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1058

DIETZGEN  
NEW YORK

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ENGINEERS  
FIELD BOOK  
No. 403

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# EUGENE 1058 CO.

DRAWING MATERIALS, MATHEMATICAL and  
SURVEYING INSTRUMENTS

Chicago New York San Francisco New Orleans Pittsburg Toronto

Distances from Center of Roadway for Cross-Sectioning  
Roadway 16 feet wide. Side Slopes 1 on 1.  
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	0
1	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	1
2	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	2
3	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	3
4	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	4
5	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	5
6	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	6
7	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	7
8	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	8
9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	9
10	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	10
11	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	11
12	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	12
13	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	13
14	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	14
15	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	15
16	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	16
17	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	17
18	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	18
19	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	19
20	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	20
21	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	21
22	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	22
23	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	23
24	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	24
25	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	25
26	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	26
27	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	27
28	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	28
29	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	29
30	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	30
31	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	31
32	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	32
33	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	33
34	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	34
35	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	35
36	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	36
37	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	37
38	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	38
39	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	39
40	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	40

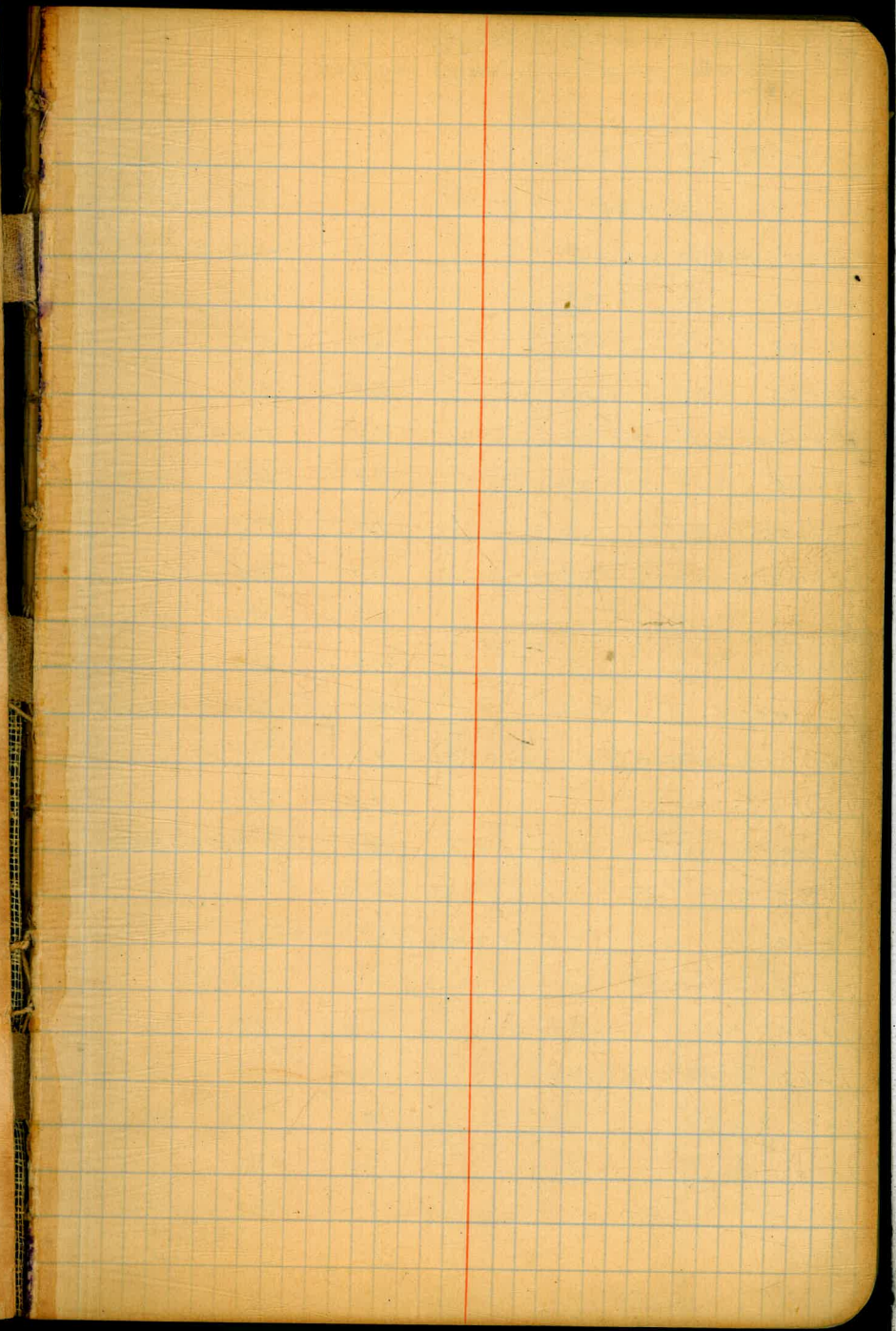
**Example**—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 30.6. For same slopes but other widths of roadbed, correct above figures by one-half difference in width of roadbed; thus in example above, for 20 ft. roadbed distance will be  $30.6 + (20 - 16) \div 2$  or 2 ft. added to  $30.6 = 32.6$ . For slopes of 1 on  $1\frac{1}{2}$  see inside of back cover.

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J.W. Williams Const. Eng  
City Hall



MICROFILMED  
DEC 21 1964





19 Gregory  
 B.B. Moore  
 W. Shaw.  
 Geo. Cromwell  
 L.B. Harris  
 H.N. Savage

OTAY CREEK  
 McHenry Cross Section

	86		
	326	97.06	93.8
0+00 = Hole in wall =	1.80	95.26	
0+25	4.4	92.7	
0+28	4.7	92.4	
0+35	6.5	90.6	
0+40	6.7	90.4	
0+42	8.9	88.2	
0+50	9.4	87.7	
0+62	11.7	85.4	
0+80	11.9	85.4	
1+00	11.5	85.6	
1+07	10.5	86.6	
1+11 = 9' upstream from Sycamore stump.	13.0	84.1	
1+18	14.0	83.1	
1+22	13.6	83.5	str stream
1+35	13.3	83.8	
1+39	12.6	86.5	
1+46	10.6	86.5	
1+55	10.4	86.7	
1+63	8.9	88.2	
1+76	8.1	89.0	
1+85	7.5	89.6	
1+95	8.1	89.0	
2+00	9.2	87.9	

on distance  
 100 of 100  
 Base of rock  
 175 ft. above wall  
 elev. determined  
 from level of  
 172' from  
 top of opening

97.06

2+03	10.6	86.5
2+13	10.7	86.4
2+21	10.5	86.6
2+25	9.6	87.5
2+32	7.8	89.3
2+48	7.3	89.8
2+52	6.5	90.6
2+65	5.6	91.5
2+75	5.2	91.9
2+85	4.0	93.1
3+00	3.1	94.0
3+15	0.2	96.9

→ Elev. on Top of Flank Bolted to Sycamore Tree 9' S. of Sta 1+11 on McHenry Xsection 9.42 87.64

185' N. of op is half yard boulder half buried  
 Top of Boulder 2' above present level of ground

102.06 H.S. from page 8

Continuation of McHenry Xsection 11/19 Gregory Cromwell Earle

3+28	3.6	98.5
3+40	3.3	98.8
3+80	3.4	98.7
4+00	3.9	98.2



4/29

Gregory  
Moore  
Shaw  
Cromwell  
Harris  
SampsonTraverse Levels up Otay Creek  
from McHenry Xsection  
Taken in etc. of Stream

2

	6.48	94.12	87.64	Top of Flood 10 5/8 ft more Tree 100 ft on McHenry Xsection
0+00 = 1+28 on McHenry Xsection		10.5	83.6	
1+00		10.2	83.9	
2+00		8.9	85.2	
3+00		7.1	87.0	
T.P.	9.45	98.56	5.01	89.11
4+00		10.6	88.0	
5+00		10.1	88.5	
6+00		9.0	89.6	
7+00		8.4	90.2	
T.P.	10.37	104.85	4.08	94.48
8+00		13.7	91.2	
9+00		10.7	94.2	
10+00		10.5	94.3	



4/5/19

Gregory  
Moore  
Shaw  
Cromwell  
Harris  
Savage.Traverse Levels down  
Otay Creek  
from McHenry Xsection

3

					81.93			
					22+00	7.6	74.3	
on B.M.	2.57	9221	87.64	Top of Plank bolted to Spinnery stump on 14+00 Xsection	22+50 = 1445 on Arrowhead Xsection	7.4	74.5	
0+00 = 1428 on McHenry Xsection			6.6	83.6	TP 5.91	80.90	69.4	74.99 <small>stake top</small>
1+00			7.0	83.2	23+00	7.2	73.7	
2+00			7.9	82.3	24+00	7.6	73.3	
3+00			8.5	81.7	25+00	8.6	72.9	
4+00			8.6	81.6	26+00	10.2	70.6	
5+00			9.0	81.2	27+00	10.6	70.3	
6+00			9.1	81.1	28+00	10.9	70.0	
7+00			9.2	81.0	29+00	11.1	68.8	
TP.	5.99	8778	84.2	81.79	T.P. 7.80	78.00	10.70	70.20
8+00			5.8	82.0	30+00	8.1	69.9	
9+00			6.3	81.5	31+00	9.1	68.9	
10+00			6.8	81.0	32+00	10.2	67.8	
11+00			7.3	80.5	33+00	10.7	67.3	
12+00			7.8	80.0	34+00	11.0	67.0	
13+00			8.4	79.4	35+00	12.5	65.5	
14+00			9.0	78.8	TP 3.42	69.82	11.60	66.40
15+00			9.5	78.3	36+00	4.7	65.1	
16+00			10.0	77.8	37+00	6.0	63.8	
T.P.	3.38	81.93	92.3	78.55	38+00	7.9	61.9	
17+00			4.4	77.5	TP 5.59	68.92	6.49	63.33
18+00			5.2	76.7	39+00	7.9	61.0	
19+00			5.6	76.3	40+00	8.3	60.6	
20+00			6.4	75.5	41+00	8.8	60.1	
21+00			6.8	75.1	42+00	10.1	58.8	
					43+00	11.0	57.9	
					TP 4.69	66.33	6.164	on rock.
					44+00	9.2	57.1	
					44+20 = 1425 on Pt of Rocks Xsection	9.1	57.2	cont. on page 6



4/5/19

Gregory  
Moore  
Shaw  
Cromwell  
Harris  
SavageCROSS SECTION OF  
OTAY CREEK  
AT ~~THE APPROXIMATE~~ STA. 22+50 ON  
~~AS ESTABLISHED BY~~ TRAVERSE  
STAKE

4

on T.P. shown	8.77	83.76	74.99	Top Stake
0+00			1.2	82.6
0+15			1.8	82.0
0+25			3.5	80.3
0+40			7.9	75.9
0+50			8.9	74.9
0+75			9.2	74.6
1+00			9.3	74.5
1+05			9.8	74.0
1+11			10.3	73.5
1+18			9.0	74.8
1+45 = 22+50 on Traverse levels.			9.2	74.6
1+50			10.0	73.8
1+58			9.0	
2+00			8.9	
2+15			9.2	
2+25			7.4	
2+35			6.6	
2+50			6.6	77.2
2+75			7.1	
3+00		83.8	6.9	76.9
3+35			4.7	79.1
T.P.	4.74	87.01	1.49	82.27
3+50			3.0	
3+75			1.0	

4+00

1.1



4/5/19

Gregory  
Moore  
Shaw  
Cromwell  
Harris  
SavageCross Section of  
Otay Creek  
at the Point of Rocks

5

H.I. from page 3  
66.33

T.P.	12.56	78.65	0.24	66.09
	9.44	86.27	1.82	76.83
0+00			0.7	85.6
0+12			5.9	80.4
0+18			7.6	78.7
0+20			8.9	77.4
0+32			9.5	76.8
T.P.	2.16	75.57	12.86	73.41
0+34			7.0	68.6
0+43			6.9	68.7
0+45			10.8	64.8
0+49			11.4	64.2
T.P.	0.44	66.53	9.48	66.09
0+51			5.2	61.3
0+85			4.9	61.6
1+00			6.3	60.2
1+06			7.4	59.1
1+12			7.6	58.9
1+13			9.2	57.3
1+25 = 44+20 on Traverse			9.3	57.2
1+31			9.2	57.3
1+33			8.0	58.5
1+63			6.1	60.4
1+68			2.7	63.8
T.P.	9.48	75.57	0.44	66.09

T.P.	12.86	86.27	2.16	73.41
1+74			11.2	75.1
1+90			14.3	72.0
1+98			13.5	72.8
2+00			12.2	74.1
2+15			10.3	76.0
2+17			7.3	79.0
2+25			8.2	78.1
2+50			4.1	82.2



continuation of  
Traverse Levels  
down Otay Creek.

Ad. from  
page 5  
66.53

6

45+00			9.7	56.8
46+00			9.9	56.6
47+00			10.3	56.2
T.P.	5.17	61.86	9.84	56.69
48+00			6.0	55.9
49+00			6.3	55.6
50+00			6.8	55.1
51+00			7.2	54.7
52+00			7.9	54.0
53+00			9.1	52.8
54+00			9.5	52.4
54+20			9.6	52.3



4/7/19

Gregory  
Miller  
Shaw  
Cromwell  
Harris  
SavageCROSS SECTION F  
OTAY CREEK  
at Sta on Traverse  
where Arrowwood Roots  
were pointed out by  
Stiles

on T.P. at pt. Rocks 7.78	69.42	61.64	
T.P.	9.24	75.50	316
T.P.	12.51	82.98	5.03
0+00		8.5	74.5
0+18		9.1	73.9
+21		9.9	73.1
+28		13.3	69.7
+38		13.0	70.0
+50		13.5	69.5
+70 = 29+97 on Traverse		13.2	69.8
+75		13.2	69.8
1+00		12.5	70.5
+15		12.4	70.6 ✓
+23		13.3	69.7
+32		13.5	69.7
+50		12.3	70.7
+65		12.7	70.3
+75		11.7	71.3
2+00		11.7	71.9
+25		10.5	72.5
+35		9.9	73.1
+50		10.2	72.8
+75		10.6	72.4
3+04		11.0	72.0
+25		9.8	73.2

T.P. from  
page 3

83.00

3+38 - where former notes marked Arrow woods 8.9	74.1
+42	10.4
+46	8.9
+75	10.0
+85	10.7
4+00	13
+08	82
+22	40
+32	29
+50	26

74.1

72.6

74.1

73.0

72.3

73.7

74.8

79.0

80.1

80.4

7

= state  
marked  
+62



Levels in Otay Creek  
near McHenry X Section

2.51	90.15	87.64	Plank on old stump Elev. of K = Original Ground 25' West of Plank on stump.
		340	86.75
		1.96	88.19
			Cut-off on = Old Sparrow stump 25' West of Plank on stump.
		3.90	86.25
			(Present Existing Ground level at stump 35.5)
T.P.	12.94	102.06	103
			89.12
		12.0	90.1
			(Old Arrow = wood root elev. of ground prior to 1916 20' West of 1780.00 McHenry X section)



April 14<sup>th</sup> 1920  
 W. C. Earle  
 R. H. Gregory  
 C. A. Moore  
 F. D. Miller  
 John Seuss

Cross SECTION OF Section F. R. Clark.  
 Dulzura Creek. Taken at West End  
 of old House  
 at Dulzura Post Office  
 Taken at 17' ANGLES TO STREAM.

Assumed elev. on Rock embankment  
 300.00. <sup>inground at NE cor. window tower.</sup>

17 B.M.	3.06	303.06	
Floor of old house N. side of creek at site of X section	4.06	299.0	
1916 Flood High water mark on inside wall of old House	2.45	300.61	
1915 Flood was .25 above floor of old House			
0400	0.3	302.8	
0436	2.45	300.61	
0455	3.2	299.9	
1400	5.0	298.1	
1407 = Head house			West End of House
1428 = S. v	5.6	299.5	
1437	8.9	294.2	
1445 = center of stragg.	9.9	293.2	
1453	8.9	294.2	
1462	6.1	297.0	
2400	2.45	300.61	
2424	0.3	302.8	
T.P.	9.15	307.52	4.69 298.37

April 14<sup>th</sup> 1920 Traverse on Dulzura Creek  
 Taken up & down stream from X section on opposite page

9.15	307.52			T.P. on opposite page
				298.37
				UPSTREAM.
0400 = site of X section	14.3	293.2		
1400 up stream from X section	11.6	295.9		
2200 - - - -	7.4	300.1		
3400 - - - -	37	303.8		
4400 - - - -	1.6	305.9		
T.P.	12.91	318.16		227 305.25
500' up stream	10.1	308.1		
600' - - - -	77	310.5		

				DOWNSTREAM.
	26.2	301.01		298.37 T.P.
100' Downstream from X section	8.1	292.9		
200' - - - -	12.8	288.2		



April 14  
W.C.E.  
R.M.  
C.E.M.  
F.O.A.  
J.G.P.

Grade Line Survey from Redens Dam to SanVicente

J.W. Williams  
J. Van Horn Level  
Thompson M.C.  
Mansfield P.C.  
Jan 31, 1924

Sta	Description	Gr. Rod	Grade				
							720.33
874+78	South end of Tunnel drop 0.5 to 100ft Conduit Line drop 1.0 to 100ft.	10.01	712.32 710.32				
			.20				
881+78		10.21	712.12 710.12				
			.10				
883+00		10.33	712.00 710.00	T.P. 10.35	709.98	+ 7.04	717.02
0+00			.20				
0+36 885-		7.22	711.80 709.80	6.80	710.20	Co.4	
0+55			.20				
1+00 887-		7.42	711.60 709.60				
1+07			.20				
1+28 889-		7.62	711.40 709.40				
1+37			.20				
1+45 891		7.82	711.20 709.20				
1+53			.20				
1+62 893		T.P. 8.02	711.0 709.0			+ 9.99	718.99
2+00			.20				
2+24 895		10.19	710.80 708.80				
T.P.			.20				
897		10.39	710.60 708.60				
			.10				
898		10.49	710.50 708.50				
			.10				
899		10.59	710.40 708.40				
			.10				
900		T.P. 10.69	708.30			+ 10.40	718.70



	Gr. Rod	Grade		
902	10.60	710.10 708.10		718.70
904	10.80	<sup>20</sup> 709.90 707.90		
906 Begin Peach Orch	11.00	<sup>20</sup> 709.70 707.70		
908	11.20	<sup>20</sup> 709.50 707.50	- 11.25 706.95 F0.55	
910 ✓	T.P. 11.40	<sup>20</sup> 709.30 707.30	End Jan 31. 1924	+ 10.36 717.66
912	10.56	<sup>20</sup> 709.10 707.10	Begin Feb. 1. 1924	
914 + 50	10.61 15	<sup>05</sup> 709.05 707.05	7.20 712.46 710.46	C3.4
914 -	10.76	<sup>15</sup> 708.90 706.90	on Gr.	
915 -	10.86	<sup>10</sup> 708.80 706.80		
916 + 50	11.01	<sup>15</sup> 708.65 706.65		
918 + 50	11.21	<sup>20</sup> 708.45 706.45		
919 + 50	11.31	<sup>10</sup> 708.35 706.35		
921 ✓	T.P. 11.46	<sup>15</sup> 708.20 706.20		+ 11.82 718.02



Conduit Grade from Roden Dam to San Vicent.

