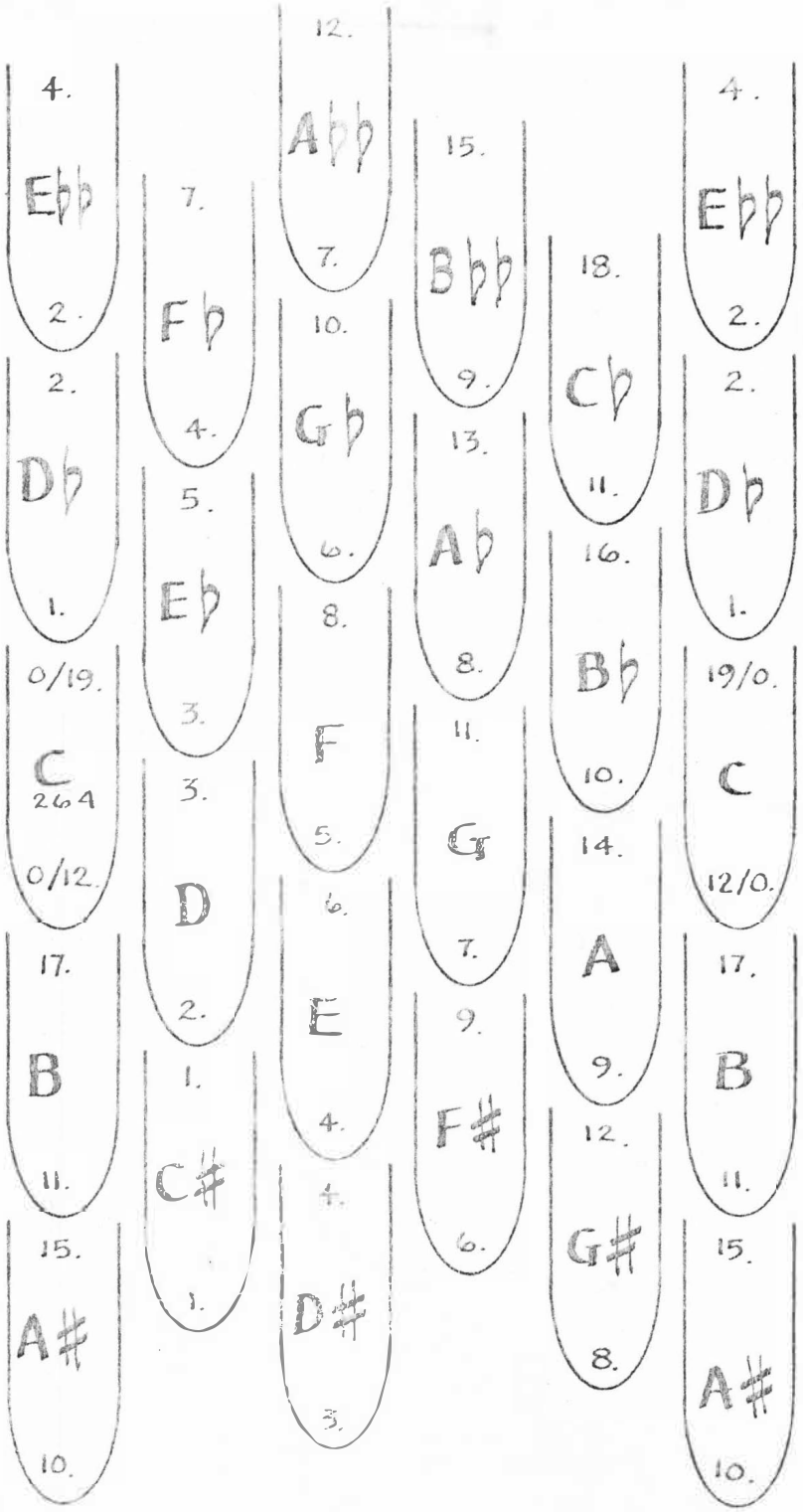
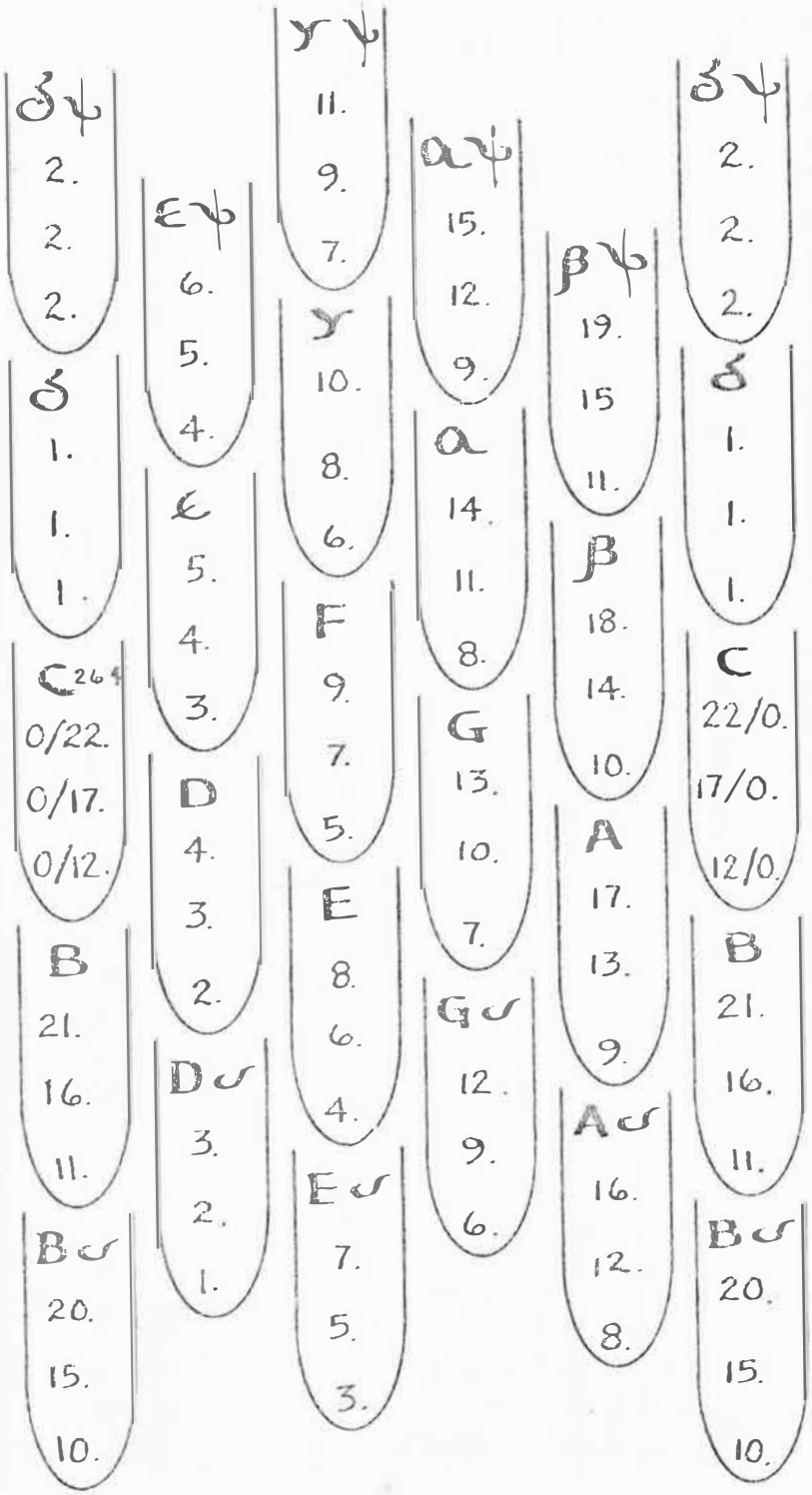
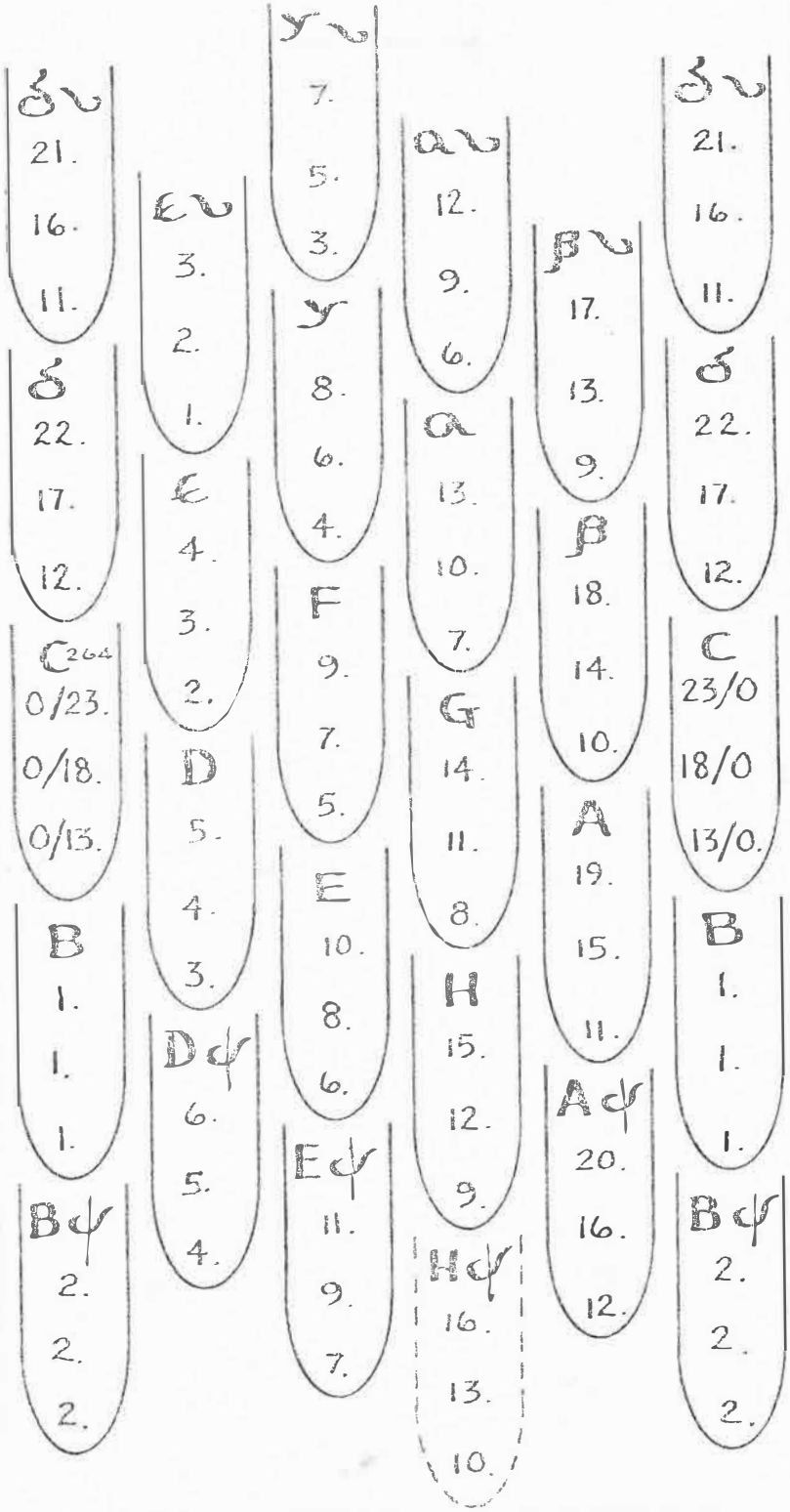
12 and 19 on the Quintal Keyboard with conventional notation



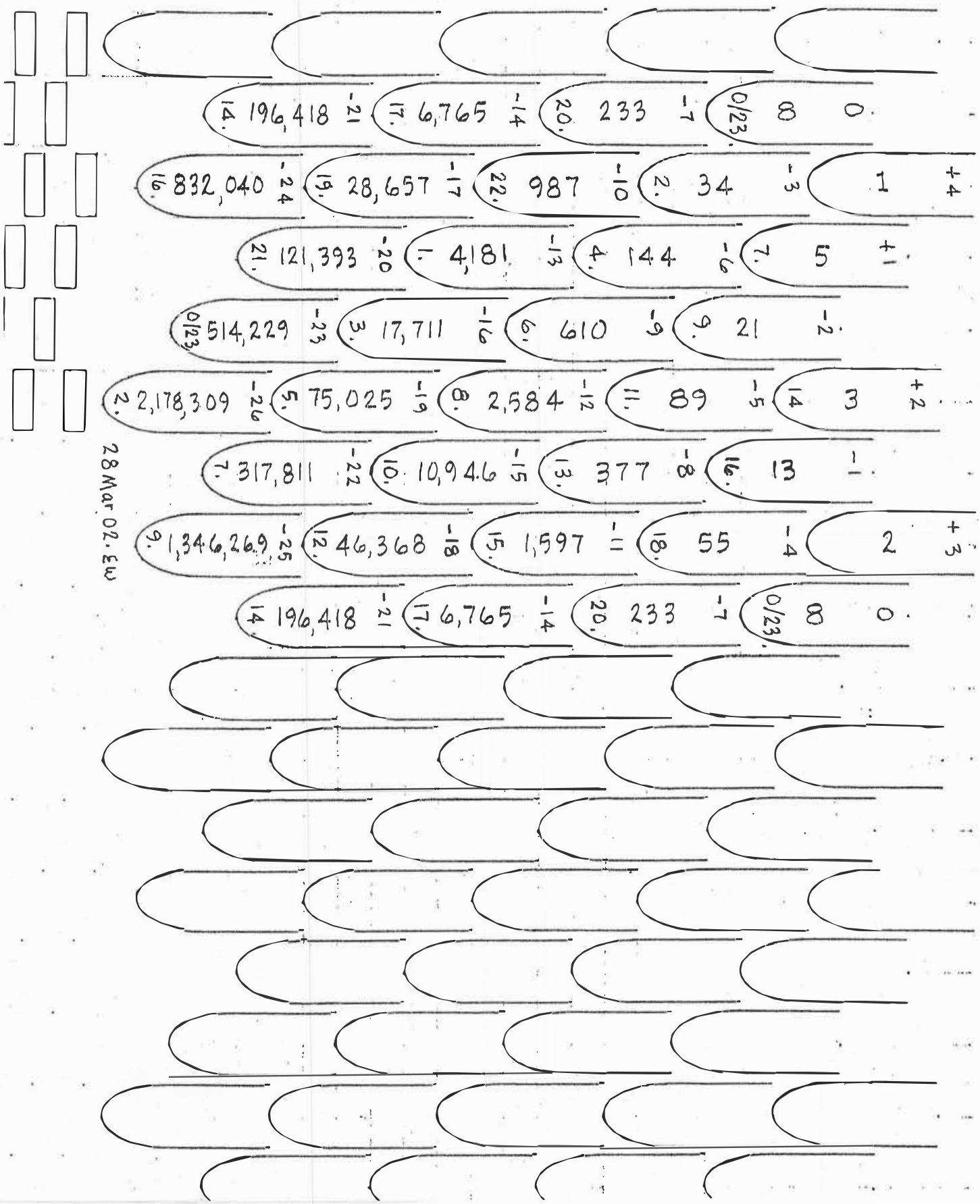
12, 17, & 22 on the Quintal Keyboard
with duodecimal notation



13, 18, & 23 on the Quintal Keyboard with tridecimal notation



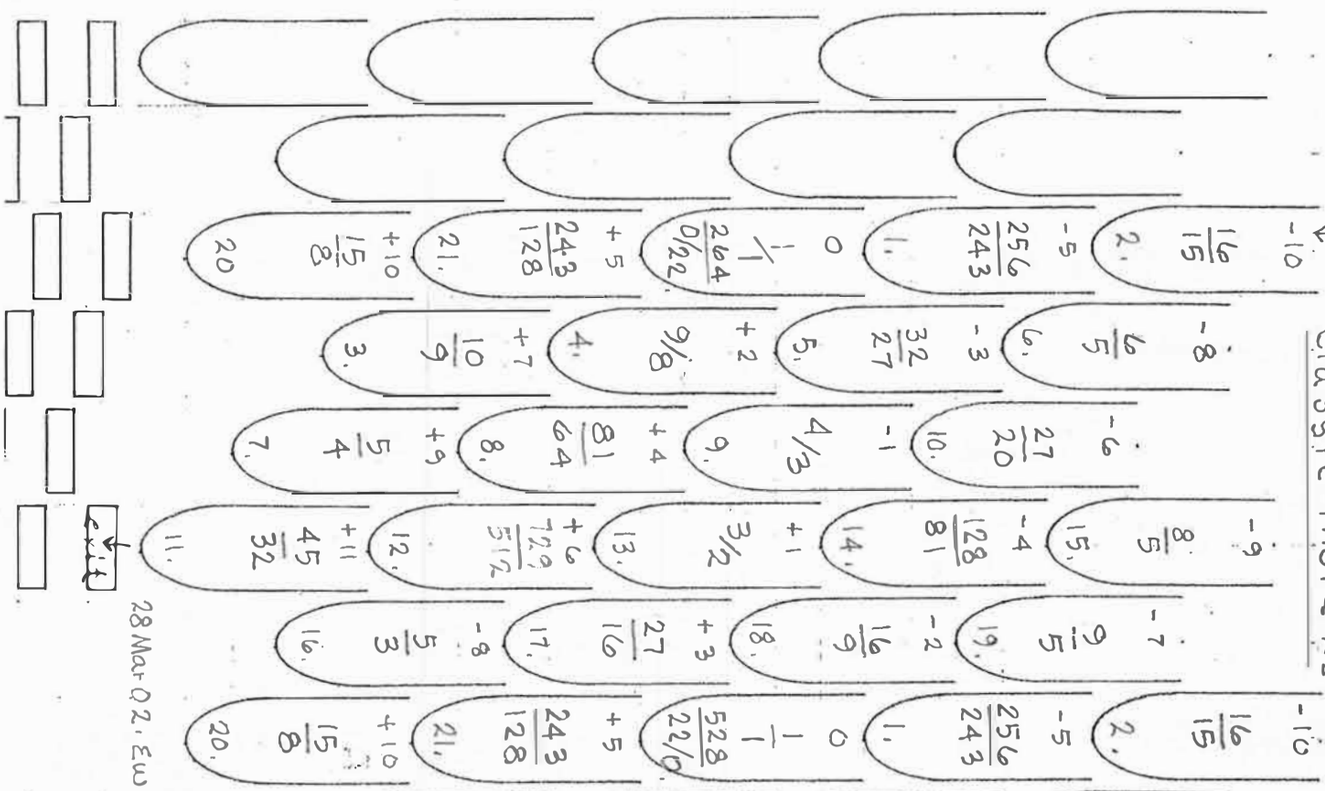
Fibonacci Series 23-Tone Scale, on Wilson's Generalized Keyboard (Patent No. 3,342,094).

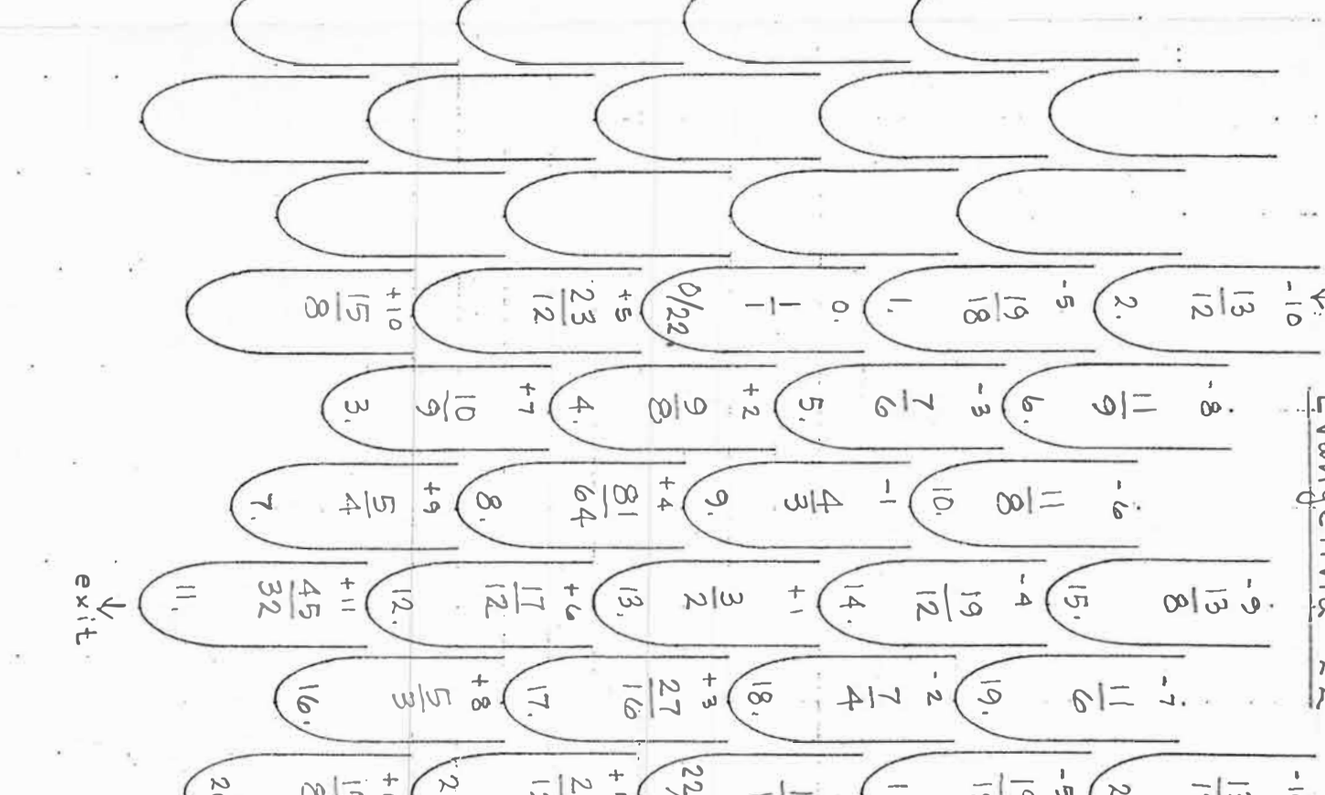


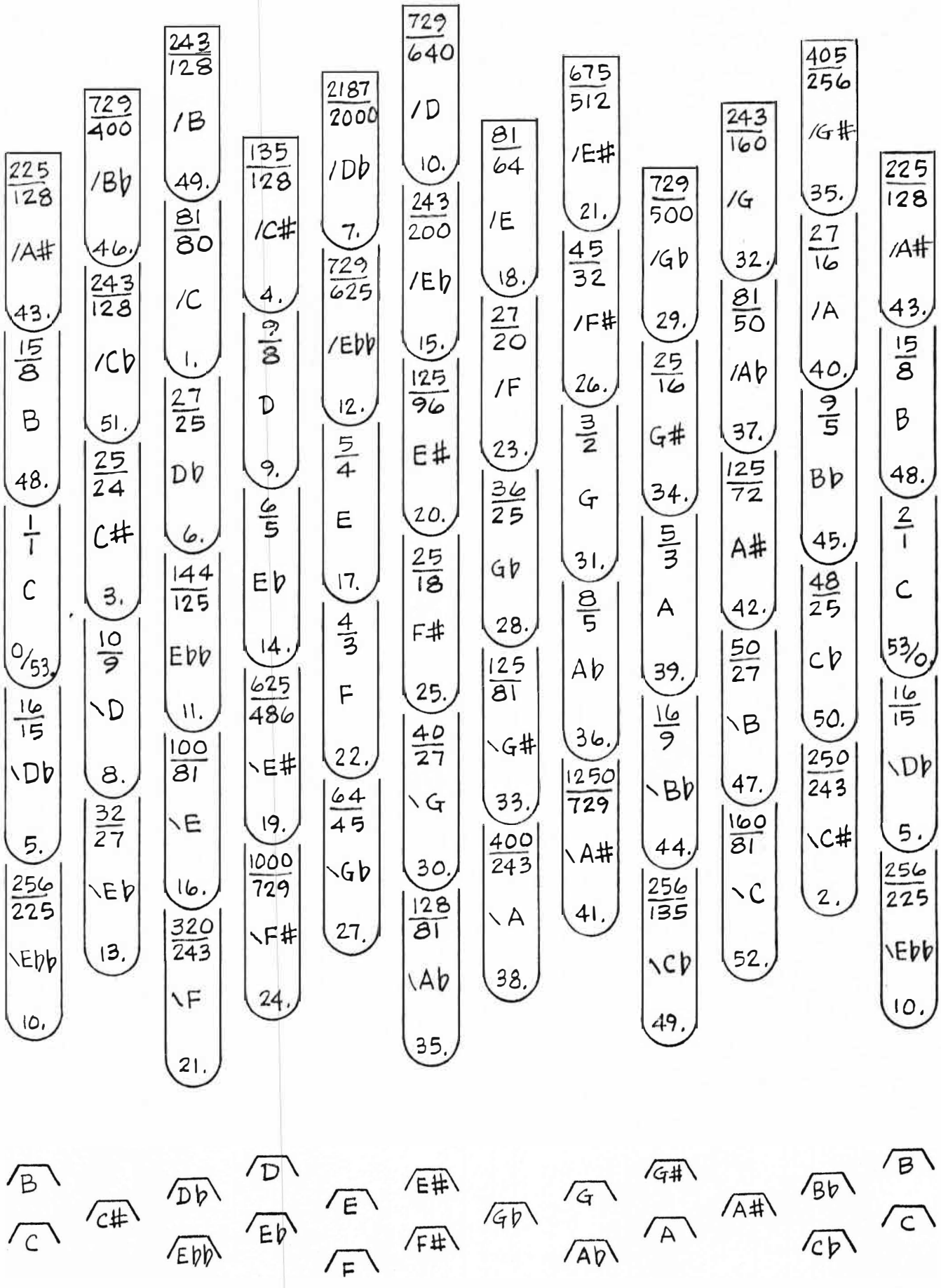
28 Mar 02. EW

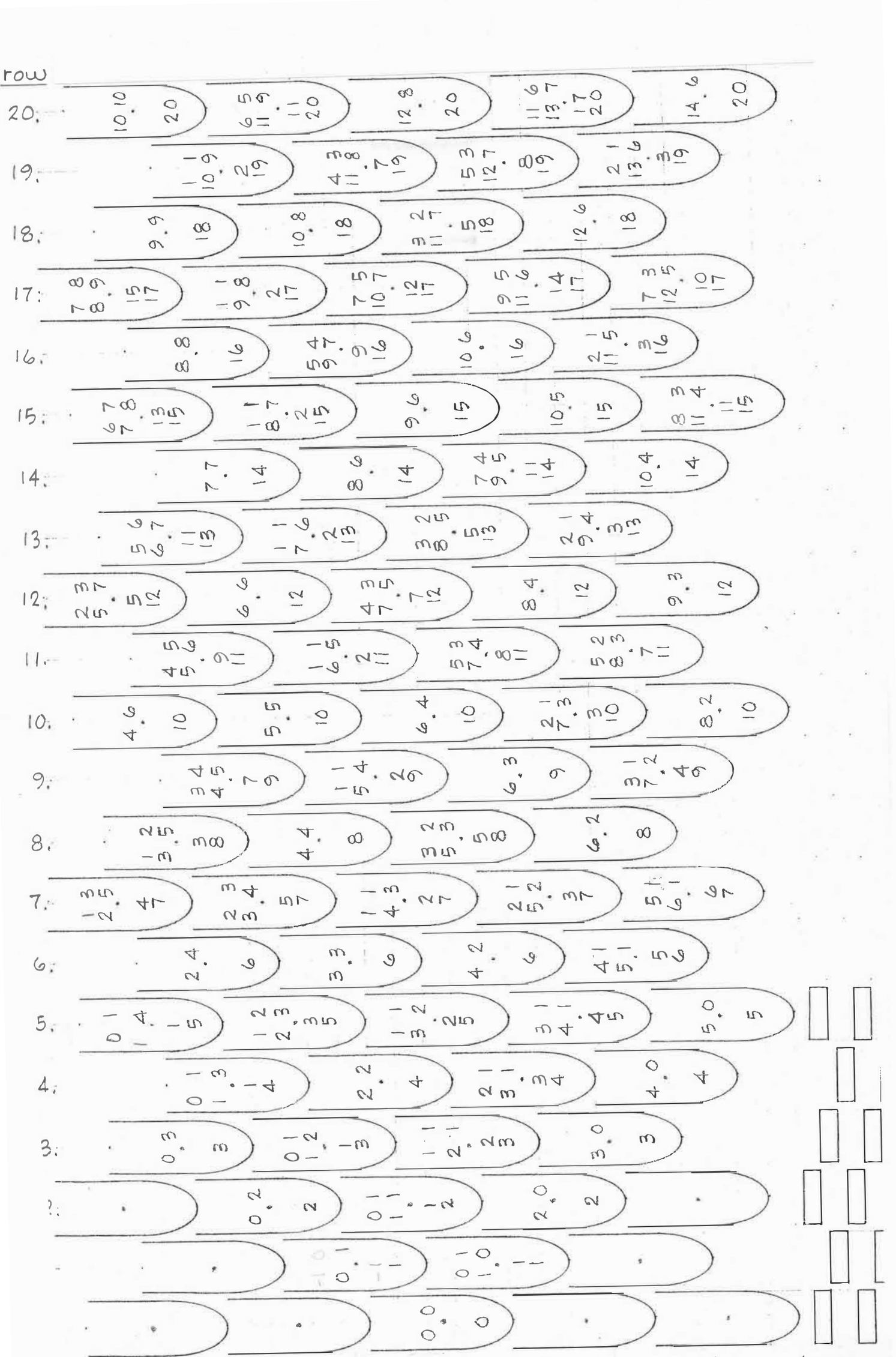
2 Variations on the 22-tone Scale, on Wilsons Generalized Keyboard (Patent No 3,342,094)

2 Variations on the 22-tone Scale, on Wilsons Generalized Keyboard (Patent No 3,342,094)

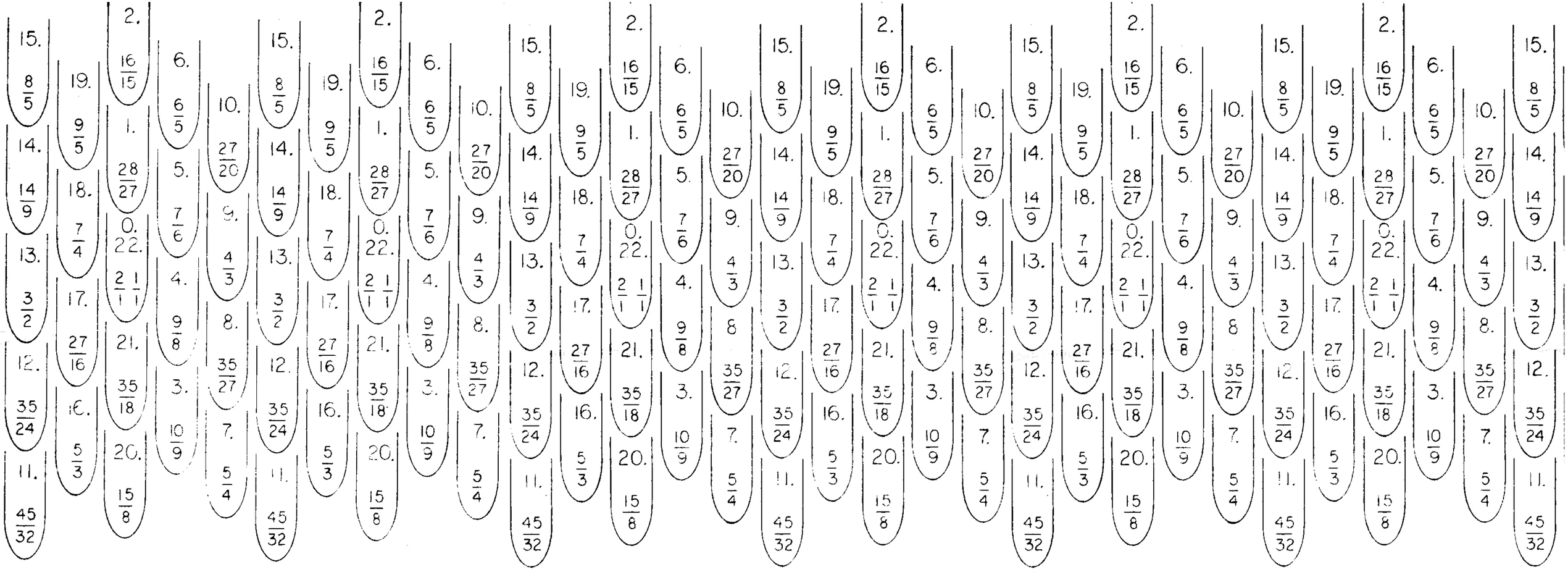




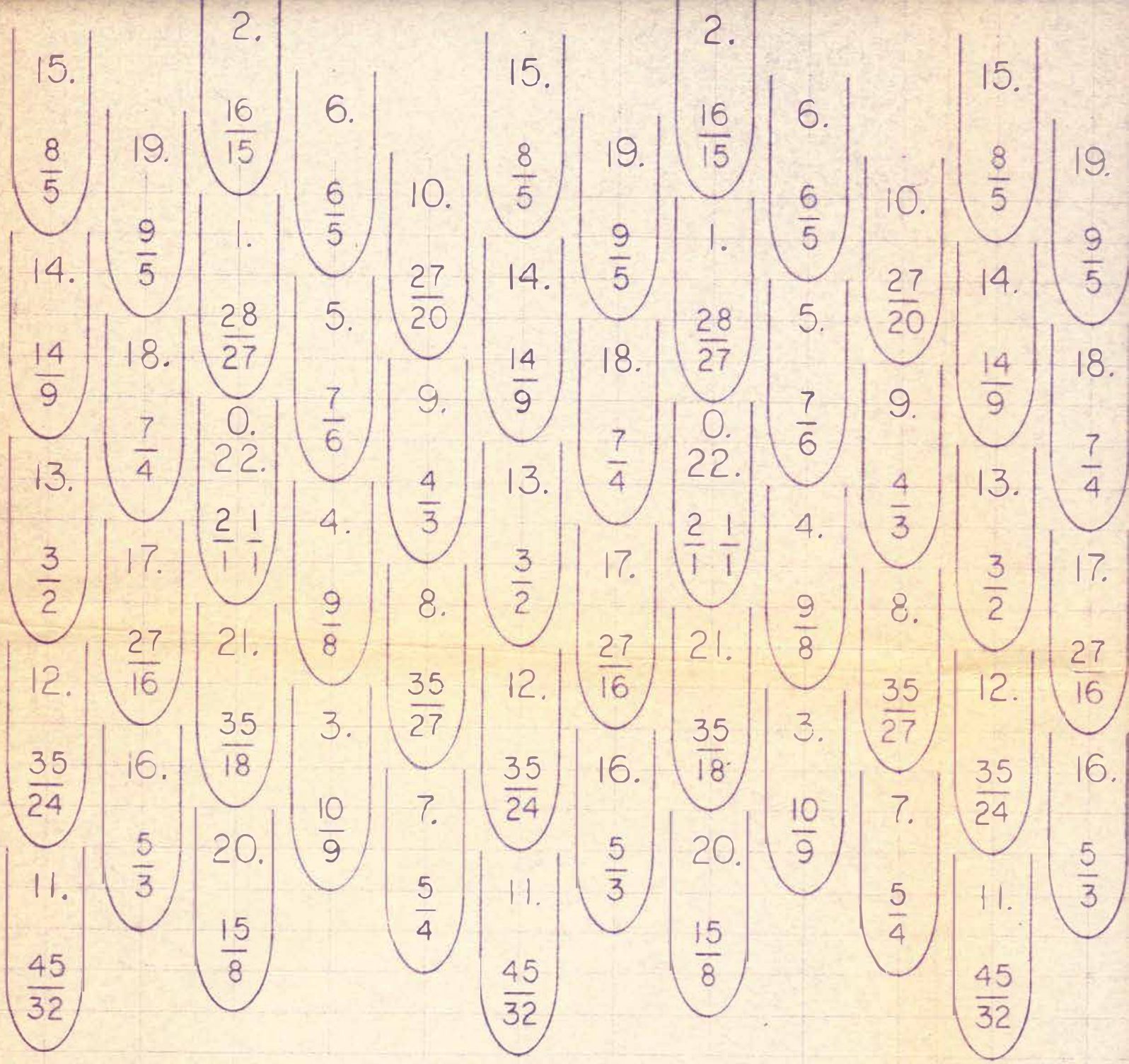

225/128 /A# 43.
15/8 B 48.
1/1 C 0/53.
16/15 \Db 5.
256/225 \Ebb 10.
729/400 /Bb 46.
243/128 /Cb 51.
25/24 C# 3.
10/9 \D 8.
32/27 \Eb 13.
243/128 /B 49.
81/80 /C 1.
27/25 Db 6.
144/125 Ebb 11.
100/81 \E 16.
320/243 \F 21.
135/128 /C# 4.
9/8 D 9.
6/5 Eb 14.
625/486 \E# 19.
1000/729 \F# 24.
2187/2000 /Db 7.
729/625 /Ebb 12.
5/4 E 17.
4/3 F 22.
64/45 \Gb 27.
729/640 /D 10.
243/200 /Eb 15.
125/96 E# 20.
25/18 F# 25.
40/27 \G 30.
128/81 \Ab 35.
81/64 /E 18.
27/20 /F 23.
36/25 Gb 28.
125/81 \G# 33.
400/243 \A 38.
675/512 /E# 21.
45/32 /F# 26.
3/2 G 31.
8/5 Ab 36.
1250/729 \A# 41.
729/500 /Gb 29.
25/16 G# 34.
5/3 A 39.
16/9 \Bb 44.
256/135 \Cb 49.
243/160 /G 32.
81/50 /Ab 37.
125/72 A# 42.
50/27 \B 47.
160/81 \C 52.
405/256 /G# 35.
27/16 /A 40.
9/5 Bb 45.
48/25 Cb 50.
250/243 \C# 2.
225/128 /A# 43.
15/8 B 48.
2/1 C 53/0.
16/15 \Db 5.
256/225 \Ebb 10.
B C
C#
Db Ebb
D Eb
E F
E# F#
Gb
G Ab
G# A
A#
Bb Cb
B C



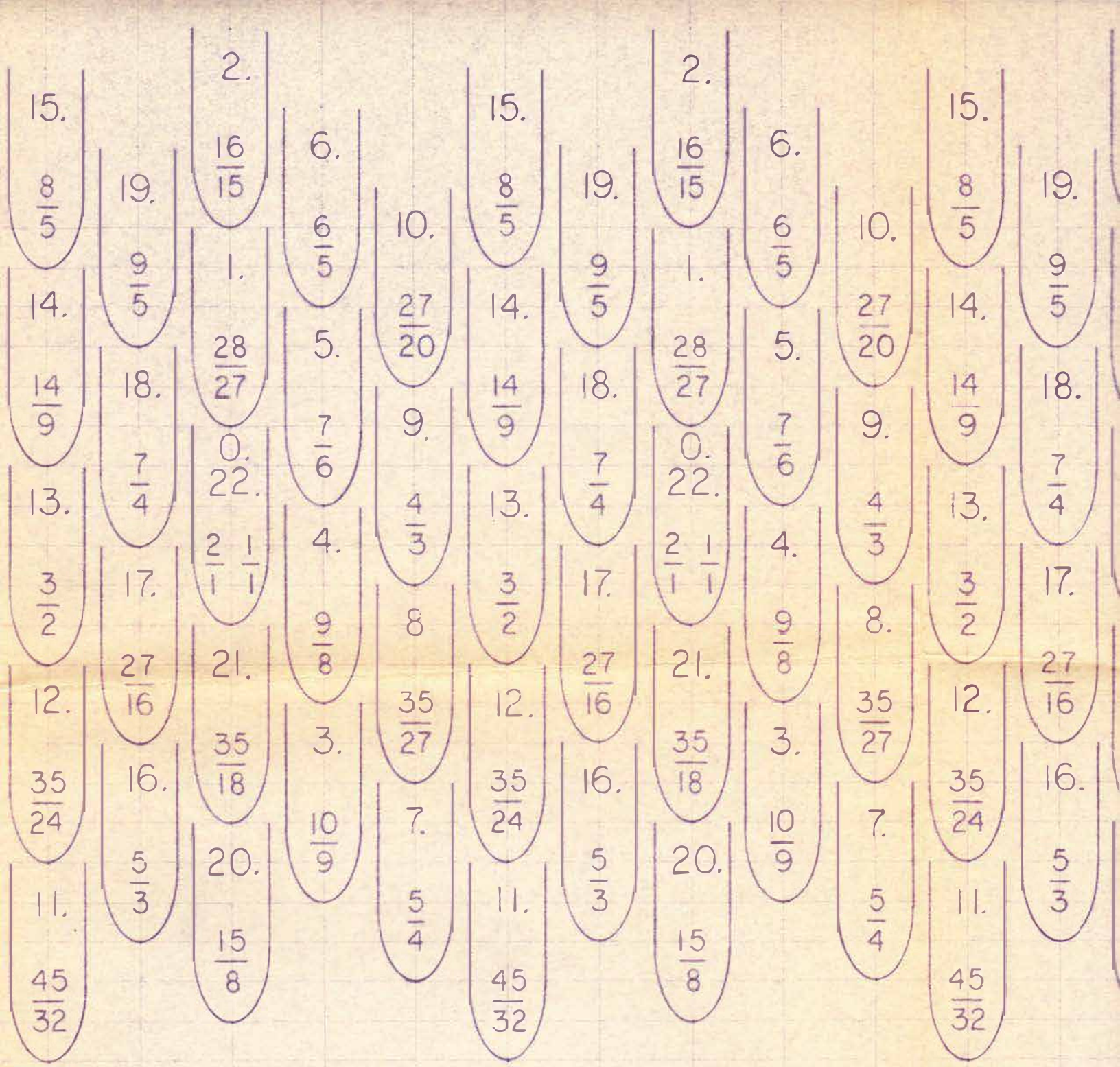
Application of Gral Keyboard Guide to Musical Instrument Keyboard (U.S. patent no. 3,342,094)



This is 6 octaves, full scale of the Infra-Generalized showing the 22-tone system as ratios and degrees.



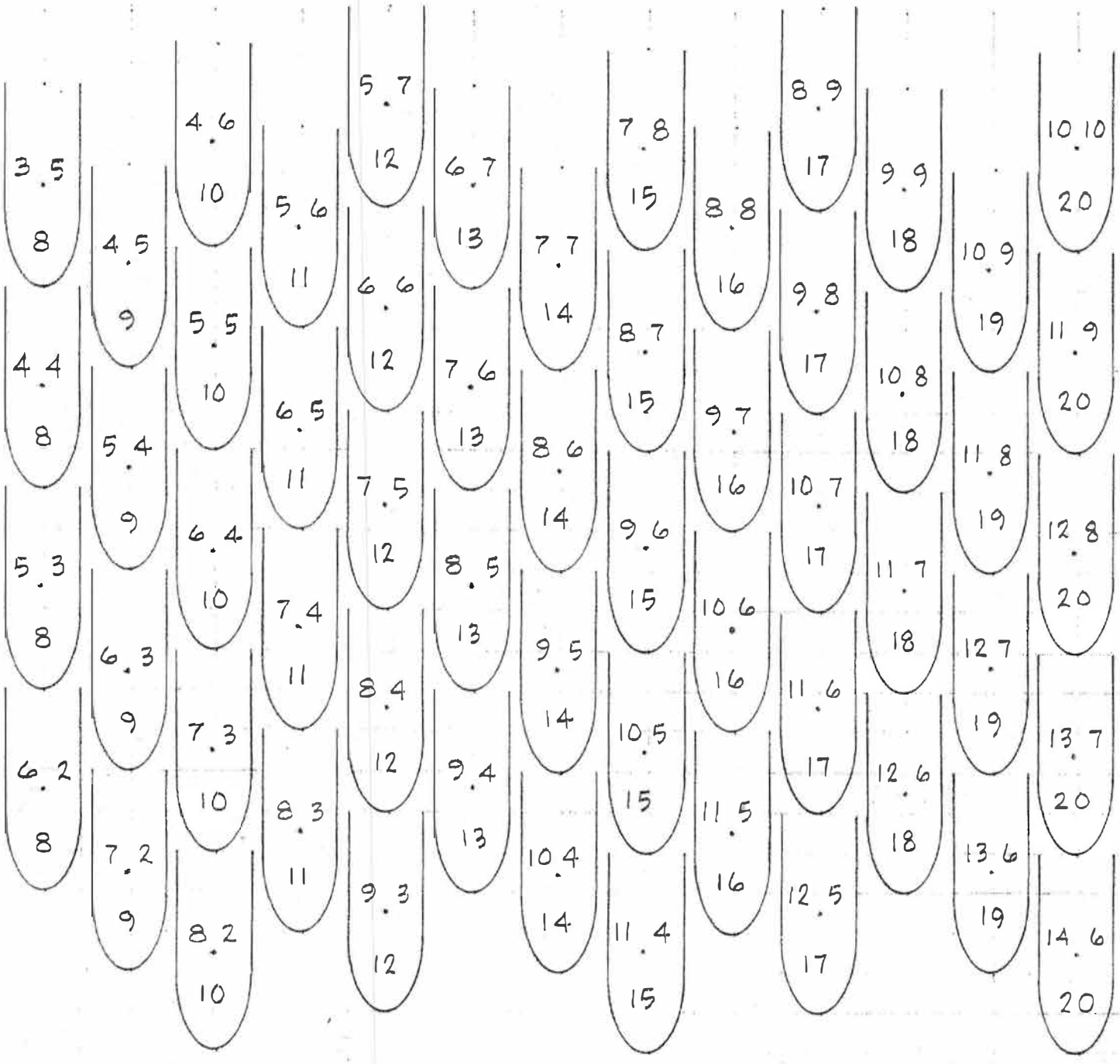
This is 6 octaves, full scale of the Infra-Generalized showing the 22-tone system as ratios and degrees.


