. Stest Expo & Dev.
1st Expo 40s
Dev. 3m 1st showed at end of 1m
½ℵ from Jar
1 sp. Pyro
10 dps Br.
2nd " Expo 20s. Want to be good.

Exposed two 22+27. 40s each.
Seem many hours been stronger or
dil may have been due to using a
dil alkali solution

P.M. Two more 4×5 Br

1st		2nd	
30s Expo.		30s Expo	
1 oz Jar Sol		1 oz B	
1 oz H2O		1 oz B	
1 sp Pyro		2 sp Do.	
6m poor.		10 dps Br	8m N.G.
Underexposed (?)			

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1889phae.proj..509C

Friday. Oct 31. 1890

Lib. in Long meridians in Ast. diff. of ☌

Hence apply formula directly $x_1 = R \cos\phi \sin(\lambda - l)$

☌ = Mathilius Mosting ☆ Picard.

λ =	+8	46	56	-5	13	23	+53	52	8
l =	-3	55	3	-3	55	3	-3	55	3
$\lambda - l$ =	+12	~~42~~	~~59~~	-1	18	20	+57	47	11

~~$\log \sin(\lambda - l)$~~ ~~1.~~ ~~1.~~ ~~1.~~

Let S = ~~semidiameter~~ of moon,

$\sin S = \frac{R}{E}$

Let $x_1 = R \cos\phi \sin(\lambda - l)$

then $\frac{x_1}{R} = \cos\phi \sin(\lambda - l)$ $x_2 = \frac{x_1 E}{E - z}$

then $x_2 = \frac{\left(\frac{x'}{R}\right) R E}{E - z} = \frac{\cos\phi \sin(\lambda - l) E^2 \sin S}{E - z}$

E may be given in units of Earth's radius.

We will have to get x, + y, in order to get z,

Let E = Dist Obsr to center of moon = 56.826.

☆ $\sin S = \frac{R}{D_R}$ $R = D_R \sin S$

$D_R = \sqrt{PC^2 + D_1^2}$ (See pg 128) $\overline{PC}^2 = .6887$ (pg 129)

$\log D_1 = 1.754501$

$D_1^2 = 3.509002$

$D_1^2 = 3236.$ ~~.6~~ -.05

$\overline{PC}^2 = .6887$

$D_R^2 = 3236.684$ | 56.89

25

106 | 736
636

112 | 10064
9024

1136 | 104000

3229.1887 = 56.826 N.B.

3228.5 6+8+7

D_R = ~~approx~~ 56.89 | $\log = 1.755036$

S = 16' 21".1 — log = $\bar{3}.677286$

arc used among D $\bar{1}.432322$

22.5
18.2
4.3
8.3 | 85
120 | 36

7 | 18.2
4 | 2.9
6 | 175 | 21.1
29

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1889phae.proj..509C

Saturday, Nov. 1, 1890

Developer of 22 x 27 Bromides of moon.

2 Bottles.

1 " = ½ from Jar from formula page 18
+ ½ Water

Add 1 tsp Pyro + 10 drops KBr to every ~~20 oz~~ two oz of liquid.

6 cc KBr = 160 drops.

About 64 oz to a bottle.

That makes two bottles of

½ from Jar
+ ½ Water
+ 32 tsp. of Pyro
+ 12 cc. KBr.

} All but Pyro mixed. Then Pyro added just before exposure. As soon as the 1st was out of Dev. the 2nd was exposed.

1st 22x27. Exposed 50s at 11h 10m A.M. 1st Dev. 3m & was a trifle too long. Began to show inside of moon at end of just 1m. It should have had an exp. of 40s or a shorter Dev - say 2m 30s

2nd Do Exposed 56s at 11h 20m A.M. 2nd Dev. 3m. Was better than first. Began to show inside in 1m 30s

Both show blisters.

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1889phae.proj..509C

Monday. Nov. 3. 1890

The ref. without cross lines, is to be taken from a new neg. with more contrast than X3244.
∴ a pos. was taken from 3244 last Sat. (as R. Platt) a neg from that this is from.

As it turns off cloudy in aft. the positions of Manilius, Picard & Mösting A can be marked on one of the refs taken.

Mösting A. The position of Mösting A is reckoned for the center of the ring.

Manilius. Manilius' position is reckoned from the ref^n in center perhaps a trifle above (S) the center.

Picard. Picard has a central ref^n $\frac{1}{10}$ R above (S) center

Measures on pinholes pricked in Bromide in above localities.

	cent. Div.		cent. Div.
Picard.	Long = +19.18	Lat = +5.93	
Manilius.	" = +5.02	" = +5.97	
Mösting A.	" = −0.59	" = −1.16	

	cent. Div.		cent. Div.
Long. of ~~W~~ E limb,	= 23.24	Lat. of N limb,	= 23.28
" " ~~W~~ E "	= 23.35	" " S "	= 23.37
	11 or .10		9 or .08

Correction for given or measured Long. = +.05
" " " " Lat = +.04

Measured positions of mountains – corrected.

	cent. Div.		cent. Div.
Picard. Long.	= +19.23	Lat. = +5.97	
Manilius. "	= +5.07	" = +6.01	
Mösting A "	= −0.54	" = −1.12	

	cent. Div.		cent. Div.
Radius in Long	= 23.29	"	= 23.32

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Tuesday Nov. 4. 1890

Positions of Mts — again,

	Long.	Lat.	Long. in R^s	Lat. in R^s
Picard	+19.23	+5.97	.8257	.2560
Manilius	+5.07	+6.01	.2177	.2577
Mösting A	−0.54	−1.12	~~.2319~~ .0232	~~.4803~~ .0480
	23.29	23.32		

	Picard	Manilius	Mösting A.
Log Long.	1.283979	0.705008	$\bar{1}$.732394
" $R_\leftarrow$ =	1.367169	1.367169	1.367169
Earth radius	$\bar{1}$.916810	$\bar{1}$.337839	$\bar{2}$.365225
Reduce to field Log R =	$\bar{1}$.436033	.2177	.023194
	.82568		
Log Lat. =	0.775474	0.778874	0.049218
" R. =	1.367729	1.367729	1.367729
	$\bar{1}$.408245	$\bar{1}$.411145	$\bar{2}$.681489
	.2560	.25772	.04803

Log $R_{(moon)}$ using D (= dist. Obs. to Moon's center) = $\bar{1}$.432322

Log D. used. = 1.755036

" Correct D = 1.758747

Dif. 003711

Log R. (moon) $\bar{1}$.432322

$\bar{1}$.436033 = Log correct R

	Picard	Manilius	~~Mösting A~~
$\lambda - \odot$ =	+57° 47′ 11″	+12° 42′ 0″	−1° 18′ 20″
Log Sin =	$\bar{1}$.927404	$\bar{1}$.342100	$\bar{2}$.357635
" Cos =	$\bar{1}$.986015	$\bar{1}$.986042	$\bar{1}$.999330
" R =	$\bar{1}$.436033	$\bar{1}$.436033	$\bar{1}$.436033
x_1 =	$\bar{1}$.349452	$\bar{2}$.764185	$\bar{3}$.792998

~~$\odot$ = 34° 12′ 48″~~

ϕ^s = +14 27 44

+14 26 54

ϑ − 3 10 55

Log

.22359 .058108 .000208

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Wednesday, Nov. 5, 1890

Yesterday A.M. took two 22×27 - direct from R2390.
N.G. on account of transp. hair in R2390.
Took 2391 - which was broken
Also took 2392-3. The latter very good but with a slight rub on film. The breakage of 2391 cost about ½h but the sun was already too low to attempt any big bromides anyway.
So took R2396 which was better than 2393.

Today. Took a 4×5 from R2396 - Tycho, showing 3 exp^{s} 20, 40, 80^{s}. Dev - had ½ P. Thought 30^{s} would do. Clock stopped during Dev. so was unable to be so certain. Exposed 1st 22×27 - 30^{s}. Moon not centred well. Dev^{d} but. 3×4^{m} too dark & too much Cry
Dev = 2 bottles - 1 bottle = ½ Water
½ Dev. fr. jar } + 16 sp^{s} Pyro

2nd 22×27 - Exposed 80^{s} Moon a little too far in opposite direction. Rather dark. 2nd d 4^{m}
3rd Do. Exp^{d} 80^{s} Centred well. 3^{d} d 4^{m}

In all prints - described on this page salt was used in 1st water bath - perhaps 3 fluid oz. gran. salt in big tray. This was to prevent blisters It worked very well.

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Thurs. Nov. 6. 1890

$x_1 = R \cos\phi \sin(\lambda - l)$

$y_1 = R\left[\sin(\phi - \tfrac{b}{2}) + \cos\phi \sin\tfrac{b}{2}\left[1 - \cos(\lambda - l)\right]\right]$

Log R = $\bar{1}.436033$

	Picard	Manilius	Twisting A
ϕ	$+14^\circ\ 27'\ 44''$	$+14^\circ\ 26'\ 54''$	$-3^\circ\ 10'\ 55''$
b	$-\ \ 23\ \ 43$	$-\ \ 23\ \ 43$	$-\ \ 23\ \ 43$
$\phi - b$	$+14^\circ\ 51\ \ 207$	$+14^\circ\ 50\ \ 37$	$-2^\circ\ 47\ \ 12$
$\lambda - l$	$+57\ \ 47\ \ 11$	$+12\ \ 42\ \ 0.$	$-1\ \ 18\ \ 20$
Log Sin $(\phi - b)$	$\bar{1}.408945$	$\bar{1}.408548$	$\bar{2}.744329$ n (686800)
" R	$\bar{1}.436033$	$\bar{1}.436033$	$\bar{1}.436033$
Log T_1	$\bar{2}.844978$ p	$\bar{2}.844581$ p	$\bar{2}.180362$ n (122833)
Log R	$\bar{1}.436033$	$\bar{1}.436033$	$\bar{1}.436033$
" Cos ϕ	$\bar{1}.986015$	$\bar{1}.986042$	$\bar{1}.999330$
" Sin b (1-Cos $(\lambda - l)$)	$\bar{3}.838776$ n	$\bar{3}.838776$ n	$\bar{3}.838276$ n
" T_2	$\bar{4}.930068$ n	$\bar{5}.649395$ n	$\bar{7}.689112$ n
T_2	$-.000851$	$-.000045$	$-.000000(49)$
$+ T_1$	$+.069981$	$+.069917$	$-.015148$ (326)
	$+.069130$	$+.069872$	$-.015148$ (1326)
y_1 Log	$\bar{2}.839667$	$\bar{2}.844303$	$\bar{2}.180350$ n
Nat Cos $(\lambda - l)$	.533077	.975535	.999740
$1 - (\text{"}(\text{"}\ 1)$	.466923	.024465	.000260

Sin b.

b = 23' 43

60

1423 Log = 3.153205

$\bar{2}.685571$

$\bar{3}.838776$

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Thurs. Nov. 6, 1890.

	Picard.	Manilius.	Winstine A.
log x_1 =	$\bar{1}.349452$	$\bar{2}.764185$	$\bar{3}.792998$ n
" x_1^2 =	$\bar{2}.698904$	$\bar{3}.528370$	$\bar{5}.585996$ p
" y_1 =	$\bar{2}.839667$	$\bar{2}.844303$	$\bar{2}.180355$ n
" y_1^2 =	$\bar{3}.679334$	$\bar{3}.688606$	4.360710
y_1^2 =	.004779	.004882	.000230
x_1^2 =	.049992	.003376	.000039
$x_1^2 + y_1^2$ =	.054771	.008258	.000269
$1-(") = z_1^2$ =	[illegible]	[illegible]	[illegible]
log R =	$\bar{1}.436033$		
" R^2 =	$\bar{2}.872066$	~~$\bar{2}.872066$~~	$\bar{2}.$
R^2 =	.074484	.074484	.074484
$x_1^2 + y_1^2$ =	.054771	.008258	.000269
$R^2 - (x_1^2 + y_1^2)$ =	.019713	.066226	.074215 = z_1^2
z =	.1404	.2573	.2724
			(just the same)

~~.074269~~ (2

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Friday, Nov. 7. 1890.

	Piaard	Manilius	Mösting A.
E	56.8 26/90	56.8 26/90	56.8 26/90
z =	.1404	.2573	.2724
E − z =	56.750	56.633	56.618
Log. E − z =	1.753966	1.753070	1.752955
Colog E−z =	$\bar{2}$.246034	$\bar{2}$.246930	$\bar{2}$.247045
Log E =	1.755036	1.755036	1.755036
Sum = x_1 =	0.001076	0,001968	0,002084
Log x_1 =	$\bar{1}$.349452	$\bar{2}$.764185	$\bar{3}$.782998
" x_2	$\bar{1}$.350523	$\bar{2}$.766154	$\bar{3}$.795082
Log y_1 =	$\bar{2}$.839667	$\bar{2}$.844303	$\bar{2}$. 80355 / 122833
" y_2 =	$\bar{2}$.840738	$\bar{2}$.846269	$\bar{1}$.124917
Log X_2 =	$\bar{1}$.350523	$\bar{2}$.766154	$\bar{3}$.795082
Subtr. log R =	$\bar{1}$.436033	$\bar{1}$.436033	$\bar{1}$.436033
Log X_0 =	$\bar{1}$.914490	$\bar{1}$.330121	$\bar{2}$.359049
Calc. X_0 =	+.82128	+.21386	−.022805
Meas.	.82568	.21577	.02319
	Error +1mm	+1mm	+0.1mm
	Long.		
Log y_2 =	$\bar{2}$.840738	$\bar{2}$.846269	$\bar{2}$.124917
Subtr. log R =	$\bar{1}$.436033	$\bar{1}$.436033	$\bar{1}$.436033
Log Y =	$\bar{1}$.404705	$\bar{1}$.410236	$\bar{2}$.746403
Calc Y =	+.25392	+.25718	.05547
Meas.	.25600	.25771	.04803
	Error +0.5mm	+0.2mm	
	Lat.		
			$\bar{2}$.688884
			− .04885
			.04803
			+0.3mm

16′ 21.″1 = 23.3mm

23.3) 981.″1 (42.1 1mm
932
490
466 1mm

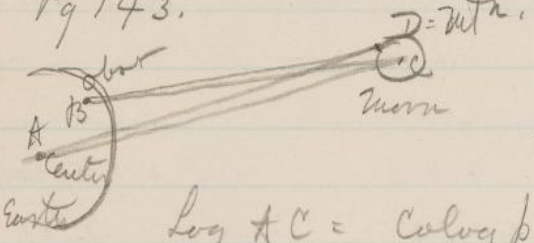
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1889phae.proj..5096

Friday. Nov. 7, 1890

Corrections in preceding Calc.

Pg 143.



AC = dist. bet. centers.

BC = required dist. Obsr & Moon's C

Log AC = Colog p - AC = 57.3783

Semid. Moon = 16′ 21.″1

R = 57.+ Sin 16′+

R has been used correctly.

Log 57.+	= 1.758747
" Sin 16′+	= 3.677286
	1.436033

Page 150

E =	56.826	56.826	56.826
z =	.140	.257	.272
E - z =	56.686	56,569	56,554
log E =	1.754547	1.754547	1.754547
" E - z	1.753476	1.752578	1.752463
Log Cor. for x, =	.001071	.001969	.002084
Value used	+70	+66	+81

For further projects & reference.

	Long	Lat
Selected. Lichtenberg.	-67° 5′ 3	+31° 25′ 20
	-.78601	+.52134
Ramsden	-31° 41′ 55	-32° 25′ 48
	-.44351	-.53627
Rosse.	+34° 19′ 38	-17° 48′ 37
	+.5369	-.30587

See pg 156

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1889phae.proj..509C

Saturday Nov. 8. 1890

Measured positions of pin holes, in Mrs given at foot of last page. – as follows –

	Lichtenberg	Ramsden	Rossa.	
Long	−17.38	− 9.42	+13.~~07~~ 91	
Lat	+14.06	−12.53	−7.11	Radii.
Cor^{d} Long (X^S)	−17.33	− 9.37	+13.96	23.29
" Lat (Y^S)	+14.10	−12.49	−7.07	23.32

R.

Log long =	1.238799 n	0.971740 n	1.144885
" R =	1.367169	1.367169	1.367169
" X_0	$\bar{1}$.871630 n	$\bar{1}$.604571 n	$\bar{1}$.777716
Log lat =	1.149219	1.096562 n	0.848419
" R =	1.367729	1.367729	1.367729 n
" Y_0 =	$\bar{1}$.781490	$\bar{1}$.728833 n	$\bar{1}$.481690 n

Gen. Note:- The preceding calculation was conducted in terms of the earth's radius. For convenience this will be, but in general it will be better to do the whole in terms of Moon's R

Apparent positions of selected Mountains as given by measurement.

in terms of Moon's Radius.

Aff.	Lichtenberg	Ramsden	Rossa
(X) Long.	−.74410	−.40232	+.59940
(Y) Lat.	+.60463	−.53559	−.30317

For Lichtenberg See Page 156

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Sat. Nov. 8. 1890

Formulas to be applied. (in future)

$x_1 = R \cos\phi \sin(\lambda - l)$ Calc $(\lambda = A)$

$y_1 = R\left[\sin(\phi - b) + \cos\phi \sin b\left[1 - \cos(\lambda - l)\right]\right]$ $(\phi = B)$

$X = x_1\left(\frac{E}{E-z}\right)$ $Y = y_1\left(\frac{E}{E-z}\right)$

	Lichtenberg	Ramsdem	Rossel
λ =	−67° 05 3	−31° 41 55	+34° 19 38
l =	− 3 55 3	− 3 55 3	− 3 55 3
$(\lambda - l)$ =	−63° 10 0	−27° 46 52	+38 14 41
ϕ =	+31° 25 20	−32° 25 48	−17 48 37

Log R = $\bar{1}.436033$ to reduce to earth's radius

Log R =	$\bar{1}.436033$	$\bar{1}.436033$	$\bar{1}.436033$
" $\cos\phi$ =	$\bar{1}.931127$	$\bar{1}.926367$	$\bar{1}.978671$
" $\sin(\lambda-l)$ =	$\bar{1}.950522$ n	$\bar{1}.668474$ n	$\bar{1}.791706$
" x_1 =	$\bar{1}.317682$ n	$\bar{1}.030874$ n	$\bar{1}.206410$ b N.B.
" x_1^2 =	$\bar{2}.635364$ b	$\bar{2}.061748$ b	$\bar{2}.412820$ p
x_1^2 =	+.043188	+.011528	+.025871

final reduction

Log x_1 =	$\bar{1}.317682$ n	$\bar{1}.030874$ n	$\bar{1}.206410$
Log $\frac{E}{E-z}$ =	0.000796	0.001569	0.001563
Colog R =	0.563967	0.563967	0.563967
Log X	$\bar{1}.882445$ n	$\bar{1}.596410$ n	$\bar{1}.771940$
Calc X	−.76286	−.39483	+.59148
~~Weber~~	~~−.7441~~	−.40232	+.59440

Log y_1 =	$\bar{1}.155452$	$\bar{1}.161313$ n	$\bar{2}.914266$ n
Log $\frac{E}{E-z}$ =	0.000796	.001569	.001563
Colog R =	0.563967	0.563967	0.563967
Log Y	$\bar{1}.720215$	$\bar{1}.726849$ n	$\bar{1}.479796$ n
Calc Y	+.52505	−.53315	−.30185
~~Weber~~	~~+.605~~	−.536	−.303

See pg 156.

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Sat. Nov. 8, 1890.

$$y_1 = R\left[\sin(\phi - b) + \cos\phi \sin b\,[1 - \cos(\lambda - l)]\right]$$

	Lichtenberg	Ramsden	Rood
ϕ	+31 25 20	−32 25 48	−17 48 37
b	− 23 43	− 23 43	− 23 43
$\phi - b$	+31 49 3	−32 2 5	−17 24 54
$\lambda - l$	−63 10 0	−27° 46 52	+38 14 41
		Log R = T. 436033 (to reduce to Earth's rad.)	
Nat. Cos$(\lambda - l)$	.451397	.884735	.785374
" Sin$(\phi - b)$	.548603	.115265	.214626
Log$(1 - \cos(\lambda - l))$	T. 739258	T. 061697	T. 331682
" Sin b	$\bar{3}$. 838776 n	$\bar{3}$. 838776 n	$\bar{3}$. 838776 n
" Cos ϕ	T. 931127	T. 926367	T. 928671
	$\bar{3}$. 509161 n	$\bar{4}$. 826840 n	$\bar{3}$. 149129 n
	−.003230	−.000671	−.001410
		−.530433	
Nat. Sin$(\phi - b)$	+.527215	−.466095	−.299290
	+.523985	−.531104	−.300700
Log a	T. 719319	T. 725180 n	T. 478183 n
Log R	T. 436133	T. 436133	T. 436133
Log y_1	T. 155452	T. 161313 n	$\bar{2}$. 914266 n
Log y_1^2	$\bar{2}$. 310904 p	$\bar{2}$. 322626 p	$\bar{3}$. 828532 p
y^2	+.02046	+.02102	+.00674
x_1^2	+.04319	+.01153	+.02587
R^2	.07448	R^2 = .07448 =	R^2 = .07448 =
$x_1^2 + y_1^2$	.06365	.03255	.03261
z^2	.01083	.04193	.04187
z	.104	.205	.204
H_1'	56.826	56.826	56.826.
$H_1' - z$	56.722	56.621	56.622
Log E	1.754547	1.754547	1.754547
" $E - z$	1.753751	1.752978	1.752985
Log $\frac{E}{E-z}$	0.000796	0.001569	0.001562

See page 156.

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1889phae.proj.:5000

Tuesday. Nov. 11. 1890.

~~R.A. 2xxx 1.xxxx~~

These have been 3 charts of Neb. Orion. Two of, ab chart, the 1st from one stone, 2nd & 3d from another. The last chart (3d) has stars very much out of place, Mag. wrong &c Something like 3 measures better be made in Dec, by four in R.A. The chart is supposed to be on a scale of 30" to the mm while plate x2917 is on scale 42".4 to the mm.

