

297A

W297A

Clay Res. ~~to~~ D. 2<sup>nd</sup> Main Pipe Line

NO. 100 F

X sections Tunnel 2

# EUGENE DIETZGEN 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) \* 2 = 30.6 - 8 = 22.6. For slopes of 1 on 1½ see inside of back cover.

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JAN 1 1953



Index

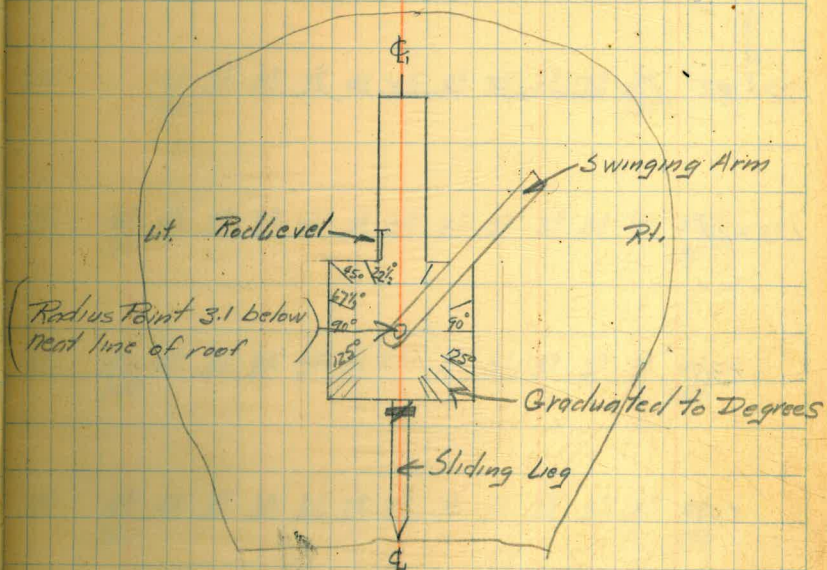
Tunnel #2 X sections pages 2-57

Method of taking X sections page 1

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JUN 1 1960

Instrument Used for X Sections



In the following notes the distances shown are from the radius point and readings are marked "Shot" or "Shot Hole" only when there is conclusive evidence that the over break is caused by shooting.



Otay Res. to San Diego 2<sup>nd</sup> Main Pipe Line  
Tunnel #2 X Sections

July 29, 1930

Elliott - Notes X 2  
Bailey - Instr.  
Soper - Ruler.  
Rt

Lt

Fiberat 6

Station  
172+09<sup>±</sup> Portal

125 90 67 1/2 45 22 1/2 4 27 1/2 45 67 1/2 90 125

↓  
Timber →

172+18<sup>±</sup> (N. face of timber)

32 47 35 38 37 40 35 36 36 38 38 46  
130 130

172+19

32 47 43 39 32 27 28 30 31 33 39 34 42 43  
127 135

+30

34 46 48 35 35 32 27 25 27 31 30 30 38 41  
140 140

+40

35 44 42 35 33 31 28 27 26 27 28 30 32 43  
135 135

+50

38 46 44 34 32 30 27 26 26 29 23 26 35 41  
140 146

+60

38 47 45 32 31 31 30 31 28 28 28 28 35 40 ✓  
140 145

172+68

Shot

38 44 37 32 31 32 31 32 31 29 30 29 32 42 ✓  
144 148







July 29, 1930

4

173+00

37 ~~41~~ 38 32 31 33 32 31 29 29 30 31 41 41 ✓  
144 146

+04

37 43 34 30 38 33 31 30 31 33 32 39 46 45 ✓  
143 144

shot

shot

+06<sup>5</sup>

37 ~~41~~ 42 37 33 30 29 27 30 33 36 35 40 42 ✓  
145 146

+10

37 44 37 33 31 33 31 31 31 31 30 41 44 ✓  
143 148

+16<sup>5</sup>

37 43 37 31 33 33 33 33 31 33 29 29 37 42 ✓  
144 148

shot

+23

38 43 36 39 32 27 31 38 36 33 29 28 37 42 ✓  
144 145

+25

38 43 37 31 31 37 37 37 38 36 30 28 37 44 ✓  
143 143

173+30

38 42 37 31 31 32 34 35 32 32 33 31 41 42 ✓  
145 145

July 29, 1930

5

173 +40

+45

+50

+55

+60

+64

+66

173 +70

36 4' 33 30 30 32 34 34 33 32 30 29 36 4' 140 ✓  
146

Shot

34 4' 32 33 33 32 31 31 34 33 31 32 36 39 145 ✓  
145

34 4' 39 31 33 34 36 32 32 35 31 32 35 32 150 ✓  
144

Shot

35 4' 42 39 34 32 38 32 36 34 31 29 33 39 146 ✓  
142

35 4' 35 32 34 40 40 39 32 34 31 28 35 41 145 ✓  
143

Shot

36 39 33 31 33 34 36 36 34 32 32 32 36 40 148 ✓  
150

Shot

Shot

35 4' 32 29 33 31 31 32 31 30 31 31 36 42 143 ✓  
143

35 40 32 22 29 30 31 31 33 31 29 30 36 40 145 ✓  
146



173+80

+85

+88

173+89

174+00

174+10

174+20

July 29

6

39 44 36 30 29 30 30 32 30 29 27 28 38 44  
150 150

39 43 36 32 32 30 30 31 27 28 29 30 36 42  
150 147

39 44 38 <sup>shot</sup> (33) 30 28 28 <sup>shot</sup> 31 26 26 28 29 37 43  
146 150

39 45 32 30 29 29 29 28 26 27 28 29 37 43  
147 148

39 42 35 30 30 30 30 29 27 28 29 27 36 42  
145 147

Aug 13, 1930

39 42 36 30 30 31 29 29 28 29 30 31 35 42  
153 146

37 40 33 27 30 31 28 28 28 30 31 31 35 42  
152 147

Aug 13, 1930

7

174+25

+27

+28

+36

+38

+40

+45

174+47

38 42 40 31 28 27 27 28 29 29 30 32 41 44 ✓  
150 144

Shot Hole  
38 43 42 36 30 27 27 29 30 30 30 30 43 46 ✓  
145 136

37 44 40 31 30 29 28 29 32 30 27 33 37 46 ✓  
146 135

38 42 39 30 31 30 29 29 29 31 29 29 32 44 ✓  
147 143

Shot Holes  
37 42 35 39 30 30 30 32 31 30 30 31 41 43 ✓  
145 142

36 40 34 30 31 34 32 33 32 31 32 31 37 43 ✓  
150 142

35 40 32 28 31 30 31 31 35 32 32 28 35 40 ✓  
148 142

Shot Hole  
35 40 39 29 30 31 30 31 32 35 38 31 33 40 ✓  
145 145



174 +50

+63

+66

+70

+72

+74

+76

174 +78

37 40 33 28 28 29 28 30 31 31 31 30 31 40 ✓  
150 146

38 40 33 27 28 28 27 29 28 28 29 29 35 42 ✓  
154 144

38 40 34 30 29 29 30 31 30 30 29 35 32 42 ✓  
149 144  
Shot Hole

38 40 35 33 33 34 34 33 31 29 27 28 32 40 ✓  
150 147

37 40 35 30 32 32 34 34 32 28 28 22 33 39 ✓  
153 148  
Shot Hole

37 41 34 31 30 30 29 30 28 29 29 30 35 40 ✓  
150 148

37 40 32 29 29 29 29 31 30 29 30 32 35 40 ✓  
150 145

37 41 38 32 32 32 33 35 30 30 31 32 34 41 ✓  
149 145  
Shot Hole Shot Hole

Aug 13, 1930

9

174+79<sup>5</sup>

+80

+90

174+97

175+02

+06

+10

175+14

Shot Hole

37 4<sup>2</sup> 3<sup>3</sup> 2<sup>9</sup> 3<sup>0</sup> 3<sup>2</sup> 3<sup>1</sup> 3<sup>6</sup> 2<sup>9</sup> 2<sup>9</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>9</sup> 4<sup>1</sup> ✓  
148 145

36 4<sup>1</sup> 3<sup>2</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>0</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>4</sup> 4<sup>0</sup> ✓  
146 146

36 4<sup>0</sup> 3<sup>5</sup> 2<sup>8</sup> 2<sup>8</sup> 2<sup>9</sup> 2<sup>9</sup> 2<sup>9</sup> 3<sup>0</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>4</sup> 4<sup>1</sup> ✓  
145 146

38 4<sup>1</sup> 3<sup>4</sup> 2<sup>7</sup> 2<sup>6</sup> 2<sup>8</sup> 2<sup>8</sup> 3<sup>0</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>0</sup> 3<sup>2</sup> 3<sup>5</sup> 4<sup>3</sup> ✓  
153 142

Shot Holes

36 4<sup>0</sup> 3<sup>5</sup> 3<sup>0</sup> 3<sup>3</sup> 3<sup>2</sup> 3<sup>4</sup> 3<sup>3</sup> 3<sup>6</sup> 3<sup>3</sup> 3<sup>5</sup> 3<sup>6</sup> 4<sup>4</sup> 4<sup>6</sup> ✓  
146 134

35 4<sup>0</sup> 3<sup>5</sup> 3<sup>0</sup> 3<sup>1</sup> 3<sup>4</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>0</sup> 2<sup>9</sup> 2<sup>9</sup> 3<sup>6</sup> 4<sup>3</sup> ✓  
146 142

Shot Hole

35 4<sup>1</sup> 3<sup>5</sup> 3<sup>0</sup> 3<sup>2</sup> 3<sup>5</sup> 3<sup>2</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>0</sup> 2<sup>9</sup> 2<sup>9</sup> 3<sup>5</sup> 4<sup>2</sup> ✓  
146 145

Shot Hole

36 4<sup>1</sup> 4<sup>0</sup> 3<sup>4</sup> 3<sup>6</sup> 3<sup>3</sup> 3<sup>5</sup> 3<sup>5</sup> 3<sup>2</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>6</sup> 4<sup>0</sup> ✓  
145 145



Flared E

175+15

125 90 67½ 45 22½ 4 22½ 45 67½ 90 125  
 36 42 35 31 34 34 34 33 32 31 31 31 33 42 ✓  
 144 145

+18

36 42 32 30 34 35 35 33 33 34 32 30 34 34 ✓  
 145 144

+21

37 41 31 30 32 31 31 31 31 31 32 28 35 40 ✓  
 147 145

+26

Shot Holes

37 43 37 35 38 33 32 33 34 33 36 34 34 43 ✓  
 144 135

+29

37 42 33 30 31 32 32 31 33 32 31 30 33 41 ✓  
 148 145

+39

38 42 32 28 27 27 26 28 30 30 31 31 36 43 ✓  
 148 143

+49

39 44 36 29 30 30 28 30 30 28 30 31 37 45 ✓  
 150 145

175+55

40 42 36 31 29 26 25 27 27 27 28 31 38 46 ✓  
 150 141

Aug 13, 1930

11.

175+57

+59.

+70

+80

175+90

176+00

176+08

176+13

Shot Holes

42 43 36 34 30 27 26 27 26 28 28 30 43 44  
 151 144

38 41 34 28 29 27 28 30 27 28 29 30 36 43  
 150 142

38 44 36 30 28 27 27 31 26 27 26 29 32 41  
 150 147

38 40 30 28 27 29 31 31 31 30 29 30 38 43  
 155 142

38 42 36 29 29 29 28 29 28 28 29 30 36 43  
 152 142

38 40 36 30 30 29 28 31 31 31 32 31 34 41  
 150 142

Aug 14, 1930

36 40 32 28 28 29 27 28 30 31 31 33 38 41  
 153 145

37 39 32 26 26 26 26 27 30 30 33 (Shot Hole) 35 36 42  
 154 145



Aug 14, 1930

12

176 + 15

38 40 31 27 26 26 27 28 30 31 31 22 35 42 ✓  
154 148

+195

38 41 31 28 29 27 28 34 34 33 34 33 34 42 ✓  
153 147

Shot Holes

+205

38 41 33 28 28 28 28 31 30 29 30 29 31 42 ✓  
152 146

+28

38 43 32 31 30 29 29 28 27 26 25 25 32 32 ✓  
151 150

+32

39 44 43 35 36 31 28 28 26 27 27 27 31 39 ✓  
145 150

+38

39 53 44 38 38 33 30 27 27 27 27 30 33 44 ✓  
135 147

Shot Holes

+40

39 45 39 32 32 31 29 31 28 27 27 29 34 42 ✓  
149 146

176 + 50

39 43 36 31 32 32 33 30 31 30 31 31 38 45 ✓  
146 145

Aug 14, 1930

13

176+60

38 43 35 29 28 28 32 31 29 28 27 30 32 41  
145 146

+67

37 41 35 30 31 33 31 29 28 27 28 29 34 41  
150 145

+70<sup>s</sup>

Shot Hole →  
38 42 41 32 36 30 30 29 27 27 28 27 31 42  
150 145 ✓

+72

38 43 32 32 33 31 32 29 26 26 28 28 36 41  
150 145 ✓

+80

39 46 38 31 31 30 29 31 27 28 29 32 40 46  
148 145 ✓

+83

Shot Holes  
40 46 38 33 35 31 31 29 29 29 30 32 40 46  
145 145 ✓

+86

39 42 33 31 32 32 29 30 30 30 32 33 42 46  
150 145 ✓

176+90

Shot Hole  
41 43 33 29 29 30 28 28 30 32 36 39 47 50  
150 140 ✓



Aug 14, 1930

14

176+92

41 41 30 30 30 30 28 28 30 33 32 43 46 ✓  
155 145

+94

41 42 28 28 30 30 31 33 31 32 32 33 43 46 ✓  
155 145

176+98

Shot Hole  
39 41 29 26 27 30 29 35 31 32 32 34 43 45 ✓  
155 145

177+00

39 42 30 26 26 27 30 31 32 32 30 30 42 46 ✓  
154 145

+03

shots  
39 40 30 25 26 28 29 31 33 35 32 30 32 46 ✓  
155 146

+05

37 37 32 26 26 26 26 29 29 30 31 31 39 42 ✓  
160 145

+10

37 40 33 29 28 27 27 31 26 27 26 28 37 43 ✓  
154 145

177+20

37 41 34 27 28 28 29 30 32 28 30 29 32 42 ✓  
153 145

Aug 14, 1930

15

177+24

+28

+30

+36<sup>5</sup>

+39

+46

+50

177+55

Shot Holes

3<sup>8</sup> 4<sup>2</sup> 3<sup>3</sup> 2<sup>2</sup> 2<sup>2</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>3</sup> 3<sup>0</sup> 2<sup>2</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>5</sup> 4<sup>2</sup> ✓  
150 145