15. 8/5
14. 14/9
13. 3/2
12. 35/24
11. 45/32
19. 9/5
18. 7/4
17. 27/16
16. 5/3
2. 16/15
1. 28/27
0.
22. 2/1 1/1
21. 35/18
20. 15/8
6. 6/5
5. 7/6
4. 9/8
3. 10/9
10. 27/20
9. 4/3
8. 35/27
7. 5/4
15. 8/5
14. 14/9
13. 3/2
12. 35/24
11. 45/32
19. 9/5
18. 7/4
17. 27/16
16. 5/3
2. 16/15
1. 28/27
0.
22. 2/1 1/1
21. 35/18
20. 15/8
6. 6/5
5. 7/6
4. 9/8
3. 10/9
10. 27/20
9. 4/3
8. 35/27
7. 5/4
15. 8/5
14. 14/9
13. 3/2
12. 35/24
11. 45/32
19. 9/5
18. 7/4
17. 27/16
16. 5/3

cale

Infra - Generatized Keyboard
patent pending
letter to John Chalmers from Erv Wilson
9 Feb. 1966

0.0 0
0.1 1 1.0 1
0.2 2 1.1 2 2.0 2
0.3 3 1.2 3 2.1 3 3.0 3
1.3 4 2.2 4 3.1 4 4.0 4
1.4 5 2.3 5 3.2 5 4.1 5 5.0 5
2.4 6 3.3 6 4.2 6 5.1 6 6.0 6
2.5 7 3.4 7 4.3 7 5.2 7 6.1 7
3.5 8 4.4 8 5.3 8 6.2 8 7.1 8
4.5 9 5.4 9 6.3 9 7.2 9 8.1 9
4.6 10 5.5 10 6.4 10 7.3 10 8.2 10
5.6 11 6.5 11 7.4 11 8.3 11 9.2 11
5.7 12 6.6 12 7.5 12 8.4 12 9.3 12
6.7 13 7.6 13 8.5 13 9.4 13 10.3 13
7.7 14 8.6 14 9.5 14 10.4 14 11.3 14
7.8 15 8.7 15 9.6 15 10.5 15 11.4 15
8.8 16 9.7 16 10.6 16 11.5 16 12.4 16
8.9 17 9.8 17 10.7 17 11.6 17 12.5 17
9.9 18 10.8 18 11.7 18 12.6 18 13.5 18
10.9 19 11.8 19 12.7 19 13.6 19 14.5 19
10.10 20 11.9 20 12.8 20 13.7 20 14.6 20


3.5 8
4.5 9
4.6 10
5.6 11
5.7 12
6.7 13
7.8 15
8.8 16
8.9 17
9.9 18
10.9 19
10.10 20
4.4 8
5.4 9
5.5 10
6.5 11
6.6 12
7.6 13
7.7 14
8.7 15
9.7 16
9.8 17
10.8 18
11.9 20
5.3 8
6.3 9
6.4 10
7.4 11
7.5 12
8.5 13
8.6 14
9.6 15
10.6 16
10.7 17
11.8 19
12.8 20
6.2 8
7.2 9
7.3 10
8.3 11
8.4 12
9.4 13
9.5 14
10.5 15
11.5 16
11.6 17
11.7 18
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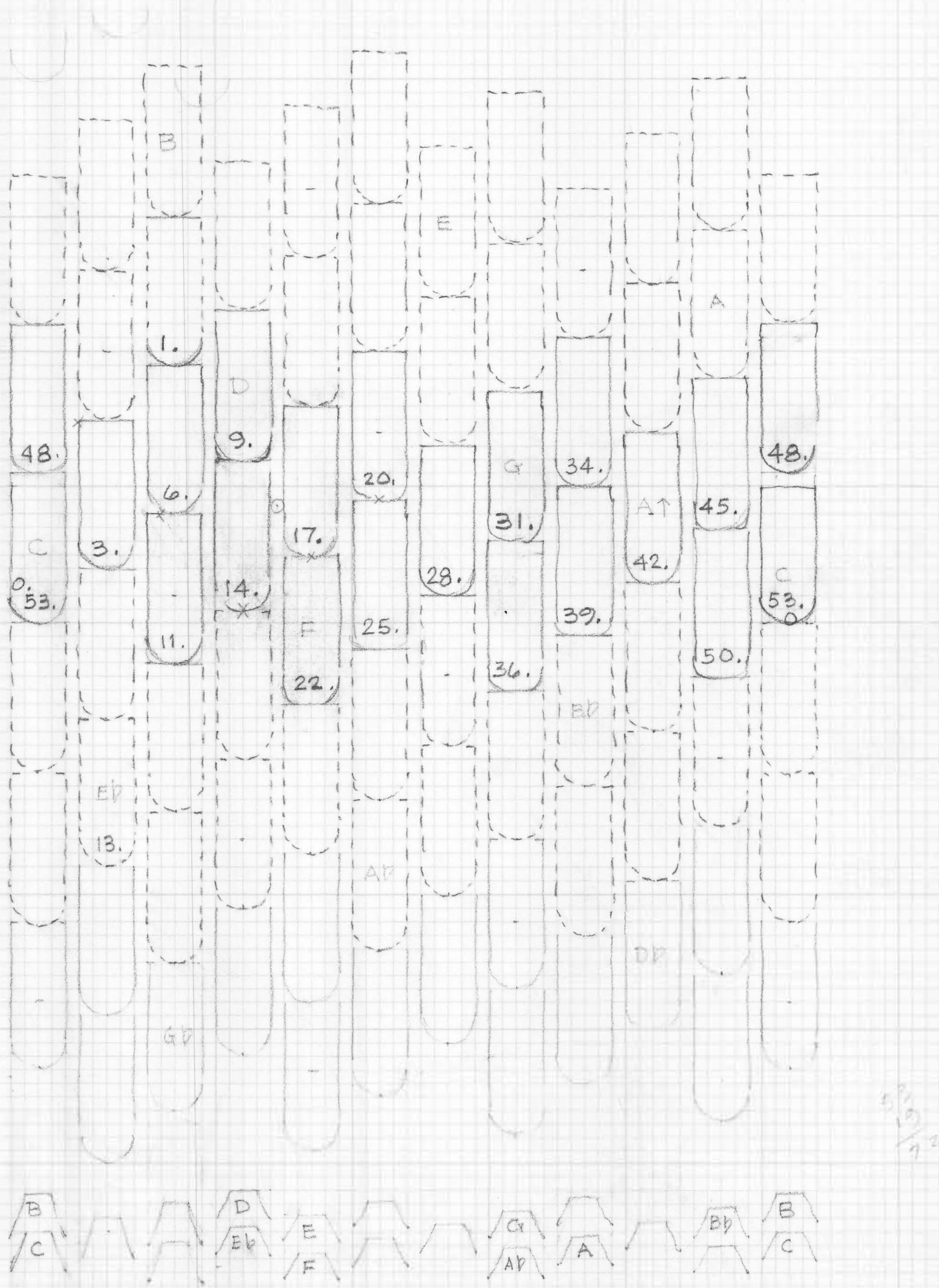
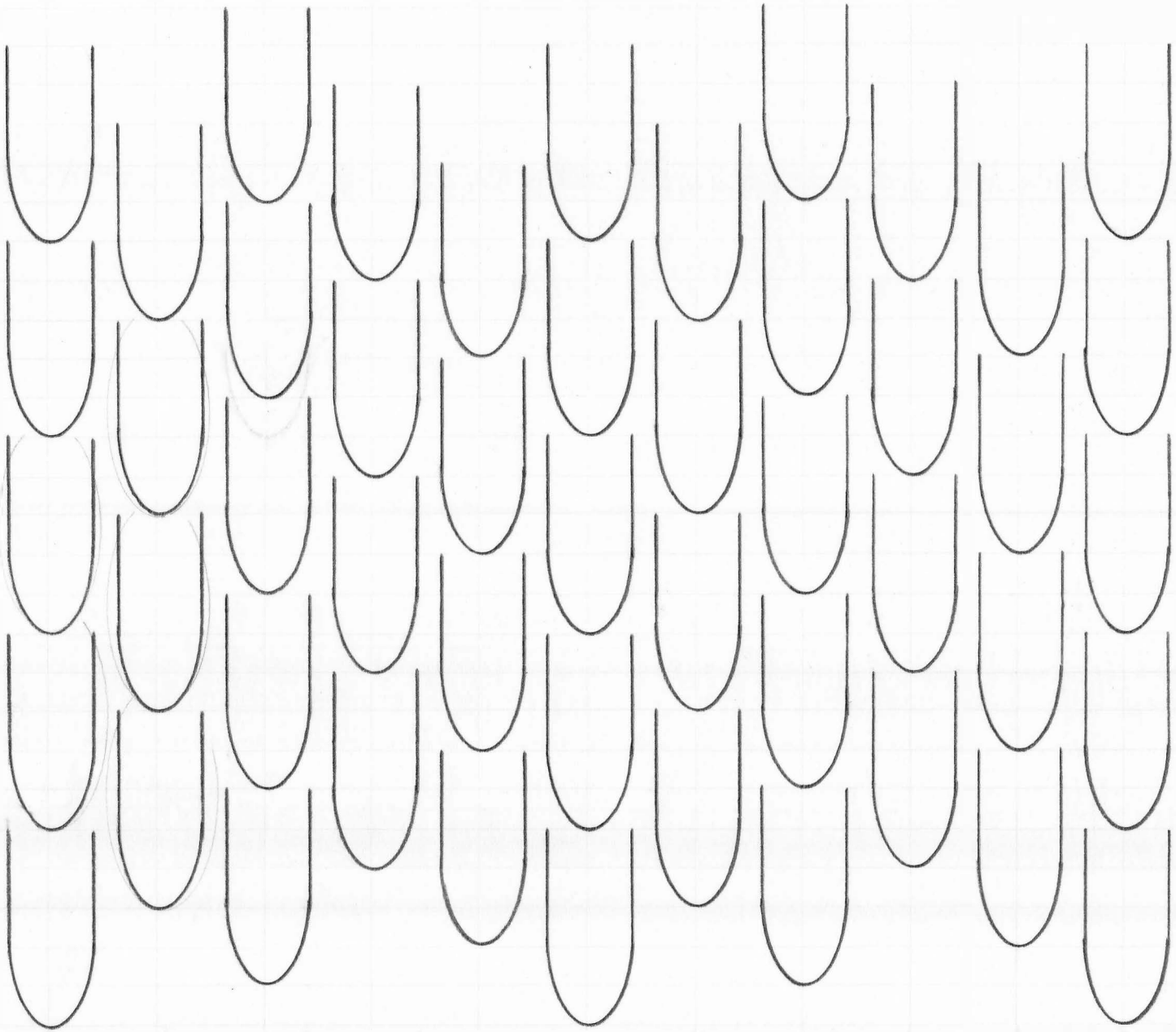
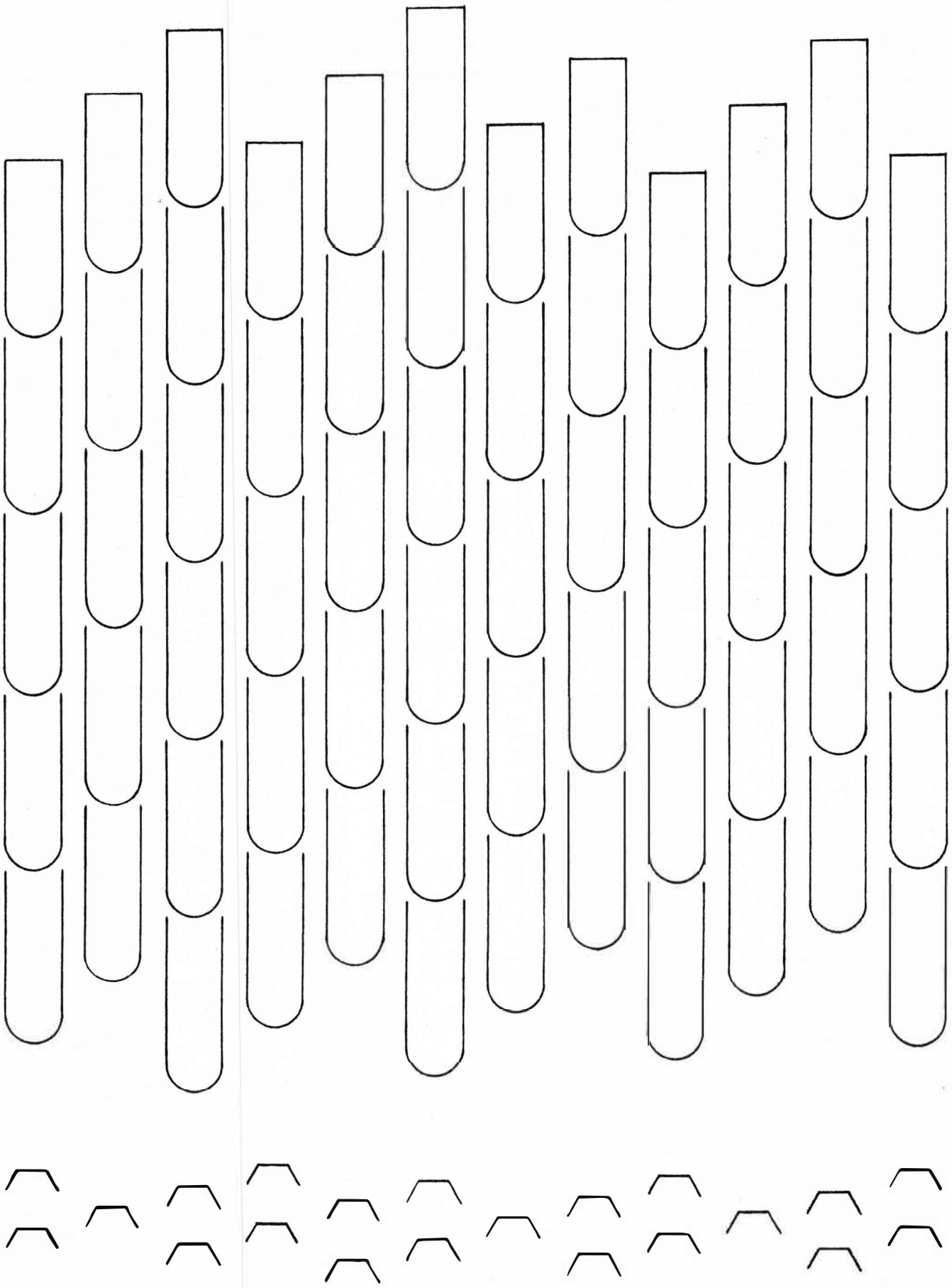
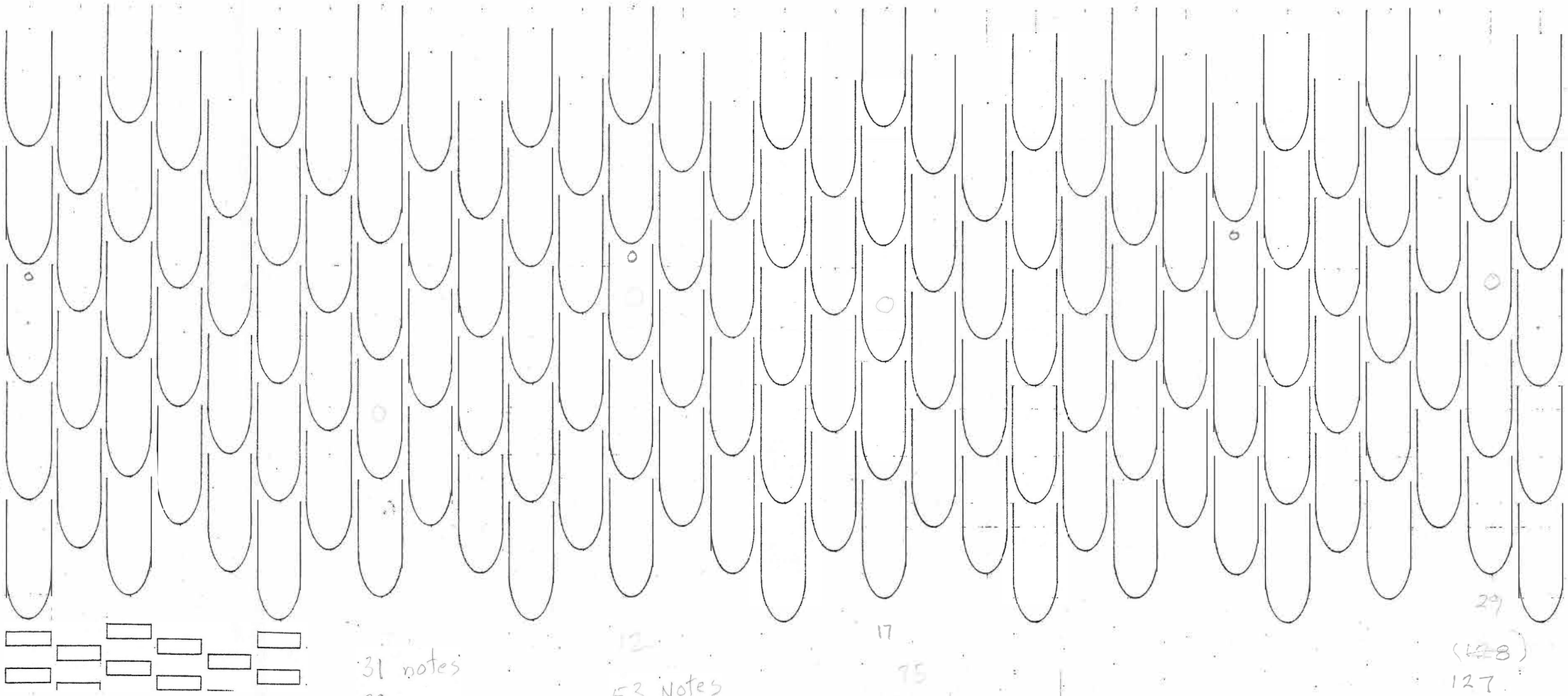
11.4 15
12.5 17
12.6 18
13.6 19
14.6 20

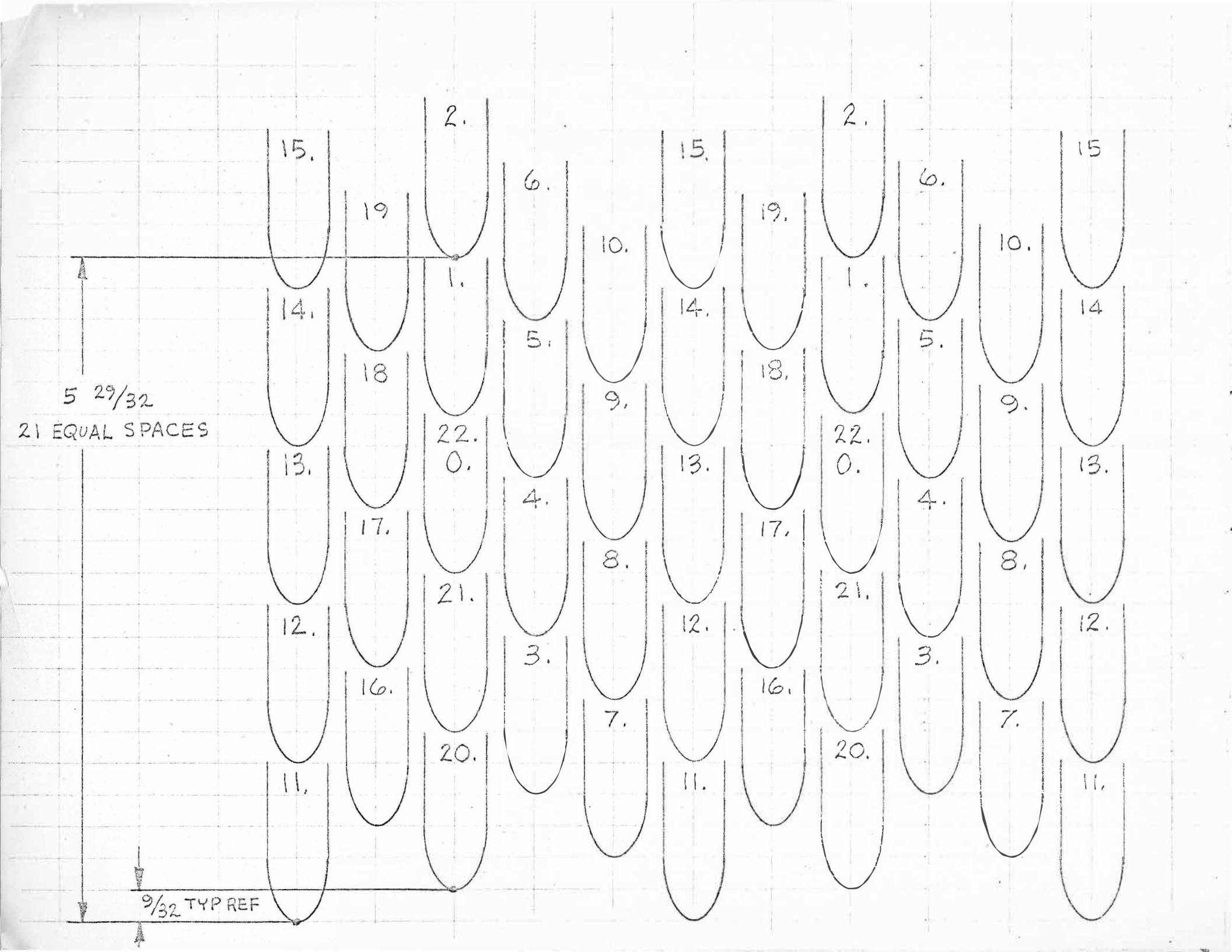


B
E
A
D
G
C
Eb
Ab
Gb
Db
Bb
F
1.
3.
6.
9.
11.
13.
14.
17.
20.
22.
25.
28.
31.
34.
36.
39.
42.
45.
48.
50.
53.
B C D Eb E F G Ab A Bb B C






31 notes
29
53 Notes
17
95
29
(28)
127


5 29/32
21 EQUAL SPACES
9/32 TYP REF
15.
19
2.
6.
10.
15.
19.
2.
6.
10.
15
14.
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1.
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14.
18.
1.
5.
9.
14
13.
17.
22.
0.
4.
8.
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17.
22.
0.
4.
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16.
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3.
7.
12.
16.
21.
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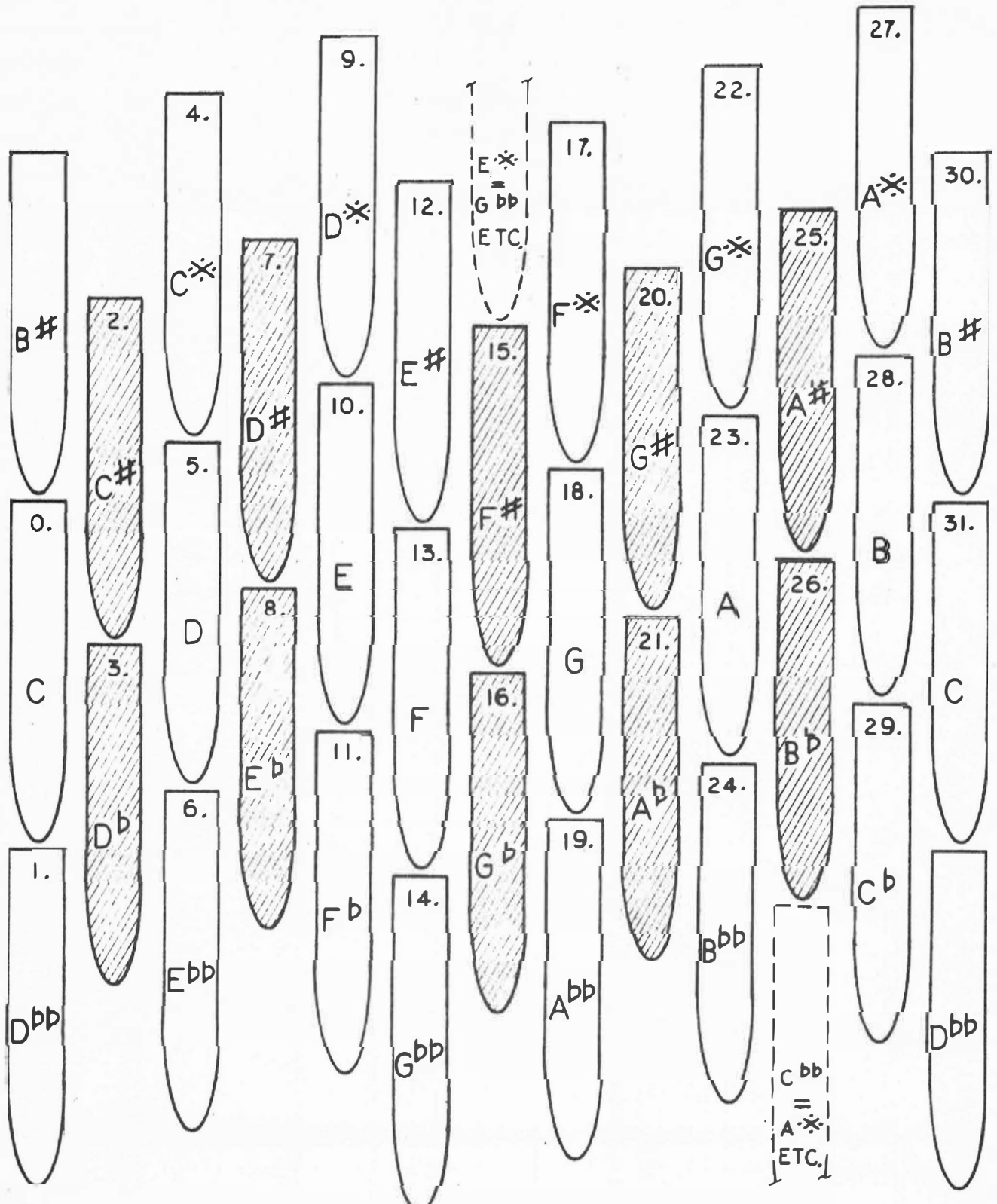
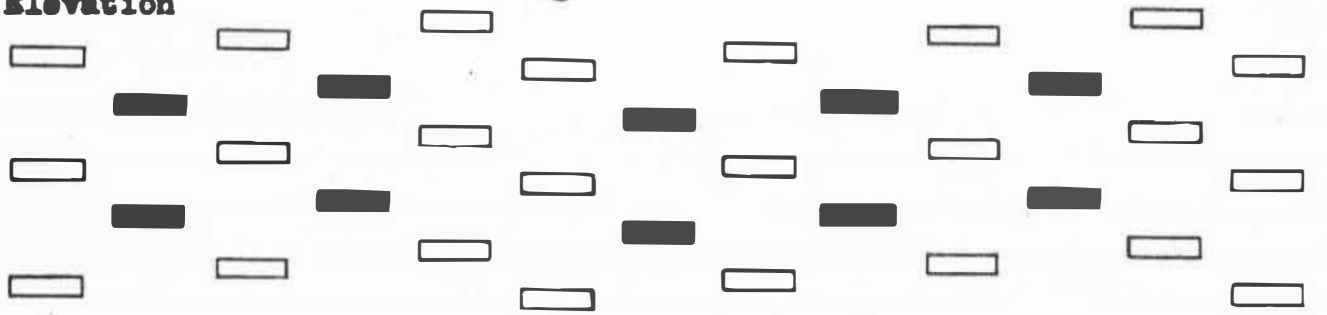
12.
11.
20.
11.
20.
11.

THE 31-TONE SCALE APPLIED TO BOSANQUET'S GENERALIZED KEYBOARD

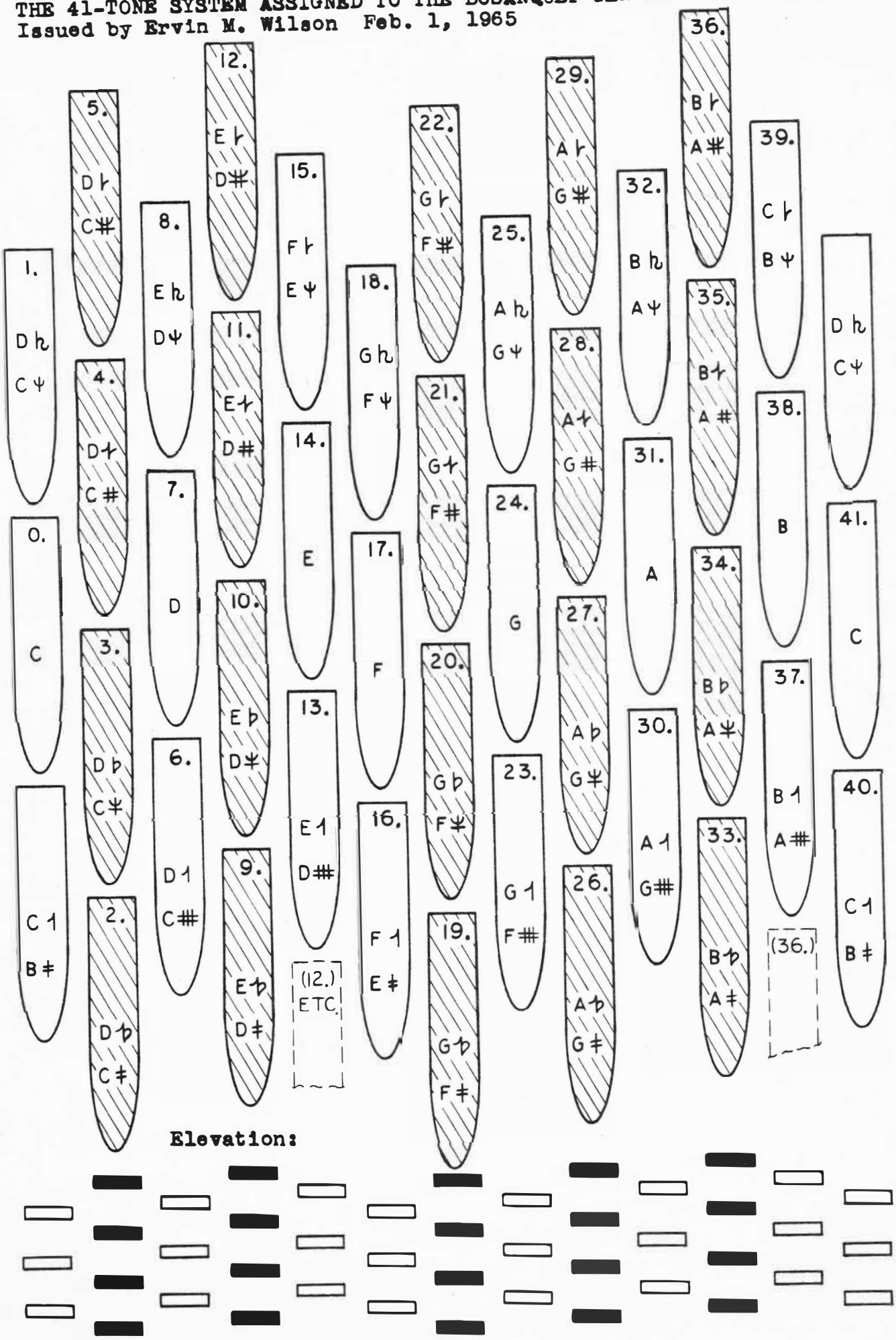


Elevation



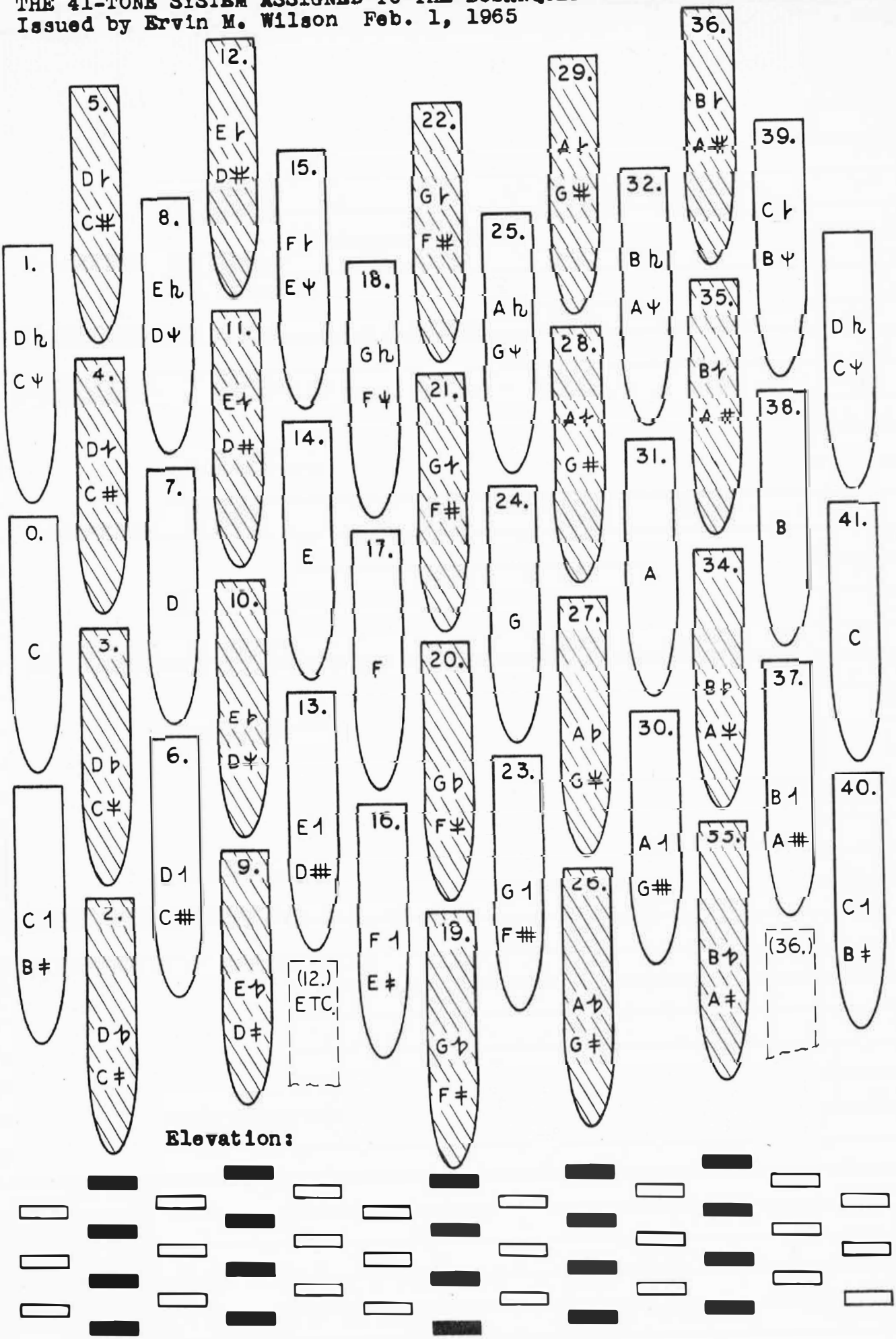
E. Wilson 1961

THE 41-TONE SYSTEM ASSIGNED TO THE BOSANQUET GENERALIZED KEYBOARD
Issued by Ervin M. Wilson Feb. 1, 1965



Elevation:

THE 41-TONE SYSTEM ASSIGNED TO THE BOSANQUET GENERALIZED KEYBOARD
Issued by Ervin M. Wilson Feb. 1, 1965



Ervin M. Wilson
651 Huntley Drive
Los Angeles, Calif. 90069

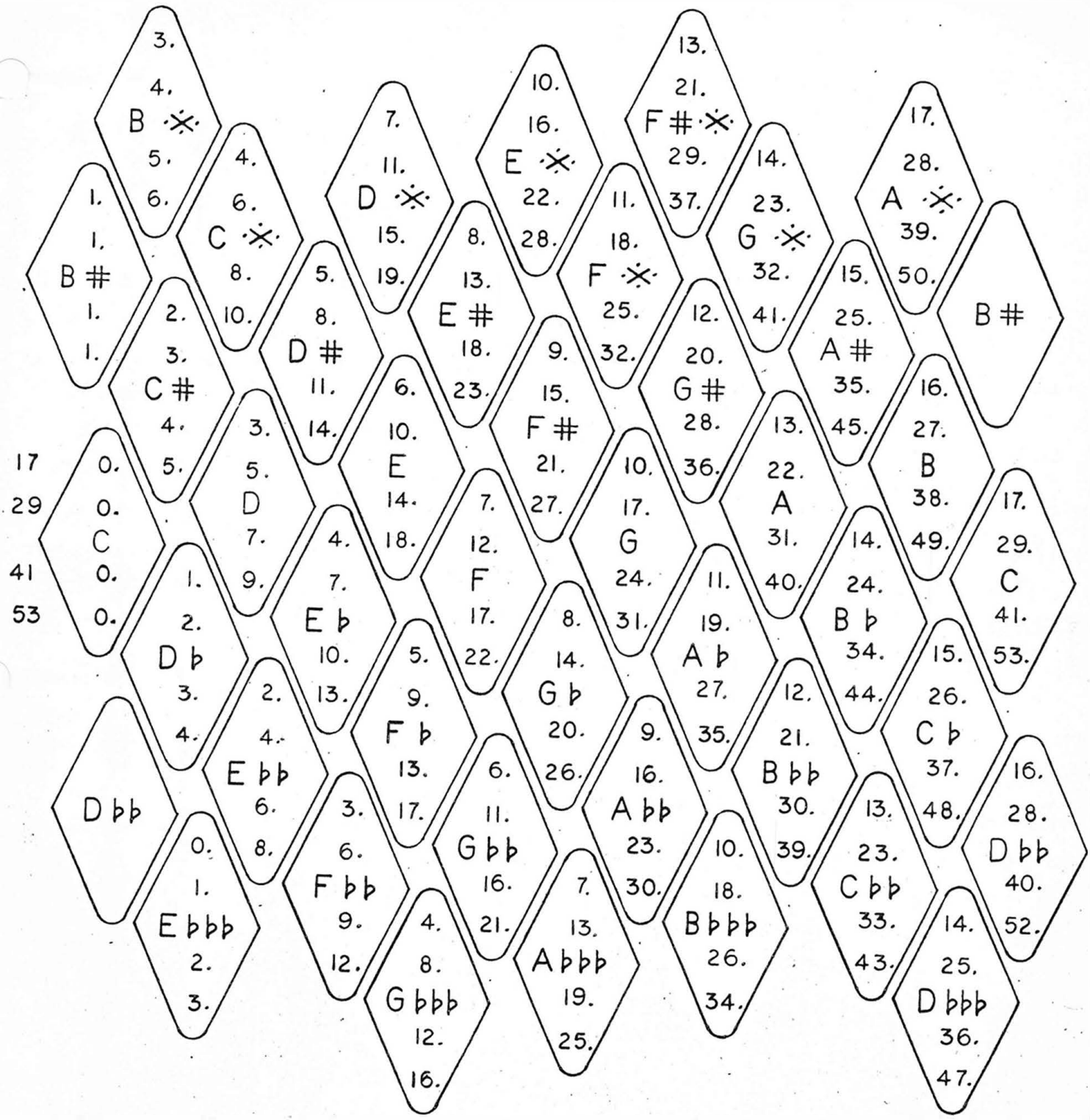
Gentlemen;

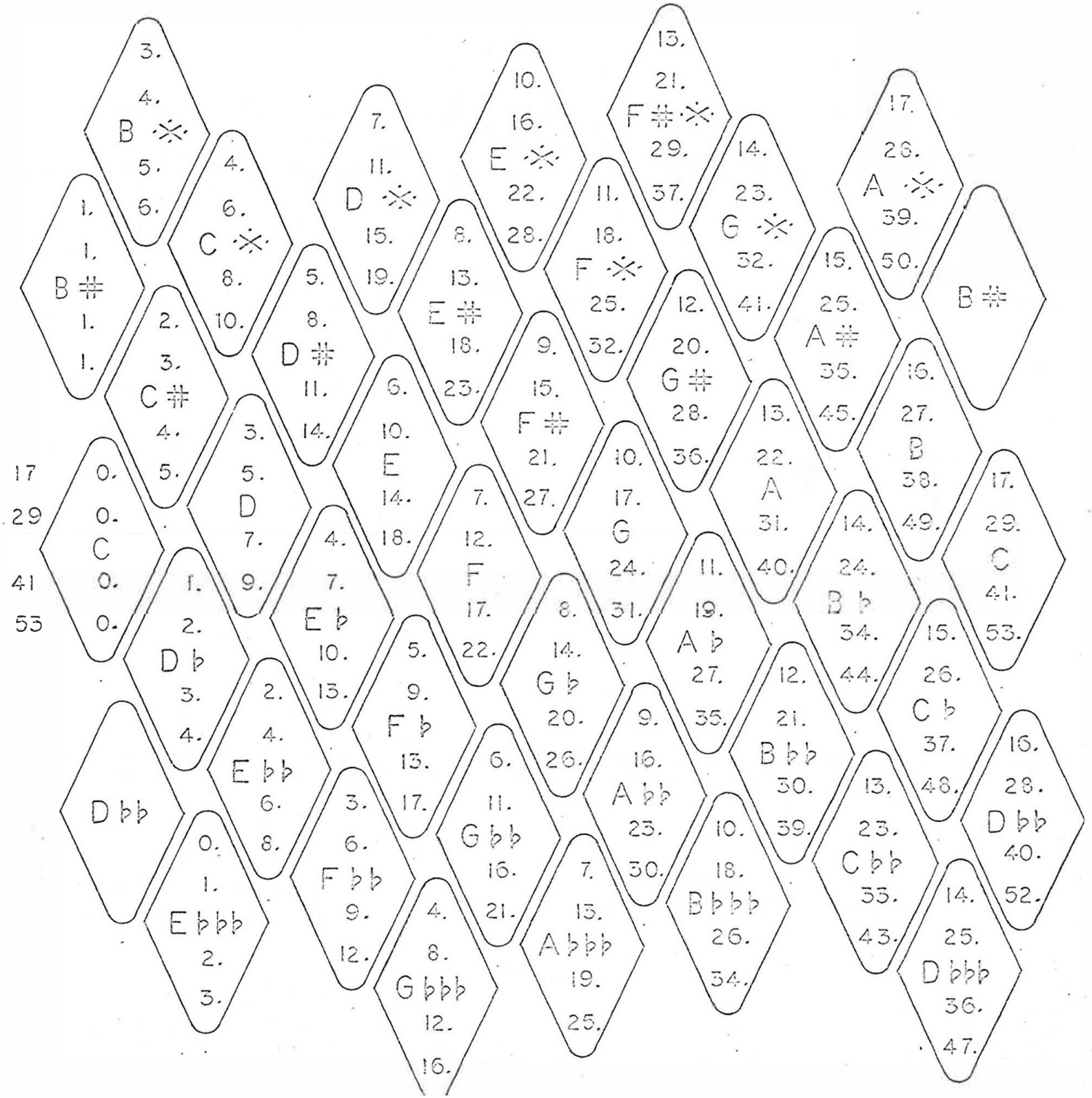
Enclosed is a diagram of the Bosanquet Generalized Keyboard (first published in Mr. R. H. M. Bosanquet's Elementary Treatise on Musical Intervals and Temperaments, 1876, and further described by Hermann Helmholtz in Sensations of Tone). This historical keyboard, now preserved in the South Kensington Museum, has the remarkable and immensely desireable property of being able to contain any musical system concieved as a series or cycle of Fourths. In addition to the Pythagorean tuning and meantone temperament this would include the negative series of equal systems having 19, 31, 43, 55 tones; the positive series of equal systems having 17, 29, 41, 53 tones; and the doubly-positive equal systems of 22 and 46 tones per Octave. Two of these systems have recieved considerable attention in recent years; the 31-tone system and the 41-tone system. Prof. A. D. Fokker of Holland is the primary exponent of the 31-tone system (ref. Equal Temperament and the 31-keyed Organ by A. D. Fokker in the Scientific Monthly, October 1955). However, an interest in the 31-tone system has also arisen independently in various parts of the United States. The 41-tone equal system is parallel, melodically and harmonically to the 43-tone unequal scale used by Harry Partch (ref. Genesis of a Music by Harry Partch). Mr. Partch's thoughtful approach to new scale resources has not been without a significant influence. (In this regard ref. On the Development of Musical Systems by David Kraehenbuehl and Christopher Schmidt in the 'Journal of Music Theory', 1962, a Yale School of Music publication.)

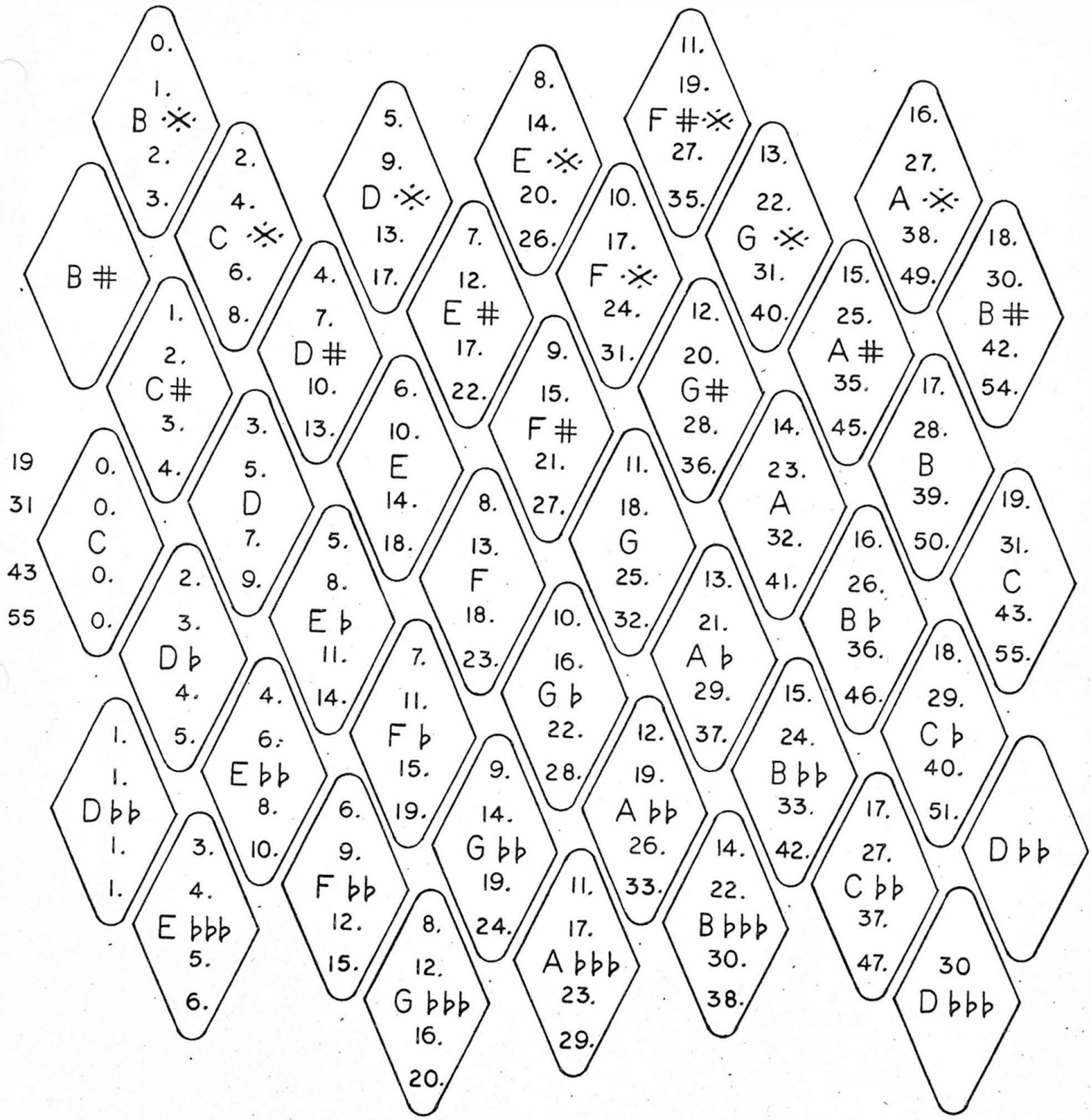
A most urgent need is being felt by a creative minority for keyboard instruments embodying these two microtonal schemes. It is with this same urgency that I, as a creative musician, submit these keyboard diagrams and pitches for the 31-tone and 41-tone systems to you for re-consideration in the light of a contemporary trend and resultant need. Please let it be understood that these are submitted with no expectation of financial reward. It would be reward enough to have such instruments commercially available.

May I cordially invite a fair and realistic consideration of these instruments.

Most sincerely yours,


3. 4. B ♯ 5. 6.
1. 1. B ♯ 1. 1.
4. 6. C ♯ 8. 10.
2. 3. C ♯ 4. 5.
7. 11. D ♯ 15. 19.
5. 8. D ♯ 11. 14.
10. 16. E ♯ 22. 28.
8. 13. E ♯ 18. 23.
13. 21. F ♯ ♯ 29. 37.
11. 18. F ♯ 25. 32.
14. 23. G ♯ 32. 41.
12. 20. G ♯ 28. 36.
17. 28. A ♯ 39. 50.
15. 25. A ♯ 35. 45.
B ♯
16. 27. B 38. 49.
17 29 41 53
0. 0. C 0. 0.
3. 5. D 7. 9.
6. 10. E 14. 18.
9. 15. F ♯ 21. 27.
10. 17. G 24. 31.
13. 22. A 31. 40.
14. 24. B ♭ 34. 44.
17. 29. C 41. 53.
1. 2. D ♭ 3. 4.
4. 7. E ♭ 10. 13.
7. 12. F 17. 22.
8. 14. G ♭ 20. 26.
11. 19. A ♭ 27. 35.
12. 21. B ♭♭ 30. 39.
15. 26. C ♭ 37. 48.
16. 28. D ♭♭ 40. 52.
D ♭♭
2. 4. E ♭♭ 6. 8.
5. 9. F ♭ 13. 17.
6. 11. G ♭♭ 16. 21.
9. 16. A ♭♭ 23. 30.
10. 18. B ♭♭♭ 26. 34.
13. 23. C ♭♭ 33. 43.
14. 25. D ♭♭♭ 36. 47.
0. 1. E ♭♭♭ 2. 3.
3. 6. F ♭♭ 9. 12.
4. 8. G ♭♭♭ 12. 16.
7. 13. A ♭♭♭ 19. 25.


17
29
41
53
C
C ♯
D
D ♯
E
E ♯
F
F ♯
G
G ♯
A
A ♯
B
B ♯
D ♭
E ♭
G ♭
A ♭
B ♭
C ♭
D ♭♭
E ♭♭
F ♭♭
G ♭♭
A ♭♭
B ♭♭
C ♭♭
D ♭♭♭
E ♭♭♭
G ♭♭♭
A ♭♭♭
B ♭♭♭


0.
1.
B ×
2.
3.
B #
2.
4.
C ×
6.
8.
5.
9.
D ×
13.
17.
8.
14.
E ×
20.
26.
11.
19.
F # ×
27.
35.
13.
22.
G ×
31.
40.
16.
27.
A ×
38.
49.
18.
30.
B #
42.
54.
1.
2.
C#
3.
4.
4.
7.
D #
10.
13.
7.
12.
E #
17.
22.
10.
17.
F ×
24.
31.
12.
20.
G#
28.
36.
15.
25.
A #
35.
45.
17.
28.
B
39.
50.
19
31
43
55
0.
0.
C
0.
0.
3.
5.
D
7.
9.
6.
10.
E
14.
18.
9.
15.
F #
21.
27.
11.
18.
G
25.
32.
14.
23.
A
32.
41.
19.
31.
C
43.
55.
2.
3.
D ♭
4.
5.
5.
8.
E ♭
11.
14.
8.
13.
F
18.
23.
10.
16.
G ♭
22.
28.
13.
21.
A ♭
29.
37.
16.
26.
B ♭
36.
46.
18.
29.
C ♭
40.
51.
1.
1.
D ♭♭
1.
1.
4.
6.
E ♭♭
8.
10.
7.
11.
F ♭
15.
19.
9.
14.
G ♭♭
19.
24.
12.
19.
A ♭♭
26.
33.
15.
24.
B ♭♭
33.
42.
17.
27.
C ♭♭
37.
47.
D ♭♭
3.
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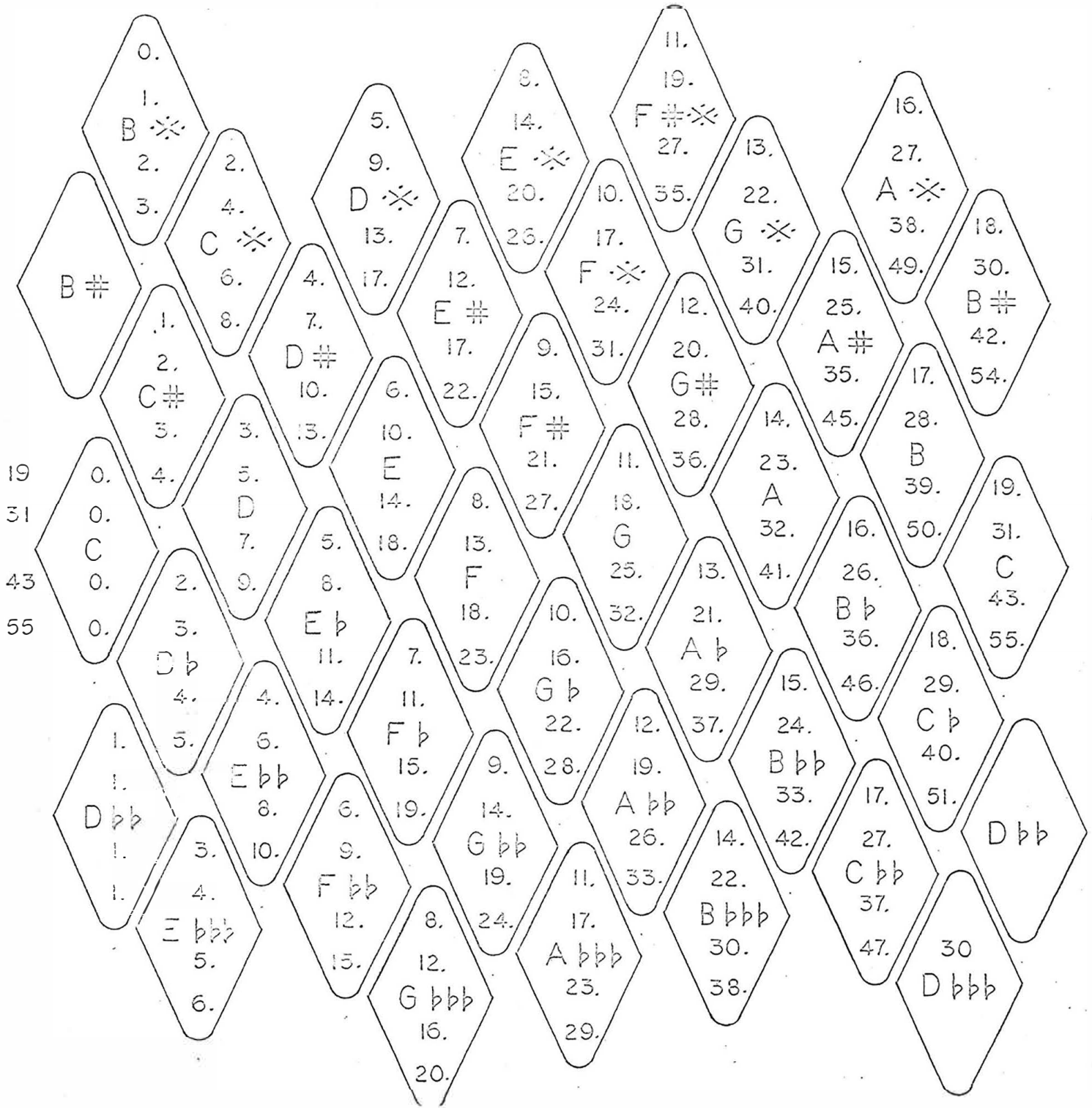
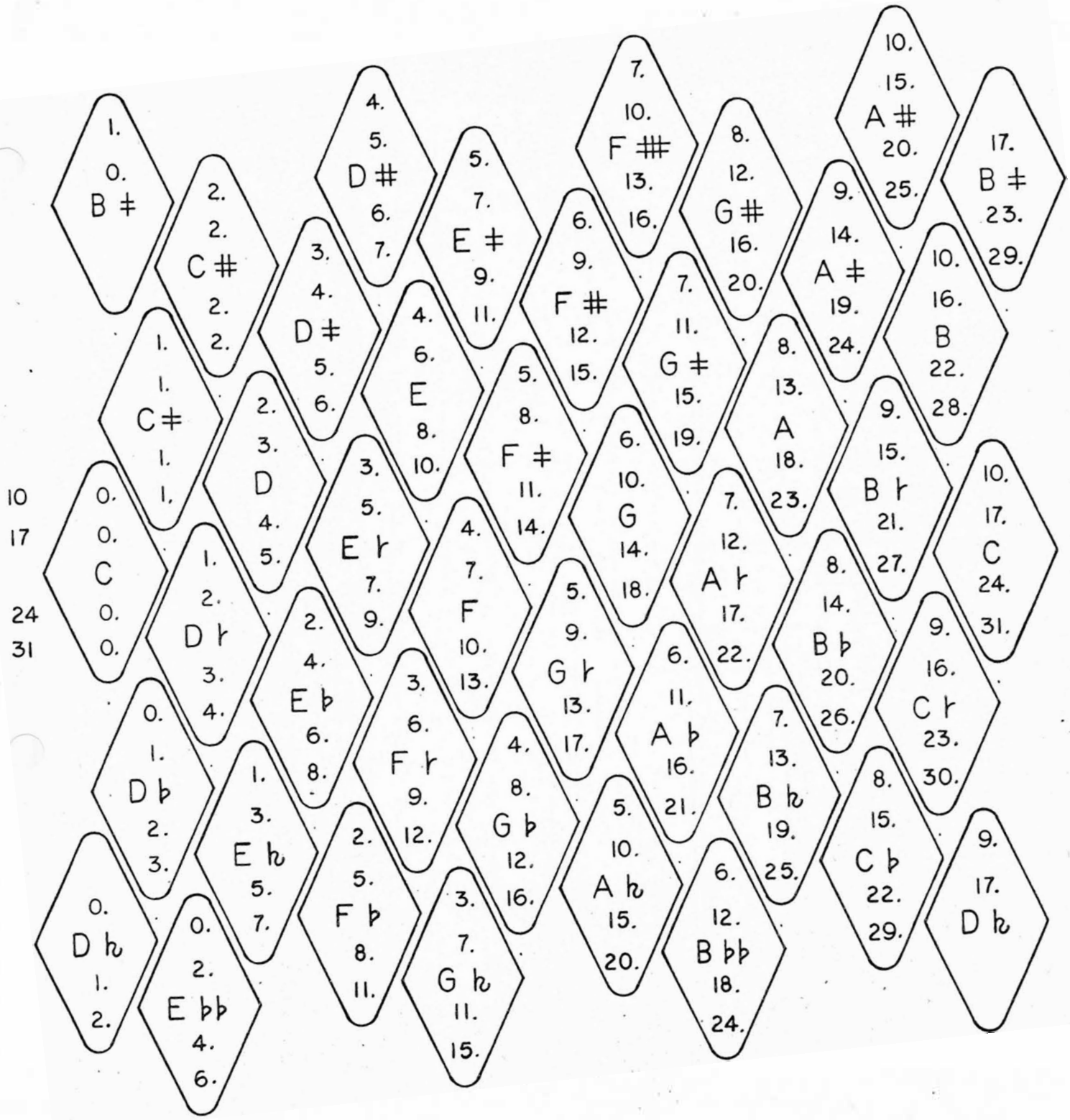
E ♭♭♭
5.
6.
6.
9.
F ♭♭
12.
15.
8.
12.
G ♭♭♭
16.
20.
11.
17.
A ♭♭♭
23.
29.
14.
22.
B ♭♭♭
30.
38.
30
D ♭♭♭