Measurements

Stars in Dec.	On Neg.	On Chart	Logs On Neg.	Logs On Chart	Dif.	Ratio
39 to 41a	54.1	78.2	1.7332	1.8932	.1600	1.446
579 to 5/6 36	110.5	157.8	2.0434	2.1981	.1547	1.428
(10) 52 to (10) 44	90.9	130.3	1.9586	2.1150	.1564	1.434
Stars in R.A.						
136 to (10) 63	87.0	127.	1.9395	2.1038	.1643	1.460
38a to (10) 69	103.4	150.7	2.0145	2.1782	.1637	1.458
164 to 143a	86.7	127.3	1.9380	2.1049	.1669	1.469

In Dec 1.45
1.43 Average ratio 1.44
1.43 Correct ratio 1.413

In R.A. 1.46
1.46 Average ratio 1.46
1.47

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1889phae.proj..509C

Tuesday. Nov. 11, 1890.

Remeasurement of Lichtenberg.

Found on referring to Neison that the wrong mountain had been selected as Lichtenberg.

Pricked in the comet Mtn and measured pin hole as follows.

$X = -17.\overset{69}{74}$ $\log = 1.248954$ $\log Y = 1.091667$

$Y = +12.\overset{39}{35}$ $\therefore R = 1.367169$ $\therefore R = 1.367729$

$\log X = \bar{1}.881785$ $\log Y = \bar{1}.723938$

Meas. X .76170 Meas. Y = .52959

	Lichtenberg	Ramsden	Rosse
Calculated or Neison			
Positions X =	-.7629	-.3948	+.5915
Measured do.	-.7617	-.4023	+.5994
Errors	$+^{mm}.28$ $\frac{1}{3}$ mm	$-^{mm}1.75$	$+^{mm}1.84$
	+.05		
Y =	+.5251	-.5332	-.3019
	+.5296	-.5360	-.3030
	$+^{mm}1.05$	$-^{mm}.65$	$-^{mm}.25$
	+.04		

Summary of errors

	1st quad. Picard	2nd Quad. Maraldus.	Lichtenberg.	3d Quad Mösting	A. Ramsden.	4th Quad Rosse
X	$+^{mm}1.00$	+1.00	+1.28	.10	-1.75	+1.84
	$3\frac{1}{3}$ mm	$3\frac{1}{3}$ mm	.9	.33	5.8	6.1
	6.7	6.7	1.8	.7	11.6	12.2
	26.8	26.8	7.2	2.8	46.4	48.8
Y	+.50	+.20	+1.05	+.30	-.65	-.25
	1.7	.66	3.5^{mm}	1mm	2.2	.8
	3.4	1.3	7.	2.	4.4	1.6
	13.6	5.3	28.	8.	17.6	6.4

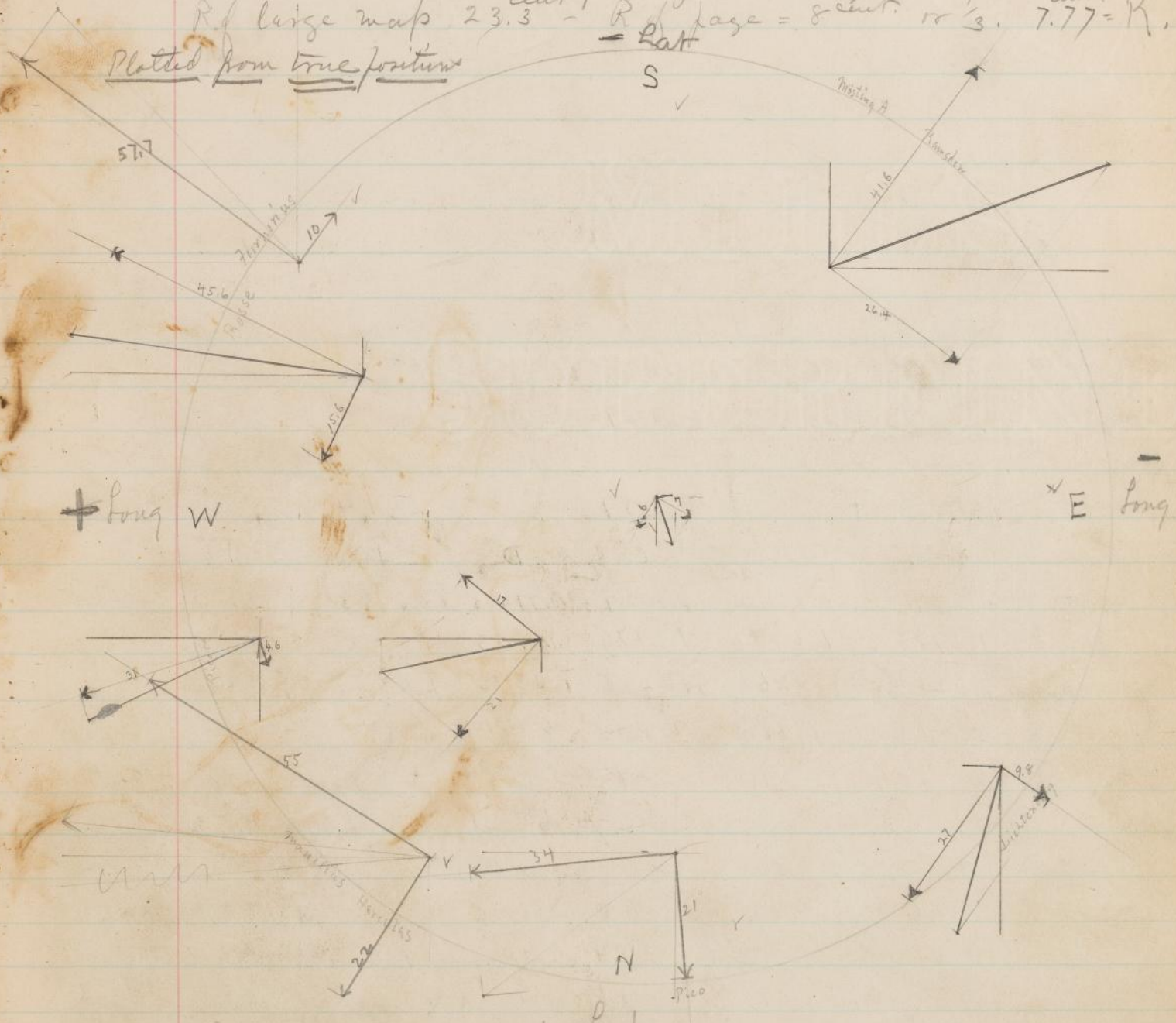
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Wednesday, Nov. 12. 1890

What the errors at foot of last page, indicate.
R of large map 23.3 cent. - R of page = 8 cent. or 1/3. 7.77 unit. = R.

Plotted from true position



Moon on scale of 1/3 of large chart.
Errors on scale of 80/3 " " "

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Wed. Nov. 12, 1890

Measurements on orientation of moon.

W. Limb. Point A (Picard.)

Dist – 47.60 alt. 5.00

Point B Dist. 47.60 alt 5.06

Point C Dist 47.60 alt 5.04

Point D Dist 47.56 alt 5.18

Point E Dist 47.49 alt 5.12

Point F Dist 47.57 alt 5.14

	A	B	C	D	E	F
Log alt.	0.6990	0.7042	0.7024	0.7143	0.7093	0.7110
" Dist.	1.6776	1.6776	1.6776	1.6773	1.6766	1.6768
Log Tan $\frac{1}{2}$ =	$\bar{1}$.0214	$\bar{1}$.0266	$\bar{1}$.0248	$\bar{1}$.0370	$\bar{1}$.0327	$\bar{1}$.0342
$\frac{1}{2}$ =	5°59″50	6″6″10	6″4″40	6″15″10	6″11″20	6″12″40

Required angle = 6° 7′ 42″

A	5	59	50	or	– 10″
B	6	6	10	+ 6′	+10″
C	6	4	40	4	40
D	6	15	10	15	10
E	6	11	20	11	20
F	6	12	40	12	40
				6	48 50

Average 8′ 18″

Error 36″ Make a diff. of .04 m.m. on limb

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Wed. Nov. 12 1890

Estimation of weights of various points.

Scheme – Anything known within 2mm may be marked 8 4 or as below

Anything known within ¼mm may be marked 1,

" " " ½ " " " 2

" " " 1 " " " 3

" " " 2 " " " 4

4

The 6 mountains may be classed as follows

Picard	2 or 3	2	2	2	2
Manilius	2	1	1	1	1
Lichtenberg	1 or 2	1 or 2	3	2	2
Mosting A	1	1	1	1	1
Ramsden	1 or 2	2	1	1	1
Rose	1	2	2	2	2
Estimate	1st	2nd	3d	4th	Final Sum

Nets – N to W is –

				Resolv. force
Hercules	−55 × 3/80	= −2.06	× 66.5/77.7	= −1.76
Pico	−34	−1.28	× 55.8/77.7	= −.92
Furnerius	−10	−.38	× 71.6/77.7	= −.35
				3.03
				−1.07

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Thursday. Nov. 13. 1890.

Measurements on diameter of moon.

Lat N limb ~~232.8~~ mm D = 11
S 233.9
466.7

Long W limb 232.6
E " 3.7 D = 11
466.3



To determine force of rotation. — (Pos. Rotat = N to E)

Lat	Force	Reduce Scale	Lever arm
Picard	+ 4.6 mm	• 3/80	• 19.98 cent
Manilius	- 17.0	• 3/80	• 7.74
Lichtenberg	- 27.	• 3/80	• 21.53
Ramsden	- 26.4	• 3/80	• 15.56
Mosting A	- 7.	• 3/80	• 1.30
Rosse	+ 15.6	• 3/80	• 15.54

Log 3. = 0.4771 = + 3.45 mm
× 80 1.9031 = - 49.3
Log 3/80 = $\bar{2}$.5740 = - 21.80
- 424.7
+ 125.4
- 299.3
= - 154.0
= - 03.4
+ 90.9
- 299.3 mm

Name	Picard	Manil.	Lich	Ramsd.	Most.	Rosse
Log Force	0.6628	1.2304	1.4314	1.4216	0.8451	1.1931
" 3/80	$\bar{2}$.5740	$\bar{2}$.5740	$\bar{2}$.5740	$\bar{2}$.5740	$\bar{2}$.5740	$\bar{2}$.5740
" Lever Arm	1.3008	0.8887	1.3330	1.1920	0.1139	1.1914
Log Moment	0.5376	0.6931	1.3384	1.1876	$\bar{1}$.5330	0.9585
	+ 3.45	- 4.93	- 21.80	- 15.40	- 0.34	+ 9.09

Log R = 2.4761
" R = 2.3674
0.1087
( ) — 1.28 mm
— .21

N.B. The above Lever arms were measured direct on large chart & hence are not the most accurate values, and all ought to be increased by a small proportion. The latter error does not amount to 3/4 of 1% in any, while the total prob. error is largest in Mosting A & equals perhaps 4%

14

Force of rotation at Limb is — 1.28 mm N / 1.28 to W

I.H. The measured positions are NW of Calc. positions on N W limb ✓

See last page

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Moon. Nov. 13. 1890

	Error in X	in Y	Liability to error
	mm	mm	
Picard	+ 1,00	+ ,50	2
Maulius	+ 1,00	+ ,20	1
Lichtenberg	+ .28	+ 1,05	2
Mosting A	~~+ ,10~~ .10	+ ,30	1
Ramsden	~~+ 1,75~~ 1,75	~~+ ,65~~ - ,65	1
Rosse	+ 1,84	~~+ ,25~~ - ,25	2
	+ 4,12 - 1,85	+ 2,05 - ,90	
6	+ 2,27	+ 1,15	
	mm	mm	
Average error =	+ 0.38 in X	0.19 in Y	
=	1.″6 in Long	0.″8 in Lat.	

In Libration

Log error =	$\bar{1}.579784$	$\bar{1}.278754$
" R	$\bar{2}.367356$	2.367356
	$\bar{3}.212428$	$\bar{4}.911398$
	$\bar{6}.685575$	$\bar{6}.685575$
	2.526853	2.225823
	336″	170″ = 2′ 50″
	5′ 36″	

Error in Lib in Long - ~~34~~ 5′ 40 In Lat + ~~17~~″ 2′ 50″

If the measured distances are all too great, then really the libration

1″ from ☾ = 3′ 37.″3 in moon.

Semi moon = 16′ 21″ $\frac{1}{24}$

= 981″ = 233.3 mm

4″ = 1 mm

1″ = $\frac{1}{4}$ mm = 3.″7 in moon

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Monday. Nov. 17. 1890.

Examination of several Bond Stars unaccounted for.

See Page 132 for Nos 296. 418, 675. & 949 & 954.

Stars here examined Nos 612. 615. 617, 618. 715, 717, 720 & 739. No 615 - for mag & any data, the rest for hours

Star	2917	2925	2312	2324	
612	n	n	n	n	see below
615	—	—	n	n	No equator in these two plates
617	S	S	n	n	see below
618	n	n	n	n	see below
715-717-720	—	—	S	S	
739	~~Non~~ —	—	S	S	

marked d in Cat. See page 166

N.B. In the above plates 2917 & 2925 around the stars near which these unaccounted for stars ought to be, the other two didn't. When the required star was outside the larger star, & yet invisible, n is put; when it is under the larger star, S is put opposite it: but when neither show on account of nebula, n is put down.

On by chart 733 & 739 are 1.mm apart. Ratio $\frac{2.5}{7.5} = \frac{1}{3}$ on plate 2917 - They would be 1/3

Other Nos on plates 2312 & 2324

321. 623. & 50, 968, 994.

Plate	2312	2324		2312	2324
321	S	S	968	—	—
623	—	S	994	—	—
858	—	S			

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Monday. Nov. 17. 1890

Investigation of points that may explain the errors in positions of Mts on the moon, See Page 121

The transit force of rotation is 2.5' on limb.

C There is no appreciable error in C for the entirely separate calculations of it give same value & the change of 8'.913" in $\Delta\delta$ & 30" in $\Delta\alpha$ only makes a dif of 11" It depends most strictly on i

The ndl change of 11" in C comes from a change of 29" in $\Delta\alpha$

In general x' depends on $\Delta \sin \lambda$

" " y' " " $\Delta \sin \phi$

Radial forces may be result of irradiation

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Wednesday, Nov 19. 1890.

Selection of six most important points on moon whose apparent positions are to be computed.

Wt by No of obs.	order		Long.	Lat	x	Y
11	2	Wurt	+1° 9' 10"	+7° 48' 24"	+.01993	+.13583
9	1	Hercules D	+38° 23 26	+46° 23 22	+.42834	+.72405
10	3	Pico.	−9 12 31	+45° 28'	−.11223	+.71287
9	5	Tycho.	−11 52 25	−42 52 19.	−.15079	−.68038
9	6	Furnerius A	+57° 51' 52	−33 6 4	+.70937	−.54612
2	4	Manius	−49° 57' 5	+11 58 44	−.74878	+.20784

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Thursday, Nov 20. 1890.

Weights for Above mountains.

Hercules	1 or 2	1	1	which may be adopted.
Upert	2	1	1	
Pico	2	2	2	
Marius	2 or 3	3	3	
Tycho	2 or 3	3	2	
Purverius	3	4	3	

Have increased l from $-3^\circ\ 5'\ 5''.3$ to $-3\ 55'\ 10''$

" decreased b " $-23^\circ\ 43''$ to $-23^\circ\ 5'\ 3''$

Consequently all calculated values of x should be increased by Δx (sin' X + 3") for ϕ or thereabouts.

All calc. values of Y should be diminished in like measure.

As the error of the measured position angles is 5' 36" in lib. and 31" in lat is by the above reduced to 31" & lib in lat is increased to 27 for central regions.

But that doesn't help matters at all.

3

1" =

from 2

1/30 "

1889phae.proj..509C

Monday Nov. 24. 1890

Discussion of certain stars about the Trapezium.
Examination of every found star within limits ±4' R.A. & Dec.
There are 8 plates to be examined, which will be called 1-2-3-4-5-6-7-8. They are.
1 = x2399 x is on larger scale than the rest
2 = x2354 begins to show Nebula
3 = x2359
4 = x2189
5 = 2656
6 = 2655
7 = 2163
8 = 2375

8-7-4-1 have dark films - 8 is the worst & the last of them 4
These have less difference between them and ~~with the rest~~ increase regularly in density

Star	Bond No	mag.	1	2	3	4	5	6	7	8
	524	12,5			✓	✓	✓	✓	✓	✓
	58	10,7		✓	✓					
	67	13,9			✓					
	73	13.9			✓					
	✓75	11,9			✓					
	81	14,2			✓					
	✓59	12.7			✓					
S	✓95	13.4								
S	✓601	15.6			c	c	c	c	c	c
S	✓2	14,3			c	C	—	Cor✓c	Cor✓	cor✓
S	✓8	14.3								
S	✓12	13,5								
T	✓17		✓	✓	Covered by 628					
S	✓18	13.1			✓	✓	✓	✓	—	✓
T	✓19		✓	✓	✓	✓	Merged with 628			
S	✓21	15.6								
S	✓22	12,7								

Completed.

Completed.

N.B. Not put in big chart.

621, 622, 625 have same Con all

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Tuesday Nov. 25. 1890

		Bond	Star Mg mag	Plate 1	2	3	4	5	6	7	8
T	✓	624		✓	✓	✓	✓	✓	✓	Joined	D not
	S	✓25	15,6			See	62	1 & 2			
T		✓28		✓	✓	✓	✓	Mixed with		619	
	S	✓31	14,3			Cm ✓	C	rmC	Vbr C	—	—
T		✓33		✓	✓	Covered by 619 & not					
		35	10,5	✓	✓	✓	✓	✓	✓	✓	✓
	S	✓36	13,3								
T		✓40		✓	✓	✓	✓	✓	✓	Joined	D not
	S	41	14,8			✓					
	S	✓42	15,6	Does'nt appear many	New star	✓	✓	rmC	C	C	C
		✓47	12,1			✓					
	S	✓48	14,3	Stars m=3,5,6,7,8	New star by mistake	✓	✓	✓	Cm ✓	—	C
		✓51	13,1			✓					
		52	13,9			✓					
	S?	✓54	12,3			—	—	—	?	~~✓~~	— ✓
		57	13,1		✓	✓					
		63	11,7			✓					
		66	13,9			✓					
		69	9,8	✓	✓	✓	✓	✓	✓	✓	✓
	S	✓71	11,5			✓					
	S	✓75	15,2			—	—	—	—	—	?
	S	✓76	13,1			?	?	—	—	—	✓?
		77	14,8			✓					
		81	14,8			✓					
		85	8,3	✓	✓	✓	✓	✓	✓	✓	✓
	S	✓86	15,6			} Stars in all 6 as two heavy condensations					✓
	S	✓88	15,6								✓
		708	9,6	✓	✓	✓	✓	✓	✓	✓	✓
		709	12,3		✓	✓	✓	✓	✓	✓	✓
		724	10,5	✓	✓	✓	✓	✓	✓	✓	✓

Between 40 & 54 are two condensations appearing in all 6 plates

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Tuesday, Nov 25, 1890

Plate 3. (×2359).

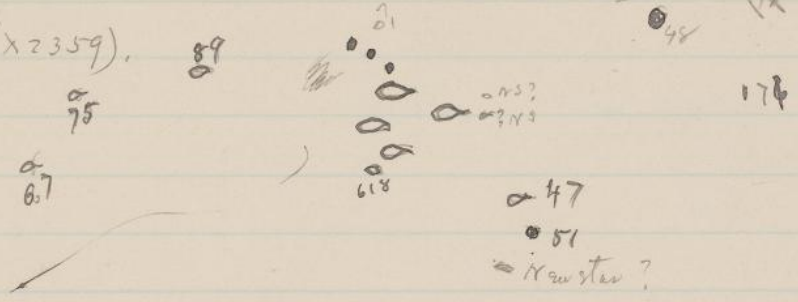


Plate 4. ×2189

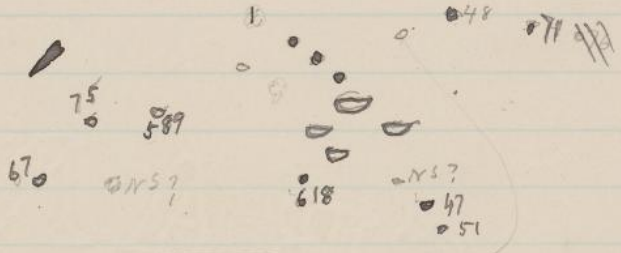


Plate 5, ×2656

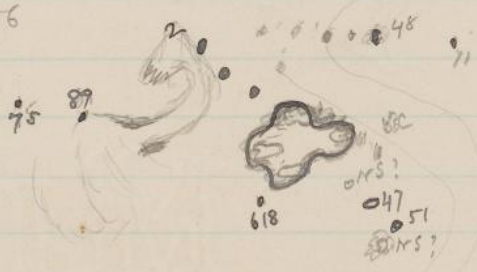


Plate 6, ×2655

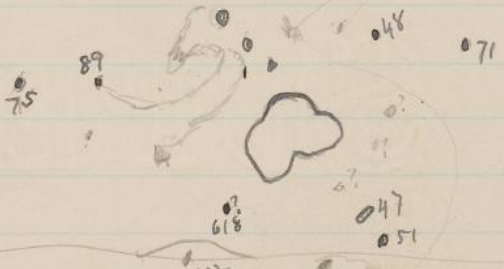
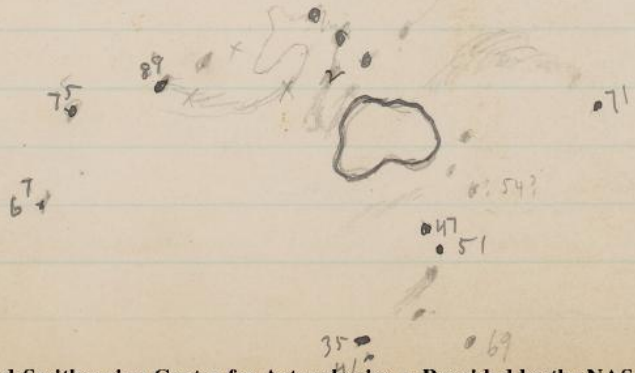


Plate 7, ×2163



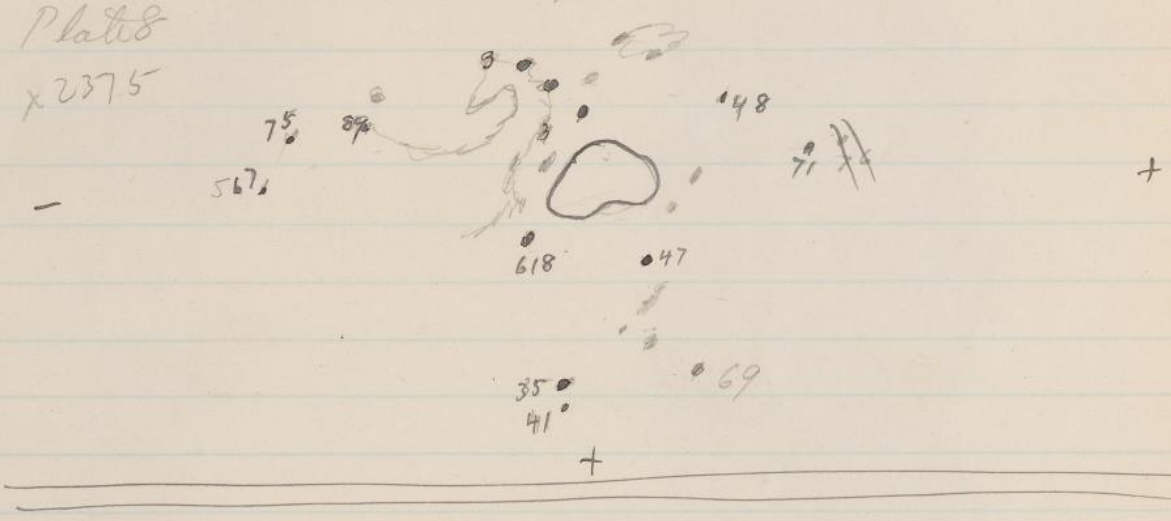
wanting 1, —618
648

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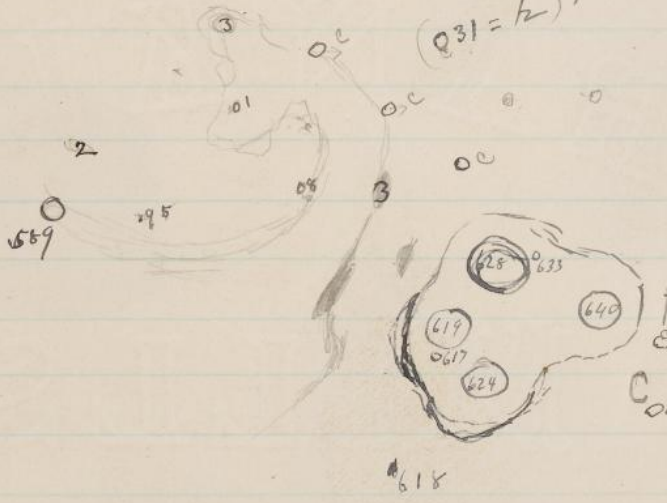
1889phae.proj..509C

Thursday Nov 25, 1880

Plate 8
x 2375



Summary



A
048 = 5 probably a new star.