3<sup>8</sup> 4<sup>2</sup> 3<sup>1</sup> 2<sup>5</sup> 2<sup>5</sup> 2<sup>8</sup> 2<sup>8</sup> 3<sup>3</sup> 3<sup>5</sup> 3<sup>1</sup> 3<sup>2</sup> 3<sup>3</sup> 3<sup>7</sup> 4<sup>3</sup> ✓  
150 144

3<sup>9</sup> 4<sup>1</sup> 3<sup>3</sup> 2<sup>9</sup> 2<sup>8</sup> 2<sup>2</sup> 3<sup>0</sup> 3<sup>1</sup> 3<sup>9</sup> 3<sup>4</sup> 3<sup>3</sup> 3<sup>1</sup> 3<sup>6</sup> 4<sup>1</sup> ✓  
150 143

Shot

3<sup>6</sup> 4<sup>1</sup> 3<sup>3</sup> 2<sup>9</sup> 3<sup>0</sup> 2<sup>9</sup> 2<sup>8</sup> 3<sup>0</sup> 3<sup>2</sup> 3<sup>3</sup> 3<sup>2</sup> 3<sup>3</sup> 3<sup>2</sup> 4<sup>1</sup> ✓  
150 145

Shot Holes

3<sup>7</sup> 4<sup>3</sup> 3<sup>4</sup> 2<sup>8</sup> 3<sup>0</sup> 2<sup>9</sup> 3<sup>0</sup> 3<sup>1</sup> 3<sup>2</sup> 3<sup>2</sup> 2<sup>8</sup> 2<sup>8</sup> 3<sup>0</sup> 4<sup>0</sup> ✓  
150 146

3<sup>7</sup> 4<sup>1</sup> 3<sup>3</sup> 2<sup>9</sup> 3<sup>0</sup> 3<sup>3</sup> 3<sup>6</sup> 3<sup>5</sup> 3<sup>0</sup> 2<sup>9</sup> 2<sup>8</sup> 2<sup>8</sup> 3<sup>3</sup> 4<sup>0</sup> ✓  
150 147

3<sup>6</sup> 4<sup>0</sup> 3<sup>6</sup> 3<sup>1</sup> 3<sup>3</sup> 3<sup>3</sup> 3<sup>8</sup> 3<sup>7</sup> 3<sup>1</sup> 2<sup>9</sup> 2<sup>7</sup> 2<sup>7</sup> 3<sup>0</sup> 3<sup>2</sup> ✓  
146 150

3<sup>6</sup> 4<sup>3</sup> 3<sup>8</sup> 3<sup>1</sup> 3<sup>3</sup> 3<sup>3</sup> 3<sup>5</sup> 3<sup>7</sup> 3<sup>0</sup> 2<sup>7</sup> 2<sup>7</sup> 2<sup>7</sup> 3<sup>0</sup> 3<sup>7</sup> ✓  
140 146



177+57

|    |    |    |    |    |    |    |    |    |    |    |    |     |    |
|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| 36 | 40 | 37 | 29 | 28 | 30 | 29 | 30 | 29 | 26 | 26 | 27 | 32  | 36 |
|    |    |    |    |    |    |    |    |    |    |    |    | 146 |    |

+65

|    |    |    |    |    |    |    |    |    |    |    |    |     |    |
|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| 38 | 42 | 33 | 27 | 22 | 30 | 32 | 31 | 31 | 28 | 28 | 28 | 32  | 40 |
|    |    |    |    |    |    |    |    |    |    |    |    | 107 |    |

+70

(Shot Hole)

|    |    |    |    |    |    |    |    |    |    |    |    |     |    |
|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| 39 | 41 | 33 | 30 | 28 | 30 | 34 | 37 | 28 | 30 | 34 | 33 | 39  | 43 |
|    |    |    |    |    |    |    |    |    |    |    |    | 145 |    |

+75

Shot Hole

|    |    |    |    |    |    |    |    |    |    |    |    |     |    |
|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| 37 | 40 | 33 | 29 | 30 | 30 | 34 | 36 | 34 | 30 | 32 | 34 | 38  | 41 |
|    |    |    |    |    |    |    |    |    |    |    |    | 145 |    |

+77

|    |    |    |    |    |    |    |    |    |    |    |    |     |    |
|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| 38 | 39 | 32 | 28 | 33 | 30 | 30 | 34 | 30 | 29 | 28 | 28 | 33  | 41 |
|    |    |    |    |    |    |    |    |    |    |    |    | 145 |    |

+80

|    |    |    |    |    |    |    |    |    |    |    |    |     |    |
|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| 38 | 38 | 30 | 29 | 28 | 31 | 29 | 31 | 32 | 29 | 30 | 29 | 32  | 40 |
|    |    |    |    |    |    |    |    |    |    |    |    | 142 |    |

+84

|    |    |    |    |    |    |    |    |    |    |    |    |     |    |
|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| 38 | 41 | 30 | 30 | 29 | 30 | 30 | 34 | 32 | 29 | 28 | 29 | 34  | 42 |
|    |    |    |    |    |    |    |    |    |    |    |    | 147 |    |

177+87

|    |    |    |    |    |    |    |    |    |    |    |    |     |    |
|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| 29 | 42 | 32 | 26 | 28 | 32 | 37 | 36 | 28 | 26 | 26 | 27 | 37  | 43 |
|    |    |    |    |    |    |    |    |    |    |    |    | 146 |    |

AUG 14, 1930

17

177+92

39 42 35 31 33 38 37 34 39 32 31 31 35 44  
146 142

177+96

38 42 31 30 32 33 32 32 33 32 31 30 40 42  
145 141

178+00

38 41 35 31 33 35 32 31 32 33 32 32 39 44  
146 141

178+06

39 41 37 29 29 30 31 30 30 32 31 31 45 46  
151 141

178+12

39 43 48 47 37 34 37 30 30 30 28 28 40 43  
146 141

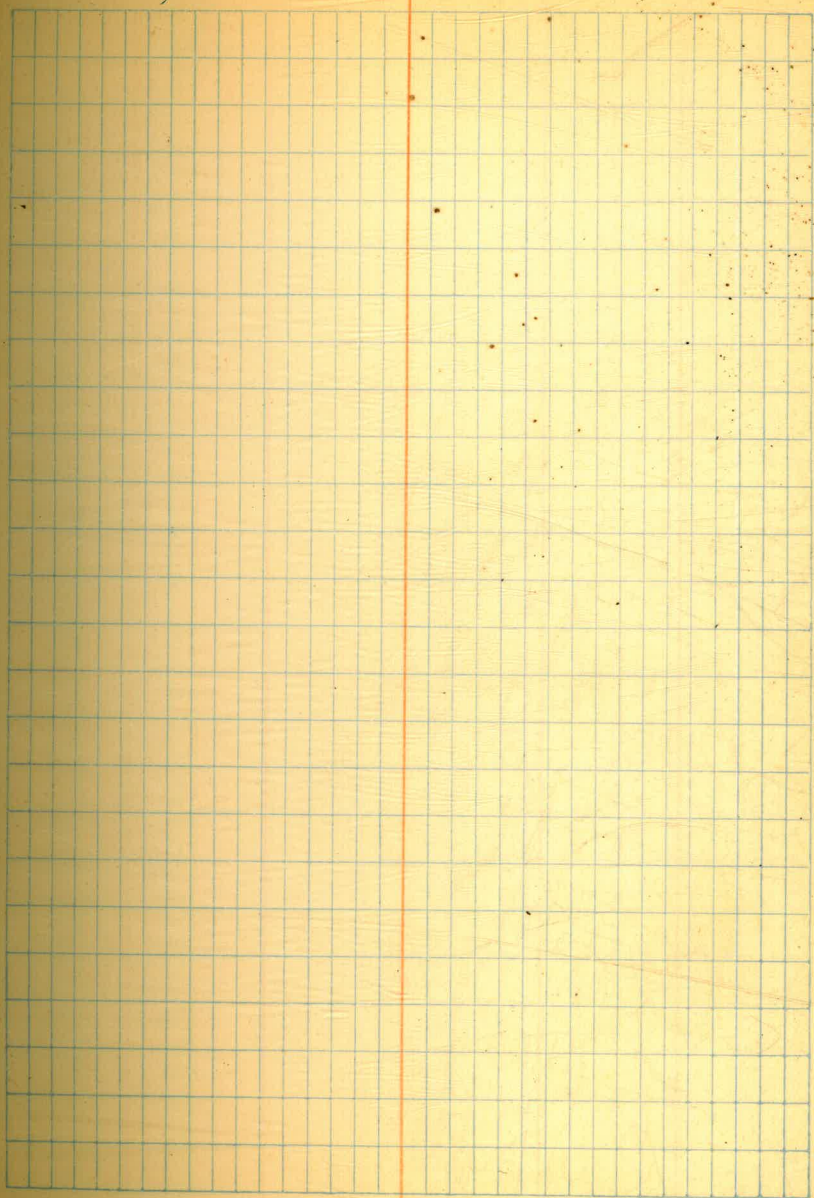
178+13<sup>3</sup>

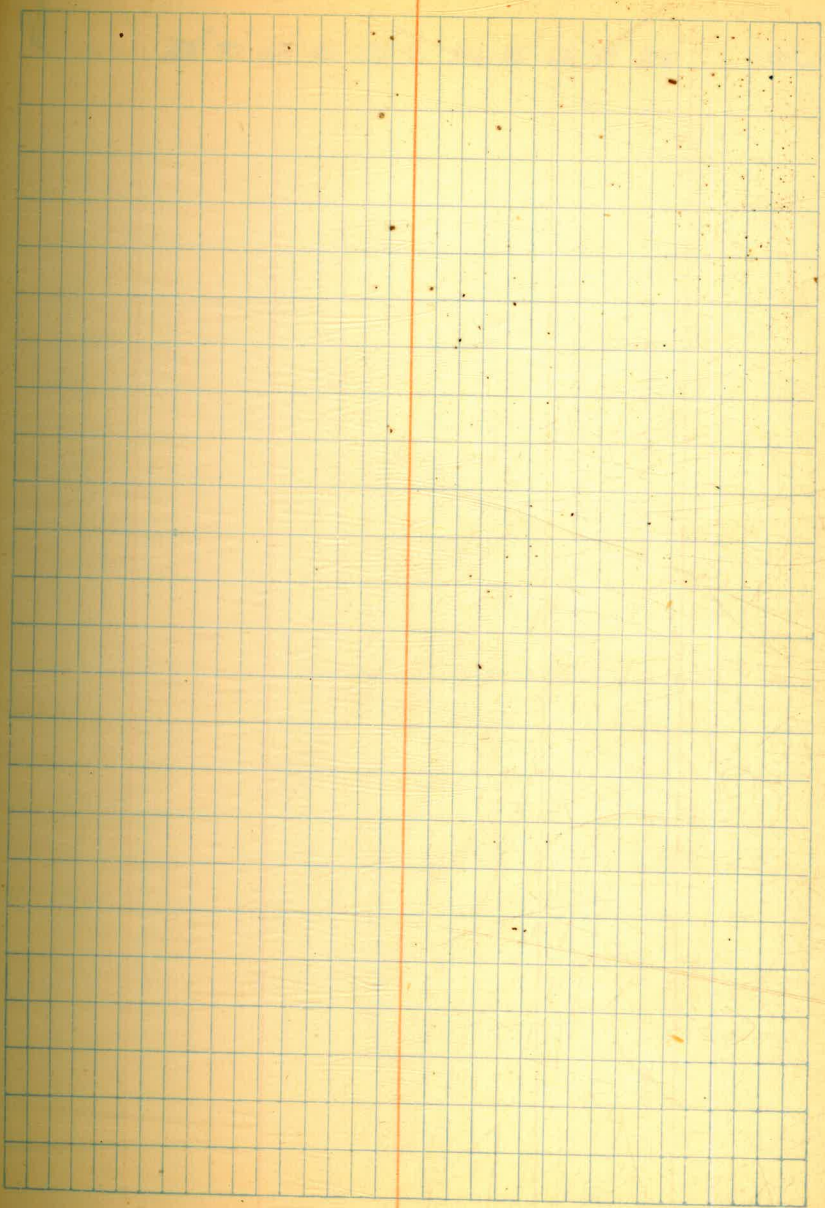
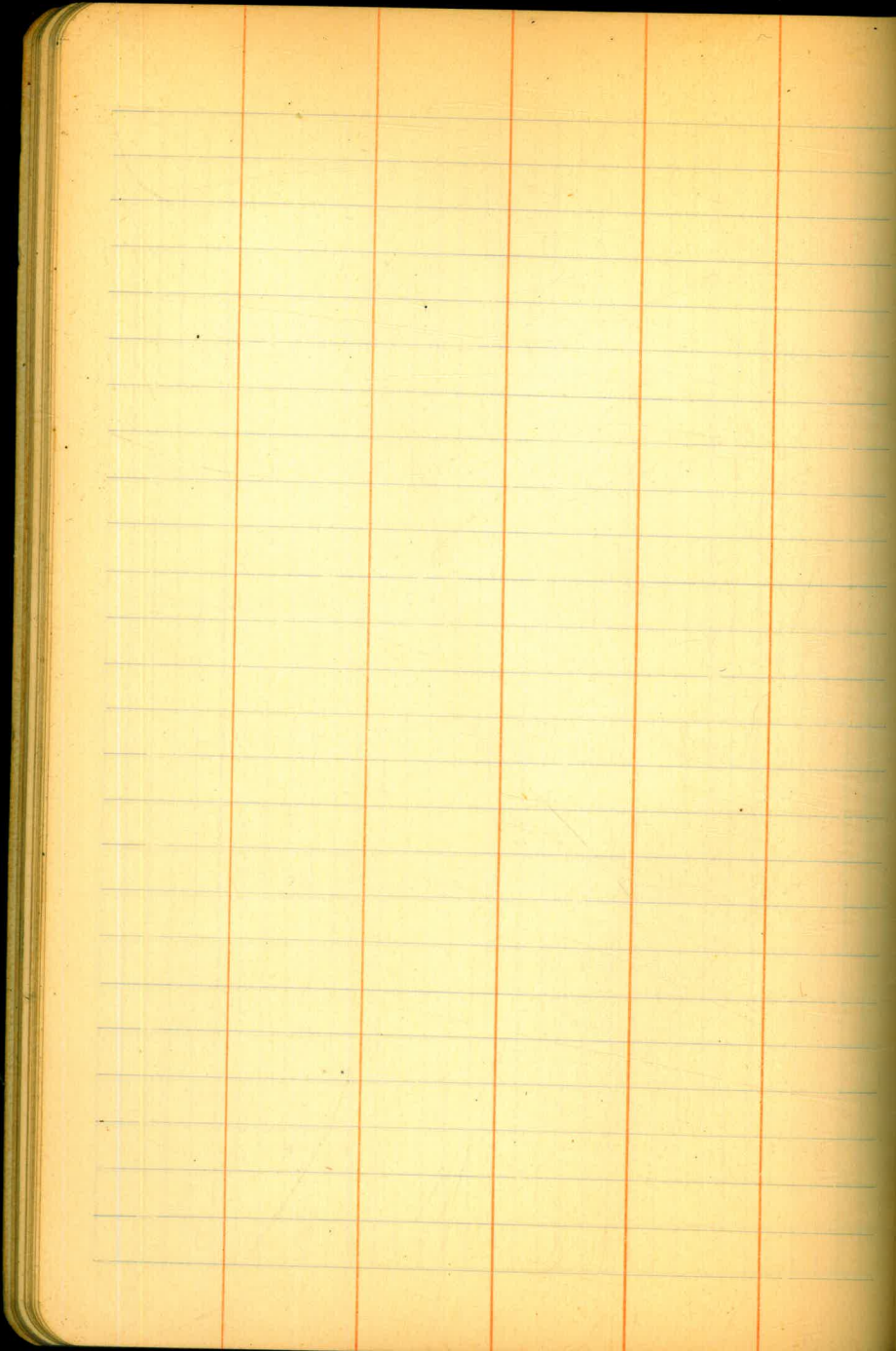
Continued on page 36

↑  
Timber  
↓

38 42 47 47 40 35 39 40 42 40 37 35 45 40  
150 149









Sta.