0. 1. B ※ 2. 3.
2. 4. C ※ 6. 8.
5. 9. D ※ 13. 17.
8. 14. E ※ 20. 26.
11. 19. F ♯ ※ 27. 35.
13. 22. G ※ 31. 40.
16. 27. A ※ 38. 49.
18. 30. B ♯ 42. 54.
B ♯
1. 2. C ♯ 3. 4.
4. 7. D ♯ 10. 13.
7. 12. E ♯ 17. 22.
9. 15. F ♯ 21. 27.
12. 20. G ♯ 28. 36.
15. 25. A ♯ 35. 45.
17. 28. B 39. 50.
19 31
0. 0. C 0. 0.
43 55
3. 5. D 7. 9.
6. 10. E 14. 18.
8. 13. F 18. 23.
11. 18. G 25. 32.
14. 23. A 32. 41.
16. 26. B ♭ 36. 46.
19. 31. C 43. 55.
2. 3. D ♭ 4. 5.
5. 8. E ♭ 11. 14.
7. 11. F ♭ 15. 19.
10. 16. G ♭ 22. 28.
13. 21. A ♭ 29. 37.
15. 24. B ♭♭ 33. 42.
18. 29. C ♭ 40. 51.
1. 1. D ♭♭ 1. 1.
4. 6. E ♭♭ 8. 10.
6. 9. F ♭♭ 12. 15.
9. 14. G ♭♭ 19. 24.
12. 19. A ♭♭ 26. 33.
14. 22. B ♭♭♭ 30. 38.
17. 27. C ♭♭ 37. 47.
D ♭♭
3. 4. E ♭♭♭ 5. 6.
8. 12. G ♭♭♭ 16. 20.
11. 17. A ♭♭♭ 23. 29.
30 D ♭♭♭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0. 1. D ♭ 2. 3.
0. D ♮ 1. 2.
4. 5. D ♯ 6. 7.
3. 4. D ♯ 5. 6.
2. 3. D 4. 5.
1. 2. D ♭ 3. 4.
0. 2. E ♭♭ 4. 6.
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4. 6. E 8. 10.
3. 5. E ♭ 7. 9.
2. 4. E ♭ 6. 8.
1. 3. E ♮ 5. 7.
3. 7. G ♮ 11. 15.
4. 7. F 10. 13.
3. 6. F ♭ 9. 12.
2. 5. F ♭ 8. 11.
7. 10. F ♯♯ 13. 16.
6. 9. F ♯ 12. 15.
5. 8. F ♯ 11. 14.
4. 8. G ♭ 12. 16.
5. 9. G ♭ 13. 17.
6. 10. G 14. 18.
5. 10. A ♮ 15. 20.
6. 11. A ♭ 16. 21.
7. 12. A ♭ 17. 22.
6. 12. B ♭♭ 18. 24.
8. 12. G ♯ 16. 20.
7. 11. G ♯ 15. 19.
8. 13. A 18. 23.
7. 13. B ♮ 19. 25.
10. 15. A ♯ 20. 25.
9. 14. A ♯ 19. 24.
10. 16. B 22. 28.
9. 15. B ♭ 21. 27.
8. 14. B ♭ 20. 26.
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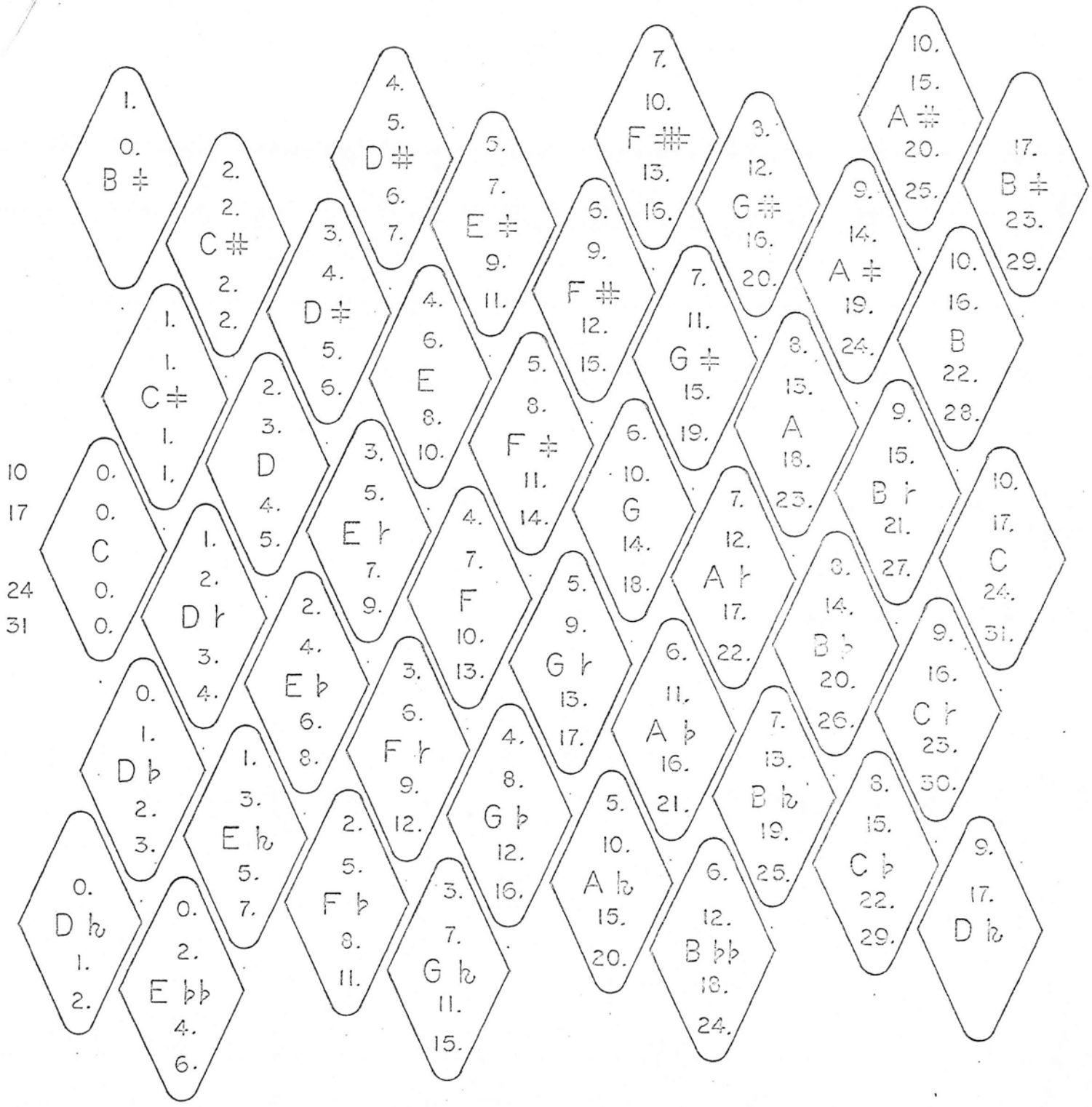
9. 17. D ♮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17
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31
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1. 1. C ♯ 1. 1.
0. 0. C 0. 0.
2. 3. D 4. 5.
1. 2. D ♭ 3. 4.
0. 1. D ♭ 2. 3.
1. 3. E ♭ 5. 7.
0. D ♭ 1. 2.
0. 2. E ♭♭ 4. 6.
3. 4. D ♯ 5. 6.
4. 5. D ♯ 6. 7.
3. 5. E ♭ 7. 9.
2. 4. E ♭ 6. 8.
2. 5. F ♭ 8. 11.
4. 6. E 8. 10.
4. 7. F 10. 13.
3. 6. F ♭ 9. 12.
3. 7. G ♭ 11. 15.
5. 7. E ♯ 9. 11.
5. 8. F ♯ 11. 14.
4. 8. G ♭ 12. 16.
5. 9. G ♭ 13. 17.
5. 10. A ♭ 15. 20.
6. 9. F ♯ 12. 15.
6. 10. G 14. 18.
6. 11. A ♭ 16. 21.
6. 12. B ♭♭ 18. 24.
7. 10. F ♯♯ 13. 16.
7. 11. G ♯ 15. 19.
7. 12. A ♭ 17. 22.
7. 13. B ♭ 19. 25.
3. 12. G ♯♯ 16. 20.
8. 13. A 18. 23.
8. 14. B ♭ 20. 26.
8. 15. C ♭ 22. 29.
10. 15. A ♯♯ 20. 25.
9. 14. A ♯ 19. 24.
9. 15. B ♭ 21. 27.
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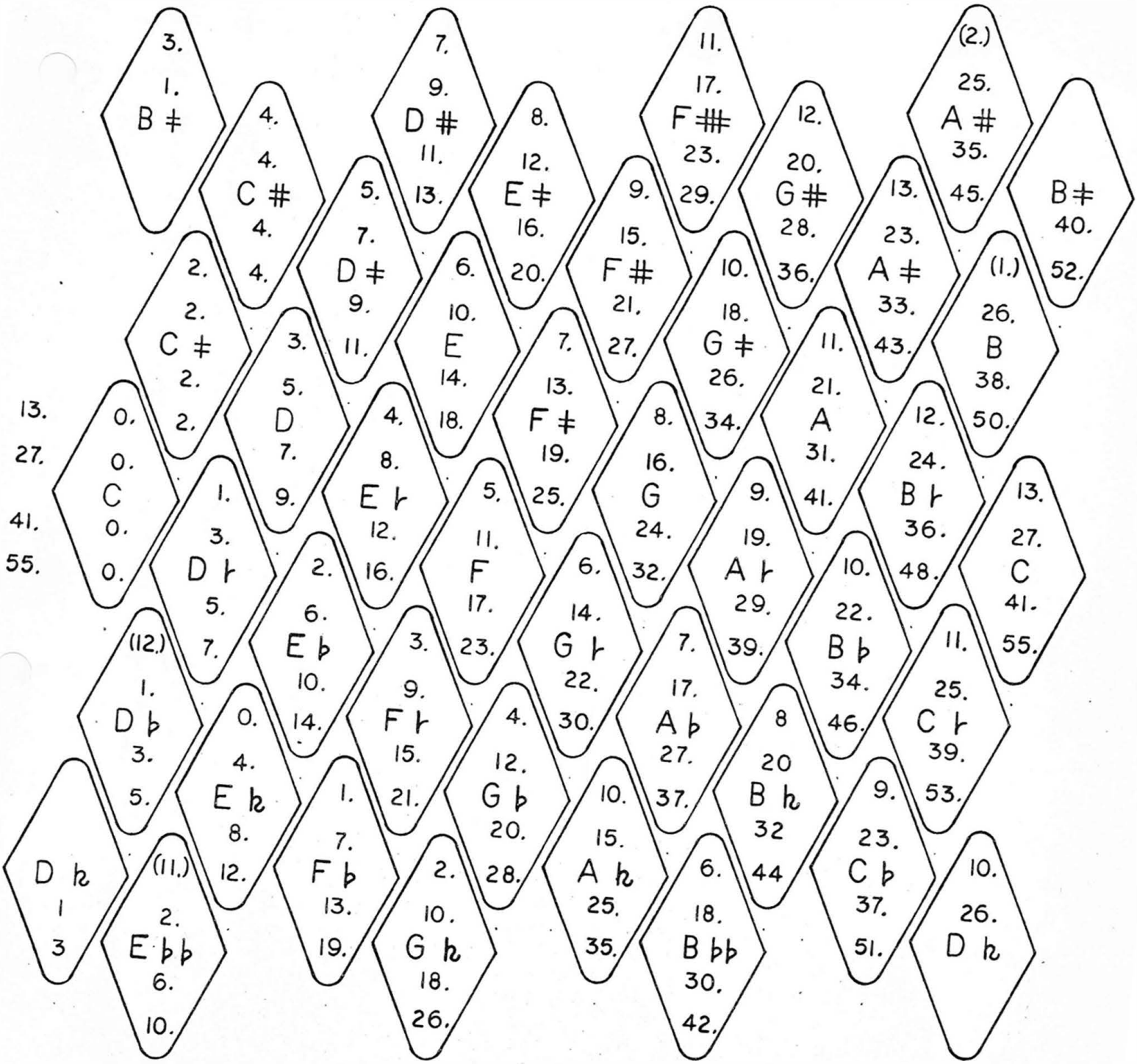
17. B ♯ 23. 29.
10. 16. B 22. 28.
10. 17. C 24. 31.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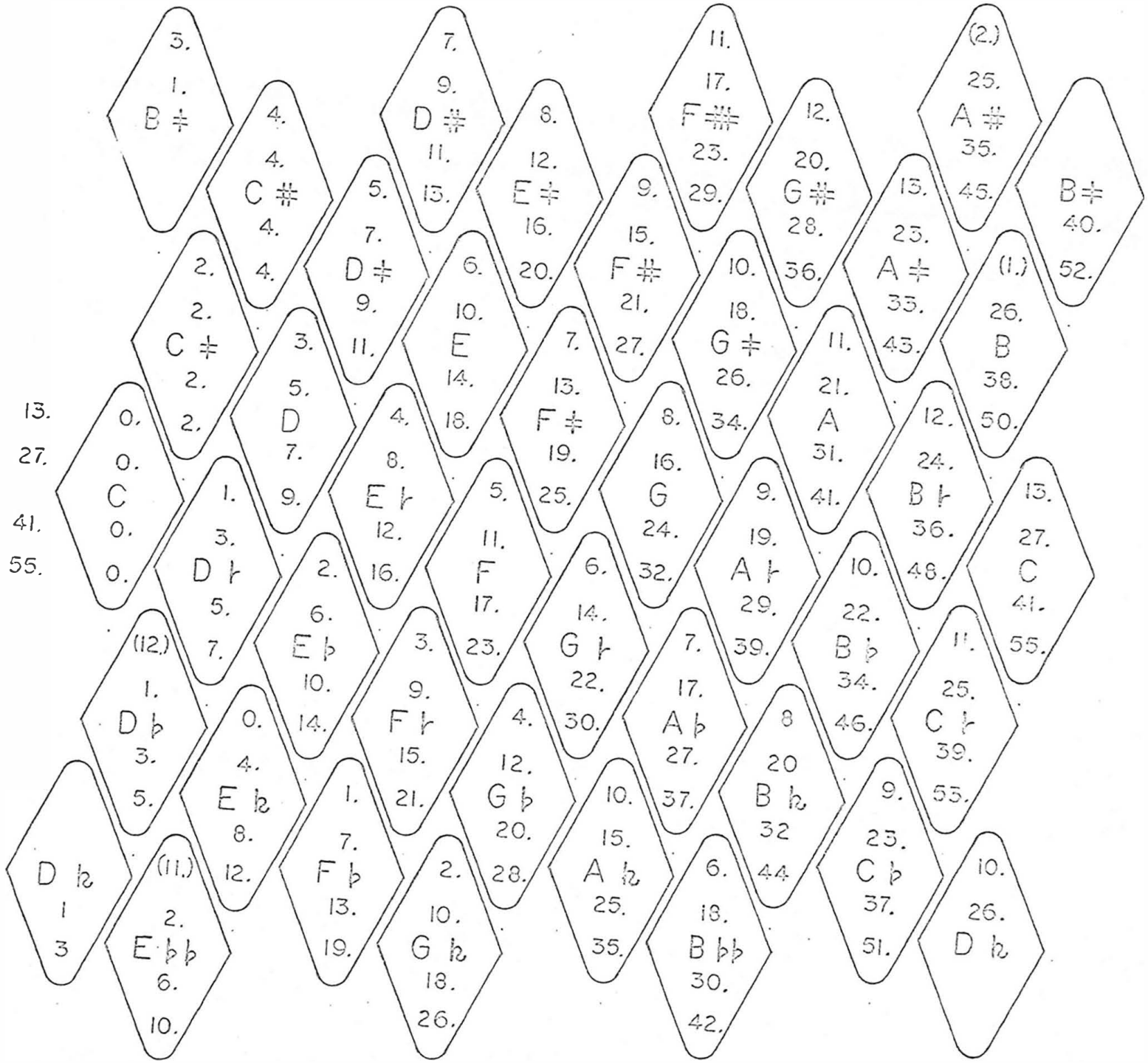
8. 12. E ♯ 16. 20.
11. 17. F ♯♯ 23. 29.
12. 20. G ♯ 28. 36.
(2.) 25. A ♯ 35. 45.
B ♯ 40. 52.
2. 2. C ♯ 2. 2.
5. 7. D ♯ 9. 11.
6. 10. E 14. 18.
9. 15. F ♯ 21. 27.
10. 18. G ♯ 26. 34.
13. 23. A ♯ 33. 43.
(1.) 26. B 38. 50.
13. 27. 41. 55.
0. 0. C 0. 0.
3. 5. D 7. 9.
4. 8. E ♭ 12. 16.
7. 13. F ♯ 19. 25.
8. 16. G 24. 32.
11. 21. A 31. 41.
12. 24. B ♭ 36. 48.
1. 3. D ♭ 5. 7.
5. 11. F 17. 23.
9. 19. A ♭ 29. 39.
13. 27. C 41. 55.
(12.) 1. D ♭ 3. 5.
2. 6. E ♭ 10. 14.
3. 9. F ♭ 15. 21.
6. 14. G ♭ 22. 30.
7. 17. A ♭ 27. 37.
10. 22. B ♭ 34. 46.
11. 25. C ♭ 39. 53.
D ♮ 1 3
0. 4. E ♮ 8. 12.
1. 7. F ♭ 13. 19.
4. 12. G ♭ 20. 28.
8 20 B ♮ 32 44
9. 23. C ♭ 37. 51.
(11.) 2. E ♭♭ 6. 10.
2. 10. G ♮ 18. 26.
10. 15. A ♮ 25. 35.
6. 18. B ♭♭ 30. 42.
10. 26. D ♮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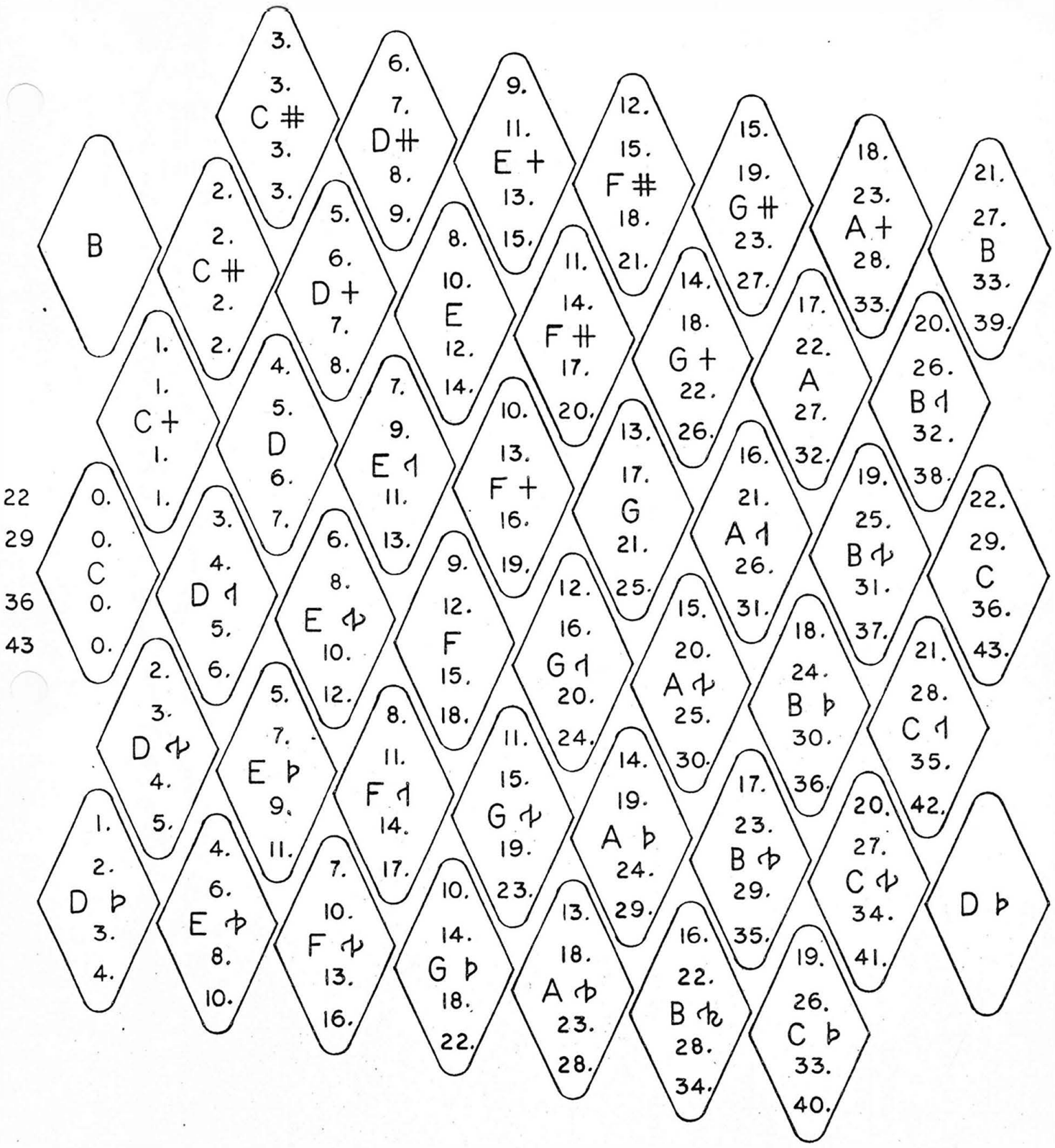
8. 12. E ♯ 16. 20.
11. 17. F ♯♯ 23. 29.
12. 20. G ♯♯ 28. 36.
(2.) 25. A ♯ 35. 45.
B ♯ 40. 52.
2. 2. C ♯ 2. 2.
5. 7. D ♯ 9. 11.
6. 10. E 14. 18.
9. 15. F ♯ 21. 27.
10. 18. G ♯ 26. 34.
13. 23. A ♯ 33. 43.
(1.) 26. B 38. 50.
13. 27. 41. 55.
0. 0. C 0. 0.
3. 5. D 7. 9.
4. 8. E ♭ 12. 16.
7. 13. F ♯ 19. 25.
8. 16. G 24. 32.
11. 21. A 31. 41.
12. 24. B ♭ 36. 48.
1. 3. D ♭ 5. 7.
5. 11. F 17. 23.
9. 19. A ♭ 29. 39.
13. 27. C 41. 55.
(12.) 1. D ♭ 3. 5.
2. 6. E ♭ 10. 14.
3. 9. F ♭ 15. 21.
6. 14. G ♭ 22. 30.
7. 17. A ♭ 27. 37.
10. 22. B ♭ 34. 46.
11. 25. C ♭ 39. 53.
D ♭ 1 3
0. 4. E ♭ 8. 12.
1. 7. F ♭ 13. 19.
4. 12. G ♭ 20. 28.
8 20 B ♭ 32 44
9. 23. C ♭ 37. 51.
(11.) 2. E ♭♭ 6. 10.
2. 10. G ♭ 18. 26.
10. 15. A ♭ 25. 35.
6. 18. B ♭♭ 30. 42.
10. 26. D ♭


B
C♯ 3. 3. 3.
C♯ 2. 2. 2.
C+ 1. 1. 1.
C 0. 0. 0.
D♯ 8. 7. 6.
D+ 7. 6. 5.
D 6. 5. 4.
D♭ 3. 4. 1.
E+ 13. 11. 9.
E 12. 10. 8.
E♭ 10. 8. 6.
E♭ 9. 7. 5.
F♯ 18. 15. 12.
F♯ 17. 14. 11.
F+ 16. 13. 10.
F 15. 12. 9.
F♭ 14. 11. 8.
F♭ 13. 10. 7.
G♯ 23. 19. 15.
G+ 22. 18. 14.
G 21. 17. 13.
G♭ 20. 16. 12.
G♭ 19. 15. 11.
G♭ 18. 14. 10.
A+ 28. 23. 18.
A 27. 22. 17.
A♭ 26. 21. 16.
A♭ 25. 20. 15.
A♭ 24. 19. 14.
A♭ 23. 18. 13.
B 33. 27. 21.
B♭ 32. 26. 20.
B♭ 31. 25. 19.
B♭ 30. 24. 18.
B♭ 29. 23. 17.
B♭ 28. 22. 16.
C 36. 29. 22.
C♭ 35. 28. 21.
C♭ 34. 27. 20.
C♭ 33. 26. 19.
D♭
22
29
36
43

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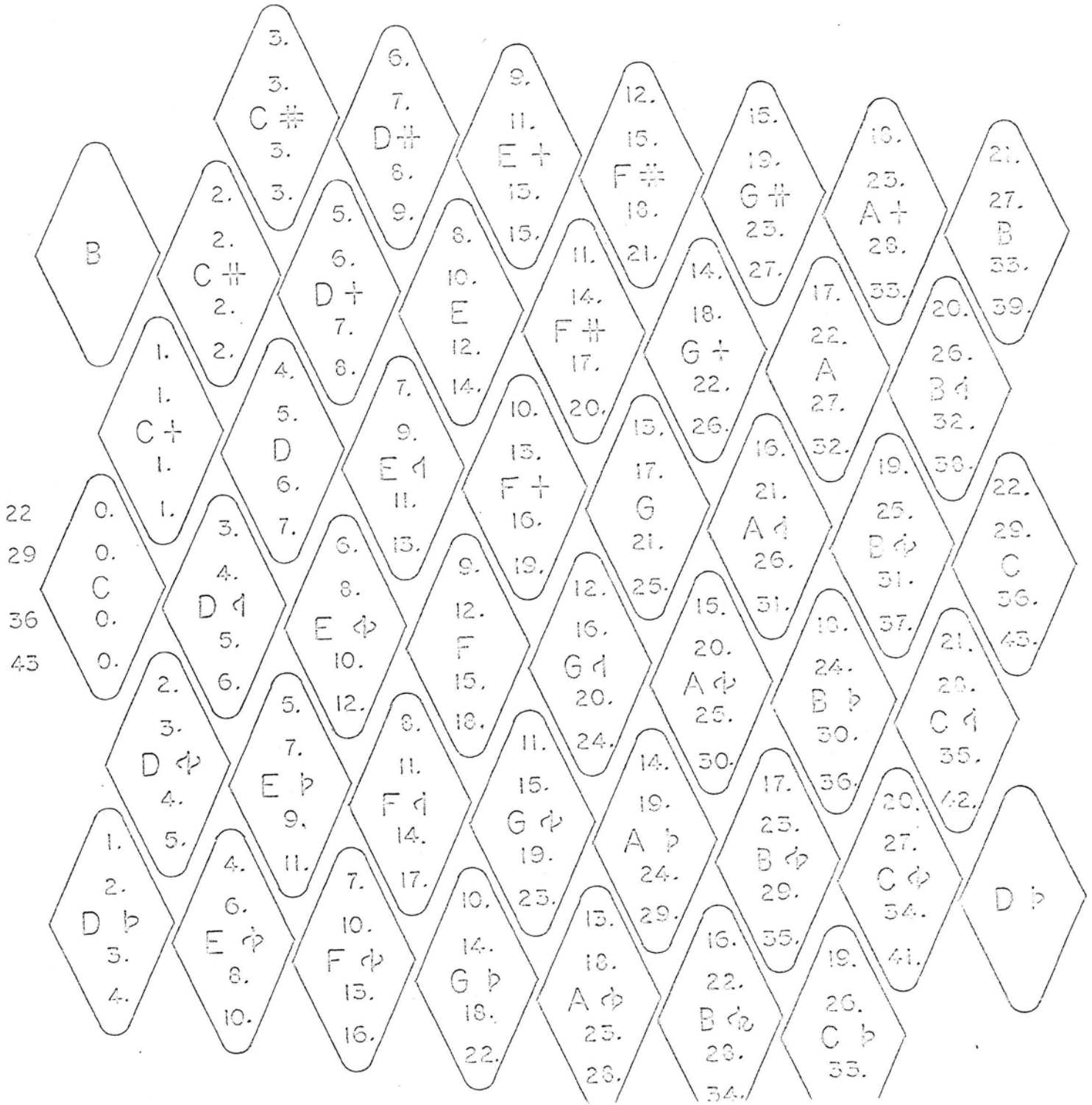
B
C
C♯
D♭
D
D♯
E♭
E
F
F♯
G♭
G
G♯
A♭
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B♭
B
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A♭
A
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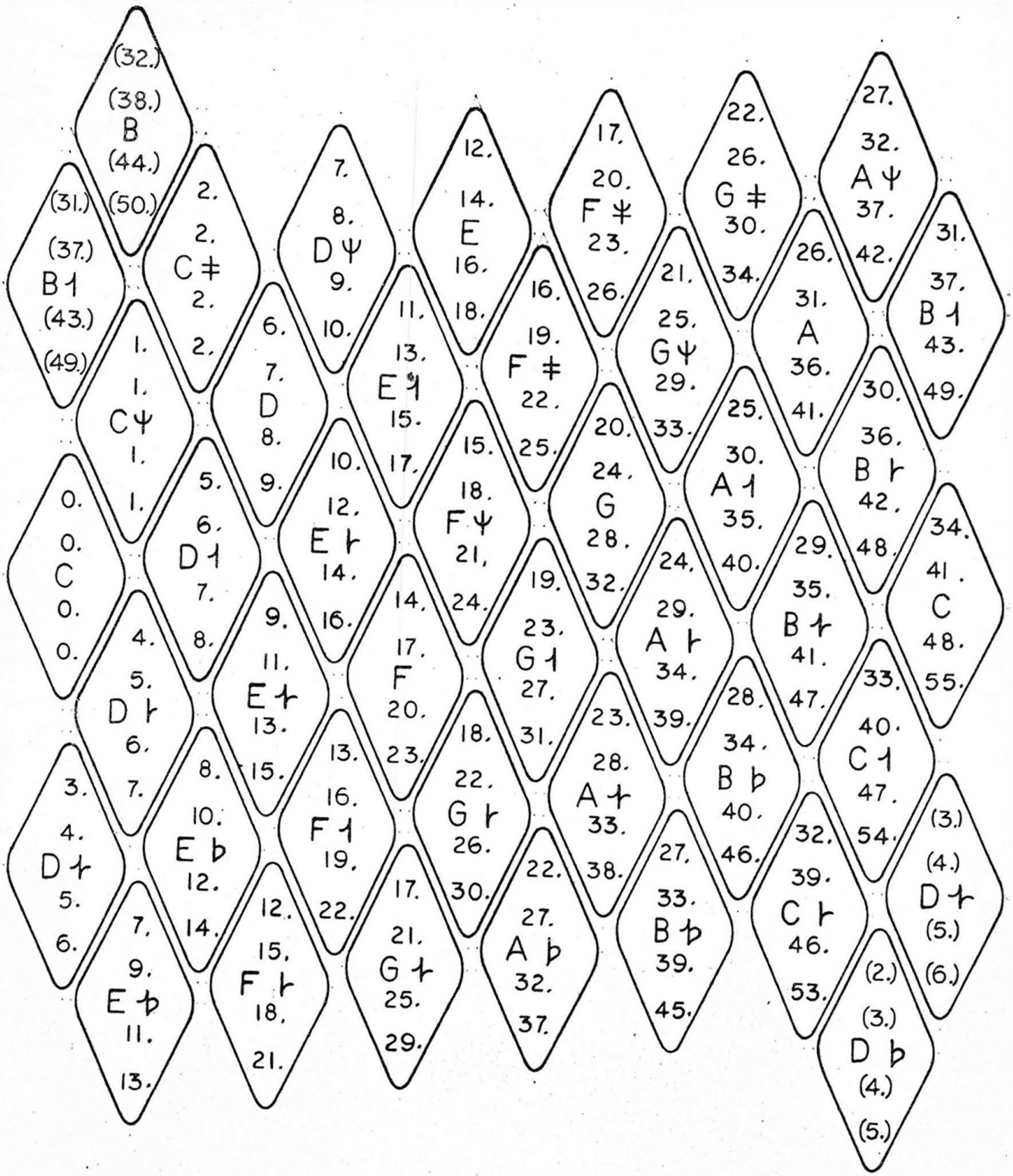
C
22
29
36
43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B
(44.)
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(50.)
(37.)
B 1
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2.
2.
C ♯
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2.
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C Ψ
1.
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6.
7.
D
8.
9.
7.
8.
D Ψ
9.
10.
11.
13.
E 1
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17.
12.
14.
E
16.
18.
16.
19.
F ♯
22.
25.
17.
20.
F Ψ
23.
26.
21.
25.
G Ψ
29.
33.
22.
26.
G ♯
30.
34.
26.
31.
A
36.
41.
27.
32.
A Ψ
37.
42.
31.
37.
B 1
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49.
34
41
48
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C
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5.
6.
D 1
7.
8.
10.
12.
E ♭
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16.
15.
18.
F Ψ
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24.
20.
24.
G
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32.
24.
29.
A ♭
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30.
A 1
35.
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29.
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B ♭
41.
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B ♭
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C
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D ♭
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15.
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16.
F 1
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22.
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G ♭
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23.
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A ♭
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B ♭
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C 1
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F ♭
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G ♭
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A ♭
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B ♭
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32.
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C ♭
46.
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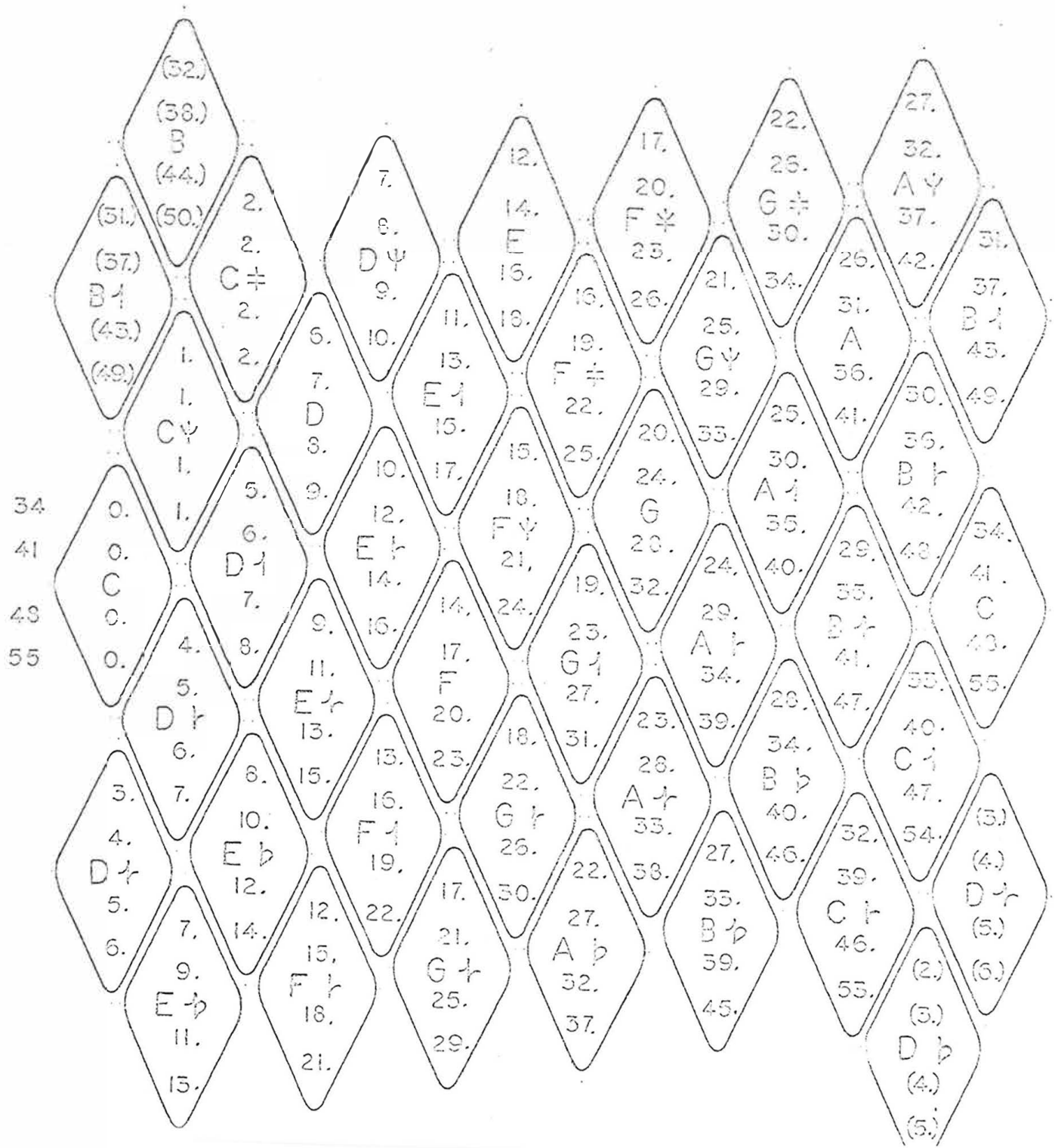
(4.)
D ♭
(5.)
(6.)
(2.)
(3.)
D ♭
(4.)
(5.)

E. Wilson 65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(32.)
(38.)
B
(44.)
(31.)
(50.)
(37.)
B♭
(43.)
(49.)
2.
2.
C♯
2.
2.
1.
1.
C♈
1.
1.
0.
0.
C
0.
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5.
6.
D♩
7.
8.
4.
5.
D♭
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10.
E♭
12.
14.
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D♯
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D
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7.
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D♈
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F♭
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F
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E
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F♈
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15.
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G♯
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F♯
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23.
G♩
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17.
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F♉
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23.
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A♯
33.
38.
24.
29.
A♭
34.
39.
25.
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A♩
35.
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33.
B♯
39.
45.
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31.
A
36.
41.
28.
34.
B♭
40.
46.
27.
32.
A♈
37.
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29.
35.
B♯
41.
47.
30.
36.
B♭
42.
48.
32.
39.
C♭
46.
53.
31.
37.
B♩
43.
49.
33.
40.
C♩
47.
54.
34.
41.
C
48.
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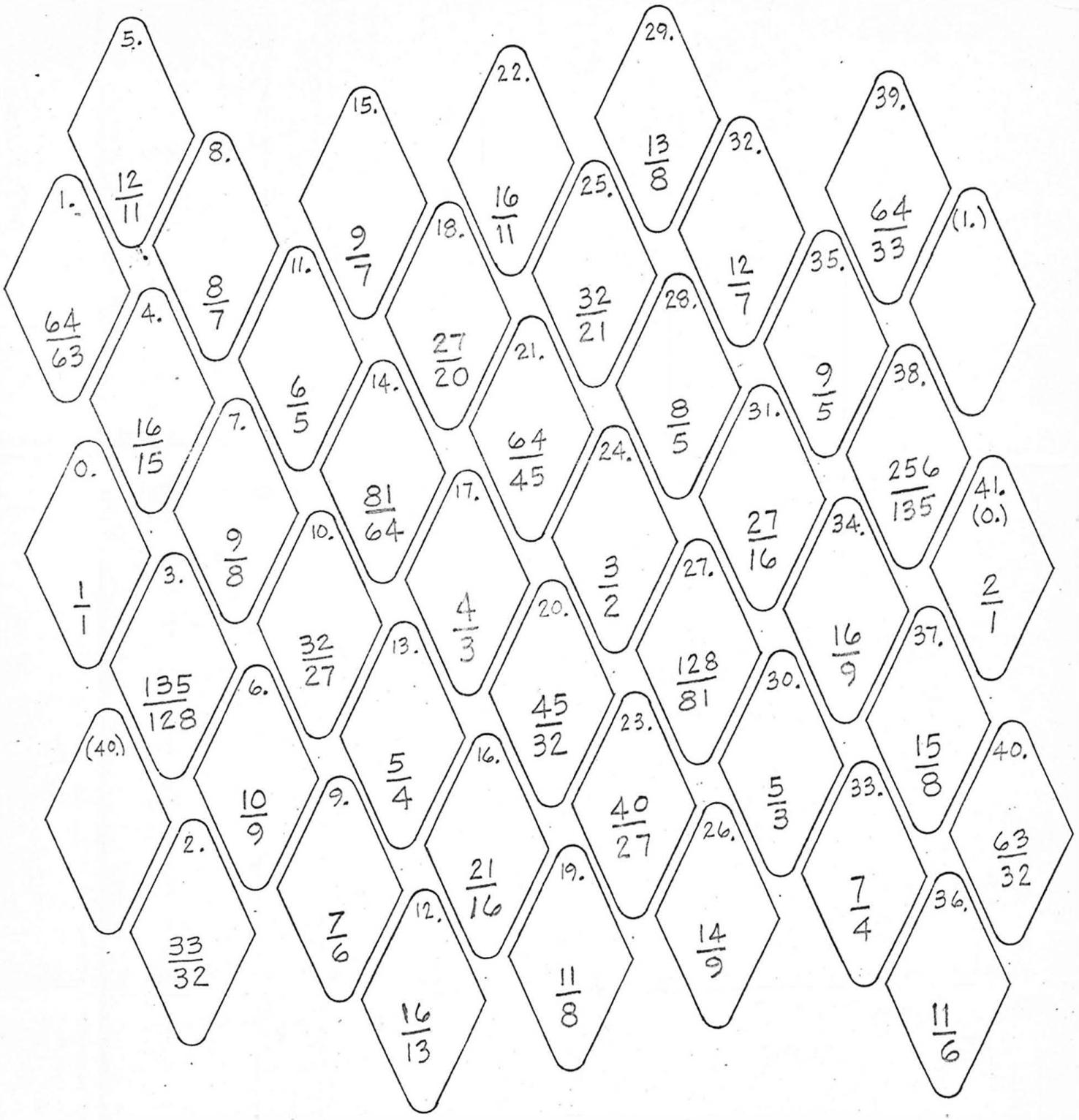
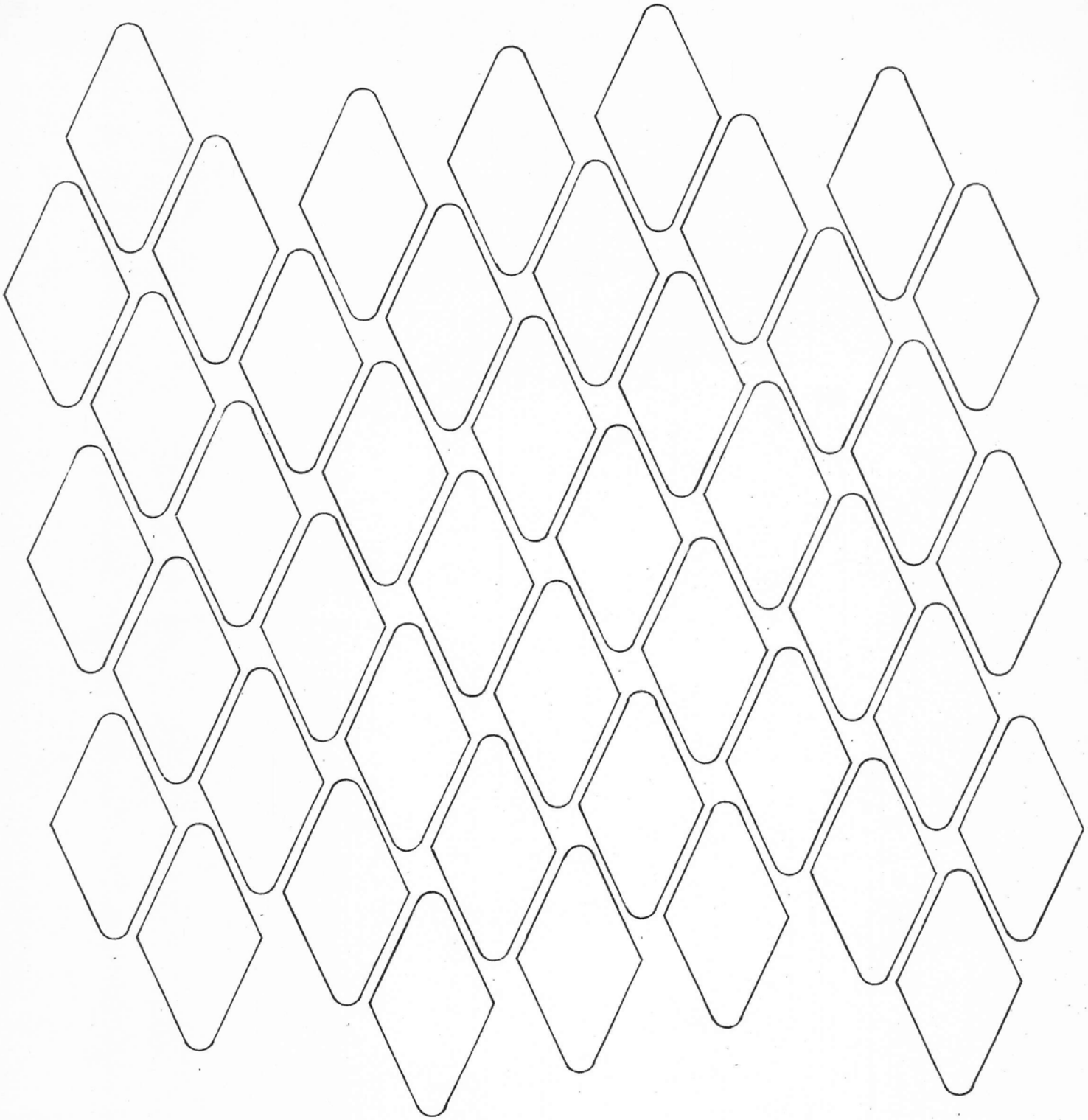
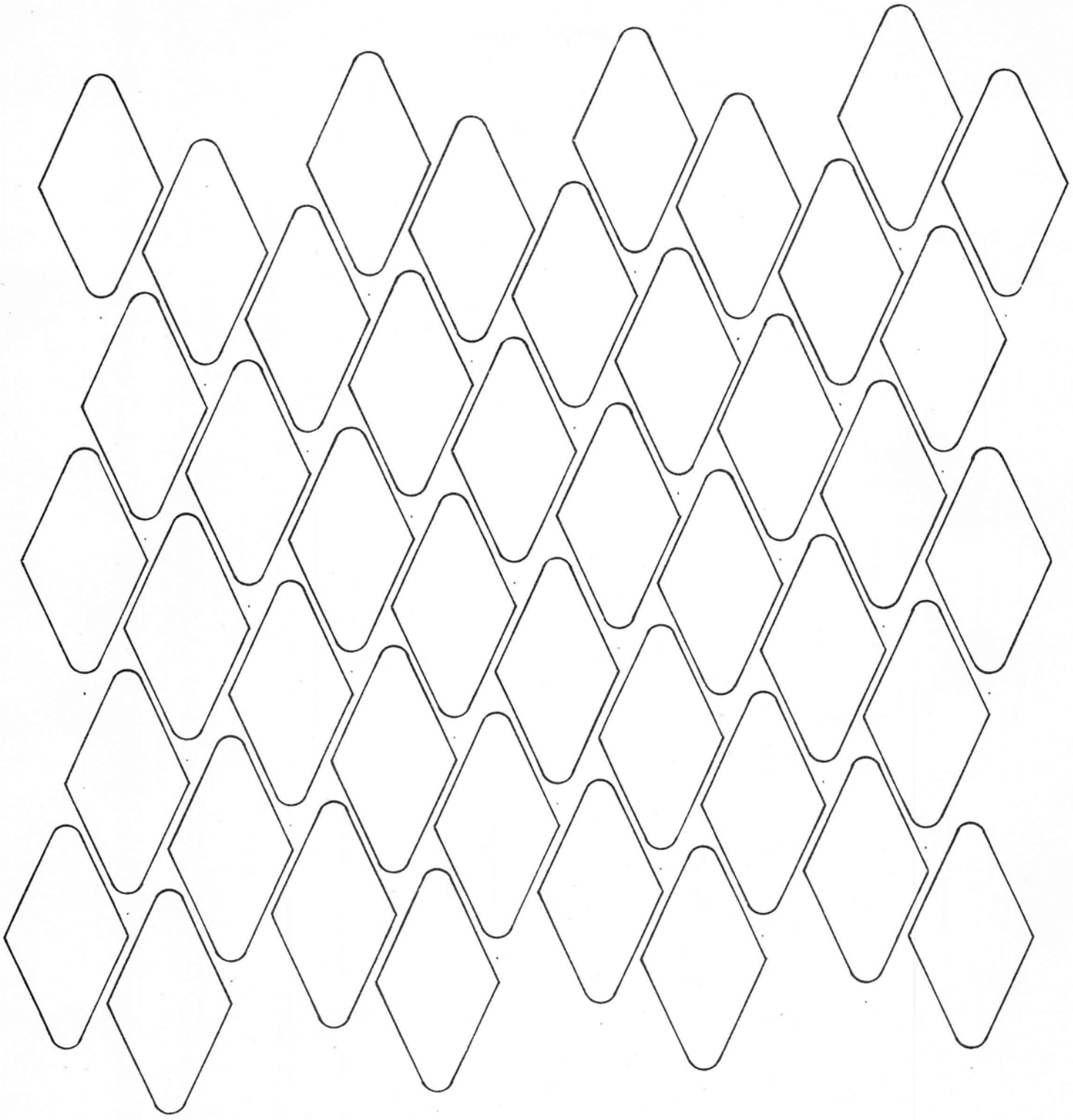
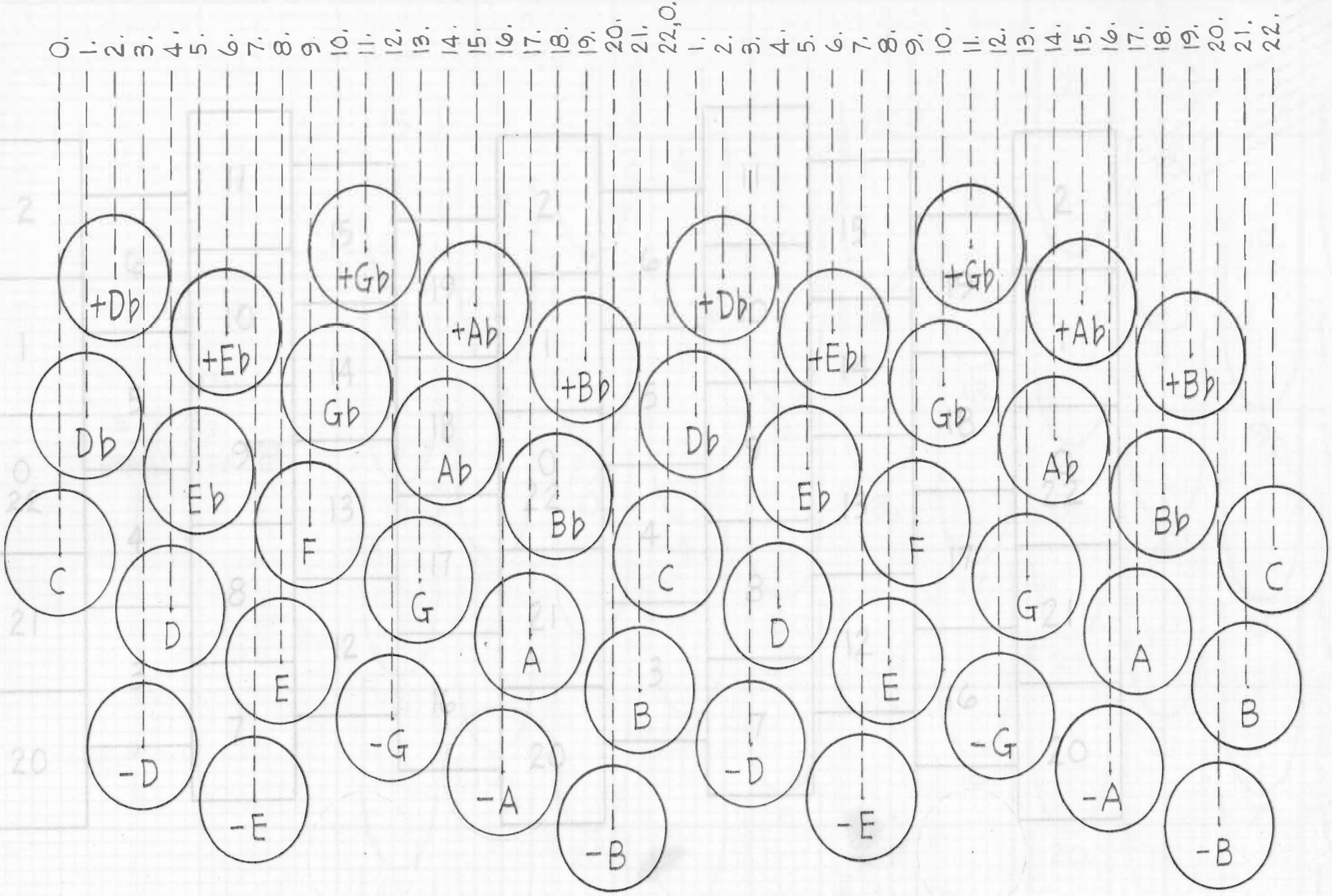
(2.)
(3.)
D♭
(4.)
(5.)
(3.)
(4.)
D♯
(5.)
(6.)