	Gr Rod	Grade		
922	11.92	708.10 706.10		718.02
		10		
923	12.02	708.00 706.00		
		10		
924	12.12	707.90 705.90		
		20		
926	12.32	707.70 705.70		
		10		
927	12.42	707.60 705.60		
		15		
928+50	12.57	707.45 705.45		
		15		
930	14.72	707.30 705.30		
		15		
931+50	12.87	707.15 705.15		
		15		
933-	T.P. 13.02	707.00 705.00	+11.00	X 716.00
		10		
934-	11.10	706.90 704.90		
		10		
935-	11.20	706.80 704.80		
		10		
936	11.30	706.70 704.70		
		14		
937+20	11.42	706.58 704.58		
		13		
		15		



	Gr. Rod	Grade		
938+50	11.55	706.45 704.45		716.00
	.15	15		
940+50	T.P. 11.70	706.30 704.30	+ 11.14	715.44
		.12		
941+20	11.26	706.18 704.18		
1 30		.13		
942+50	11.39	706.05 704.05		
	.10	.10		
943+50	11.49	705.95 703.95		
	.15	.15		
945	11.64	705.80 703.80		
	.10	.10		
946	11.74	705.70 703.70	T.P. 11.77 703.67 + 7.93	711.60
		.15		
947+50	8.05	705.55 703.55		
	.10	.10		
948+50	8.15	705.45 703.45		
	.15	.15		
950	8.30	705.30 703.30		
		.10		
951	T.P. 8.40	705.20 703.20	+ 10.77	713.97
		.10		
953	10.97	705.00 703.00		
	.16	.16		
954+60	11.13	704.84 702.84		
	.14	.14		



	Gr Rod	Grade	El.	
956	11.27	704.70 702.70	10.37 703.6	C.9 Σ 713.97
	.10	704.60		
957	11.37	702.60		
	.20	704.40		
959	11.57	702.40		
	.15	704.25		
960+50	11.72	702.25		
	.05	704.20		
961	11.77	702.20	T.P. 9.34 704.63. C2.43	+ 6.13 Σ 710.76
	.15	704.05		
962+50	8.71	702.05	Begin of SYPHON	Begin Feb 2. 1924

No 10

See Page 50 Book No 1 Roden Dam & Conduit for SYPHON (Grade of SYPHON 1.5 to 1000ft)

			- 1.20	
971+80		702.65 Gr.	End of SYPHON T.P. 8.71 702.05	Cut 1.40 + 7.73 Σ 709.78
		702.48		
973+50	T.P. 9.30	700.48		+10.86 Σ 711.34
		702.40		
974+30	10.44	700.40		
		702.28		
975+50	T.P. 11.06	700.98		+10.59 Σ 710.85
		702.18		
976+50	10.67	700.18		
		702.07		
977+60	10.78	700.07		

Bee's in rock 40' to 60' off line



2/2/24

15

978+50	Gr Rod	Grade				
	T.P. 10.87	701.98 699.98		+10.60	X 710.85	X 710.58
980+50		<sup>70</sup> 701.78 699.78				
1 50	10.80					
982		<sup>15</sup> 701.63 699.63				
50	10.95					
982+50		<sup>05</sup> 701.58 699.58		+11.25	X 710.83	
	T.P. 11.00					
984+50		<sup>20</sup> 701.38 699.38				
1 50	11.45					
986-		<sup>15</sup> 701.23 699.23				
50	11.60					
986+50		<sup>05</sup> 701.18 699.18				
Tunnel Portal	11.65					
↑						
1630						
↓						
Sec Book No 1 Page 51		0.15				
1003+43° Tunnel Outlet Portal		700.33 698.33	7.00	701.96	C. 3.63	X 708.96
1 57	10.63					
1005+00		<sup>16</sup> 700.17 698.17				
	10.79					
	30					
1007-		<sup>20</sup> 699.97 697.97				
1 75	10.99					
	17					
1008+75		<sup>17</sup> 699.90 697.80				
	11.16					
	13					
1010-		<sup>13</sup> 699.67 697.67				
	11.29		T.P. 11.30	697.66	+11.77	709.43



	Gr. Rod	Grade		
1011	11.86	697.67 699.57 697.57		709.43
1013	T.P. 12.06	20 699.37 697.37		+11.57 708.94
1014	11.67	10 699.27 697.27		
1015	11.77	10 699.17 697.17		
1016	T.P. 11.87	10 699.07 697.07		
1017+35	12.47	698.9 696.93	Feb - 4 - 1924 stake set 103 (51.9 - 695.03)	+ 1227 709.34
1017+40	12.41	698.03 696.33	stake at Grade.	
Thru Cut sta 1017+40 to 1024+00				
1018+35	7.42	698.83 696.83	- .04 709.30 715.84	+ 11.6 721.26 713.84 = <u>Cut 17.61</u>
1019+35	10.90	698.73 696.73	- .02 721.24 724.63	+ 1229 733.53 722.63 = <u>Cut 26.50</u>
1020+35	1.75	698.63 696.63	733.78 731.78	= <u>Cut 35.75</u>
1021+35	6.75	698.53 696.53	728.78 726.78	= <u>Cut 30.85</u>
1022+35	3.25	698.43 696.43	- 12.99 719.46 717.76	720.54 721.01 = <u>Cut 2.189</u>

2/2/26

24.63  
98.73  
59.0

2/4-24  
Van Horn  
Brennet  
Thompson  
Stout  
Mansfield  
Windy in P.M.  
End 2/2/24



	Grade Rod	Grade		
1023+35	11.10	696.33	711.91 709.91 = Cut 1A.18	709.04
		698.33		
		-13.01	703.00 + 1.04	709.04
1024+00	8.57	696.27	Note - Through cut daylight at 1023+85	
		698.27	702.47	
		-13.00	696.04 + 4.66	700.70
1026+00	4.63	696.07		
		698.07		
1029+00	4.93	695.77		
		697.77		
1031+00	5.12	695.57	+855	704.12
		697.57		
1033+00	8.75	695.37		
		697.37		
1034+50	8.90	693.87	Cut 0.7	906.12 97.87 8.25
		695.87		
1035+75	9.03	695.10		
		697.10		
1037+00	9.15	694.97		
		696.97		
1038+75	9.32	694.79		
		696.79		
1040+100	T.P. 9.45	694.67	+11.33	706.00
		696.67		
1041+00	11.43	694.57		
		696.57		



⋈

1042+00	11.53	Gr. Rod	696.47 694.47			
T.P. Rock				- 11.59	694.41	+ 5.29
1042+50			696.42 694.42			⋈ 699.70
1044+25		Gr. Rod	696.25 5.45			
1046+00		5.63	696.07 694.07			
1048+00		5.83	695.87 693.87			
1050+00		6.03	695.67 693.67			
1050+75		6.10	695.60 693.60			
1052+00		6.28	695.47 693.47			
1054		11.50	693.27 693.27	- 6.28		+ 11.35
1055+50		11.65	695.12 693.12			
1056+20		10.26	695.05 693.05	T.P. - 13.01	El. 691.76	+ 11.55
1057 -		10.34	694.97 694.97			⋈ 703.31
1058+40 -		10.48	694.83 692.83	T.P. - 10.40	692.91	+ 10.13
						703.04

705.31  
11.10  
698.6



Williams  
Van Horn  
Thompson  
Mansfield  
Hunt

19

	Elev.	Gr Rod	Grade				
1058+90 Begin of siphon		10.26	694.78 692.78	End of Jan 4 - 1924			$\Sigma$ 703.04

3578.7

See Page 59 Book No 1 Roden

1094+68.7 End of siphon Begin Jan 5 - 1924	9.22		689.41 687.41	6.8	691.83 689.83	C 2.4	$\Sigma$ 696.60
--------------------------------------------	------	--	------------------	-----	------------------	-------	--------------------

1095+50	9.30		689.33 687.33				
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1096+50	9.40		689.23 687.23	-9.40	689.23	+8.37	695.60
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1098	8.52		689.08 687.08				
------	------	--	------------------	--	--	--	--

1099+50	8.67		688.93 686.93	-8.64	686.96	+9.78	696.74
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1101+50	10.01		688.73 686.73				
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1103+00	10.16		688.58 686.58				
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1103+50	10.21		688.53 686.53				
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1104+50	10.31		688.43 686.43	-10.33	686.41	+8.88	695.29
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1106+30	692.67	2.60	688.35 686.35	$\frac{6.3}{6.3}$ C 7.3			
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1105+80	695.39	11.23	688.27 686.27	-0.48	694.81	+11.81	706.67
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Station	Description	Elev	Gr. Rod	Grade	Cut	Notes
1106+10		701.72 699.74	1.38	686.24	cut 13.48	Tunnel Portal
1200+65.7	ahead 57°33' E True Swung Rt. 4°00' 567°00' E True	692.81 690.81	9.28	683.51 681.51	Cut 9.3	Stowe is 165° H 40°30' E of Sta 1200+65.7
1201		690.39 688.34	7.32	683.47 681.47	Cut 6.92	
1201+54	Low point in Creek Bed (Tunnel Adit)	686.6	7.71	683.42 681.42	cut 3.12	Elevation 691.42 150' rt down stream
1202		688.7 686.70	9.42	683.37 681.37	Cut 5.3	
1204		691.8 689.80	9.62	683.17 681.17	cut 8.8	
1205+80	Begin of Tunnel #6	702.8 700.8	9.79	683.00 681.00	Cut 19.8	
	Corrected Course of Tunnel			3.75		Mag. 575°33' E Mag. 1188°27' E
1280+72.5	End of Tunnel w side Creek	679.30 677.30	4.92	679.25 677.25	Cut 0.5	End 2/9/24 Begin 7/11/24
1281+10	☉ Creek bed	677.00 675.00		.07		
1281+40	East side Creek	677.30 677.30	3.00	679.18 677.18	cut 1.2	
1282		680.8 677.84	3.05	679.12 677.12	Cut 1.7	T.P. 2.87 677.30 + 11.12 688.42
1284			11.50	678.9 676.9		
1286			11.70	676.7		

9455.7  
547°23' E  
Mag.  
for tunnel

7492.5  
37.5



Williams Cr. Mt.  
 Van Horn Level  
 Brockett Transit  
 Thompson H. Ch.  
 Mansfield R. Ch.

Stout Rod + Stake man

7/1/24

21

	Elev	Gr. Rod	Grade			
1288		11.90	678.52 676.54			688.42
			.20			
1290		12.10	678.32 676.32			
			.10			
1291	T.P.	12.20	678.22 676.22	+ 9.03		685.25
			.20			
1293		9.23	678.02 676.02			
		.10	.10			
1294		9.33	677.95 675.92			
		.20	.20			
1296		9.53	677.72 675.72			
		.10	.10			
1297	T.P. 9.37	675.88 9.63	677.62 675.62	Cut 0.3	+10.56	686.44
			.07			
1297+75		10.89	677.55 675.55			
		.13	.13			
1299+00		11.02	677.42 675.42			
		.10	.10			
1300		11.12	677.32 675.32			
		.20	.20			
1302	T.P.	11.32	677.12 675.12	+11.20		686.32
			.10			
1303		11.30	677.02 675.02			
		.10	.10			
1304		11.40	676.92 674.92			



2/11/24

Williams Ch. Pkts.  
Van Horn level  
Brackett Frank  
Thompson H. Ch.  
Hansfield R. Ch.  
Stout Red.

22

		Elev.	Gr. Red.					
12	1305		11.50	676.92 674.92 678.82 674.82		+12.96	Σ 686.32 Σ 687.78	
12	1306		13.06	676.72 674.72				
12	1308		13.26	678.52 676.52 674.52				
12	1309+25	Intake Tunnel Portal #7	2.81	686.97 684.97	13.39	674.39 676.39	Cut 10.58 TP. 0.0 687.78 End 7/11/24	
	647.5	See page 83 this book						
12	1315+77.5	End Tunnel Portal #7	0.0	686.75 684.75		676.06 674.06	Cut 10.7 Σ 684.75 Begin 7/12/24	
	60.5							
12	1316+33.0	Grade point		674.0	10.75	676.00 674.00		
12	1 67				17.			
12	1318		10.94		17.	675.83 673.83		
12	1320		11.12		20.	675.63 673.63		
12	1322		11.32		20.	675.43 673.43		
13	1323		11.42		10.	675.33 673.33	TP. 11.43 673.32 +12.48 Σ 685.80	
13	1324		12.57		10.	675.23 673.23		
13	1325		12.67		10.	675.13 673.13		
					10.	673.03		



7/12/24

			Elev.	Gr. Rod	Grade		
1326	8.78		679.52 677.52	12.77	675.03 673.03	Cut 4.5	⌊ 685.80
1327	T.P. 5.37		682.48 680.43	12.87	674.93 672.93	cut 7.5	+12.23 ⌊ 692.66
1328	Beq. Tunnel #8	6.21	686.45 686.45	12.97	674.83 672.83	cut 13.6	True N 48° 00' E Mag N 32° 00' E
1361 + 34.4					673.16	(set at 673.06)	

see page 79 for Tunnel

Downstream Portal

3324.4







Williams  
notes Van Horn  
Rod Stout  
2/24-24  
clear

Σ	Ob. Dist	V. Ang.	D.F.P. Elev.	Hor. Dist	Elev.
	instan	R.I.	Elev.	857°	
5°15					
245°50	9.61	-2°50	-47.4	958.6	809.6
215°00	6.61	-5°10	-59.3	658.0	797.7
208°25	6.31	-5°20	-58.4	625.5	798.6
196°00	5.71	-6°10	-61.0	564.0	796.0
183°40	5.51	-6°40	-63.5	543.6	793.5
166°50	5.91	-7°00	-71.5	582.2	785.5
154°10	6.61	-6°40	-76.5	652.1	780.5
141°30	6.71	-7°00	-81.0	661.0	776.0
135°35	6.61	-7°25	-84.5	650.2	772.5
131°40	6.81	-7°20	-86.3	670.0	770.7
128°20	7.66	-6°50	-90.5	755.2	766.5
125°20	8.66 x	-6°35	-97.6	859.8	758.5
122°05	7.71	-6°50	-91.2	760.1	765.8
115°50	7.16	-7°05	-87.7	705.4	769.3
102°05	7.31	-7°05	-89.5	720.1	767.5
89°20	8.16	-5°50	-82.5	807.5	774.5
85°10	8.51	-5°15	-77.5	844.1	779.5
79°05	8.76	-4°45	-72.3	870.2	784.7
73°15	8.91	-4°15	-65.8	886.3	791.2
68°40	8.91	-3°55	-60.8	887.0	796.2
58°35	9.71	-3°00	-50.7	965.3	806.3
54°50	10.51	-2°20	-42.8	1049.2	814.2
67°35	10.86	+0°45	+14.2	1088.9	871.2

H.I. 5°

To South Axis of Raden Canyon Dam Site

edge of Road

" " "

" " "

" " "

" " "

" " "

" " "

✓

" " "

edge of Rd @ center of Big Dams

edge of Rd @ North Edge of "

edge of Rd.

" " "

" " "

" " "

@ branch to Jones' Ranch

" " "

" " "

✓

" " " Edge of Road at Bend to Branch of Confluence

1st Break on Ridge at Bend.



Inston Pk. (Continued) Elev. 857°

H.I. 5°

74°45	11.26	+1°35	+ 31.7	1125.2	888.1	2 <sup>nd</sup> Break on Ridge at Bend.
80°50	11.16	+2°00	+ 38.9	114.7	895.9	
84°55	11.51	+2°20	+ 46.8	114.71	903.8	in small draw
90°30	12.46	+2°40	+ 57.9	1243.3	914.9	Ridge between small draws
96°00	11.61	+3°10	+ 64.0	1157.4	921 <sup>0</sup>	in small draw.
102°50	11.01	+3°55	+ 74.9	1096.0	931.9	
109°15	11.31	+4°10	+ 82.0	1125.0	939 <sup>0</sup>	on Ridge of Bend into large draw.
117°25	12.45	+3°15	+ 70.5	1241.2	927 <sup>5</sup>	W. slope of draw
119°00	13.31	+3°10	+ 73.4	1326.9	930.4	in branch of draw
122°05	14.01	+3°10	+ 77.3	1396.7	934.3	" " " "
125°25	13.41	+3°10	+ 74.0	1336.9	937 <sup>0</sup>	Ridge between draws { draws join 1/2 way between Rd & this point.
133°00	14.61	+3°10	+ 80.6	1455.5	937 <sup>6</sup>	Channel of Main Draw
136°10	13.40	+3°20	+ 77.9	1335.5	934 <sup>9</sup>	small Ridge
142°10	12.21	+3°20	+ 70.8	1217.0	927 <sup>8</sup>	" "
150°00	10.81	+2°50	+ 53.4	1078.4	910 <sup>0</sup>	Small Draw
130°20	-	-	-	-	-	" " intercepts Road approx. 150' W of main dr.
151°50	10.21	+3°15	+ 57.8	1017.8	914.8	
155°05	9.21	+3°00	+ 48.1	918.5	905.1	Beginning of Round Point
160°05	8.40	+3°05	+ 45.1	837.7	902.1	on E slope of draw
166°	8.01	+3°00	+ 41.8	798.8	898.8	Depression in Point
175°30	6.96	+3°35	+ 44.0	693.4	901 <sup>0</sup>	on Round Point
183°45	6.56	+2°35	+ 29.5	654.8	886.5	" " " at Bend to draw
191°15	6.61	+1°55	+ 22.1	660.3	879.1	" " "
202°15	6.91	+1°40	+ 20.1	690.4	877.1	" " "



618	633	550
350	370	440
268	263	770

24-24 27

Qz.	Co. Dist	V.A.	Diff. Elev.	Hor. D.	Elev.
	Inst. on A1. (con.)		Elev	857°	
214.30	7.71	+1025	+ 19.0	770.6	876°
221°50	8.57	+1°40	+ 25.0	856.1	882°
228°55	9.00	+0°20	+ 5.2	900.0	862°
236°35	9.50	-0°50	- 13.8	949.8	843°
242°50	9.65	-2°00	- 33.7	963.8	823.3
253°10	9.40	-4°40	- 76.2	933.8	780.8
257°55	9.60	-5°10	- 86.1	952.2	770.9
266°15	9.90	- 7°15	- 123.9	974.6	733.1
267°55	10.00	-7°45	- 133.6	982.2	723.4
B, 122°15	1.12	-16°34	- 30.6	102.9	826.4
B2 266°33	2.65	-9°43	- 44.08	257.5	812.9

on Round Point  
 Top of Ridge  
 " " "  
 " " "  
 " " "  
 " " "  
 " " "  
 " " "  
 " " "  
 " " "  
 " " "  
 line is about 50' N of R.D.M.W. on road

Inst at B2 Elev. 812.2

Starting from A-B, Produced Qz 266°33

276°45	7.10	-10°40	- 129.15	685.7	683.8
276°05	7.90	- 9°10	- 124.3	771.0	688.6
286°45	8.81	-9°00	- 136.0	859.5	676.9
268°20	6.31	-12°00	- 128.3	603.7	684.6
288°00	4.91	-15°10	- 123.9	457.3	689.0
210°05	4.26	-17°20	- 121.2	388.2	691.2
A- 182°30	4.21	-16°40	- 115.9	386.4	697.2

on Peery nose H.I. 5°  
 Edg Cr.  
 Edg Cr.  
 Top of S1 & Edg of CC. } Island  
 H<sub>2</sub>O level main channel  
 Top of Slope.  
 Top of Slope  
 Top of Slope  
 " " "

Inst at N. Axis Elev. 825.2

Starting from S. Axis Qz 182°00

218°25	4.21	- 18°50	- 128.6	370.1	696.4
192°20	3.57	-22°30	- 126.3	304.8	698.3

H.I. 5°  
 Top of S1 & chart reading  
 " " "



Inst on S. Axis (Con). Elev 825° = **825°** H.I. 5°

166°25	3.81	-19°40	-120.7	337.8	704.3	Top of Sl
155°30	4.00	-19°00	-123.1	357.6	701.9	Top of C. H <sub>2</sub> O Level

Inst on B, Elev. **8264**

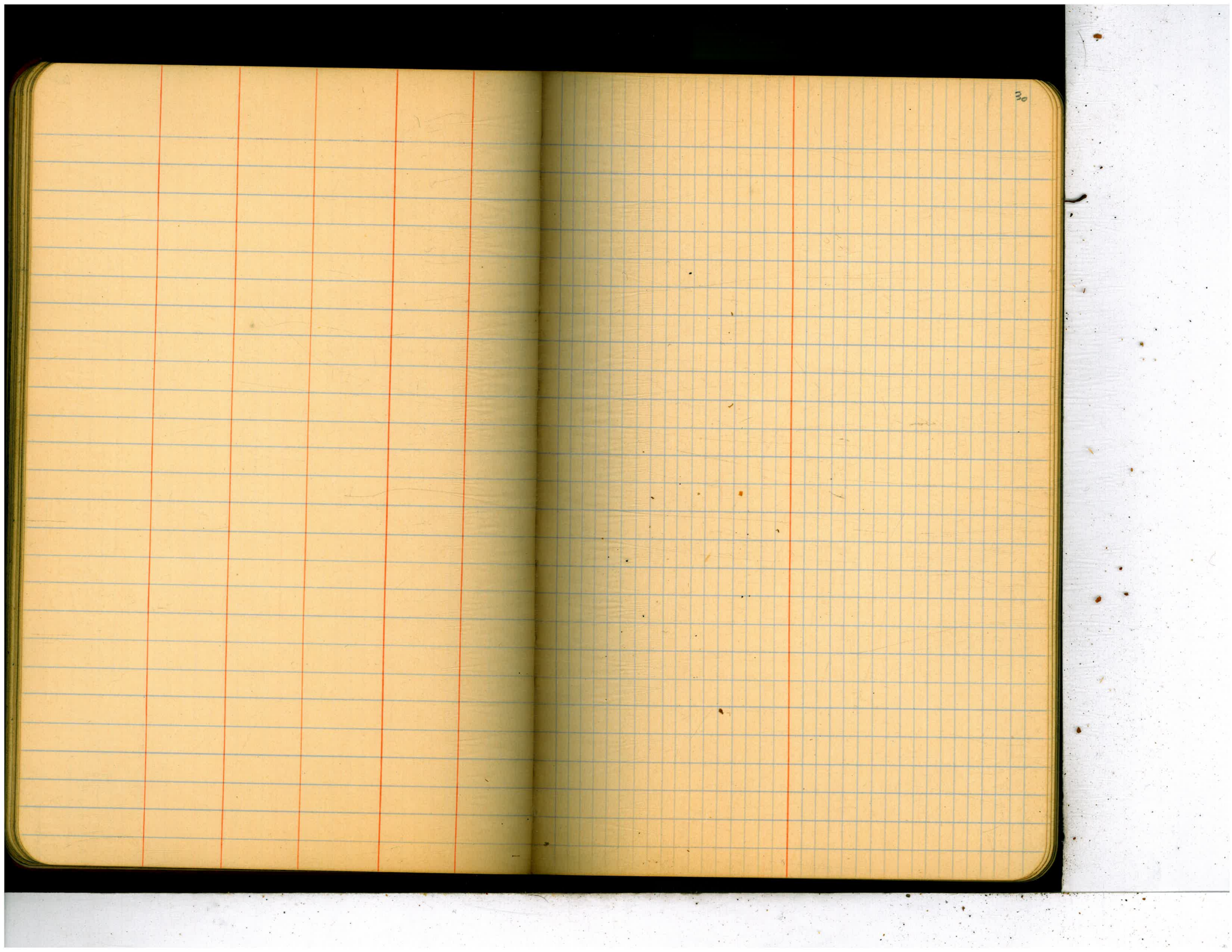
Starting from P<sub>1</sub>-B, Reduced  $Q_2$  122° 15'