Floor at  $\Phi$

20

$125^\circ 90' 67\frac{1}{2}' 45' 22\frac{1}{2}' \Phi; 22\frac{1}{2}' 45' 67\frac{1}{2}' 90' 125'$





This page features a grid of blue horizontal lines and five vertical red lines, creating six columns. The grid is empty and spans most of the page.

This page features a grid of blue horizontal lines and one vertical red line, creating two columns. Additionally, there is a large blue grid area covering the right side of the page, with a vertical red line on its left edge. The grid is empty and spans most of the page.

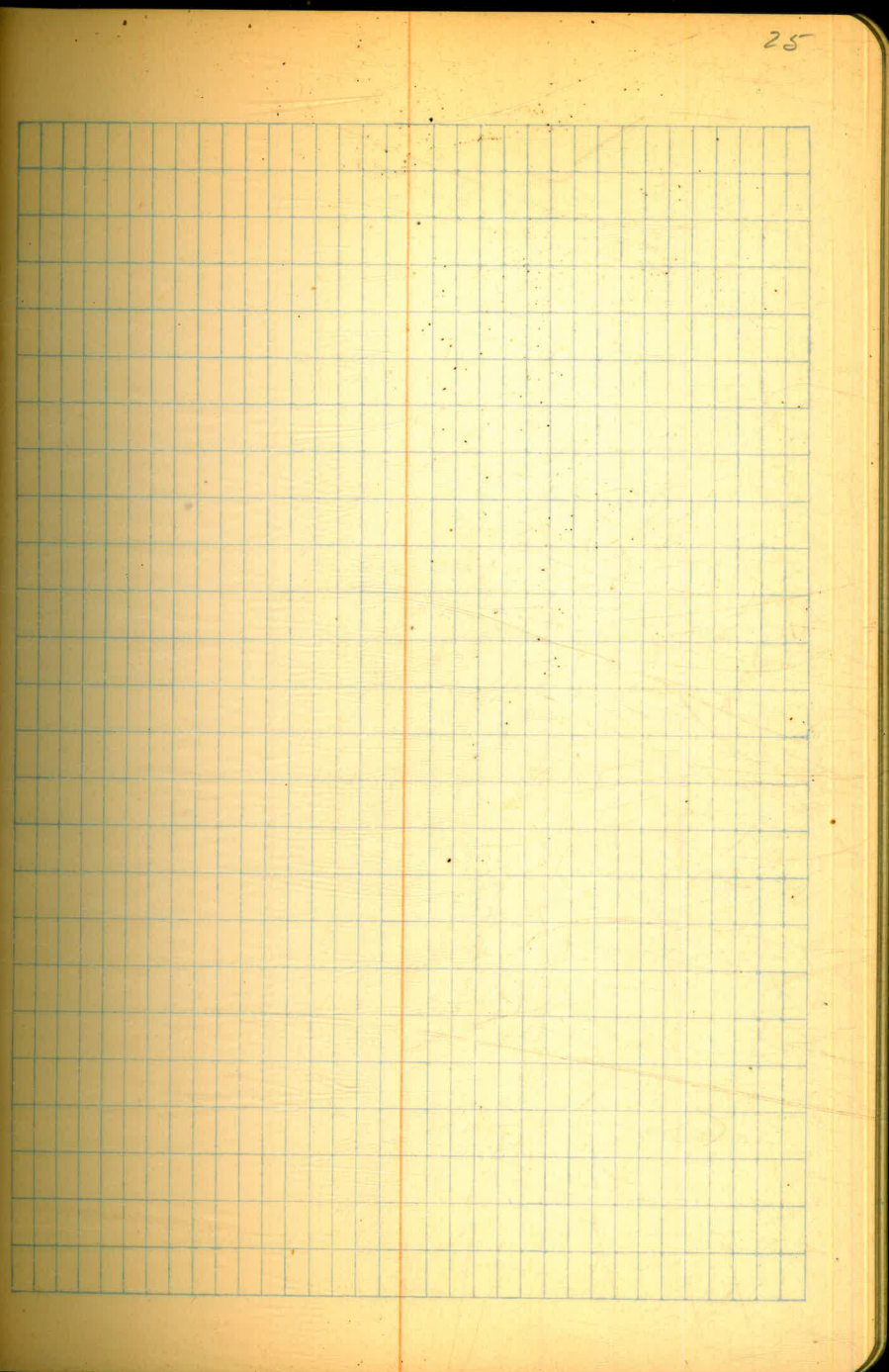
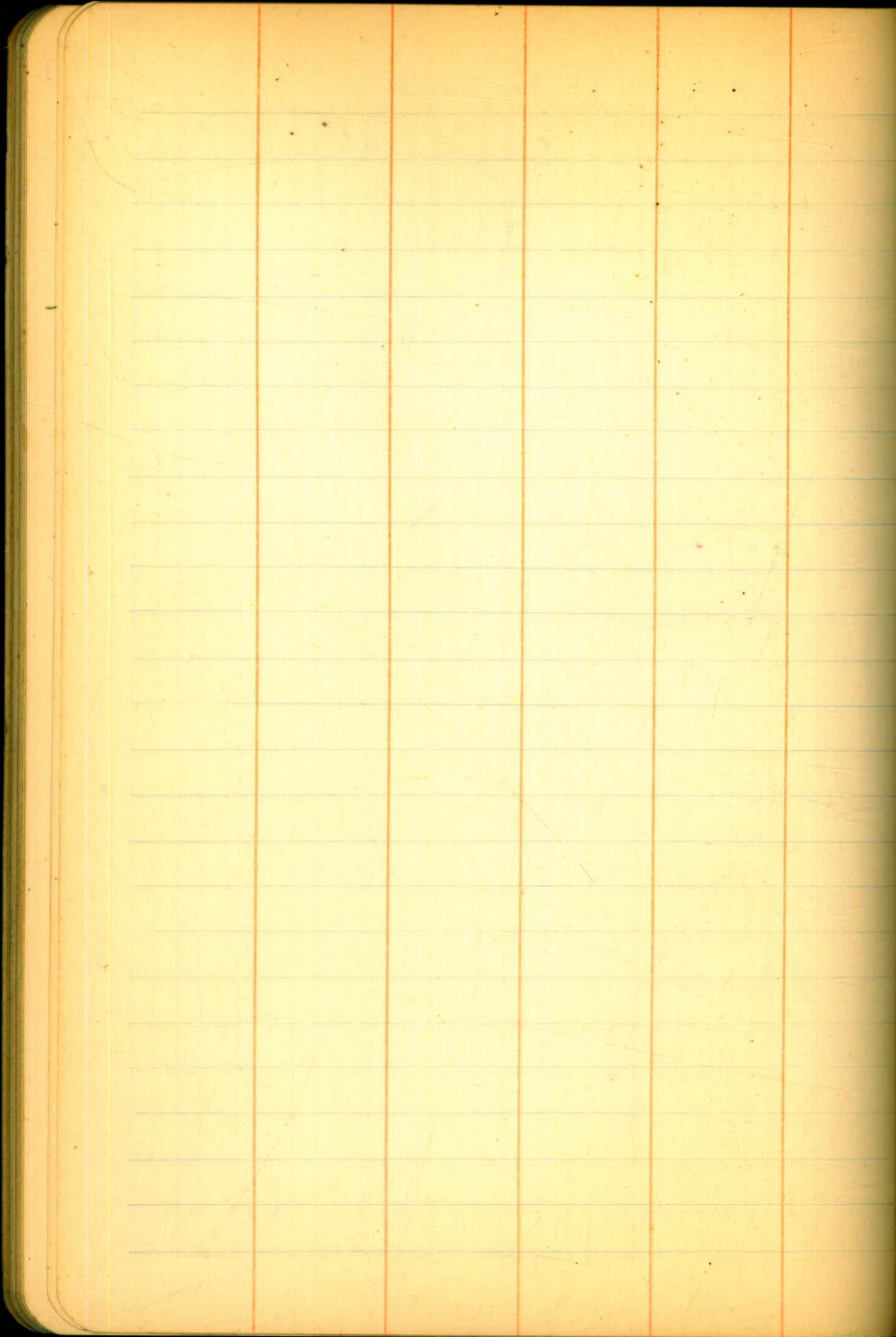
This page features a grid of blue horizontal lines and four vertical red lines, creating five columns. The grid is empty.

This page features a grid of blue horizontal lines and one vertical red line, creating two columns. Additionally, there is a large blue grid area covering most of the page, which is empty.

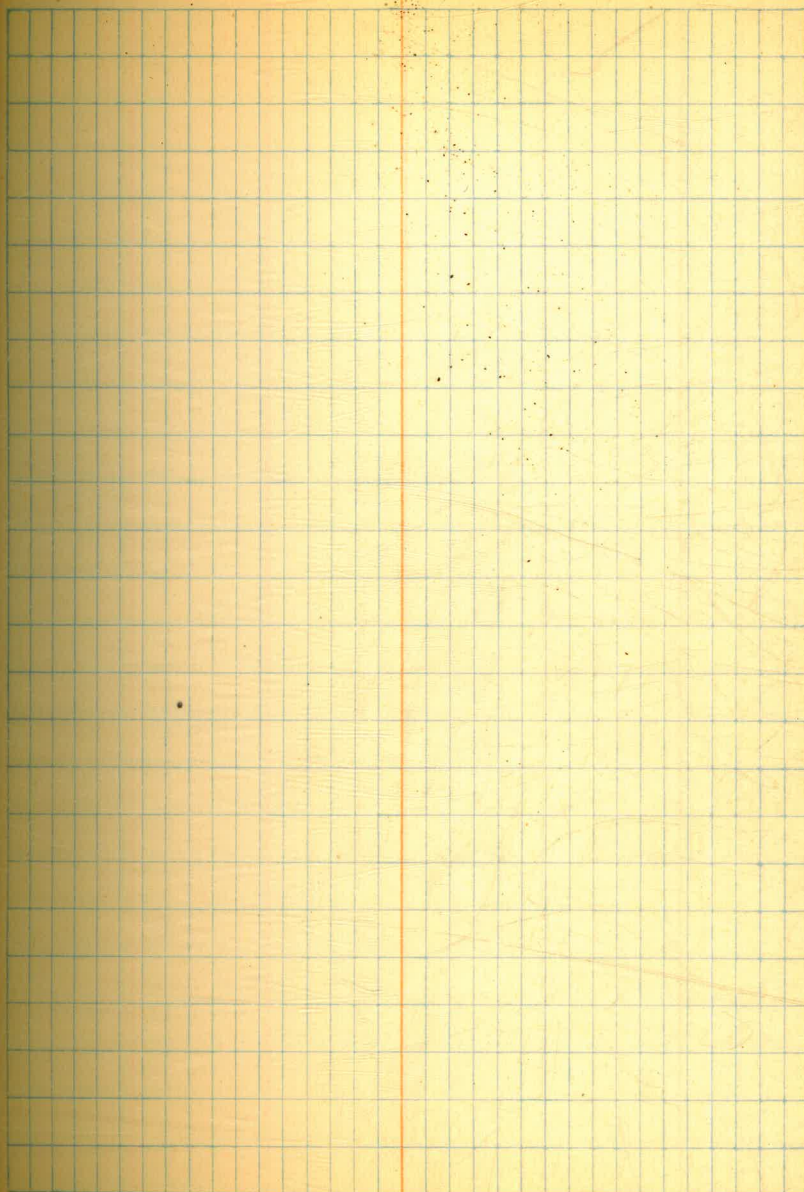
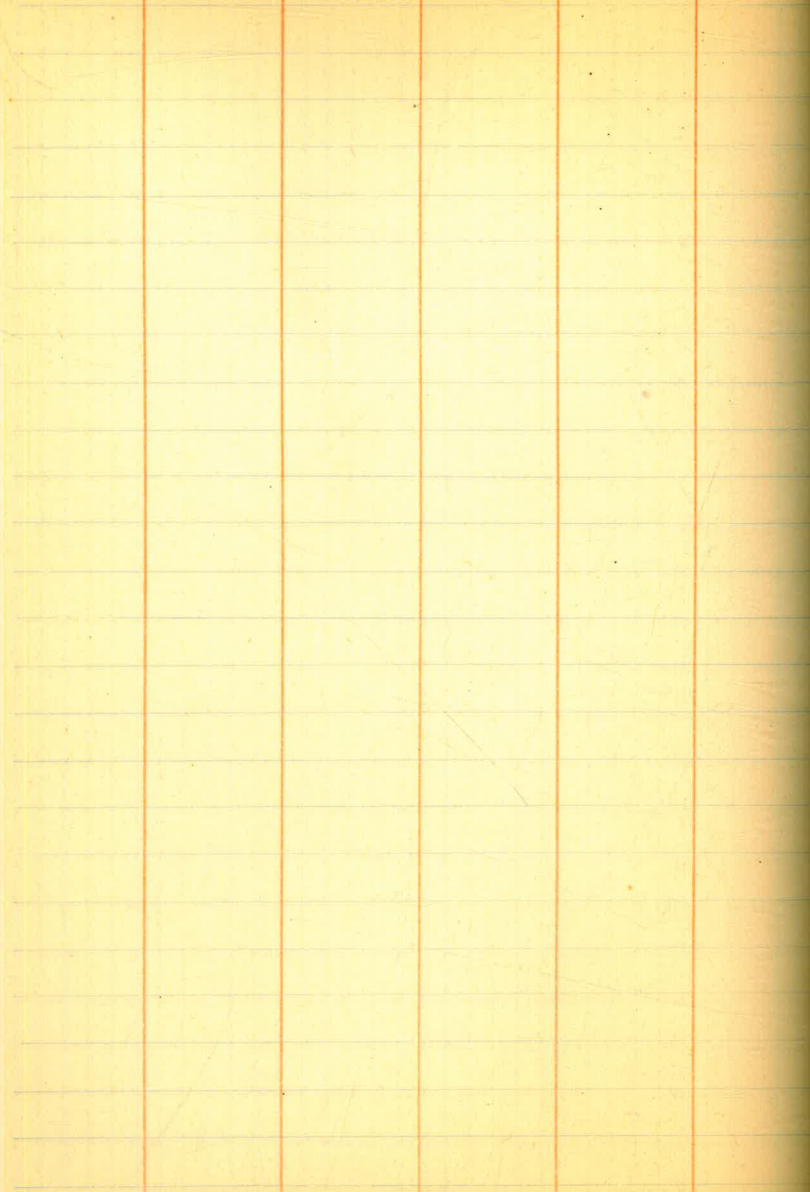