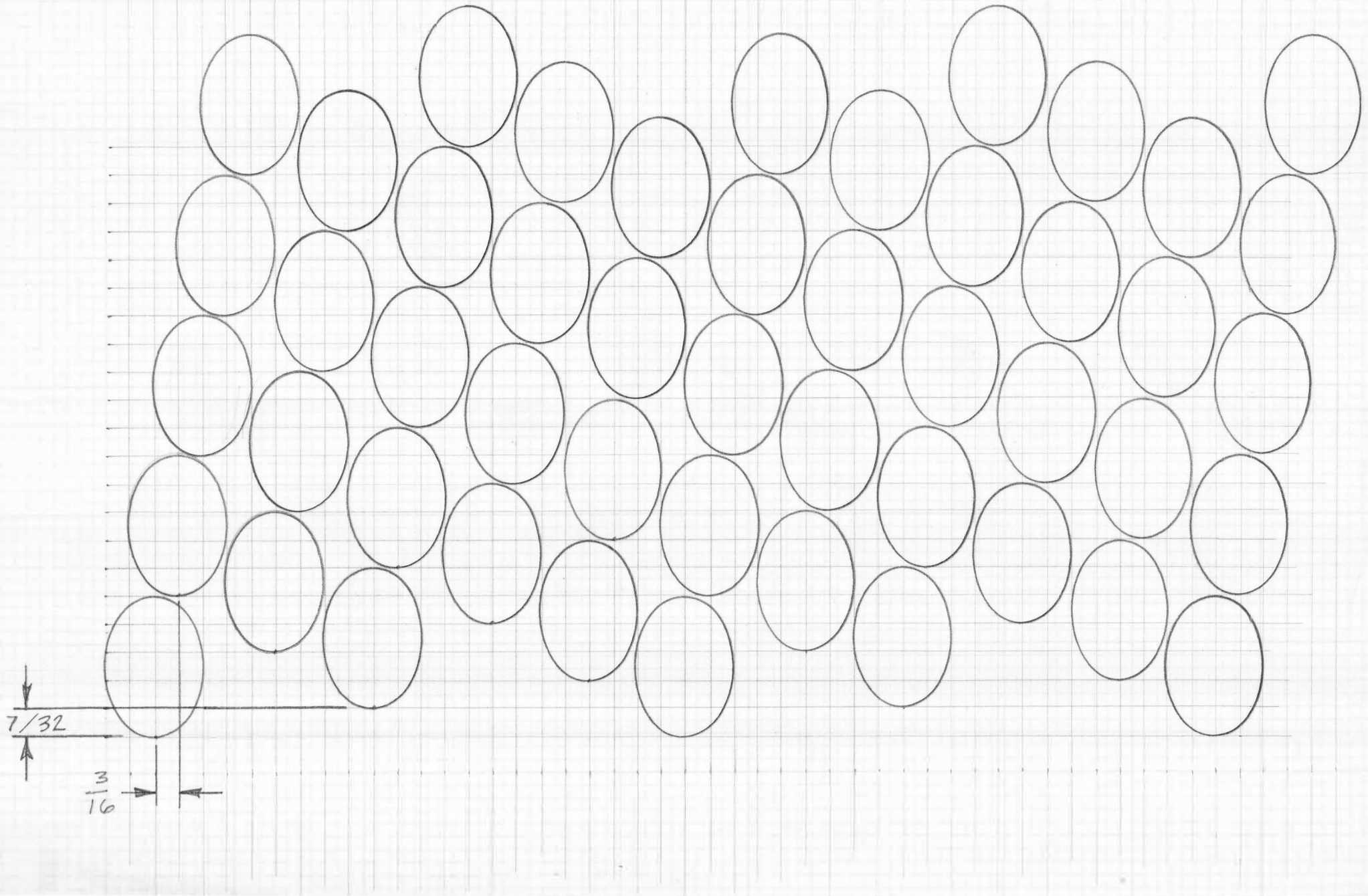
THE ASSIGNMENT OF WILSON'S 41-TONE MATRIX TO THE BOSANQUET PATTERN
DIGITAL DESIGN BY ERV WILSON







22-tone Keyboard (D)
Issued by Ervin M. Wilson, 1969
U.S. Patent No. 3342094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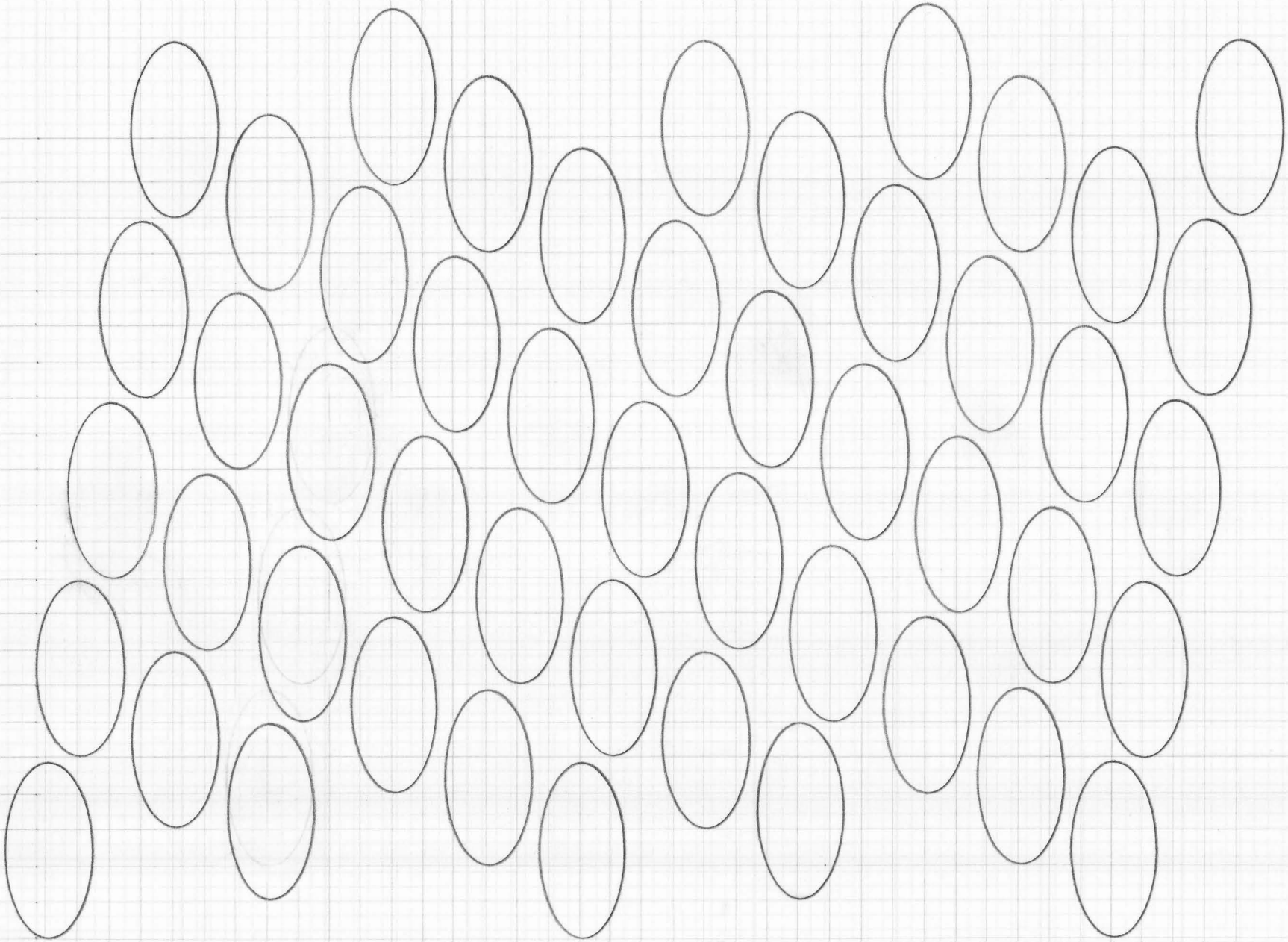
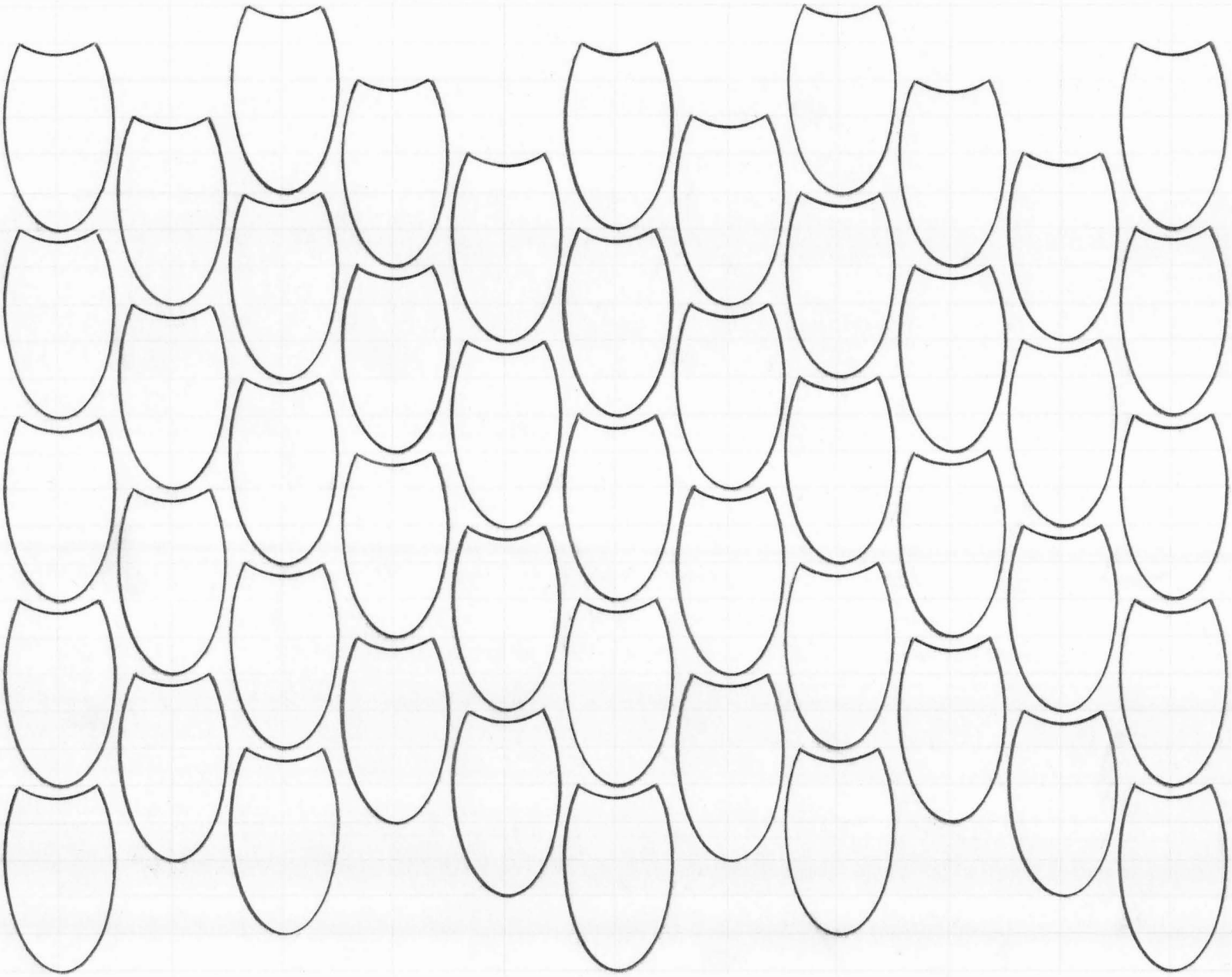
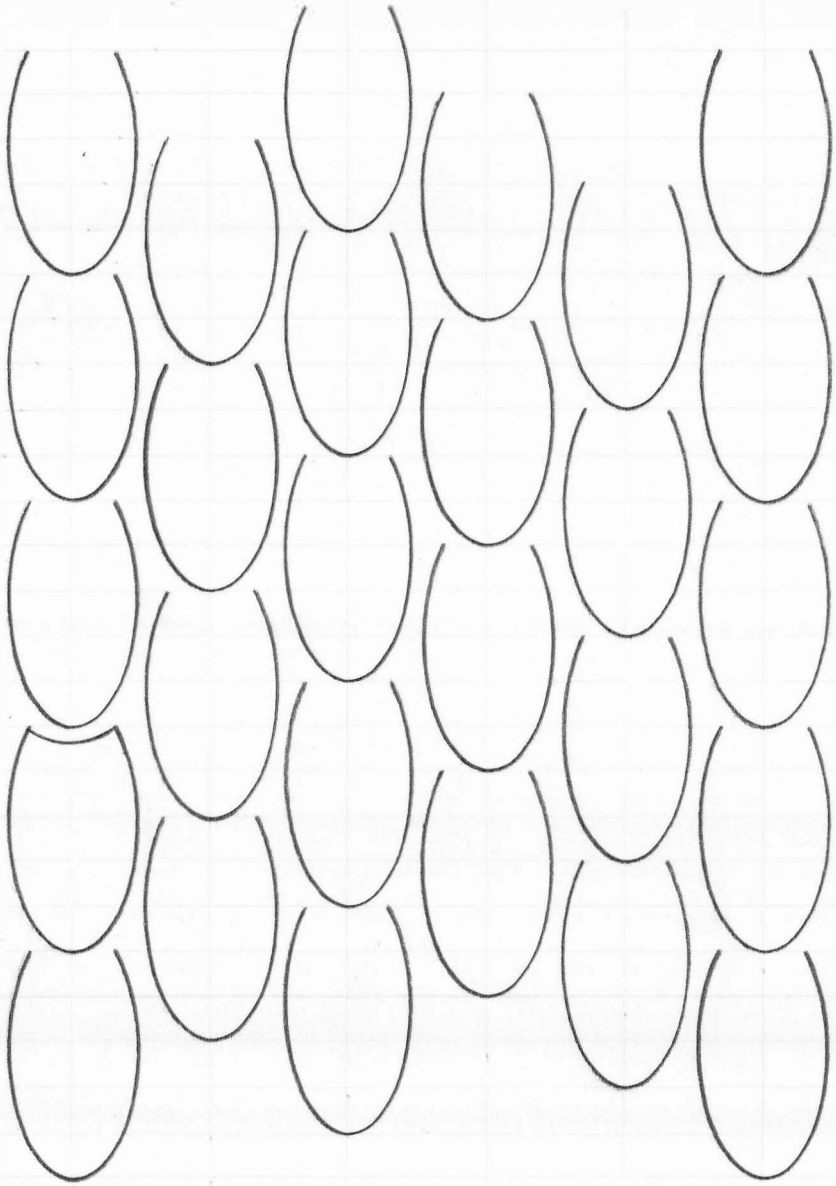
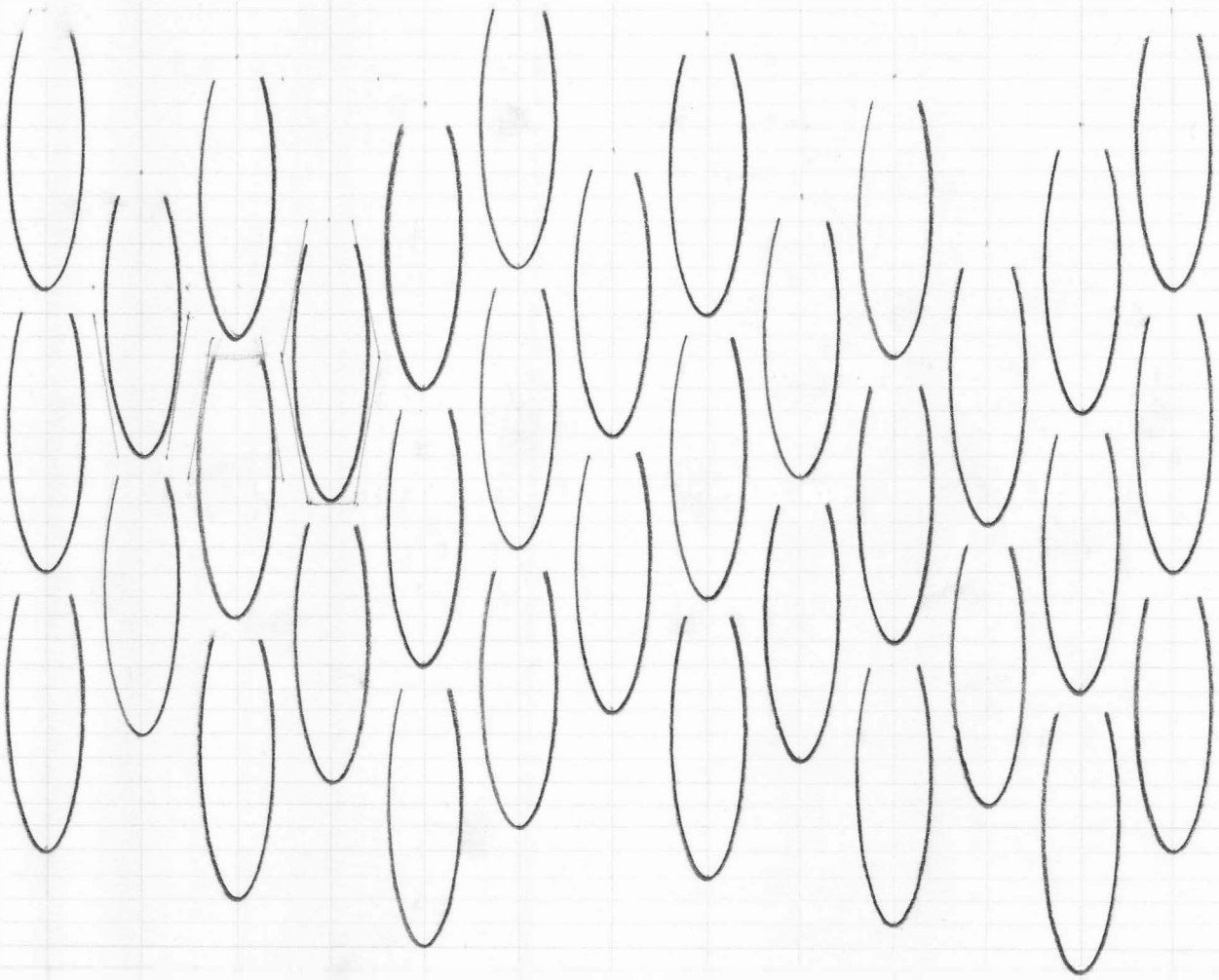


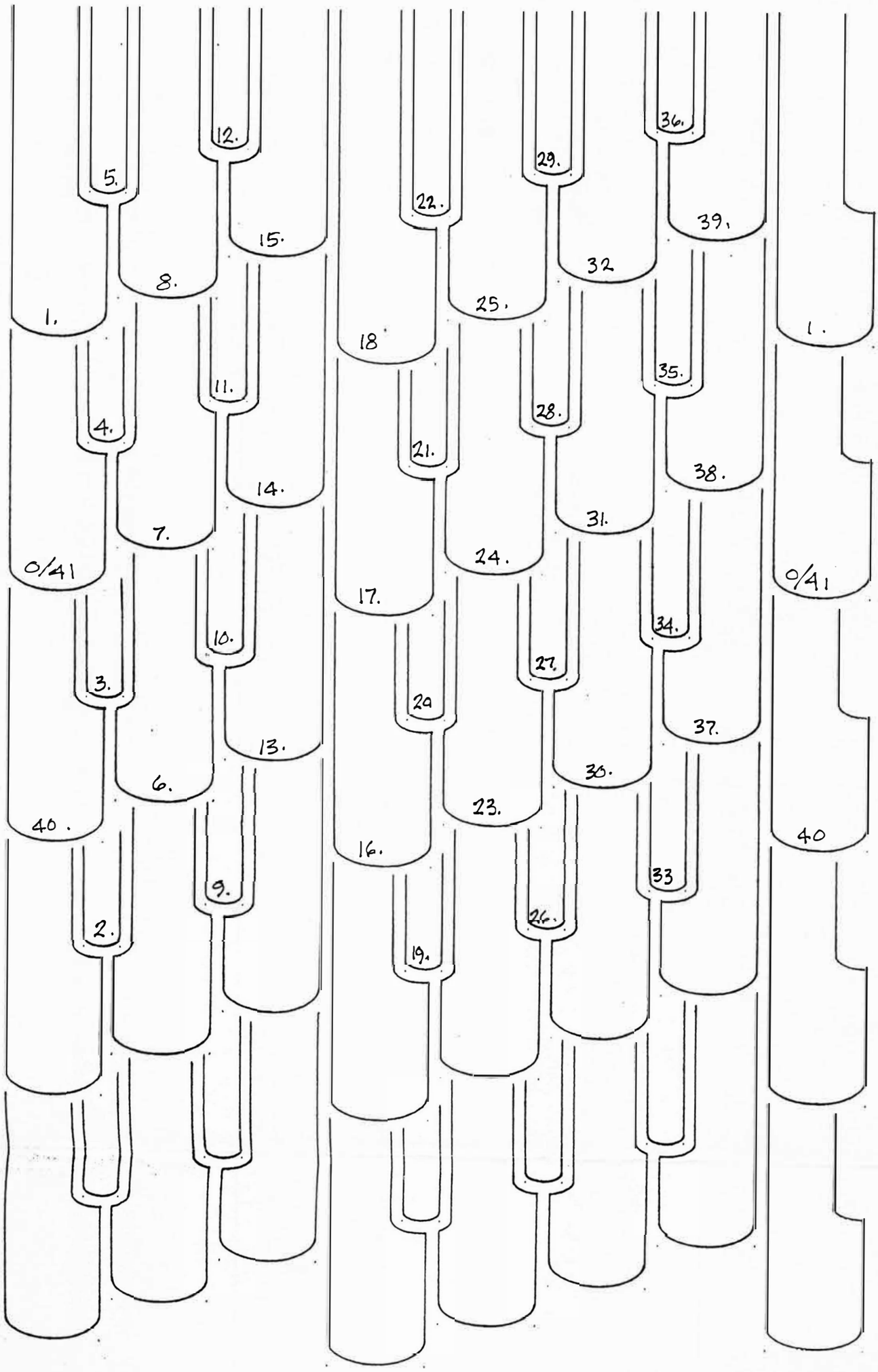






Faber Bosanquet

Notated for 41, Aug 10, 1998 by Eru Wilson



Circa 1974, E.W.

This figure is

This is Fig 1 from The Bosanquetian 7-rank Keyboard After Poole & Brown, from the pages of Xenharmonikon No. 1, 1974
This figure has been annotated to clarify the ~~the relati~~ association of the Peirce Series, (State 7, from 0/1 to 1/2) — with the the ~~straight-Line continuum~~ generator continuum ~~in~~ and the straight-Line pattern. On the left side is ~~a~~ the corresponding scale-tree (Peirce sequence) This ~~diagram~~ (historical) diagram is a thumb-nail sketch of the Linear ~~[illegible]~~ MOS continuum, ~~and is tacitly reflected~~ as ~~generated~~ expressed by the generator continuum.

5																2
5								7								2
5				12				7				9				2
5		17		12		19		7		16		9		11		2
5	22	17	29	12	31	19	26	7	23	16	25	9	20	11	13	2

27 33 30 15 2

This diagram is originally from XH no. 1, 1974, The Bosanquetian 7-rank Keyboard after Poole & Brown by Erv Wilson. It historically marks the time where Wilson spontaneously regenerates the Scale Tree (~~utterly~~ unaware of ~~Peirce~~ Charles Sanders Peirce) and associates it with the generator continuum and the straight-line-pattern. This diagram is annotated accordingly ~~to c~~ for clarification. E.W. 1997

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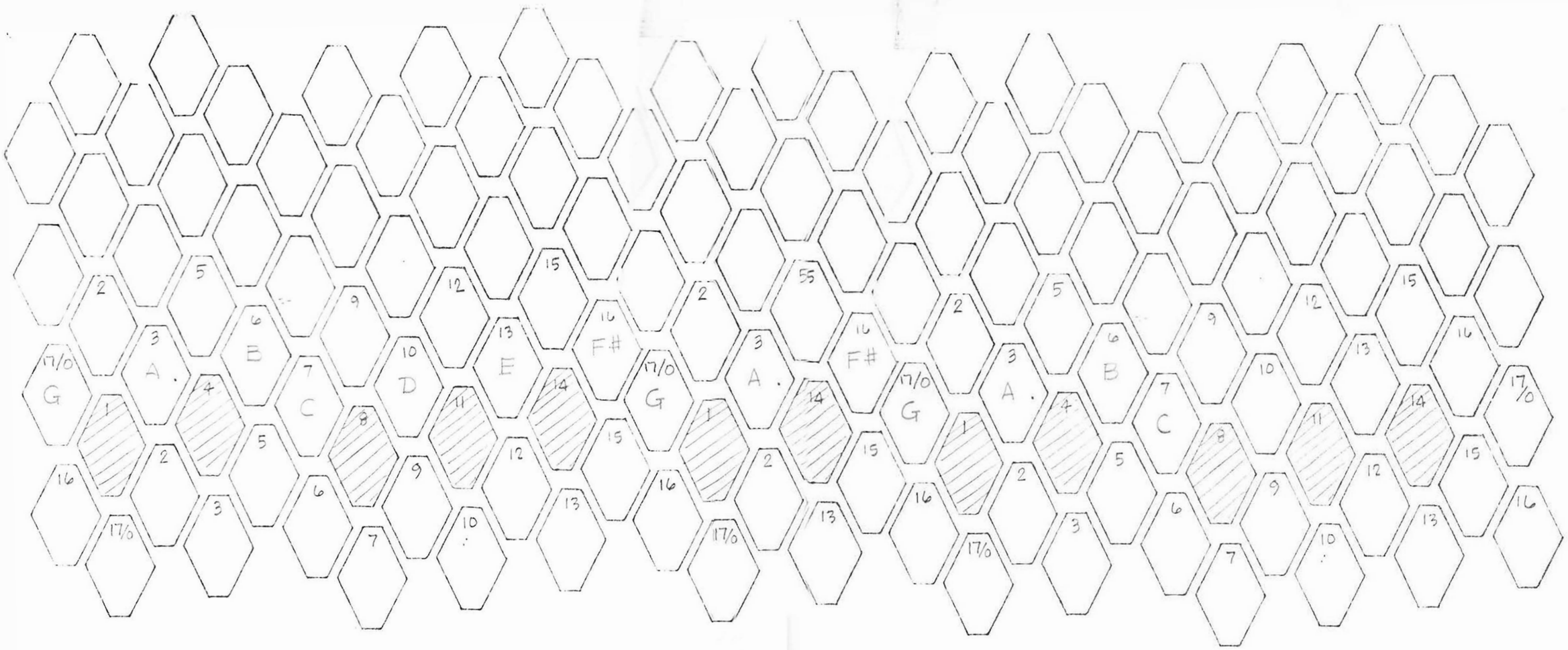
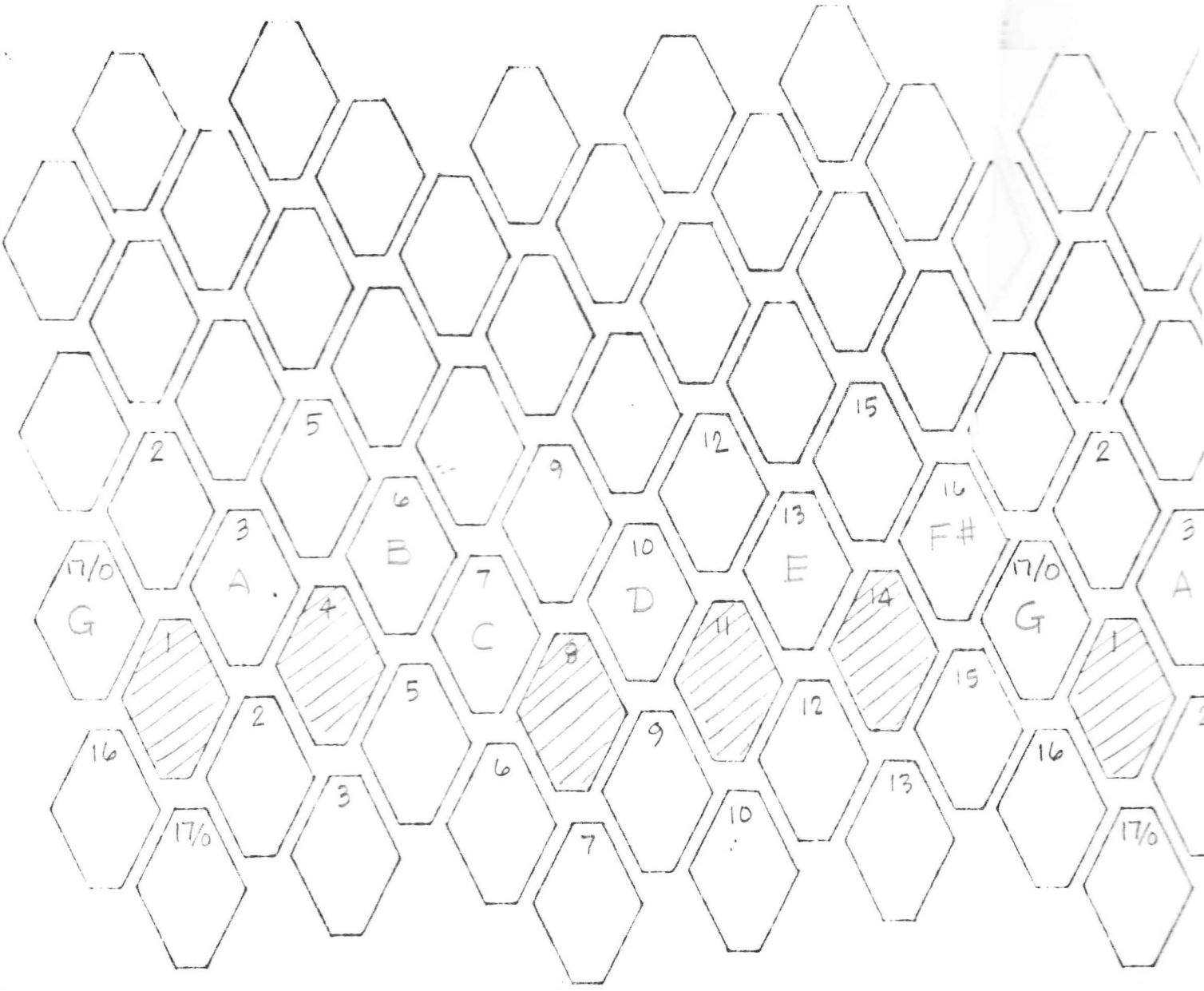
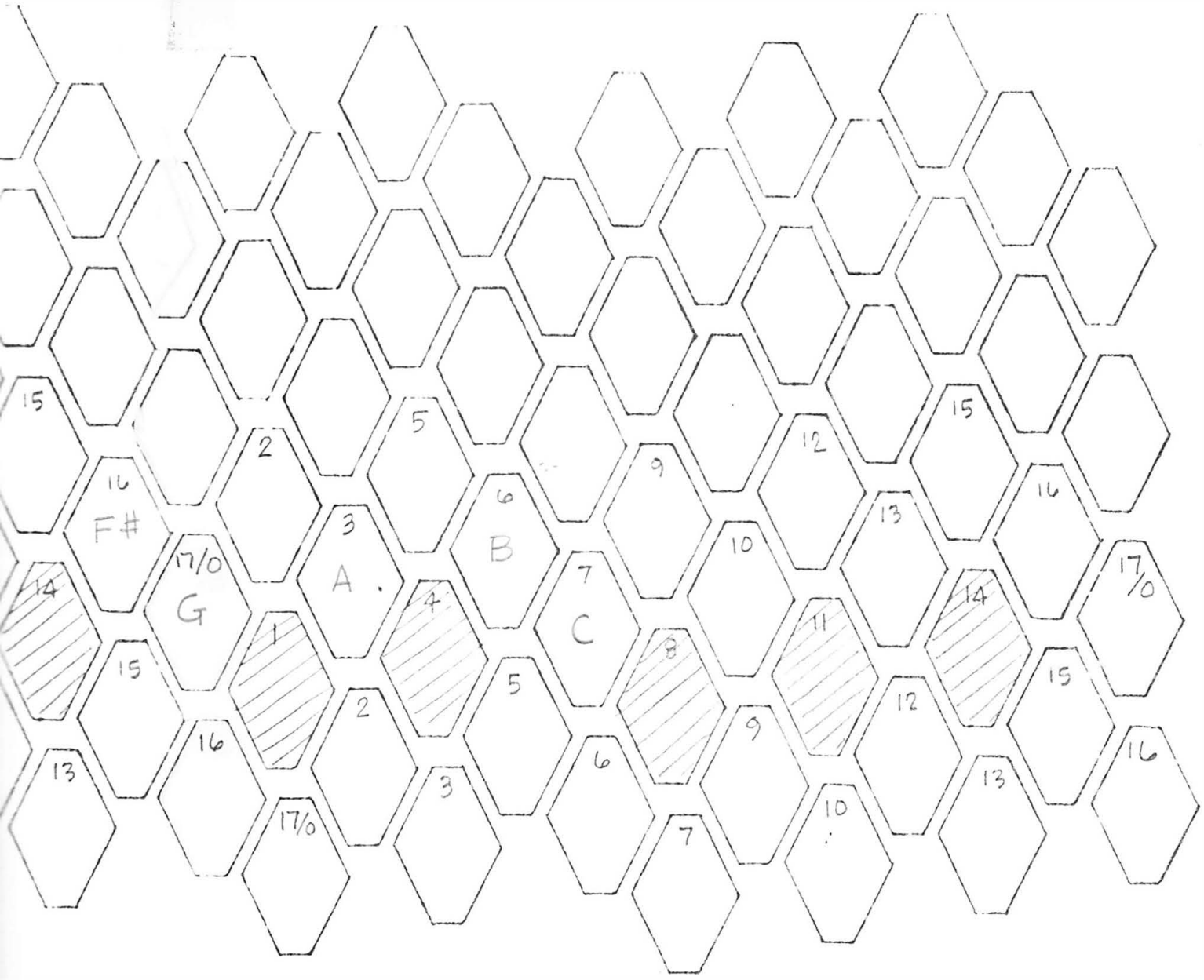
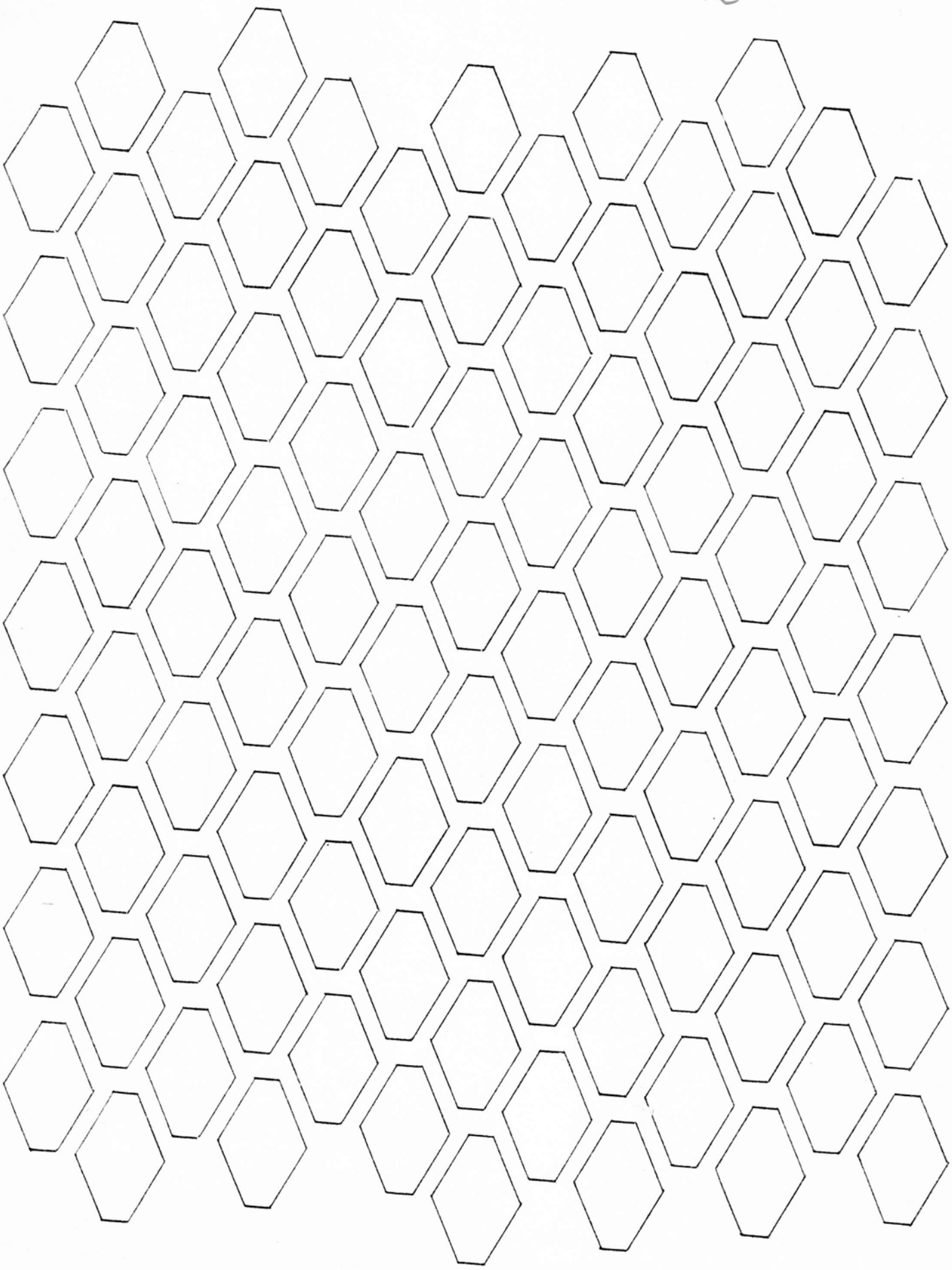


VARIATION ON BOSANQUET





Variation on Bosanquet Keyboard
Proprietary design © 1984 by Eru Wilson



VARIATION ON BOSANQUET
DESIGN © 1978 BY ERV WILSON
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VARIATION ON BOSANQUET
DESIGN © 1978 BY ERV WILSON
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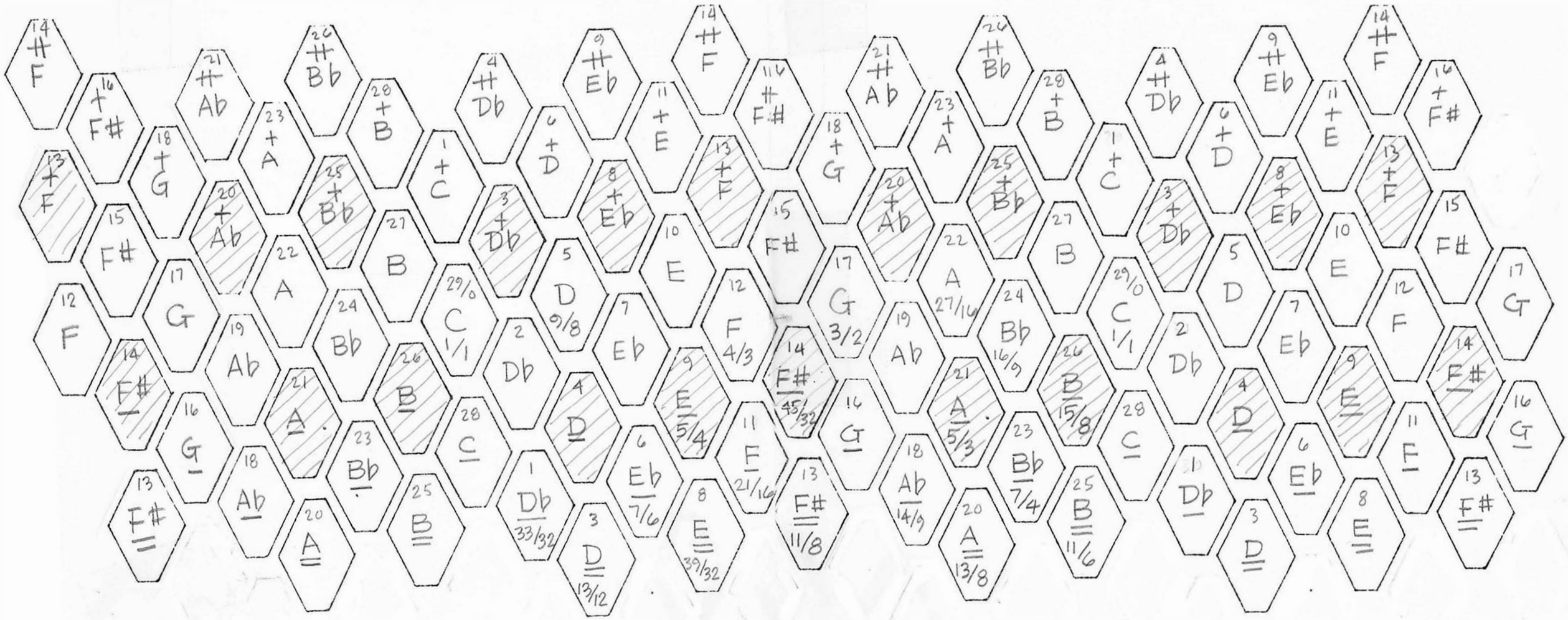
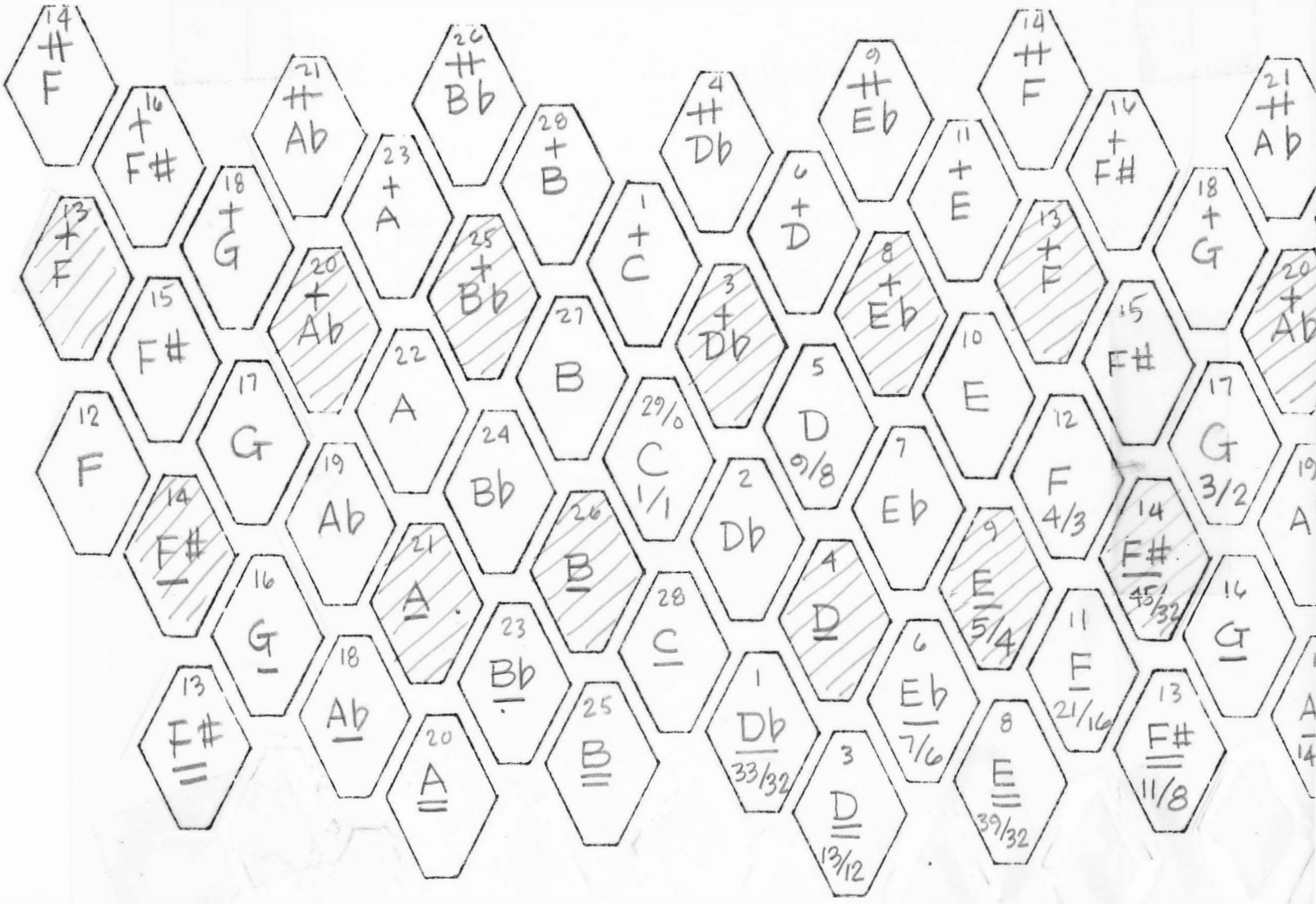
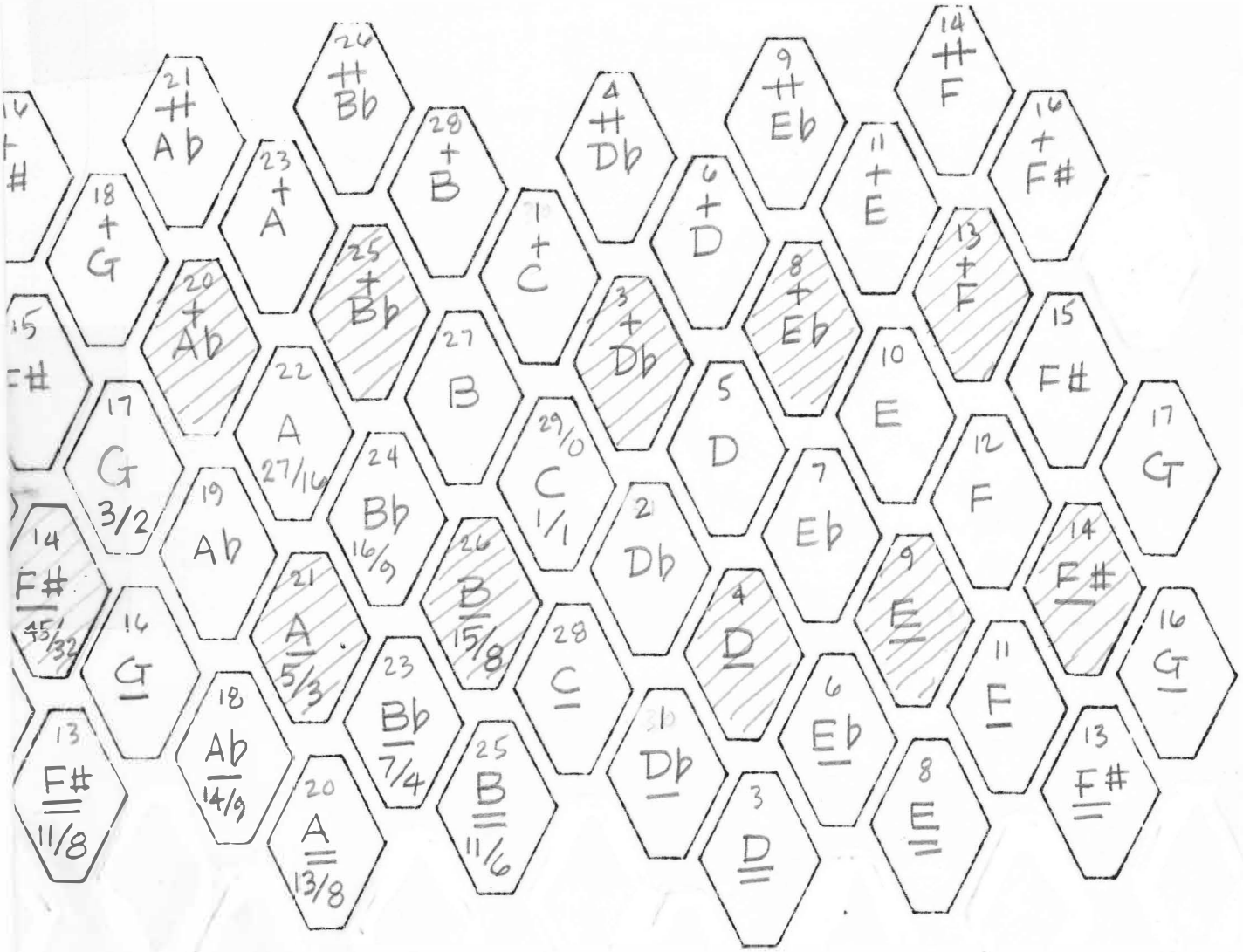