170°10	4.36	-17°15	-123.5	398.1	702.9	Top of Sl
157°55	5.01	-14°00	-117.6	471.6	708.8	" " "
133°45	4.81	-14°35	-117.2	450.8	709.2	" " " 50' W. of mouth of Draw
125°30	4.91	-13°00	-107.6	466.2	718.8	on Rocky E Bank of Draw
107°50	5.40	-11°45	-107.7	518.0	718.7	Top of Sl
88°55	5.71	-10°50	-105.4	550.7	721.0	" " "
76°20	6.06	-10°10	-105.3	587.1	721.1	" " "
58°25	6.01	-10°40	-109.3	580.4	717.1	" " "
45°35	6.70	-9°35	-110.0	651.7	716.4	" " "
36°25	7.41	-9°10	-116.5	722.2	709.9	Top of Sl. & edge of Cr
44°00.	8.85	-7°50	-43.7	882.8	782.7	Break in Sl on Bend @ Reservoir (Bench in Back Steeps to Cr.)
57°20	7.10	-5°20	-65.7	703.9	760.7	@ Bee Hives
55°45	5.25	-13°30	-119.1	496.4	707.3	edge of Cr. on Sand Bank } channel turns sharply N. For 50' then continues W.
77°55	5.00	-14°30	-121.2	468.7	705.2	" " " " " " } channel in N
105°50	4.61	-16°10	-123.3	425.3	703.1	on Sand Bank slightly higher than channel
128°35	4.15	-18°15	-123.5	374.6	702.9	Edge of Cr.
194°50						

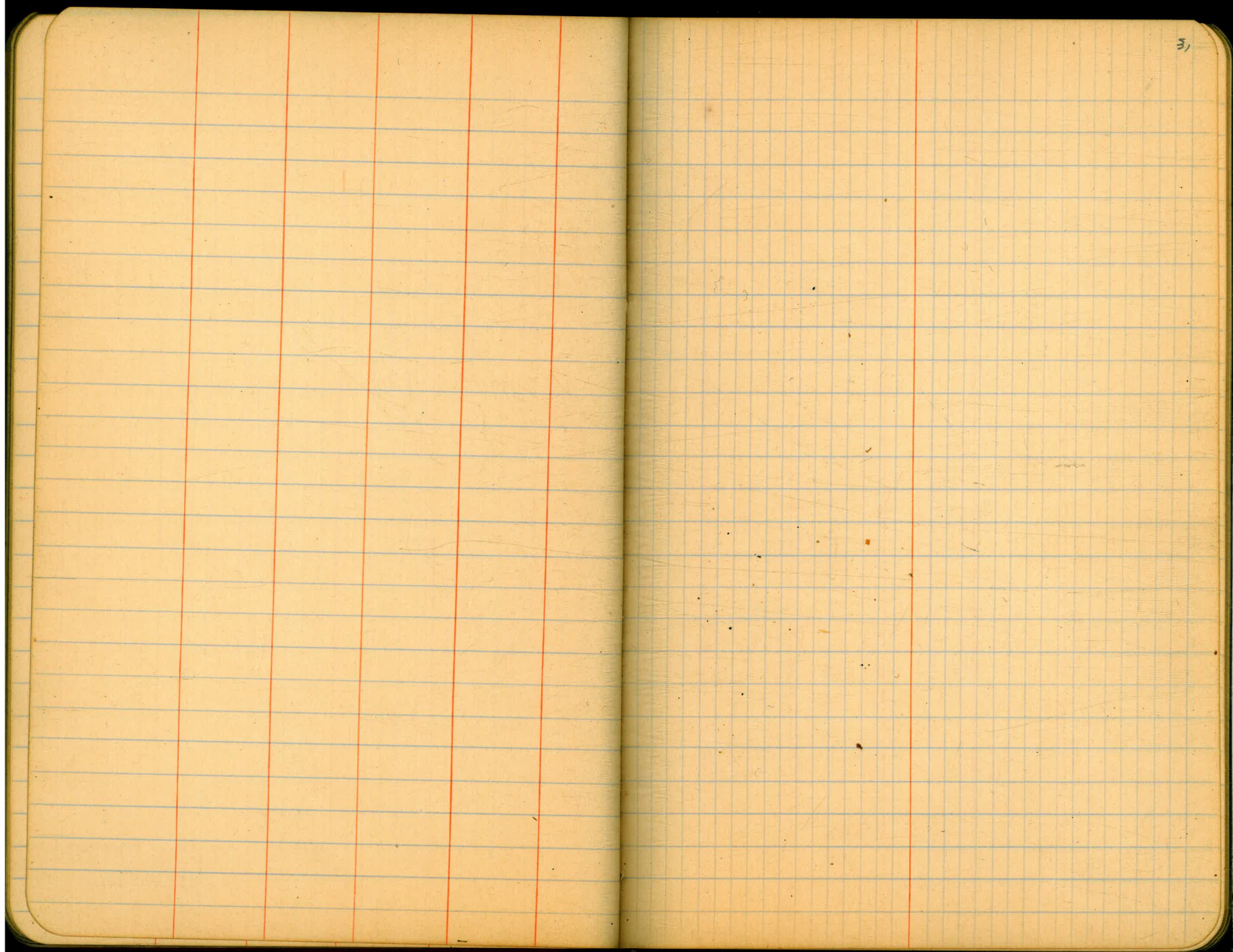
















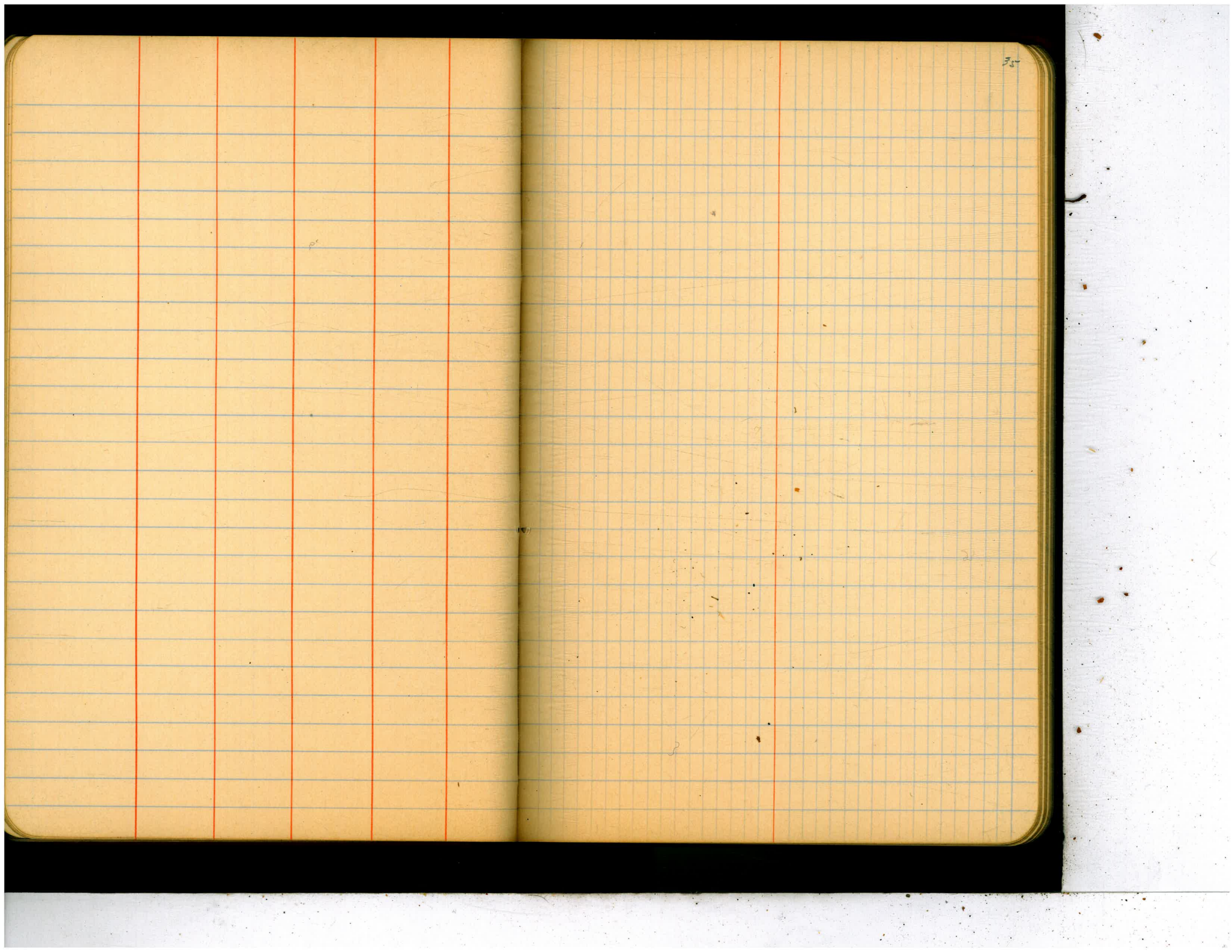








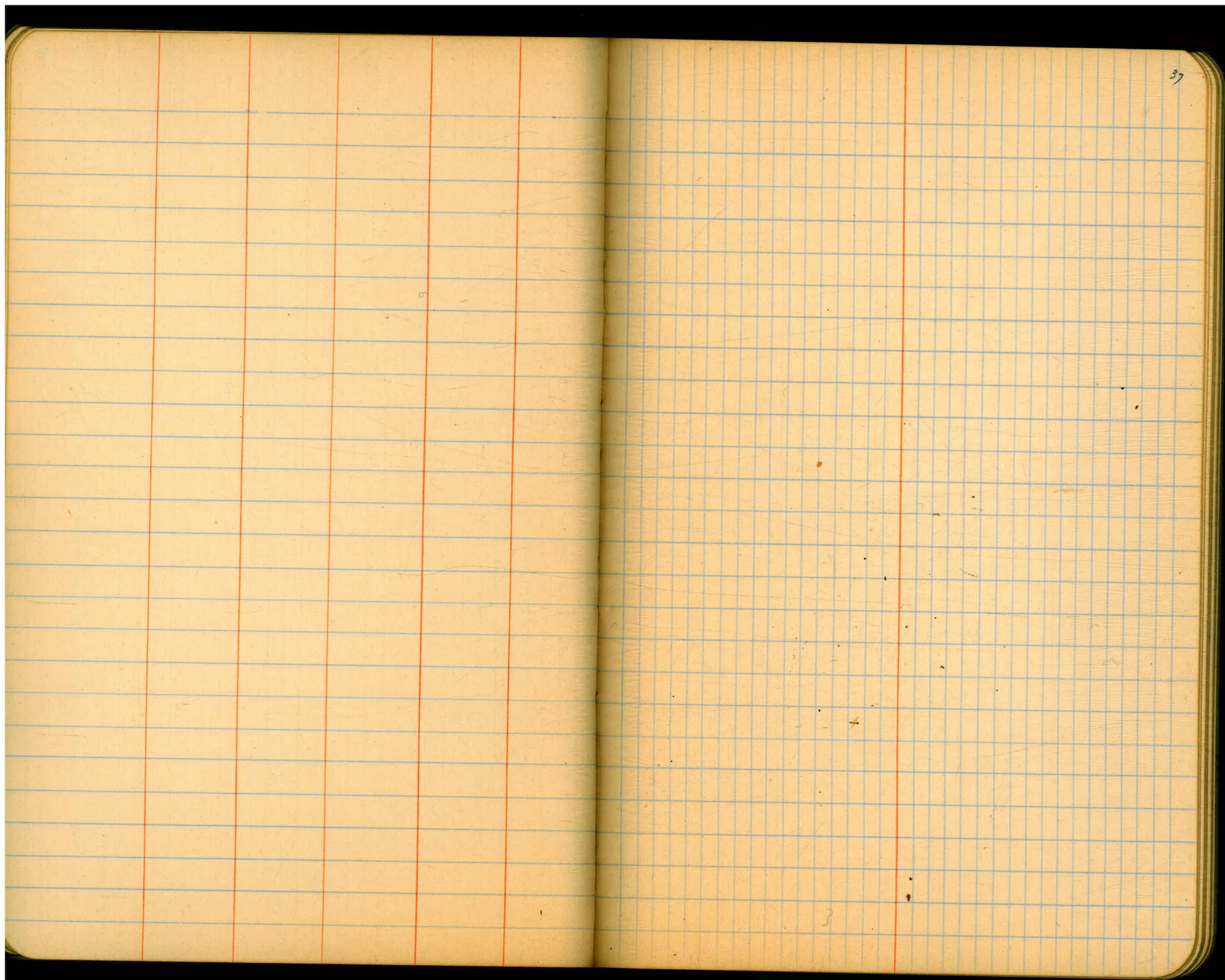












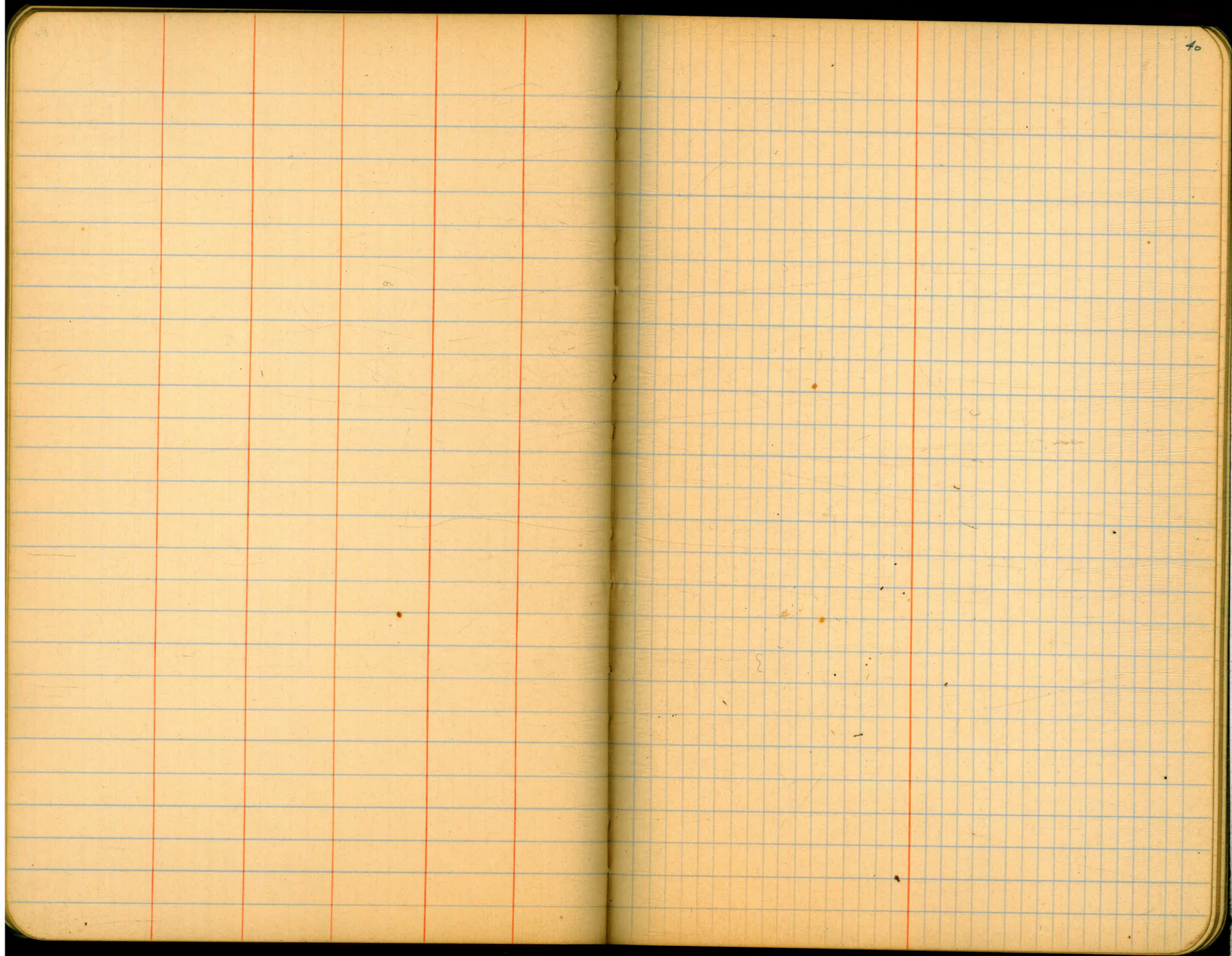




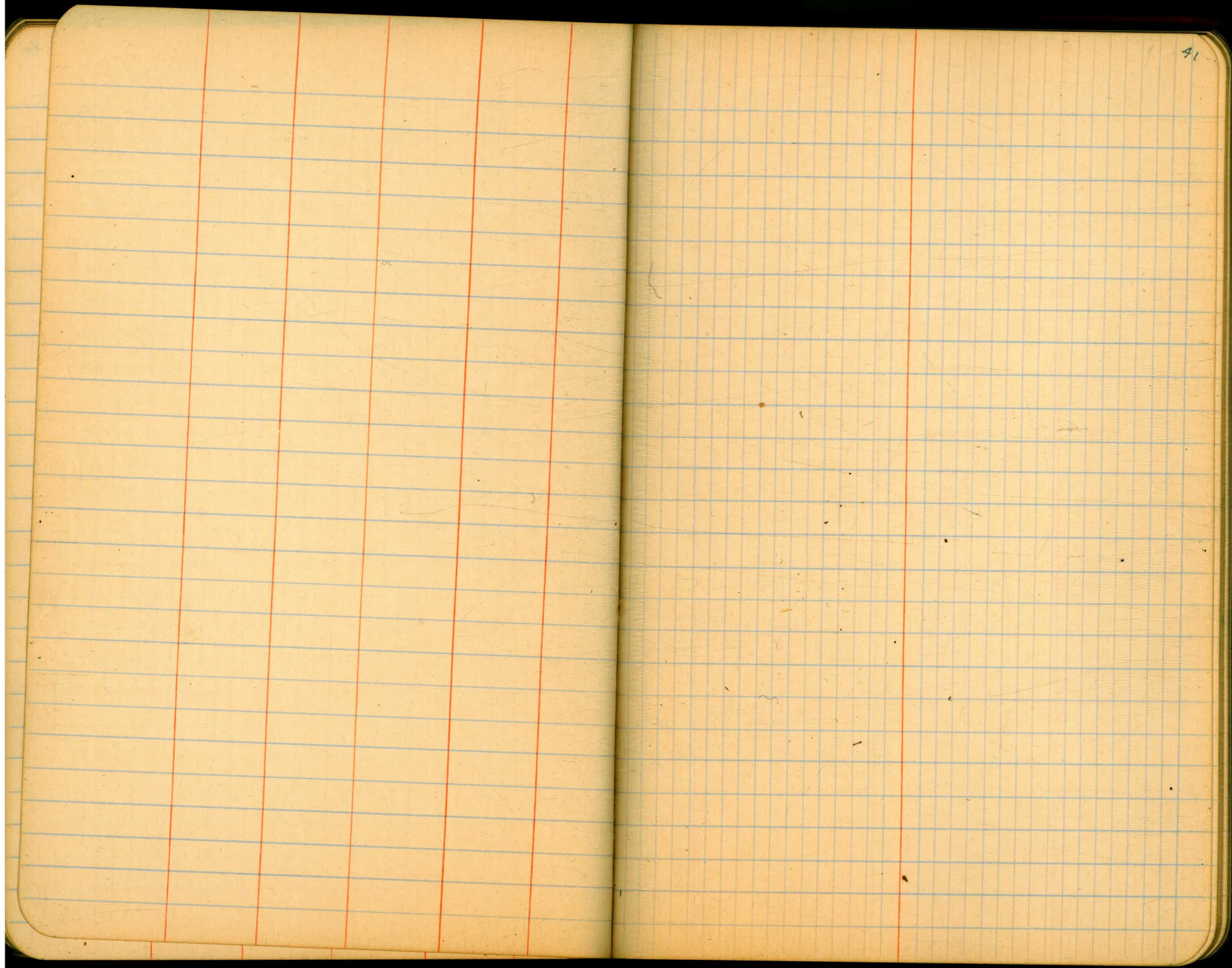












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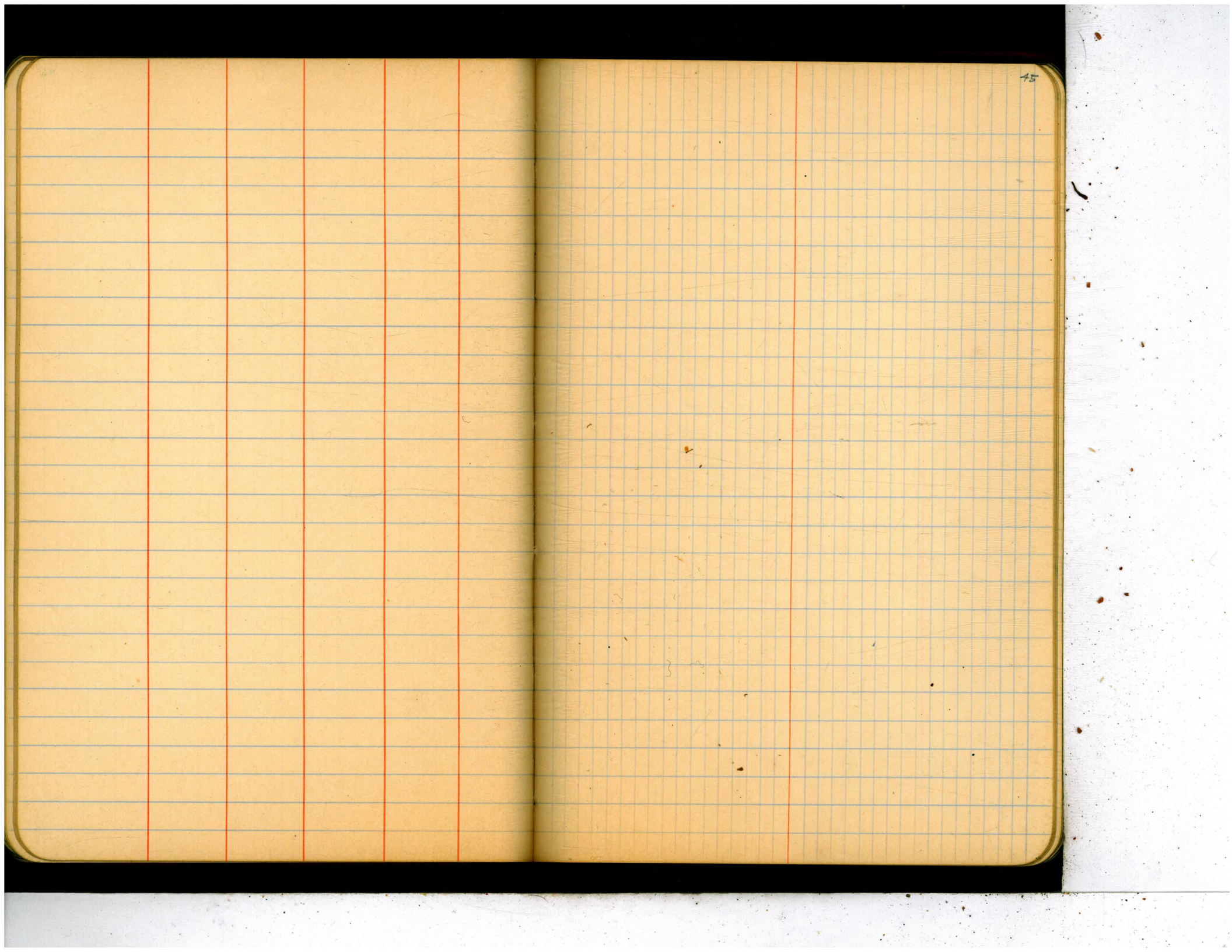