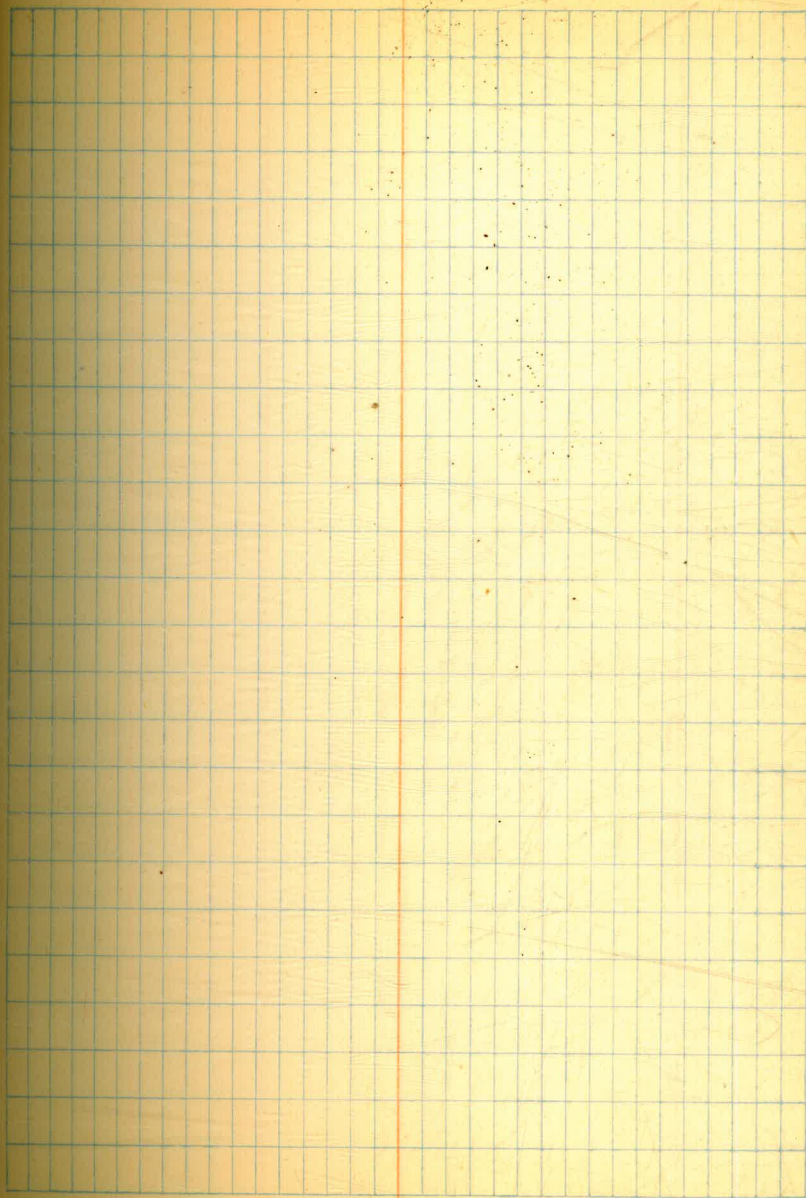
This page features four vertical red margin lines that divide the page into five columns. The columns are of varying widths, with the two outer columns being wider than the three inner columns. Horizontal blue lines are spaced evenly down the page, creating a grid for writing.

This page is a full sheet of graph paper with a uniform grid of blue lines. The grid consists of 20 columns and 25 rows of small squares. The paper is otherwise blank, with no text or markings.