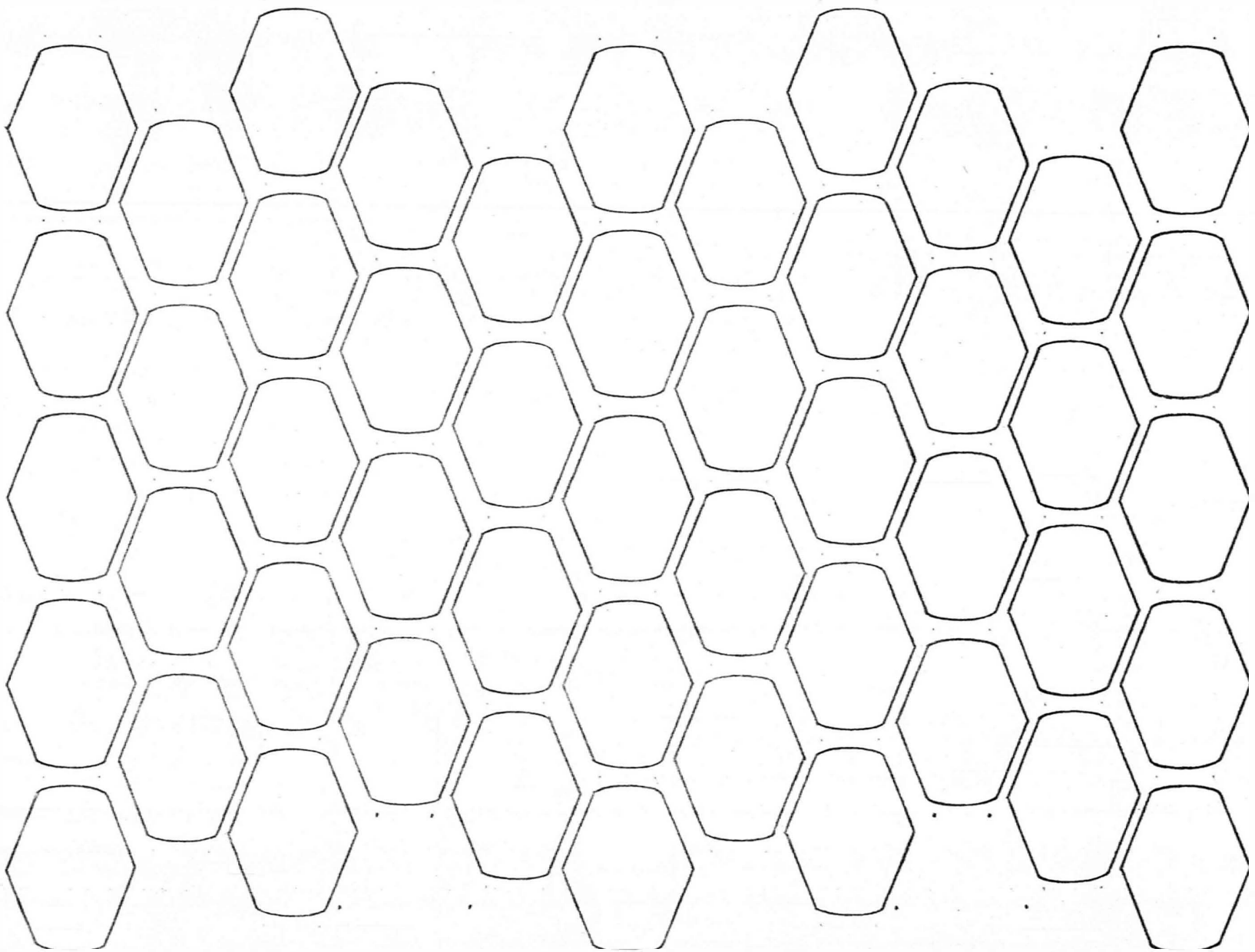
E1
LSON
D

VARIATION ON BOSANQUET



VARIATION ON BOSANQUET





γ
g
G
α
a
A
β
b
c
C
δ
d
D
ε
e
E
F
γ

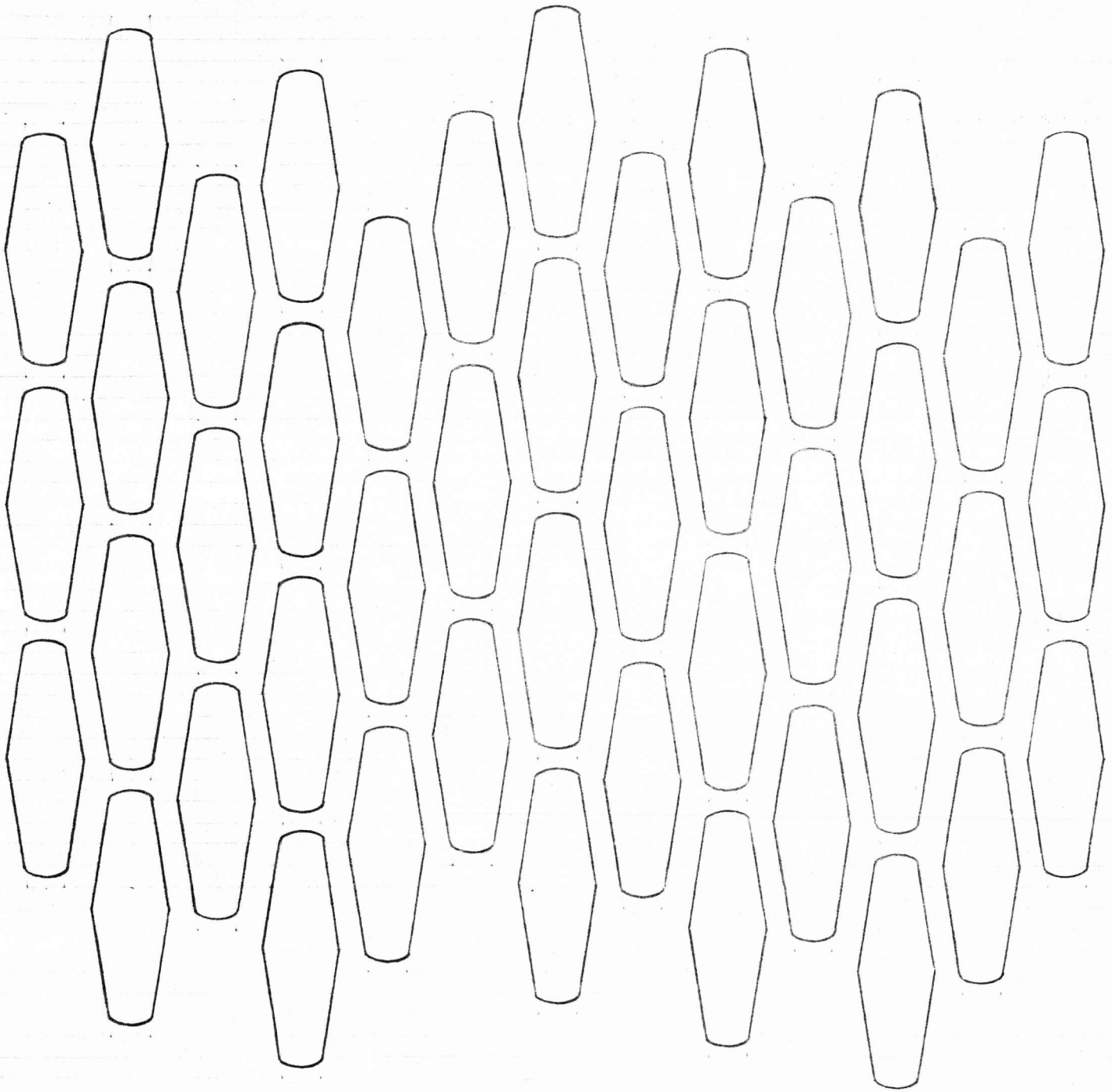
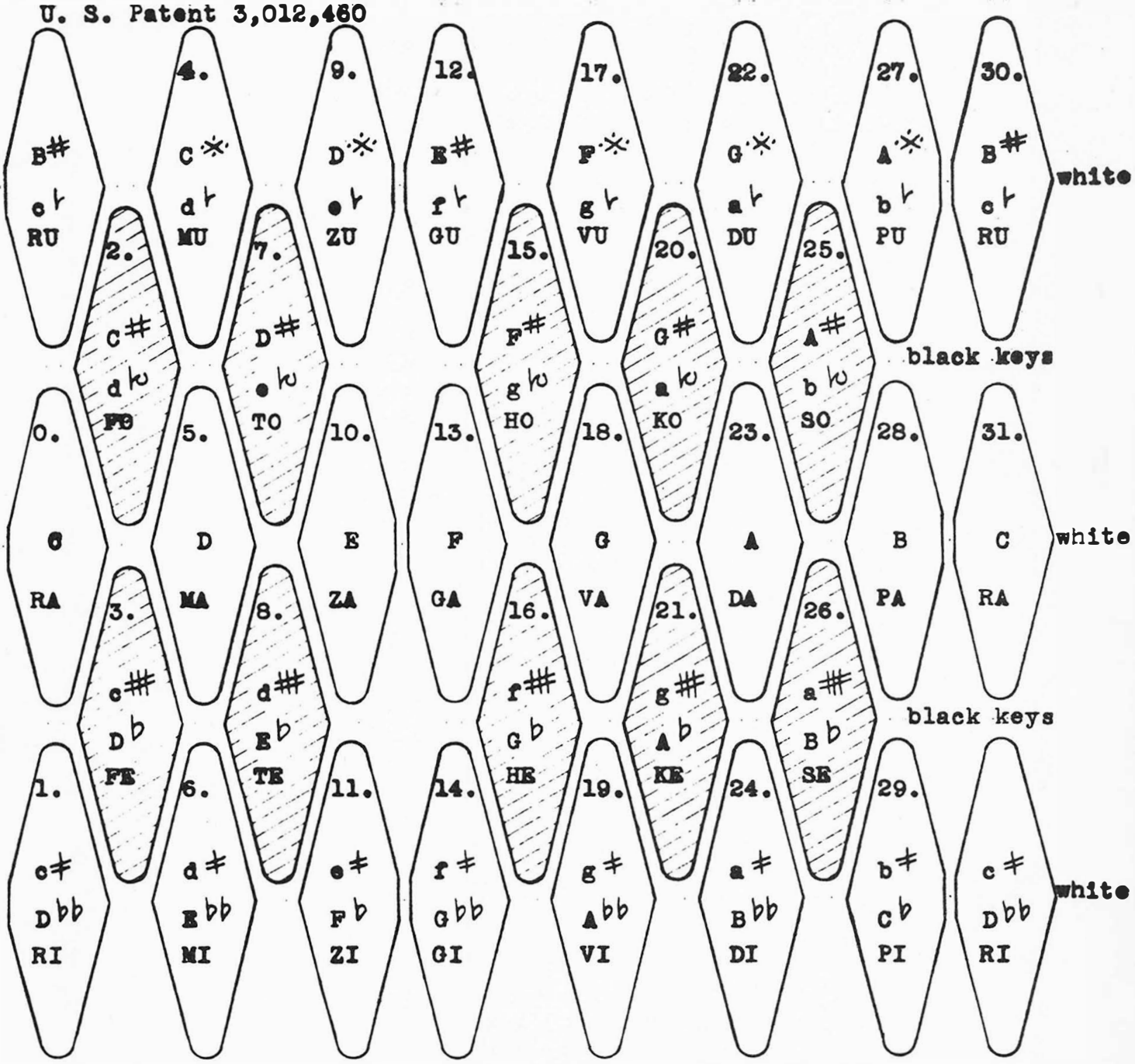


FIG. I

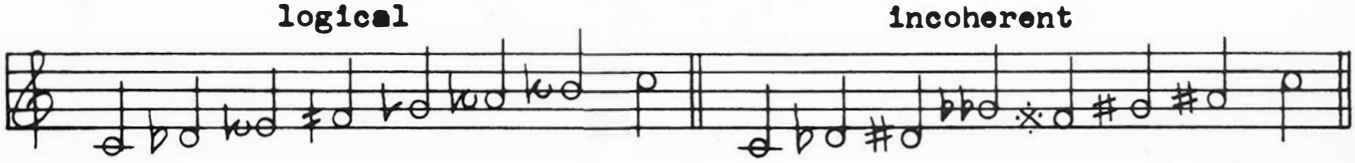
Digital ranks are successively elevated, receding from performer.
Pitches ascend according to numerals; from top to bottom, left to right.

U. S. Patent 3,012,460

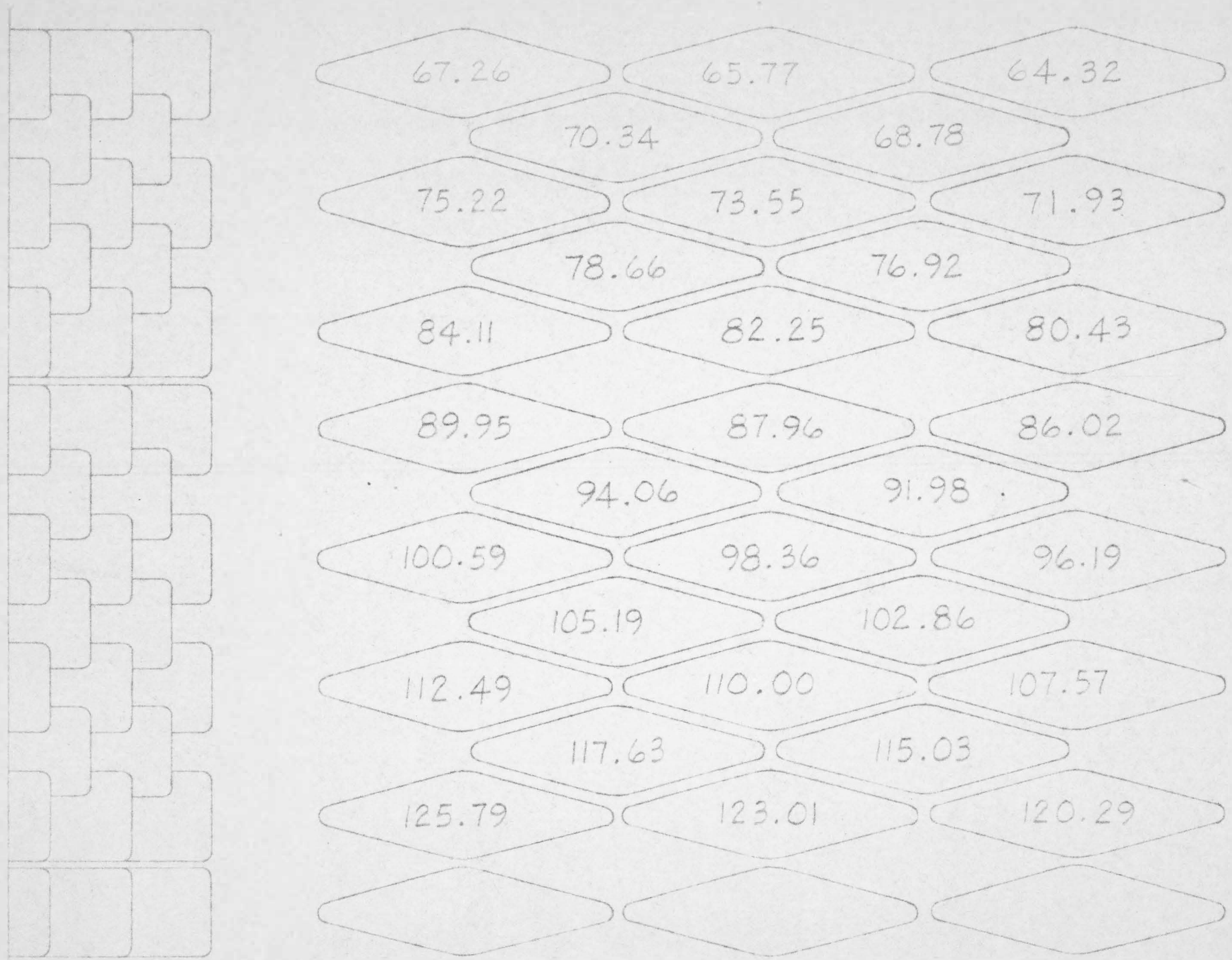


Traditional notation in upper case. Exotic equivalents in lower case.
The $\frac{1}{3}$-flat, $\flat$, and the $1\frac{1}{2}$-flat, $\natural\flat$, are provided by Giuseppe Tartini.
The $\frac{1}{3}$-sharp, $\sharp$, and the $1\frac{1}{2}$-sharp, $\natural\sharp$, are provided by A. D. Fokker.

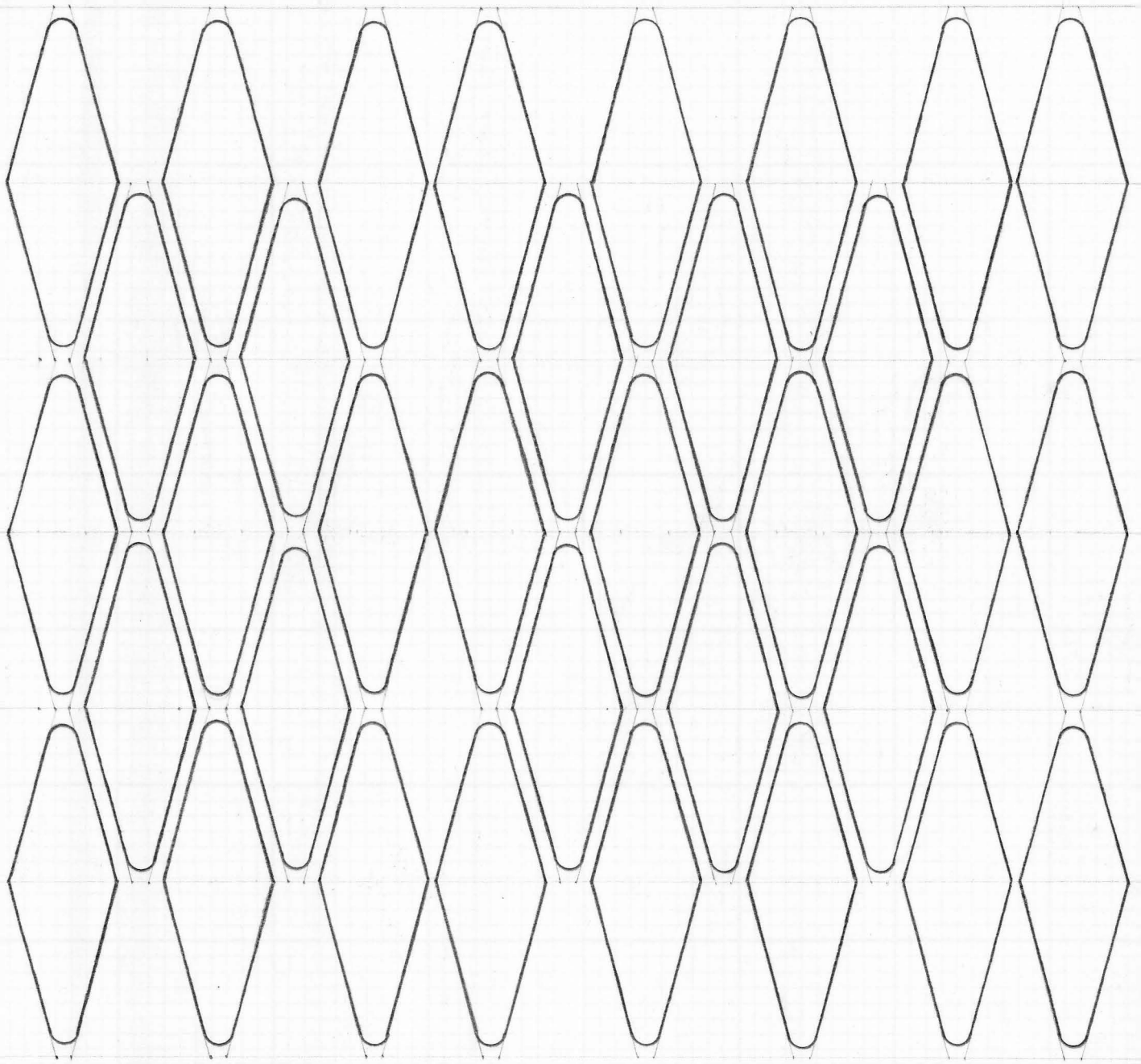
Equivalent notations for Pelog on degrees 0-3-7-14-17-20-25-31:

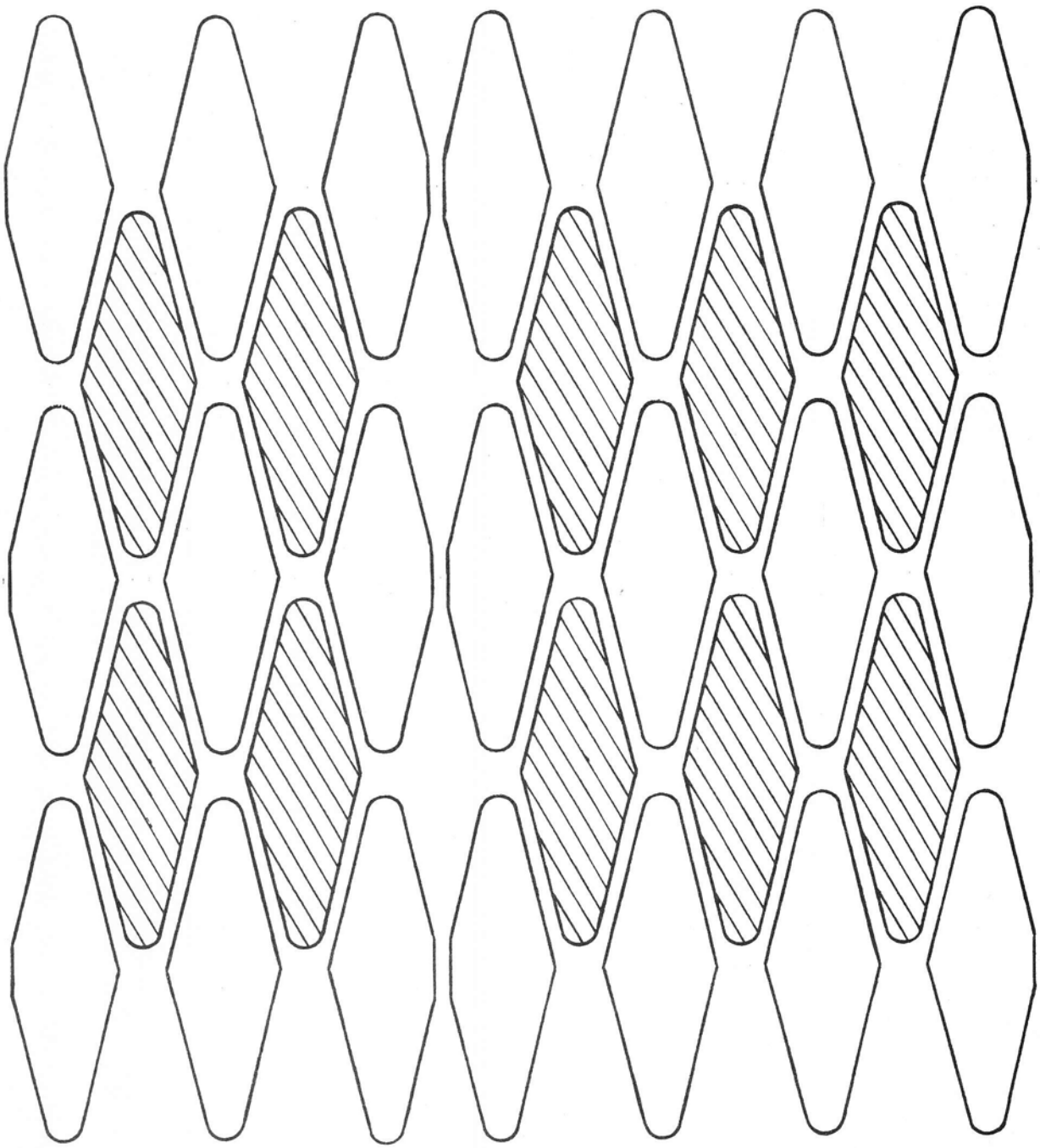


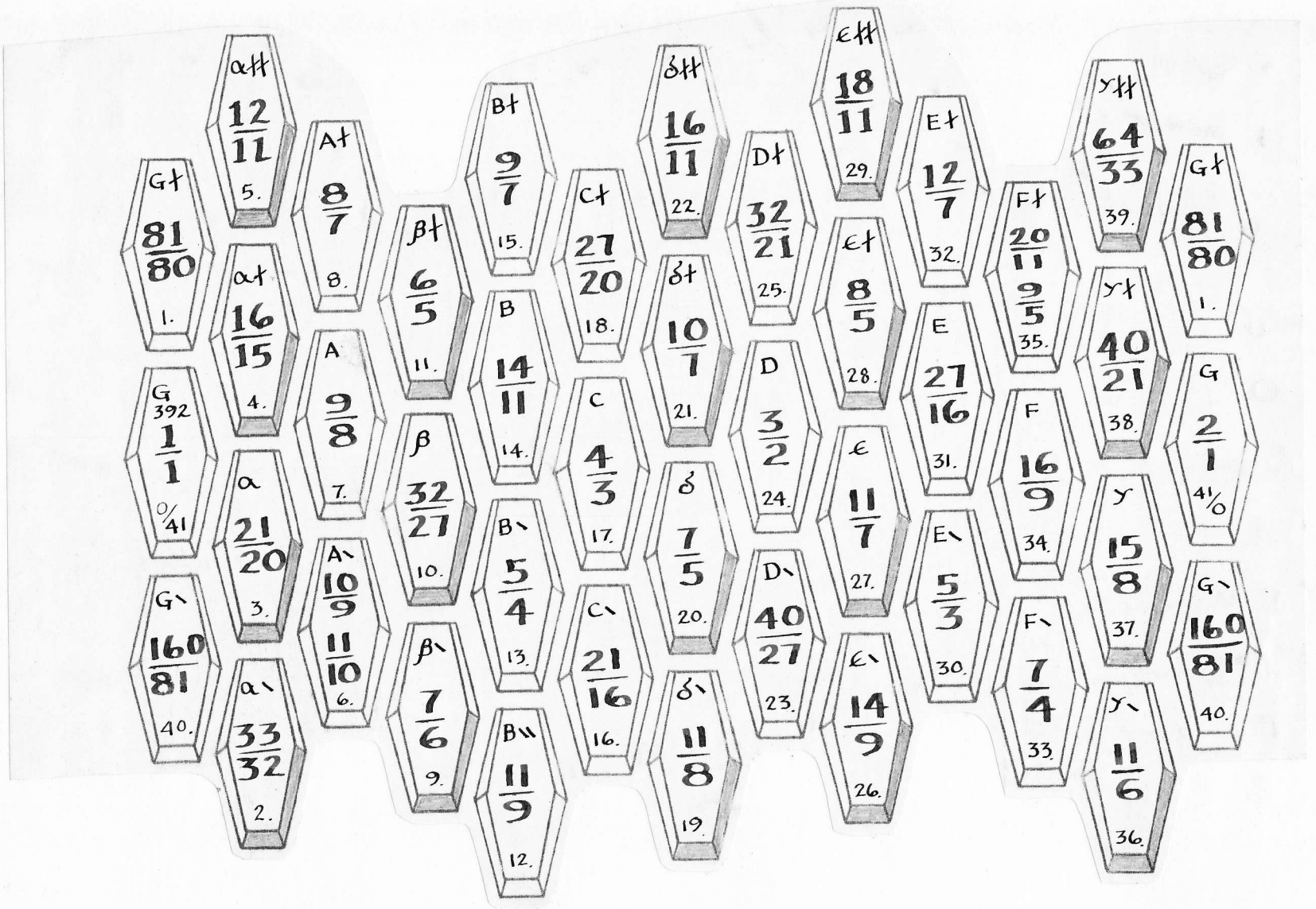
E. Wilson 1961

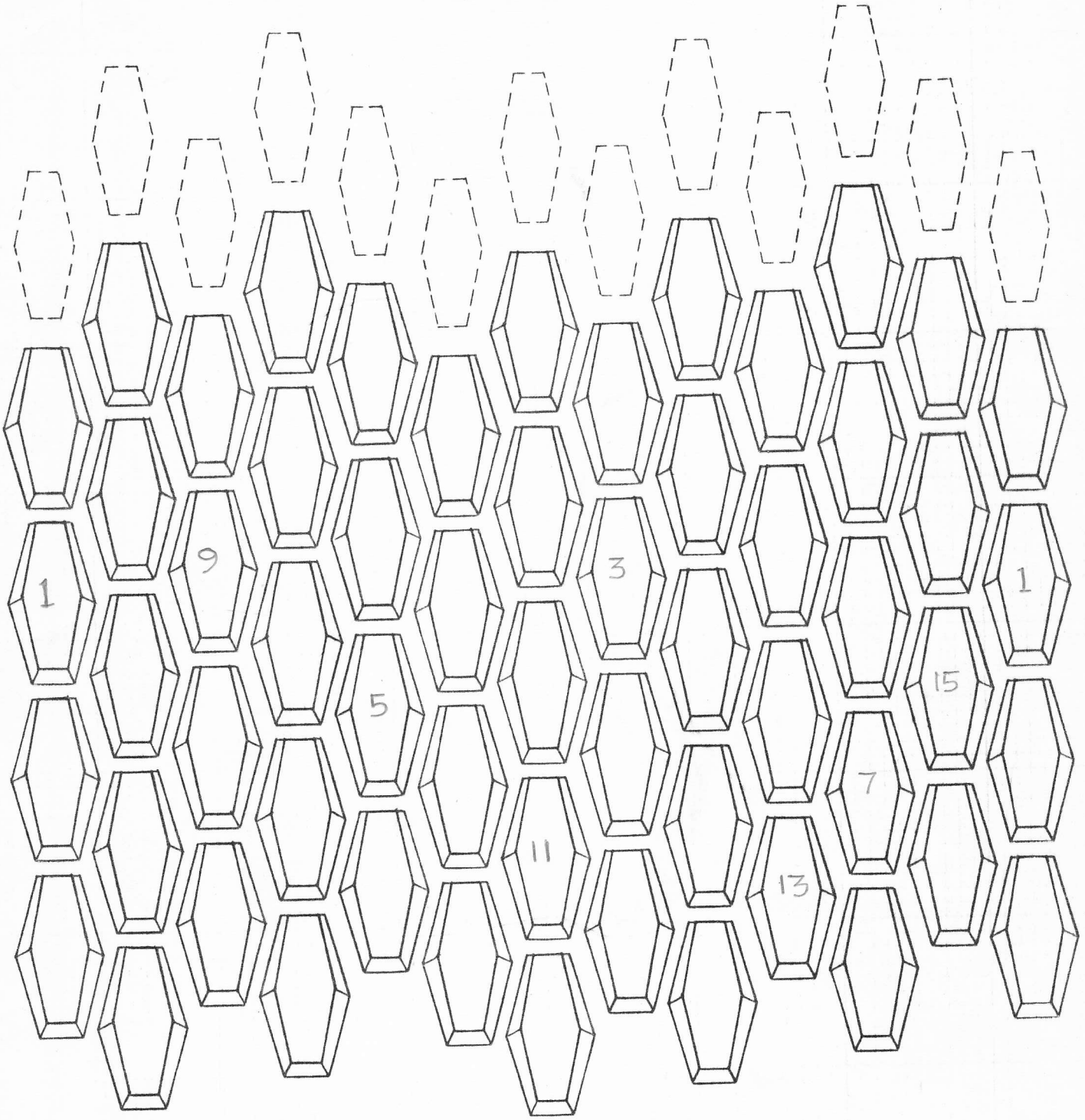

67.26
65.77
64.32
70.34
68.78
75.22
73.55
71.93
78.66
76.92
84.11
82.25
80.43
89.95
87.96
86.02
94.06
91.98
100.59
98.36
96.19
105.19
102.86
112.49
110.00
107.57
117.63
115.03
125.79
123.01
120.29

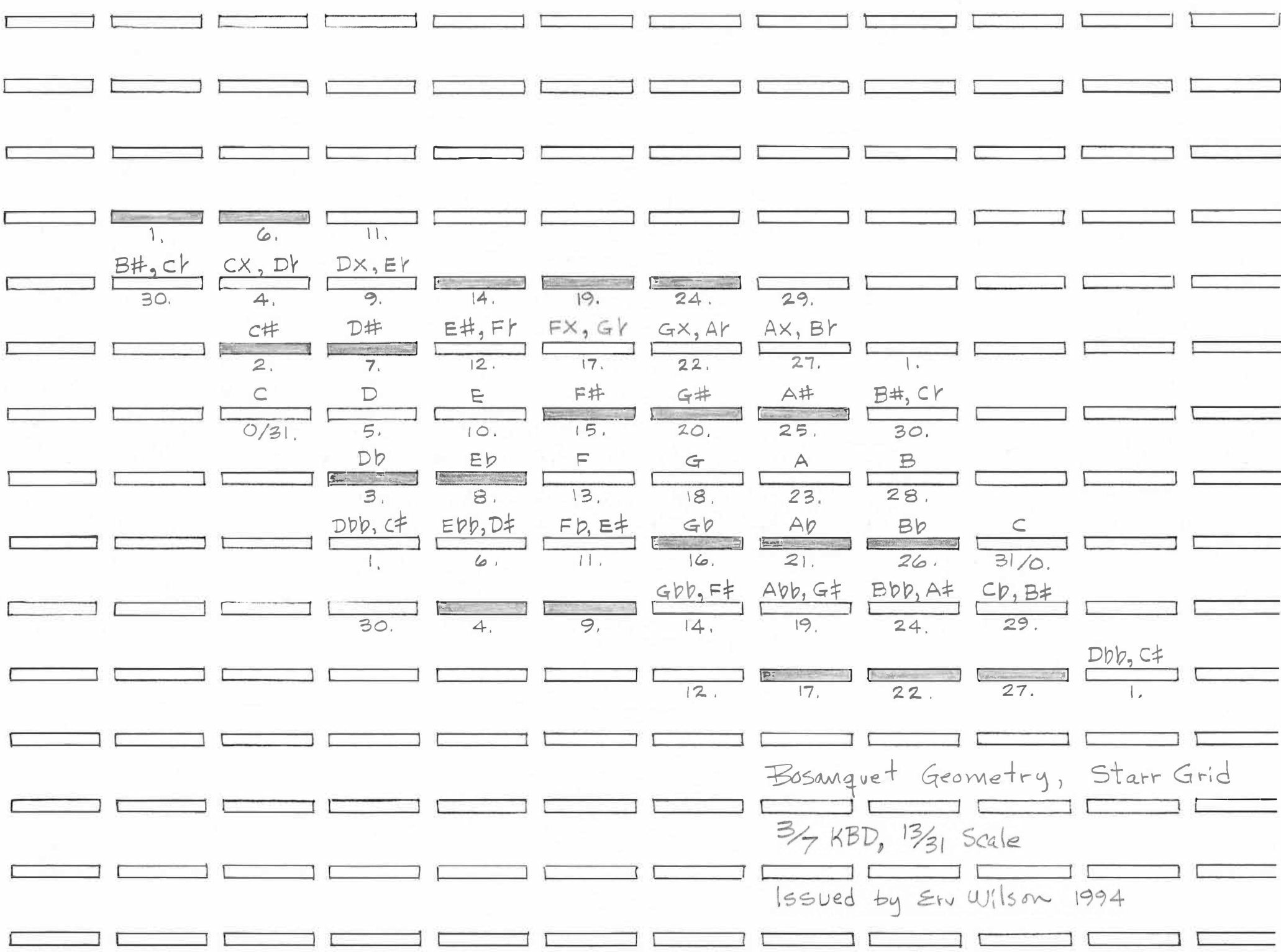
614 65 SH 2

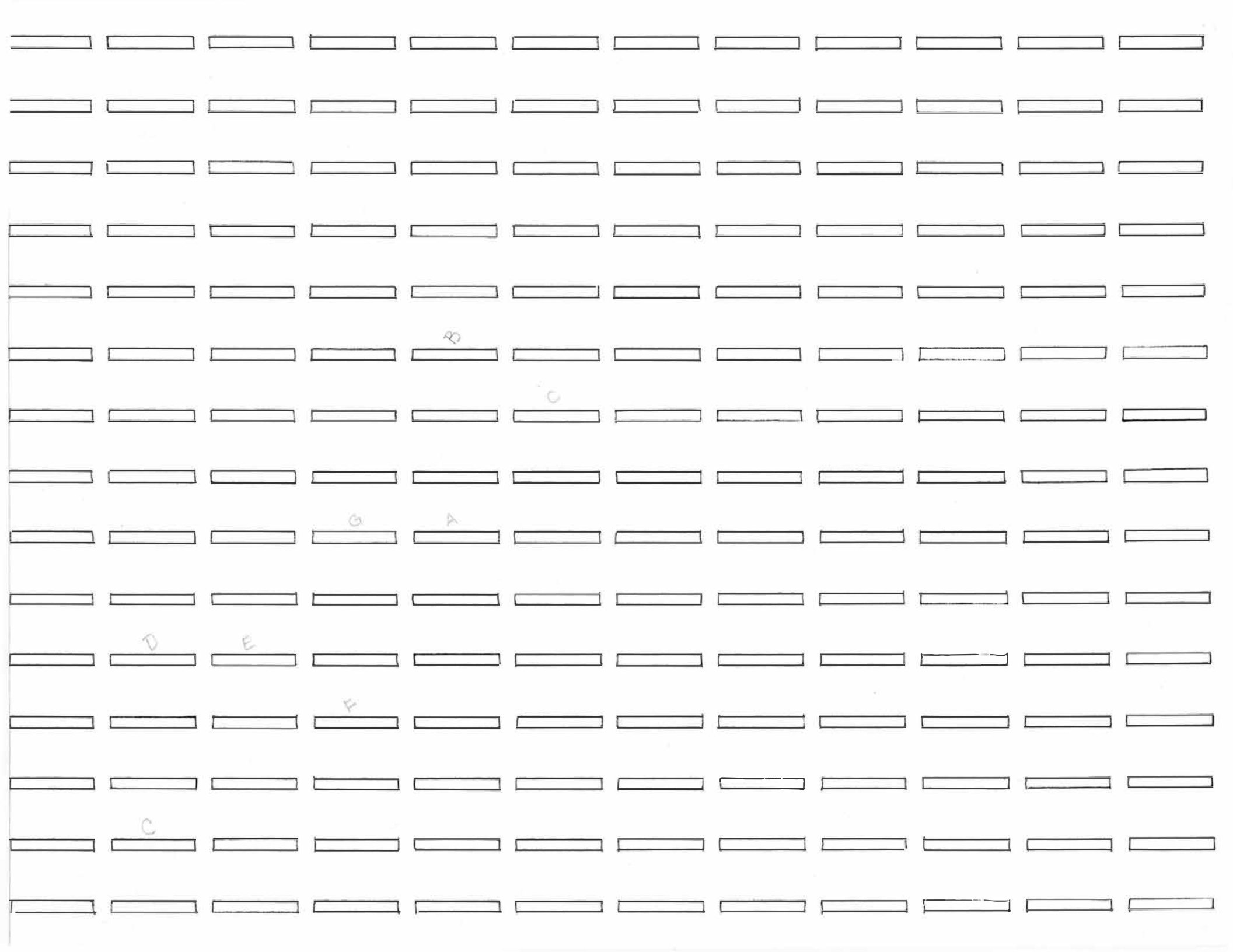


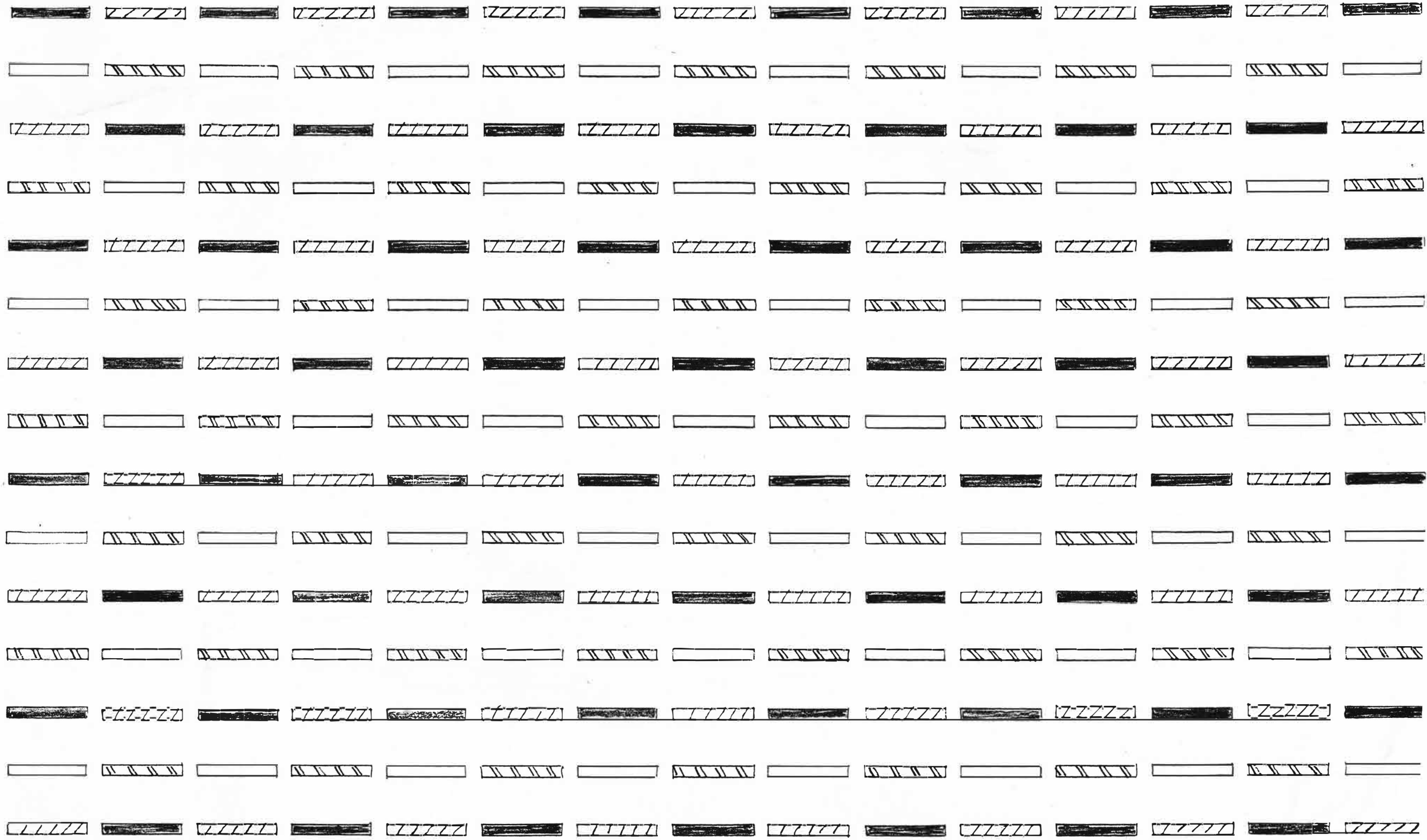


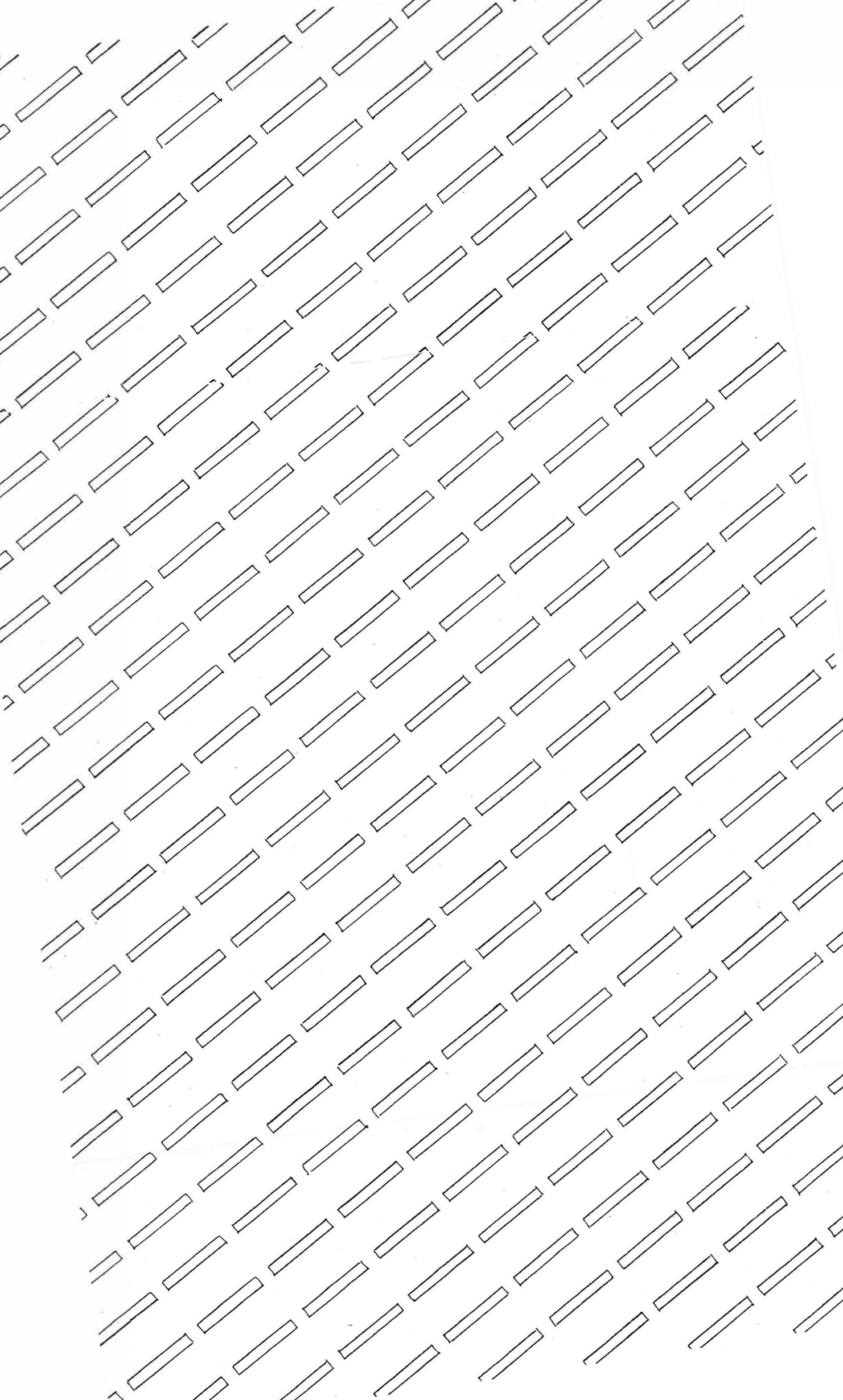

G♯ 81/80 1.
α♯♯ 12/11 5.
A♯ 8/7 8.
β♯ 6/5 11.
B♯ 9/7 15.
C♯ 27/20 18.
δ♯♯ 16/11 22.
D♯ 32/21 25.
ε♯♯ 18/11 29.
E♯ 12/7 32.
F♯ 20/11 9/5 35.
γ♯♯ 64/33 39.
G♯ 81/80 1.
G 392 1/1 0/41
α♯ 16/15 4.
A 9/8 7.
β 32/27 10.
B 14/11 14.
C 4/3 17.
δ♯ 10/7 21.
D 3/2 24.
ε♯ 8/5 28.
E 27/16 31.
F 16/9 34.
γ♯ 40/21 38.
G 2/1 41/0
G♭ 160/81 40.
α 21/20 3.
A♭ 10/9 11/10 6.
β♭ 7/6 9.
B♭ 5/4 13.
C♭ 21/16 16.
δ 7/5 20.
D♭ 40/27 23.
ε 11/7 27.
E♭ 5/3 30.
F♭ 7/4 33.
γ 15/8 37.
G♭ 160/81 40.
α♭ 33/32 2.
B♭♭ 11/9 12.
δ♭ 11/8 19.
ε♭ 14/9 26.
γ♭ 11/6 36.

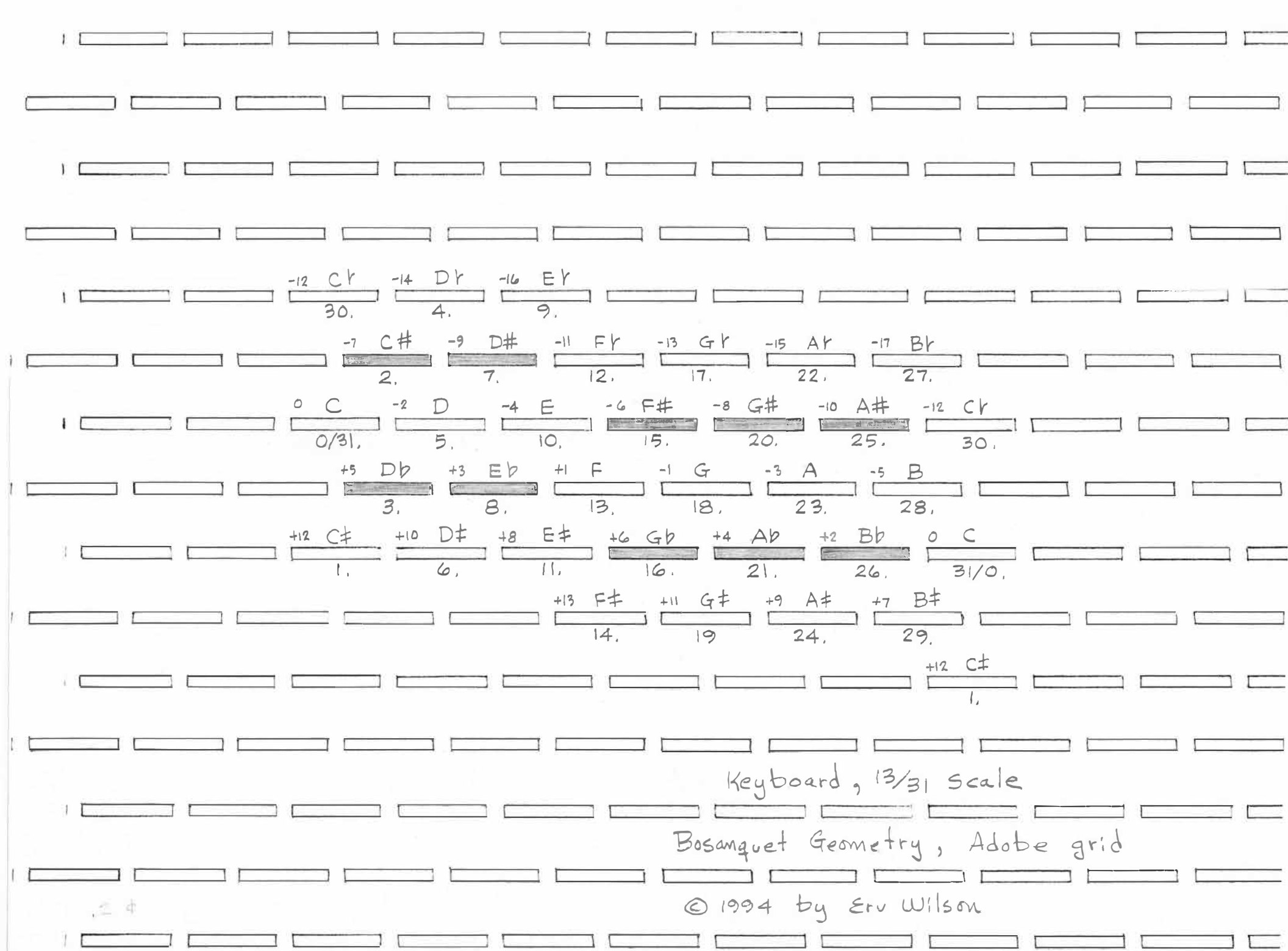

1
9
5
3
11
13
7
15
1


1.
6.
11.
B#, C𝄫
30.
CX, D𝄫
4.
DX, E𝄫
9.
14.
19.
24.
29.
C#
2.
D#
7.
E#, F𝄫
12.
FX, G𝄫
17.
GX, A𝄫
22.
AX, B𝄫
27.
1.
C
0/31.
D
5.
E
10.
F#
15.
G#
20.
A#
25.
B#, C𝄫
30.
D𝄫
3.
E𝄫
8.
F
13.
G
18.
A
23.
B
28.
D𝄫𝄫, C#
1.
E𝄫𝄫, D#
6.
F𝄫, E#
11.
G𝄫
16.
A𝄫
21.
B𝄫
26.
C
31/0.
30.
4.
9.
G𝄫𝄫, F#
14.
A𝄫𝄫, G#
19.
B𝄫𝄫, A#
24.
C𝄫, B#
29.
12.
17.
22.
27.
D𝄫𝄫, C#
1.
Bosanquet Geometry, Starr Grid
3/7 KBD, 13/31 Scale
Issued by Erv Wilson 1994