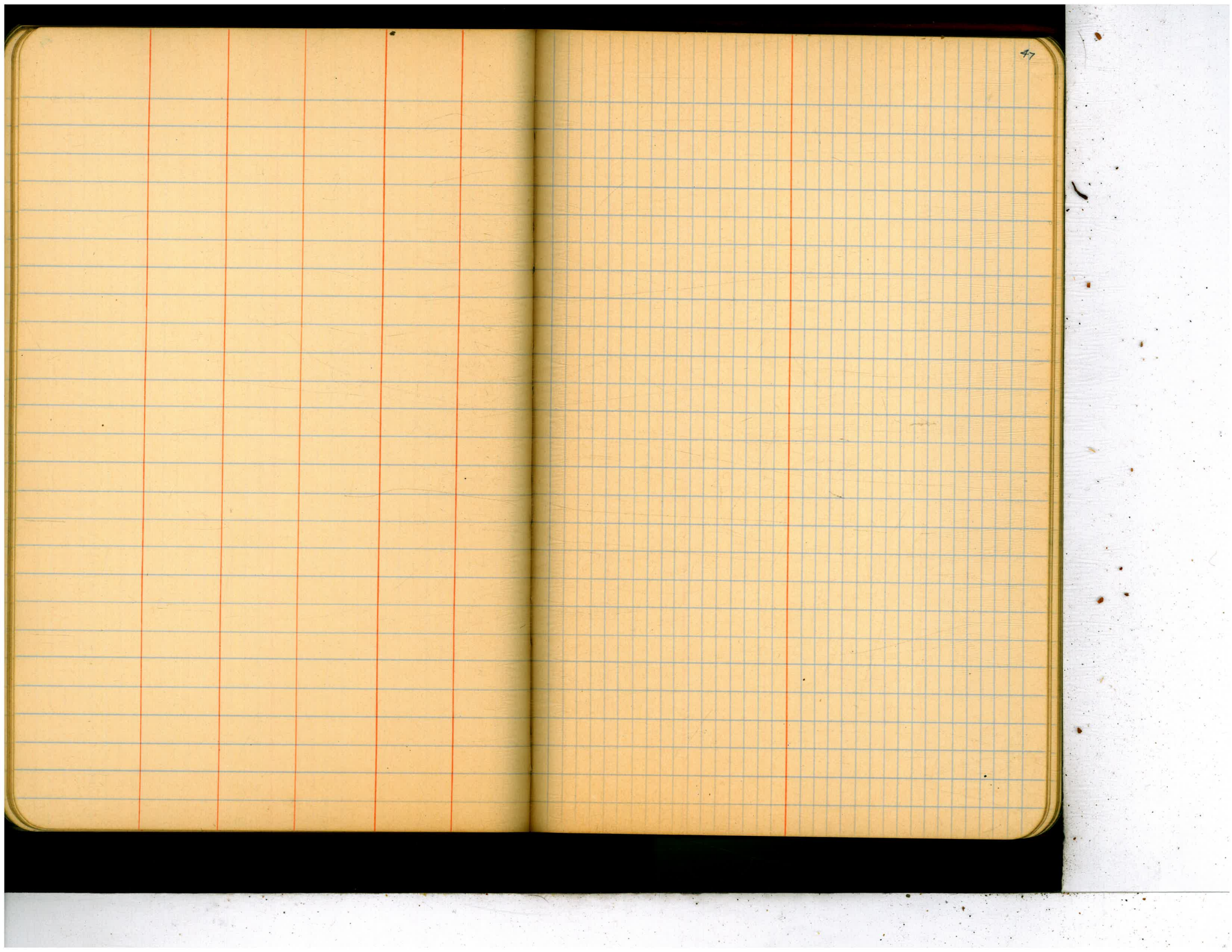




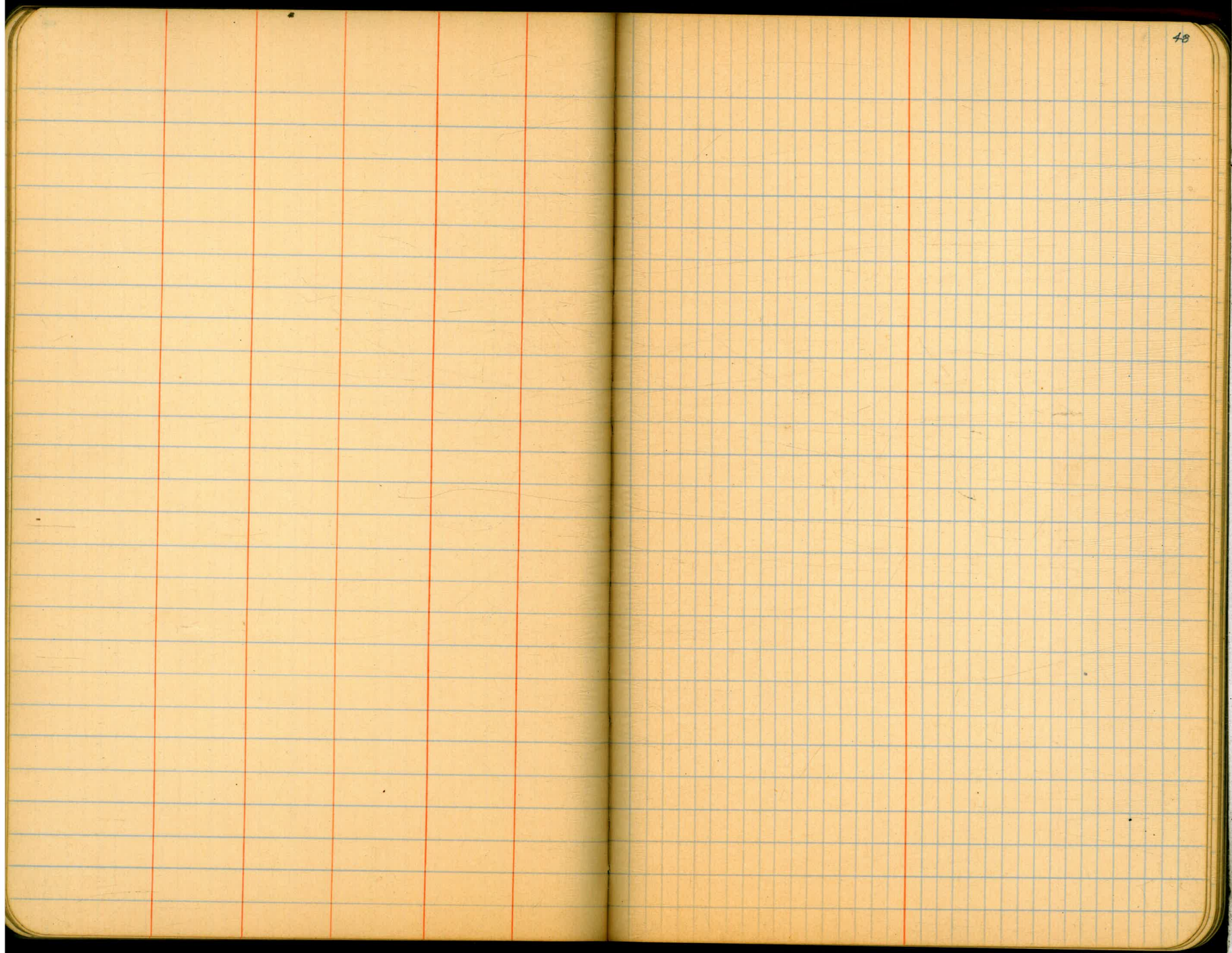




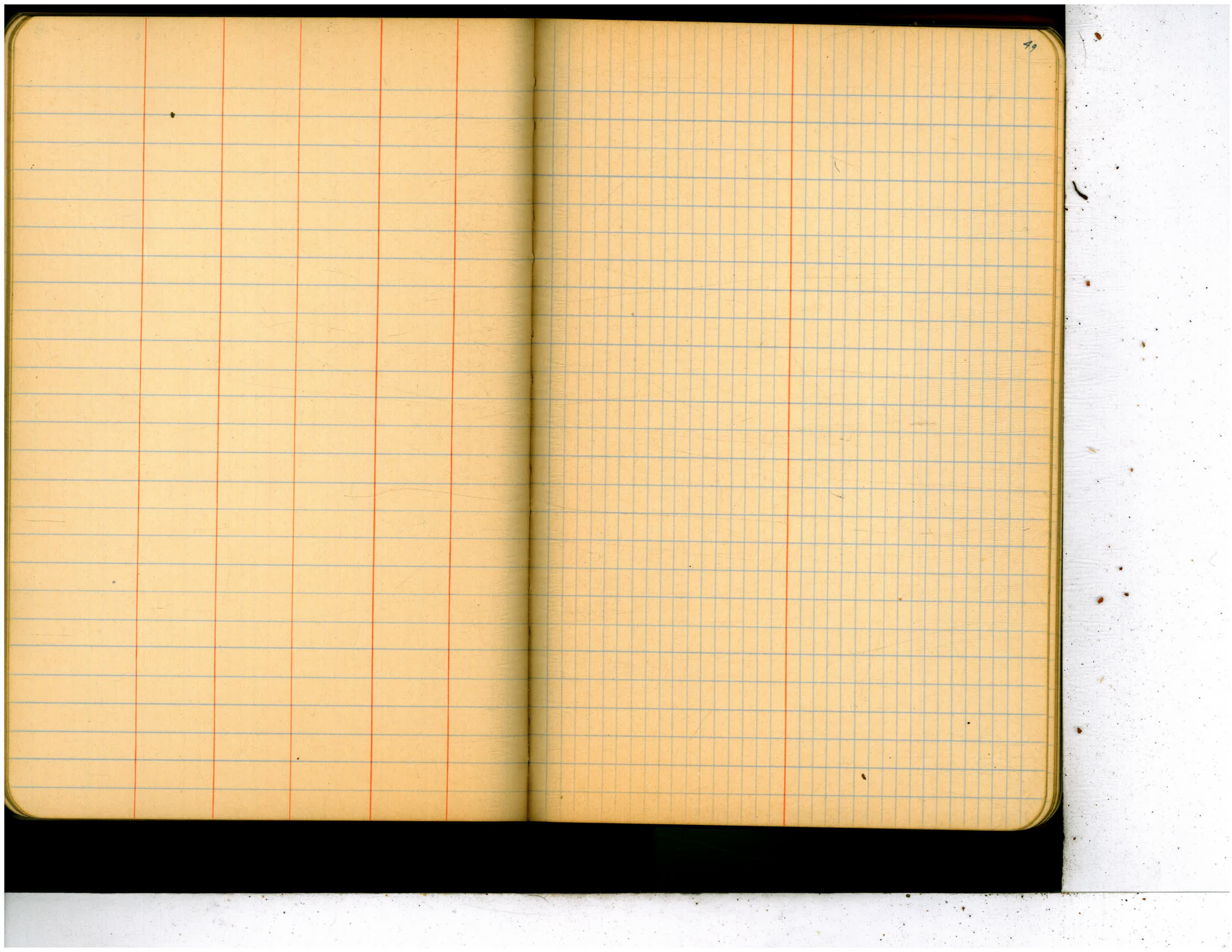








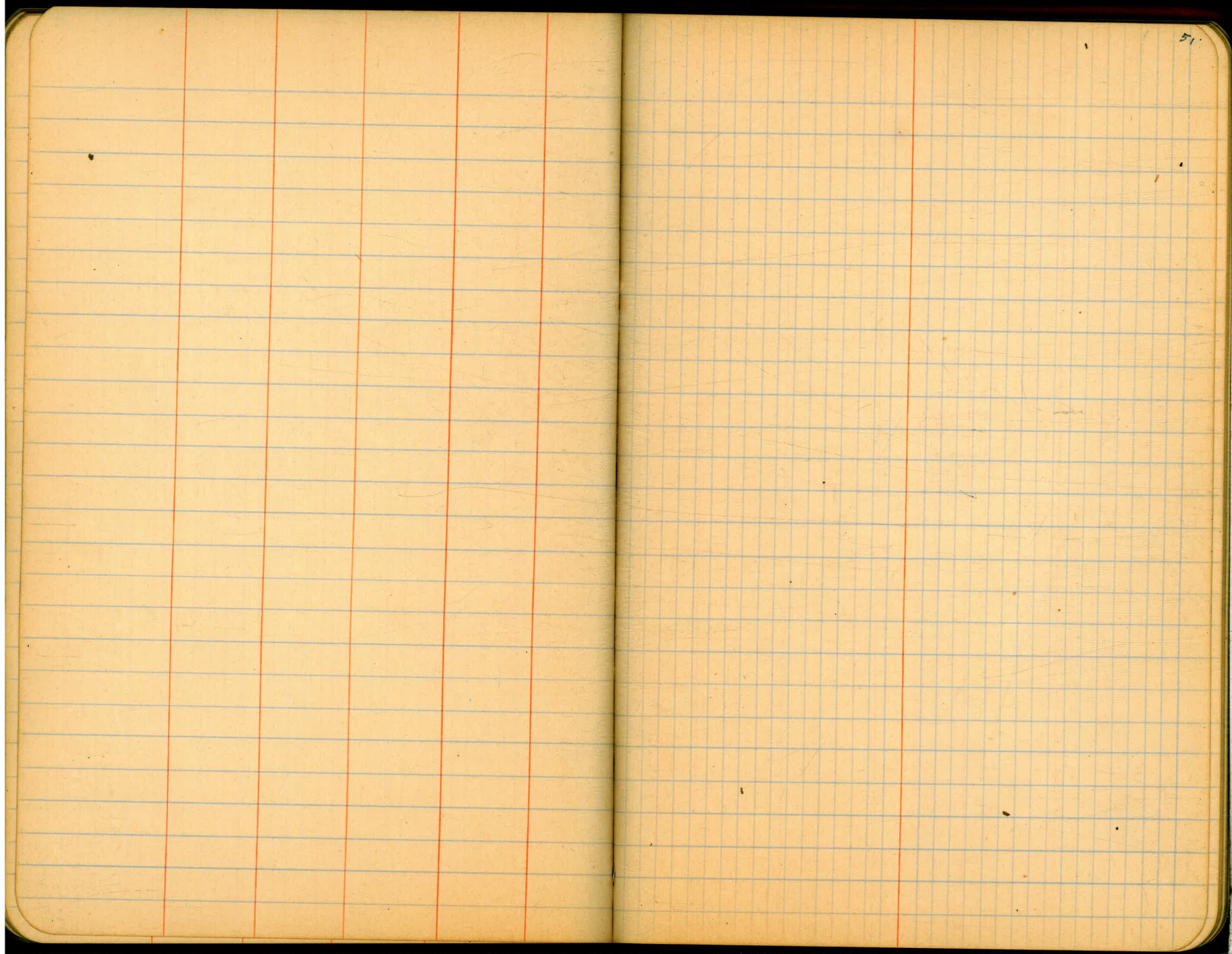




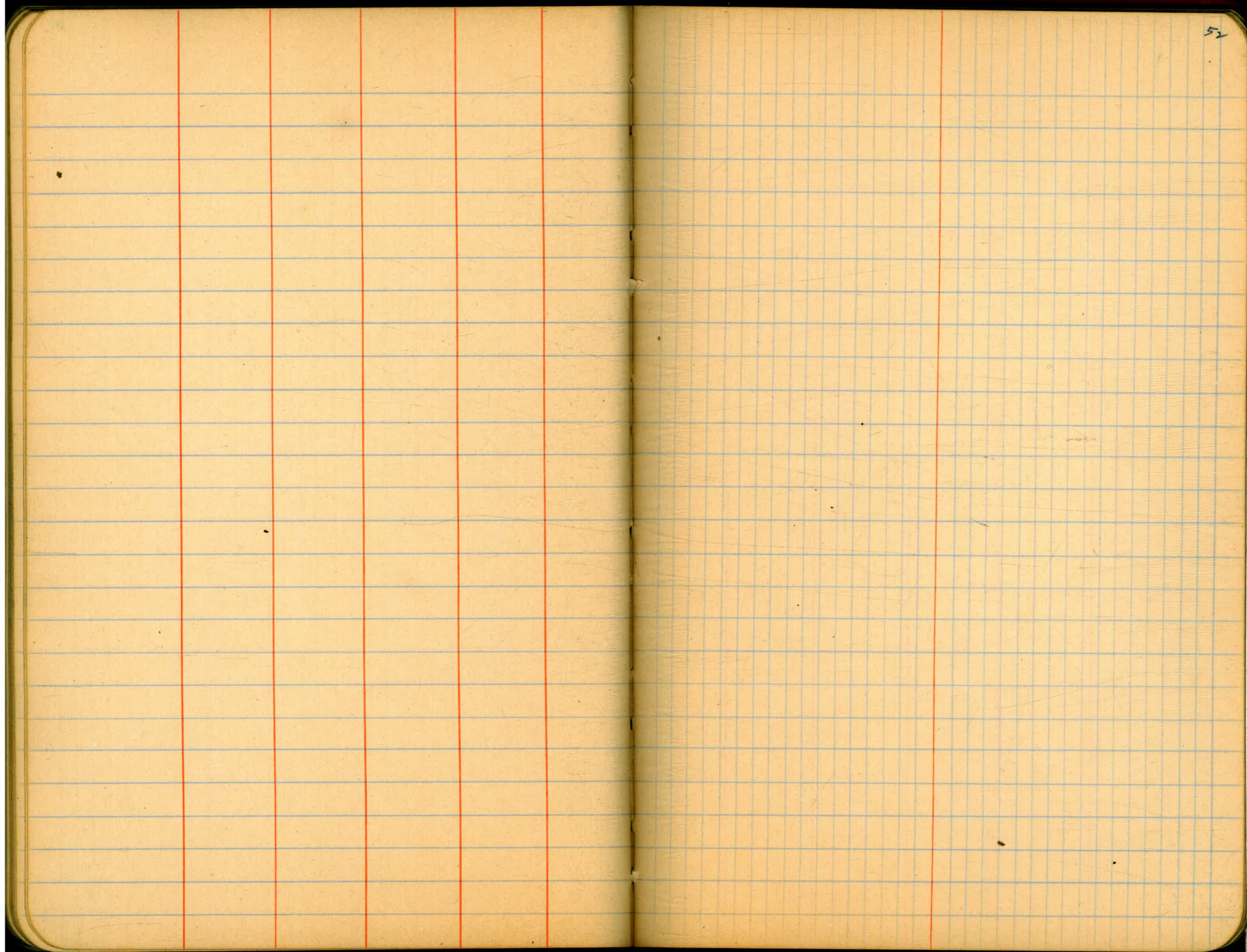








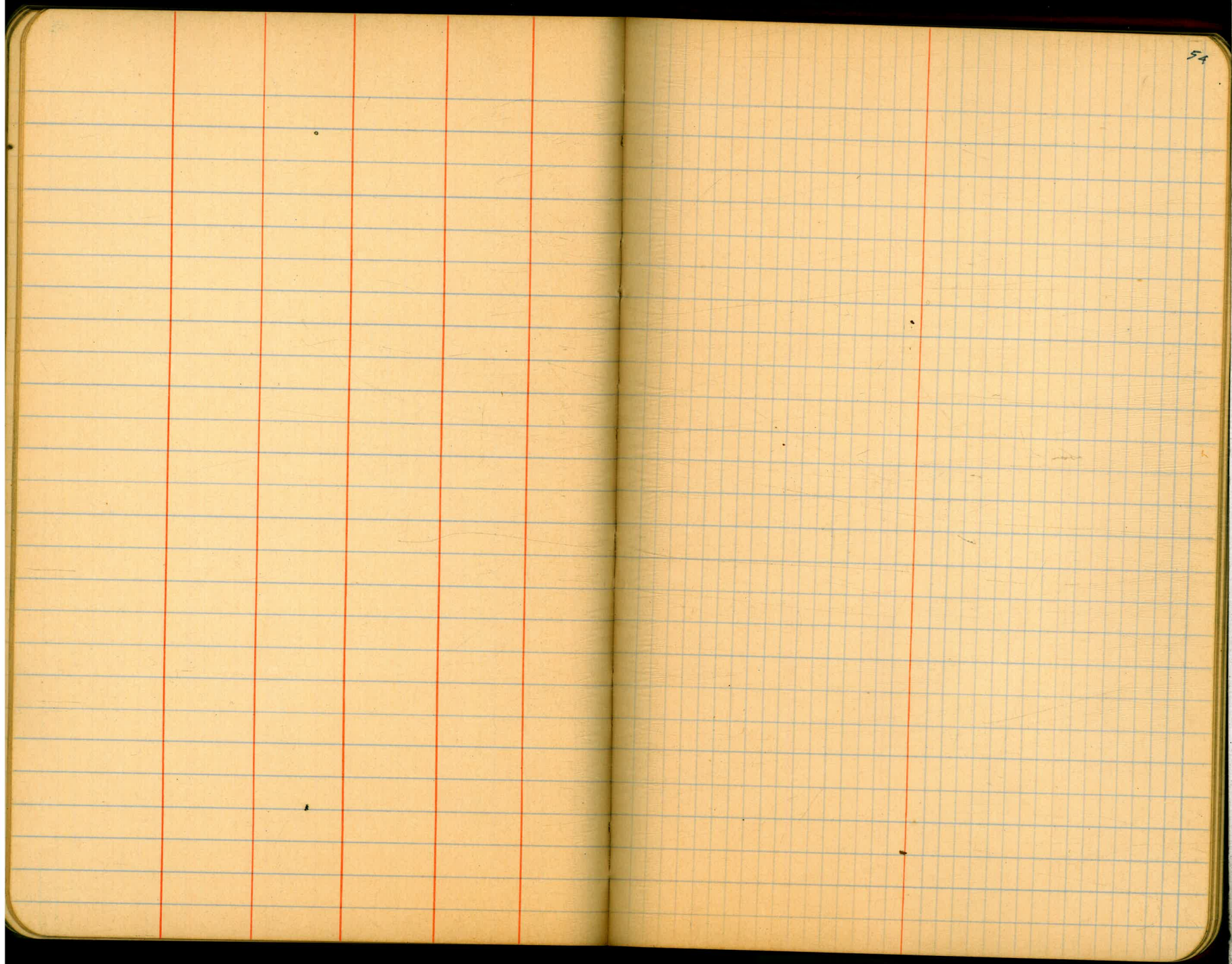