071 = 6

~~Orw star~~ = 5 = c This is probably 48

B
0 N new star = 5
0654 = 1

C
0 N new star = 3

047

051

642 could not be found.

D 0 N new star = 2

For 602 See bottom opposite page.

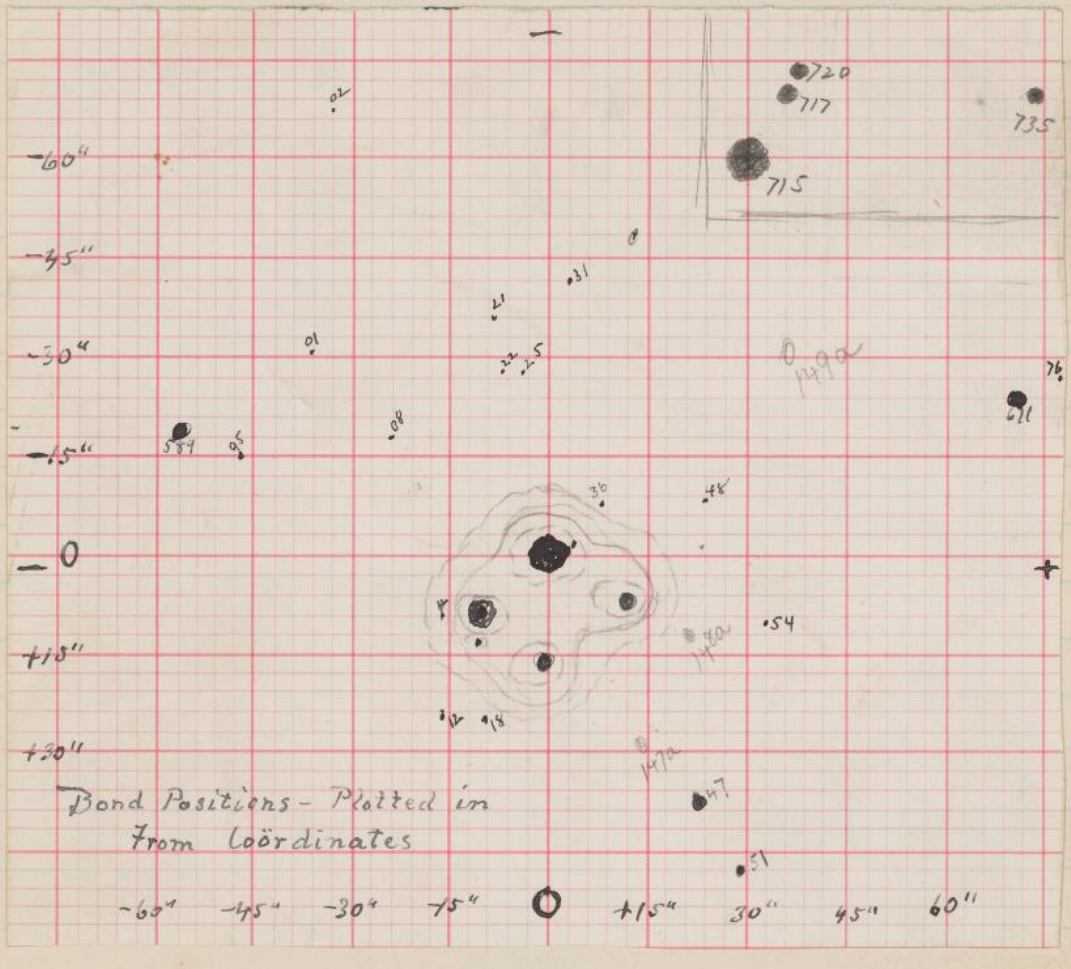
A, B, & C seem to be pretty certainly new stars, D appears on two few plates though having an appearance of a star other points only appeared as condensations.

C comes first as 147a
B " 2nd as 148a
A " 3d as 149a

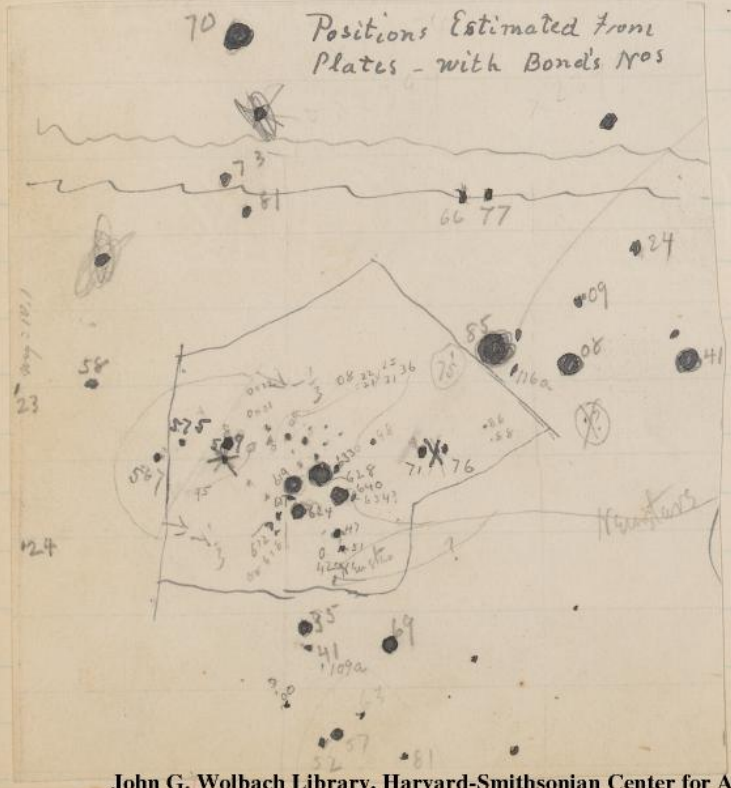
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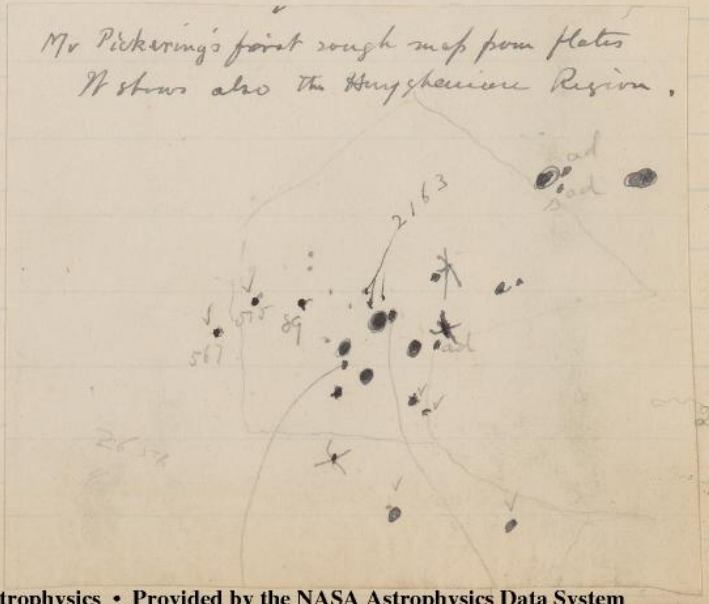
Tuesday Nov. 25. 1890



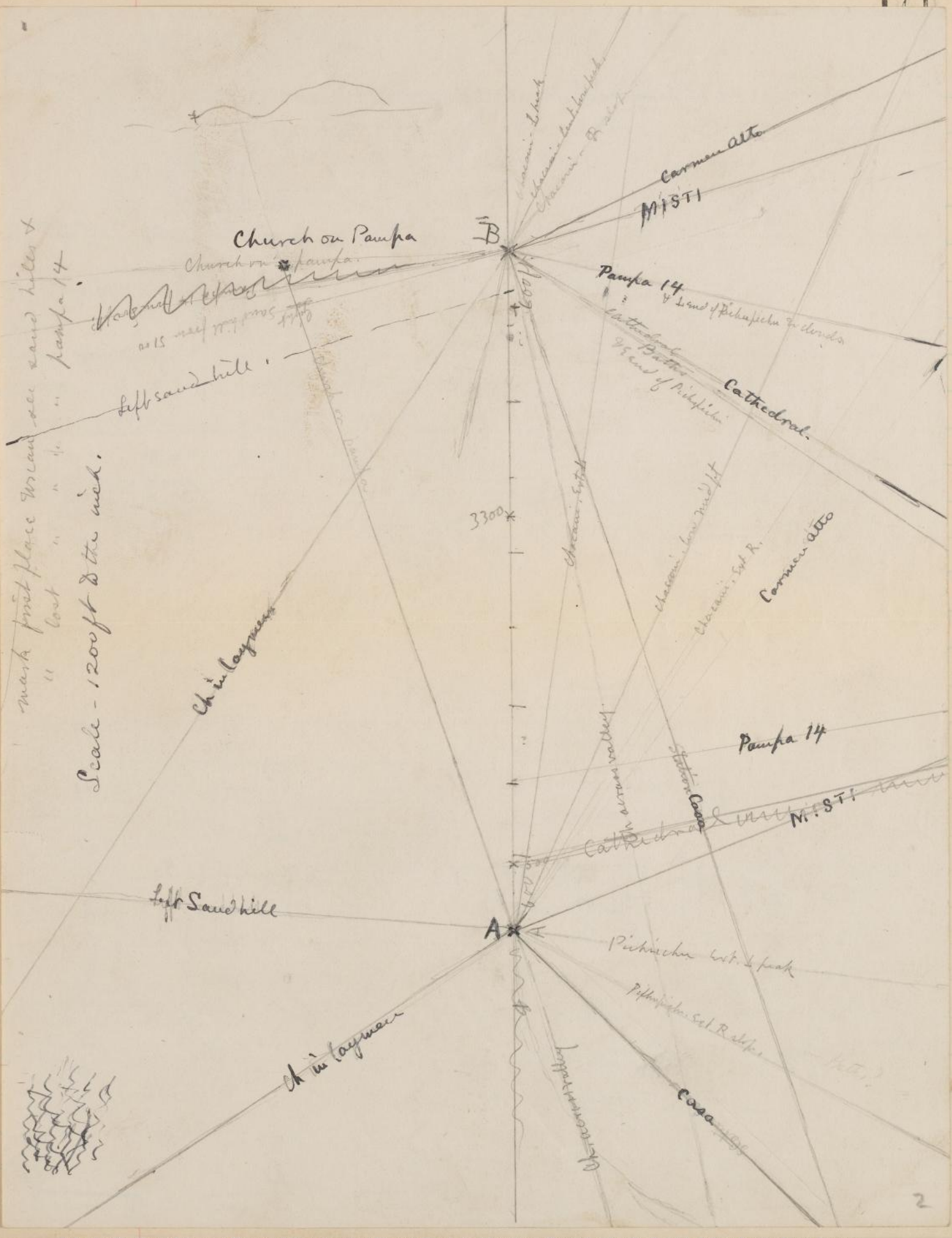
New stars marked above:-
147a, 148a, 149a.



Mr Pickering's first rough map from plates
It shows also the Hungaria Region.



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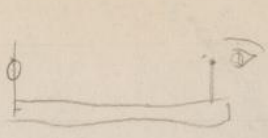
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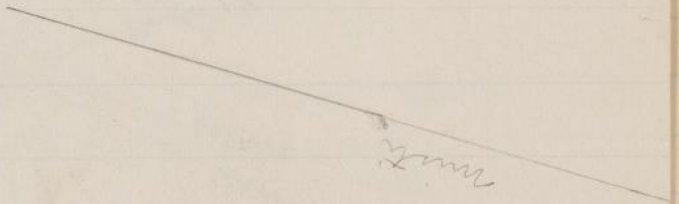
from 6	from 7	from 5	
Ch 1. =	M	23	
Ch. 2.	⊥	22	
3	K	24	San Antonio - near 5
4	—	25	runs across valley to ESE fr. 8.
5			
Pointed hill. rock to R.	✓	✓	
6			
7.			
8	Ch next lot	21 - next lot,	
9	San José	28	San José on road to Pantion,
10			
11	I	1	Timbers & roof.
12	Sacalaya Ch	27	= Sacabaya.
13	G	5	
14			
15			
16			
17			
18			
19			
20	Λ		
21.			





PRR Bridge E end
" " W "
RR Cut. Tinzo
River "
Iron stone bridge
Upper " "
Azequia Alto - house
" " R + L.
Pantion





1889phae.proj..509C

1889phae.proj..509C

Wednesday Nov. 26. 1890

Investigation of other stars, not found on plates hitherto & marked N in list of stars unaccounted for. Nos 1 & 2 left out.

Bond No.	Mag.	R.A. in (")	Dec. in (")	3	4	5	6	7	8
249	14.8	-1198	+969	—	—	—	—	—	—
448	12.3	-507	+2394	0	0	0	0	0	0
466	14.8	-433	+2479	0	0	0	0	0	0
520	14,8	-256	-1877	?	✓	?	—	—	—
552	14,9	-169	-393	✓	✓ or ?	?	—	— ?	—
600	13,9	-37	-1206	—	?	—	—	—	—
615	14,2	-12	+501	✓	✓	—	—	✓	✓
766	14,8	+314	+1563	0	✓ or ?	—	? or —	—	—
795	14.8	+359	+1583	0	✓ or ?	—	? or —	—	—
826	14,8	+521	+420	—	—	—	—	—	—
859	14.8	+661	-578	—	—	—	—	—	—

(600 ? 3 ?)

766 } ?
795 }

Summary

No 615 is the only star affected by the above. It shows in 4 of these plates, though it did not show in the four 8×10 union plates. Consequently it should be withdrawn from the list of stars unaccounted for & to May (15th) put in the full list.

715.17.20 Plate 2354(2)

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1889phae.proj..509C

Tuesday, Dec. 2, 1890.

Began today overhauling bundles of lumber to be sent to South America, & putting on labels

Last night examined positions of all stars down to 11th mag in Orion chart for position.

This afn. examined any one to same mag for magnitude. Made all necessary corrections.

All magnitudes are right within 1/4 mag. except 734 which now has size of a 7.5 mag star instead of a 7.0;

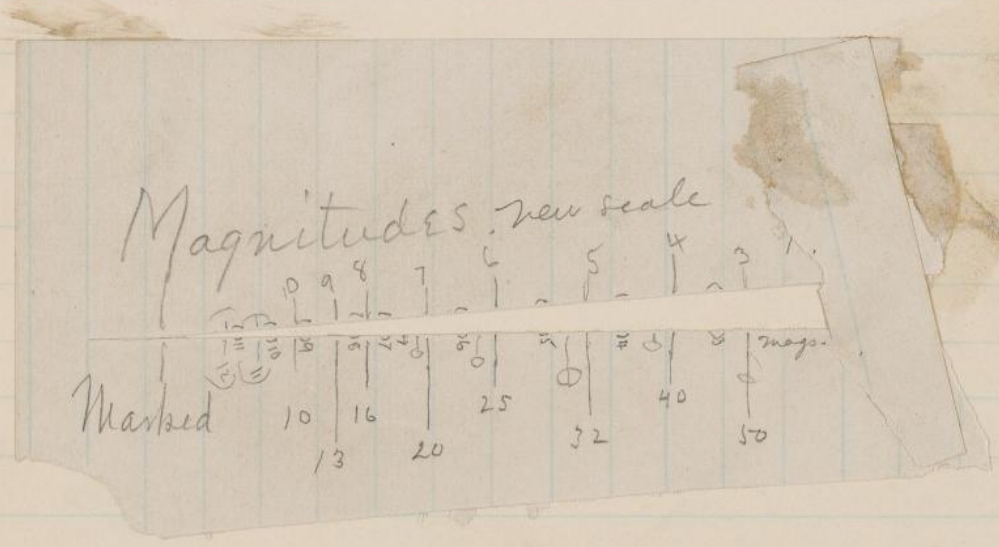
and 752 has size of a 9.5 instead of a 9.0 mag. star.

N.B. Found new mag. scale on chart must be changed to exactly reproduce the old.

Nos 614 & 29 need investigating.

83a has no mag given.

781 & 85 are out of position some how



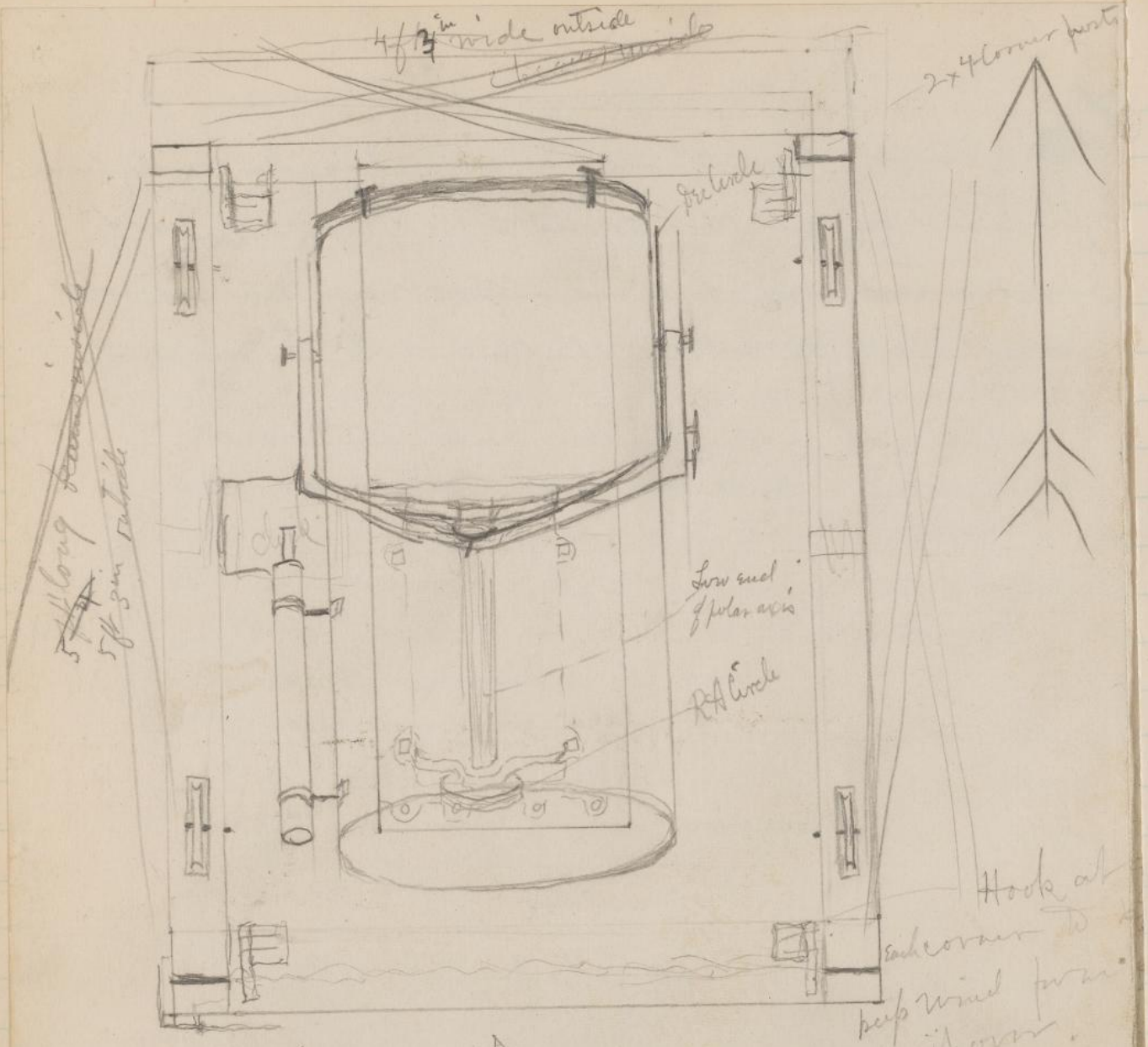
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The 2in Equatorial camera has the pendulum fastened on with a screw & not with a hook. Can neat key used in removing this fund. every time the whole instrument is moved.