B
C
G
A
D
E
F
C

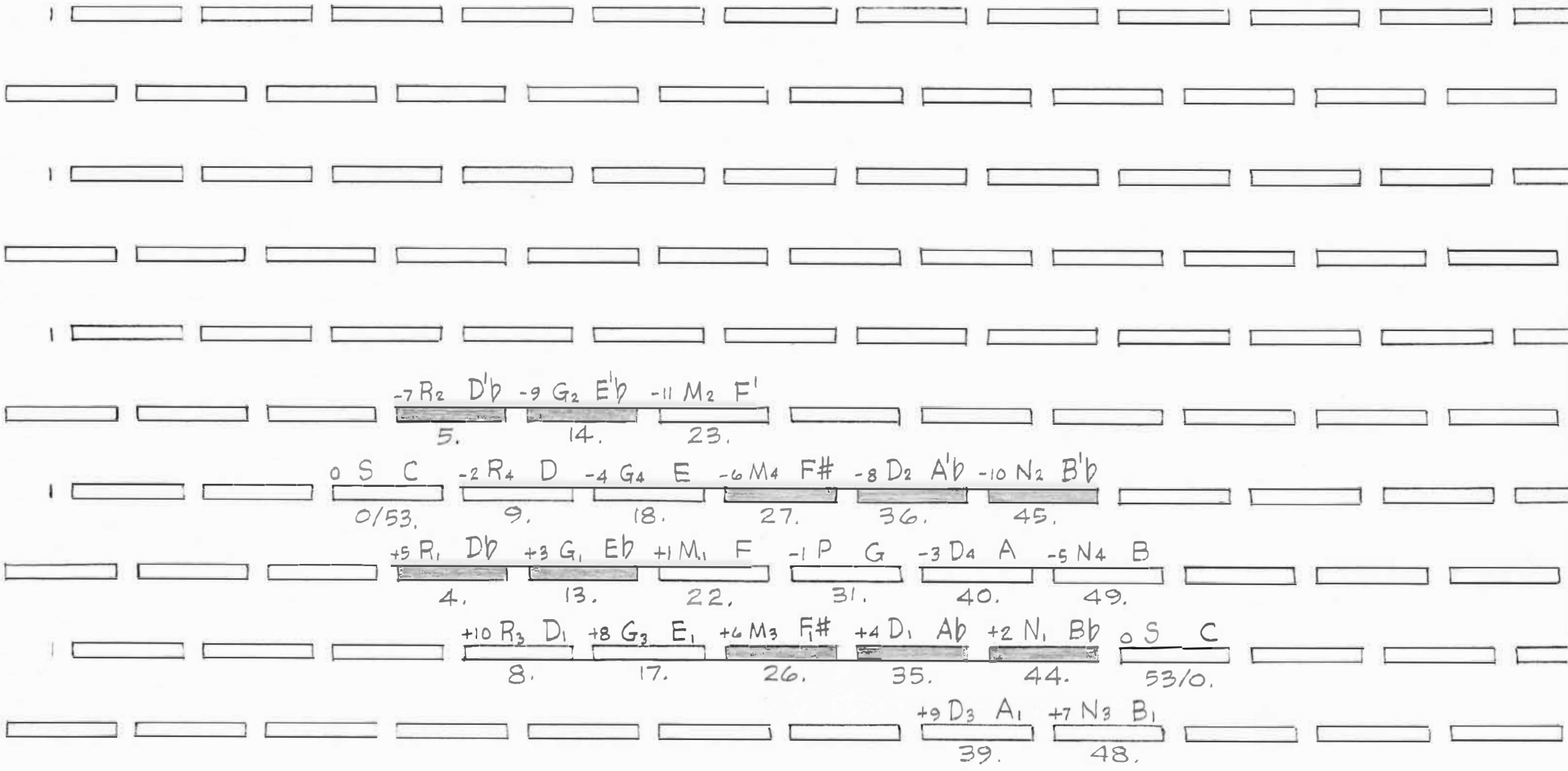


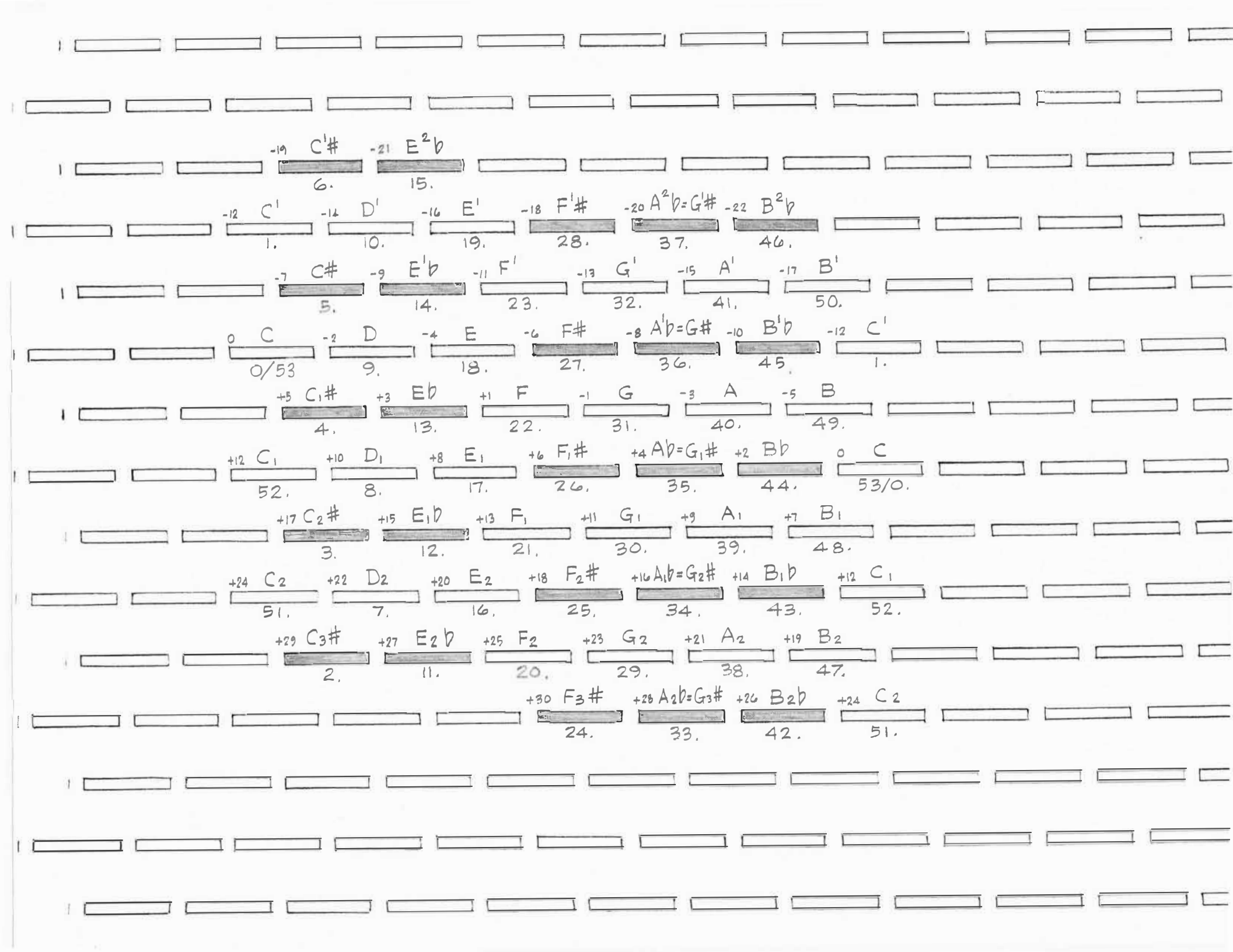


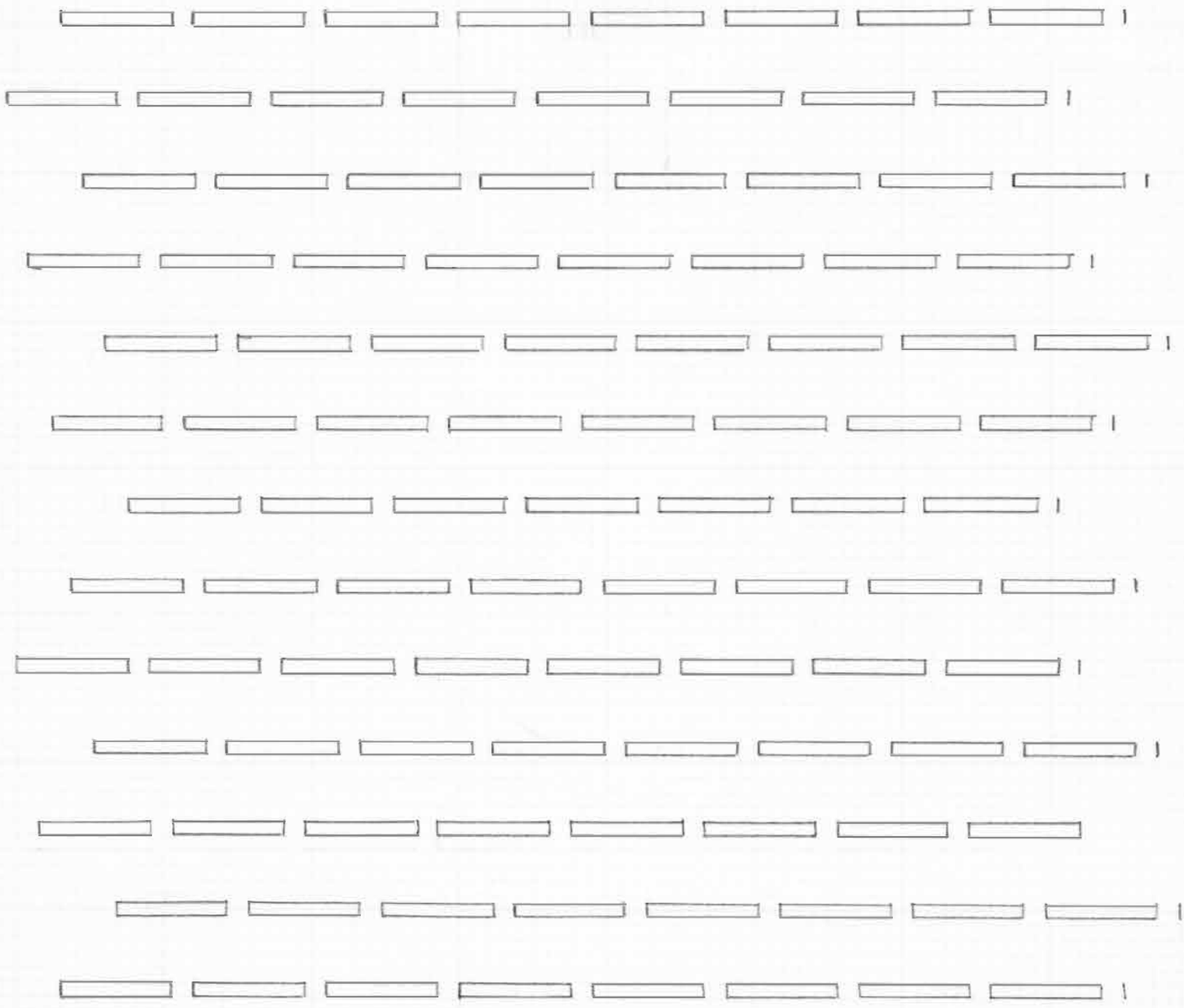


Keyboard, 13/31 scale

Bosanquet Geometry, Adobe grid


-7 R2 D'b -9 G2 E'b -11 M2 F'
5. 14. 23.
0 S C -2 R4 D -4 G4 E -6 M4 F# -8 D2 A'b -10 N2 B'b
0/53. 9. 18. 27. 36. 45.
+5 R1 Db +3 G1 Eb +1 M1 F -1 P G -3 D4 A -5 N4 B
4. 13. 22. 31. 40. 49.
+10 R3 D1 +8 G3 E1 +6 M3 F1# +4 D1 Ab +2 N1 Bb 0 S C
8. 17. 26. 35. 44. 53/0.
+9 D3 A1 +7 N3 B1
39. 48.


-19 C'#
6.
-21 E²♭
15.
-12 C'
1.
-14 D'
10.
-16 E'
19.
-18 F'#
28.
-20 A²♭=G'#
37.
-22 B²♭
46.
-7 C#
5.
-9 E'♭
14.
-11 F'
23.
-13 G'
32.
-15 A'
41.
-17 B'
50.
0 C
0/53
-2 D
9.
-4 E
18.
-6 F#
27.
-8 A'♭=G#
36.
-10 B'♭
45.
-12 C'
1.
+5 C1#
4.
+3 E♭
13.
+1 F
22.
-1 G
31.
-3 A
40.
-5 B
49.
+12 C1
52.
+10 D1
8.
+8 E1
17.
+6 F1#
26.
+4 A♭=G1#
35.
+2 B♭
44.
0 C
53/0.
+17 C2#
3.
+15 E1♭
12.
+13 F1
21.
+11 G1
30.
+9 A1
39.
+7 B1
48.
+24 C2
51.
+22 D2
7.
+20 E2
16.
+18 F2#
25.
+16 A1♭=G2#
34.
+14 B1♭
43.
+12 C1
52.
+29 C3#
2.
+27 E2♭
11.
+25 F2
20.
+23 G2
29.
+21 A2
38.
+19 B2
47.
+30 F3#
24.
+28 A2♭=G3#
33.
+26 B2♭
42.
+24 C2
51.



844 N. Ave 65
Los Angeles, CA 90042
April 6, 1992

Copy: John Chalmers

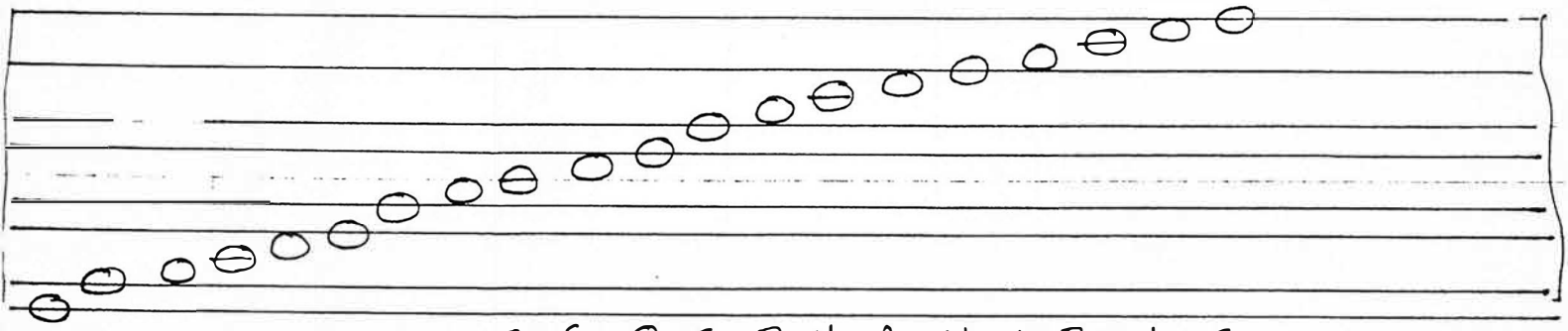
Dear Harry,

A couple of little items - first I took the liberty of sending your article in XH XII off to David Doty at 1/1 who states he has not seen, and asked me to send it.

ITEM 2. Some time ago I mentioned my tree notation for your 19, enclosed. I like this because it treats the bridge of minor thirds from the root to the Fifth as naturals, (as in a sense they should be) rather than as chain of curiously arranged sharps and flats. I.E.

F H N T S A C O Q U M E G I Ng L R B D
F Ab Cb Ebb F# A C Eb Gb A# C# E G Bb Db E# G# B D

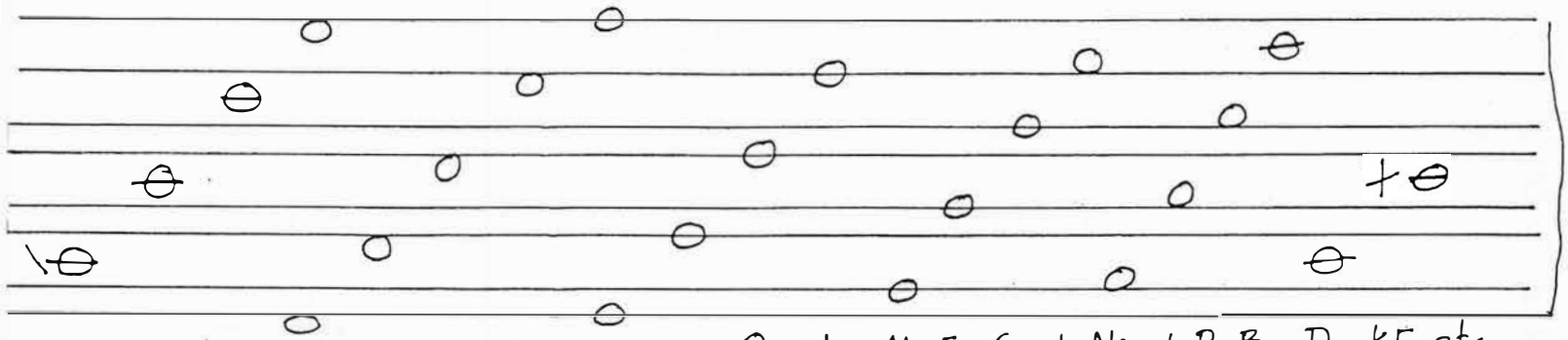
The minor thirds Ebb-F#, Gb-A#, ~~Db~~E# are spelled as doubly-augmented Seconds, enough to throw anybody. The script is taken with the organic 7-scale by a chain of minor thirds as the staff:



C M Ng D T O E L F S Q G R H A U I B N C
C C# Db D Ebb Eb E E# F F# Gb G G# Ab A A# Bb B Cb C

This allows using the supra-chromatic 19-tone scale as the basic artifact for composition and modulation without being bogged down (in this context) by archaic signatures. 2-interval patterns of 7, 11, 15, are easy to recognize and modulate, as well as the 19, 34 53 etc.

along the chain of minor thirds:



^D F H N T S A C O Q U M E G I Ng L R B D ^F etc
^D F Ab Cb Ebb F# A C Eb Gb A# C# E G Bb Db E# G# B D ^F etc

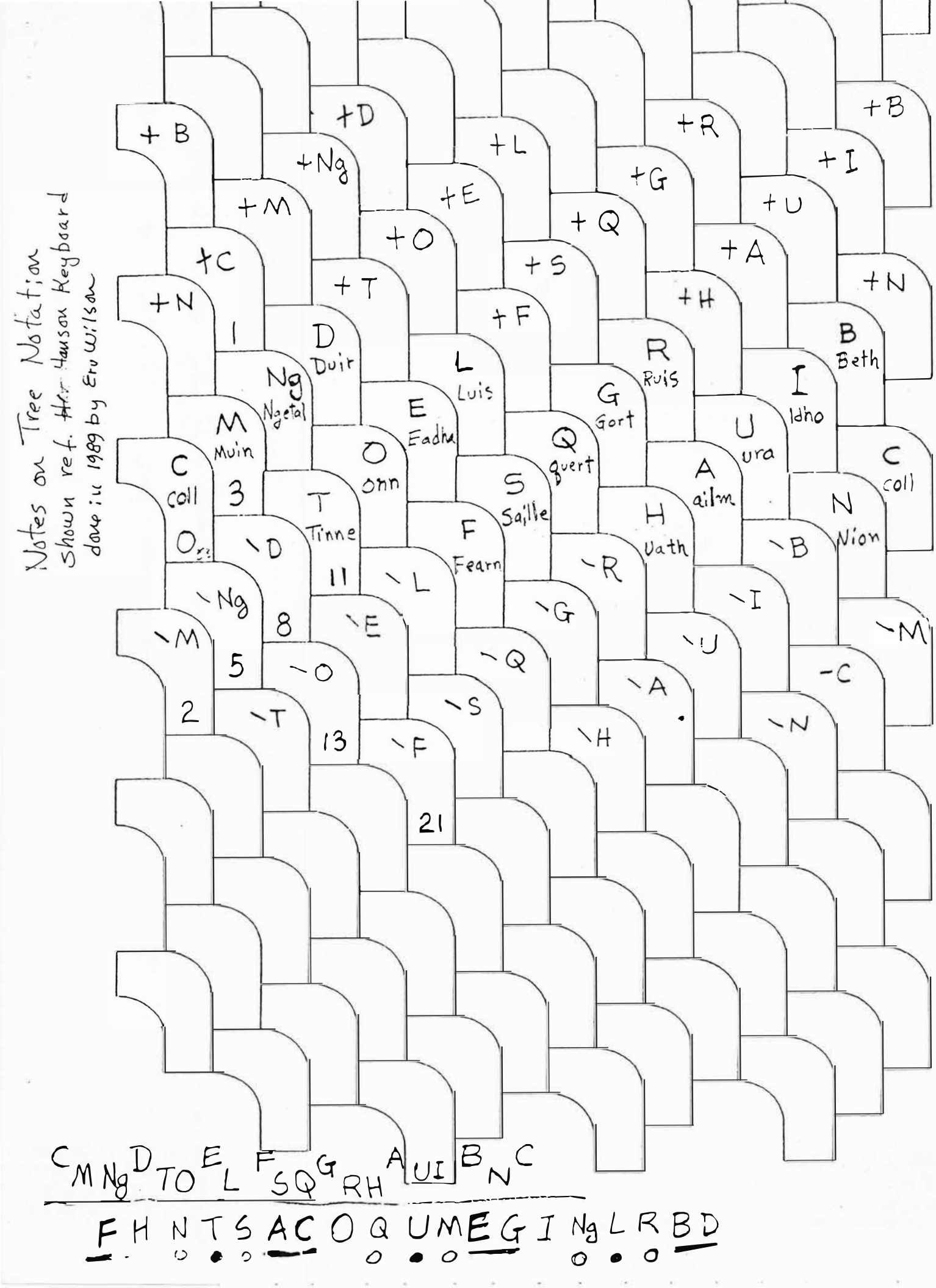
ITEM 3

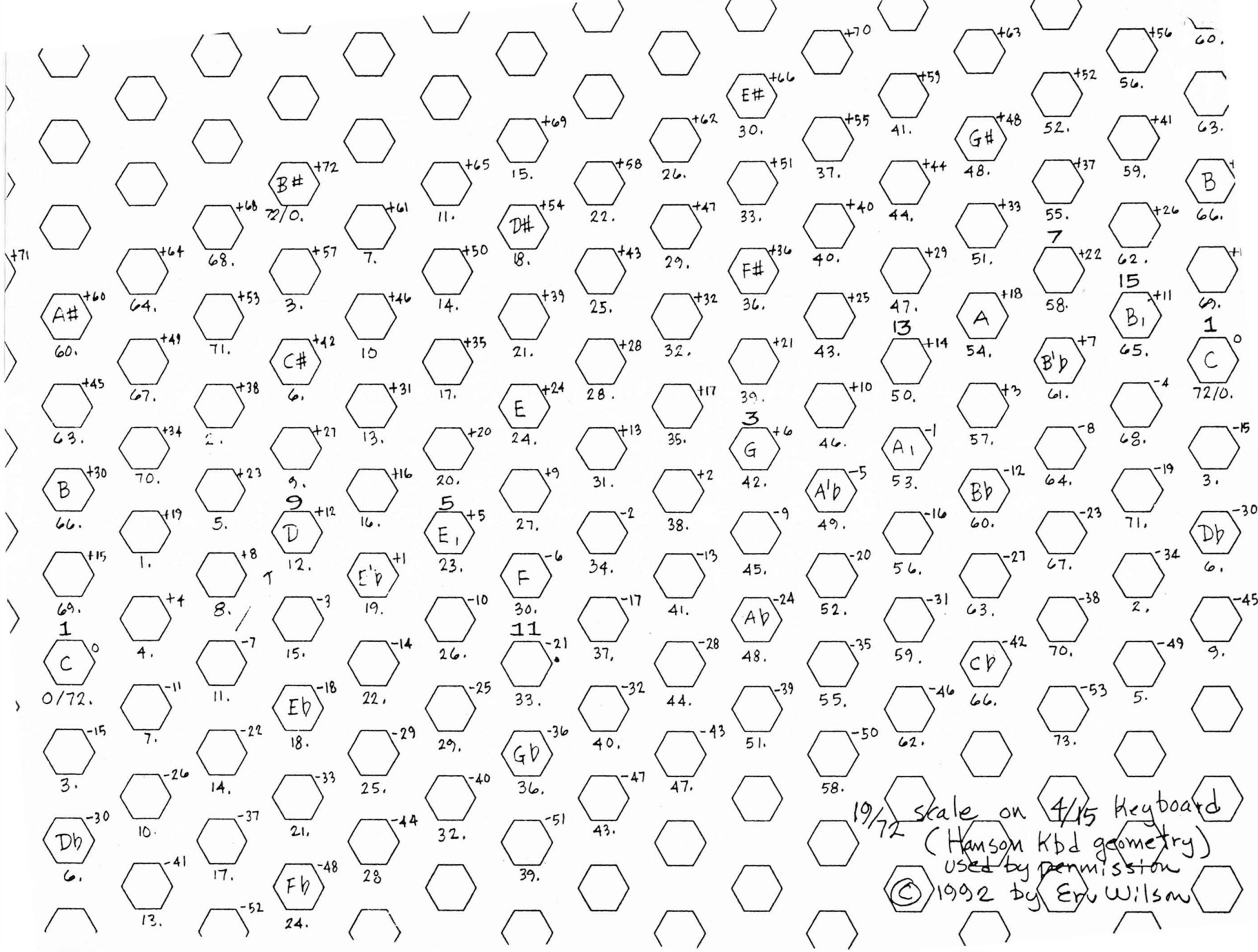
I like this encl. variation of the Hanson Kbd. The octave reach is deliberately forfeited in order to git down into the micro-intervals of (here shown) 72 scale. ~~Or~~ With the right hand the "virtual pitch continuum" can be performed with speed and potential ~~velocity~~ virtuosity. The left hand will take a little more practising, and by a conscientious performer. This "virtual-pitch-continuum" is powerful stuff. One has to hear it. 53 has close to the same quality.

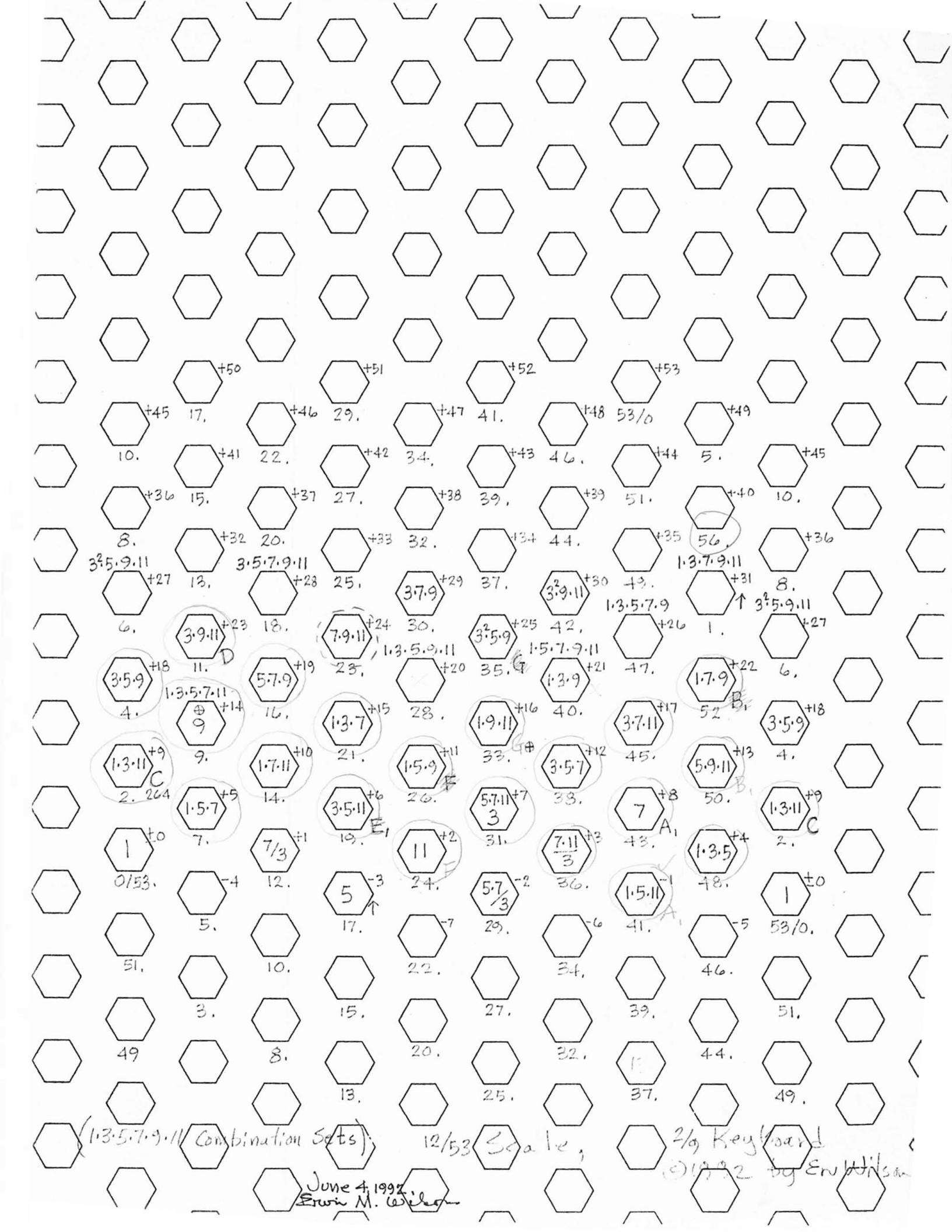
Two of my instruments are presently on display at the Hollywood Bowl museum for a year; the 19-tone clavichord built by Scott Hackleman, and the Hebdomekontany (= a 70-tone per 8ve, 2 octaves, percussive tubulong of 1" aluminum tubing) the sound of this thing is beyond belief. The tuning of this is attained by the 70 combinations of 4 out of 8 elements, where these elements are the harmonic entities 1, 3, 5, 7, 9, 11, 13, 15. The 4 elements of each combination ~~of 4~~ are multiplied (as 1x3x5x7 etc) to get 70 pitches. It is from this instrument that I learned how dramatically effective these small interval can be in sequence.

Yours,

Erv


Notes on Tree Notation
shown ref. Hr. Hanson Keyboard
done in 1989 by Eru Wilson
+B
+D
+L
+R
+B
+Ng
+E
+G
+I
+M
+O
+Q
+U
+C
+T
+S
+A
+N
+N
+F
+H
1
D
Duir
L
Luis
R
Ruis
B
Beth
Ng
Ngetal
E
Eadha
G
Gort
I
Idho
M
Muin
O
onn
Q
quert
U
ura
C
coll
C
coll
3
T
Tinne
S
Saille
A
ailm
N
Nion
O
D
F
Fearn
H
Uath
B
11
L
R
I
Ng
8
E
G
M
U
M
5
O
Q
C
2
T
13
F
S
A
N
21
H
C M Ng D T O E L F S Q G R H A U I B N C
F H N T S A C O Q U M E G I Ng L R B D


19/72 scale on 4/15 keyboard
(Hanson kbd geometry)
used by permission
© 1992 by Erv Wilson

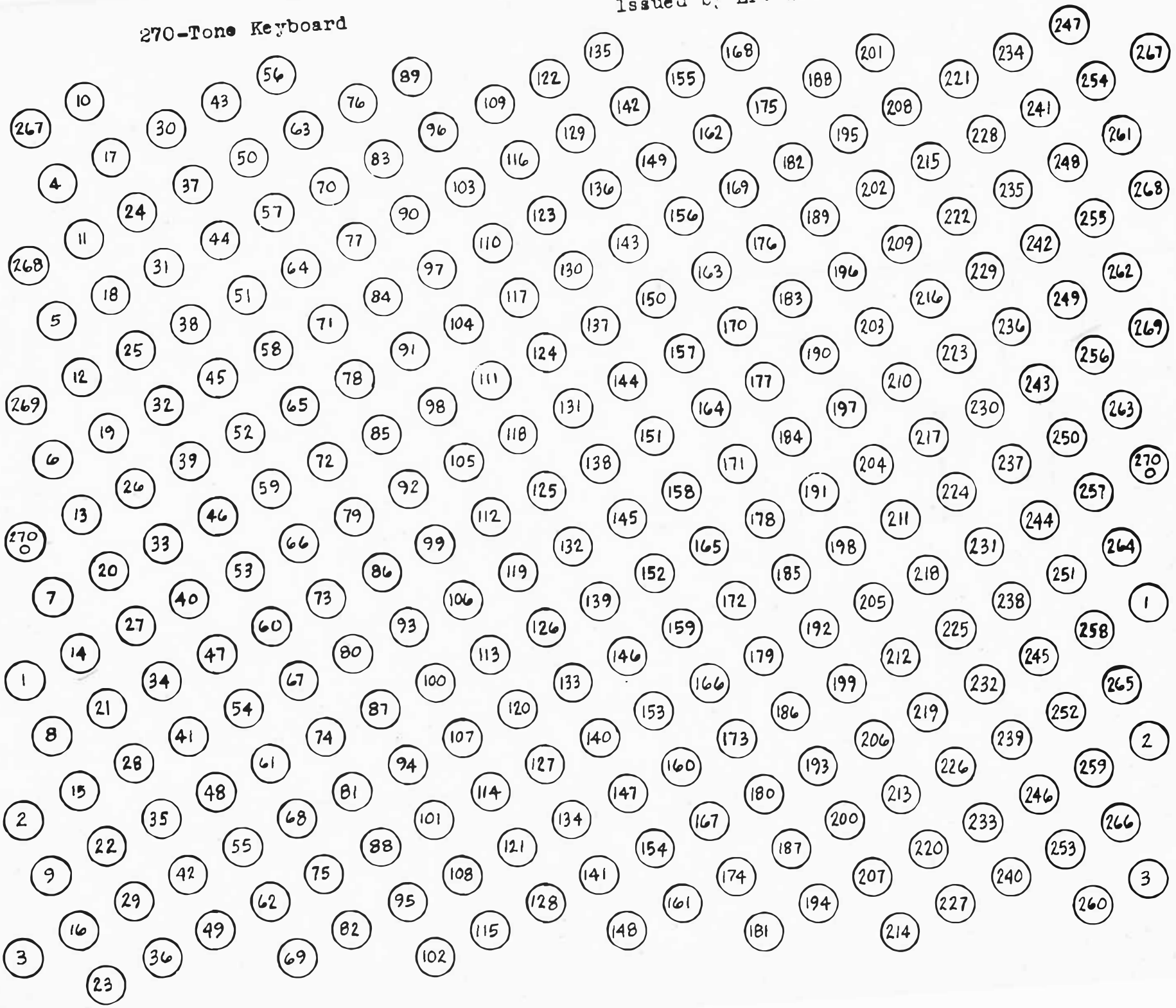


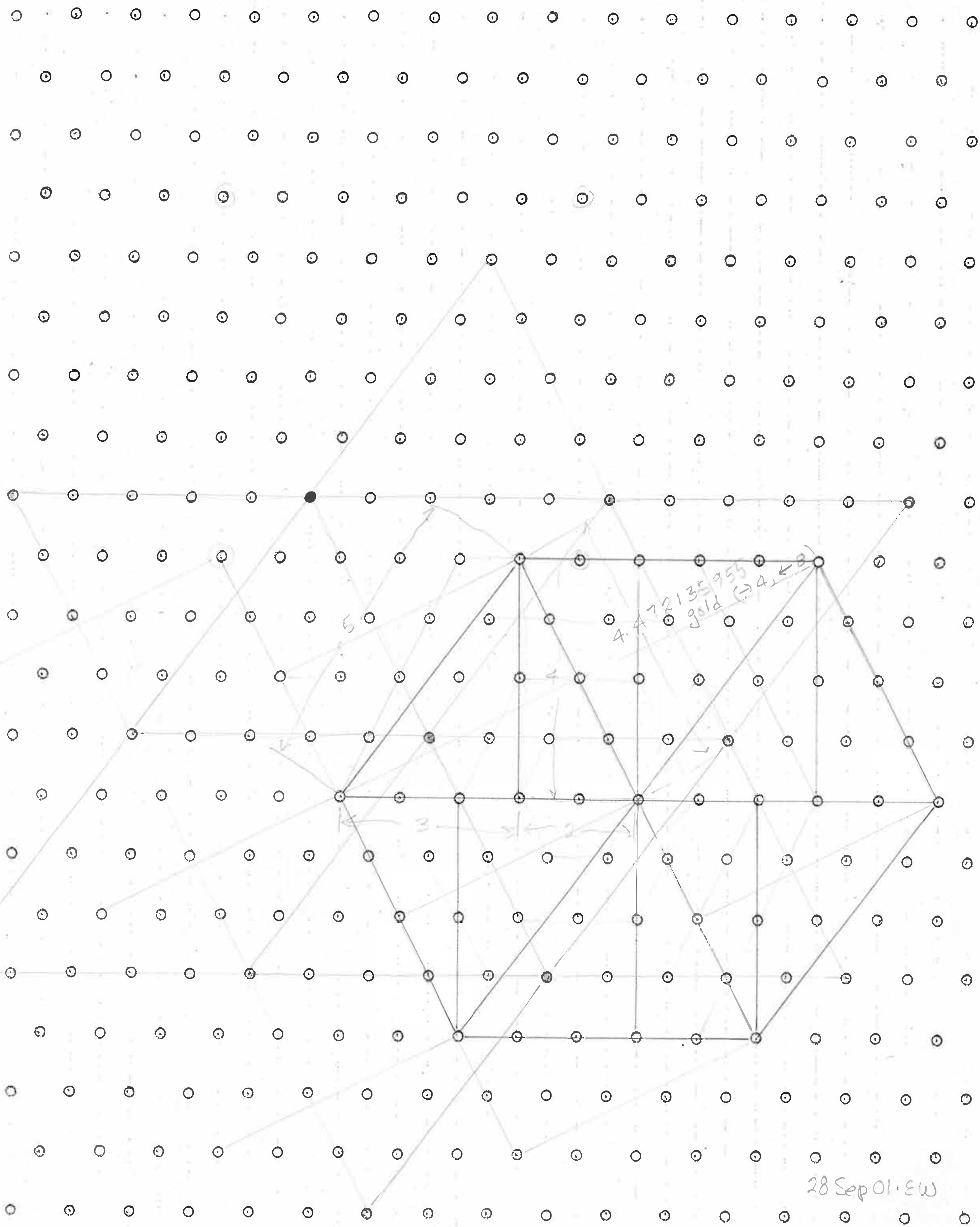
(1·3·5·7·9·11 Combination Sets). 12/53 Scale; 2/9 Keyboard

June 4, 1992
Erwin M. Wilson

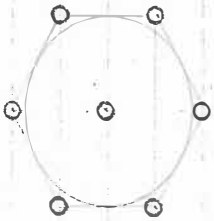
270-Tone Keyboard

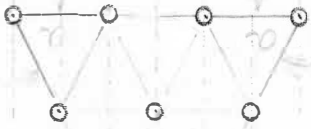
Issued by Erv Wilson 1968





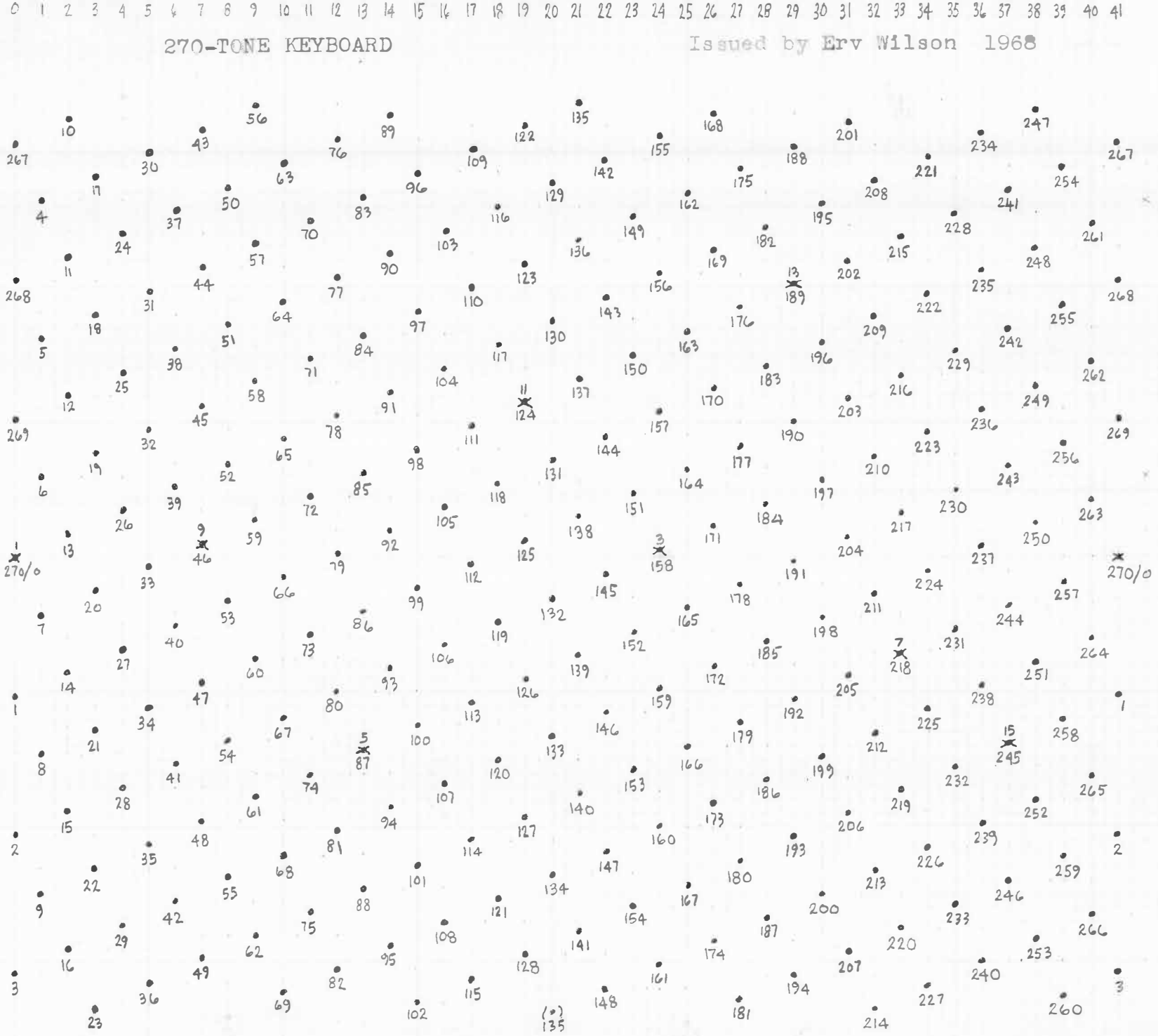
28 Sep 01 · EW





270-TONE KEYBOARD

Issued by Erv Wilson 1968



Uath Outlines, Retrograde mirror B-E, Fig # 1

re-done for clarity
5 Aug 97
E. W.

Uath dash no.									
120	rank	10	180	300	420	540	660	780	900	1020
108	rank	9	162	270	378	486	594	702	810	918
96	rank	8	144	240	336	432	528	624	720	816
84	rank	7	126	210	294	378	462	546	630	714
72	rank	6	108	180	252	324	396	468	540	612
60	rank	5	90	150	210	270	330	390	450	510
48	rank	4	72	120	168	216	264	312	360	408
36	rank	3	54	90	126	162	198	234	270	306
24	rank	2	36	60	84	108	132	156	180	204
12	rank	1	18	30	42	54	66	78	90	102 ← note count
			B							E

Reference: → note range →

Midi-Note #	23	40	52	64	76	88	100	112	124
	B	E	E	E	E	E	E	E	E

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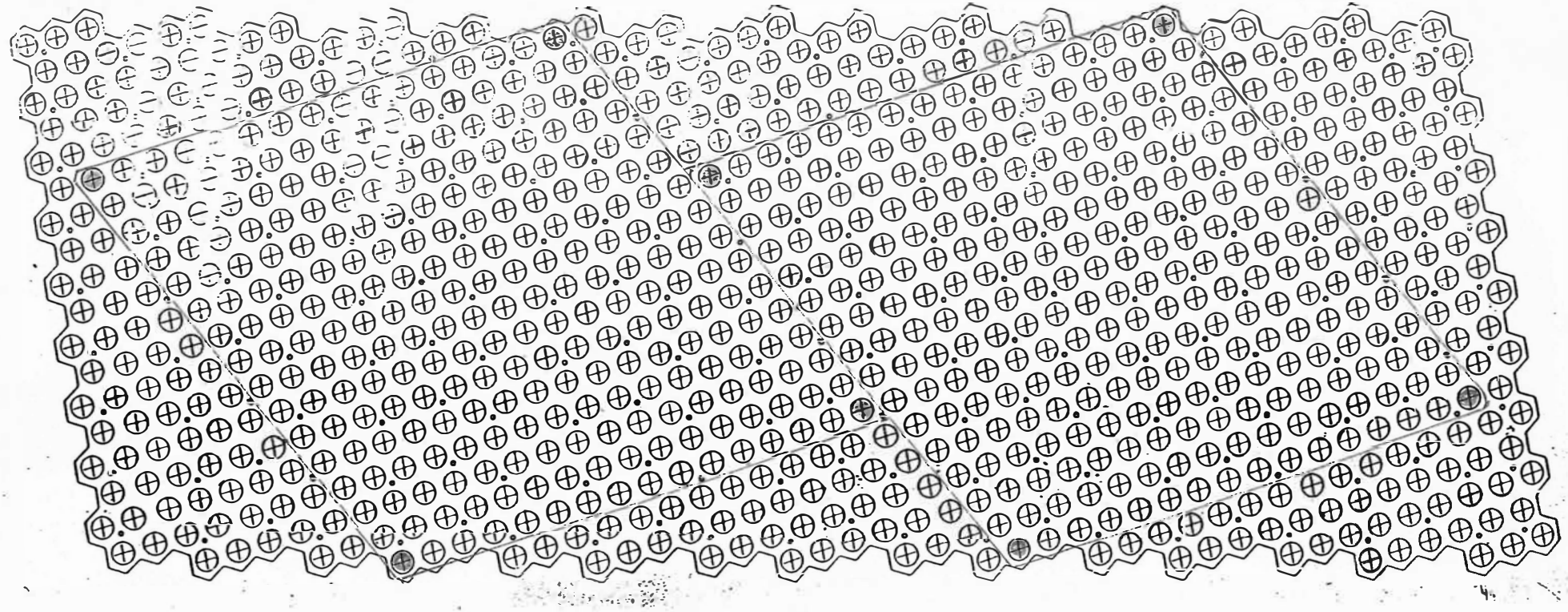
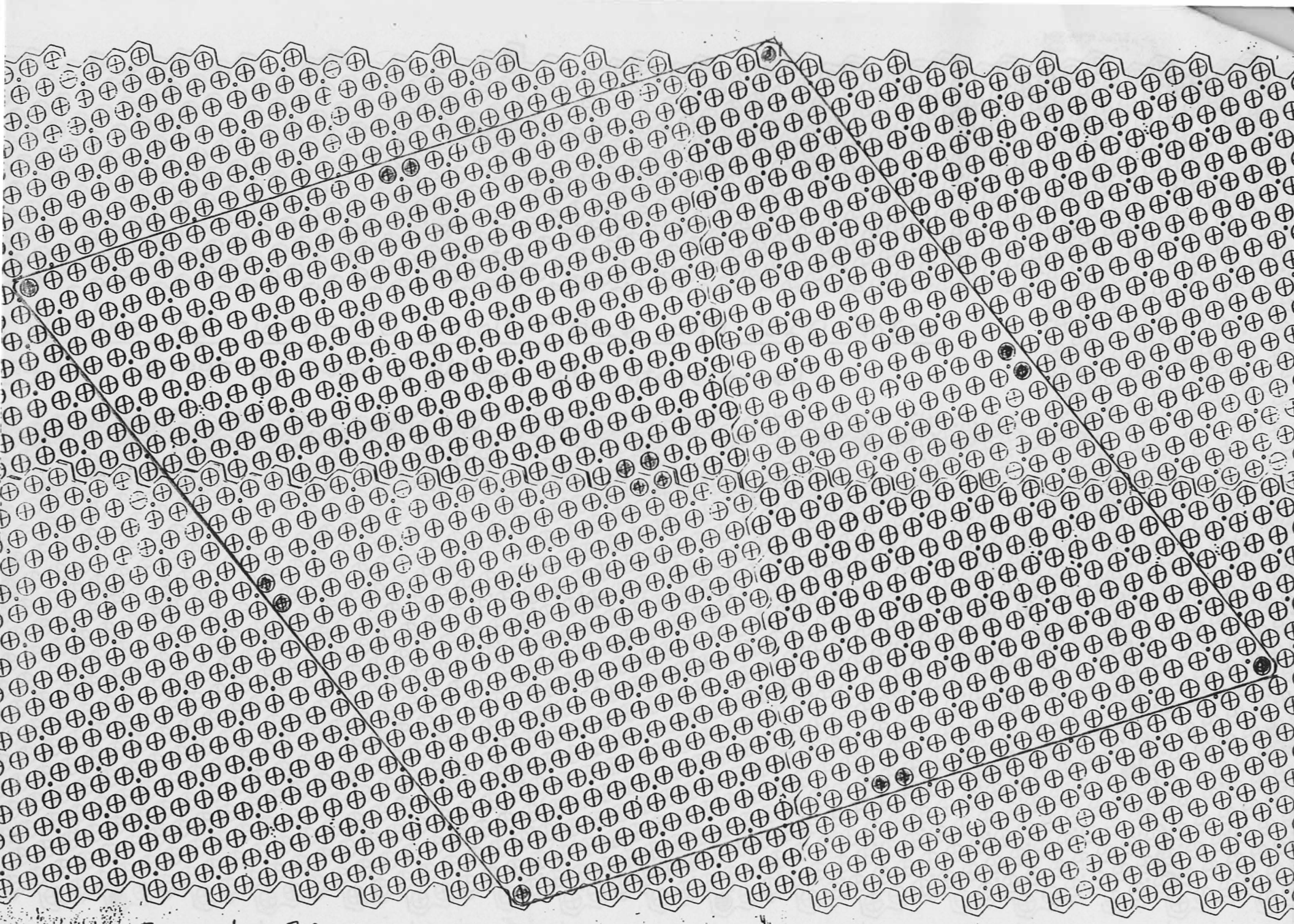
of Erv Wilson, such information shall not
disclosed to others or used for any purpose
shall not be duplicated in whole or in part.