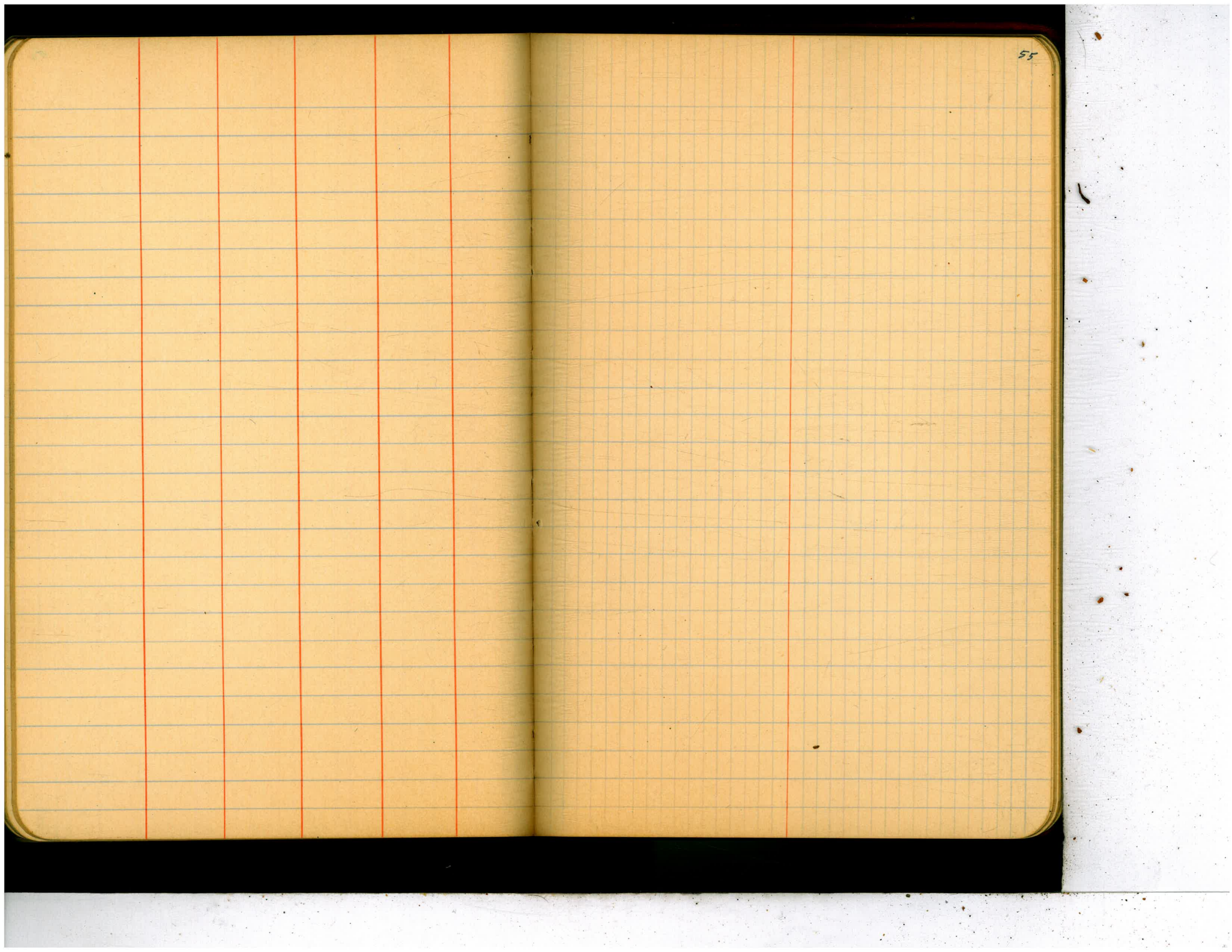








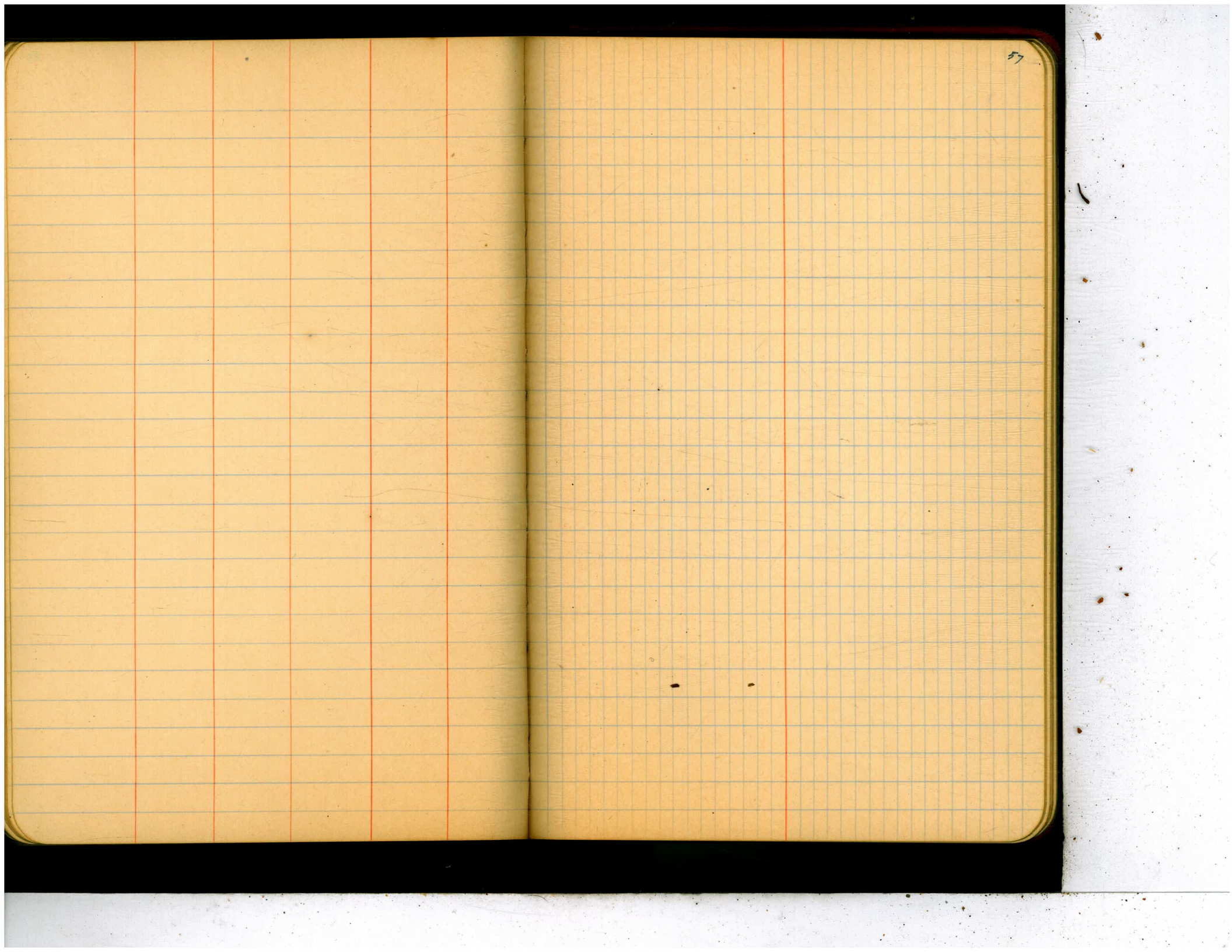




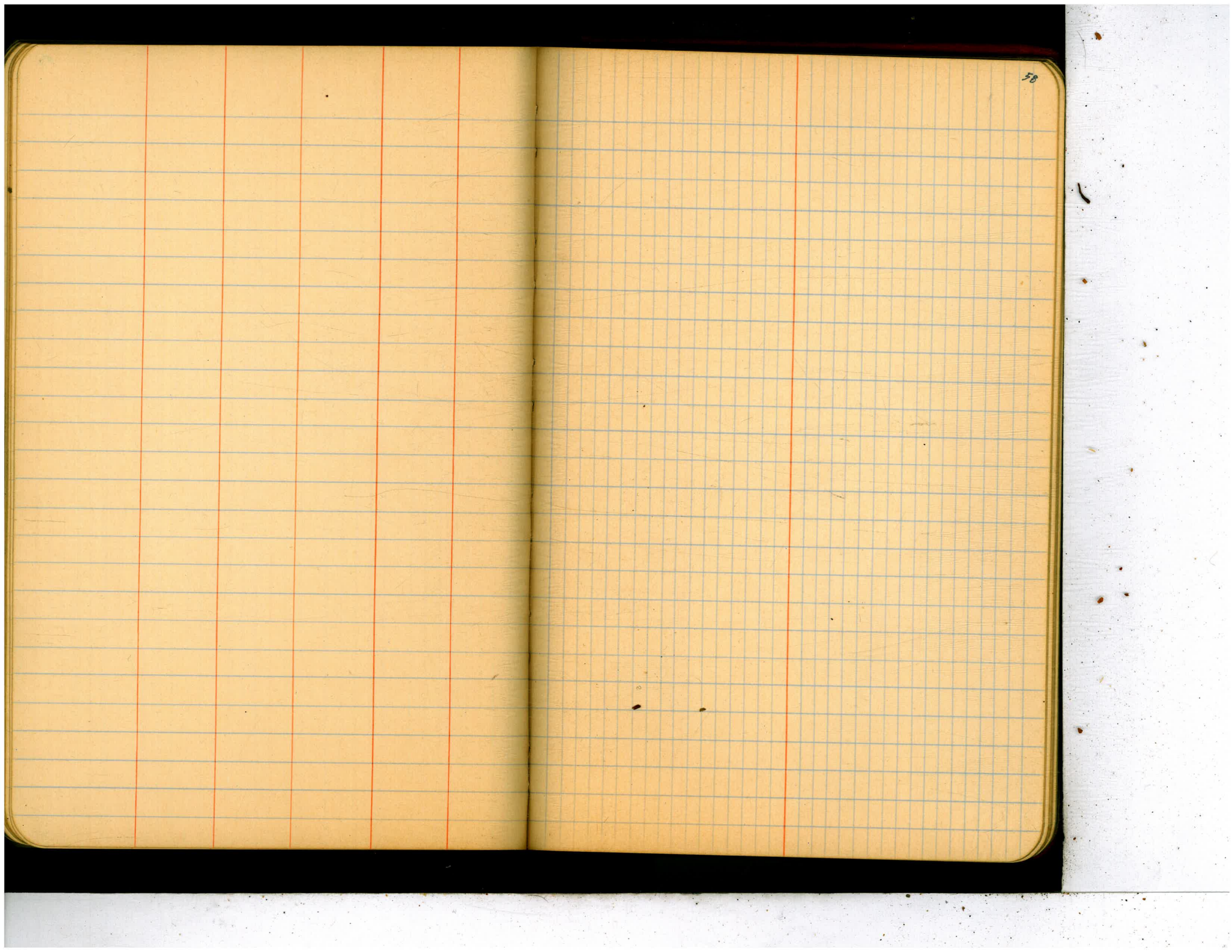




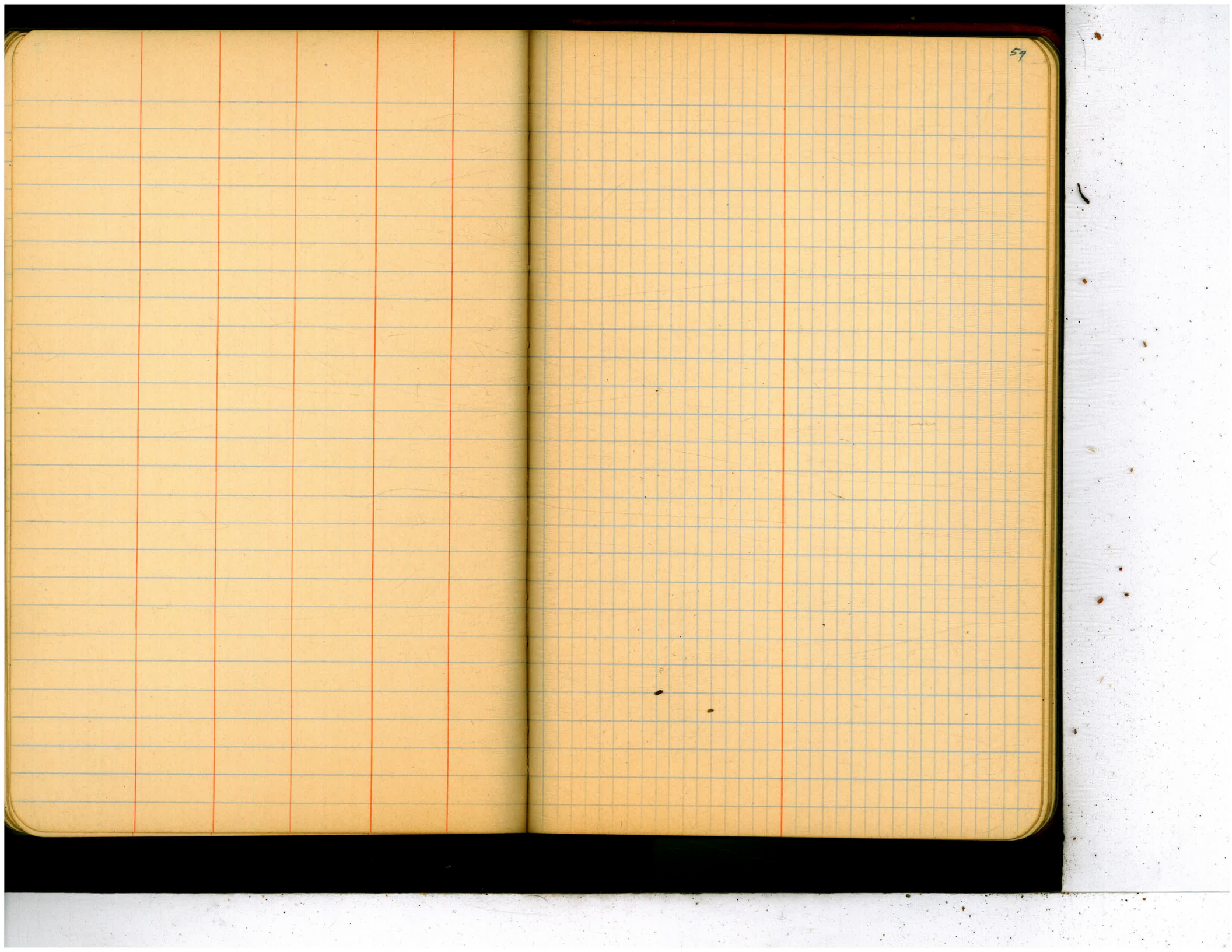




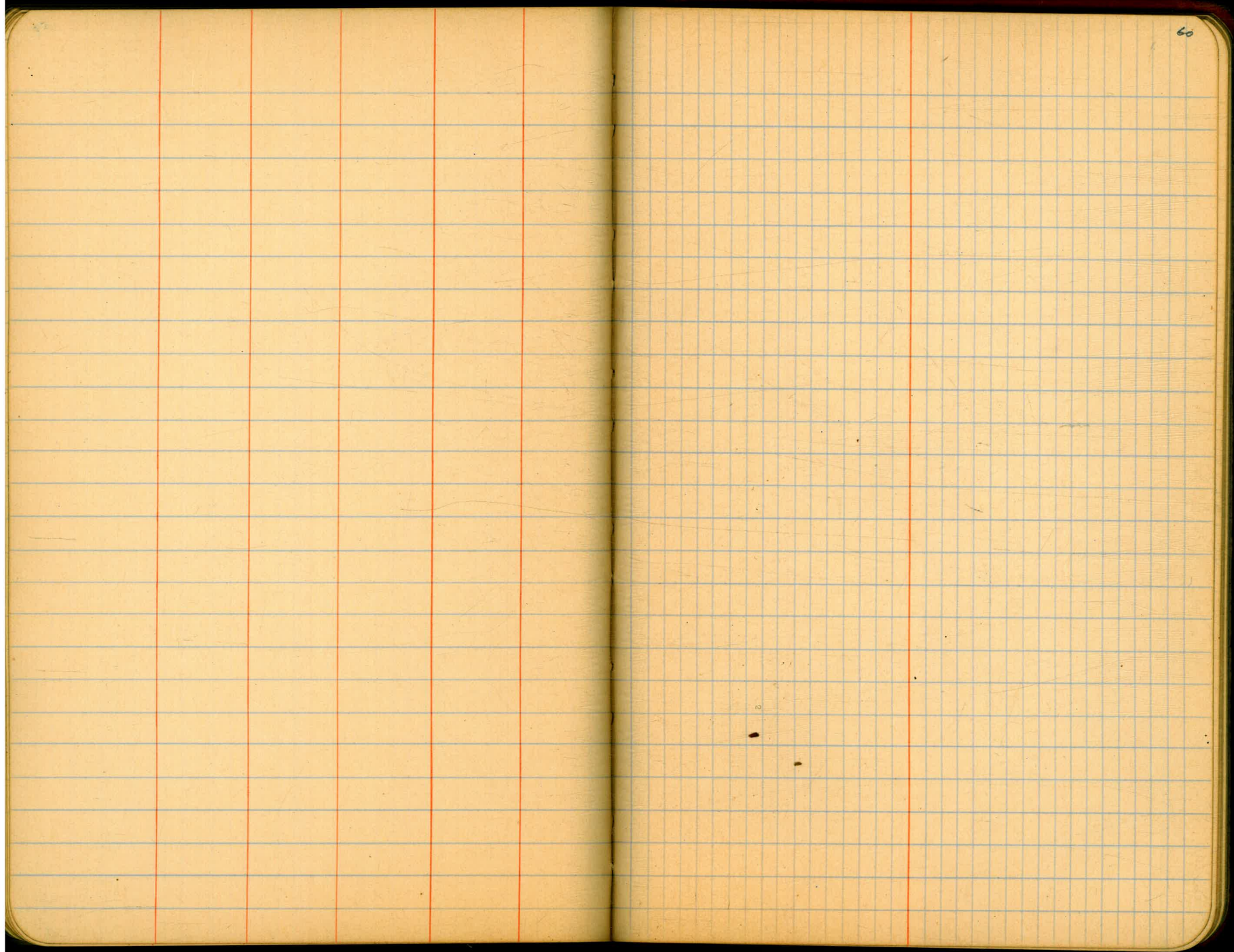




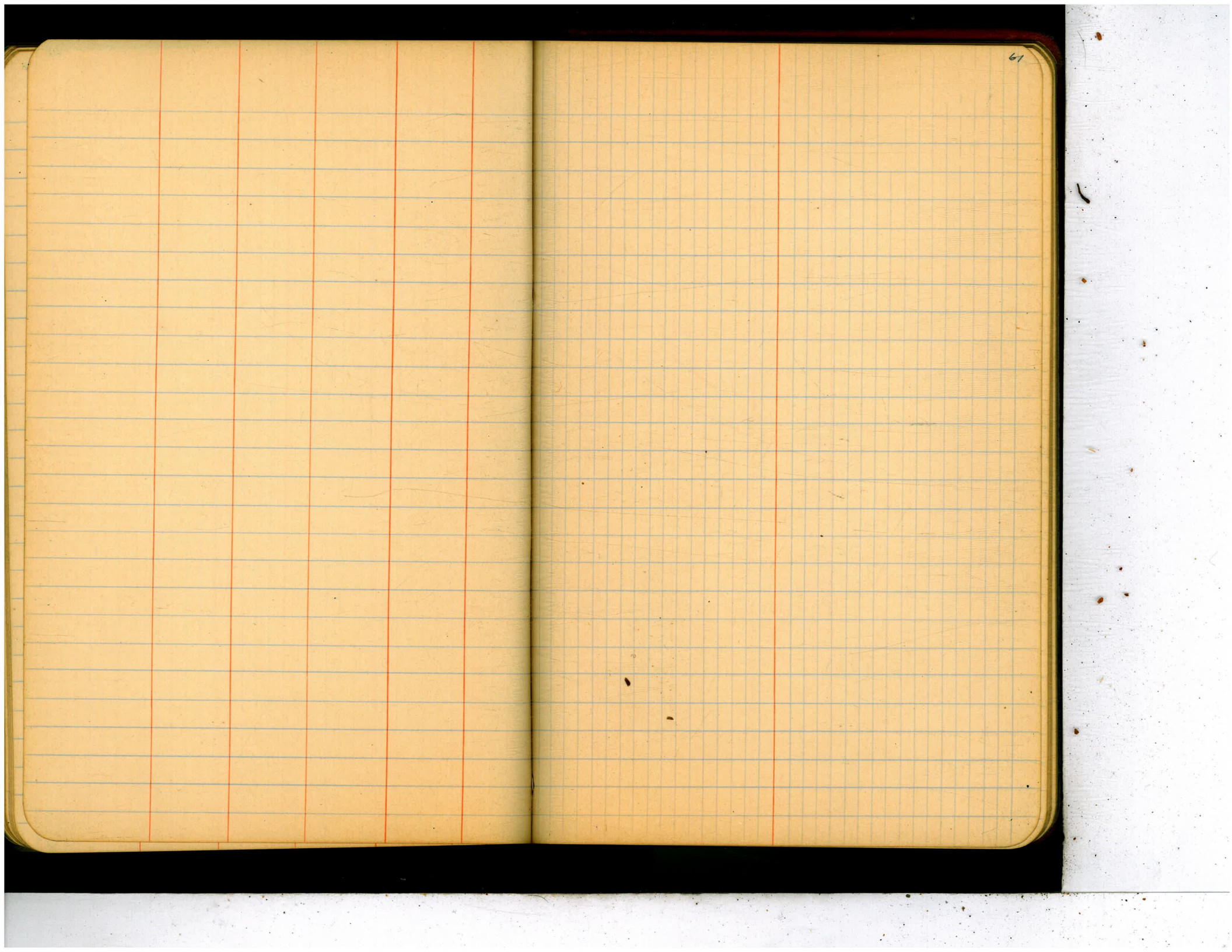










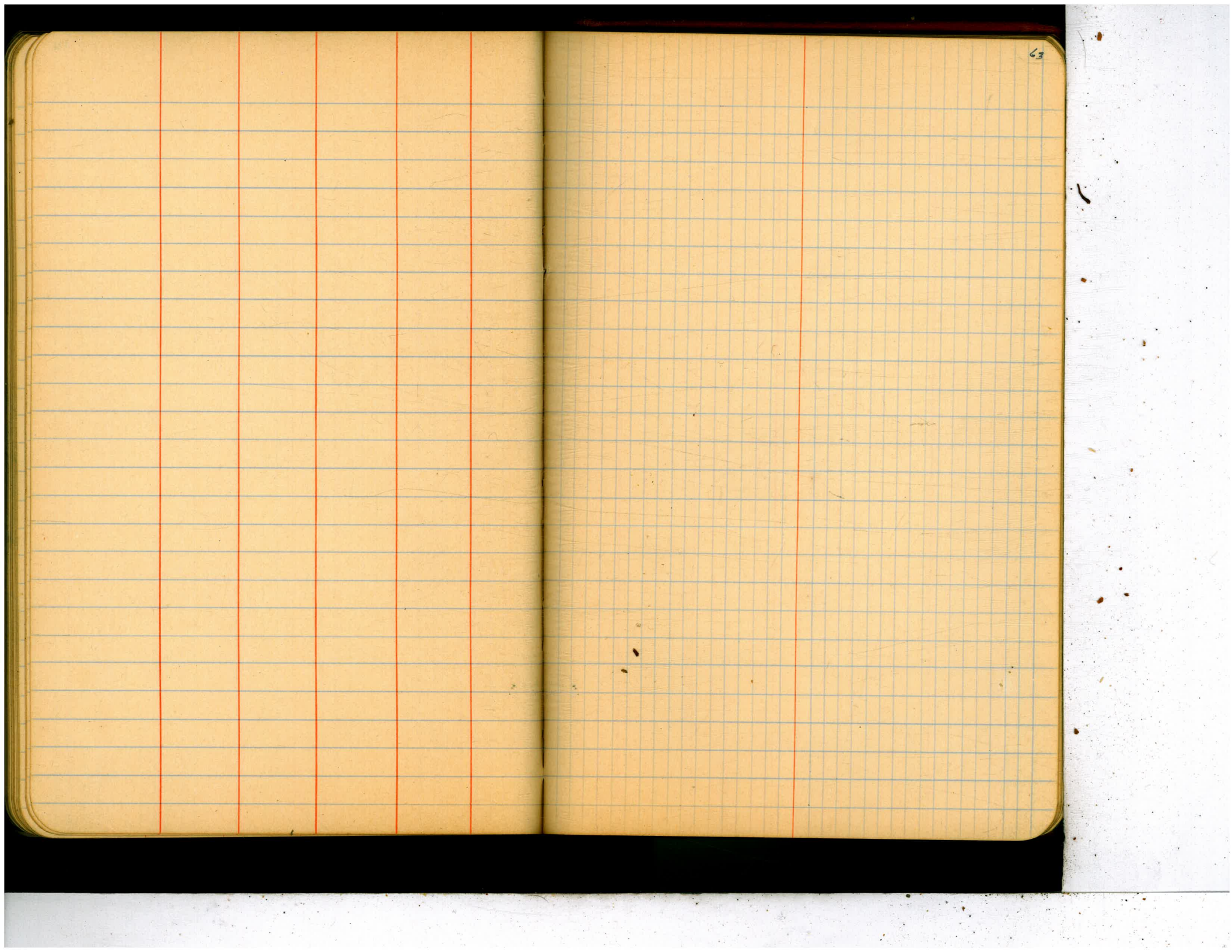