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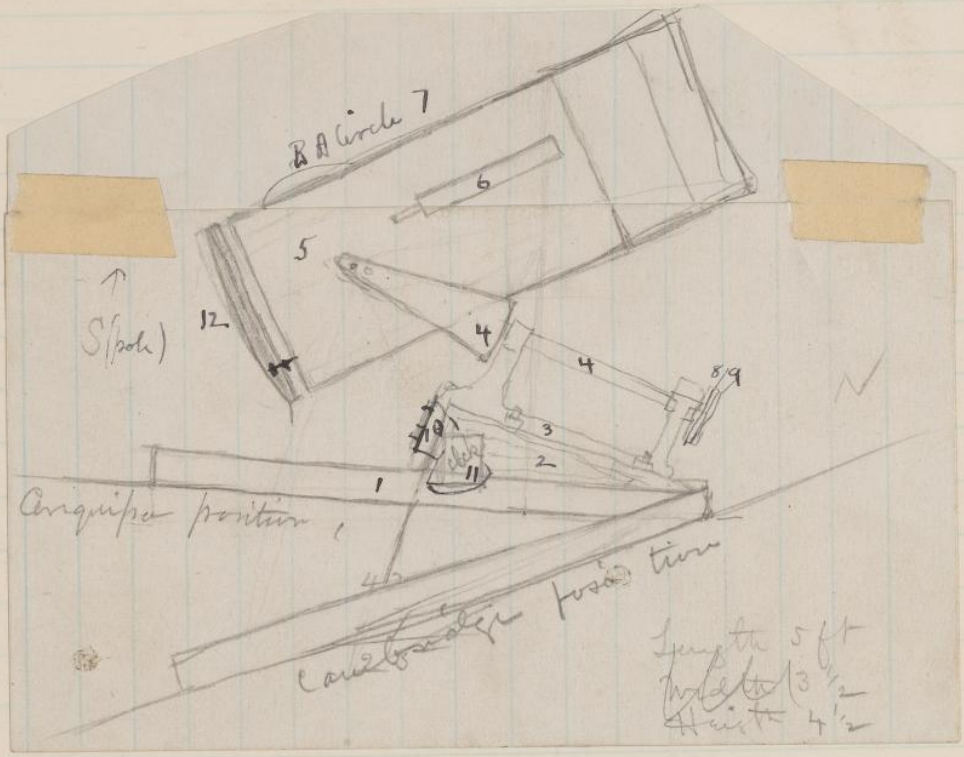
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1889phae.pro

20in Reflector



Nos show order of putting together

Inner nuts for folding mirror were not moved. So be careful about moving them when the mirror is put up.

Shipped Dec. 5 — Mirror in one box. No 153
Tube, finder, lenses, plates to go inside tube & certain ends of screws of finder & R.A. Circle.
Clock, Gov. not taken out. Box No 154

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Monday Dec. 8. 1890

Mountains on the moon whose positions have been computed. — Long. Lat.

Comp. Hercules. +10,79 +16,97 ✓

Meas +11,02 +16,95

Error in meas. pos. + ,23 = +2,3 mm — .0.2 = −0,2 mm

+0,63

May have chosen wrong bright spot in measuring.

~~67,71~~ +22,07

West. Mistake in position.

Pico −1,56 +16,75 ✓

−1,44 +16,84

+ ,12 = +1,2 mm + ,09 = +0,9 mm

Manins −16,48 + 4,9~~0~~5 ~~✓~~ Dont work.

good deal out.

Tycho

Comp. wrong.

Furnerius +17,17 −12,74 Dont work

+17,32 −12,90

+,15 = +1,5 mm −,16 = −1,6 mm

Pr

For weights see page 165

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Tuesday Dec. 9. 1890

General principles of observing variable stars

Select star & take a ~~small~~ map of surrounding stars. Select from these, a requisite number of comparison stars, covering the variation of the variable, & letter them a, b, c, &c

In observing - estimate number of smallest observable intervals between v & one brighter, & v & one less bright. Record them thus

g 3 v
v 2 l

Make at odd times a requisite number of ^like comparisons between the different comparison stars, thus establishing a scale.

One obs a night is sufficient for long period stars, Short period stars should be observed more frequently during time of most rapid change.

Evening,

Bond stars requiring mags - 647, 648, 653, 648, 671, 949, 954
~~from 2759~~

New stars requiring mags - ~~83a~~, 147a, 148a, 149a.

147a

147a shows on 2656 2655 2163?
148a " " 2359 " " ? " 48
149a " " " 2189 " " "

642 does N.B. not show on

See if 642 shows on 8x10[5] & if it does, take it out of Table III & put it in Table I with mag 12 as before. If does not show on 4x5

1889phae.proj..509C

Wednesday, Dec. 10. 1890

Mags &c of various stars (see bottom last pg)

617 +33 from plate X2399.
Both appear about half as big as 724
724 is 9th mag. 709 doesn't show at all & is 11th mag.
Hence 617+33 are 10th mag.
In 2354, 709 just shows & 17+33 are only a little
brighter which may be accounted for by their
being brought out by the haze of 679+628,
647 appears about same, — It is 11th —
Hence 617+33 are 11th mags.
Found Mr King had assumed 671=676, He made 676, 11.5
so I put 676, N & 671 - 11th mag.
By comparisons with 581, 587, 651, 677, +116a, 618 appears
to be 13th mag,
648 shows with an 7 is fainter than 116a, Thus making it 15
From Plate X2759, 614+679 appear as as of equal mag &
between 888+852. These both being 9th mag make 614+29 of 9th mag
Correct Table I, 8 to 9th mag ✓
83a. = 474+484 - both 14. 459(15. <83a<530(13 Makes 83a = 14 mag

Approx. positions of	a - a'	δ - δ'	mag. from plates
147a	+14"	+29.	should say these 89 appeared on two few plates.
148a	+11.	+12.	
149a	+36	−30.	15th 2184 Sawyer 2655

3 4 5 6 7 8
147a — — V — — — —
148a — — — — V —

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1889phae.proj..509C

Wed.
P.M. Mar 25.
D = at depot
S = sent from depot
R = rec'd at Lot

Tuesday. Dec. 16, 1890

Full lists of articles sent D Perry
1 to 155 inc. sent Dec. 5.

	No	Size	Description	
	~~S 1~~	~~21~~	~~x 6 x 6~~	~~Sleepers~~
✓	~~S 2~~	4		Joists & Sills
	~~S 3~~	1		
	S 4	7		
	~~S 5~~	4		
	~~S 6~~	4		
	~~S 7~~	16 x 1	x 1	Tongue & groove boards
	~~S 8~~	10 x 1	x 1	" "
	~~1~~	8	x 2 x 4	Scantlings
	~~S 10~~	12 x 1	x 1	Boards,
	~~S 11~~			
	~~12~~	12 x 1	x 1	Sill
	13	4	" "	4
	~~14~~	"	"	9
	~~15~~	"	"	7
	~~16~~	"	"	4
	~~17~~	"	"	"
	18	"	"	"
	19	8	2 x 4	Scantlings
	S 20	16 x	2 x 6	Planks
	~~S 21~~	12 x 1	x 1	Boards
	S 22	16	2 x 6	Planks
	S. S 23	10	2 x 4	Scantling
	24	10	2 x 4 4 x 4	"
	S 25	10	4 x 4	"
	26			
	~~S 27~~	5	2 x 6	Planks
	~~S 28~~	6	1 x 1	Boards.

Mar 26.
Nos not accounted for on this page

4	probably R	✓
13		✓
18		✓
19		
20		✓
22		✓
27		
24		
25		✓
26		

Extra Nos — No 2, Rec'd two
23, Sent two R none

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1889phae.proj..509C

Tuesday. Dec. 16. 1890.

Articles sent to Pierce. Dec 5. 90

Nº	Size ft.	Size ins	Description
~~29~~	10	1x1	Styr Boards
~~30~~	8	2x6	Curves.
~~31~~			
~~32~~			
~~33~~			
~~34~~			
~~35~~			
~~36~~			
~~37~~			
~~38~~			
~~39~~			
~~40~~			
~~41~~			
~~42~~			
~~43~~			
~~44~~			
~~45~~			
~~46~~			
47			
~~48~~	4	2x4	Short bundle.
49	4	4	
~~50~~	8		Curves.
~~51~~ 5R.	10	1x5	Boards
~~52~~	10	1x2	Strips
~~53~~		2x6	Scantlings
~~54~~	10	1x4	Boards
~~55~~	"	2x2½	Strips
~~56~~	5	3x6	} Posts.
~~57~~	5	"	

Mar 26

Nos Not accounted for

47

49

Extra Nos 51, 52 R'

X = another

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1889phae.proj..509C

Tuesday Dec. 16. 1890

Articles sent to Peru. Dec 5.

No	Size in ft	in	Description.		
~~58~~	5	2×4	Posts		
~~59~~	10	1×2	strips	Nos Not accounted for	Mar 26 probably R
~~60~~	"	1×5	Boards	66	
~~61~~	3	2×4	Scantlings	68	✓
~~62~~	7	1×5	Curves	75	
~~63~~	4	2×6	"	77	
~~64~~		1×1	Stgr Boards	78	
~~65~~		2×4	short bundle.	82	
66	6	1×1	Tgr Boards.	84	
~~67~~	8	4×6	Posts	86	
68	6	2×6	Planks	Extra Nos 69. S²R'	
~~69~~	10		½ in strips		
~~70~~	10	2×2½	strips		
~~71~~	10	1×2	"		
~~72~~	10	2×3	Boards.		
~~73~~	"	1×5	"		
~~74~~	"	"	"		
15			Diamond shaped bundle 1 in Brds.		
~~76~~		1×4	Boards.		
17		2×4	" short.		
78	12	1×1	Tongue & Groove Boards		
~~79~~					
~~80~~					
~~81~~					
82					
~~83~~					
84					
~~85~~					
86	10	4×4	Scantlings.		

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1889phae.proj..509c

Tuesday. Dec. 16. 1890.

Articles sent to Penn. Dec. 5.

	No	Size pt	Size in.	Description.		
	87	10	2×6	Planks.		
	88	"	"			
D	89			Bale of canvas		
	~~90~~	~~illegible~~		" " "		
	~~91~~	10	1×1	Boards	1891 Mar 26 Not accounted for	
	~~92~~	24		Sills	87 probable R ✓	
	~~93~~	"			88 ✓	
	94	"			94	
	~~95~~			Bale of canvas		
	~~96~~			" " "		
	~~97~~	10	1×1	Boards		
	~~98~~	14		Tongue & groove boards.		
	~~99~~	8	2×6	Curves.		
	~~100~~	3	2×2	Scantlings		
	~~101~~	12	1×1	Boards.		
D	102			Shutters of drum		
D	103			" " "		
	~~104~~			Window Frames		
	~~105~~	2		Bundle of wedges		
	~~106~~	12		Bundled strips		
	~~107~~	16	1×4	"		
	~~108~~	12	2×4	"		
	~~109~~	6	"	"		
	~~110~~	12		" "		
	~~111~~	"		" "		
	~~112~~	"		" "		
	~~113~~	7		Bundle of "		
	~~114~~	6		" " odd size boards		
	~~115~~	"		" " " " "		
	~~116~~	7	1×6	3 "		
	~~117~~		2×1	Starboard [illegible] (domicile?)		

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1889phae.proj..509C

Tuesday. Dec 16. 1890

Articles sent to Peru. Dec. 5.

Files	Nos	Sizes	ft.	in.	Description	
	~~118~~	12			Buried strips	
	~~119~~	"			" "	
	~~120~~	"	2	2	"	
21	~~121~~	✓			Box screws & bolts 2½ in bolts.	
22.5	~~122~~	✓			" " " 3½ in bolts.	
17.5	~~123~~	✓			" " " 5½ x 6 in screws.	
	~~124~~	✓			Glass	
	~~125~~	✓			Iron	
	~~126~~	4ft			Bundles of odd size boards	
	127	to				
	~~128~~					
	~~129~~					
	~~130~~	7ft.				
	~~131~~					
	~~132~~	17	2	4	Timber	127
	133	5			Odd size boards	133
	~~134~~	"			" " "	136 ✓
	~~135~~	"			" " "	137
	136	5				138
	137					140
	138					
	~~139~~					
	140					
	~~141~~					
	~~142~~					
	~~143~~					
D	144				Iron work of Eul. mirror	
	~~145~~				3 bundles of iron rails	
	~~146~~					
	~~147~~					
D	148	7			Bundle odd length boards.	

Mar 26
Nos Not accounted for
Probably 2

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Tuesday. Dec 16. 1890.

Articles sent to Peru. Dec 5.

	No	Size	Description.
S	149	12ft x 1 x 1 in	Boards.
S	150		Box of iron rollers for Drum.
~~S~~	~~151~~		~~Door for Drum.~~
S	~~146~~ 152	2ft x 2ft.	Box of iron.
D	153	2" x 2" x 8 in	Box containing 20 in mirror of Reflector.
D	154		"
	~~Next~~		les.
	155	5ft	

Freight for Arequipa —

Nos 156 to 197 inclusive.

156 to 180 Inc & 183-4-5 sent Friday Dec 12.

Nos 181-2 & 186-997 Inc. sent Saturday Dec 13.

No.	Description.	
156.	20 in Reflector shed. - slats	3ft x 1ft.
157	"	5 x 1
158	"	7 x 1
159	"	6 x 1
160	"	7 x 1
161	"	6 x 1
162.	8 in Finder Tube - Eyepiece in small box in 188. Lens in express box —	
163	Dec. Axis - 18 in cradle & straps for same	
164.	Small Lathe. Hour circles of Reflector in small box in top & [illegible] for eyepiece & 8 in finder. screws for same with eyepiece. Also Driving sector and worm of Reflector. Bathes for dark room key of one bath in 188. Some tools? Private box of Mr Pictorings from E.T.B.	
165 }	Paint	
166 }		
167	Door to Reflector Shed	

Mar 26

Nos Not accounted for trouble by R

149

155

Further ... to, New York.

1 Keg

1 Box

" 4

" 4

" 4

" 4

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Tuesday Dec 16. 1890.

Articles sent to Penn. Dec 5.

No	Size	Description.
S 149	12 ft x 1 x 1 in	Boards.
S 150		Box of iron rollers for Drum.
~~S 151~~		Door for Drum.
S ~~16 152~~	2 ft x 2 ft.	Box of iron.
D 153	2" x 2 x 8 in	Box containing 20 in Mirror of Reflector.

168 Small parts of 13 in Box tools. Weights
nearly all small things going inside semicircle of 13 in clock &c except two pieces in 175 friction rollers & four of 13 in Sector 13 in (screws for Dec clocks)

169. 13 in Tube & trim. Iron braces for drum. Iron extension rod for Sector Dec clamps. Needs a hole or two & threads put in it, Some long slow motion rods.

170. Small camera mounted as Equatorial telescope.

171. Polar Axis 13 in

172. semicircle 13 in

173 Driving weight. wheel & pin in ~~175 & 168~~

174. Bed plate 13 in

175 Small box:- steel driving bands, Cup connecting Sov & driving clutches. Sov. springs 13 in Sov. clock 13 in Connecting rod Polar axis to Hedge clock 13 in Worm of 13 in. Cross connection of slow motion screws. Wts of prism 13 in. Some extras - bolts & Section? Roller & rod of driving cat.
Screws,

176. Hedge clock 13 in

177 Fork & clock frame of Reflector.

178 Bed plate of same (with bearings)

179 Bale of canvas.

180 Cells of 13 in lens & prism. Two clamps to go on 13 in tube to hold camera see No 196. Slow motion screw in Dec.
Dec index & off Sector for Dec clamps No 181.

181. Long center of Dec clamps 13 in

182. Bottle sulphuric acid.

183. Sx2 plates

184. Holders & new apparatus.

185. Bottle Ammonia.

186. Pantons, Student lamps, Varnish for keys
2 Graduates, 1 cc Graduate & pipettes

187. 13 in Prism frame. 3 - 4x5 printing frames
2 - 8x10 Camera backs for 13 in

188 - Bench box. Books in bottom. Sensit back
Ext. lens & Mg ribbon. Tube for 4 in Comet sucker
to Mic, eye piece with same of 8 in finder,
2½ ft rod & Univ. Joint for 13 in Ground glass for
Ext Aff. Empty bottles & some in box. 3 Drying racks
In small box:- Thermometers. Drawing mat. Mm Rule (evaporating dish, clock & therm. for dark room)
Water colors &c Eye piece of 8 in finder. Mic. do of comet sucker. ~~Radiating screens of 8 in finder~~

189 Cell 8 in prism. Cyls of Barographs & key. Wicking

190. Big box. Thermographs. Anemometer. Tail piece
13 in. Mirror of Ext. Aff. Books in boxes,
Dark room supplies:- printing frames &c
Polarizing photometer & Sunshine recorders
with Eye pieces for 13 in or finder? Tubes of Sensit.

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Tuesday Dec 16. 1890.

Articles sent D Penn. Dec 5.

Nos	Size	Description.
S 149	12ft x 1 x 1in	Boards.
S 150		Box of iron rollers for Drum.
~~S 151~~		Door for Drum.
S ~~146 151~~	2ft x 2ft.	Box of iron.
D 153	2" x 2 x 8in	Box containing 20in mirror of Reflector.
D 154	"	" " Tube " "
~~Nos~~		Clock, finder, screws for finder & Dec circles.
155	5ft -	Extra boards.

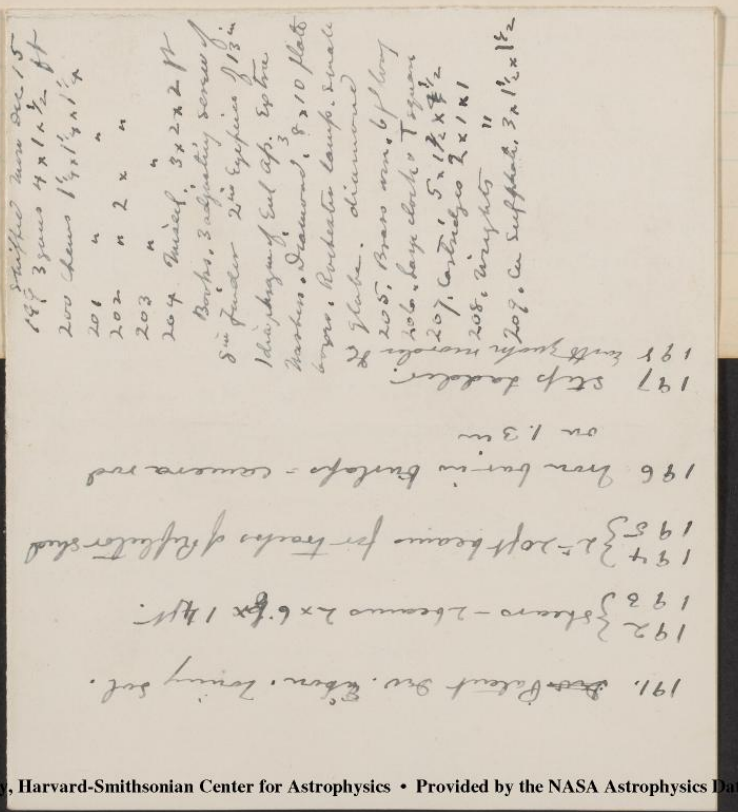
Evaluation. Rusk. Dome building $800

Box 144
153 400
154 } 200
155 }

mar 26
Nos Not accounted for
149
155

Further articles sent Dec 5. through WR Grace & Co, New York.

1 Keg	of nails	$3.50
1 Box	No 1	2 Rockers
"	" 2	1 table
"	" 3	1 Chair
"	" 4	1 Buffet
"	" 5	1 Desk
"	" 6	1 Desk



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Tuesday. Dec 16.
Freight for Arequipa. Continued.
Shipped Dec. 12.

	N°	Size	Description of contents.
D	156	8ft x 1ft	Slats &c for Reflector shed.
	~~157~~	5 x 1	
	~~158~~	7 x 1	
	159	6 x 1	
	~~160~~	7 x 1	
	~~161~~	6 x 1	

N° not accounted for - Mar 26
159

50. D162 8in Finder tube. Eyepiece in small box in 188. Contents by Express

200. D163 Dec Axis 13in with cradle & straps.

300 ~~164~~ SR Small lathe. Hour circles for Reflector in small box in top & for eye end 8in finder. (Adjusting screws in 204) Driving sector & worm of Reflector. Battens for dark room. (leg of one batten in 184) Tools. Boxes 2, 7, 13.

8.00 SR ~~165~~ } Paint.
8.00 SR ~~166~~

3.50 D167 Door of Reflector shed.

1000 S168 Small parts of 13in. Box tools. Weight tray, all small things going inside semicircle 13in Clock &c (Except two cast pieces & gov. clock in 175.) Friction rollers & sector

200 D169 13in Tube & rim. Iron bars for drum. Iron extension rod for sector Dec clamp-(needs a hole or two & threads put in it) Long slow motion rod.

250 ~~170~~ Camera mounted as Equatorial Interior.

200 D171 Polar axis 13in

200 D172 Semicircle 13in

70. D173 Driving weight. (Wheel & pin in 175.

200 D174 Rod Plate 13in

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1889phae.proj..509C

Tuesday Dec 16. 1890
Freight for Paris. Dec 12. to 13th

Shipped to — Description of contents.

Dec 13. P. 175 Small box contains:- Sector bands. Cogs connecting Driv. & gov. clocks. Spring Gov.r

400 Gov. clock. Rod connecting polar axes & indep clocks. Worm. Cross connection slow motion screw in R.A. Weights of 13in prism, some extra bolts. Roller & pin of driving weight. Box of Screws. for Tel.