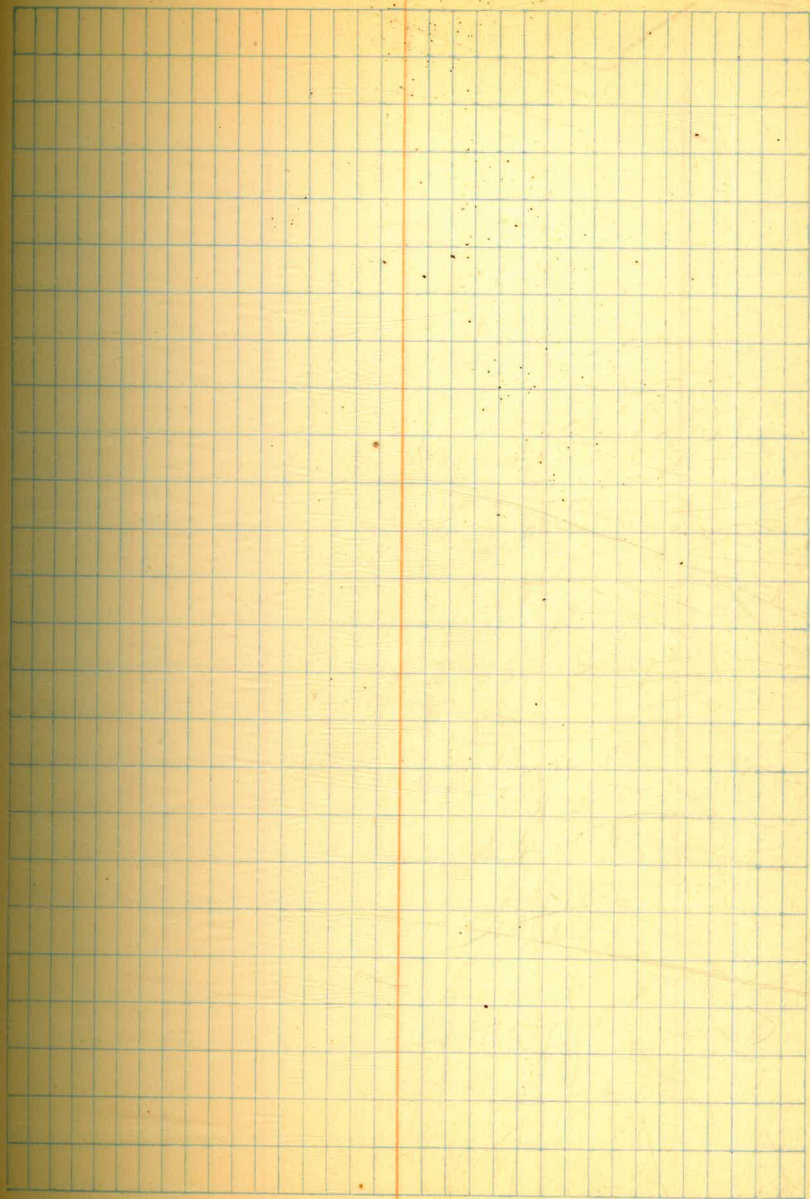


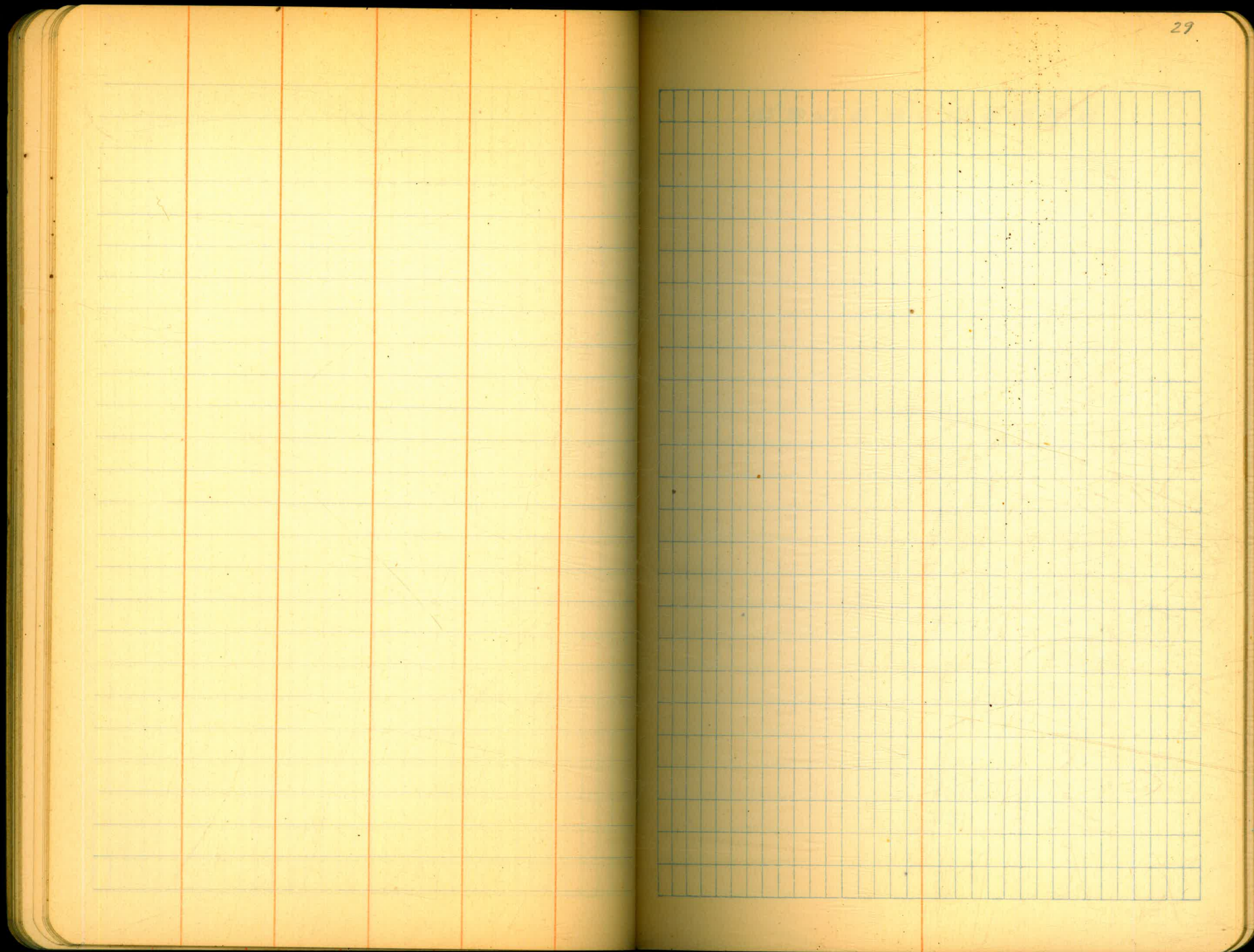








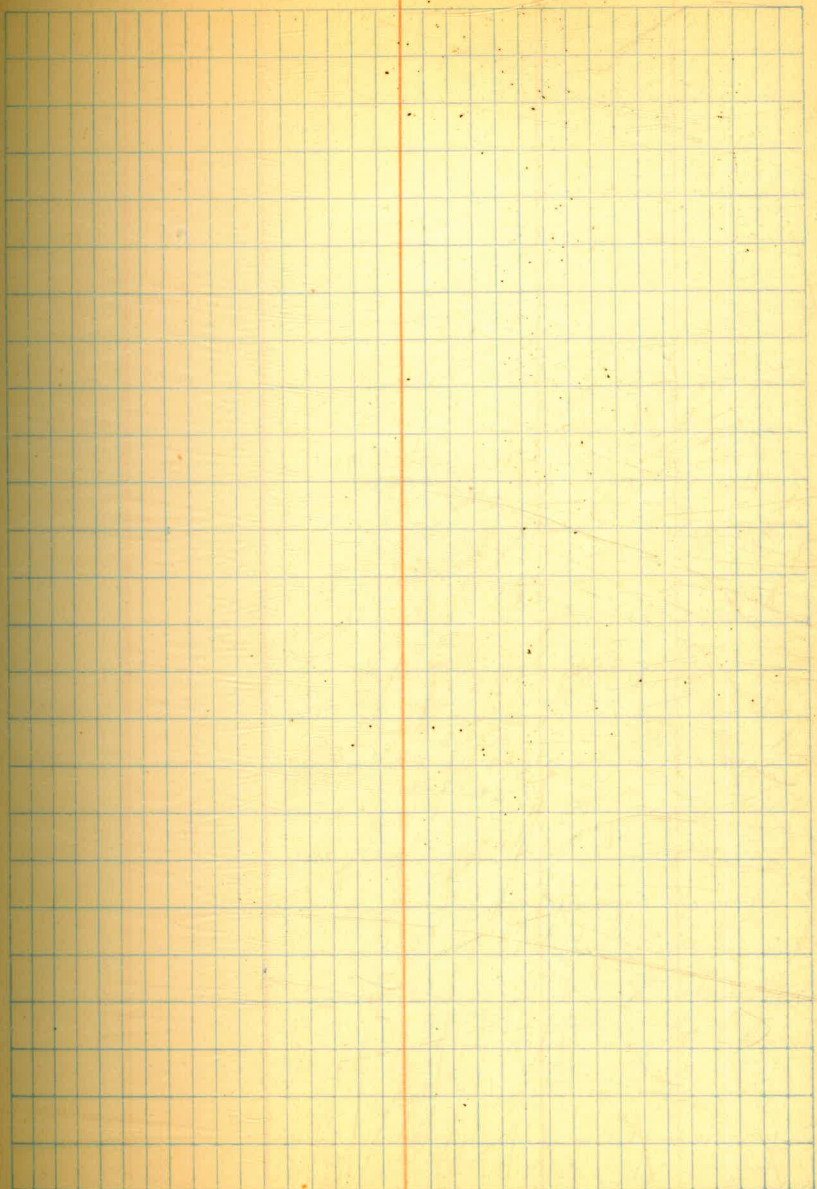
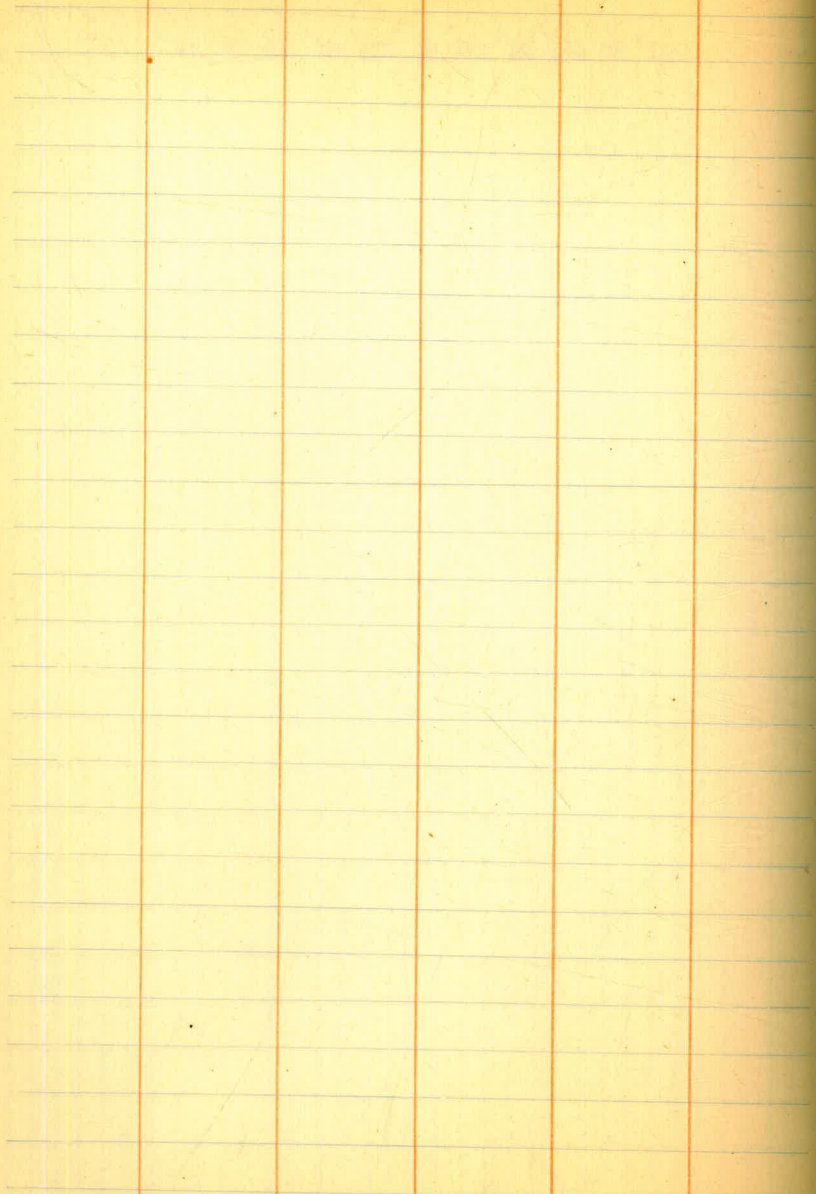






Floor of G

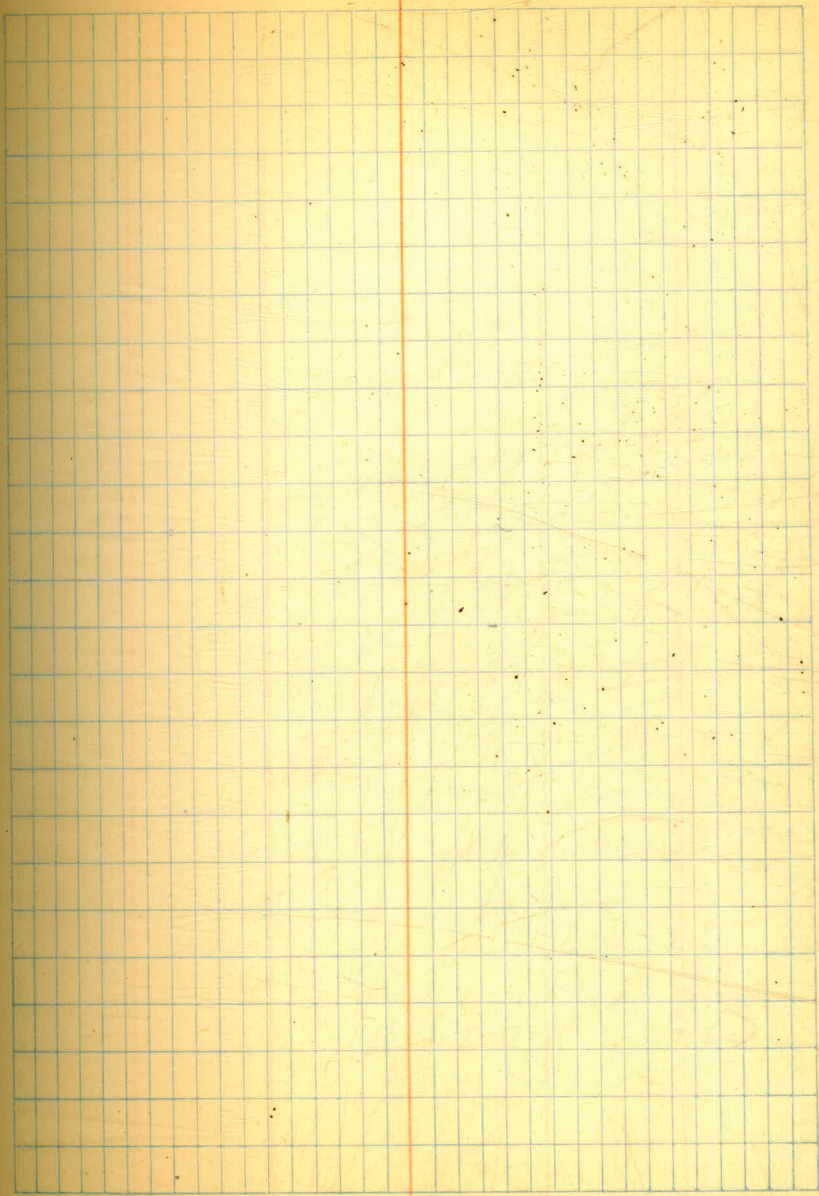
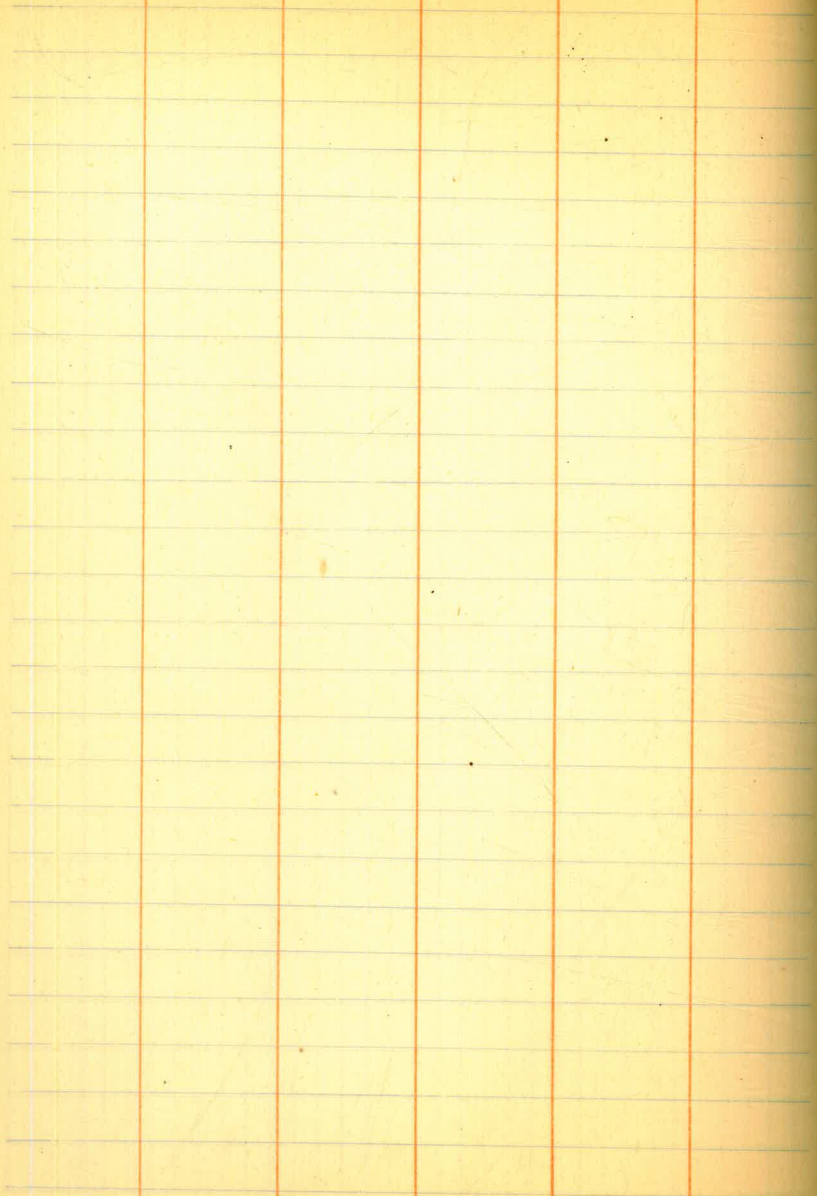
 $125^{\circ} 90 67\frac{1}{2} 45 22\frac{1}{2} \Phi, 22\frac{1}{2} 45 67\frac{1}{2} 90 125^{\circ}$