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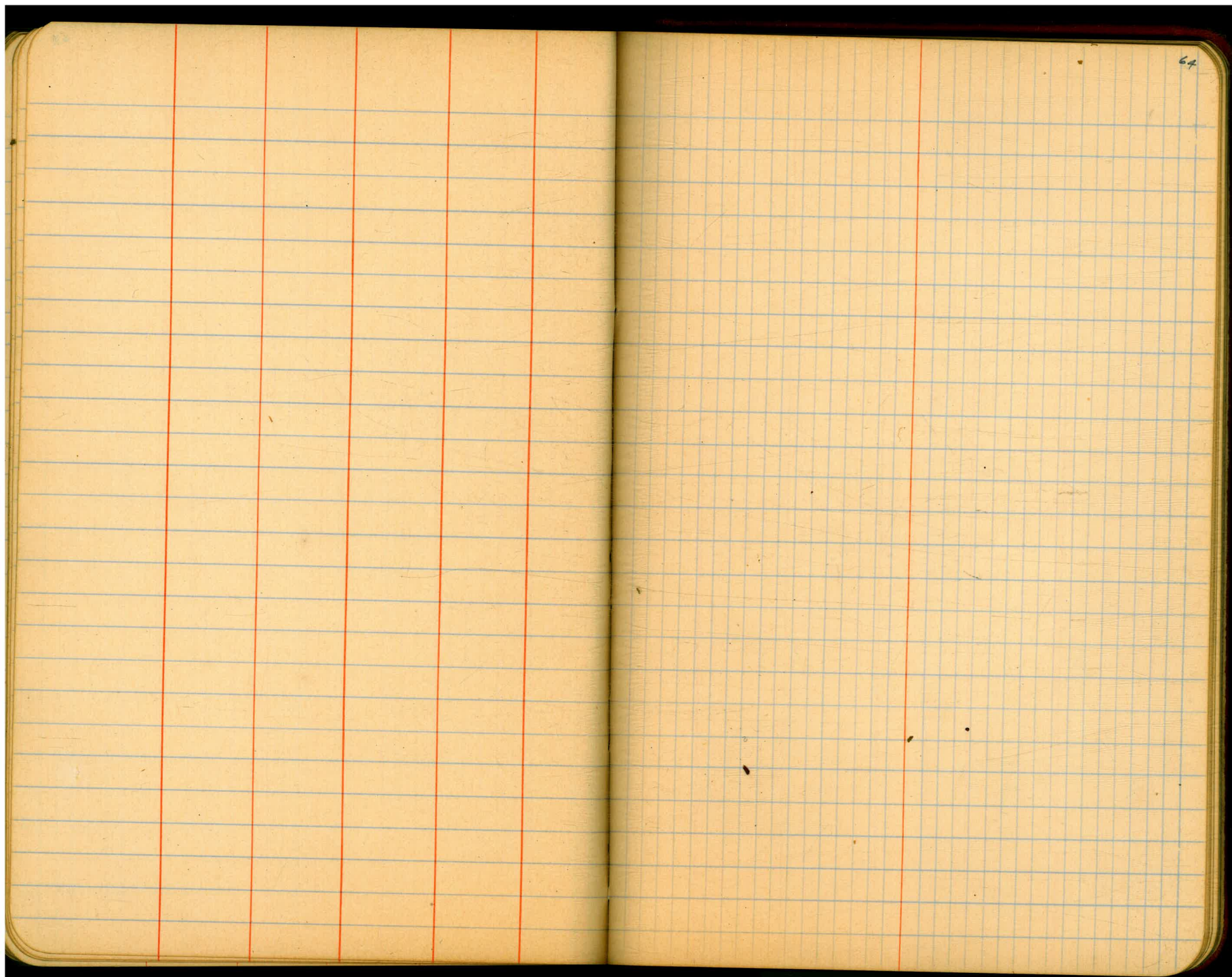




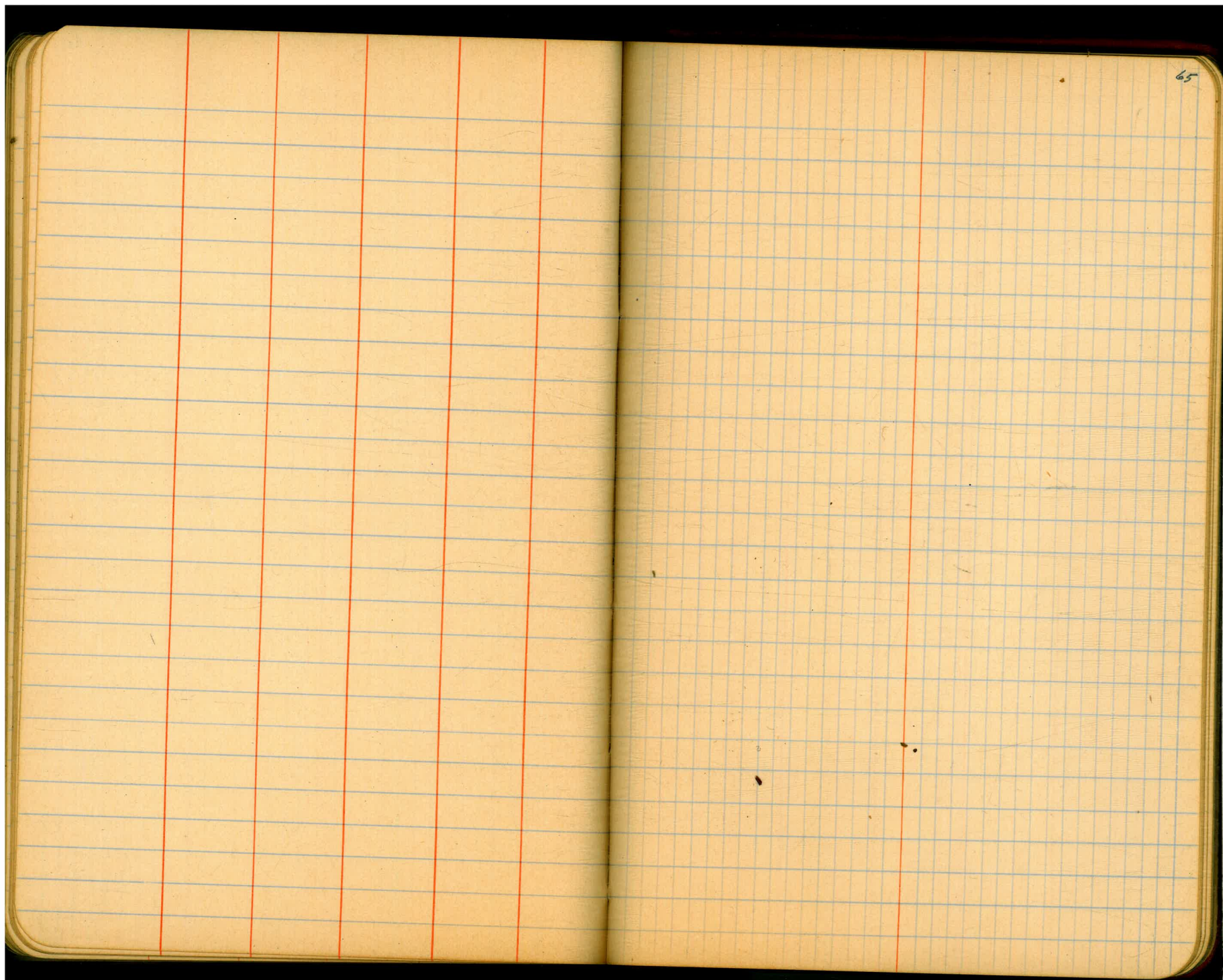






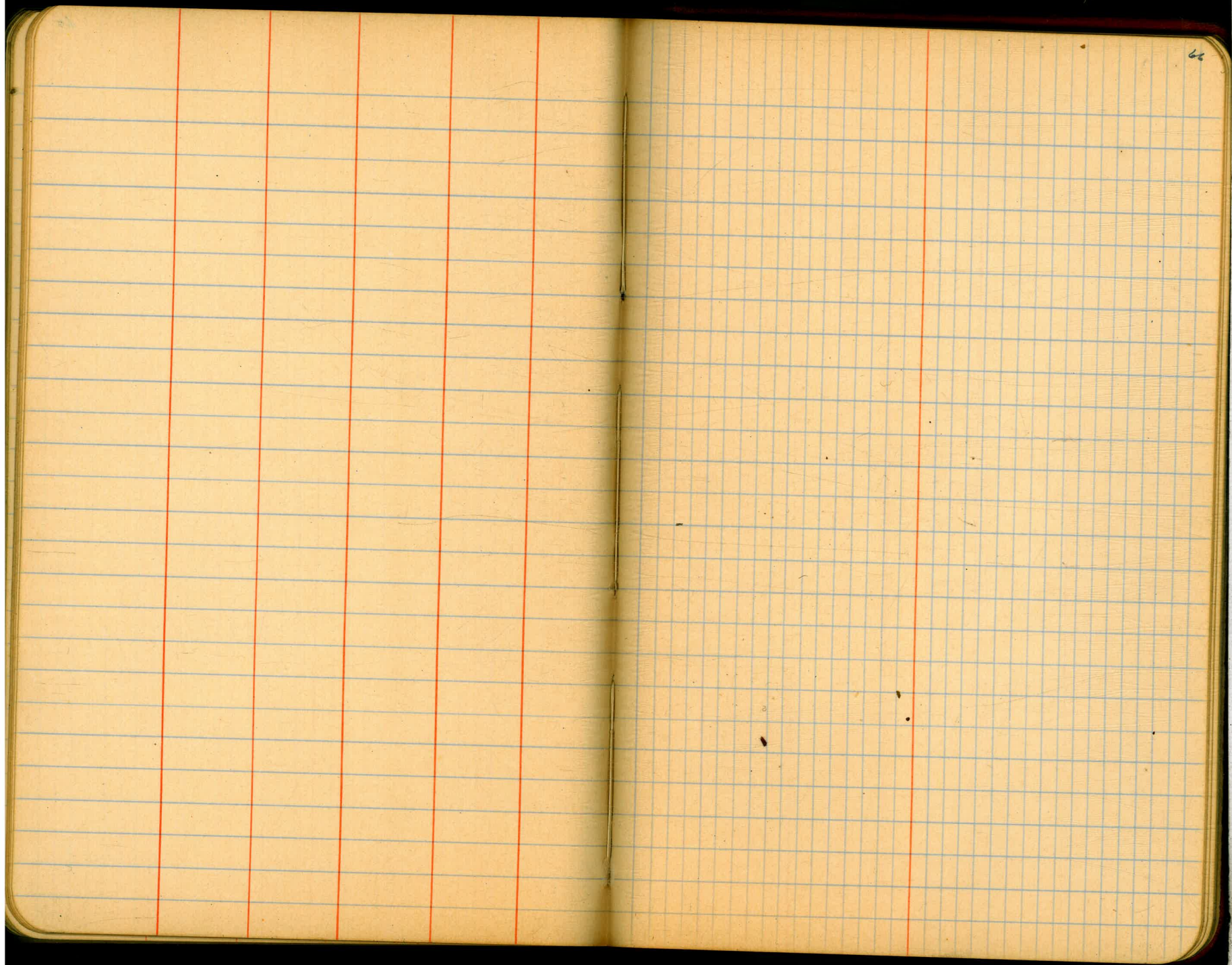






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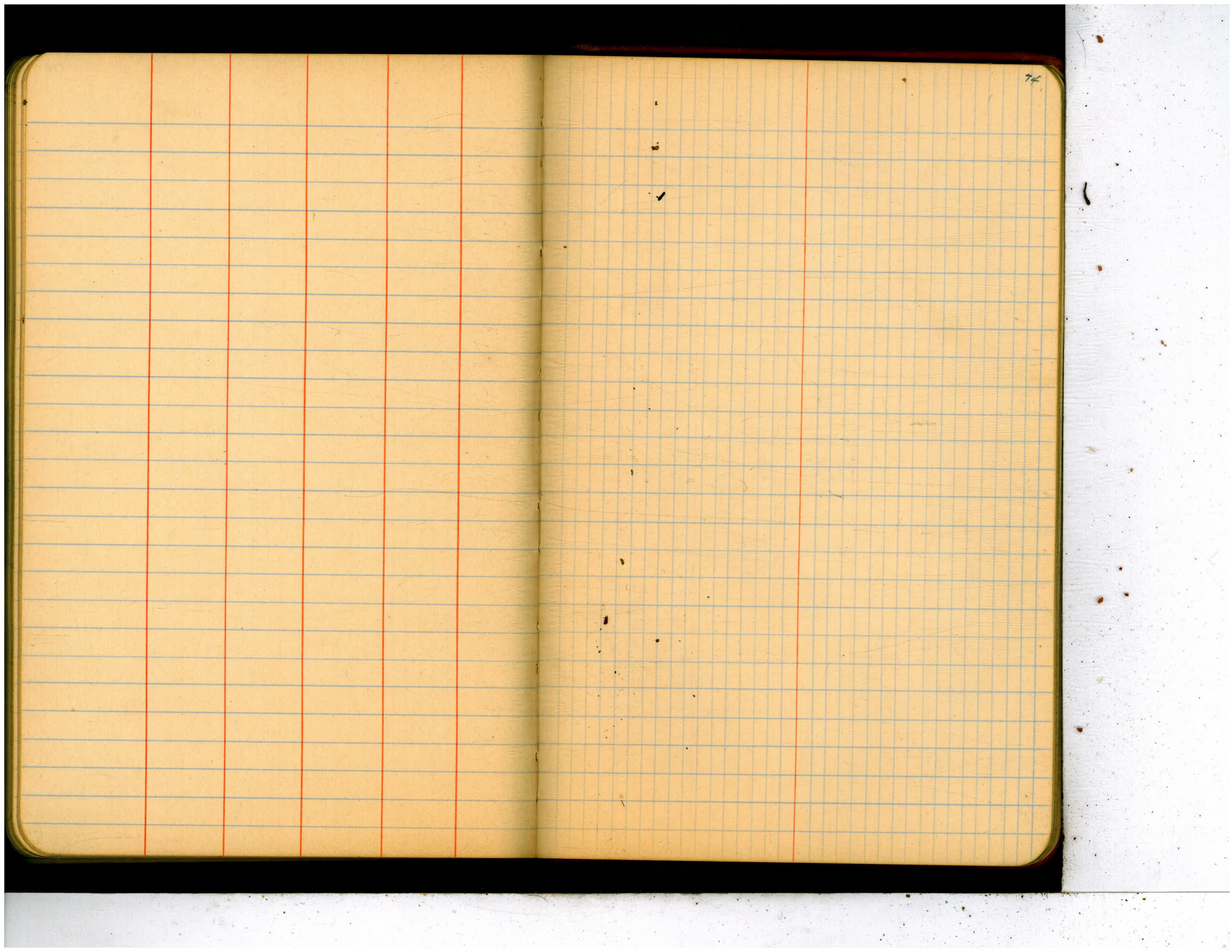