D 50. 176 Indep clock 13in

D 50. 177 Fork & clock frame of Reflector

D 50. 178 Bed plate of same with bearings

8. ~~179~~ Bale of canvas

D 150 180 Cells of 13in lens & prism. Two clamps to go on 13in tube to hold camera rod (No 196) Slow motion screw in Dec. Dec indep off sector for Dec clamps (No 181)

13 to D 20 181 Long sector of Dec clamp 13in

H SO4 .50 ~~182~~ Bottle sulphuric acid.

12 to D 24 183 Send 23 plates

D 50 184 Plate holders & new apparatus.

SR 1.25 ~~185~~ Bottle Ammonia

13 to S 15 ~~186~~ Pentane student lamp. Varnish for neg. 2 graduates, 1cc Grad. pipette.

D 10 187 13in prism frame 3-4x5 printing frames 2 - 8 x 10 camera backs for 13in

125. ~~188~~ Bench box. Books in bottom. Small tacks. Eye Asp. with lens. Mg ribbon. Tube for 4in Comet seeker Eye micrometer eyepiece with eyepiece of 8in finder 2½ ft rod & univ. joint for 13in. Ground glass. empty bottles (for Drugs) & some in box & drying racks.

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1889plrae.proj.:5000

Tuesday Dec 16. 1890
Freight for Ston. Dec 13 x 15-50

Shipped. No Description of contents.

the 13th ~~188~~ Continued. – In small box Thermometers. Drawing Instruments Rule. Water colors &c. Eyepiece of 8in finder Micrometer of small refractor. ~~3a~~

SR ~~40~~.

S ~~189~~ 2.40 Cole 8in prism. Cylinders of Barographs & key. wicking
~~190~~ Big box: – 2 Thermographs. 1 Anemometer. 4 Sunshine recorders
330. Last piece 13in Mirror Bulkeps. Books in boxes. Desks room supplies printing frames & Polarizing photometer. Set of eye pieces for 13in or finder. Tubes of refract. Micrometer. Polestar recorder. Hastle Transit? Plate holders.

~~191~~ 3.50 Eikonogen Dev. Toning solution.

S ~~190~~ 1.00 } stems & 2 beams 2 x 6 – 16 ft long.
S ~~115~~ 1.00 }

~~111~~ 2.00 } 20 ft beams 4 x 6 for tracks to Refractor shed.
~~115~~ 2.00 }

D 5.00 196 Camera rod 13in – iron bar in burlaps.

10.~~197~~ step ladder tall.

S 10.~~198~~ Earth quake recorder and

15th ~~199~~ 60 4ft. x 1ft x 1/2 ft. 2 guns. 1 rifle.

~~200~~ 25 Chain. 1 1/4 x 1 1/4 x 1 1/4

~~201~~ 25 " "

~~202~~ 20 " 2 x "

~~203~~ 25 " "

SR ~~204~~ 35 Barrel. 3 x 2 x 2 Books. 3 adjusting screws of 8in finder 3in eye piece of 13in. 1 diaphragm of end. aff. Extra Washers Diamond. 2 – 8 x 10 plate boxes. Rochester lamp. small globe

S ~~205~~ 2.00 Brass wire – 6 ft long. 2.00 5 x 1 1/2 x 1

R ~~206~~ 30 Large clock & T square circuit Weber & some later.

D 17.~~207~~ Cartridges 2 x 1 x 1

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1889phae.proj..509C

Tuesday Dec. 16 1879
Weight for Sun. Dec 15.

No
8.00 208 Weight 2 x 1 x 1 ft^s
~~8.00 209~~ Copper sulphate 3 x 1½ x 1½ ~~8.00~~

Iron pier 13in 100. of D.S.R.
" " Rifle. 25. D

Telegraph Alphabet.

A	•—	2	••—
B	—•••	3	•••—
C	—•—•	4	••••—
D	—••	5	•••••
E	•	6	—••••
F	••—•	7	——•••
G	——•	8	———••
H	••••	9	————•
I	••	0	—————
J	•———		
K	—•—		
L	•—••		
M	——		
N	—•		
O	———		
P	•——•		
Q	——•—		
R	•—•		
S	•••		
T	—		
U	••—		
V	•••—		
W	•——		
X	—••—		
Y	—•——		

Order of Mounting 13in.
Nos refer to boxes containing articles mentioned.
Bed Plate 174 bolting it to iron pier.
No? putting in adjusting screws.
If bolts D to bed semicircle.
Semicircle 174 Securing it at proper angle.
Sector 175, leaving off upper part 168? containing clamp till the polaraxis is on.
Polar axis 171, not removing hoisting roundrelief pin) axis on P i.e. Hoist up polaraxis (with its bearings on 168!) put on hour circle, then the foot 168, then slide the axis up till the bearings can be secured to semicircle
Top of sector, containing clamp 168? screws &c.
All bolts inside semicircles 168+175
This may be done at leisure afterwards
— Driving 148 and Relay 176 clocks
Dec. Axis 163, circle & half of cradle.
Dec sector & clamp 181
Begin putting counterpoises on Dec axis
13in Tube 169
8in Finder 162
&c

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Tuesday Dec. 16 1890
Freight for Pem. Dec 15.

D 8.00 No 208 Wright 2 x 1 x 1 ft^s
~~8.00 209~~ Copper sulphate 3 x 1½ x 1½ ~~2.07~~

Iron pier 13^{in} 100. D.S.R.
" " Reflr. 25. D

Telegraph Alphabet.

Notes on the 20^{in} Reflector.

Build stone pier to about level of tracks.
Put on iron (inclined) pier  Bolts to fasten it to stone pier are in box with sheet do to fasten bed plate on to this head a few washers between plate & pier as pier top is not planed. This pier was to be sent direct from foundry to Westboat Dec 13
Bed plate. 178
Fork - 177. driving clock (155(!)) & frame in 177
Tube 155! having first put on finders from 155 and circle from 177 screws, inside plates to secure them, screws &c in box in 155 these may all be 155 instead of 155 - anyway the big box containing tube.
Lay tracks & build shed - then put on mirror & adjust.

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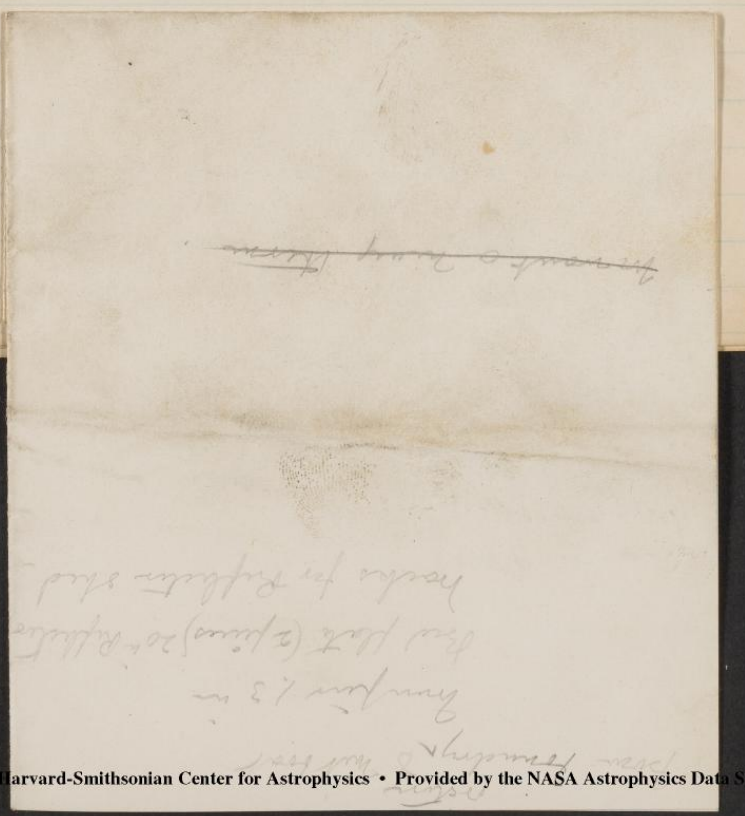
Tuesday Dec. 16 1890
Freight for Penn. Dec 15.

D 8.00 208 Night · 2 × 1 × 1 pts
~~8.00 209~~ Copper sulphate 3 × 1½ × 1½ ~~8.00~~

From pier 13th 100. D.S.R.
" " Reflr. 25. D

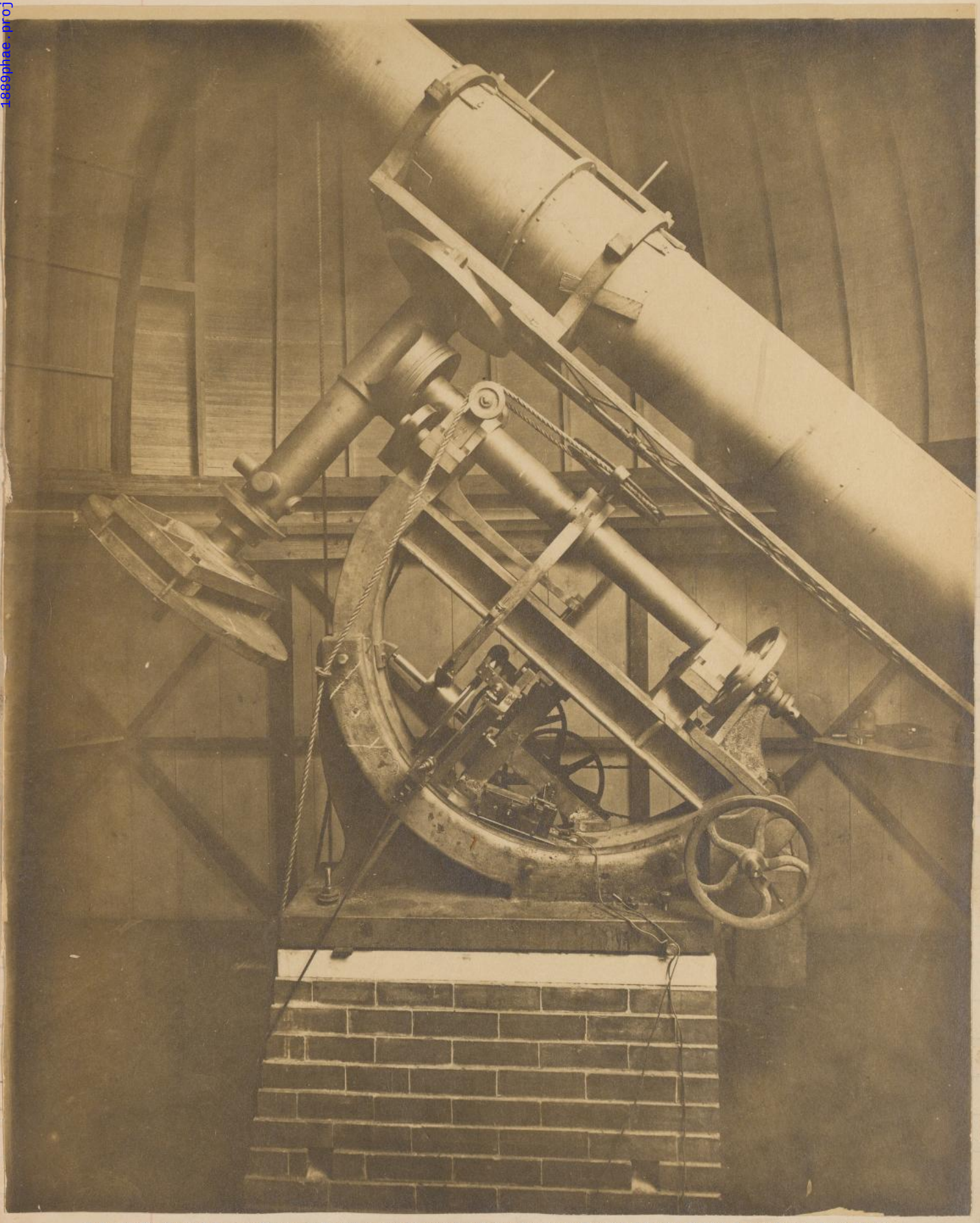
Telegraph Alphabet.

A	·—	Z	——··
B	—···	&	·—···
C	—·—·	1	·———·
D	—··	2	··——··
E	·	3	···—·
F	··—·	4	····—
G	——·	5	·····
H	····	6	—····
I	··	7	——···?
J	·———	8	———··
K	—·—	9	————·?
L	·—··	0	—————
M	——	.	
N	—·	!	
O	———	?	··——··
P	·——·		
Q	——·—		
R	·—·		
S	···		
T	—		
U	··—		
V	···—		
W	·——		
X	—··—		
Y	—·——		



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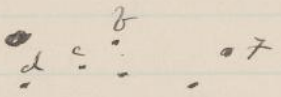


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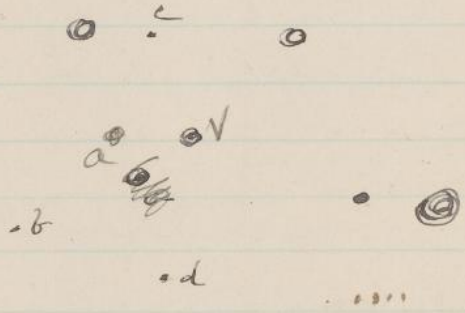
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Jan 1891
Variables

R Doradis
v - 2 - a
b - 1 - v
c - 3 - v
v - 3 - d
7 - 0 - v



L_2 Puppis
a - 3 - v
b - 1 - v
v - 4 - c
v - 2 - d



Feb. 13. 1891.
R Doradus. 2.30 P.M.
v - 0 - c
ε - 1 - v
v - 2 - 7

Feb. 13. 91.
L_2 Puppis 8.45 P.M.
v - 1 - c
ε - 1 - v

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1891

Wed. Feb. 18. 1891

Resumé of work on Base Line &c in Arequipa for survey of the valley & mountains &c.

Feb. 13. After examining the R R & finding the longest available base line would be only 500 paces about 2½ towards Tingo, we tried the Puno R.R. Bridge on Puno R.R. 1 Kilom. from station :-

Going - 542 paces coming 532.6 (worth much more)

From 6 or more tests of length of pace got - 2.94 ft.

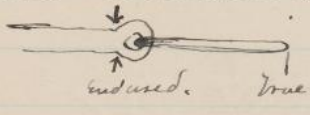
5
2663.0
542
6)3205
534.16
2.94

Length of bridge - 1570.45 feet.

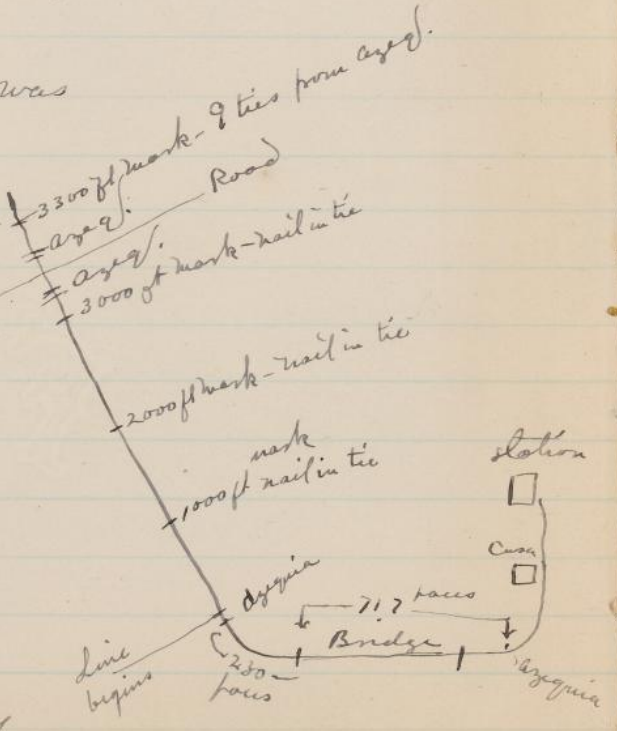
Could get a line of 750 paces or about 2000 feet, taking in bridge.

There is a curve beyond bridge & at 4th Tel. pole from bridge the straight track begins.

In this measurement the tape was used a little short



See pg- for correction.



Post. A. 4th Tel pole beyond Bridge - i.s. just around curve & across Arequipa.
3.428 beyond further side of Asyeq.
Beginning of line at 5th & last dent in outer edge of left rail - going towards Puno.

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Wed. Feb. 18. 1891.

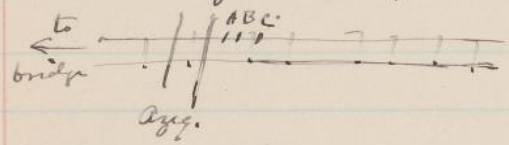
Feb. 13. 91 Survey of Valley of Arequipa &c. Cont^d

3300 mark 3300 ft mark[1] - or 66 lengths of liner is 0.ft3 short of 9th sleeper beyond culvert other side of Trigo road-crossing. Or:- Rail dent dents dent (outside)

↑ ft.09 ↑ ft.11 ↑ Cor here = +6.369 ft.

Feb. 17 "91 Measured on from 3300 mark. In former measurement we put dents in rails at every 50ft - didnt here.

5000 mark. 5000 ft mark on Arequipa this side of Kilo Post 3.



Expl:- A = End of rail
B = Beginning of next rail.
C = 5000ft mark ft.378 beyond B.

Line here as before, a little short. Cor for 5000 mark = +2.ft55

See page — for locations of true distances

K.P.3. Kilo Post 3 at mark 5116

Measured to 5300 mark & laid off 20 ft exact back. then just in the correction. The mark is not exact on account of not knowing exactly the correction in 50ft. outer rail

True Mile Mark - Count 7 whole rails beyond K.P.3. True mile mark is ft 2.100 beyond beginning of 8th rail.

Post #3 At upper end of base line. Have measured to further side of big Arequipa beyond K.P.3. (The Arq. has a line of willows along it on city side) Exact point measured to is in line with further end of outside brass rail below track as it crosses Arq. Sight up from perpendicular end of this rail. Dist from this sight to nearest edge of tie on further bank of Arq. is ft 0.28

This exact point is 120.95 over 1 mile or 5400.95 ft.

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Wed. Feb. 18, 1891

Base Line - Exact Points.

Station X. Bridge end of line. 5th pole beyond bridge - small azeguia beyond pole. 3.428 ft beyond further edge of Azeg. are 5 cents. the 5th & last is the zero point.

(a) Minor points. for future use

		- sums -
Edge of Az. next O point	3.428 ft	from zero point.
" " " away fr. "	2.222	5.650
To end of rail	4.560	10.210
" " " 2nd "	23.965	34.175
" " " 3d "	23.460	57.635
" point off. Tel. pole.		48.762

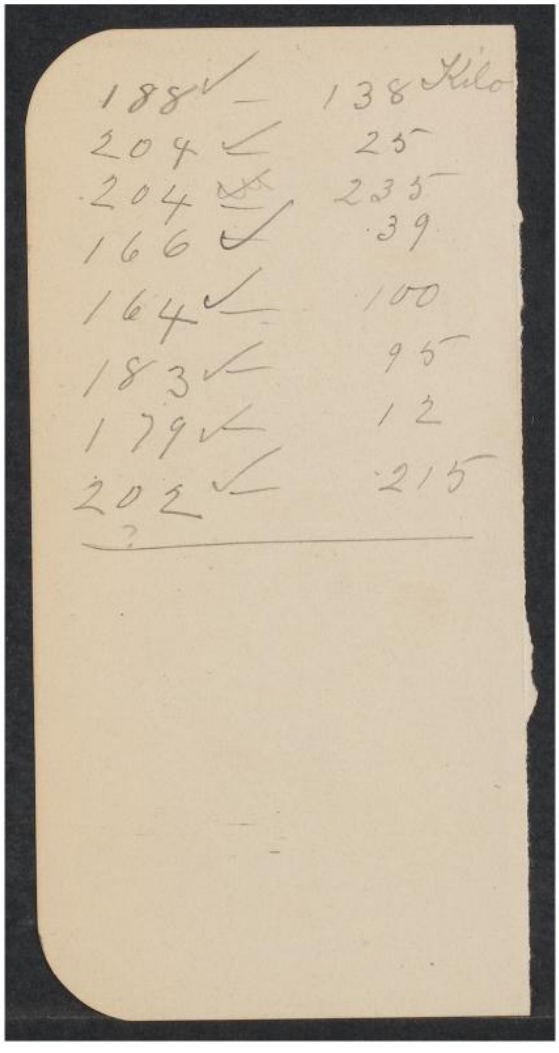
along 3d rail - 14.587

Post to outer edge of 3d rail	11.48
" " inner " " "	11.66
" " end of 2nd rail	18.60
" - " " 3d "	14.60
Circumference of Post	1.423

Station B Big Azequia with line of Willows, beyond K.P. 3. Further side in line with end of lower outer brace rail below track, O is the exact point measured D. 5400 ft. 75