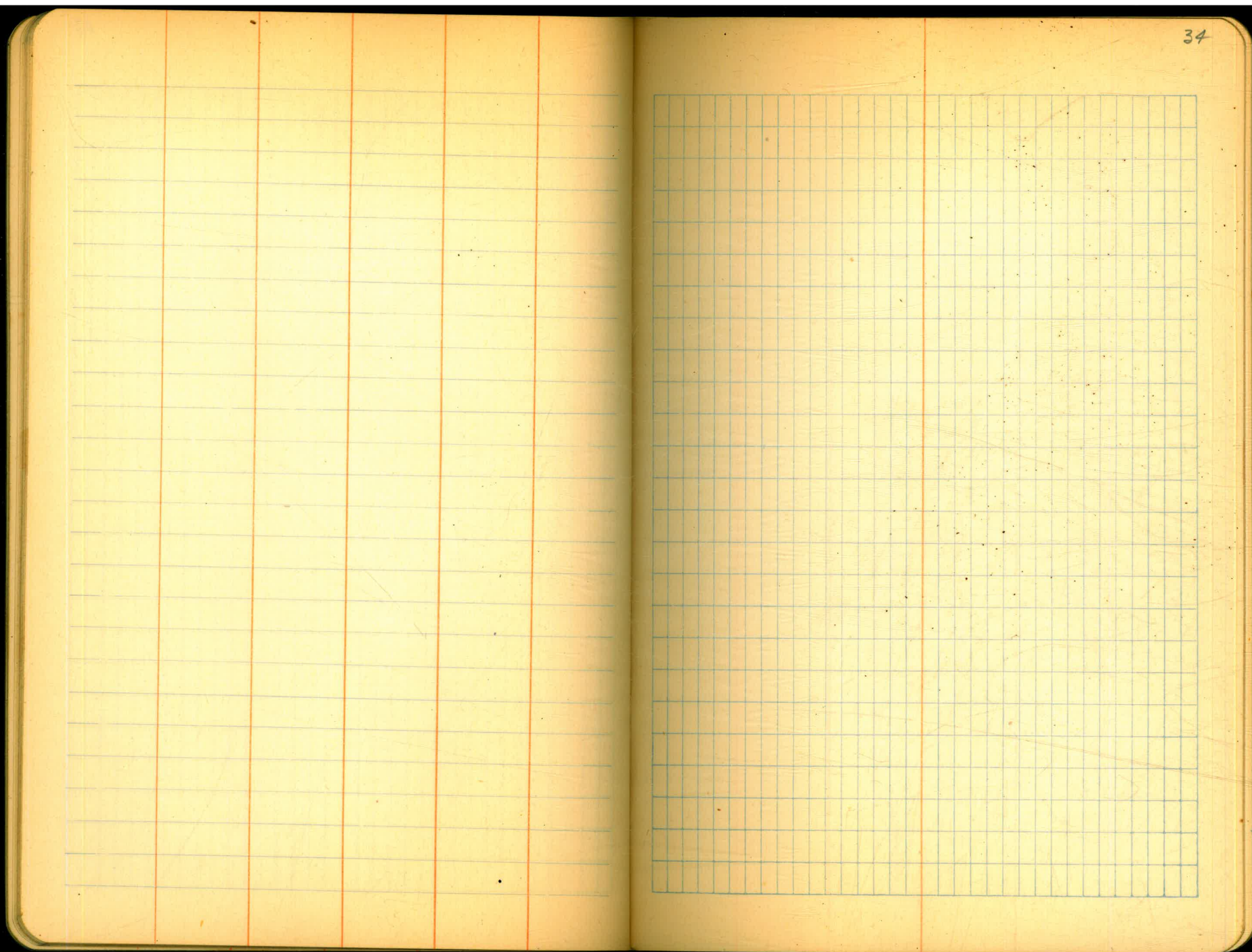


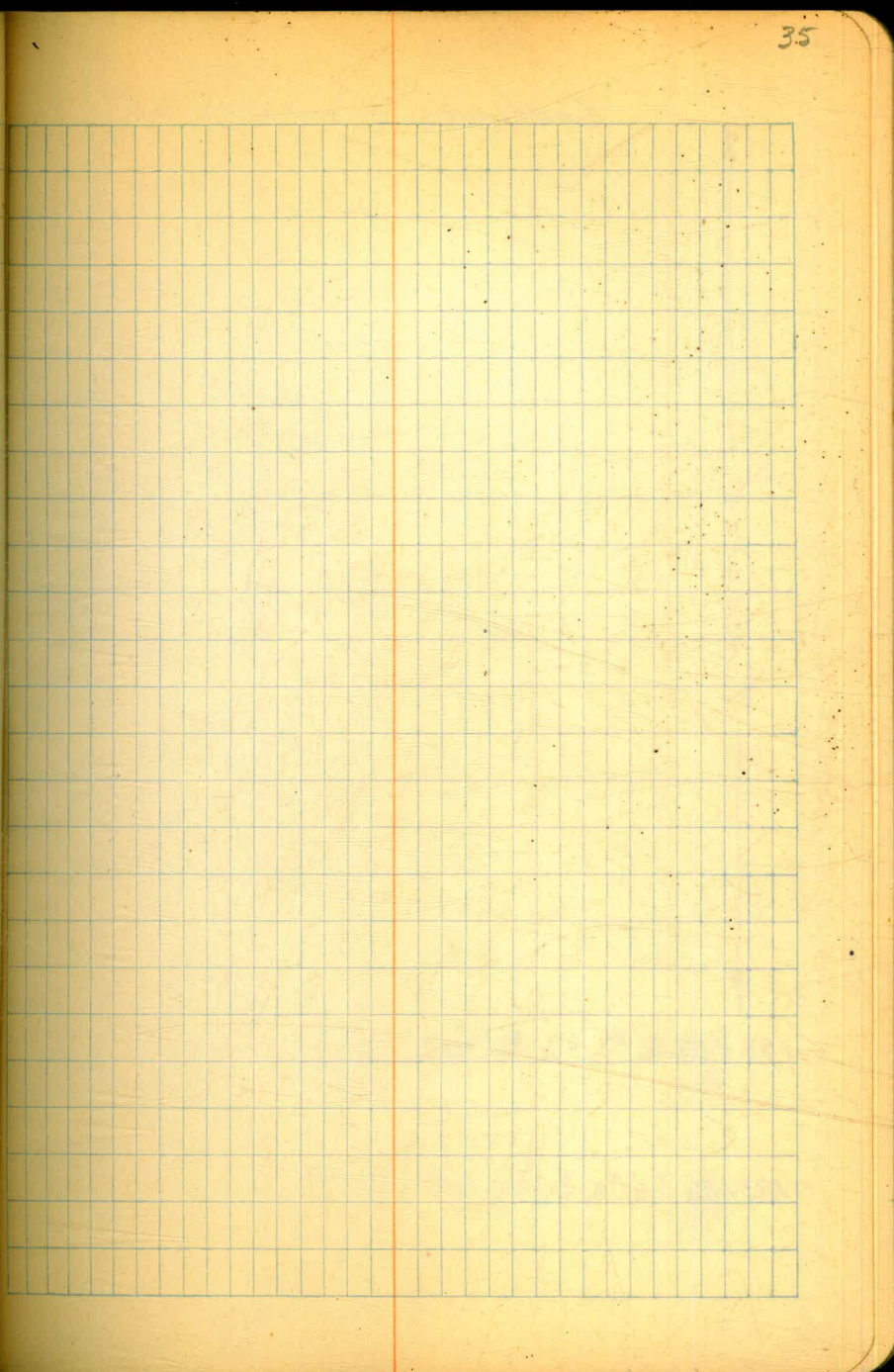
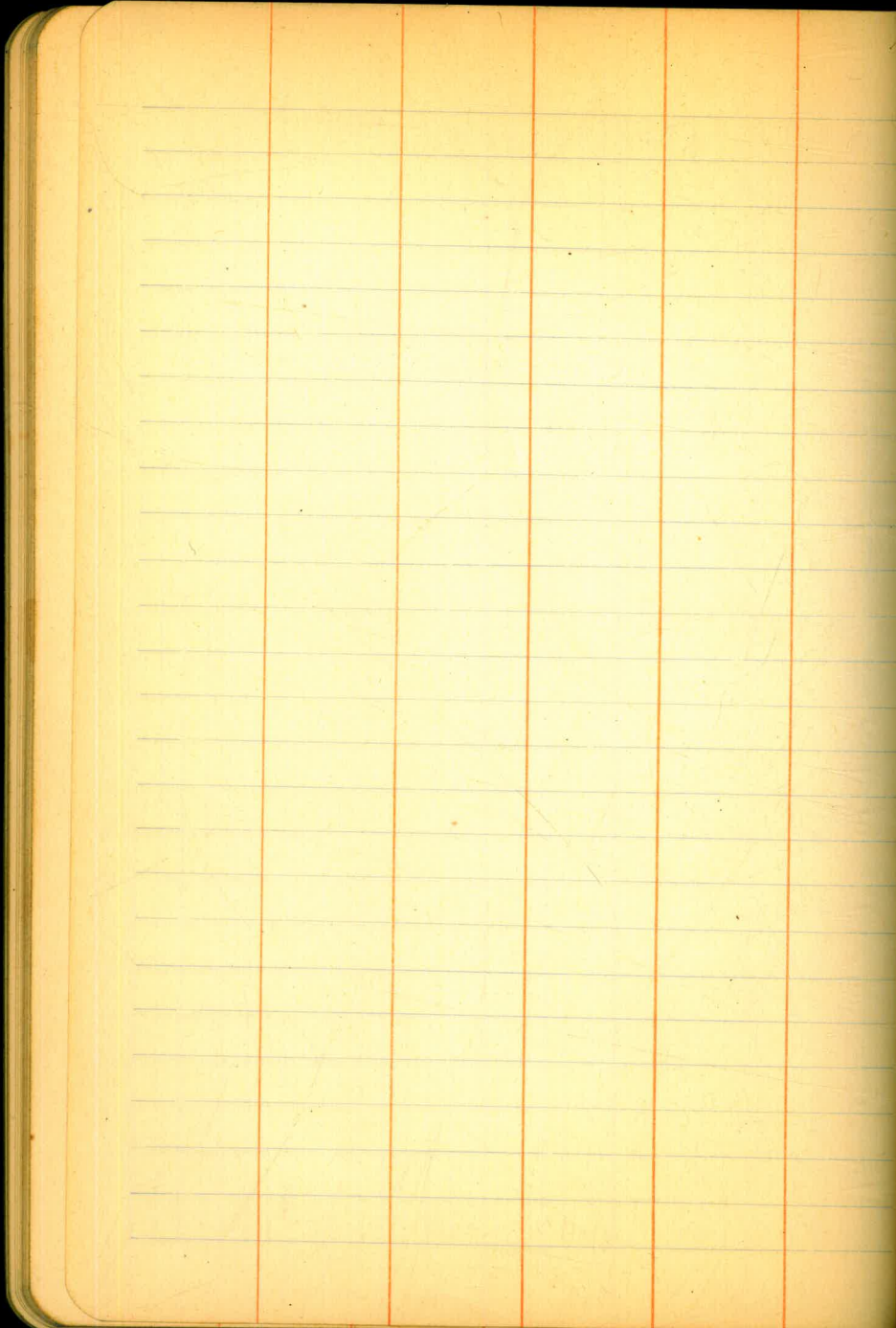
This page features four vertical red margin lines that divide the page into five columns. The rest of the page is filled with horizontal blue lines, creating a standard lined notebook format.

This page contains a large grid of blue lines, forming a graph paper layout. A single vertical red margin line is positioned on the left side of the grid. The grid is approximately 20 columns wide and 25 rows high.











Continued from page 17

↑  
Timbered  
↓

183+82

183+86

Aug 13, 1930

36

3<sup>2</sup> 9<sup>0</sup> 3<sup>8</sup> 3<sup>4</sup> 3<sup>0</sup> 3<sup>2</sup> 3<sup>4</sup> 3<sup>3</sup> 3<sup>0</sup> 2<sup>8</sup> 2<sup>7</sup> 2<sup>9</sup> 3<sup>6</sup> 3<sup>7</sup>  
139 146

3<sup>3</sup> 3<sup>8</sup> 3<sup>6</sup> 3<sup>0</sup> 3<sup>1</sup> 3<sup>0</sup> 2<sup>9</sup> 2<sup>8</sup> 2<sup>6</sup> 2<sup>6</sup> 2<sup>8</sup> 3<sup>0</sup> 3<sup>3</sup> 3<sup>8</sup>  
140 143

183+90

Shot  
 35 40 37 35 30 28 27 27 26 27 29 32 38 42 ✓  
 140 140

183+95

34 37 33 30 27 25 25 26 28 28 30 38 41 40 ✓  
 138 136

184+00

34 39 37 32 27 29 28 27 27 27 28 32 35 40 ✓  
 142 141

+06

34 41 38 33 28 26 27 23 21 21 23 25 35 38 ✓  
 141 143

+10

34 44 42 30 29 26 25 29 22 25 26 35 43 43 ✓  
 135 139

+14

Shot  
 34 42 43 37 32 27 25 24 26 29 30 32 38 43 ✓  
 144 137

+20

36 43 35 28 26 26 28 31 25 25 26 29 40 42 ✓  
 145 146

184+25

37 44 36 29 27 26 26 29 26 27 28 32 36 40 ✓  
 145 145

partly shot

shattered  
Shot







Aug 13, 1930

39

184+82

|    |     |    |    |    |    |    |    |    |    |    |    |    |     |   |
|----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|---|
| 33 | 40  | 35 | 27 | 26 | 25 | 25 | 25 | 24 | 27 | 24 | 25 | 33 | 37  | ✓ |
|    | 138 |    |    |    |    |    |    |    |    |    |    |    | 142 |   |

+83

|    |     |    |    |    |    |    |    |    |    |    |    |    |     |   |
|----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|---|
| 34 | 50  | 51 | 40 | 30 | 25 | 25 | 25 | 25 | 25 | 25 | 24 | 33 | 40  | ✓ |
|    | 130 |    |    |    |    |    |    |    |    |    |    |    | 145 |   |

Cut for car bypass

+87<sup>5</sup>

|    |     |    |    |    |    |    |    |    |    |    |    |    |     |   |
|----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|---|
| 34 | 51  | 47 | 38 | 33 | 26 | 25 | 22 | 23 | 23 | 23 | 23 | 32 | 36  | ✓ |
|    | 130 |    |    |    |    |    |    |    |    |    |    |    | 146 |   |

184+90

|    |     |    |    |    |    |    |    |    |    |    |    |    |     |   |
|----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|---|
| 34 | 41  | 38 | 29 | 25 | 24 | 24 | 24 | 22 | 24 | 24 | 24 | 36 | 37  | ✓ |
|    | 140 |    |    |    |    |    |    |    |    |    |    |    | 145 |   |

185+00

|    |     |    |    |    |    |    |    |    |    |    |    |    |     |   |
|----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|---|
| 34 | 40  | 35 | 28 | 25 | 23 | 21 | 21 | 23 | 24 | 25 | 30 | 36 | 41  | ✓ |
|    | 145 |    |    |    |    |    |    |    |    |    |    |    | 145 |   |

+10

|    |     |    |    |    |    |    |    |    |    |    |    |    |     |   |
|----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|---|
| 33 | 42  | 37 | 29 | 27 | 25 | 24 | 24 | 24 | 23 | 25 | 27 | 32 | 40  | ✓ |
|    | 142 |    |    |    |    |    |    |    |    |    |    |    | 140 |   |

+20

|    |     |    |    |    |    |    |    |    |    |    |    |    |     |   |
|----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|---|
| 32 | 42  | 36 | 28 | 25 | 23 | 21 | 23 | 21 | 21 | 20 | 26 | 35 | 38  | ✓ |
|    | 140 |    |    |    |    |    |    |    |    |    |    |    | 145 |   |

185+22

|    |     |    |    |    |    |    |    |    |    |    |    |    |     |   |
|----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|---|
| 32 | 44  | 42 | 35 | 24 | 23 | 22 | 23 | 22 | 22 | 21 | 34 | 40 | 40  | ✓ |
|    | 138 |    |    |    |    |    |    |    |    |    |    |    | 143 |   |

Shot Shattered!

Shot Shattered



E. Niott Notes &  
Soper Ruler  
Bailey Instr.

185+27

+31

+32<sup>E</sup>

+37

+42

+47

+50

185+54

Aug 13, 1930

40

47.