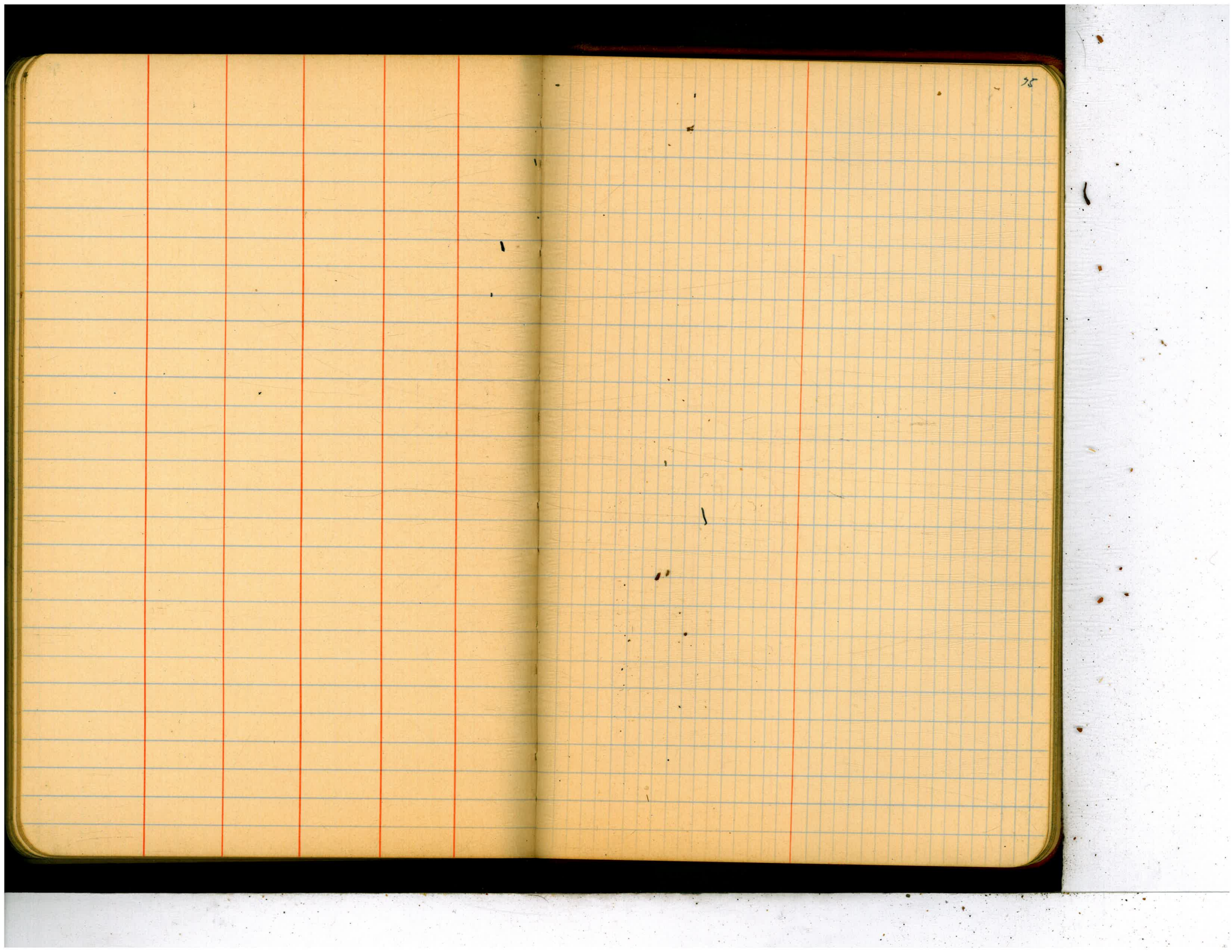




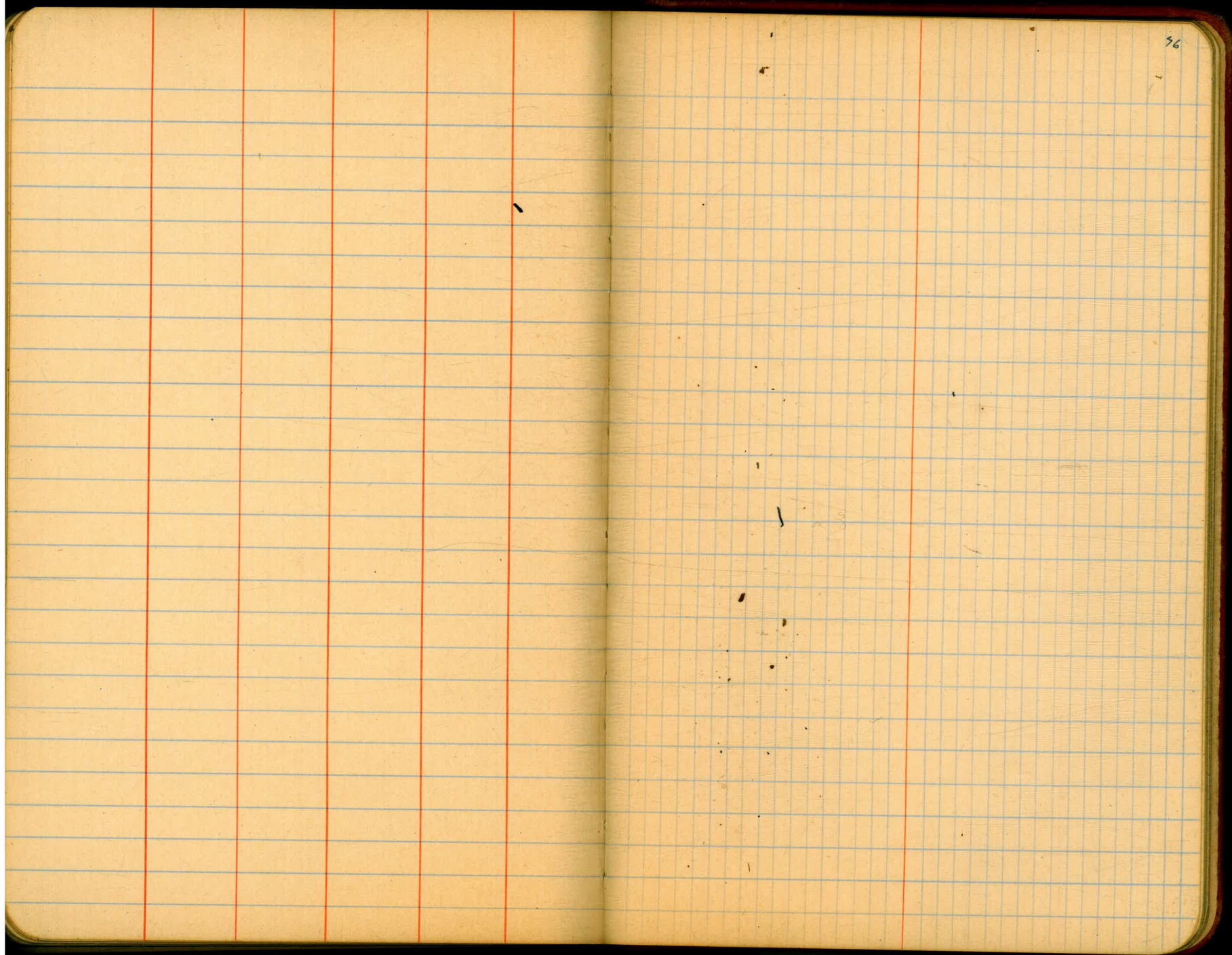






















#8

Elev. 1328 = <sup>686.45</sup> Gr. = <sup>674.83</sup> 672.83

2/12/24

Williams Chief  
Brockett Inst  
Manfield Rod  
Stout Rod

79

Random Line of Tunnel N48°E True outlet swing South 92° to N57°26'E True

Inst. at	Intercept	Vert Ang	Horiz Dist	Vert. Dist	To	Inst. H.I.	Angle Rod	Mag. Azim.	Elev.	Stout Rod	Brockett Rod
1328+00	2.32	+6°46	228.9	+27.2	#1 ✓	5.6	5.6		715.65	1330+29?	
"	6.12	+16°12	565.4	168.23	#2 ✓	5.6	9.6		<sup>848.7</sup> <del>846.68</del>	1333+65	
#2	1.40	+10°22	136.5	+25.0	#3 ✓	5.2	12.2		873.6	1335+01.9	
"	4.35	+13°22	412.7	+99.06	#4 ✓	5.2	4.2		<sup>947.9</sup> <del>945.92</del>	1337+78.1	
#4	4.36	-13°32	<sup>412.9</sup> 413.1	<sup>99.29</sup> 99.42	#2 ✓	5.4	5.4				
"	3.63	+4°22	362.0	+27.6	#5 ✓	5.4	11.4		975.5	1344+01	12.5' ahead + 12' lower
"	10.20	+4°44	1014.1	+83.92	#6 ✓	5.4	5.4		<sup>1031.84</sup> <del>1029.84</del>	1347+92	13 bottom of Wash
#6	10.20	-4°44	<sup>1014.1</sup> 1014.1	83.92	#4 ✓	5.0	5.0				
"	1.54	+1°12	154.9	-0.75	#7 ✓	5.0	9.0		1031.11	1349+47	
#7	1.55	+1°22	<sup>155.0</sup> 155.9	+0.72	#6 ✓	5.3	8.3				
"	1.53	-1°52	153.9	-9.02	#8 ✓	5.3	9.3		1021.90	1351+01	
#8	1.55	+5°42	<sup>154.2</sup> 154.5	<sup>9.12</sup> +9.40	#7 ✓	5.4	11.4		<del>1019.90</del>		
"	0.54	-14°02	57.8	-12.95	#9 ✓	5.4	5.4		1008.9	1357+52	
#9	0.58	+16°16	<sup>53.1</sup> 54.4	<sup>13.42</sup> 13.88	#8 ✓	5.3	7.3		<del>1006.95</del>		
"	2.42	-18°04	219.7	-76.66	#10 ✓	5.3	10.3		932.3	1353+72	
#10	0.97	-19°16	87.5	-30.55	#11 ✓	5.0	5.0		<del>932.29</del>		
"	0.98	+19°18	<sup>87.9</sup> 88.3	<sup>30.73</sup> 30.90	#10 ✓	5.0	5.0		<sup>901.7</sup> <del>899.56</del>	1354+60	
"	0.75	-17°32	69.2	-24.85	#12 ✓	5.0	8.0		876.7	1355+29	
#12	2.14	-11°38	206.3	-42.47	#13 ✓	5.0	5.0		<del>874.71</del>		
#13	3.46	-8°06	340.1	-48.42	#14 ✓	5.1	5.1		<sup>834.2</sup> <del>832.24</del>	1357+35	
#14	3.46	+8°00	<sup>340.2</sup> 340.3	<sup>48.13</sup> 47.83	#13 ✓	4.7	4.7		<sup>776.1</sup> <del>784.11</del>	1360+75	
"	2.32	-14°38	218.2	-56.95	#15 ✓	4.7	4.7		728.7	1363+93	
#15	2.35	+14°41	<sup>219.8</sup> 220.9	<sup>57.41</sup> 57.87	#14 ✓	5.3	5.3		<del>726.70</del>		
"	0.62	-9°48	61.2	-10.56	"14A" ✓	5.3	5.3		718.14	1362+32	
"	0.58	-19°32	52.5	-18.6	"14B" ✓	5.3	5.3	867°22'E	710.1	1363+46.3	bottom of Creek back from #15
"	1.84	-7°32	187.8	-24.0	"14C" ✓	5.3	5.3	880°02'E	704.7	1364+78.6	bottom stream

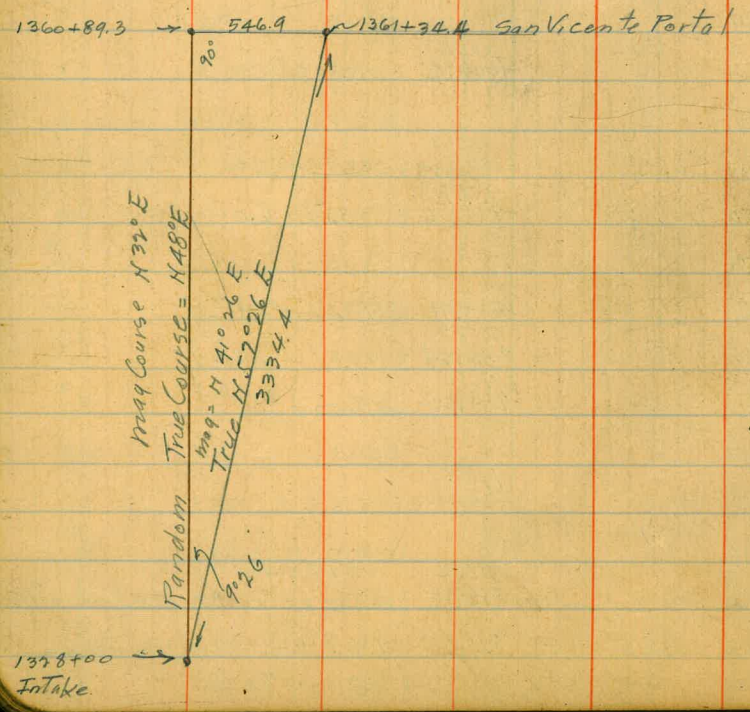
Mag. N32°00'E Survey to N41°26'E mag

6.4  
2.0  
4.4  
63.5  
1347+43.1



Inst at	Intercept	VA	Hor Dist	Vert Dist	To	H.I.	Angle Rod	Elev	
# 15	2.58	Level	259	+25	15 A	5.2	2.7	729.2	100° 12' L (Down Stream) of Back Line
# 15 A	2.29	Level	2.30	-4.5	15 B	4.0	8.5	724.7	79° 48' L " of Back Line
# 15 B	3.07	-10° 34'	297.7	-55.53	15 C	5.1	10.1	6.7	90° Down stream
# 15 C	.35	Level	36.0		15 D				81° 01' L of back Line
tie to Reservoir (San Vicente) contour Point.									
15 D	8.58	+1° 08'			15 E	4.0	4.0		Mag. S 56° 00' E
	5.45	-8° 40'			15 F =				S 35° 40' E
					# 623	5.1	5.1		
					Contour Line				

Note 15 D = Portal of tunnel =  $1366 + 063$   
 $1361 + 18$





Inst. at	Intercept	V.A	Horiz. Dist.	Vert. Dist To Sta.	H.I. Rod Station	Elev.
#17	1.53	-1°11'	148.26	29.30	#18 ✓	52 52 1284+10.97 658.87
#18	1.53	+1°11'			#17	52 52
#18	6.40	-15°47'	593.64	167.32	#19 ✓	52 52 1290+10.57 671.7 641.55
#18	7.90	-14°41'	693.5	181.70	#20 ✓	51 51 1291+10.4 657.3
#19	70	-1°11'	71.0	- 1.4	#18 C ✓	51 51 1290+7.56 670.3
#18C	80	-2°41'	80.8	- 3.7	#18 B ✓	51 101 1291+56.4 661.6
"	158	+7°11'	156.6	+19.6	#18 A ✓	51 51 1291+61.2 691.3
Siphon #						
#20 Tunnel =	1.38	-16°31'	127.8	- 37.8	#2 ✓	51 51
#1 Siphon	1.90	-14°38'	179.1	- 46.6	#3 ✓	51 51
657.3	2.55	-12°21'	244.6	- 53.3	#4 ✓	51 51
	3.98	-8°16'	342.0	- 49.6	#5 ✓	51 51
	4.82	Level		0.0	#6 ✓	51 51

End Feb. 8/24  
 Beginning Feb 9/24  
 Bed of Drain  
 Grade ± Tunnel Portal

Tunnel #6	Intercept	V.A	Horiz. Dist.	Vert. Dist To Sta.	H.I. Rod Station	Elev.
90°00 Left.	7.40	-13°09'	703.2	- 164.1	#17-A	51 51 702.2
#17						
49°01' R. from S.S.	2.78	-6°21'	275.6	- 30.6	#17-B	671.5
#17-A						
Upstream						

Level  
 677.3  
 5.8  
 Feb. 11-1924

abandoned



Tone 1<sup>st</sup> #6

2/7/24

Williams Cr. Party  
Van Horn Level  
Brookell. Inst.  
Trans. from  
Van Horn  
25-1El. Ground 1204+00-689.8  
691.8Grade = 681.17  
683.17

27

Inst at	Intercept	Vert. Ang	Horiz. Dist	Vert. Dist	To Station	H.L. Pa Station	Elevation	
1204+00 Flv 691.8	9.10	+8°58'	888.70	+130.29	#1 x	5.3 5.3 1212+88.7	822.1 890.1	
"	18.50	+10°33'	1787.55	+336.30	#2 ✓	5.3 5.3 1221+87.50 ✓	1028.1 1026.1 ✓	
#2	18.50	-10°39' <sup>10°34'</sup>	1787.55	336.30	1204+00	5.3 5.3 1204+00	691.80 689.80	
"	6.4	-16°30'	589.35	-174.55	#1 A ✓	5.3 5.3 1215+98.20	853.4 851.34	
"	0.98	+10°20'	95.84	+17.48	#3 ✓	5.3 5.3 1222+83.8 ✓	1045.6 1043.6 ✓	
#3	0.98	-10°20'	95.84	17.48	#2	1221+87.55	1027.9 1025.94	
"	3.82	+7°33'	376.33	+49.87	#4 ✓	1226+59.70 ✓	1095.5 1093.50 ✓	
#4	0.45	0°0'	46.00	-4.9	#5 x	5.1 10.0 1227+05.70 ✓	1090.6 1088.6 ✓	End 2/7/24 Begin 2/8/24
#5	8.22	-16°06'	760.5	-219.3	#6 ✓	1234+66.2	871.2	
"	10.30	-6°04'	1019.7	-108.4	#7 ✓	1237+25.8	982.2	
"	12.66	-3°04'	1263.45	67.7	#8 ✓	1239+69.0 ✓	1022.9 1020.9 ✓	
#10	6.9	0°0'	691.00	+7.0	#8 x #10 →	5.0 12.0 #10 1246+60.0 ✓	1027.9 1027.9 ✓	Moved past #8 set Nat #10
"	3.96	-22°17'	340.6	-139.2	#9 x	5.0 12.0 1243+19.4	890.7	
"	0.95	+12°54'	91.25	20.89	#11 ✓	5.0 5.0 1247+51.3 ✓	1050.8 1048.8 ✓	
#11	0.95	-12°54'			#10	5.3 5.3		
"	0.64	-7°38'	64.24	10.70	#12 ✓	5.3 5.3 1248+15.5 ✓	1040.1 1038.1 ✓	
#12	0.65	+9°28'	64.24	10.70	#11	5.3 5.3		
"	1.40	-18°20'	668.7	-221.3	#13 ✓	5.3 5.3 1254+83.2	818.8	Bottom of Canyon
"	14.20	+1°43'	1420.0	+42.5	#14 ✓	5.3 5.3 1262+35.5	1082.6	Shoulder of Hill
"	17.04	+2°36'	1701.6	77.23	#15 ✓	5.3 5.3 1265+16.9 ✓	1117.3 1115.3	Ridge
#15	4.50 ±	50.0' below #16			#15 A ✓	1269+66.9	956.9	Small Draw
#15	6.60	-9°46'	642.4	-110.4	#16 ✓	5.3 5.3 1271+59.3	1006.9 868.3	Ridge
"	17.80	-8°07'	1745.4	249.00	#17 ✓	5.3 5.3 1282+62.3 ✓	866.3	Ridge
#17	4.40	+2°11'	-440.0	+20.6	#16 A ✓	5.2 5.2 1278+23.3	888.9	Ridge
"	2.75 ±	50.0' Below #16	-275.0		#16 B ✓	1279+87.3	838.9	Small Draw

Continued on Preceding Page



Inst. at	Intercept	Vert Ang	Horiz. Dist	Vert Dist
#1	2.47	-9° 30	241.3	-45.37
#2	1.64	0° 00	165.00	-1.6
#3	1.69	-4° 12		
#4	3.13	-4° 39		-25.35

Elev. 1309+25 = 686.97  
 1311+66.3 = 730.34  
 1313+31.3 = 728.74  
 1316+43.4 = 703.40  
 = 674.39

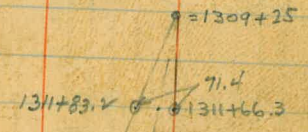
7.22 over Mag N 57° 30' E

#1	2.46	-10° 42		45.05
#2	0.85	+2° 12		
#3	0.85	-2° 14		

71.4 over Mag N 72° 10' E

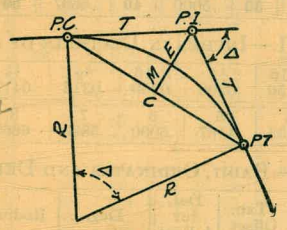
#1	4.54	-6° 11	449.8	-48.6
"	0.64	-3° 09	64.8	-3.5
"	2.81	-5° 27	279.6	-21.6

#1 = 1311+83.2  
 #2 = 1311+18.4  
 #3 = 1314+62.8  
 730.6  
 727.0  
 708.91



# DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES

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## CURVE FORMULAS

- Radius =  $R = \frac{50}{\sin \frac{\Delta}{2}}$  (1) Degree of Curve = D and  $\sin \frac{D}{2} = \frac{50}{R}$  (2)
- Tangent =  $T = R \tan \frac{\Delta}{2}$  (3) Length of Curve =  $L = 100 \frac{\Delta}{D}$  (4)
- Middle ordinate =  $M = R(1 - \cos \frac{\Delta}{2})$  (5) =  $R \text{vers} \frac{\Delta}{2}$  (6)
- External =  $E = T \tan \frac{\Delta}{4}$  (7) =  $R \div \cos \frac{\Delta}{2} - R$  (8) =  $R \text{exsec} \frac{\Delta}{2}$  (9)
- Long Chord =  $C = 2 R \sin \frac{\Delta}{2}$  (10)  $\Delta$  = Central Angle

## EXPLANATION AND USE OF TABLES

**Stations.**—Given P. I.—Sta. 161+60.35 to find Sta. of P. C. and P. T.  $\Delta=62^\circ 10'$   $D=8^\circ 20'$ . From Table IV for  $1^\circ$  curve  $T=3454.1$  and  $\div 8\frac{1}{2}=414.49$  ft. From Table V correction=.36 or  $T=414.85$  ft. P. C.—Sta. P.I.— $T=157+45.50$ . Also from (4)  $L=746.00$  and P. T.—Sta. P. C. + $L=164+91.50$ .

**Offsets.**—Tangent offsets vary (approximately) directly with D and with square of the distance. Thus tangent offset for Sta. 158 on above curve is 2.16 ft. found as follows. From Table III tangent offset for 100 ft.=7.27 ft. Distance=158—Sta. P. C.=54.50, hence offset=7.27  $(54.50 \div 100)^2=2.16$  ft. Also square of any distance divided by twice the radius equals (approximately) the distance from tangent to curve. Thus  $(54.50)^2 \div (2 \times 688.26)=2.16$  ft.