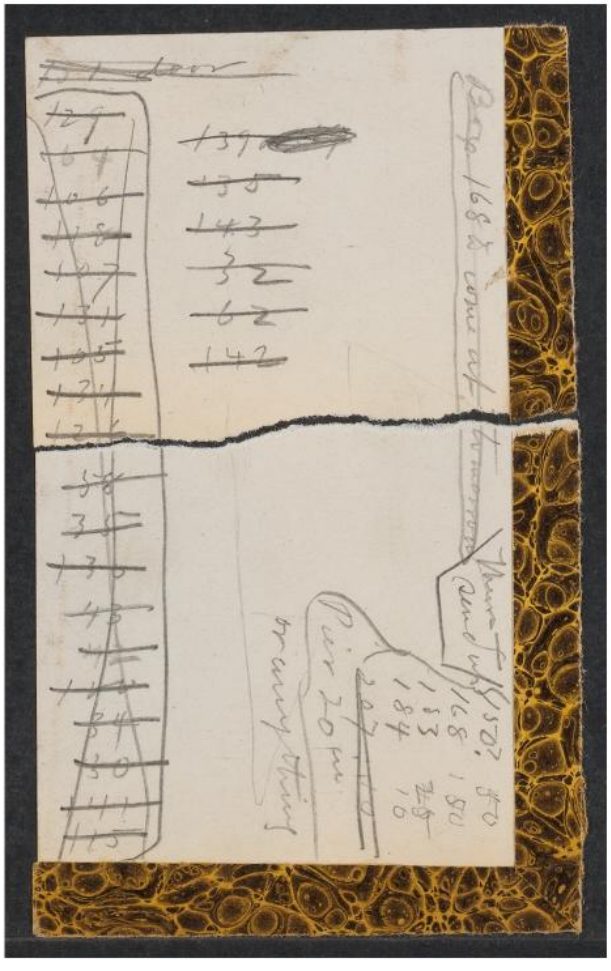
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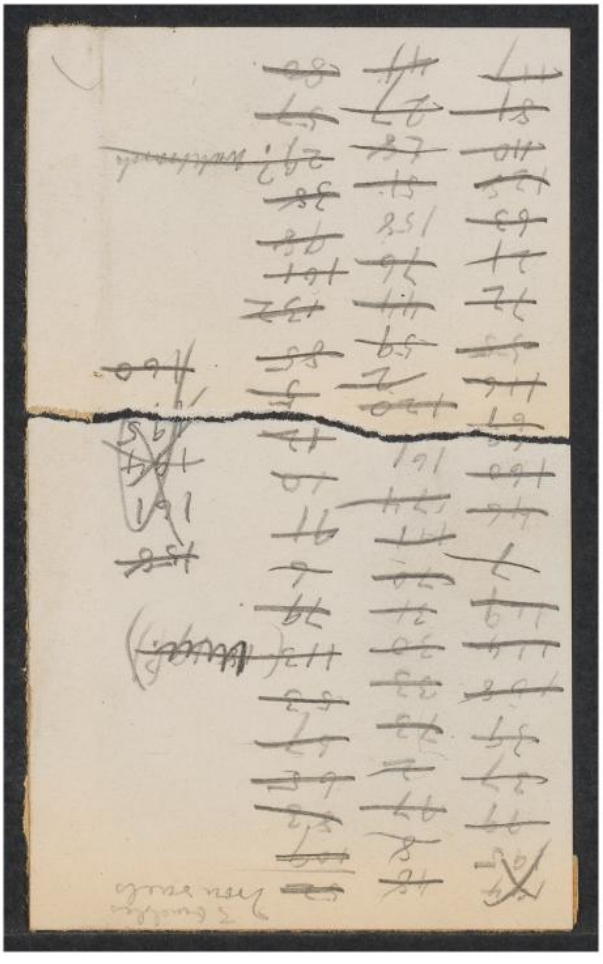
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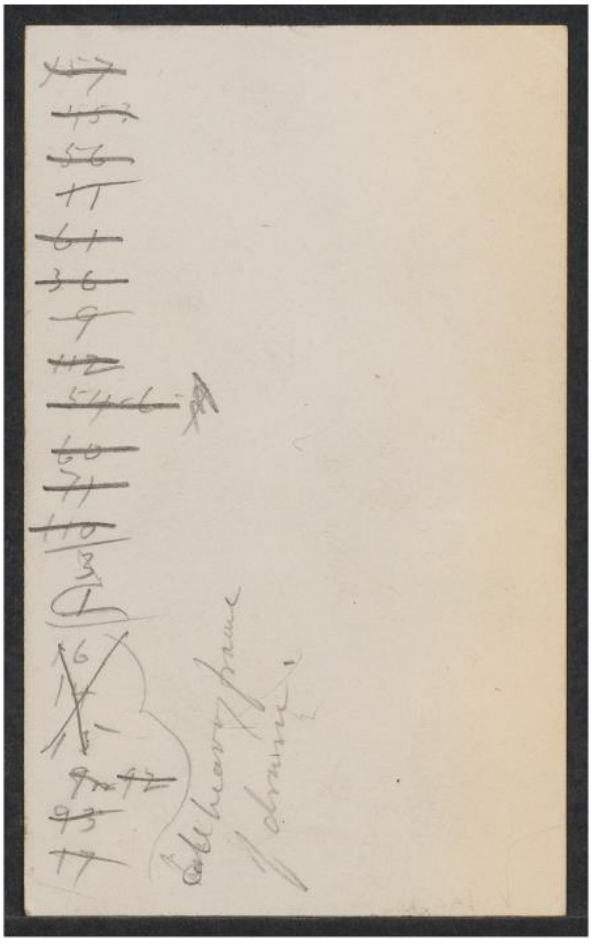
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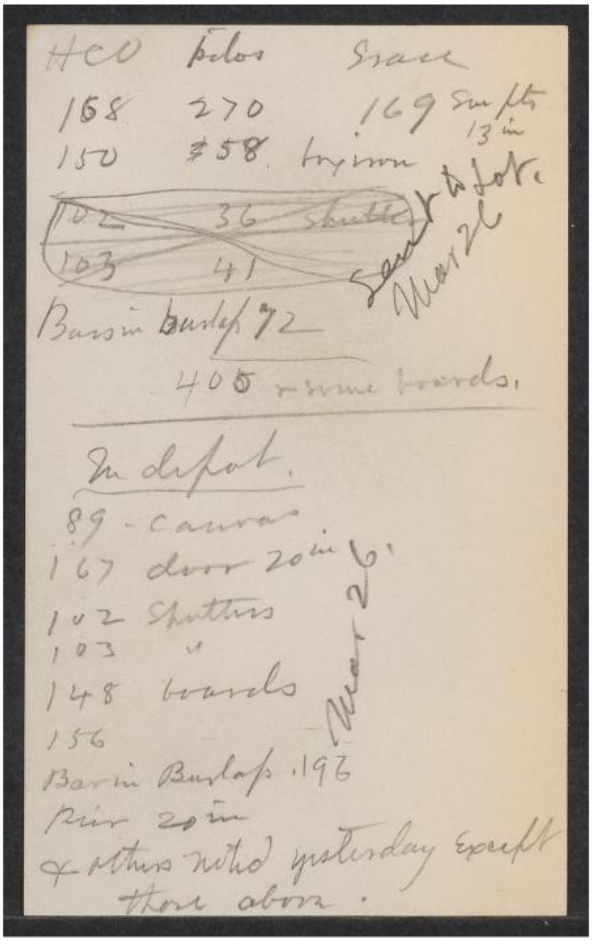
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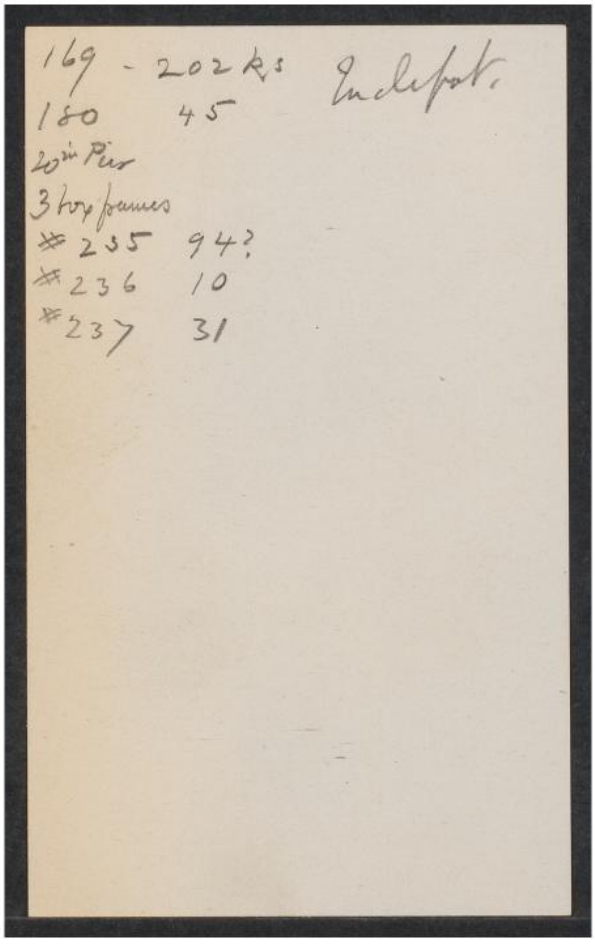
HCO Poles Space
168 270 169 Sm pts 13 in
150 258 boy room
102 36 shutters
103 41
Bars in burlap 72
405 reserve boards.

In depot.
89 - Cameras
167 door 20 in
102 Shutters
103 "
148 boards
156
Bars in Burlap 196
Pier 20 in
& others used yesterday except those above.

Wear 26

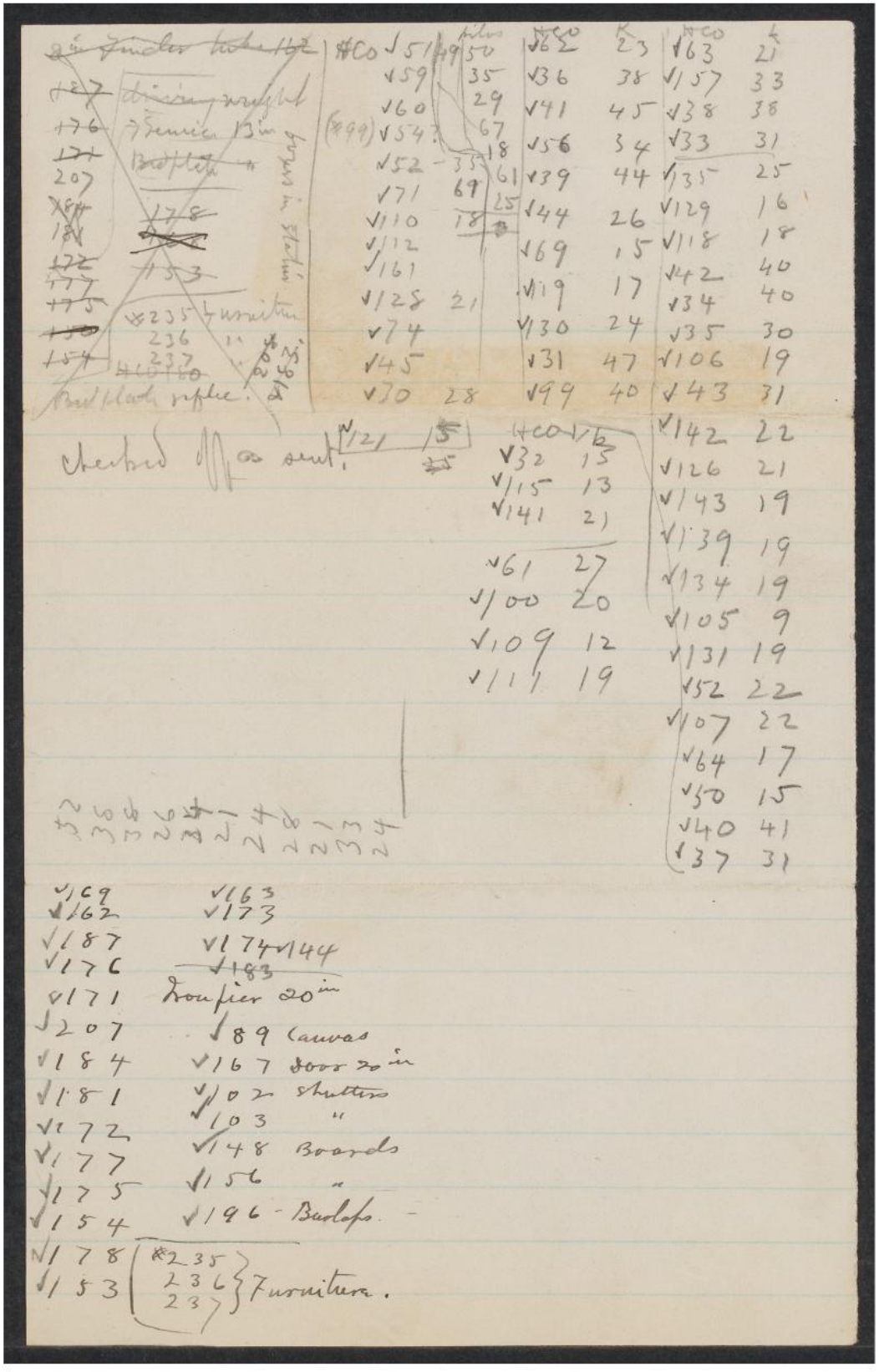
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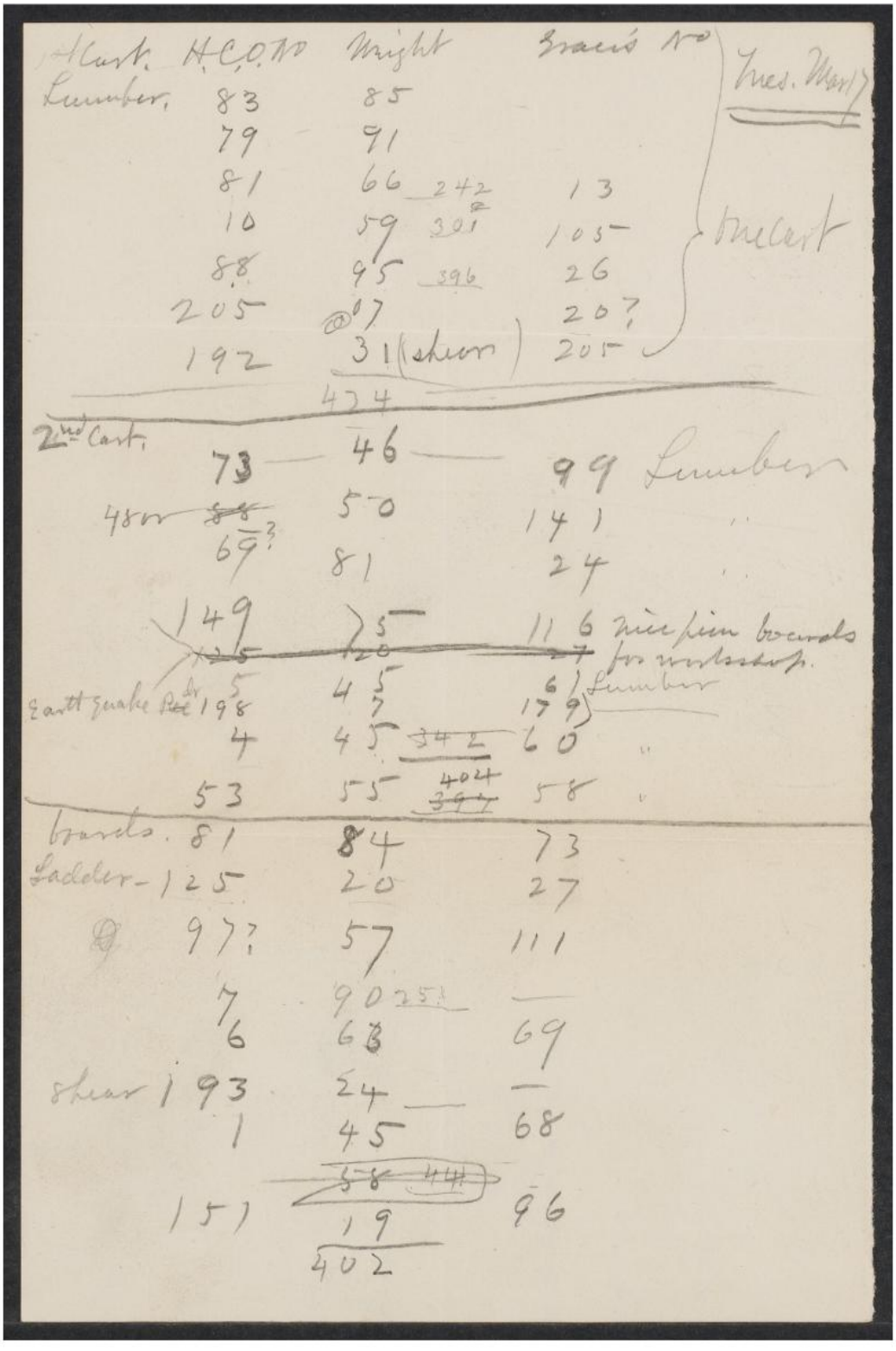
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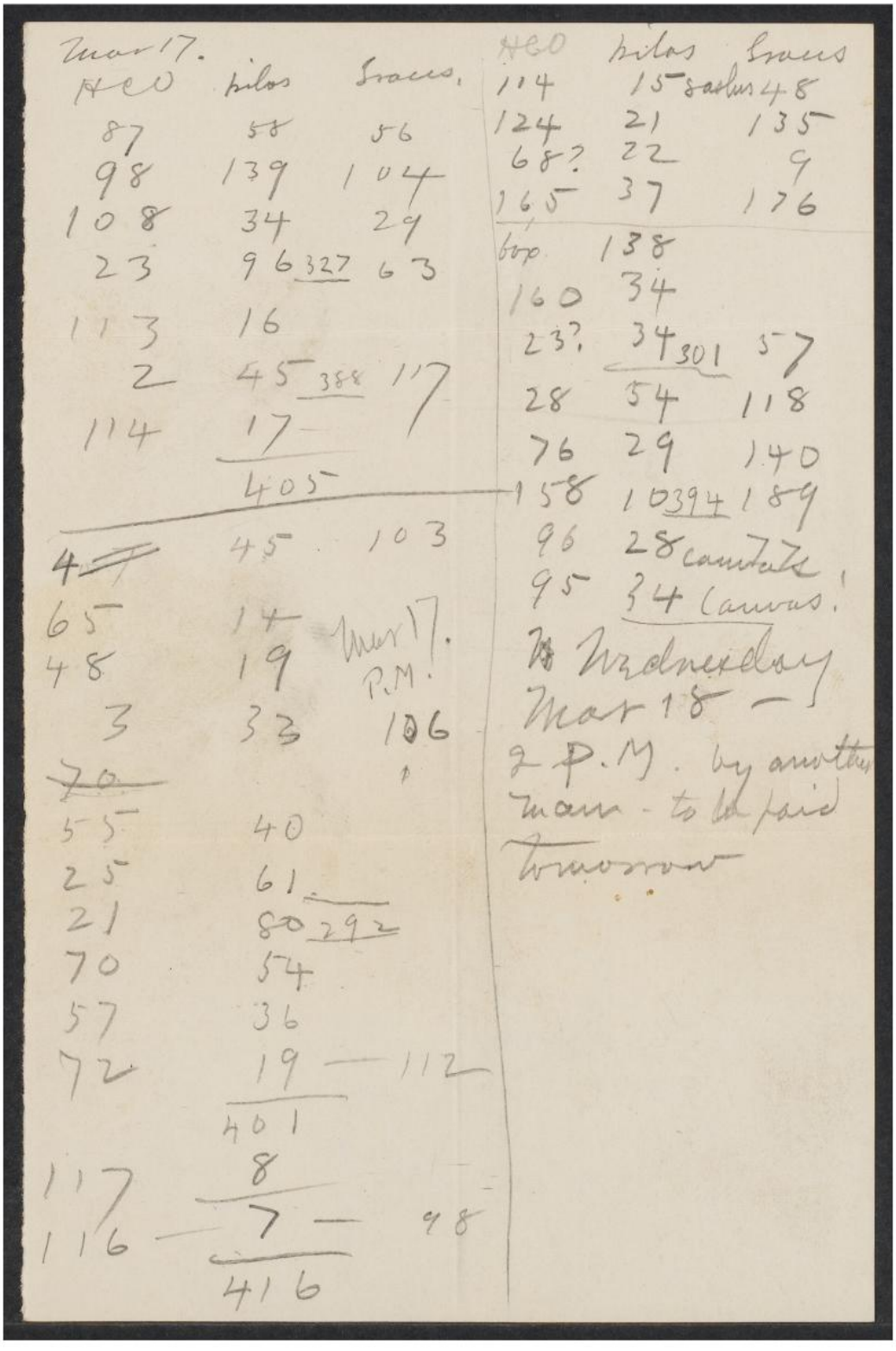
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Mar 17.

Hed	bilos	Saccs.
87	58	56
98	139	104
108	34	29
23	96 327	63
113	16	
2	45 388	117
114	17	
	405	
~~4~~	45	103
65	14	
48	19	
3	33	106
~~70~~		
55	40	
25	61	
21	80 292	
70	54	
57	36	
72	19 —	112
	401	
117	8	
116	7 —	98
	416	

Mar 17. P.M.

Hed	bilos	Saccs
114	15 sacks	48
124	21	135
68?	22	9
165	37	176
boo	138	
160	34	
23?	34 301	57
28	54	118
76	29	140
158	10394	189
96	28 canvas	
95	34 canvas.	

Wednesday Mar 18 — 2 P.M. by another man - to be paid tomorrow

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1st cart early in month.

2nd, 3d, & 4th on Monday, Mar 16. 91

2nd contained nos - H.C.O. 91 × 11 & 152
also Graces 21, 72, × 108

3d " nos H.C.O. 8, 132, 136 × 189
also Graces 132 = HCO 123.

4th " nos H.C.O. 121, 122, × 186 (= Graces 171)
also Graces 70, 101, 134, 115, 52

---

4 carts.

HCO nos		also Graces nos	
~~90~~	Canvas	21	Lumber.
× 28	timbers	72	
× 91	boards	108	
× 11	"	70	
~~152~~	Box of tools	101	
× 8	boards	134	
× 132	Timber	115	
× 136	boards	52	
~~189~~	Cylinders of barographs		
~~121~~	Small boxes screws & bolts		
~~122~~			
Graduated 86	(= Graces 171)		
~~123~~	(= " 132) "		

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Wed Feb 18, 1891

Feb. 16. 91

Examination of Transit Theodolite.

Angles between Church on Pampa (3)
upper cross + right tower of double towered
church 40° 0 to the right. (1)

Clamp near side.	Left V			Right V		
Ch. 1	114	21	40	294	20	40
Ch. 3.	75	02	00	255	01	00
Ch. 1.	204	24	00	24	21	20
Ch 3	165	02	00	345	01	00
Ch. 1.	249	22	00	69	19	40
Ch. 3.	210	02	00	30	00	20
Ch. 1.	339	23	00	159	21	20
Ch. 3.	300	02	00	120	00	40

Took these after adjusting levels.
Clamped lower screw & set upper Plate 3 times
on each point Thus :- only read Left V.

Ch. 1.	339	23	00	Ch. 3	300°	02	00
	"	23	20		"	02	20
	"	23	00		"	02	00

Right V is 1' or 40" too long at 300° Left is O.K.

Errors of above readings come in graduation or
in reading vernier. - prob. both.

Altitude snow line - near Right end of Chacani Mesta Pinkupiche.
6°20' 7°32' 3°52'

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Wed. Feb. 18, 1891

Observations for ~~Error~~ Variation of the Compass

With theodolite in middle of street

in front of Casa Grande.