R4

Floor at 6

|    | 125                | 90 | 67 1/2 | 45 | 22 1/2 | 4  | 22 1/2 | 45 | 67 1/2 | 90 | 125 |                    |    |
|----|--------------------|----|--------|----|--------|----|--------|----|--------|----|-----|--------------------|----|
| 32 | 39                 | 40 | 31     | 29 | 27     | 30 | 26     | 25 | 26     | 27 | 39  | 42                 | 39 |
|    | 143                |    |        |    |        |    |        |    |        |    |     | 142                | ✓  |
| 32 | 38                 | 37 | 32     | 27 | 26     | 25 | 26     | 27 | 27     | 27 | 29  | 40                 | 38 |
|    | 142                |    |        |    |        |    |        |    |        |    |     | 144                | ✓  |
|    | Shot Hole          |    |        |    |        |    |        |    |        |    |     |                    |    |
| 32 | 38                 | 35 | 33     | 27 | 26     | 25 | 35     | 33 | 27     | 31 | 31  | 39                 | 38 |
|    | 140                |    |        |    |        |    |        |    |        |    |     | 142                | ✓  |
| 32 | 38                 | 35 | 33     | 32 | 31     | 31 | 30     | 30 | 31     | 38 | 35  | 37                 | 40 |
|    | 135                |    |        |    |        |    |        |    |        |    |     | Shot Hole 130      | ✓  |
| 33 | 40                 | 34 | 32     | 30 | 30     | 28 | 29     | 30 | 30     | 29 | 31  | 38                 | 34 |
|    | Shot Spattered 137 |    |        |    |        |    |        |    |        |    |     | Shot Spattered 141 | ✓  |
| 32 | 36                 | 33 | 33     | 30 | 30     | 30 | 27     | 27 | 29     | 27 | 29  | 33                 | 36 |
|    | 145                |    |        |    |        |    |        |    |        |    |     | 142                | ✓  |
| 31 | 40                 | 38 | 33     | 32 | 32     | 27 | 27     | 26 | 28     | 27 | 31  | 37                 | 40 |
|    | 145                |    |        |    |        |    |        |    |        |    |     | 135                | ✓  |
| 33 | 40                 | 35 | 32     | 30 | 28     | 28 | 27     | 25 | 25     | 26 | 31  | 40                 | 38 |
|    | 140                |    |        |    |        |    |        |    |        |    |     | 142                | ✓  |



Aug 13, 1930

4)

185+58

+66

+68

+72

+78

+86

+88

185+90

39 40 36 26 26 25 23 23 23 24 25 29 31 40 ✓  
145 140

35 40 40 28 27 26 24 24 22 24 24 30 41 40 ✓  
146 147

36 42 35 25 25 28 30 27 26 26 28 36 42 40 ✓  
145 142

35 32 31 26 26 25 23 20 23 25 26 26 31 32 ✓  
146 146

35 45 44 30 26 20 19 21 21 23 22 36 42 43 ✓  
138 144

34 42 34 28 28 29 28 26 28 24 25 33 34 38 ✓  
144 147

34 44 42 31 30 29 30 28 22 26 27 27 33 32 ✓  
142 148

36 46 44 39 31 30 32 33 27 26 31 38 34 41 ✓  
145 146

shattered

shattered

shot shattered

shot

shot

shot



Aug 12, 1930

42

186+00

103

107

+11

+17

+27

186+30

37  $\frac{45 \ 37 \ 37}{142}$  29 28 27 24 20 20 22 25 28 37 ✓  
158

36  $\frac{44 \ 40 \ 40}{103}$  30 27 26 22 19 21 21 26 28 37 ✓  
153

37  $\frac{44 \ 43 \ 41}{141}$  32 28 25 22 21 22 22 23  $\frac{38 \ 42}{149}$  ✓

37  $\frac{44 \ 40 \ 29 \ 26 \ 25 \ 25 \ 25 \ 20 \ 20 \ 21 \ 29}{144}$  42 49 ✓  
135

38  $\frac{51 \ 52 \ 31 \ 24 \ 24 \ 25 \ 24 \ 26 \ 27 \ 30}{137}$  44 53 50 ✓  
135 Shattered

38  $\frac{44 \ 36 \ 33}{145}$  24 23 22 22 22 22 25 25 37 46 ✓  
140 Shot

39  $\frac{46 \ 40}{145}$  29 29 28 26 23 24 25 22  $\frac{32 \ 43 \ 47}{135}$  ✓



Aug 12, 1930

43

186 + 38

+ 42

+ 45

+ 49

+ 53

+ 63

+ 67

186 + 68

3<sup>9</sup> 4<sup>2</sup> 3<sup>4</sup> 2<sup>7</sup> 2<sup>4</sup> 2<sup>3</sup> 2<sup>2</sup> 2<sup>3</sup> 2<sup>5</sup> 2<sup>8</sup> 2<sup>9</sup> 3<sup>6</sup> 3<sup>7</sup> 4<sup>4</sup> ✓  
150 100

3<sup>9</sup> 4<sup>3</sup> 3<sup>5</sup> 3<sup>2</sup> 2<sup>4</sup> 2<sup>3</sup> 2<sup>2</sup> 2<sup>3</sup> 2<sup>5</sup> 2<sup>5</sup> 2<sup>7</sup> 2<sup>9</sup> 3<sup>9</sup> 4<sup>4</sup> ✓  
146 143

3<sup>8</sup> 4<sup>5</sup> 4<sup>0</sup> 3<sup>0</sup> 2<sup>9</sup> 2<sup>8</sup> 2<sup>8</sup> 2<sup>5</sup> 2<sup>5</sup> 2<sup>6</sup> 3<sup>0</sup> 3<sup>3</sup> 4<sup>3</sup> 4<sup>4</sup> ✓  
141 140 Shattered

3<sup>8</sup> 4<sup>4</sup> 3<sup>4</sup> 2<sup>7</sup> 2<sup>7</sup> 2<sup>6</sup> 2<sup>4</sup> 2<sup>4</sup> 2<sup>4</sup> 2<sup>5</sup> 2<sup>7</sup> 2<sup>9</sup> 3<sup>8</sup> 4<sup>3</sup> ✓  
143 140 Shot Shattered

3<sup>5</sup> 4<sup>5</sup> 4<sup>5</sup> 3<sup>0</sup> 2<sup>7</sup> 2<sup>8</sup> 2<sup>7</sup> 2<sup>6</sup> 2<sup>6</sup> 2<sup>6</sup> 2<sup>7</sup> 2<sup>8</sup> 3<sup>3</sup> 3<sup>8</sup> ✓  
138 143 Shattered

3<sup>6</sup> 4<sup>2</sup> 3<sup>6</sup> 3<sup>2</sup> 2<sup>3</sup> 2<sup>5</sup> 2<sup>6</sup> 2<sup>6</sup> 2<sup>5</sup> 2<sup>6</sup> 2<sup>7</sup> 2<sup>8</sup> 3<sup>7</sup> 4<sup>2</sup> ✓  
142 141 Shattered

3<sup>6</sup> 4<sup>0</sup> 3<sup>8</sup> 2<sup>9</sup> 2<sup>8</sup> 2<sup>6</sup> 2<sup>6</sup> 2<sup>5</sup> 2<sup>5</sup> 2<sup>6</sup> 2<sup>8</sup> 3<sup>0</sup> 4<sup>5</sup> 4<sup>2</sup> ✓  
143 138 Shot

3<sup>6</sup> 4<sup>0</sup> 3<sup>8</sup> 2<sup>9</sup> 2<sup>8</sup> 2<sup>6</sup> 2<sup>6</sup> 2<sup>5</sup> 2<sup>5</sup> 2<sup>6</sup> 2<sup>8</sup> 3<sup>0</sup> 4<sup>5</sup> 4<sup>2</sup> ✓  
143 138 Shot







Aug 12, 1930

45

187+05

3<sup>6</sup> 4<sup>1</sup> 3<sup>6</sup> 2<sup>5</sup> 2<sup>4</sup> 2<sup>4</sup> 2<sup>2</sup> 2<sup>4</sup> 2<sup>3</sup> 2<sup>3</sup> 2<sup>2</sup> 2<sup>4</sup> 3<sup>2</sup> 3<sup>2</sup> ✓  
 146 148

Shot

+08

3<sup>6</sup> 4<sup>4</sup> 4<sup>1</sup> 3<sup>5</sup> 2<sup>9</sup> 2<sup>5</sup> 2<sup>4</sup> 2<sup>3</sup> 2<sup>3</sup> 2<sup>5</sup> 2<sup>6</sup> 2<sup>7</sup> 3<sup>2</sup> 4<sup>0</sup> ✓  
 140 145

+12

3<sup>6</sup> 4<sup>3</sup> 3<sup>6</sup> 2<sup>8</sup> 2<sup>6</sup> 2<sup>4</sup> 2<sup>3</sup> 2<sup>2</sup> 2<sup>1</sup> 2<sup>3</sup> 2<sup>4</sup> 2<sup>7</sup> 3<sup>4</sup> 4<sup>0</sup> ✓  
 143 144

+23

3<sup>7</sup> 4<sup>3</sup> 3<sup>7</sup> 2<sup>9</sup> 2<sup>8</sup> 2<sup>8</sup> 2<sup>8</sup> 2<sup>7</sup> 2<sup>6</sup> 2<sup>6</sup> 2<sup>7</sup> 2<sup>6</sup> 3<sup>4</sup> 4<sup>1</sup> ✓  
 148 145

+34

3<sup>6</sup> 4<sup>1</sup> 3<sup>4</sup> 2<sup>6</sup> 2<sup>3</sup> 2<sup>3</sup> 2<sup>3</sup> 2<sup>3</sup> 2<sup>5</sup> 2<sup>6</sup> 2<sup>8</sup> 3<sup>1</sup> 3<sup>8</sup> 4<sup>2</sup> ✓  
 147 141

+37

3<sup>8</sup> 4<sup>9</sup> 3<sup>6</sup> 3<sup>0</sup> 2<sup>7</sup> 2<sup>5</sup> 2<sup>4</sup> 2<sup>6</sup> 2<sup>6</sup> 2<sup>9</sup> 3<sup>2</sup> 3<sup>1</sup> 3<sup>8</sup> 4<sup>5</sup> ✓  
 140 144

Cut for bypass

+42

3<sup>8</sup> 4<sup>8</sup> 3<sup>9</sup> 2<sup>8</sup> 2<sup>5</sup> 2<sup>2</sup> 2<sup>0</sup> 2<sup>3</sup> 2<sup>3</sup> 2<sup>5</sup> 2<sup>7</sup> 2<sup>7</sup> 4<sup>0</sup> 4<sup>6</sup> ✓  
 137 141

187+45

3<sup>8</sup> 4<sup>5</sup> 3<sup>6</sup> 2<sup>6</sup> 2<sup>2</sup> 1<sup>9</sup> 2<sup>0</sup> 2<sup>2</sup> 2<sup>3</sup> 2<sup>3</sup> 2<sup>5</sup> 2<sup>7</sup> 3<sup>8</sup> 4<sup>1</sup> ✓  
 145 145



Aug 12, 1930

46

187 + 50

+60

+70

+80

+91

187 + 93

188 + 04

188 + 10

| Shot        |     |    |    |    |    |    |    |    |    |    |    |     |    |   |
|-------------|-----|----|----|----|----|----|----|----|----|----|----|-----|----|---|
| 38          | 42  | 42 | 27 | 25 | 24 | 23 | 25 | 22 | 22 | 25 | 27 | 35  | 42 | ✓ |
|             | 140 |    |    |    |    |    |    |    |    |    |    | 145 |    |   |
| 36          | 42  | 36 | 26 | 23 | 22 | 21 | 23 | 23 | 23 | 26 | 30 | 33  | 41 | ✓ |
|             | 150 |    |    |    |    |    |    |    |    |    |    | 146 |    |   |
| 38          | 42  | 35 | 28 | 26 | 26 | 25 | 26 | 25 | 25 | 26 | 27 | 36  | 42 |   |
|             | 150 |    |    |    |    |    |    |    |    |    |    | 150 |    |   |
| 38          | 43  | 40 | 32 | 28 | 26 | 25 | 31 | 22 | 22 | 24 | 27 | 33  | 42 |   |
|             | 150 |    |    |    |    |    |    |    |    |    |    | 150 |    |   |
| 32          | 40  | 31 | 26 | 24 | 23 | 25 | 24 | 23 | 23 | 24 | 25 | 31  | 42 | ✓ |
|             | 155 |    |    |    |    |    |    |    |    |    |    | 148 |    |   |
| Shot        |     |    |    |    |    |    |    |    |    |    |    |     |    |   |
| 36          | 40  | 31 | 28 | 25 | 25 | 26 | 28 | 29 | 31 | 33 | 34 | 38  | 43 | ✓ |
|             | 151 |    |    |    |    |    |    |    |    |    |    | 145 |    |   |
| Aug 7, 1930 |     |    |    |    |    |    |    |    |    |    |    |     |    |   |
| 36          | 40  | 34 | 29 | 26 | 27 | 30 | 27 | 28 | 27 | 27 | 27 | 38  | 43 | ✓ |
|             | 148 |    |    |    |    |    |    |    |    |    |    | 148 |    |   |
| 36          | 43  | 39 | 30 | 28 | 26 | 26 | 25 | 27 | 30 | 32 | 34 | 38  | 43 |   |
|             | 144 |    |    |    |    |    |    |    |    |    |    | 145 |    |   |



188 +12

36 44 38 29 27 27 26 27 27 30 36 37 40 44 ✓  
143 145

+17

36 43 37 28 27 26 25 26 27 28 29 30 37 43 ✓  
145 146

+21

36 45 35 28 28 26 26 26 26 30 <sup>Shot</sup> (35 35) 41 45 ✓  
145 145

+24

36 42 35 27 26 26 29 31 30 27 31 30 36 44 ✓  
145 145

+29

36 47 38 30 30 28 28 33 34 30 30 30 38 45 ✓  
145 144

+31.5

35 42 39 37 33 32 33 33 29 28 28 29 35 41 ✓  
145 145

+33

35 43 39 32 32 31 32 35 30 28 27 28 34 40 ✓  
146 145

188 +40

35 42 39 29 28 28 33 34 30 28 28 28 34 40 ✓  
146 145



Aug 7, 1930

48

188 + 44

+ 48

+ 50

+ 55

+ 60

+ 70

+ 72

188 + 76

shot

34 44 39 (34 34) 31 30 34 35 33 (32 35) 39 45 ✓  
144 145

shot

34 43 31 29 30 28 33 35 32 30 30 32 37 44 ✓  
145 144

34 42 39 30 30 31 31 35 30 27 29 29 37 42  
144 143

34 44 36 29 28 28 30 30 30 31 32 31 37 44  
145 145

35 43 35 26 25 23 23 25 26 25 22 22 38 44  
146 145

37 43 38 30 22 25 24 23 23 27 30 31 40 46 -  
146 145

shot

36 46 37 31 28 26 26 26 25 27 31 (36 44 45) ✓  
144 146

37 44 38 30 27 29 27 28 24 27 29 31 39 44 ✓  
145 146



188+87

36 40 35 29 27 26 25 31 26 23 24 22 34 41  
149 147 ✓

188+95

36 43 34 22 26 25 25 27 28 28 29 30 38 43 ✓  
145 148

189+00

36 43 37 30 29 30 30 33 34 31 30 30 36 42 ✓  
146 145

Shattered

+03

36 43 37 33 33 31 34 36 33 33 31 34 38 41 ✓  
140 140

+07

38 43 38 32 31 31 34 32 31 33 35 35 40 43 ✓  
145 146

Shot

+11

37 45 39 35 36 32 33 34 30 32 31 30 39 44 ✓  
144 142

+15

38 44 35 31 30 28 28 30 26 26 28 29 41 49 ✓  
146 144

Shot

189+18

38 41 33 31 28 25 24 29 26 26 25 28/40 45 ✓  
150 145

+23

38 44 35 29 28 27 29 33 27 28 28 30 45 49 ✓  
147 142

Shot



Aug 7, 1930

50

189+26

125 90 67 45 22 1/2 41 22 1/2 45 67 90 125  
 37 45 33 28 26 25 30 30 29 31 35 39 42 42 ✓  
 146 Shot 140

+30

Shot  
 38 43 40 34 32 32 28 29 28 29 31 33 45 42 ✓  
 147 144

+33

38 41 41 36 35 34 29 27 34 33 33 36 42 45 ✓  
 146 141

+37

Shot  
 36 45 42 34 36 31 32 38 39 33 34 32 37 41 ✓  
 141 143

+43

37 41 34 31 31 32 32 33 30 32 26 26 37 39 ✓  
 147 150

+46 1/2

38 42 34 27 27 29 29 30 29 28 27 28 36 42 ✓  
 150 145

+48 1/2

Shot Hole  
 38 43 35 31 31 33 32 33 33 30 27 30 43 44 ✓  
 145 Shattered 144

189+50

38 43 37 29 31 32 34 32 31 30 28 29 43 41 ✓  
 147 142



Aug 7, 1930.