**Deflections.**—Deflection angle= $\frac{1}{2} D$  for 100 ft.,  $\frac{1}{4} D$  for 50 ft., etc. For c ft.=(in minutes)  $.3 \times C \times D^\circ$  or=defl. for 1 ft. from Table III  $\times C$ . For Sta. 158 of above curve= $.3 \times 54.5 \times 8\frac{1}{2}=136.2'$  or  $2^\circ 16.2'$ , or= $2.50 \times 54.5=136.2'$  from Table III. For Sta. 159 deflection angle= $2^\circ 16.2' + 8^\circ 20' \div 2=6^\circ 26.2'$ , etc.

**Externals.**—May be found in similar manner to tangents. Thus E for curve above is 115.37. For from Table IV for  $1^\circ$  curve  $E=960.6$  for  $8^\circ 20'=960.6 \div 8\frac{1}{2}=115.27$  and from Table V correction=.10 or  $E=115.37$ . Or suppose  $\Delta=32^\circ$  and E is measured and found to be 42 ft. What is D? From Table IV  $E=230.9$  and  $\div 42=5.5$  or  $D=5^\circ 30'$ .

Red.  
 5.2 10.2  
 5.2 6.8  
 5.1 5.1  
 5.1 5.1  
 5.1 5.1



TABLE I.—MINUTES IN DECIMALS OF A DEGREE.

1'	.0167	11'	.1833	21'	.3500	31'	.5167	41'	.6833	51'	.8500
2	.0333	12	.2000	22	.3667	32	.5333	42	.7000	52	.8667
3	.0500	13	.2167	23	.3833	33	.5500	43	.7167	53	.8833
4	.0667	14	.2333	24	.4000	34	.5667	44	.7333	54	.9000
5	.0833	15	.2500	25	.4167	35	.5833	45	.7500	55	.9167
6	.1000	16	.2667	26	.4333	36	.6000	46	.7667	56	.9333
7	.1167	17	.2833	27	.4500	37	.6167	47	.7833	57	.9500
8	.1333	18	.3000	28	.4667	38	.6333	48	.8000	58	.9667
9	.1500	19	.3167	29	.4833	39	.6500	49	.8167	59	.9833
10	.1667	20	.3333	30	.5000	40	.6667	50	.8333	60	1.0000

TABLE II.—INCHES IN DECIMALS OF A FOOT.

1-16	3-32	3-16	5-16	1-2	3-8	1-2	3-8	1-2	3-8	1-2	3-8
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729	
1	2	3	4	5	6	7	8	9	10	11	
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167	

TABLE III.—RADI, ORDINATES AND DEFLECTIONS.

Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot
0° 10'	34377.5	.036	.145	0.05'	7°	819.02	1.528	6.105	2.10'
20	17188.8	.073	.291	0.10	20'	781.84	1.600	6.395	2.20
30	11459.2	.109	.436	0.15	30	764.49	1.637	6.540	2.25
40	8594.42	.145	.582	0.20	40	747.89	1.673	6.685	2.30
50	6875.55	.182	.727	0.25					
1	5729.65	.218	.873	0.30	8	716.78	1.746	6.976	2.40
10	4911.15	.255	1.018	0.35	20	688.16	1.819	7.266	2.50
20	4297.28	.291	1.164	0.40	30	674.69	1.855	7.411	2.55
30	3819.83	.327	1.309	0.45	40	661.74	1.892	7.556	2.60
40	3437.87	.364	1.454	0.50					
50	3125.36	.400	1.600	0.55	9	637.28	1.965	7.846	2.70
					20	614.56	2.037	8.136	2.80
					30	603.80	2.074	8.281	2.85
					40	593.42	2.110	8.426	2.90
2	2864.93	.436	1.745	0.60	10	573.69	2.183	8.716	3.00
10	2644.58	.473	1.891	0.65	30	546.44	2.292	9.150	3.15
20	2455.70	.509	2.036	0.70	20	521.67	2.402	9.585	3.30
30	2292.01	.545	2.181	0.75	30	499.06	2.511	10.02	3.45
40	2148.79	.582	2.327	0.80	40	478.34	2.620	10.45	3.60
50	2022.41	.618	2.472	0.85	12	459.28	2.730	10.89	3.75
3	1910.08	.655	2.618	0.90	30	441.68	2.839	11.32	3.90
10	1809.57	.691	2.763	0.95	13	425.40	2.949	11.75	4.05
20	1719.12	.727	2.908	1.00	30	410.28	3.058	12.18	4.20
30	1637.28	.764	3.054	1.05	14	396.20	3.168	12.62	4.35
40	1562.88	.800	3.199	1.10					
50	1494.95	.836	3.345	1.15	15	383.07	3.277	13.05	4.50
4	1432.69	.873	3.490	1.20	30	370.78	3.387	13.49	4.65
10	1375.40	.909	3.635	1.25	16	359.27	3.496	13.92	4.80
20	1322.53	.945	3.718	1.30	30	348.45	3.606	14.35	4.95
30	1273.57	.982	3.926	1.35	17	338.27	3.716	14.78	5.10
40	1228.11	1.018	4.071	1.40	18	319.62	3.935	15.64	5.40
50	1185.78	1.055	4.217	1.45	19	302.94	4.155	16.51	5.70
5	1146.28	1.091	4.362	1.50	20	287.94	4.374	17.37	6.00
10	1109.33	1.127	4.507	1.55	21	274.37	4.594	18.22	6.30
20	1074.68	1.164	4.653	1.60	22	262.04	4.814	19.08	6.60
30	1042.14	1.200	4.798	1.65	23	250.79	5.035	19.94	6.90
40	1011.51	1.237	4.943	1.70	24	240.49	5.255	20.79	7.20
50	982.64	1.273	5.088	1.75					
6	955.37	1.309	5.234	1.80	25	231.01	5.476	21.64	7.50
10	929.57	1.346	5.379	1.85	26	222.27	5.697	22.50	7.80
20	905.13	1.382	5.524	1.90	27	214.18	5.918	23.35	8.10
30	881.95	1.418	5.669	1.95	28	206.68	6.139	24.19	8.40
40	859.92	1.455	5.814	2.00	29	199.70	6.360	25.04	8.70
					30	193.18	6.583	25.88	9.00

Note. Chord Deflection=2 times tangent deflection.

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
1°	50.00	.22	11°	551.70	26.50	21°	1061.9	97.57
10'	58.34	.30	10'	560.11	27.31	10'	1070.6	99.16
20	66.67	.39	20	568.53	28.14	20	1079.2	100.75
30	75.01	.49	30	576.95	28.97	30	1087.8	102.35
40	83.34	.61	40	585.36	29.82	40	1096.4	103.97
50	91.68	.73	50	593.79	30.68	50	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.80



TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.	Angle	Sine.	Tan.	Cotg.	Cosin.		
32	.5299	.6249	1.600	.84805	58						
10	.5324	.6289	1.590	.84650	50	30	.6225	.7954	1.257	.78261	30
20	.5348	.6330	1.580	.84495	40	40	.6248	.8002	1.250	.78079	20
30	.5373	.6371	1.570	.84339	30	50	.6271	.8050	1.242	.77897	10
40	.5398	.6412	1.560	.84182	20	39	.6293	.8098	1.235	.77715	51
50	.5422	.6453	1.550	.84025	10	10	.6316	.8146	1.228	.77531	50
33	.5446	.6494	1.540	.83867	57	20	.6338	.8195	1.220	.77347	40
10	.5471	.6536	1.530	.83708	50	30	.6361	.8243	1.213	.77162	30
20	.5495	.6577	1.520	.83549	40	40	.6383	.8292	1.206	.76977	20
30	.5519	.6619	1.511	.83389	30	50	.6406	.8342	1.199	.76791	10
40	.5544	.6661	1.501	.83228	20	40	.6428	.8391	1.192	.76604	50
50	.5568	.6703	1.492	.83066	10	10	.6450	.8441	1.185	.76417	50
34	.5592	.6745	1.483	.82904	56	20	.6472	.8491	1.178	.76229	40
10	.5616	.6787	1.473	.82741	50	30	.6494	.8541	1.171	.76041	30
20	.5640	.6830	1.464	.82577	40	40	.6517	.8591	1.164	.75851	20
30	.5664	.6873	1.455	.82413	30	50	.6539	.8642	1.157	.75661	10
40	.5688	.6916	1.446	.82248	20	41	.6561	.8693	1.150	.75471	49
50	.5712	.6959	1.437	.82082	10	10	.6583	.8744	1.144	.75280	50
35	.5736	.7002	1.428	.81915	55	20	.6604	.8796	1.137	.75088	40
10	.5760	.7046	1.419	.81748	50	30	.6626	.8847	1.130	.74896	30
20	.5783	.7089	1.411	.81580	40	40	.6648	.8899	1.124	.74703	20
30	.5807	.7133	1.402	.81412	30	50	.6670	.8952	1.117	.74509	10
40	.5831	.7177	1.393	.81242	20	42	.6691	.9004	1.111	.74314	48
50	.5854	.7221	1.385	.81072	10	10	.6713	.9057	1.104	.74120	50
36	.5878	.7265	1.376	.80902	54	20	.6734	.9110	1.098	.73924	40
10	.5901	.7310	1.368	.80730	50	30	.6756	.9163	1.091	.73728	30
20	.5925	.7355	1.360	.80558	40	40	.6777	.9217	1.085	.73531	20
30	.5948	.7400	1.351	.80386	30	50	.6799	.9271	1.079	.73333	10
40	.5972	.7445	1.343	.80212	20	43	.6820	.9325	1.072	.73135	47
50	.5995	.7490	1.335	.80038	10	10	.6841	.9380	1.066	.72937	50
37	.6018	.7536	1.327	.79864	53	20	.6862	.9435	1.060	.72737	40
10	.6041	.7581	1.319	.79688	50	30	.6884	.9490	1.054	.72537	30
20	.6065	.7627	1.311	.79512	40	40	.6905	.9545	1.048	.72337	20
30	.6088	.7673	1.303	.79335	30	50	.6926	.9601	1.042	.72136	10
40	.6111	.7720	1.295	.79158	20	44	.6947	.9657	1.036	.71934	46
50	.6134	.7766	1.288	.78980	10	10	.6967	.9713	1.030	.71732	50
38	.6157	.7813	1.280	.78801	52	20	.6988	.9770	1.024	.71529	40
10	.6180	.7860	1.272	.78622	50	30	.7009	.9827	1.018	.71325	30
20	.6202	.7907	1.265	.78442	40	40	.7030	.9884	1.012	.71121	20
						50	.7050	.9942	1.006	.70916	10
							.7071	1.	1.	.70711	45
											°
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE IX.—CALCULATION OF EARTHWORK.

70991  
69573  
14.18

Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	1.04	1.11
5	.09	.19	.28	.37	.46	.56	.65	.74	.83	.93	1.02	1.11	1.20	1.30	1.39
6	.11	.22	.33	.44	.56	.67	.78	.89	1.00	1.11	1.22	1.33	1.44	1.55	1.67
7	.13	.26	.39	.52	.65	.78	.91	1.04	1.16	1.30	1.42	1.55	1.68	1.81	1.94
8	.15	.30	.44	.59	.74	.89	1.04	1.19	1.33	1.48	1.63	1.78	1.92	2.08	2.22
9	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50
10	.18	.37	.56	.74	.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41	2.59	2.78
11	.20	.41	.61	.82	1.02	1.22	1.43	1.63	1.83	2.04	2.24	2.44	2.65	2.85	3.06
12	.22	.44	.67	.89	1.11	1.33	1.56	1.78	2.00	2.22	2.44	2.67	2.89	3.11	3.33
13	.24	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.41	2.65	2.89	3.13	3.37	3.61
14	.26	.52	.78	1.04	1.30	1.55	1.81	2.08	2.33	2.59	2.85	3.11	3.37	3.63	3.89
15	.28	.56	.83	1.11	1.39	1.67	1.94	2.22	2.50	2.78	3.06	3.33	3.61	3.89	4.17
16	.30	.59	.89	1.18	1.48	1.78	2.07	2.37	2.67	2.96	3.26	3.56	3.85	4.15	4.44
17	.31	.63	.94	1.26	1.57	1.89	2.20	2.52	2.83	3.15	3.46	3.78	4.09	4.41	4.72
18	.33	.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
19	.35	.70	1.06	1.41	1.76	2.11	2.46	2.82	3.17	3.52	3.87	4.22	4.57	4.92	5.28
20	.37	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70	4.07	4.44	4.81	5.18	5.56
21	.39	.78	1.17	1.55	1.94	2.33	2.72	3.11	3.50	3.89	4.28	4.67	5.06	5.44	5.83
22	.41	.81	1.22	1.63	2.04	2.44	2.85	3.26	3.67	4.07	4.48	4.89	5.30	5.70	6.11
23	.43	.85	1.28	1.70	2.13	2.56	2.98	3.41	3.83	4.26	4.68	5.11	5.54	5.96	6.39
24	.44	.89	1.33	1.78	2.22	2.67	3.11	3.56	4.00	4.44	4.89	5.33	5.78	6.22	6.67
25	.46	.92	1.38	1.85	2.31	2.78	3.24	3.70	4.17	4.63	5.09	5.56	6.02	6.48	6.94
26	.48	.96	1.44	1.92	2.41	2.89	3.37	3.85	4.33	4.82	5.30	5.78	6.26	6.74	7.24
27	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50
28	.52	1.04	1.55	2.07	2.59	3.11	3.63	4.15	4.67	5.18	5.70	6.22	6.74	7.26	7.78
29	.54	1.07	1.61	2.15	2.68	3.22	3.76	4.30	4.83	5.37	5.91	6.44	6.98	7.52	8.06
30	.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	5.55	6.11	6.67	7.22	7.78	8.33
31	.57	1.15	1.72	2.30	2.87	3.44	4.02	4.59	5.17	5.74	6.32	6.89	7.46	8.04	8.61
32	.59	1.18	1.78	2.37	2.96	3.56	4.15	4.74	5.33	5.92	6.52	7.11	7.70	8.30	8.89
33	.61	1.22	1.83	2.44	3.05	3.67	4.28	4.89	5.50	6.11	6.72	7.33	7.94	8.55	9.17
34	.63	1.26	1.89	2.52	3.15	3.78	4.40	5.04	5.67	6.29	6.93	7.56	8.18	8.81	9.44
35	.65	1.30	1.94	2.59	3.24	3.89	4.53	5.18	5.83	6.48	7.13	7.78	8.42	9.08	9.72
36	.67	1.33	2.00	2.67	3.33	4.00	4.66	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
37	.68	1.37	2.06	2.74	3.42	4.11	4.79	5.48	6.17	6.85	7.54	8.22	8.91	9.59	10.28
38	.70	1.41	2.11	2.82	3.52	4.22	4.92	5.63	6.33	7.03	7.74	8.44	9.15	9.85	10.56
39	.72	1.44	2.17	2.89	3.61	4.33	5.05	5.78	6.50	7.22	7.95	8.67	9.39	10.11	10.83
40	.74	1.48	2.22	2.96	3.70	4.44	5.18	5.92	6.67	7.41	8.15	8.89	9.63	10.37	11.11

Table gives cu. yds. in 1 ft. of a triangle of given width and height. Corrections for tenths of width are one tenth the values found under each height considering the widths from 1 to 9 as tenths and similarly the corrections for tenths of height are one tenth the figures opposite width considering the heights from 1 to 9 as tenths. Thus if  $w = 16.2$  and  $h = 5.3$ , cu. yds.  $= 1.48 + .028 + .059 = 1.567$  cu. yds. or practically 160 cu. yds. per 100 ft. If  $w$  exceeds 40 ft., use one half and multiply result by 2, if both  $w$  and  $h$  are large use one half of each and multiply result by 4. Any cross-section may be divided into triangles by the following rule. To the triangle of the sum of the outside cuts (or fills)  $= h$ , and  $\frac{1}{2}$  the roadbed  $= w$ , add the triangles formed by taking the distance out to each break in turn ( $= w$ 's) by the difference between the cuts (or fills) on each side of it ( $= h$ 's) always subtracting the outer from the inner.



692.78

53/753  
53  
473  
474

2+50	86.27	4.1	83.2
2+25	86.27	8.2	78.1
2+17	86.27	7.3	79.0
2+15	86.27	10.3	76.0
2+00	86.27	12.2	74.1
1+75	86.27	13.5	72.8
1+50	86.27	14.3	72.0
1+74	86.27	11.2	75.1
1+68	75.57	11.7	63.8

691.78  
4.30

691.80

701.14

687.30

689.78

690.06

689.29

39.05  
x  
66.5  
-----  
13.50

82.9  
75.9  
68.9  
61.9  
54.9

82.9  
28  
54.9

692.78  
5.86  
-----  
698.64  
5.84  
-----  
48

698.78  
5.84  
-----  
698.62  
692.78  
8.34  
-----  
701.12

698.63 - 74.1  
692.78  
5.84  
-----  
57.2  
16.9

26.10 - 10.30

78 + 30.58

4.28  
8.56

62  
63

7.3

670  
1540

67  
134

6.0

53/128000  
128000  
220

686.44  
8.00

### DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

Roadway 16 feet wide. Side Slopes 1 on 1 1/2.  
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.2	8.3	8.5	8.6	8.8	8.9	9.1	9.2	9.4	0
1	9.5	9.7	9.8	10.0	10.1	10.3	10.4	10.6	10.7	10.9	1
2	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4	2
3	12.5	12.7	12.8	13.0	13.1	13.3	13.4	13.6	13.7	13.9	3
4	14.0	14.2	14.3	14.5	14.6	14.8	14.9	15.1	15.2	15.4	4
5	15.5	15.7	15.8	16.0	16.1	16.3	16.4	16.6	16.7	16.9	5
6	17.0	17.2	17.3	17.5	17.6	17.8	17.9	18.1	18.2	18.4	6
7	18.5	18.7	18.8	19.0	19.1	19.3	19.4	19.6	19.7	19.9	7
8	20.0	20.2	20.3	20.5	20.6	20.8	20.9	21.1	21.2	21.4	8
9	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9	9
10	23.0	23.2	23.3	23.5	23.6	23.8	23.9	24.1	24.2	24.4	10
11	24.5	24.7	24.8	25.0	25.1	25.3	25.4	25.6	25.7	25.9	11
12	26.0	26.2	26.3	26.5	26.6	26.8	26.9	27.1	27.2	27.4	12
13	27.5	27.7	27.8	28.0	28.1	28.3	28.4	28.6	28.7	28.9	13
14	29.0	29.2	29.3	29.5	29.6	29.8	29.9	30.1	30.2	30.4	14
15	30.5	30.7	30.8	31.0	31.1	31.3	31.4	31.6	31.7	31.9	15
16	32.0	32.2	32.3	32.5	32.6	32.8	32.9	33.1	33.2	33.4	16
17	33.5	33.7	33.8	34.0	34.1	34.3	34.4	34.6	34.7	34.9	17
18	35.0	35.2	35.3	35.5	35.6	35.8	35.9	36.1	36.2	36.4	18
19	36.5	36.7	36.8	37.0	37.1	37.3	37.4	37.6	37.7	37.9	19
20	38.0	38.2	38.3	38.5	38.6	38.8	38.9	39.1	39.2	39.4	20
21	39.5	39.7	39.8	40.0	40.1	40.3	40.4	40.6	40.7	40.9	21
22	41.0	41.2	41.3	41.5	41.6	41.8	41.9	42.1	42.2	42.4	22
23	42.5	42.7	42.8	43.0	43.1	43.3	43.4	43.6	43.7	43.9	23
24	44.0	44.2	44.3	44.5	44.6	44.8	44.9	45.1	45.2	45.4	24
25	45.5	45.7	45.8	46.0	46.1	46.3	46.4	46.6	46.7	46.9	25
26	47.0	47.2	47.3	47.5	47.6	47.8	47.9	48.1	48.2	48.4	26
27	48.5	48.7	48.8	49.0	49.1	49.3	49.4	49.6	49.7	49.9	27
28	50.0	50.2	50.3	50.5	50.6	50.8	50.9	51.1	51.2	51.4	28
29	51.5	51.7	51.8	52.0	52.1	52.3	52.4	52.6	52.7	52.9	29
30	53.0	53.2	53.3	53.5	53.6	53.8	53.9	54.1	54.2	54.4	30
31	54.5	54.7	54.8	55.0	55.1	55.3	55.4	55.6	55.7	55.9	31
32	56.0	56.2	56.3	56.5	56.6	56.8	56.9	57.1	57.2	57.4	32
33	57.5	57.7	57.8	58.0	58.1	58.3	58.4	58.6	58.7	58.9	33
34	59.0	59.2	59.3	59.5	59.6	59.8	59.9	60.1	60.2	60.4	34
35	60.5	60.7	60.8	61.0	61.1	61.3	61.4	61.6	61.7	61.9	35
36	62.0	62.2	62.3	62.5	62.6	62.8	62.9	63.1	63.2	63.4	36
37	63.5	63.7	63.8	64.0	64.1	64.3	64.4	64.6	64.7	64.9	37
38	65.0	65.2	65.3	65.5	65.6	65.8	65.9	66.1	66.2	66.4	38
39	66.5	66.7	66.8	67.0	67.1	67.3	67.4	67.6	67.7	67.9	39
40	68.0	68.2	68.3	68.5	68.6	68.8	68.9	69.1	69.2	69.4	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 41.9. For same slopes but other widths of roadbed correct above figures by one-half difference in width of roadbed; thus in example above for 20 ft. roadbed distance will be 41.9 + (20 - 16) + 2 or 2 ft. added to 41.9 = 43.9. For slopes of 1 on 1 see inside of front cover.