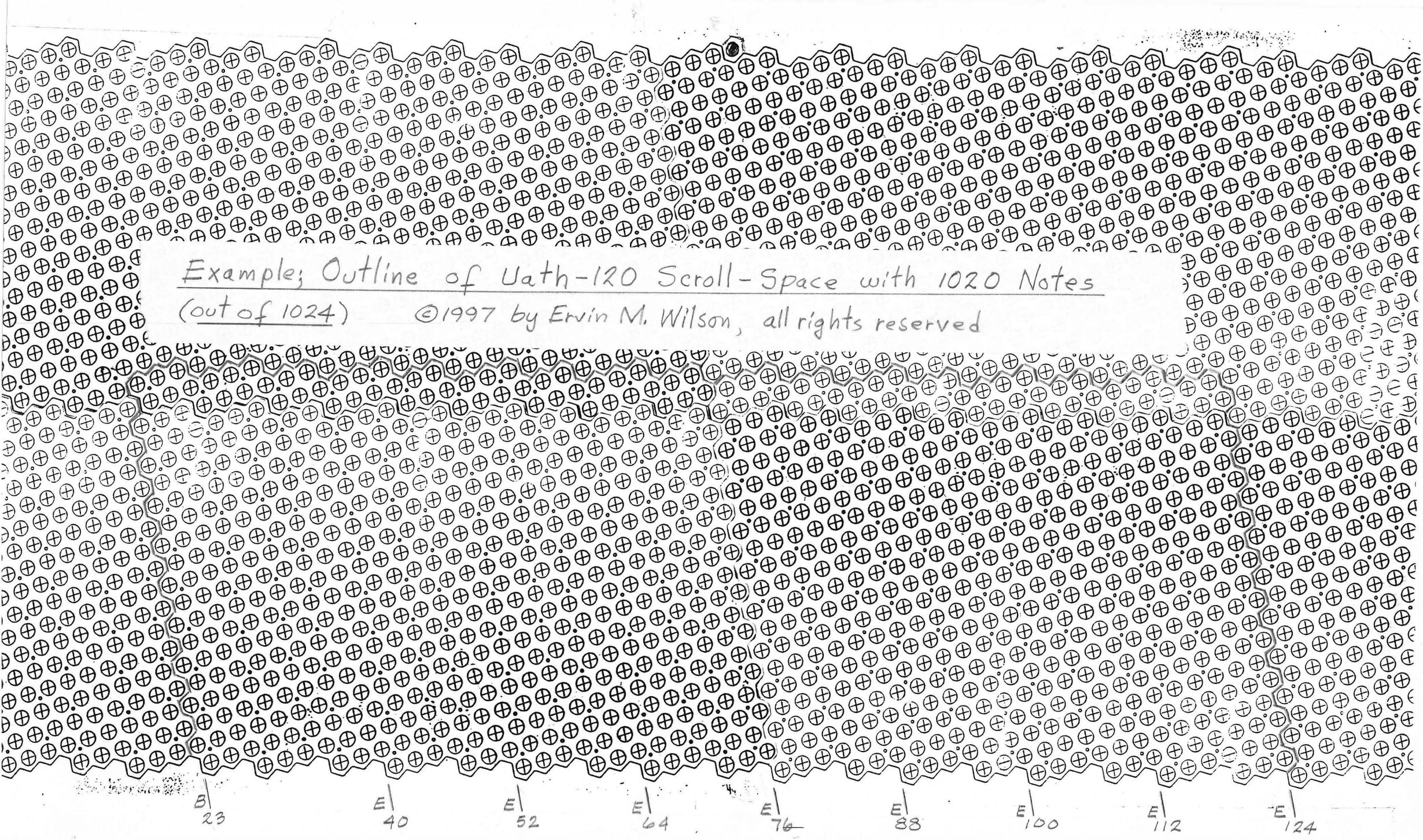
Example; Two 16x16 Cross-Sets Located on Uath-108 Keyboard



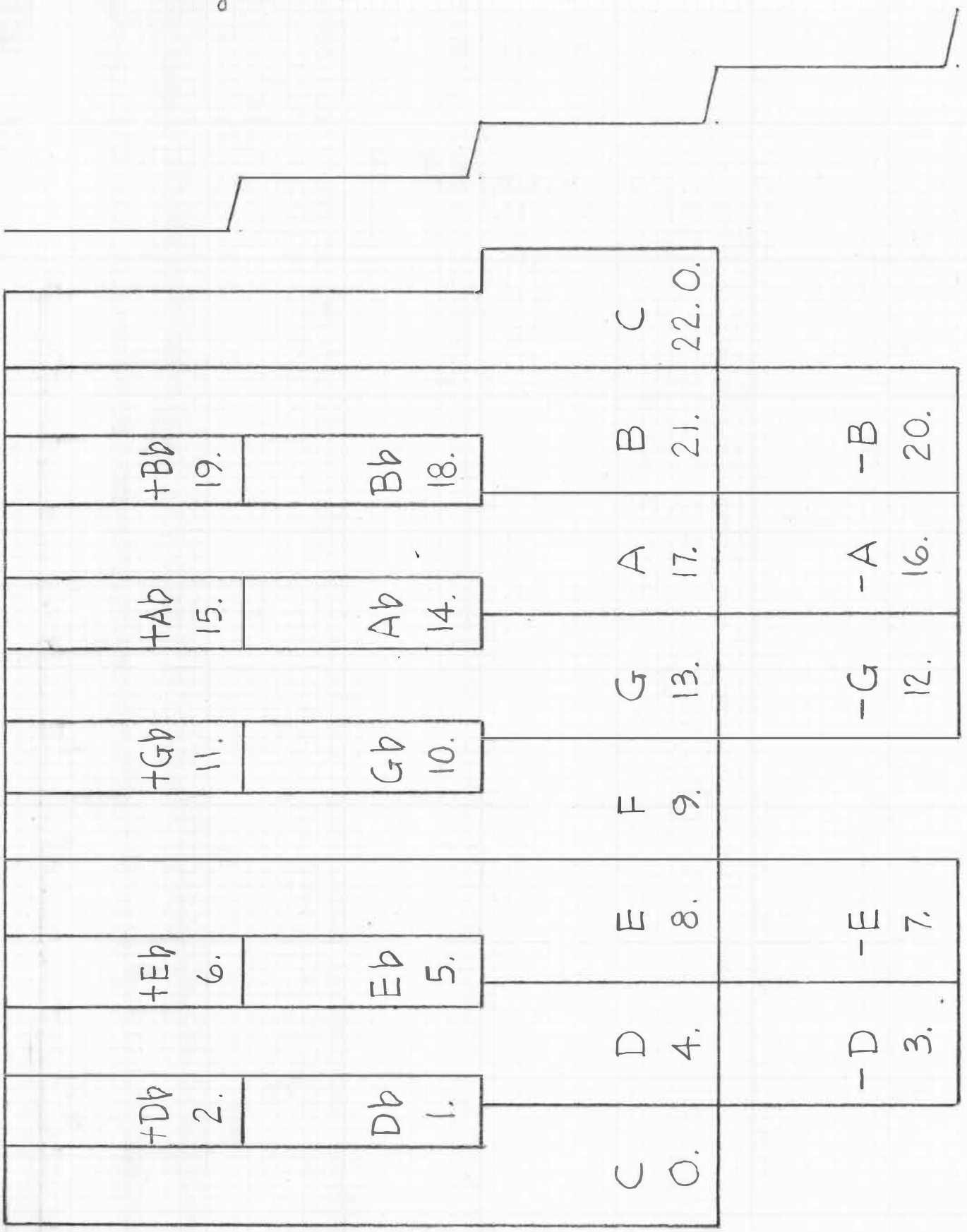
Example: 32x32 = 1024 - Note Cross-Grid and/or Scroll-Space

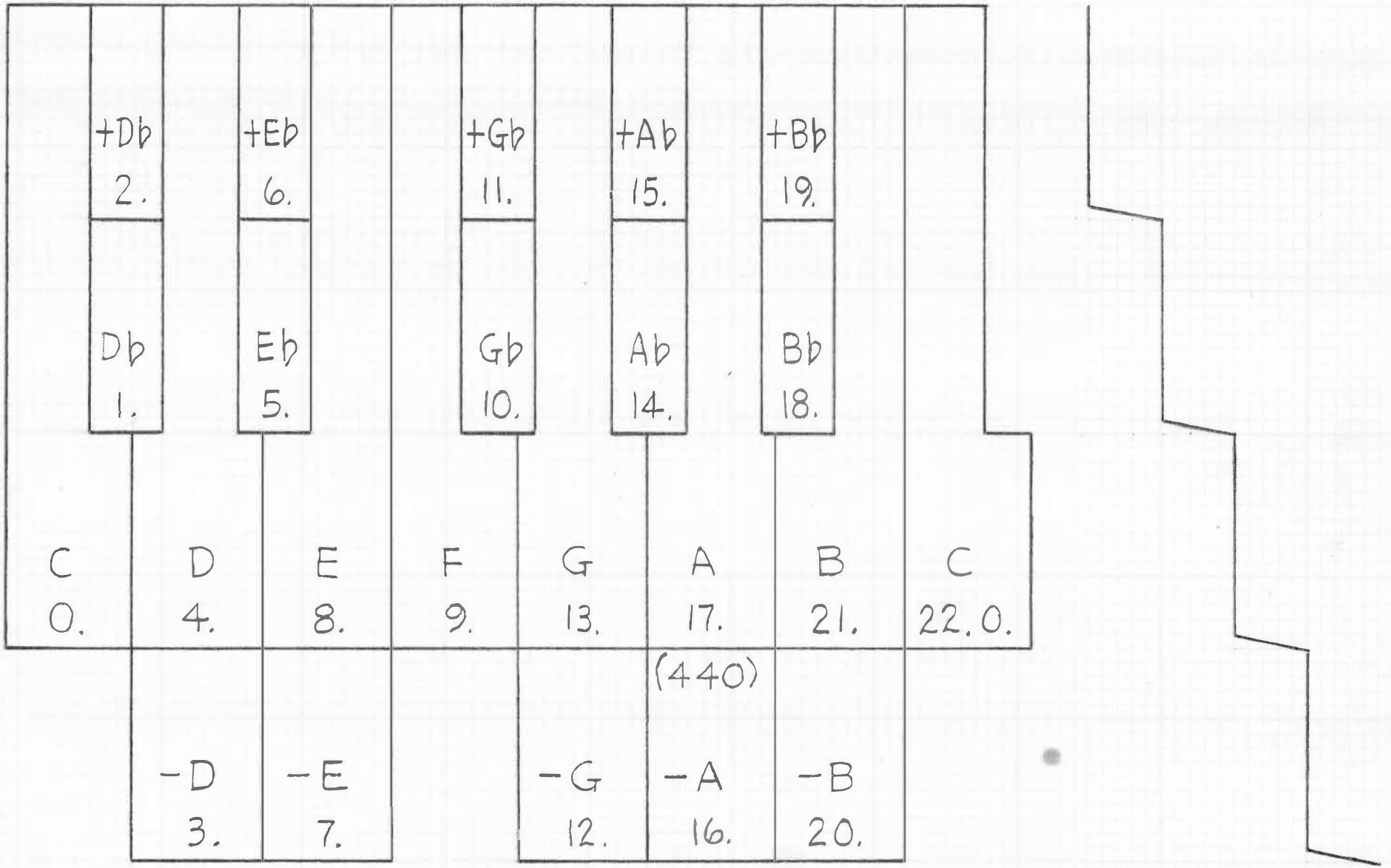
Example; Outline of Uath-120 Scroll-Space with 1020 Notes

(out of 1024)

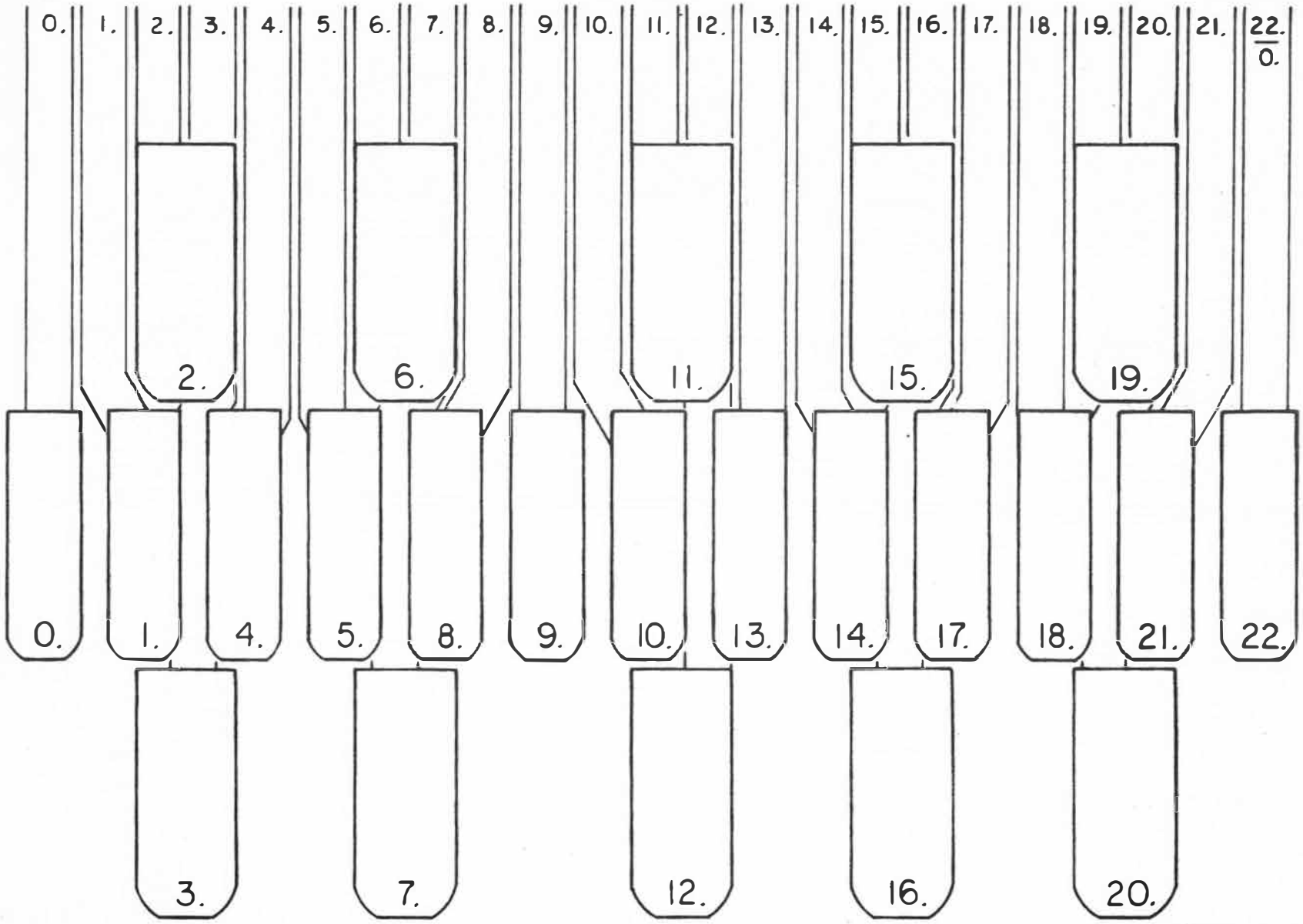


22-Tone Adaptation of Standard Keyboard
Designed & issued by Erv Wilson, March 19, 1969



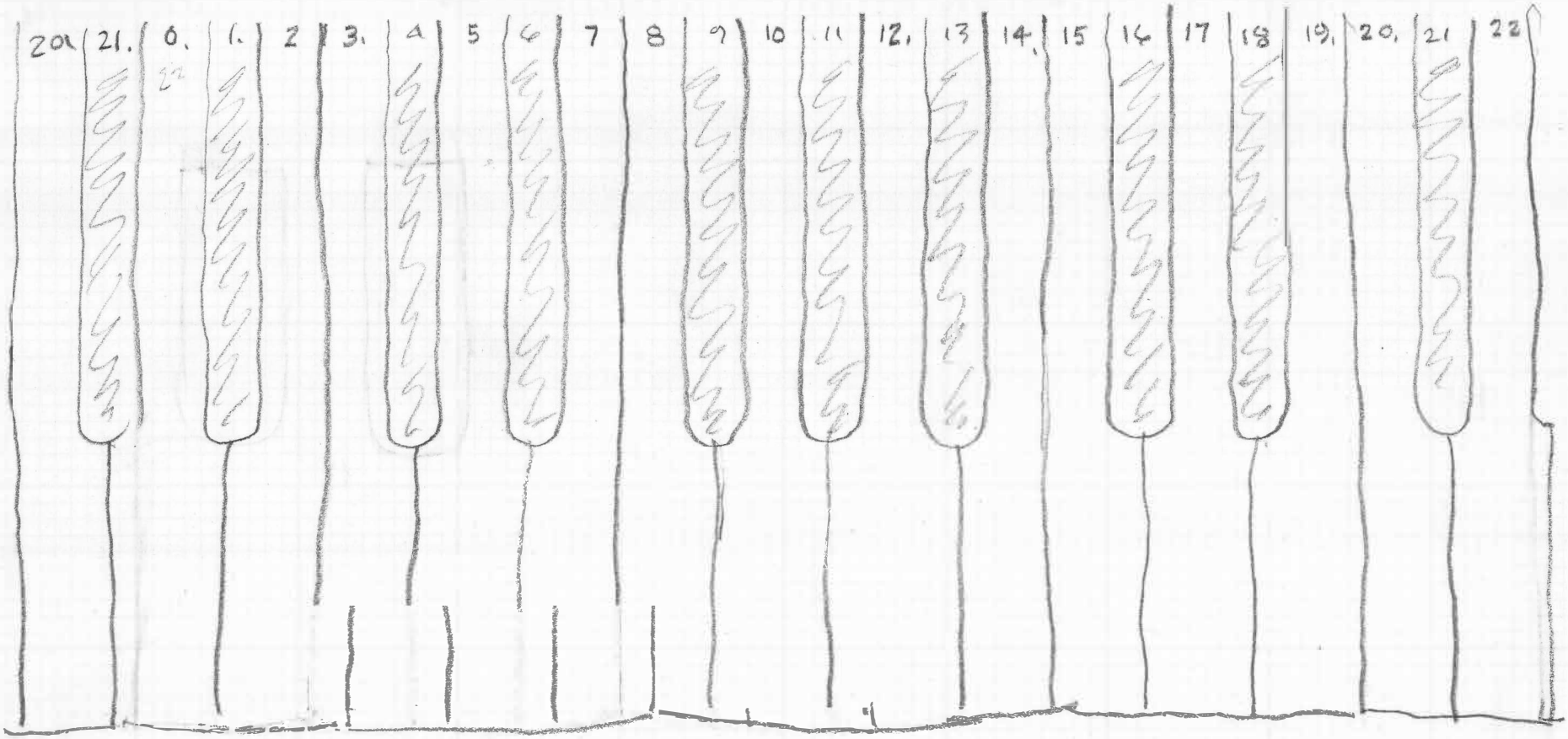


22-tone Adaptation of Standard Keyboard
Designed & Issued by Erv Wilson, Mar 19, 1969

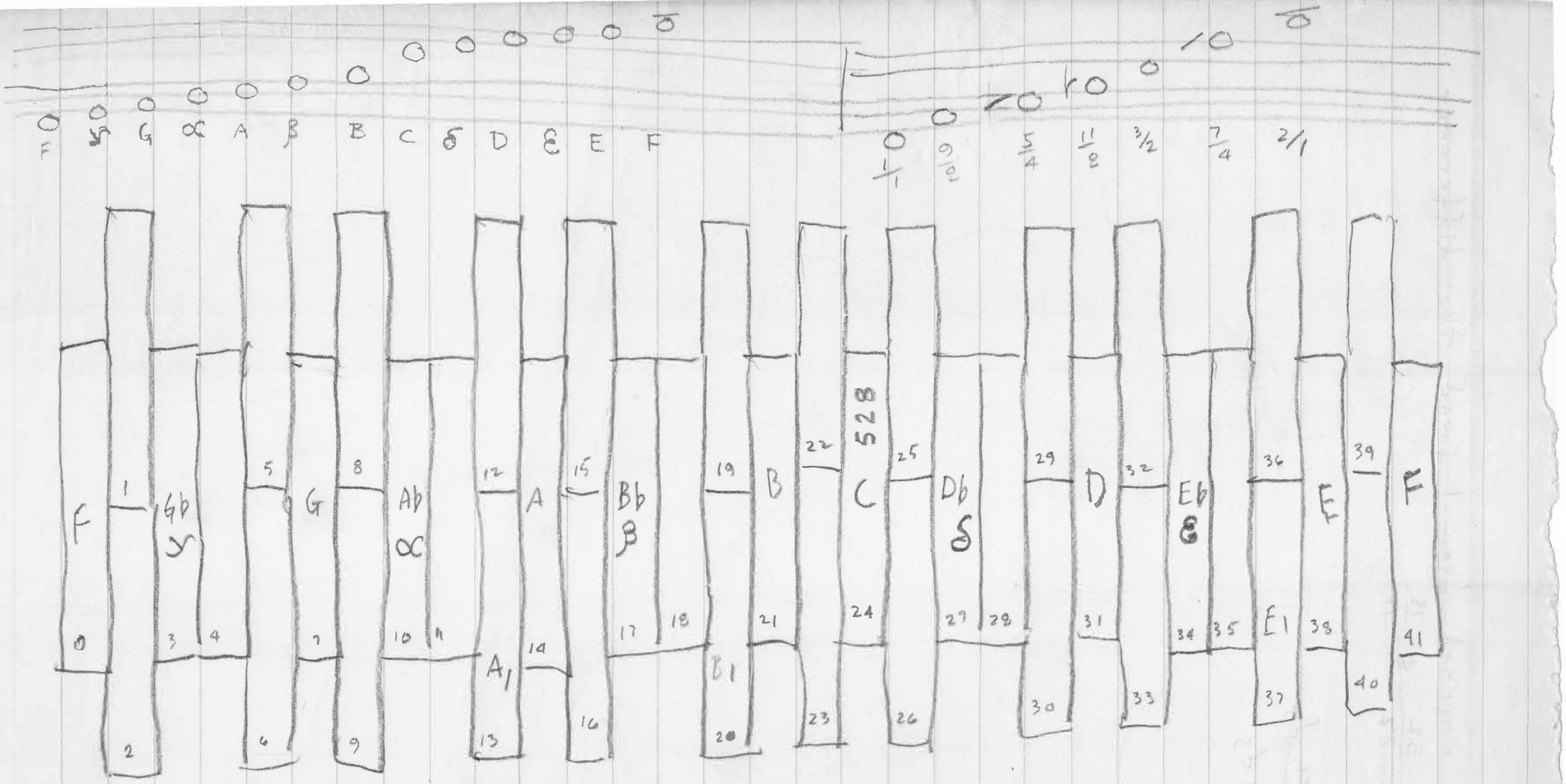


THE 5-12-5, 22-TONE KEYBOARD

INVENTOR: ERVIN M. WILSON
ISSUED JULY 28, 1965



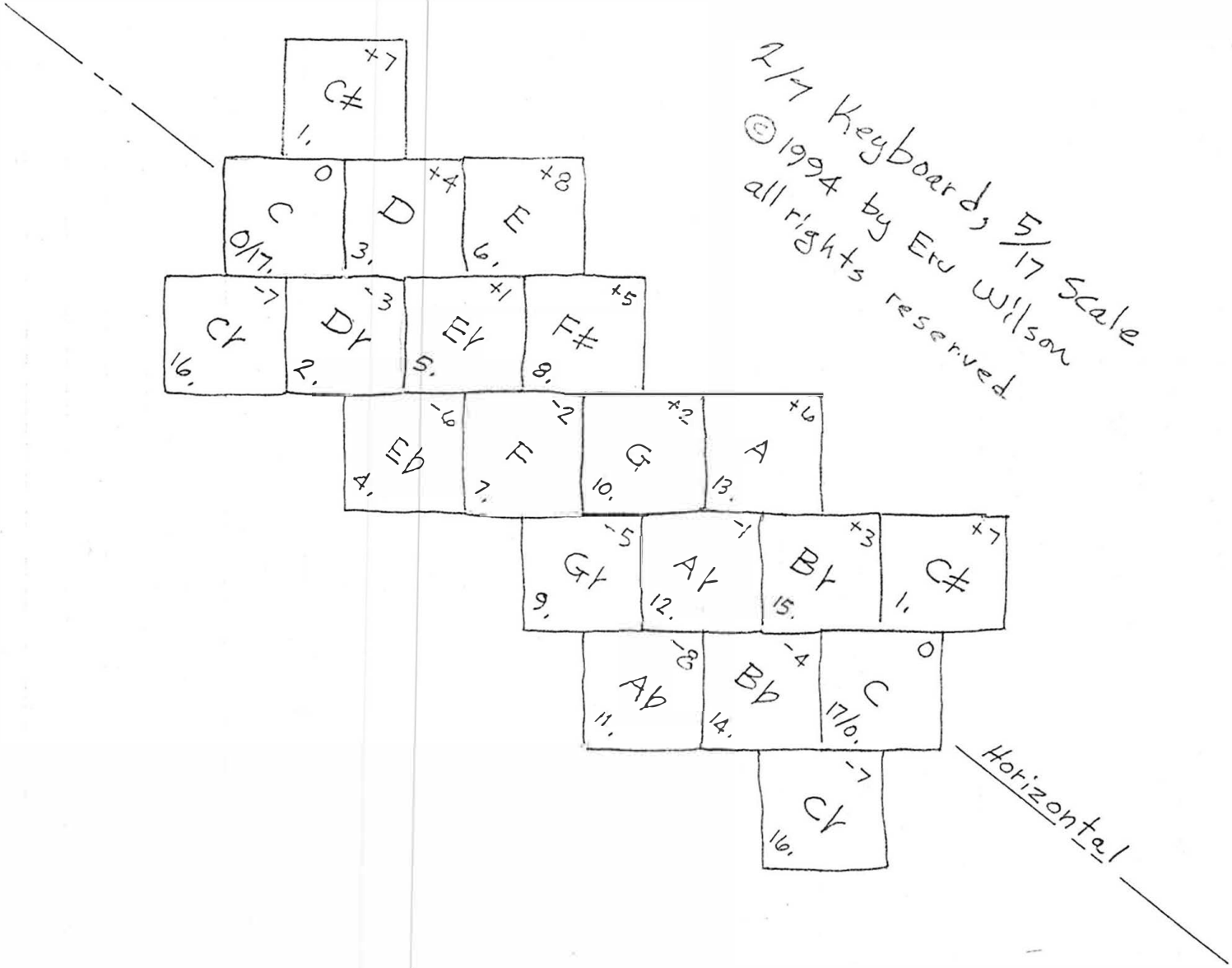
The 13+9, 22-tone Kbd
Issued by Erv Wilson 1969

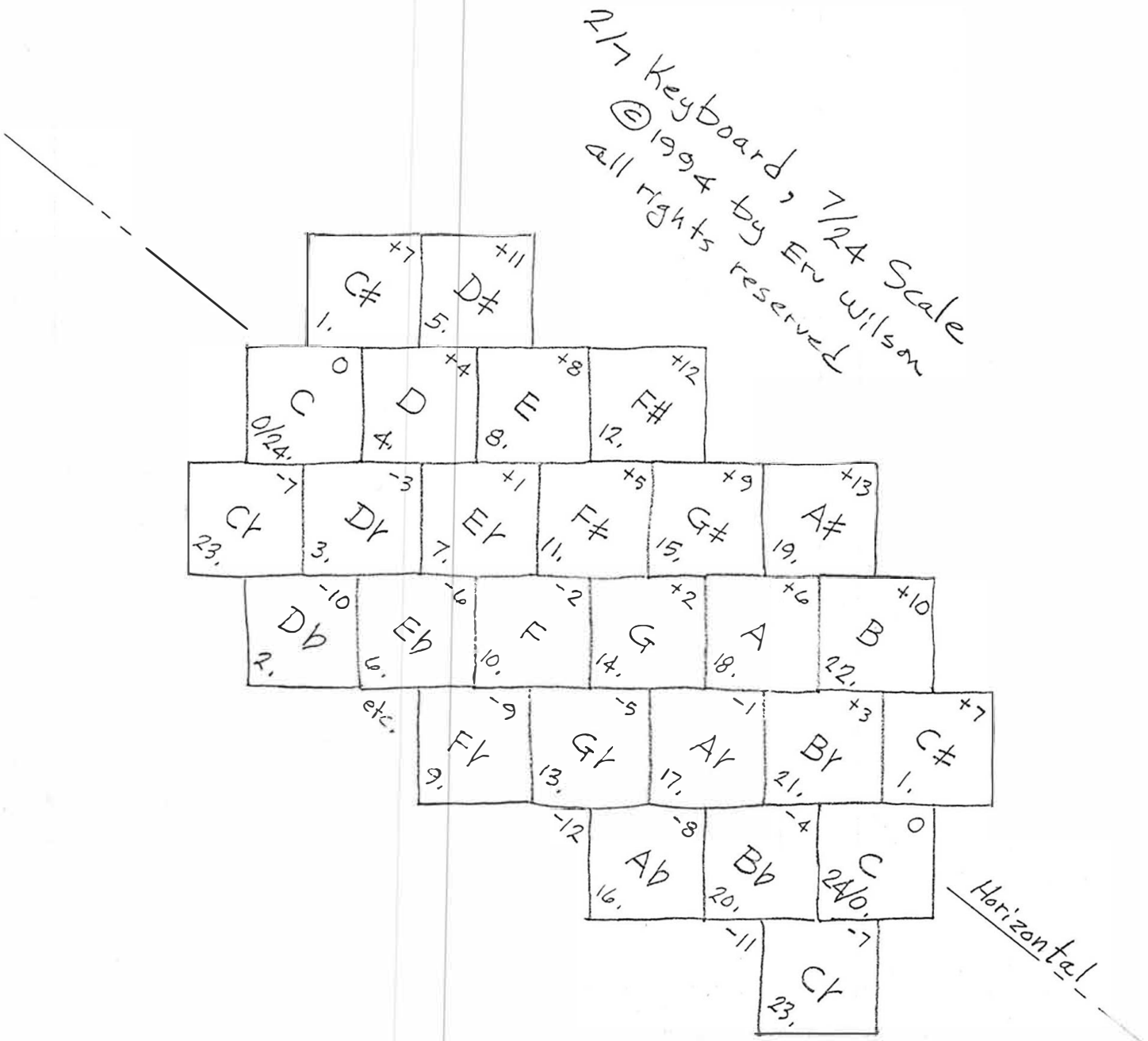


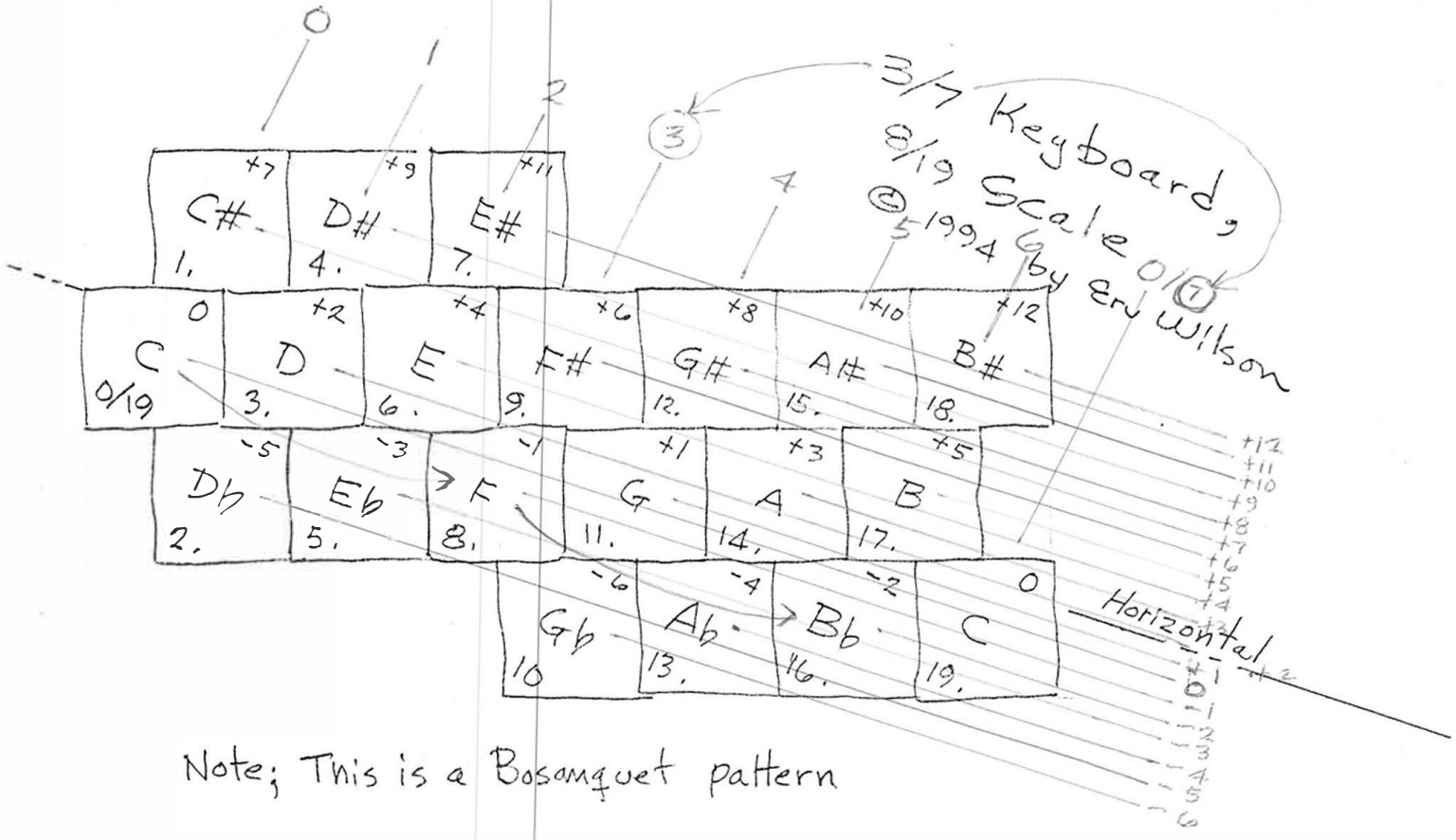
41-Tone Conduit

Ezra Wilson Sep 71

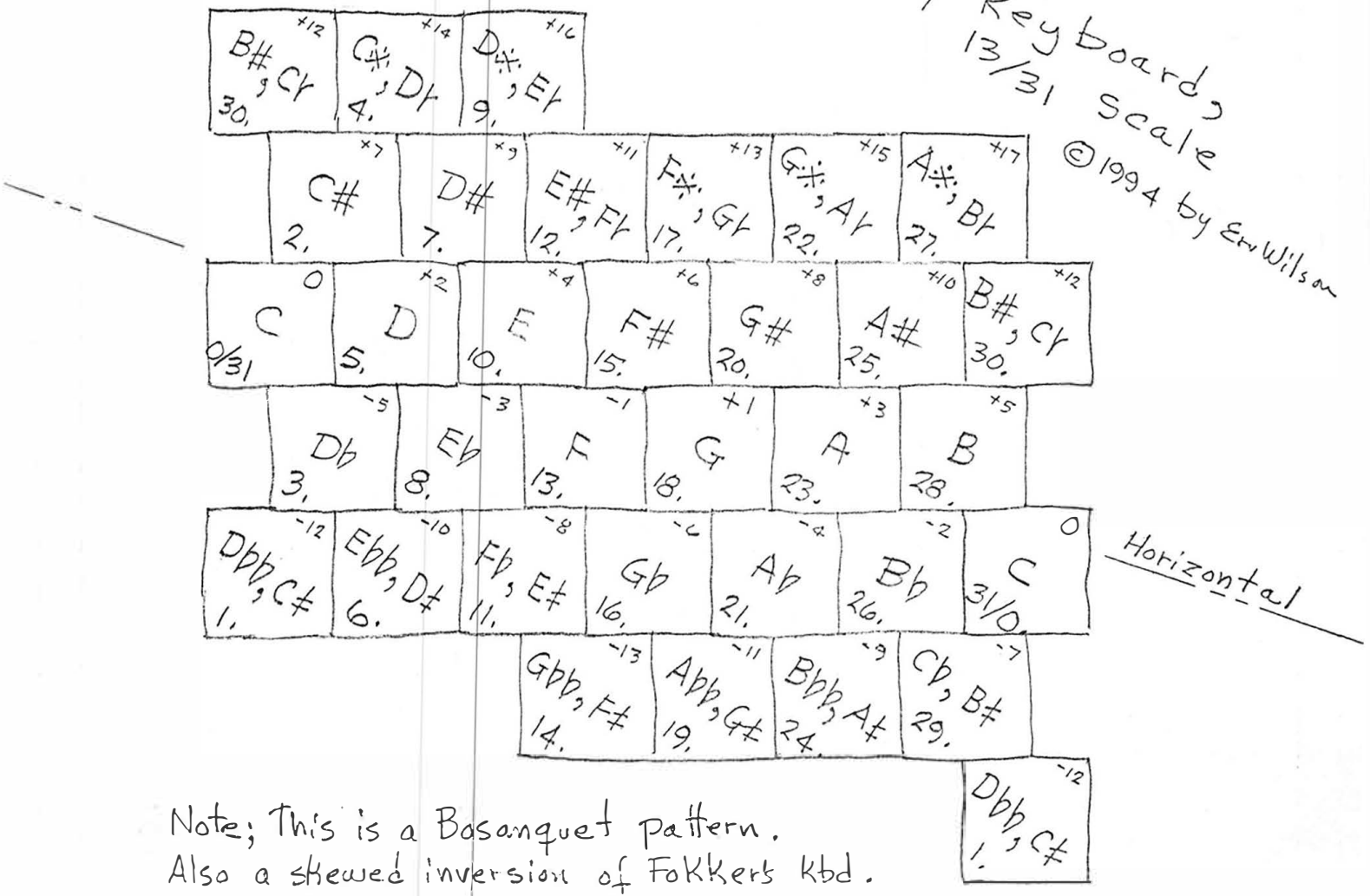
-4 -3 -2 -1 0 +1 +2 3 4


2/7 keyboard, 5/17 Scale
©1994 by Eru Wilson
all rights reserved
C♯ +7 1.
C 0 0/17.
D +4 3.
E +8 6.
C♭ -7 16.
D♭ -3 2.
E♭ +1 5.
F♯ +5 8.
E♭ -6 4.
F -2 7.
G +2 10.
A +6 13.
G♭ -5 9.
A♭ -1 12.
B♭ +3 15.
C♯ +7 1.
A♭ -8 11.
B♭ -4 14.
C 0 17/0.
C♭ -7 16.
Horizontal


2/7 Keyboard, 7/24 Scale
©1994 by Erv Wilson
all rights reserved
C♯ +7 1.
D♯ +11 5.
C 0 0/24.
D +4 4.
E +8 8.
F♯ +12 12.
C♭ -7 23.
D♭ -3 3.
E♭ +1 7.
F♯ +5 11.
G♯ +9 15.
A♯ +13 19.
D♭ -10 2.
E♭ -6 6.
F -2 10.
G +2 14.
A +6 18.
B +10 22.
etc.
F♭ -9 9.
G♭ -5 13.
A♭ -1 17.
B♭ +3 21.
C♯ +7 1.
-12
A♭ -8 16.
B♭ -4 20.
C 0 24/0.
-11
C♭ -7 23.
Horizontal

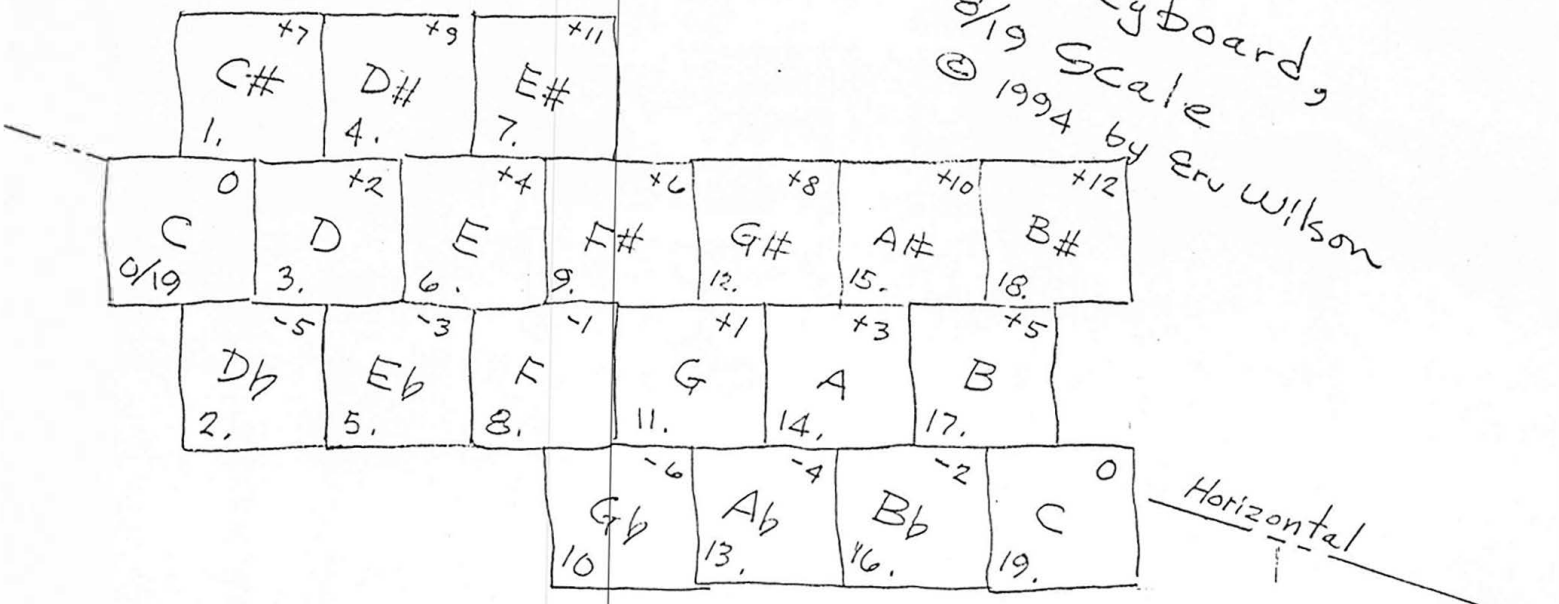


Note; This is a Bosanquet pattern



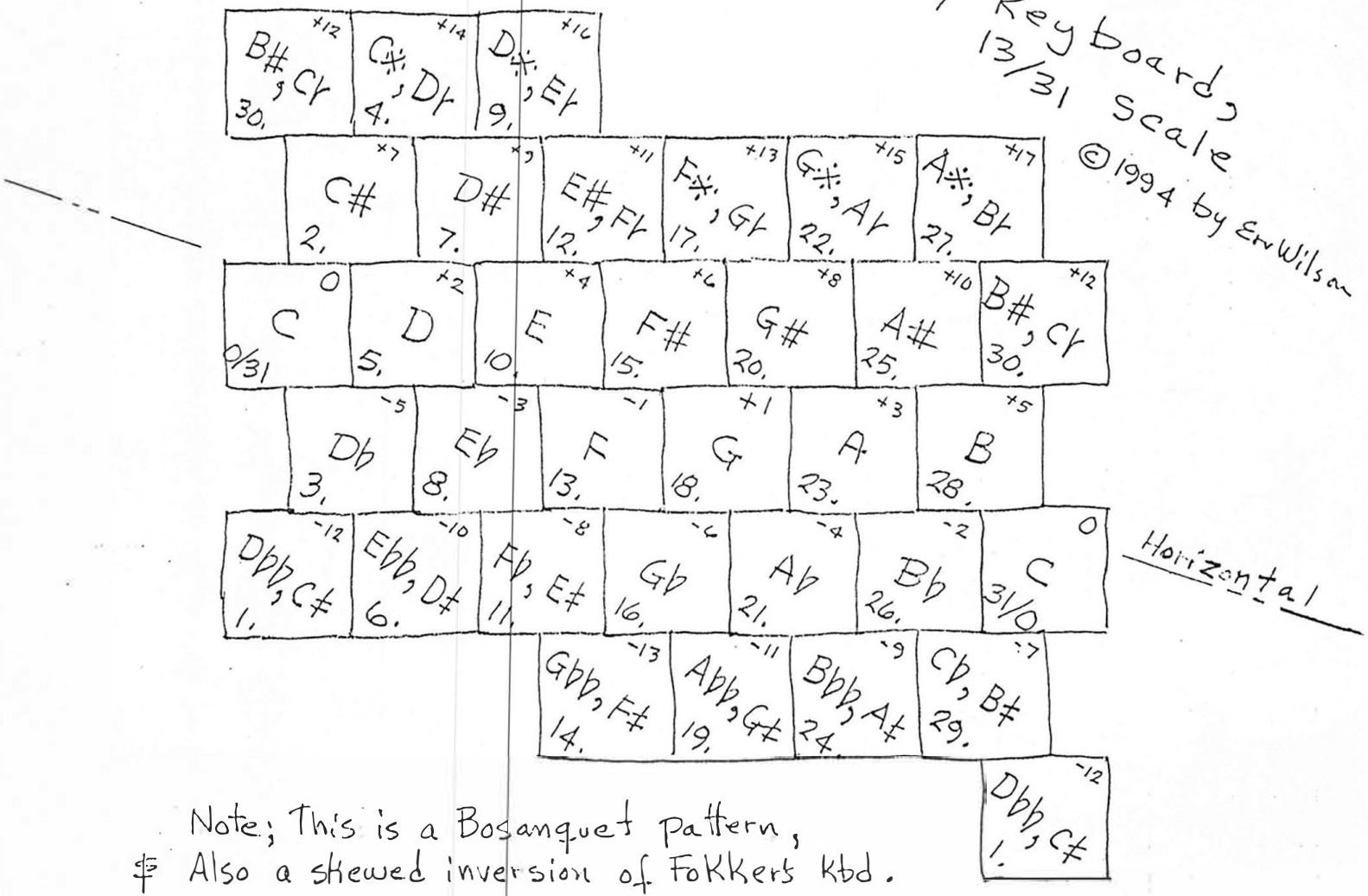
Note; This is a Bosanquet pattern.
Also a skewed inversion of Fokkers kbd.

3/7 Keyboard, 8/19 Scale

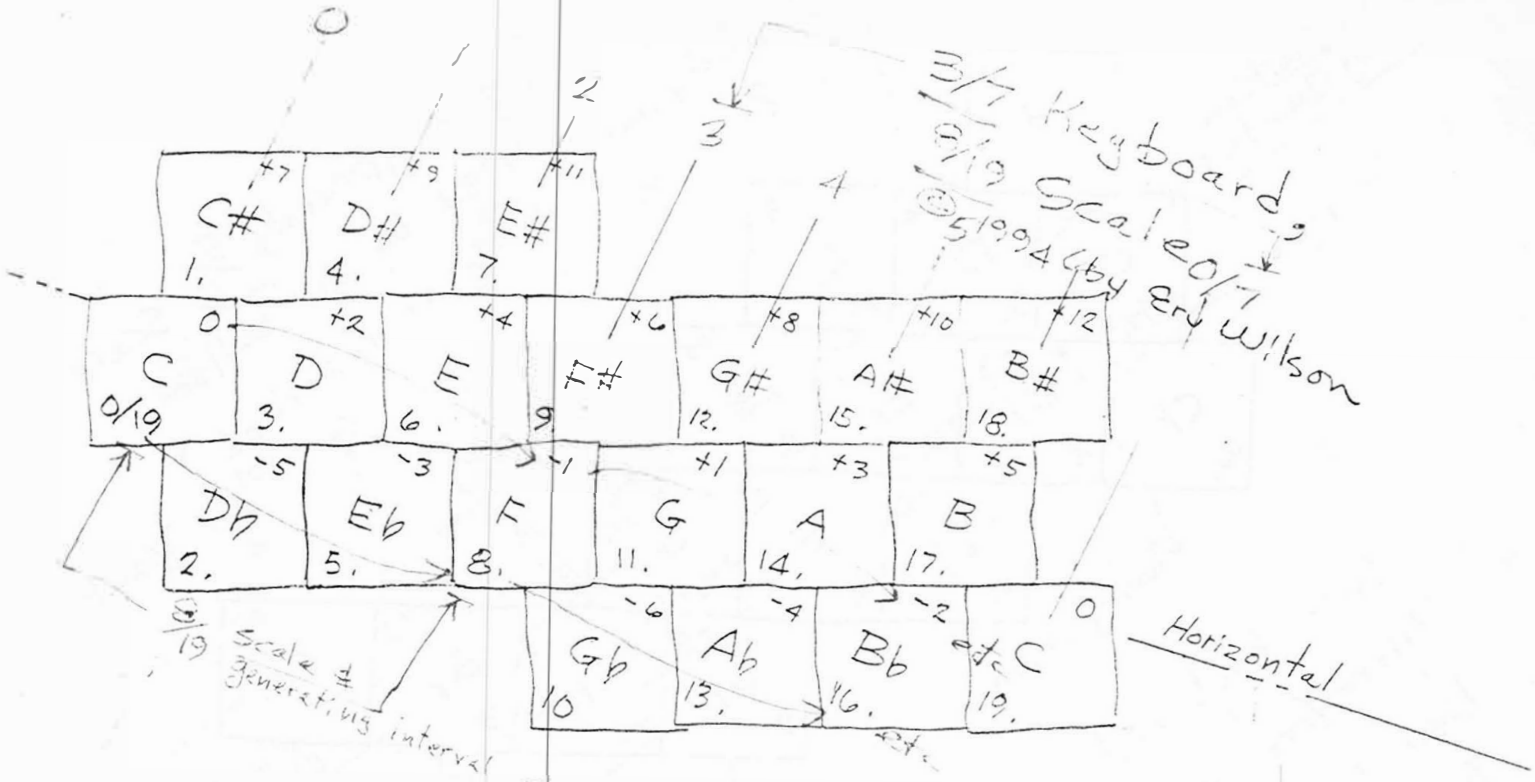


Note; This is a Bosanquet pattern

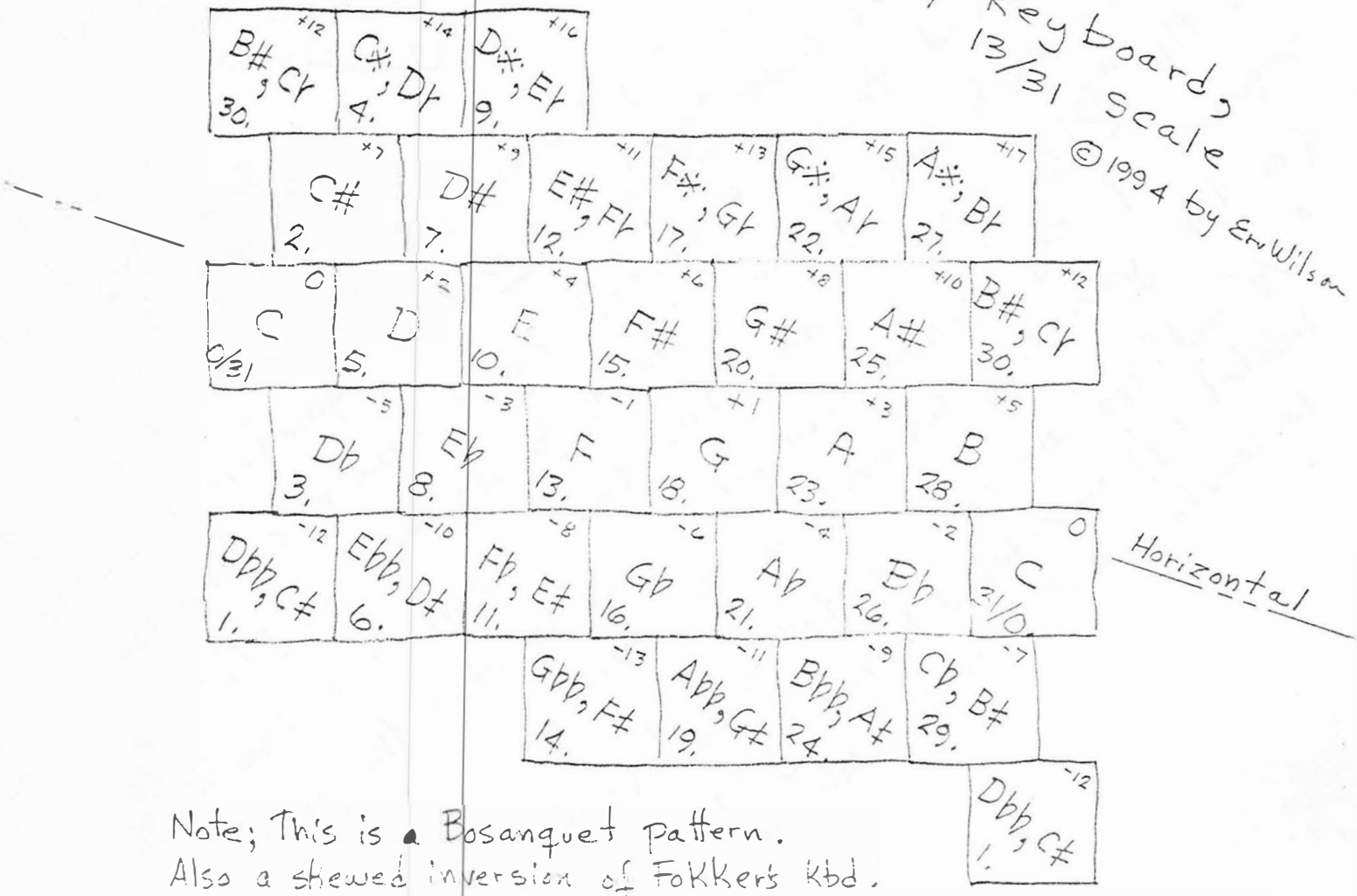
3/7 Keyboard, 13/31 Scale



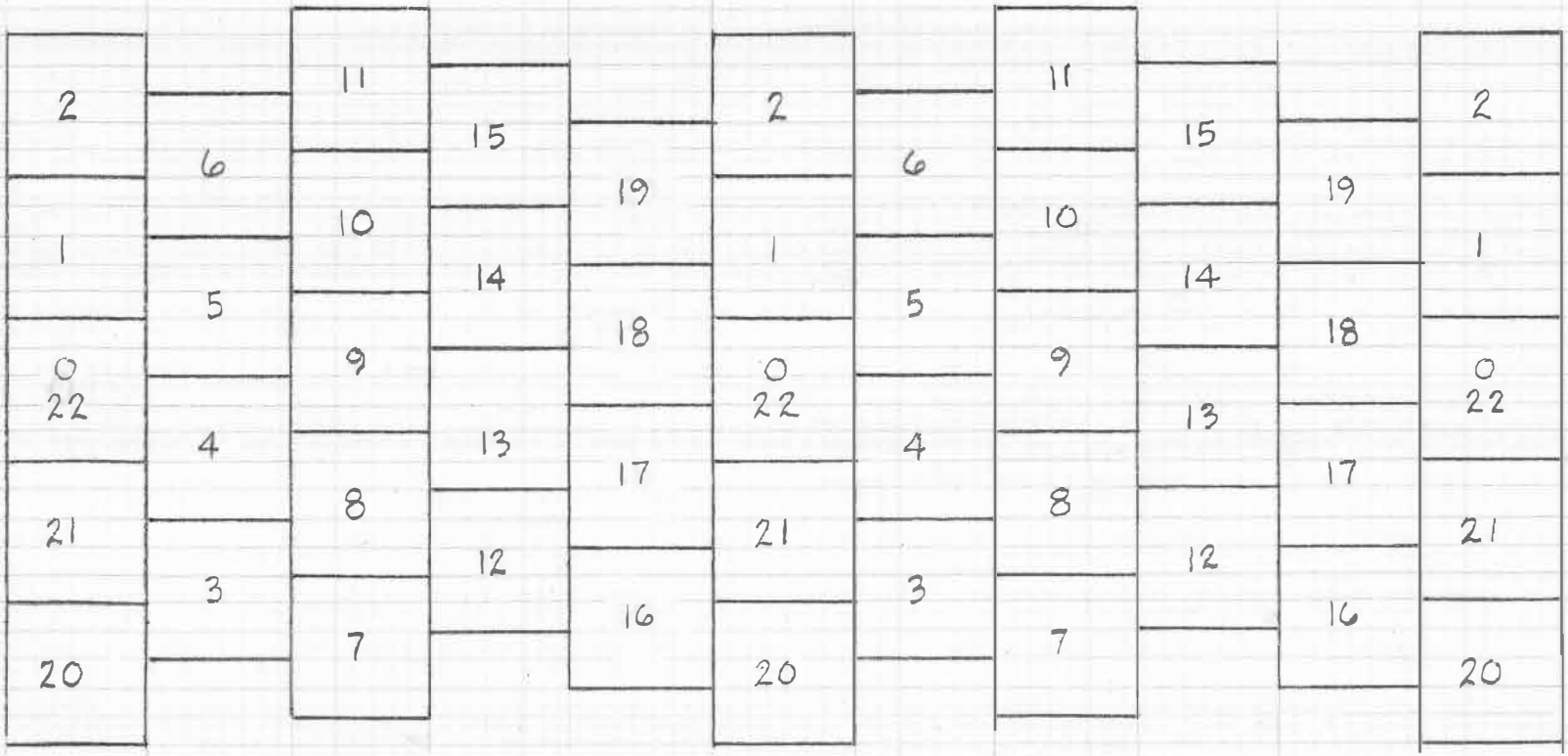
Note; This is a Bosanquet pattern,
Also a skewed inversion of Fokkers kbd.



Note; This is a Bosanquet pattern
When (+1) is greater than ½ octave I will usually use the (-1) position for the scale code, (for economy).