51

189+53

+63<sup>5</sup>

+64<sup>5</sup>

+71

+73

+76

+80

189+83

38 43 36 29 30 30 27 28 29 29 28 30 30 44  
147 143

shattered

38 43 34 26 28 28 27 31 31 31 30 30 40 44  
148 143

Shot Hole

39 42 33 26 26 27 29 36 31 30 30 30 36 46  
150 144

37 42 32 26 28 27 29 31 29 32 29 31 32 45  
148 143

shattered

37 42 32 34 30 32 30 29 30 32 31 30 38 44  
145 142

Shot

37 42 37 33 32 35 33 32 32 31 30 31 38 45  
148 144

37 43 34 30 30 30 32 33 32 34 31 32 40 44  
146 143

37 43 30 27 30 29 33 33 35 33 31 29 32 41  
146 144







190+20

Shot Hole  
 3<sup>5</sup> 3<sup>8</sup> 3<sup>2</sup> 3<sup>1</sup> 3<sup>5</sup> 3<sup>4</sup> 3<sup>3</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>4</sup> 3<sup>4</sup> 3<sup>2</sup> 4<sup>1</sup> 4<sup>1</sup> ✓  
 145 Shot 144

+23<sup>5</sup>

Shot  
 3<sup>6</sup> 3<sup>8</sup> 3<sup>4</sup> 3<sup>0</sup> 4<sup>1</sup> 3<sup>5</sup> 3<sup>3</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>0</sup> 2<sup>8</sup> 3<sup>1</sup> 3<sup>6</sup> 4<sup>2</sup> ✓  
 147 140

+26

Shot  
 3<sup>5</sup> 3<sup>8</sup> 3<sup>4</sup> 3<sup>1</sup> 3<sup>5</sup> 3<sup>5</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>2</sup> 3<sup>2</sup> 2<sup>9</sup> 3<sup>0</sup> 3<sup>5</sup> 4<sup>2</sup> ✓  
 145 144

+30

Shot  
 3<sup>5</sup> 3<sup>8</sup> 3<sup>4</sup> 3<sup>1</sup> 3<sup>3</sup> 3<sup>2</sup> 3<sup>1</sup> 3<sup>0</sup> 3<sup>1</sup> 3<sup>2</sup> 3<sup>1</sup> 3<sup>0</sup> 3<sup>4</sup> 3<sup>9</sup> ✓  
 144 138

+39

Shot  
 3<sup>3</sup> 3<sup>7</sup> 3<sup>2</sup> 2<sup>7</sup> 2<sup>9</sup> 3<sup>1</sup> 3<sup>0</sup> 2<sup>7</sup> 2<sup>8</sup> 3<sup>4</sup> 3<sup>3</sup> 3<sup>6</sup> 4<sup>2</sup> 3<sup>8</sup> ✓  
 145 140

+41

3<sup>3</sup> 3<sup>7</sup> 3<sup>4</sup> 2<sup>8</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>0</sup> 2<sup>8</sup> 3<sup>0</sup> 3<sup>0</sup> 2<sup>8</sup> 2<sup>8</sup> 3<sup>9</sup> 3<sup>6</sup> ✓  
 148 146

+46

3<sup>2</sup> 3<sup>9</sup> 3<sup>9</sup> 3<sup>2</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>2</sup> 3<sup>2</sup> 3<sup>3</sup> 2<sup>9</sup> 2<sup>9</sup> 2<sup>7</sup> 3<sup>3</sup> 3<sup>5</sup> ✓  
 143 144

190+48

Shot Hole  
 3<sup>3</sup> 3<sup>9</sup> 3<sup>8</sup> 3<sup>2</sup> 3<sup>9</sup> 3<sup>4</sup> 3<sup>3</sup> 3<sup>2</sup> 3<sup>2</sup> 3<sup>1</sup> 2<sup>8</sup> 2<sup>7</sup> 2<sup>9</sup> 3<sup>5</sup> ✓  
 140 135



Aug 7, 1930

54

190+50

+55

+59

+65

+71<sup>5</sup>

+72<sup>5</sup>

+75

190+77

Shot Hole)

34 41 36 34 34 35 35 32 34 35 30 28 33 36 ✓  
144 147

34 39 36 32 33 34 34 34 33 31 30 31 35 38 ✓  
145 145

Shot Hole)

35 38 34 35 32 36 38 36 34 34 29 28 37 38 ✓  
146 144

Shot Hole)

33 36 33 29 32 38 42 41 38 36 34 31 31 38 ✓  
144 143

34 39 35 28 29 31 32 33 35 33 32 31 41 44 ✓  
142 144

Shot Hole)

35 42 35 27 31 29 30 32 32 40 36 34 48 44 ✓  
145 144

Shot Hole)

34 38 35 31 35 32 30 32 30 32 33 32 38 43 ✓  
145 140

Shot Hole)

34 42 40 34 31 31 30 31 30 30 30 31 44 43 ✓  
141 141



Aug 6, 1930

55

190 +82

3<sup>3</sup> 3<sup>2</sup> 3<sup>4</sup> 3<sup>1</sup> 3<sup>1</sup> 2<sup>9</sup> 3<sup>1</sup> 2<sup>8</sup> 2<sup>7</sup> 2<sup>7</sup> 3<sup>1</sup> 2<sup>2</sup> 3<sup>2</sup> 3<sup>2</sup> ✓  
144 145

+94

3<sup>5</sup> 4<sup>1</sup> 3<sup>4</sup> 3<sup>1</sup> 2<sup>2</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>0</sup> 3<sup>2</sup> 2<sup>8</sup> 3<sup>0</sup> 3<sup>3</sup> 3<sup>8</sup> 3<sup>8</sup> ✓  
145 145

190 +96<sup>5</sup>

Shot Hole Shot Hole  
3<sup>5</sup> 4<sup>1</sup> 3<sup>9</sup> 3<sup>0</sup> 3<sup>3</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>7</sup> 3<sup>2</sup> 3<sup>4</sup> 3<sup>7</sup> 3<sup>5</sup> 4<sup>1</sup> 4<sup>1</sup> ✓  
140 135

191 +00

Shot Hole  
3<sup>5</sup> 4<sup>2</sup> 4<sup>1</sup> 3<sup>8</sup> 2<sup>9</sup> 3<sup>2</sup> 3<sup>2</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>2</sup> 3<sup>1</sup> 3<sup>3</sup> 3<sup>5</sup> 4<sup>2</sup> ✓  
145 145

+03

Shot  
3<sup>5</sup> 3<sup>2</sup> 3<sup>5</sup> 3<sup>0</sup> 3<sup>2</sup> (3<sup>2</sup>) 3<sup>4</sup> 3<sup>1</sup> 3<sup>4</sup> 3<sup>4</sup> 3<sup>3</sup> 3<sup>2</sup> 3<sup>8</sup> 4<sup>0</sup> ✓  
145 142

+06

Shot Hole  
3<sup>5</sup> 3<sup>8</sup> 3<sup>4</sup> 3<sup>2</sup> 3<sup>1</sup> 3<sup>2</sup> 3<sup>2</sup> 3<sup>3</sup> 3<sup>4</sup> 3<sup>4</sup> 3<sup>2</sup> 3<sup>8</sup> 3<sup>6</sup> 3<sup>8</sup> ✓  
148 145

+10

3<sup>5</sup> 3<sup>8</sup> 3<sup>5</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>2</sup> 3<sup>4</sup> 3<sup>4</sup> 3<sup>3</sup> 3<sup>2</sup> 3<sup>1</sup> 3<sup>1</sup> 3<sup>4</sup> 3<sup>7</sup> ✓  
148 146

191 +20

3<sup>7</sup> 4<sup>2</sup> 3<sup>4</sup> 3<sup>1</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>0</sup> 2<sup>9</sup> 2<sup>9</sup> 3<sup>1</sup> 3<sup>0</sup> 3<sup>0</sup> 3<sup>4</sup> 4<sup>1</sup> ✓  
142 142







191 + 715

+74

+78

+85

+92

+98

191 + 99 (At S. face of timber)

↓  
Timbered

192 + 175 Portal

35 40 39 32 31 32 31 33 32 34 31 36 42 42 ✓  
142 140

35 40 31 29 29 29 32 36 39 36 34 32 41 45 ✓  
146 141 Shot Hole

35 41 34 30 31 31 30 32 31 32 31 31 32 42 ✓  
145 140

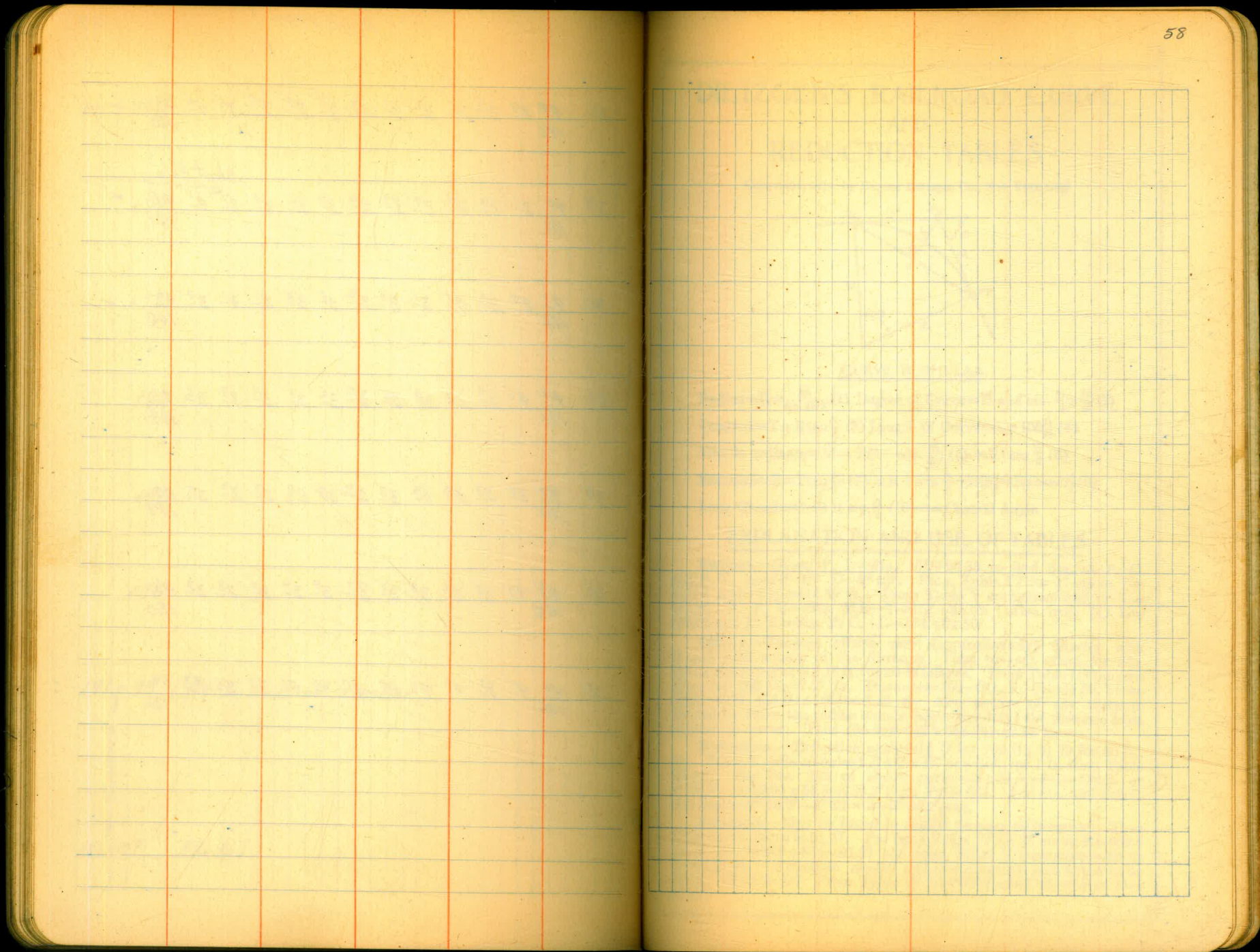
35 44 42 33 32 34 35 35 32 31 31 33 36 41 ✓  
141 144

36 43 38 33 32 33 33 30 30 28 27 27 35 40 ✓  
144 149

35 44 40 33 34 38 38 37 39 39 31 28 33 41 ✓  
145 150

35 48 47 37 40 40 40 40 40 40 35 35 43 50 ✓  
136 136

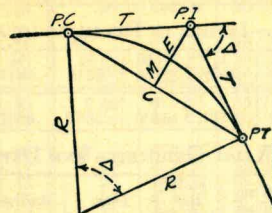






# DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES

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### CURVE FORMULAS

Radius= $R = \frac{50}{\sin. \frac{D}{2}}$  (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)  $\Delta = \text{Central Angle}$

### 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 91.37. For from Table IV for  $1^\circ$  curve  $E = 960.6$  for  $8^\circ 20' = 960.6 \div 8\frac{1}{2} = 91.27$  and from Table V correction=.10 or  $E = 91.37$  ft. 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  $D = 5^\circ 30'$ .



DISTANCES FROM CENTER OF ROADWAY FOR  
CROSS-SECTIONING.

Roadway 16 feet wide. Side Slopes 1 on 1½.

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  $41.9 + (20 - 16) \div 2$  or 2 ft. added to 41.9 = 43.9. For slopes of 1 on 1 see inside of front cover.

Made in Germany.