Watch error: ———

Prof's time → True time $9^h\ 20^m\ 00^s$

Watch $9\ \ 13\ \ 06.3$

Correction $+6^m\ 5\ 4^s.3$

All obs. with watch time.

α Eridani

(poor obs.) $9^h\ 34^m\ 30^s$ Comp. S. end $23.^\circ2$ E. of star.

$9^h\ 43^m\ 30^s$ Comp. S. end $23.^\circ0$ E. of star

N. " $22.^\circ6$

Obs'd Alt. angle $13^\circ 23'$

α Cancri

$9^h\ 56^m\ 25^s$ Comp. S. end $38.^\circ6$ W. of star

N. end 38.7

Obs'd Alt. angle $25^\circ\ 01'$

Also Comp. S. end 38.4

N. " 38.7

S. " 38.1

Better use obs^ns on N. end alone. S. end below scale.

Index corrections for Alt. angle $-4'\ 30''$

Assuming rising thread correct for level on tube.

Direct from Mr Bailey 7 Feb 17. 91

True time $1^h\ 3\ 0$ $2^h\ 29^m\ 0$ running fast Prof's watch

Watch $0^h\ 56\ 1$ $2^h\ 24\ 54.3$ Corrections as above

$3\ 59$ $4^m\ 6^s$ $4^m\ 21^s$

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Thurs. Feb. 19. 1891.

~~adjustment~~ correction of Theod. in Collimation &c.

Set at 360.

Turned tube over & the setting came 359° 56′ 30″.

Set threads

Set on 360 15 0

Turned tube & setting came 12′ 40″

Found a little motion in joint of lower plate connected it.

Friday. Feb. 20. 91

Work on variation of compass.

$9^h\ 20^m\ 0^s$ Error $6^m\ 54^s$.

26	30	0
17	10	
60		
1030		
9	43	30
	06	50
9	50	20

4	6
2	48
6	54
	4
6	50
6	48

Time of Obs on 2 End.

" " " " 2 Crucis.

$23\frac{1}{2}$ 168

1030

Log	$23\frac{1}{2}$	1.3711
"	168	2.2253
		3.5964
"	1030	3.0128
	3.8	0.5836
Log	36.5	1.5623
		2.2253
		3.7876
		3.0128
6.0		0.7748

$4^h\ 44\ 12^s$

71 48

3^m

9	49	58	Mid time mean noon (Gr)
10	02	51	

Long = $4^h\ 47^m\ 12^s$

9	49	58		10	02	51
14	37	10		14	50	03
	2	18			2	18
Cor. 2	24			6	2	26
14	39	34		14	52	29
21	52	39		21	52	39
12	32	13		12	45	08

2 End. 12 32 13

RA.	1	33	39			
9	49	58		10	02	51
	2	24			2	26
21	52	39		21	52	39
7	45	01		7	57	56
1	33	38		12	20	34
6^h	11^m	23^s		4	22	38
transit				transit		
2 Tridanus				2 Crucis		
$\delta = 57°\ 47'\ 46''$				$\delta = 62°\ 29'\ 32''$		

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Friday Feb. 20. 91.

Variation of compass

Obsn in α Eridani

h = 6h 11m 23s
90 5 45
2 45
h = 92° 30' 45"

δ = S. 57° 47' 46"

Obsn in 2 Crucis.

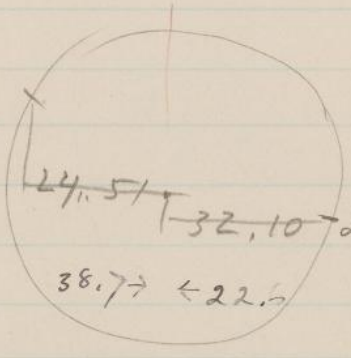
h = 4h 22m 38s
60 9 30
5 30
h = 65° 39' 30"

δ = S. 62° 29' 32"

Formula:- Sin C (= Correction in azimuth) = Cos δ Sin h.

Nat Sin h = 0,999. by = $\bar{1}$.9996
Nat Cos δ = 0,533 = $\bar{1}$.7267
0,5325 $\bar{1}$.7263
→ = Sin 32° 10'

Nat Sin h = 0,912 by = $\bar{1}$.9600
Nat Cos δ = 0,461 " = $\bar{1}$.6637
.4205 $\bar{1}$.6237
→ = Sin 24° 51'



Obsd Magnetic

Obsd by Prof P. That

α Erid
Cor to O. + 1°

2 Crucis
Cor to O − 1°

Jan 24, 1894. The difficulty in above work is undoubtedly due to wrong identification of α Crucis. Probably β Crucis was taken instead - it is α is the nearest to the pole.

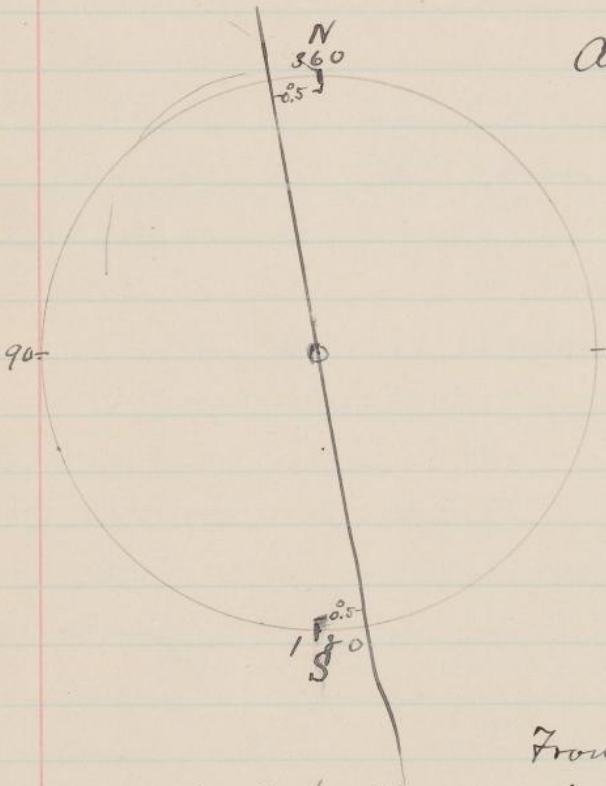
A.E.D.

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Compass on Theodolite.

Ends of needle balanced with beeswax.
After adjusting axis, collimation &c of telescope looked through wrong end at compass scale.



Axis of telescope runs to left of N & R of S or is a plus error & the reading requires a minus correction.

The two ends of the needle differ by 0.2 when N. end reads + 0.1 the S. end reads +179.9

From Obs^ns on sun taken Feb. 27 on the lot, the variation comes 10°12' or 10.2

From stake N°1 on the lot, the true south point is 5°23' to the left or east of flagstaff on Casa Grande.

To lay off south point with needle, S. end should read 350.2.

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Tuesday, Feb. 24, 1891.

From 6 Angles from Station on Obs Lot.
Near stake No 23.

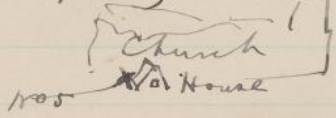
No	Object.	baths (10)	Left Vernier			Right Vernier.		
			°	′	″	°	′	″
5	Pampa 14 (= No 5)		24	44	00	204	46	15
7	Cemetary Hill (= No 7) Big stone		48	46	30	228	48	45
wrong? 4	" " " " Prob. Cairn (Scale low)		48	48	30	228	51	45
"	" " " " Big stone		48	46	00	228	49	15
8	Casa Grande - Foot of flag pole.		55	01?	15	235	04?	00
3	Church on Pampa. Sour cross.		89	04	00	269	06	30
	Church next Lot.		40			220	29	
	2 towered Ch - N.E. tower		80	36	00	260	38	15
	Church in Sachaca.		75			255	51	
	Cathedral E Tower		46			226	24	
6	Polaris Summer House } White - 100 yds from Lot. }		185			365	42	

Baths on Lib - taken first.

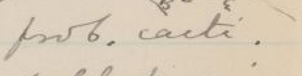
Notes As seen from Obs. Lot

No 5. (Pampa 14) is under left end of a church

Thus! -



No 7 is indefinite shows thus in telescope

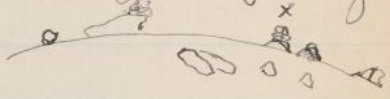


d & C are dark when sun shines & are prob. cacti.
B & C are light & C is the longer & is probably the cairn.

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Wednesday, Feb 25. 1891

From № 7 (Cem. Hill) Corapuna shows slightly S right of № 3. Top of hill at 7 is like this:- 

From 6

More sights from № 6 (Obs. lot) Only sights on the primaries are copied here.

Object	Left Vernier	Right Vernier	Elevation
Baths changed eyepiece.	090° 00' 00"	270° 03' 15"	+01° 13'
№ 5	114 44 45	294 17 00	−01 04
№ 7 Cairn	138 51 15	318 54 30	−00 50
" Big stone	138 45 45	318 49 00	— —
№ 8 Foot of pole	145 31 00	325 34 00	−01 46
№ 3. Foot of cross.	179 03 45	359 06 00	−01 23

A Vernier of Vert. circ. was set at 0 & arm adjusted to get the level at zero Horiz. thread is not adjusted

2nd D from 6

Baths-door	180 00 00	000 03 00	
№ 3	269 01 30	89 03 00	
№ 5	204 44 00	31 02 00	
Carmen Alto	231 24 45	51 27 00	−01 44
№ 7 Cairn	228 52 00	48 54 15	−00 52
№ 8 -as before-	235 31 00	55 33 00	−01 47
№ 3 again	269 03 00	89 04 15	−01 25

Center at height of cairn.

2d D from 6

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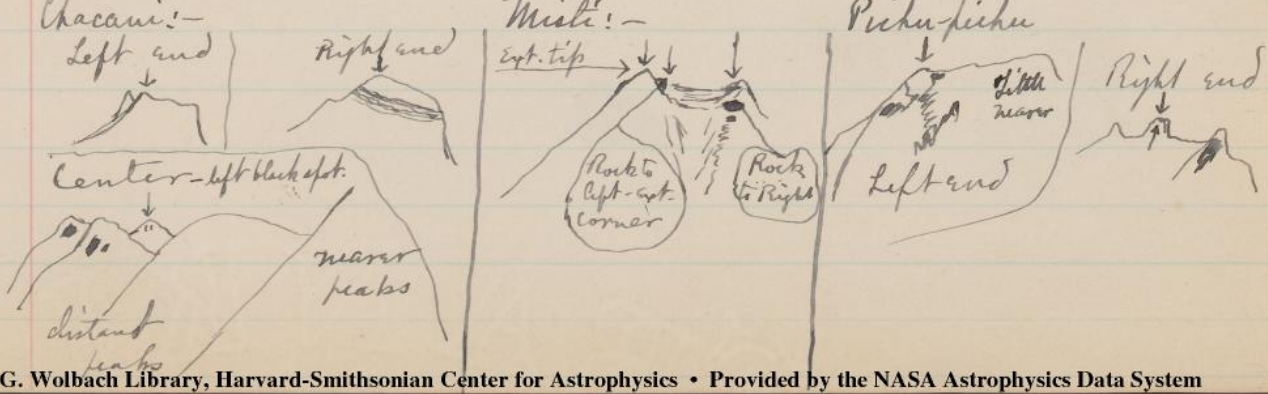
Thursday. Feb. 26. 1891.

Regular series.

Object.	Left Vernier	Right Vernier	Elevation
Baths	270° 00′ 00″	90° 01′ 30″	+ 1° 08′
5. – Top	294 43 45	114 46 00	– 1 07.5
7	318 50 30.	138 53 00	– 0 55.5
"	318 50 30	138 52 45	
8 cairn	325 30 – on line	145 31 45	
Inst moved			
8 cairn.	325 off both ends	145 01 00	
3	359 00 30	179 03 30	

Mountains.

Casa (8)	000	00	00	180	02	00	
Chacani. Left end.	164	20	30	344	22	30	+08° 59′.5
" Center	180	54	30	360	57	15	+09 27.5
" Right end	187	45	30+	(36)7	48	15	+10 17.5
Misti. Ext. tip	233	35	15	53	37	30	+11 57.5
" . Rock to left of Crater	233	47	00	53	49	15	+11 55.5
" " " Right "	235	34	30	55	36	30	+11 31.5
Picho-picho Left end.	269	22	30	89	25	00	+05 42.5
" Right "	284	59	30	105	V. off both ends		+05 11.5
Casa (8)	000	off both ends		180	00	30	– 01 49.5



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Friday. Feb. 27.

Base Line - again - Sempas 1885 190.

At Station B(=2) Telegraph Pole:- Beyond end of line ~~7.13~~ 7.13 ft

Dist - inner edge rail & pole (circ.) 10.73. Circum. of pole 1.42 ft ; total 10.96 ft

Measurements to & from top of joint in pole 1.7 ft above ground

Rail's width 0.19 ft

Stake for instrument: Beyond end of line ~~5.07~~ 5.07 ft

Dist from inner edge of rail 6.74

At station A.(=1) Telegraph Pole:- (copied from pg 193) Dist beyond (outside) Zero point 48.762

Dist & inner edge of rail from pole 11.66 ft Circum pole 1.423

Measured from same point as above. { Total 11.89 ft

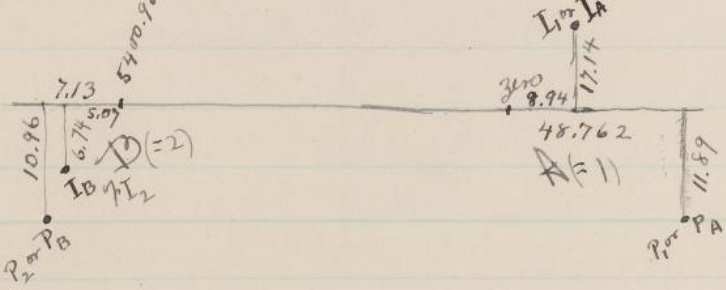
Stake - across track from pole.

Distance outside & beyond zero point 8.94 ft

Distance from inner edge of rail ~~17.44~~ 17.14 ft

Note Station A(=1) is at 5th pole from end of bridge.

Diagram to illustrate above. Radius pole = 0.23 ft



Rough coördinates

From I_1 :- I_2 = 5414.96 ft by 23.88 ft

P_2 = 5417.02 " 28.10

From I_2 :- I_1 = 5414.96 by 23.88

P_1 = 5454.78 " 5.15

Mar 9. Changed position of I_3 to a point ~~8.00~~ 8.00 ft along track + 13.25 from outer edge of rail 3.44 − .19 = 3.25 ft same side of track as Pole.

I_1 to I_2

~~Measurement of 7.08 must be wrong.~~

Mar 11 At 2. Pole is 1.95 ft above rail

Stake " 0.60 " "

At 8. Pole is 2.6 ft above rail

Stake " 3.6 " "

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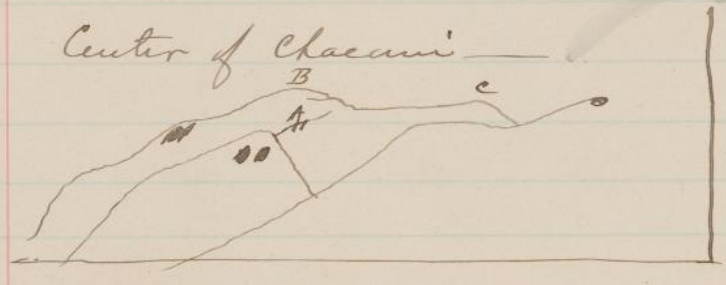
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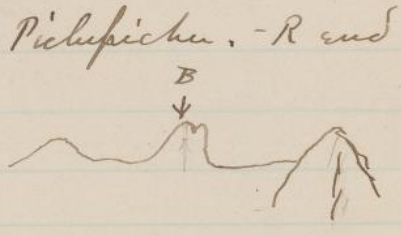
Monday. Mar 9, 1891

Mar 5. From Casa — 8, View of Mountains.

Object.	Elev.	A.V.	R.A.
3	1°,20′	000 10 00	180 12 30
Chacani, L.end	7° 39	38 30 +	218 33 30
" Center N.	8°,01	51 52 00	231 55 00
" B	8,,04	51 55 00	231 58 30
" C	8,,05½	52 11 30	232 15 00
" R.end	8,,29½	57 13 15	237 16 15
Inst. moved Misti N	10,,26½	93 15 00	273 18 30
Sagain	1,,20½	000 10 00	180 11 45
Misti C	10,,08	94 43 15	274 47 00
" A	10,,24½	93 18 00	273 21 00
" B	10,,26	93 09 30	273 12 00
Pichupichu N.	5,,59	130 54 45	310 58 00
" B	5,,39½	148 03 00	328 06 00
3	1.21	000 11 15	180 13 00

From 8, N





Corrected level reading on 3 is +1°,2′ 45

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Monday, Mar 8. 91

Mar. 5. From Case. Primary Points.

From δ_3, Object.		Elev.	I.V.	R.V.
	1	$-0^{\circ}.31'$	000 10 00	180 11 30
1st	3	+1 12	19 22 30	199 25 00
	2	+0 53	30 25 30	210 28 00
	5	+1 59½	100 36 45	280 39 45
From δ_3	γ_0	+0 56	231 17	051 19 30
on ground	1		000 06 30	180 08 15
	δ_0	about	12 55	192 57
	δ_3 is 48.50 from δ_0			
again	1		090 10 00	270 13 00
	δ_2		103	
2nd	3		109 25 15	289 29 00
	2		120 28 00	300 30 +
From δ_3	5		190 41 15	010 44 00
(Big rock)	γ_1		321 05 00	141 06 15
	γ_0		321 21 30	141 24 00
	1		090 09 30	270 12 30

From δ_2				
	4	$+0^{\circ}.05'$	000 10 00	180 12 15
	1	$-0^{\circ}.39$	031 50 45	211 53 45
	3	$+1^{\circ}.12$	050 46 30	230 49 30
	4		000 12 30	180 14 45
1st	2	$+0^{\circ}.52\frac{1}{2}$	061 52 15	241 55 15
From δ_4	γ_1	+1.47	102 47 15	282 51 00
	δ_0	about	119 17	299
	5	$+2^{\circ}.00$	131 56 15	311 60 00
	4	$+0^{\circ}.06$	000 10 30	180 13 00

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Monday, Mar 9, 1891

Mar 9. From Casa ⟶

From 8_2

		L. V.			R. V.		
4	+0 06	090	10	00	270	13	30
1	−0 37½	121	51	30	301	55	00
3	+1 13½	149	47	00	320	50	15
2	+0 53	151	54	00.	331	57	30
6	+1 46	191	30	short	611	31	00
9	+1 45	192	44	00	012	46	30
9_1			51	00		53	45
8_0 about		209	23		029	25½	
5	+1 58½	221	59	00	042	short	
4	+0 07	090	10	00	270	13	00

9^{20}_{11} From 8_2

Pier on no 6. only finished this afternoon
Changed in position from place whence angles
were taken 2ft.00 to an angle 158° 16′ to W from Casa(S)

No 9 Carmenello – 9 is S W corner upper floor – level of
floor. 9_1 is S. E. Corner of Do.

From 8_0 to 8_2 is 47.05 ft.
" 8_0 to 8_4 is 138.20 "

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Wed. March 11. 1891

March 10. From 1.

	Elev.	L − V.	R. V.
Set on 2_p	+1° 39½	000 10 00	180 12 00
9	+2 03½	039 45 15	219 47 45
9_1		53 00	56 00
10	+2 25½	116 49 45	296 53 00
8_0 Large	+0 39½	132 57 30	313 about
S.W. Corner foot Piazza floor 8_4	+0 31	134 29 00	314 30 about
7_1 Gr.	+0 55½	169 26 00	349 29 00
7_0 "	+0 55½	169 36 45	349 39 30
1_p "		215 37 —	~~035 53~~ 3—
4	+0 14½	274 37 45	094 39 30
3	+2 15	342 16 00	162 18 30
2_p	+1 40½	360 09 00	180 10 45

From 2.

1_p Gr.	−1° 45′	000 10 00	180 12 00
3	+1 56½	087 41 00	267 44 45
9		245 34 00	065 35 30
9_1	+1 44½	245 43 00	065 44 30
5 "	+1 06	~~282 33~~ 282 33 00	102 34 00
2_p about		~~289 30~~ 289 30 —	109 30 —
8	−0 55	342 22 15	162 24 15
8_4	−0 57	342 57 00	162 60 —
Too dark to see 7_0 — about	−0 02½	352 50 —	172 ~~53~~ —
1_p		360 08 45	180 10 30

Mar 11. P.M.

1_p	−1 46	000 10 00	180 12 00
7_1 Just moved slightly.	−0 02	352 50 00	172 52 00
7_0		352 56 30	172 59 30
1_p		360 12 30	180 15 00

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Wednesday, Mar. 11. 1891

Mar 11

	From 2.	Elec.	L. V.			R. V.		
	1_p Sr		090	10	00	270	12	30
	3		177	45	30	357	47	30
Do 2nd	9		335	37	45	155	39	15
From 2	9_1		335	45	15	155	48	00
	5		012	34	45	192	37	15
	P_2	about	019	35		199	35	+
	8		072	23	15	252	26	15
	7_1		082	47	00	262	50	15
	7_0		082	55	30	262	59	—
	1_p		090	09	30	270	12	15

Stake at 2 is 0.6 abov rail. Pole is 1.95 abov Do

	From 3.	Sefore 1_1	000	10	00	180	12	00
	7_0		078	50	30	258	54	30
	7_1		078	42	45	258	46	00
1st	10		035	60	—	216	00	30?
From 3	8_0		063	11	30	243	14	00
	8_4		063	46	00	243	49	00
	2		074	11	00	254	14	15
	7_0		078	49	30	258	53	15
	4		104	47	00	344	49	30
See notebook	6_0		327	53	30	147	55	45
	6_1			54	15			
	6_2			55	00			
	4		341	42	00	161	44	45
	9_1		341	48	15	161	51	15
	5		012	28	30	192	30	ab
	1		360	06	00	180	08	30

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Wed: Mar. 11.. 91.

From 3,	Elev:	L.V.			R.V.		
Left on 1.	−1° 58½	090	10	00	270	12	30
5	+0 39	102	33	30	282	36	30
10	+1 39½	126	04	30	306	07	30
8₀	−1 10	153	16	00	333	18	30
2	−2 13	164	16	45	344	19	45
7₀	−0 11½	168	57	15	348	60	——
4	−0 37	254	52	00	074	54	15
6	+1 26½	057	59	00	238	——	
9	+1 06½	071	46	45	251	50	15
1	−1 58	090	10	15	270	13	45
3₀	+4 10	109	31		289	35	

2nd D from 3

3₀ is 30.ft00 from 3, at an elevation of 4° 10′

Mar 12. 91

Mar 12.

2nd from 1.

2		090	10	00	270	13	15
9		129	47	30	309	50	45
10		206	53	30	D26	56	30
8		222	58	45	043	start	
7₀		259	37	45	079	40	15
1₀	− 6° 10′	305	43		125	45½	
4		004	39	00	184	41	30
3		072	16	30	252	20	00
2		090	18	45	270	14	00

2nd D from 1

Grade of track between 1 & 2 is (from 1) 1° 41½′. Height Inst 4.ft75

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Friday, Mar 13, 91

Mar 12. To compute rough distances of mountains.
from sights made at 6 & 8.

Misti To correct sight from 6 — add 05' to each sight on Mt^n
Distance 11 miles " " " " 8 50°46' is angle between 6 & 3 from 8,
Alt. 17920 Distance from 6 to 8 is 15300 ft.

Using sight on big rock to left of crater on the Misti
obtained a distance of 57000 ft from 8.
With sight on topmost point, obtained a height of 17950 ft.

Get distance of Right end of Pichupichu.

From 6 — 74° 55'
" 8, 97 07
172 02
" Picho 7° 58'

$\frac{\text{Sin } 74^\circ 55'}{\text{Sin } 7^\circ 58'} 15300$ = dist. between 8 & Pichupichu

Sin 74° 55' = .966 log = $\bar{1}.9850$
15300 " = 4.1847
4.1697

sin 7° 58' = .138 " $\bar{1}.1399$
5.0298

Pichupichu
Distance 20 miles
R end Distance Pichupichu = 107,100 ft.

Alt. 17940 Elev. 5° 32' + Tan = .097 log = $\bar{2}.9868$
4.0166

Note - Elev. Misti 10370 Elev. = 10390
alt station 7550
17940

Angle at 8, between 3 & 6 is 50°46'

Pichupichu L end From 8, 79 59
" 6 90 33
170 32
9° 28'

$\frac{\text{Sin } 90^\circ 33'}{\text{Sin } 9^\circ 28'} 15300$ = dist. 8, to Pich^u L. end.

Sin 90° 33' = 1,
15300 log = 4.1847
Sin 9° 28' = .1643 log = $\bar{1}.2158$
4.9689

Dist. = 17½ miles Distance = 93100 ft or 18 miles nearly.

Elev. = 5° 52' Tan .102 log = $\bar{1}.0086$
3.9775
= 9495 ft
Elev. of 8. = 7550
17045

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Friday, March 13. 1891

1st from Z.	Elev.	L.V.	R.V.	$Z_0 Z_1 = 38.00$ ft
Set on 1		000° 10′ 00″	180° 12′ 00″	
2	−0° 02′	003 54 15	183 56 30	
δ_4	−0 54	013 31 45	193 34 30	
δ_0 ±1″		014 ——	194 02 00	
9		026 02 45	206 05 15	
6	+0 50½	026 34 00	206 36 30	
5		040 03	220 05 30	
7,		100.7	280.7	
10		105 11 15	285 14 45	
4		315 13 00	135 14 30	
3		357 50 15	177 52 15	
1		360 10 00	180 11 30	
2nd from Z.				
Set on 1		090 10 00	270 13 00	
2		093 56 00+	273 60 ——	
δ_0		103 60 +——	284 01 ——	
6		116 34 30	296 37 15	
5		130 04 15	310 06 45	
4		045 15 00	225 17 00	
3 ±1′		087 51 30	267 54 30	
1		090 09 30	270 12 00	
Ch. in Trigo		032 28 30	212.4	
" Sachoca		045 02 30	225.0	
RR Bridge W end		091 34 00	271.6	
" " E "		097 24 00	277.4	
Lower stone bridge W end		110 25 45	290.4	
San José S Tower		142 25 30	322.4	
~~Upper " " " " stone~~		~~114 39 00~~	~~294.6~~	
Cathedral W. tower		118.0	298° 01′ 30″	
" E. "		118.6	298 44 00	
El Pantheon		184 03 00	00 4.1	

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Saturday. Mar 14, 1891

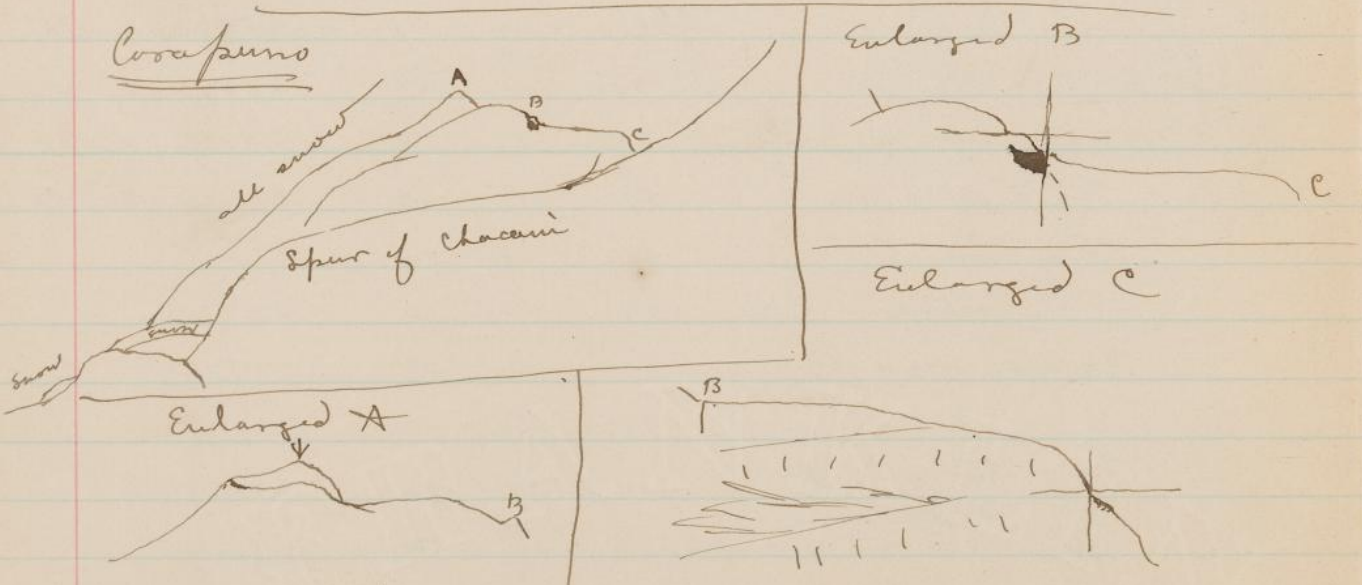
Mountains from To Lv. R.V.

	3	+	0° 11′	000	10	00	180	12 30
Catapuno	A	+	2 39	001	10	00	181	12 30
	B	+	2 35½	001	30		181	32 00
Corapuno	C	+	2 11	001	60		182	01
Snow line	Cp	+	1 42¾	358	55			
	1	−	0 53½	002	28	30	182	30 ±
	3	+	0 09½	000	12	30	180	14 45

Couldnt see snow line on Cp, it is below spur of Chacani

Obs again the lowest visible point as 2°33′ above 1.

Mts from 1	1	−	0 56	000	10	30	180	13 15
Cp	A	+	2 38	358	49	00	178	22 00
	B slightly hazy	+	2 35	359	09	00	179	11 00
	1	−	0 55	000	11	30	180	14 00
Chacani. L. end		+	6 45	020	±		200	02 15
" Center	A	+	7 08	032	06	00	212	09 30
" "	B	+	7 10½	032	09	30	212	12 30
" "	C	+	7 12½	032	25	30	212	29



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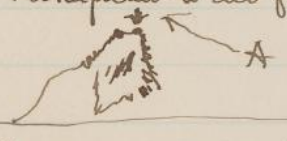
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Sat. Mar. 14, 1891

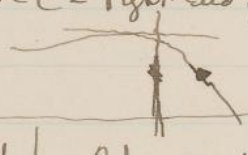
Mountains from 7 L.V.

Chacani R end		+7° 31	056	43	45	216	46	45
Mist	B	+9 35¼	068	55	45	248	60	
"	A	+9 33½	069	02	30	249	05	00
"	C	+9 19½	070	21	15	250	24	45
Snow line - right side		+5 40						
Pichupichu	A	+5 52½	107	53	00	287	56	45
Snow line		+4 43½						
Pp	C	+5 56½	108	44	30	288	47	45
	D	+5 50½	118	45	30	298	48	30
	B	+5 42	125	60		306	00	15
	E	+5 41½	127	00		307	02	30
Chacani	D	+7 55	028	28		208		
	1	−0 55	360	12	30	180	14	30
	1	−0 55	000	12	00	180	14	30
	6	+0 50	026	33	15	206	36	00
	4	−0 21	315	16	00	135	18	00
(Elw of roof)	3	+0 06¾	357	21	30	177	54	30
	1	−0 55	360	12	30	180	15	00

Pichupichu - L end from 7.



Do - C = right end of peak A

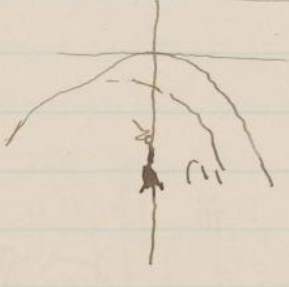


Do - D = rocky peak in center of range



Do - E is extreme right peak

Chacani D

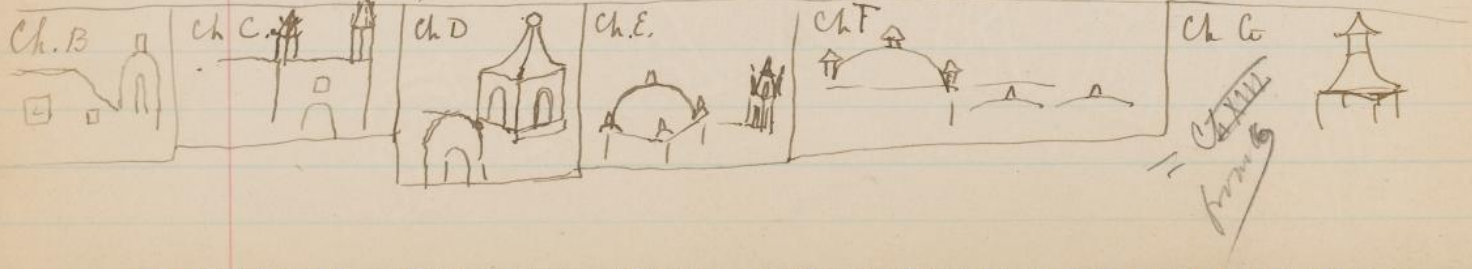


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Sat. Mar. 14, 1891

City from 7 (elev. with eye)		L.V.	R.V.
3. S.E. corner on ground		090 10 00	270 12 30
Chimney / gas factory		096 56 00	277.0
Pampa E of P.R.R.		099.3 to 101.1	
Church A. 2nd way up P.R.R.	+0° 30′	102 40 30	282.7
" B	+0 03	!	!
Casa		106.3	
S.W. Corner R.R. yard	−1 16	102 56	282.9
N.E. " "	−1 02	112 28	
Belfry of "		110 09	
2 toward Ch N.E. tower	+0 32	110 46	290.8
Church C	−0 15	111 47	
" D		114 03	
" E	+0 10	114 07	294.1
" F dome in rear →		116 55	
" " tower		117 41	
Azegnia alto. Left.	+0 57	116 10	
" " House in Center	±1 02 (exact)	117 02	
" " Right.		117 40	
Church next lot		119 21	
Convent of Sac. Heart S.W. Corner	−0°25′	119 44	
" " " N.E. "		121 51	
Dome of Ch near Am. Hotel		120 60	
Curve in ravine of river		121	
River opposite Corner Alto		122 10	
Church G		122 26	



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Sat. March 14. 1891

City from Z.V.

Church H	(clw)	123°	04
Green roof		123	40
Church I (timbers on roof		124	34
Pink Church	+0°15′	128	21
Church J		129	30+
Summit NE. of town	+0 20	130	55
E end of Do		133	40
Church K	+0 40	134	52
Pantheon near 5	(exact +0 52)	137	06
5		132	26 00
NE Point of city		147	15
Panuapatre Church L (= Ch II)	+1° 10′	207	30
Church M (= Ch I) Saw mill		244	03
South end Pantheon		241	35
Pointed Hill - Rock to right	+1° 28′	266	08 00
Lacabaya Pantheon	−0 25	284	25 00
" Church	−0 40	286	09
RR Cut - high		028	50
Bella Vista Ch.		047	47
Church N		093	52
3i as before		090	10 00
1		092	32 00



Church K - near 5

Church N below W end of RR Bridge.

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Sunday Mar. 15. 1896

1st from 5

	Rev.	R.V.	
Lebron 8_0	-2° 03'	000 10 00	180 12 15
1?		017 18 30	197 20 45
4	- 0 43	032 32 15	212 34 30
3	- 0 41½	047 44 15	227 47 30
2	- 1 10	049 56 00	229 59
9_0	+ 0 25	102 27 30	282 ab.
9_1		102 33 45	282 37 30
6	+ 1 02	118 ~~wrong~~ 437 00	298 50 45
10	+ 2 06	263 47 45	083 50 00
6		118 46 45	298 49 30
7_1	- 0 42	336 16 30	156 18 45
7_0 ?		336 24 30	156 27 30
8_5 (N2 Corner)		359 45 45	179 48 30
8_0	- 2 03	360 08 30	180 11 00

1st from 5

2nd from 5.

8_0	090 10 00	270 12 30
1?	107 18 45	287 22 00
4	122 33 30	302 36 30
3	137 46 30	317 50 00
2	139 58 00	320 short.
6	208 49 30	028 52 00
7_0 (?) better than before	066 26 00	246 29
8_0	090 11 00	270 13 45

2nd from 5

7_1	066 20 15	246 22 15
Point called 7_0.	" 26 15	" 29
" to right - white.	" 30	" 33

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Sunday Mar 15. 1891

City from 5

	Set on S_0 - L.V.		000	10	00
	Ch. 1 with Timbers	T	000	25	
	Ch 2.	T	001	46	
	Ch 3. Tingo	T	002	48	
	R.R. Cut Tingo		003		
	Ch 4.	T	004	23	
	Ch 5 = Ch G fr 7.	T	005	03	
	River off. Tingo		005	34	
	E. end R.R. bridge about same				
dome	Ch 6. near Am. Hotel.		009	30	
tower	" " " "		p10	27	
	Ch 7. near stable	T	010	37	
	" dome		012	06	
	Ch 8 in Sacbaca		012	19	
	W. end R.R. Bridge		013	30	
	Cathedral East	T	015	43	
	" West (or Calle de Santa Catalina)	T	017	42	
	Ch 9. - rumed + yellow		021	45	
	Ch 10. dome - near river		026	23	
	Ch 11. = Ch H fr 7.	T	026	44	
	Distant towers		027	36	to S.W.
	Iron tower		027	31	
	Ch 12. big blue dome only		029	30	
	Ch 13. = Ch C fr 7. Center		035	30th	
dome	Convent ans river S.E. Corner		042	08	
Tower	of dome = Ch D fr 7.		044	57	
	Ch 15. Front.		047	39	
	3_2 as before		047	37.5	
	Ch 16. in ruins = Ch B fr 7.	T	057	50	

Ch 2



Ch. 4 - low



Iron Tower



Church 15



Ch 16.



in ruins.

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Sunday. Mar. 15. 1891

City from S

(Started on δ_0 = 000 10 00)

Pampa on Puno R.R.	53°	59°	
Convent near S	057°	10′	
Ch 17. dome = Ch XVIII fr 6.	066	34	
" T	068	15	
Upper Stone Bridge. Center	046	27	
Ch 18. Way of P. R.R. T	077	54	
Ch. 19. ruins	078	35	
Ch 20. 2 towers Ch. S. T.	083	14	
" (2 towers =) W T	083	30	
Ch 21. next dot. (6)	116	33	
6	118	47½	
House in Center of Agguia Alto	119	51	
Curve in Ravine	132	45	
Just moved — δ_0 roads	000	12	
Cemetary near S	226	17½	
Village N.E. of city	273		
N.W. Road	251.7		
Ch. 22 = Ch L fr 7. T	294..	50′	
Ch 23 = Ch M " T	295	28	
Ch 24 near S. T	302	16	
Ch 25 ruin — 4 miles off Cut.	307	03	
Road down valley	314		
Pointed hill. Rock S R	306	33	
Ch 26. — doubtful T	319	42	
Sacabaya — Cemetary	323	34	
Ch 27. " T	324	48	
Ch 28 San José	330	54	
El Pantion. Cent-front.	333	14	
W.W. Corner "		57	

Ch 19



straight across river fr S.

Ch 26.

on ~~road~~ way to road ab 314°



City from S - continued.

7, (2) 8	336°	19′.5	
Convent - 3 ~~hills~~ cut of orchard	334	15	
" Tower	344	31	
Ch 29	350	41	
Ch 30. Bella Vista	354	47	
δ_0	360	12.5	

Church 29



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Monday, March 16, 1891.

City from L.V.

Feb. 2 –	Letrán Baths				000	00	00	R.V. 180	02	00
	Church mst Lat							220	29	00
	2 towered Ch. NE Tower				080	36	00?	260	38	15?
	Church in Sacbaca							255	51	
	Rob Cathedral							226	24	
	Polar's Summer House							365	42	

Elev. – all taken on bell tower.

Baths - door			180	00	00	000	03	00	
3o (= cross)			269	01	30	089	03	00	
Ch I	+ 0° 05′		202	06	30	020	08	30	
Ch II	– 0 07		Same						
Ch III	– 0 48		205°	08′		025	08		
Ch IV	– 0 27		208	00		028	01		
5			204	44	00	024	45	45	
Rock & R.	Pointed Hill.		211	03	30	036	06	00	
Ch V	– 1 13		211	17		031	19		
Ch VI	– 1 17		214	10		034			
Ch. VII	– 1 23		216	11		036			
Ch VIII	– 0 57		220	26		040			
Carmen Alto 9	– Center. Cross.	– 1 44	231	24	45	051	27	00	
7		– 0 52	228	52	00	048	54	15	
3o (= Cross)		– 1 25	269	03	00	089	04	15	
Ch IX		– 1 15	222	22	30	042			
Ch X		– 1 44	222	44		042			
Ch XI		– 1 35	222	53½		042			
Ch XII		– 0 43	224	26		044			
Ch XIII	Cross	– 1 33	225	10½		045			
Ch XIV	"	– 1 37	225	20½		045			
Ch XV		– 1 47	225	57		045			
Top E Tower	Cathedral	– 1 33	226	17		046			
" W	"	– 1 33	227	07		047			

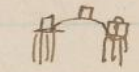


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Mount. Mar 16, 1891.

Feb. 2 –	(Set on baths = 180 00 00)		City		from 6.			
			L.L.			R.V.	Ch XVI between Cathedral towers	
	Panteon front door	-1°08'	226	27½		046		
Shook mark →	Ch. XVI	-1 33	226	31½		646.		
	Set on Casa (8)		235	30	30	055	30	
	Ch. XVII (Bell)	-2 06	236	47		056.7		
P.R.R. Bridge (& gas factory)		-2 00	239	06	30	059.		
	Ch XVIII (Bell)	-1 58	240	29	00	060	30	
	Ch XIX Top	-1 28	241	13		061	+	
	Ch XX roof	-2 05	241	57½		062	–	
	Inr W end of bridge	-2 09	243	10		063		
	Ch XXI bells	-2 46	249	12		069		
	R.R. cut beyond Tuyo	-1 13	250	27		070	30	
	River " "	-1 52	252	45	–	072	45 –	
Top of door.	House in Center of agguia alto	+2 36	029	03	00	209	31	30
	Extreme left of do village		006					
	" Right "		037	13				
	Casa (8)		235	31	30			
	" "		235	31	15			



Ch XVII



Ch XVIII



Ch XIX is Villa Vista
Ch XX under bridge is doubtful stone only side walls.
Ch XXI is in Tuyo

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Bds. Corpenters - Cambridge

Stetson & Dinsmore 83 Boylston St, Camb.

Stetson lives - next & last house on left - Banks Streets. (off Mt Auburn at Main St end.

Dinsmore - 9 Brewer (off Mt Auburn near Ash.)

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	kilos	Grace's No
No 8 HCO	119	Lumber
132 "	156	
136	76	
	17	#132 = boy
~~123~~	~~17~~	
189	10	boy
	90	#70 Tables lumber
	81	#101
	92	#134 floor timbers
	62	115
	67	52
	21	
186	~~397~~	171
121	21	
122	22	

834 in 2 carts.

5 bundles boards in 1st cart.

	~~#~~	74
Nos 91 HCO + 11.		87
108, 72, + 21. Gr.		87
		51
152		46 — boy iron

Took along in one 50 kilos / wood.

Months one pers

Mar 16

3 carts on Mar 17

105 in 3 carts	Grace's No
~~HCO~~	~~Grace~~
83	91 Kilos
79	
81	66 — 13
10	59 — 105
88	95 — 26
205	7 — 20?
192	31 — 434 kilos 205
73	46 — 99
46 or 86	50 — 141
	61 — 24
149	75 — 116
198	45 — 61
4	07 — 179
	45 — 160
53	55 — 58
	404 kilos

3d

HCO	kilos	Grace's
81	84	73
125	20	27
97?	57	111
7	90	69
6	63	68
193	24	96
1	45	
151	19	
	402 kilos	

7th

5 carts — Mar 17.

HCO	Weight	Grace's No
87	358	56
96	139	104
108	34	29
23	96	63
133	16	
114	45	117
	17	405
4	45	103
65	14	
48	19	
55	33	106
25	40	
70	61	
57	80	
71	54	
116	36	112
	19	
	8	
	1	98

5th cart

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X780
1031 mm
3

Reverse
F to light

Arequipa

Rand McNally Map

	average		
Long	71	48	72 12
Lat	− 16°	22′	16 18

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