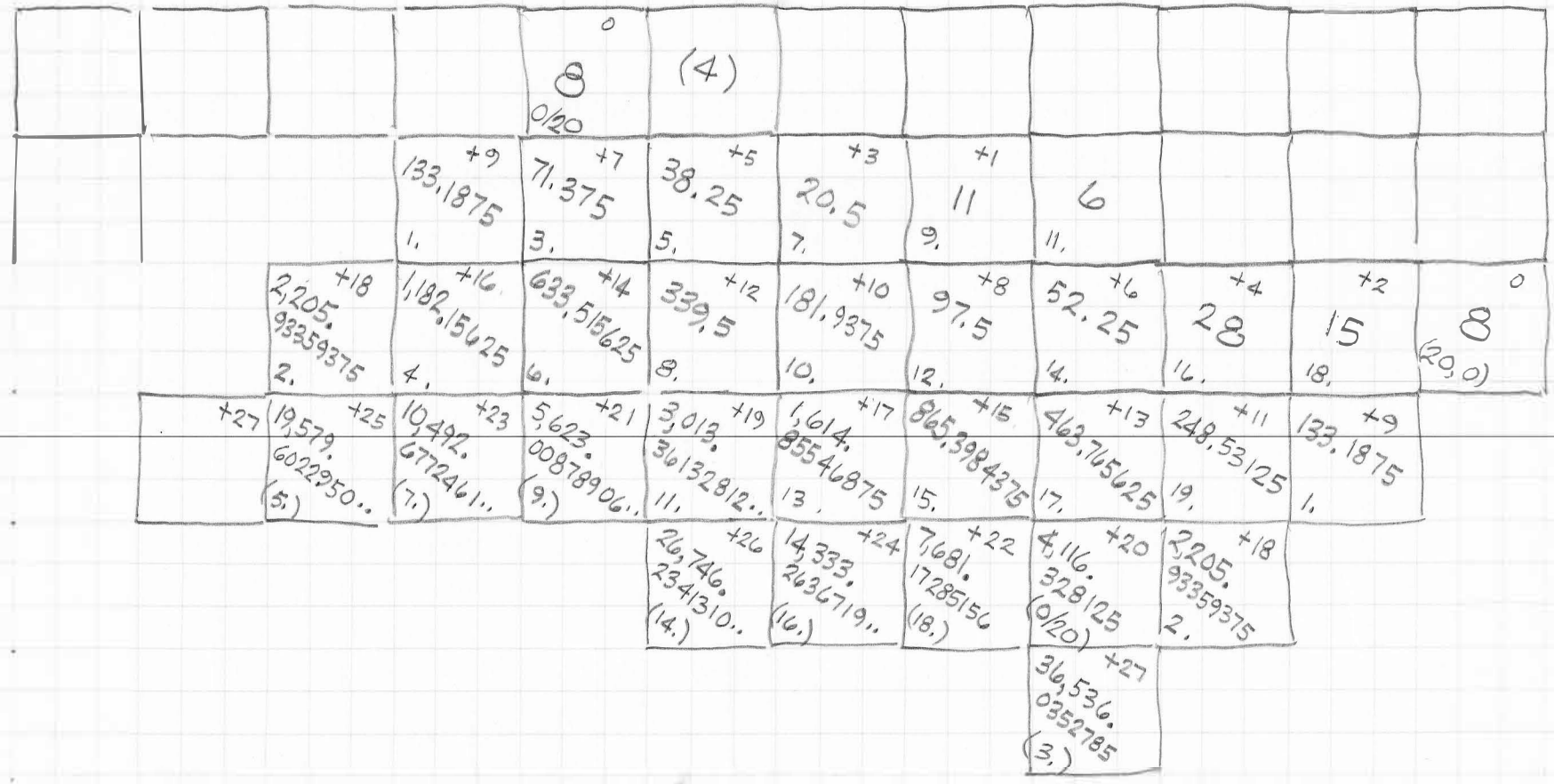
Note; This is a Bosanquet pattern.
Also a skewed inversion of Fokker's kbd.

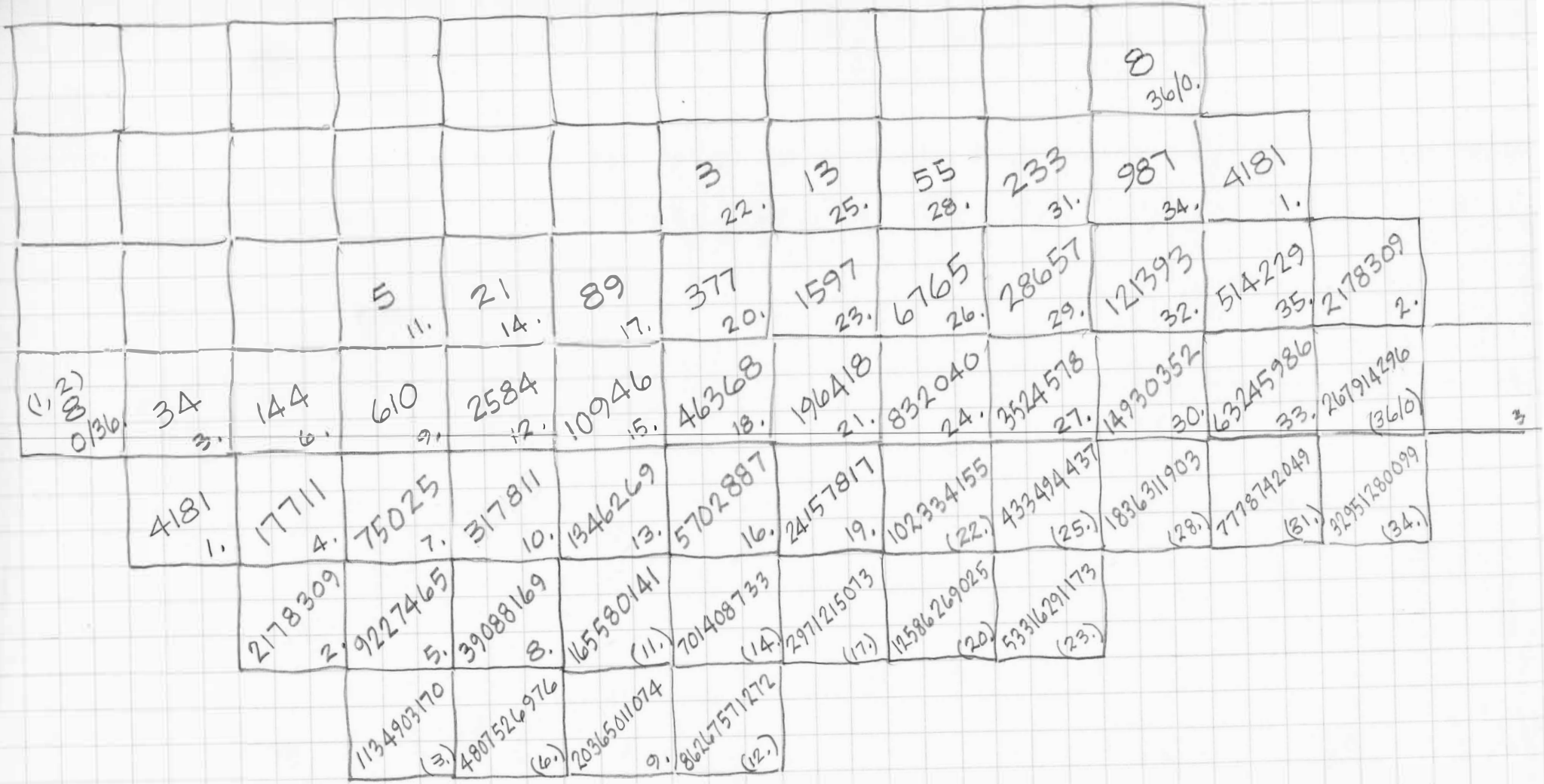


Keyboard, Musical Instrument (B)
(Applied to 22-Tone Scale)

Patent No. 3342094

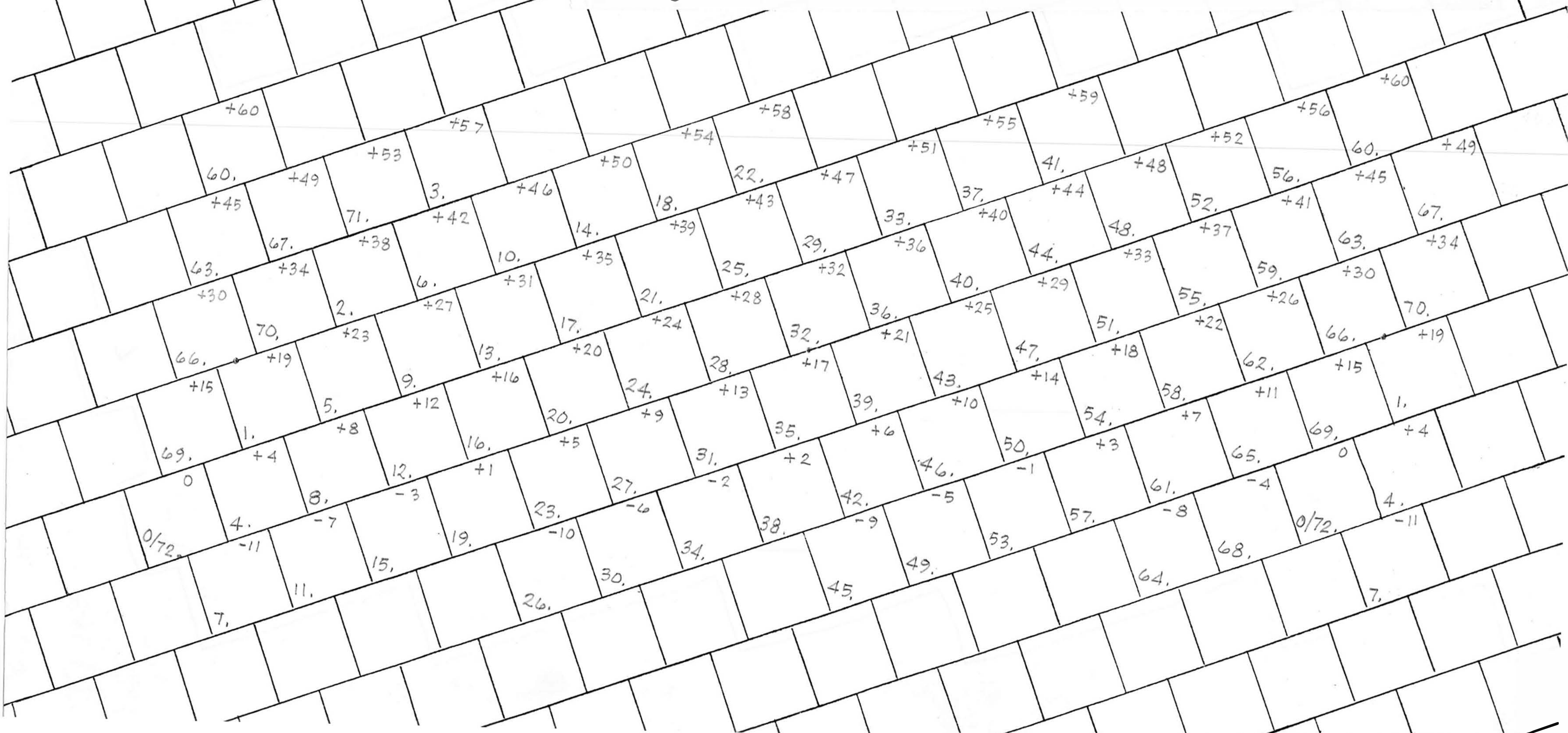
Issued by Erv Wilson 8 mar 69

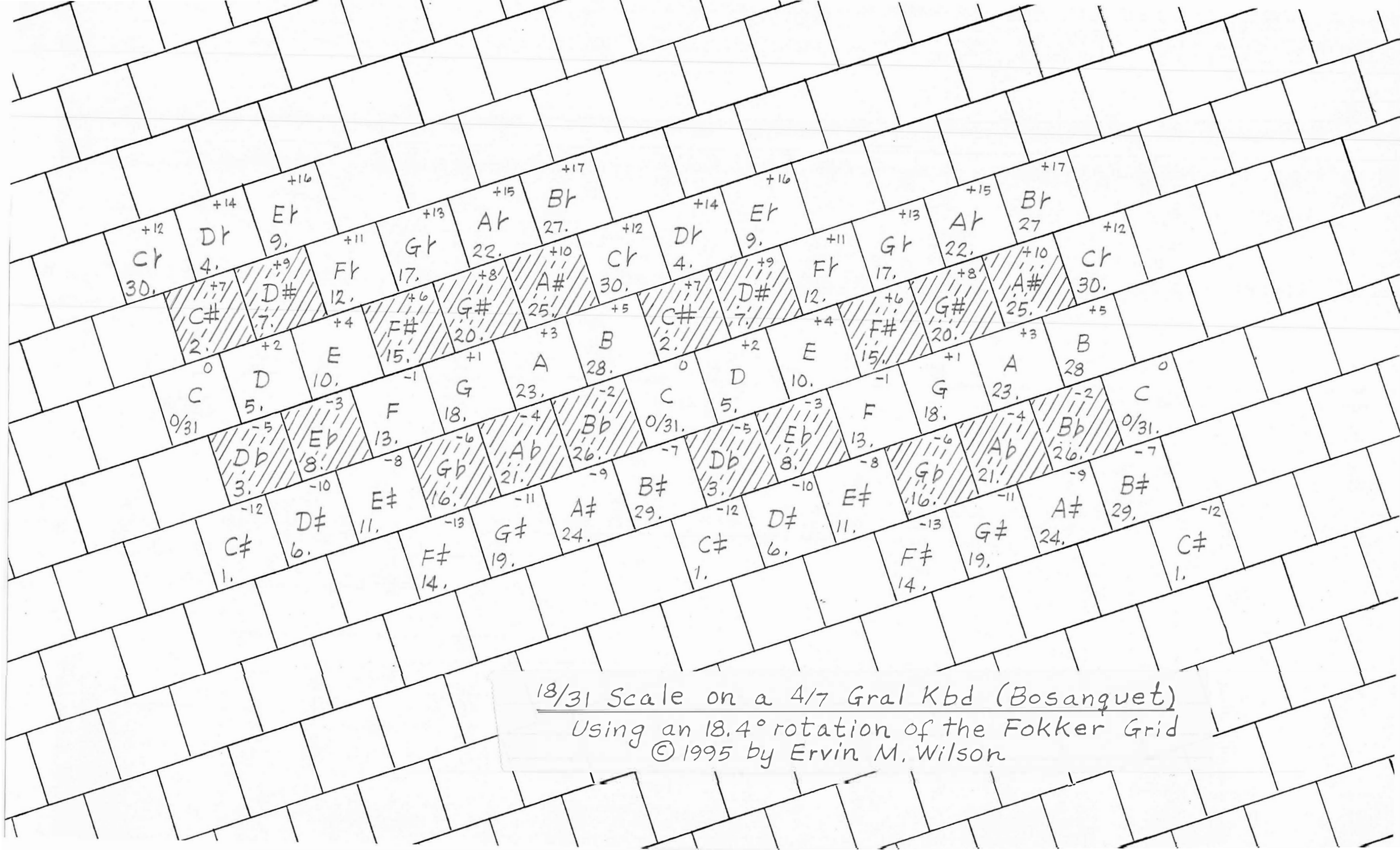

0
8
0/20
(4)
+9
133,1875
1,
+7
71,375
3,
+5
38,25
5,
+3
20,5
7,
+1
11
9,
6
11,
+18
2,205,
93359375
2,
+16
1,182,15625
4,
+14
633,515625
6,
+12
339,5
8,
+10
181,9375
10,
+8
97,5
12,
+6
52,25
14,
+4
28
16,
+2
15
18,
0
8
(20,0)
+27
+25
19,579,
6022950..
(5,)
+23
10,492,
677246 1..
(7,)
+21
5,623,
008789 06..
(9,)
+19
3,013,
36132812..
11,
+17
1,614,
85546875
13,
+15
865,39843 75
15,
+13
463,765625
17,
+11
248,53125
19,
+9
133,1875
1,
+26
26,746,
234310..
(14,)
+24
14,333,
26367 19..
(16,)
+22
7,681,
17285156
(18,)
+20
4,116,
328125
(0/20)
+18
2,205,
93359375
2,
+27
36,536,
0352785
(3,)


8
3610.
3
22.
13
25.
55
28.
233
31.
987
34.
4181
1.
5
11.
21
14.
89
17.
377
20.
1597
23.
6765
26.
28657
29.
121393
32.
514229
35.
2178309
2.
(1,2)
8
0136.
34
3.
144
6.
610
9.
2584
12.
10946
15.
46368
18.
196418
21.
832040
24.
3524578
27.
14930352
30.
63245986
33.
267914296
(3610)
4181
1.
17711
4.
75025
7.
317811
10.
1346269
13.
5702887
16.
24157817
19.
102334155
(22.)
433494437
(25.)
1836311903
(28.)
7778742049
(31.)
32951280099
(34.)
2178309
2.
9227465
5.
39088169
8.
165580141
(11.)
701408733
(14.)
2971215013
(17.)
12586269025
(20.)
53316291173
(23.)
1134903170
(3.)
4807526976
(6.)
20365011074
9.
86267571272
(12.)

19/72 Scale on a 4/15 Gral Kbd Schema (Hanson)
Using an 18.4° rotation of the Fokker Grid (Bosanquet)

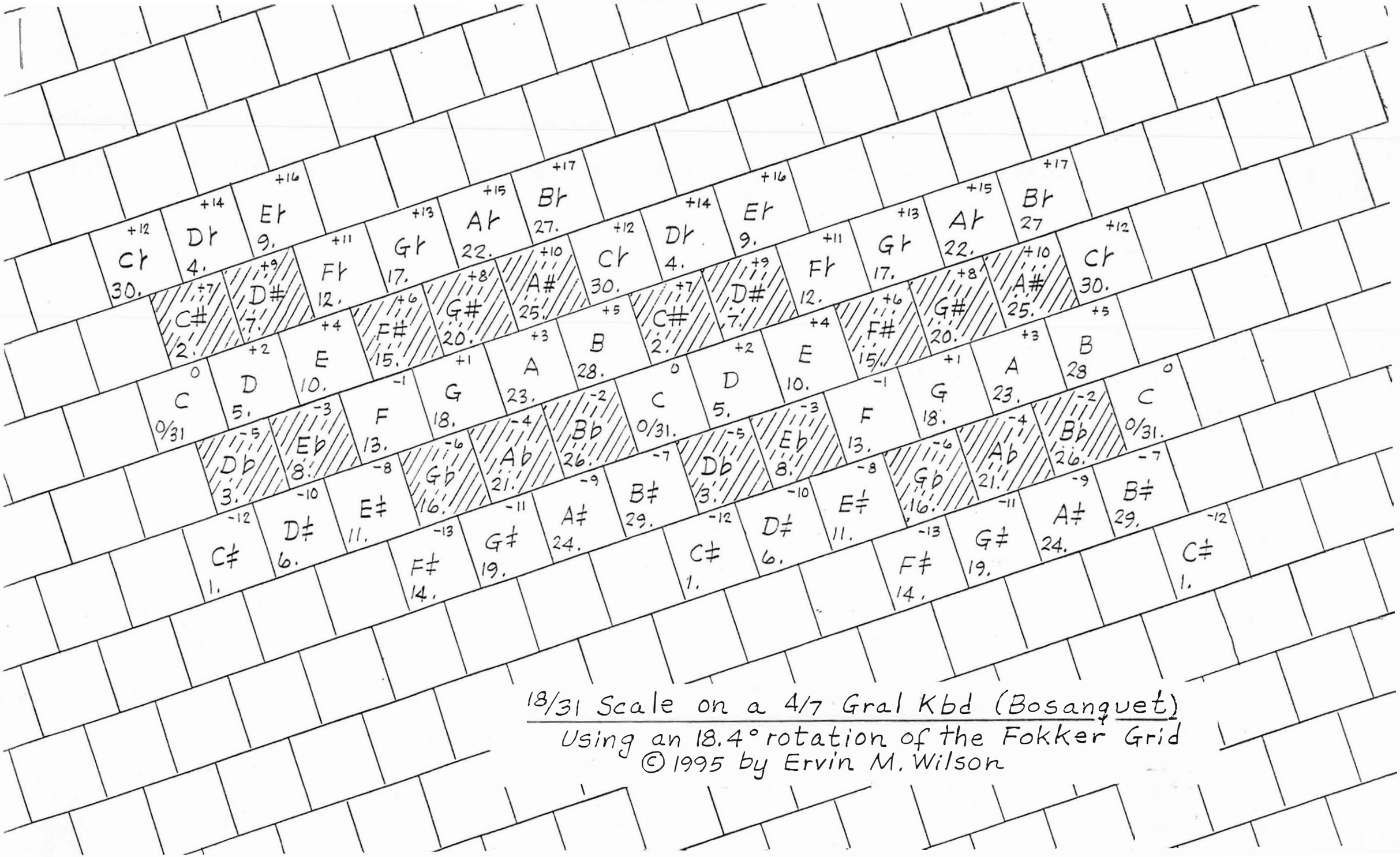
See; Development of a 53-tone Keyboard Layout
by Larry A. Hanson, Xenharmonikon XII, Spring 89

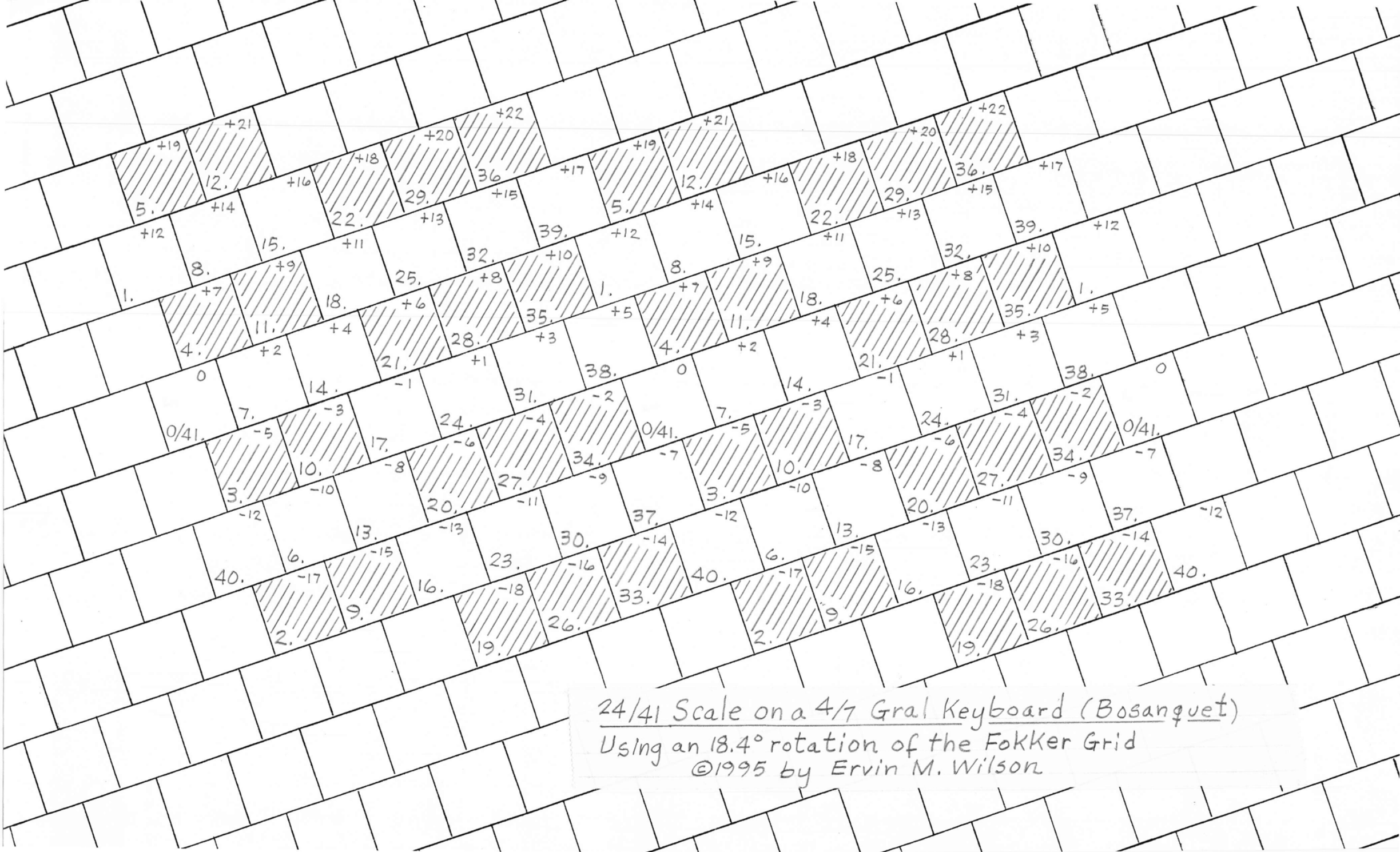


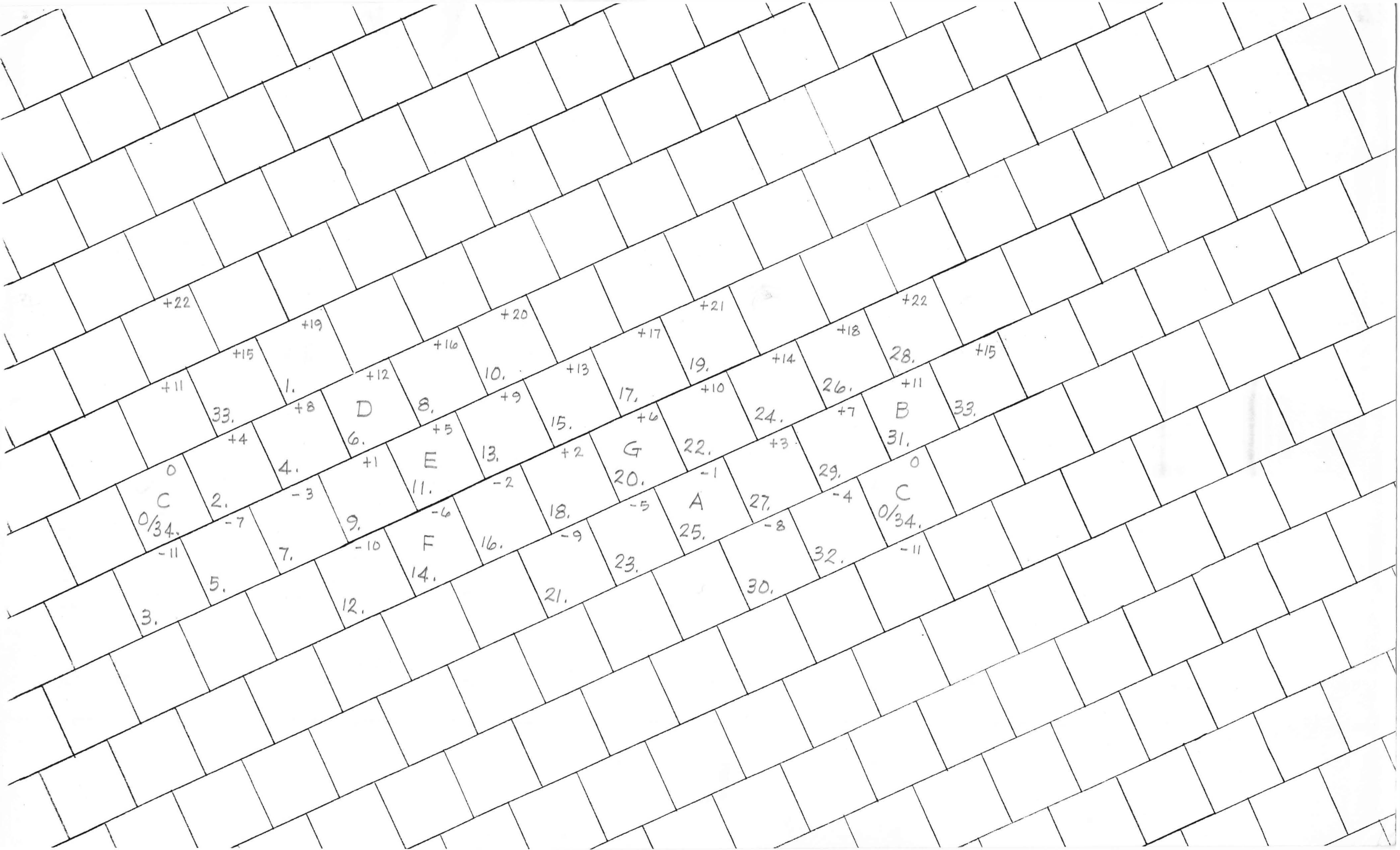


18/31 Scale on a 4/7 Gral Kbd (Bosanquet)

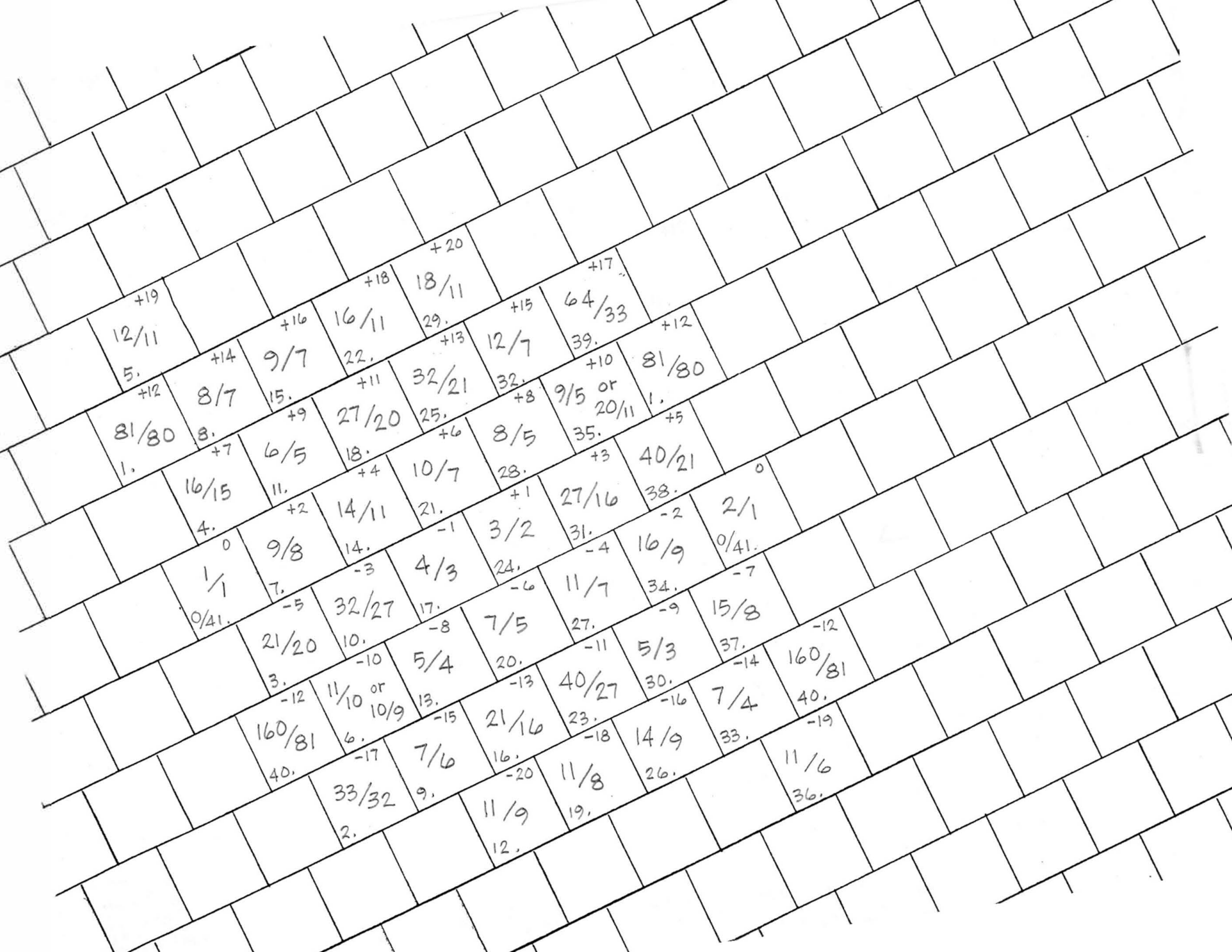
Using an 18.4° rotation of the Fokker Grid

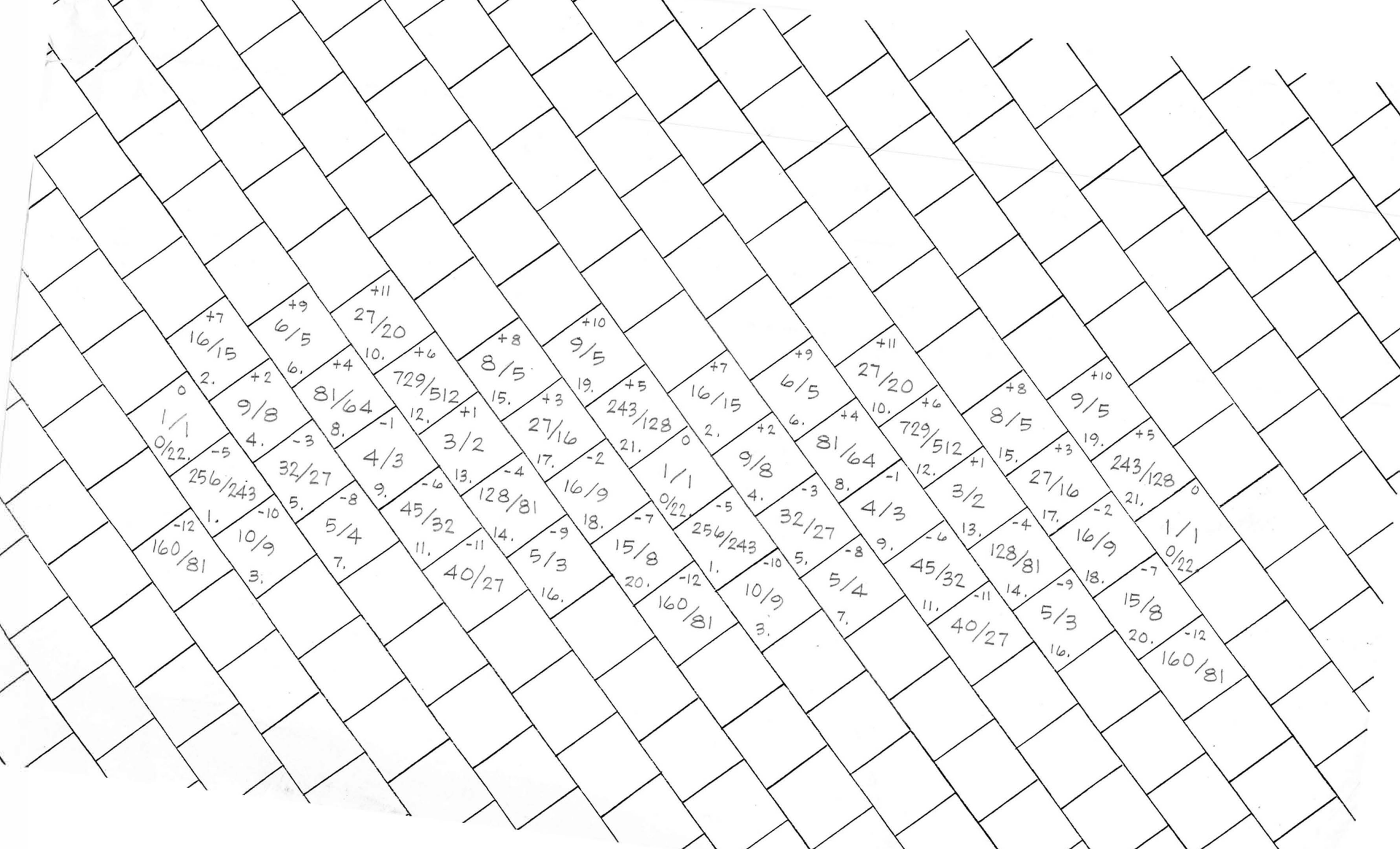

18/31 Scale on a 4/7 Gral Kbd (Bosanquet)
Using an 18.4° rotation of the Fokker Grid
© 1995 by Ervin M. Wilson


24/41 Scale on a 4/7 Gral Keyboard (Bosanquet)
Using an 18.4° rotation of the Fokker Grid
©1995 by Ervin M. Wilson



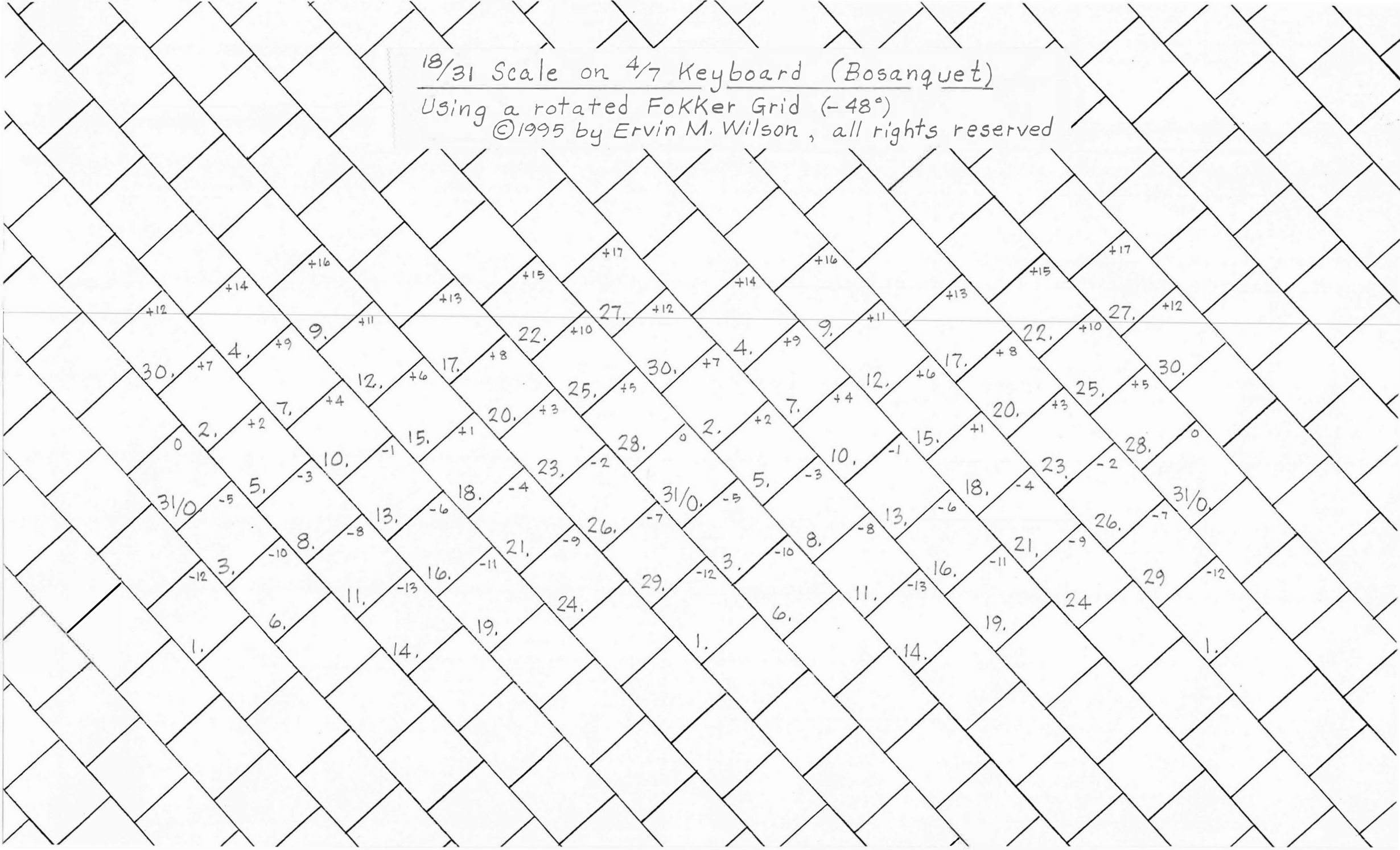
+22
+19
+20
+21
+22
+15
+16
+17
+18
+15
1.
10.
19.
28.
+11
+12
+13
+14
+11
33.
D
8.
17.
26.
33.
+8
+9
+10
+7
B
+4
6.
+5
15.
+6
24.
31.
4.
E
13.
G
22.
+3
0
+1
+2
29.
0
C
2.
11.
20.
-1
C
0/34.
-3
-2
A
27.
0/34.
-7
9.
-6
18.
-5
25.
-4
-11
7.
-10
F
16.
-9
23.
-8
32.
-11
5.
14.
21.
30.
3.
12.


+19
12/11
5.
+18
16/11
22.
+20
18/11
29.
+17
64/33
39.
+16
9/7
15.
+15
12/7
32.
+14
8/7
8.
+13
32/21
25.
+12
81/80
1.
+12
81/80
1.
+11
27/20
18.
+10
9/5 or 20/11
35.
+9
6/5
11.
+8
8/5
28.
+7
16/15
4.
+6
10/7
21.
+5
40/21
38.
+4
14/11
14.
+3
27/16
31.
0
2/1
0/41.
0
1/1
0/41.
+2
9/8
7.
+1
3/2
24.
-1
4/3
17.
-2
16/9
34.
-3
32/27
10.
-4
11/7
27.
-5
21/20
3.
-6
7/5
20.
-7
15/8
37.
-8
5/4
13.
-9
5/3
30.
-10
11/10 or 10/9
6.
-11
40/27
23.
-12
160/81
40.
-12
160/81
40.
-13
21/16
16.
-14
7/4
33.
-15
7/6
9.
-16
14/9
26.
-17
33/32
2.
-18
11/8
19.
-19
11/6
36.
-20
11/9
12.


0
1/1
0/22.
+7
16/15
2.
+2
9/8
4.
-5
256/243
1.
-10
10/9
3.
-12
160/81
+9
6/5
6.
-3
32/27
5.
+4
81/64
8.
-8
5/4
7.
-1
4/3
9.
+11
27/20
10.
-6
45/32
11.
+6
729/512
12.
-11
40/27
+1
3/2
13.
+8
8/5
15.
-4
128/81
14.
+3
27/16
17.
-9
5/3
16.
+10
9/5
19.
-2
16/9
18.
+5
243/128
21.
-7
15/8
20.

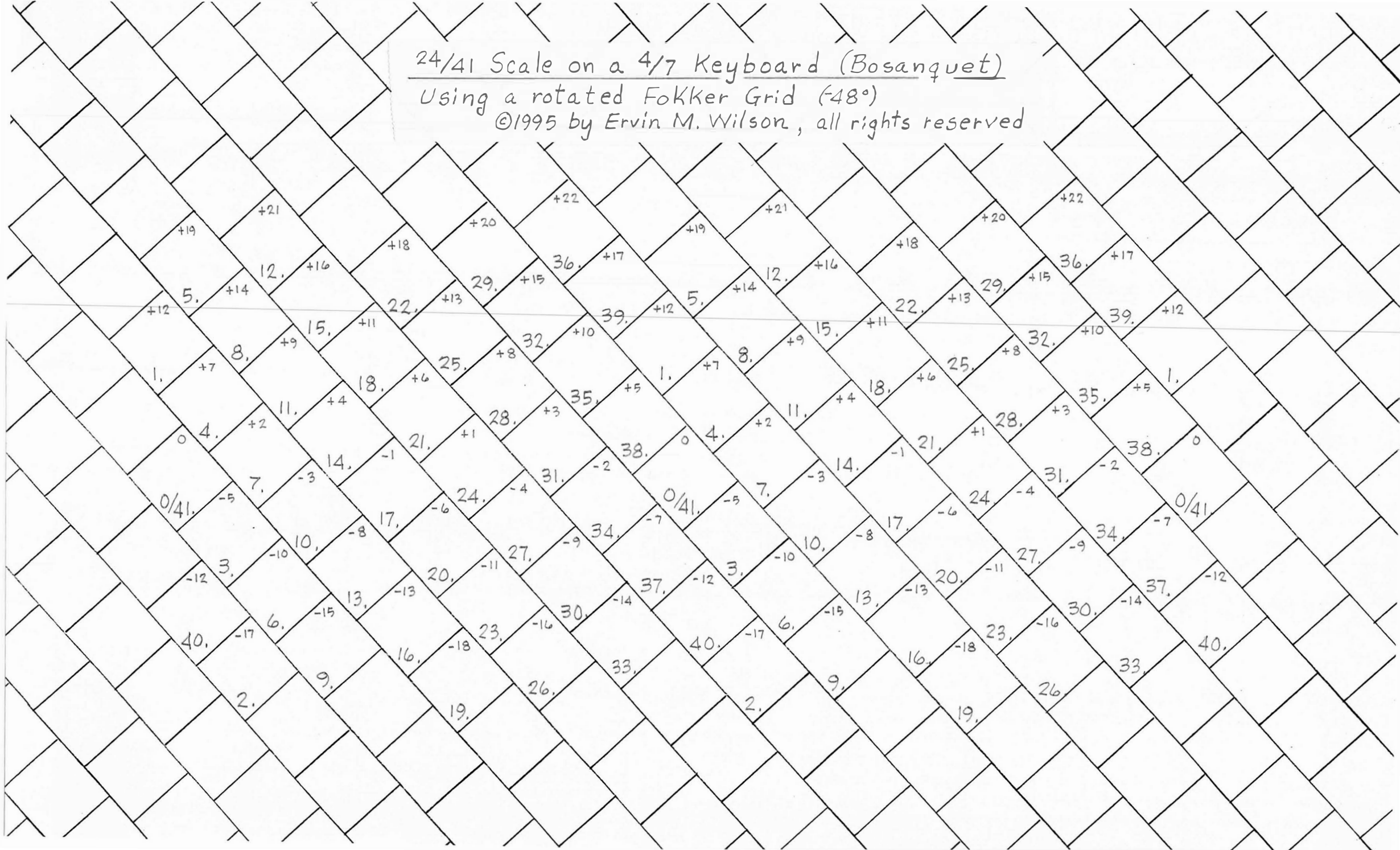
18/31 Scale on 4/7 Keyboard (Bosanquet)

Using a rotated Fokker Grid (-48°)



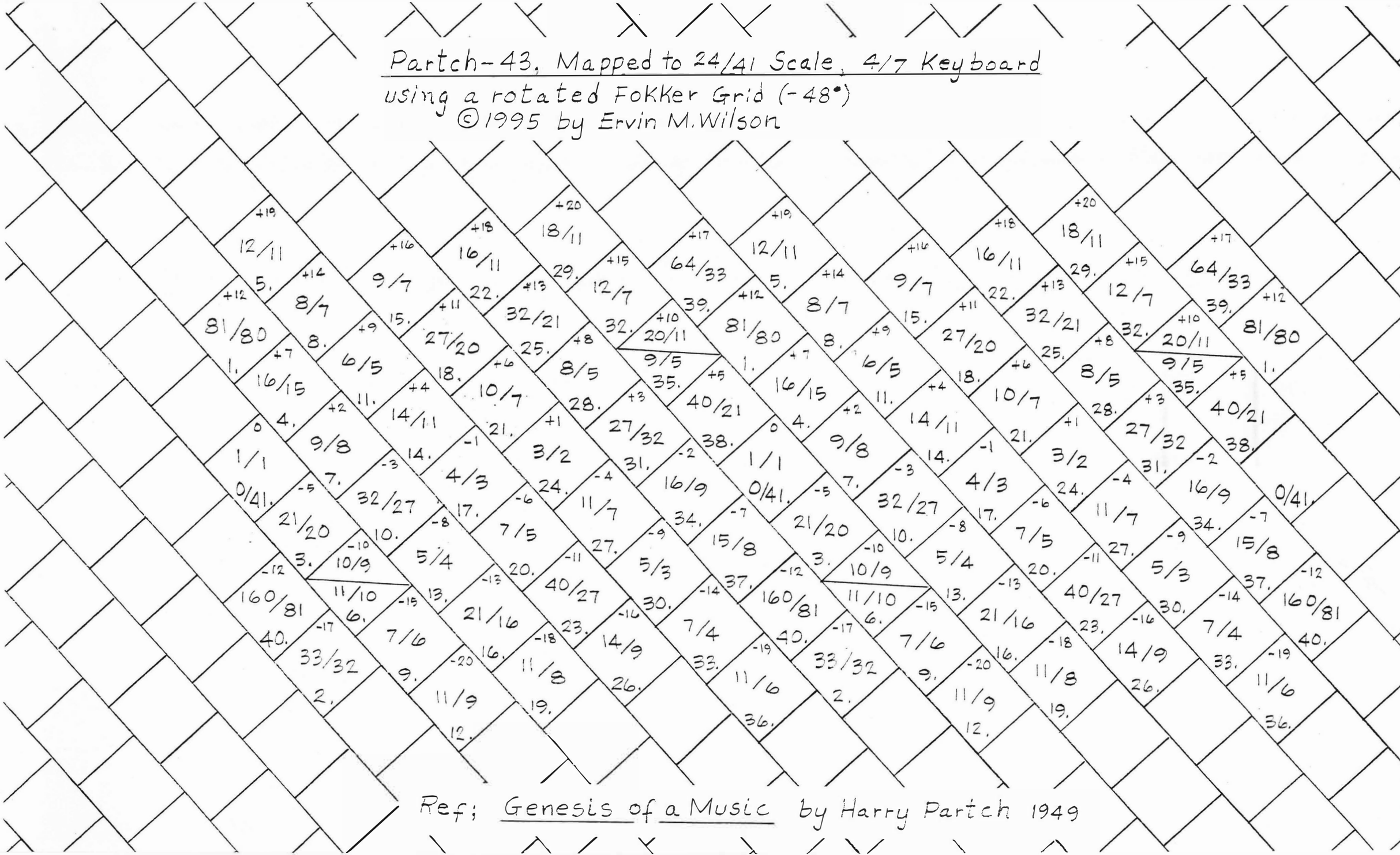
24/41 Scale on a 4/7 Keyboard (Bosanquet)

Using a rotated FoKKer Grid (-48°)



Partch-43. Mapped to 24/41 Scale, 4/7 Keyboard

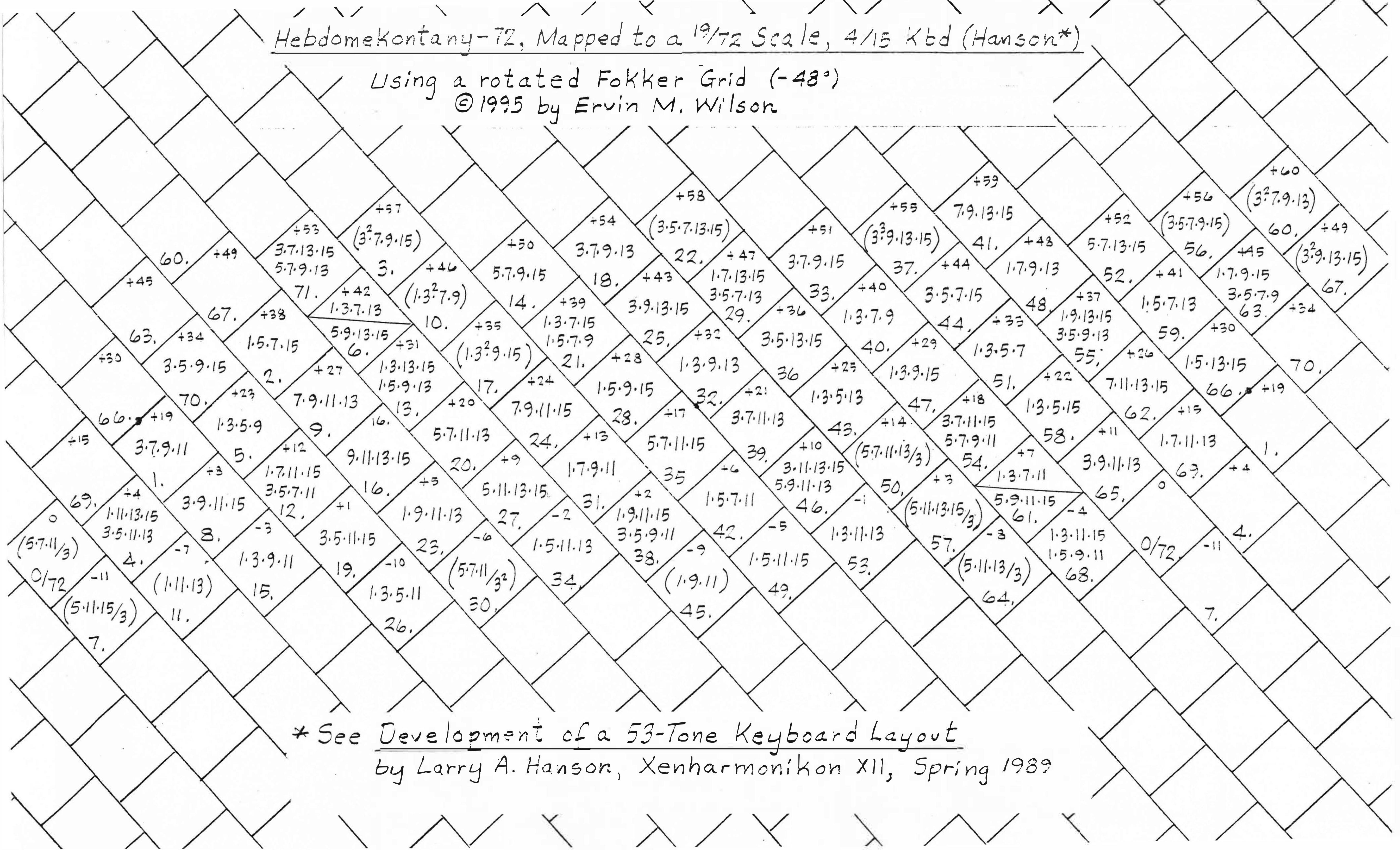
using a rotated Fokker Grid (-48°)



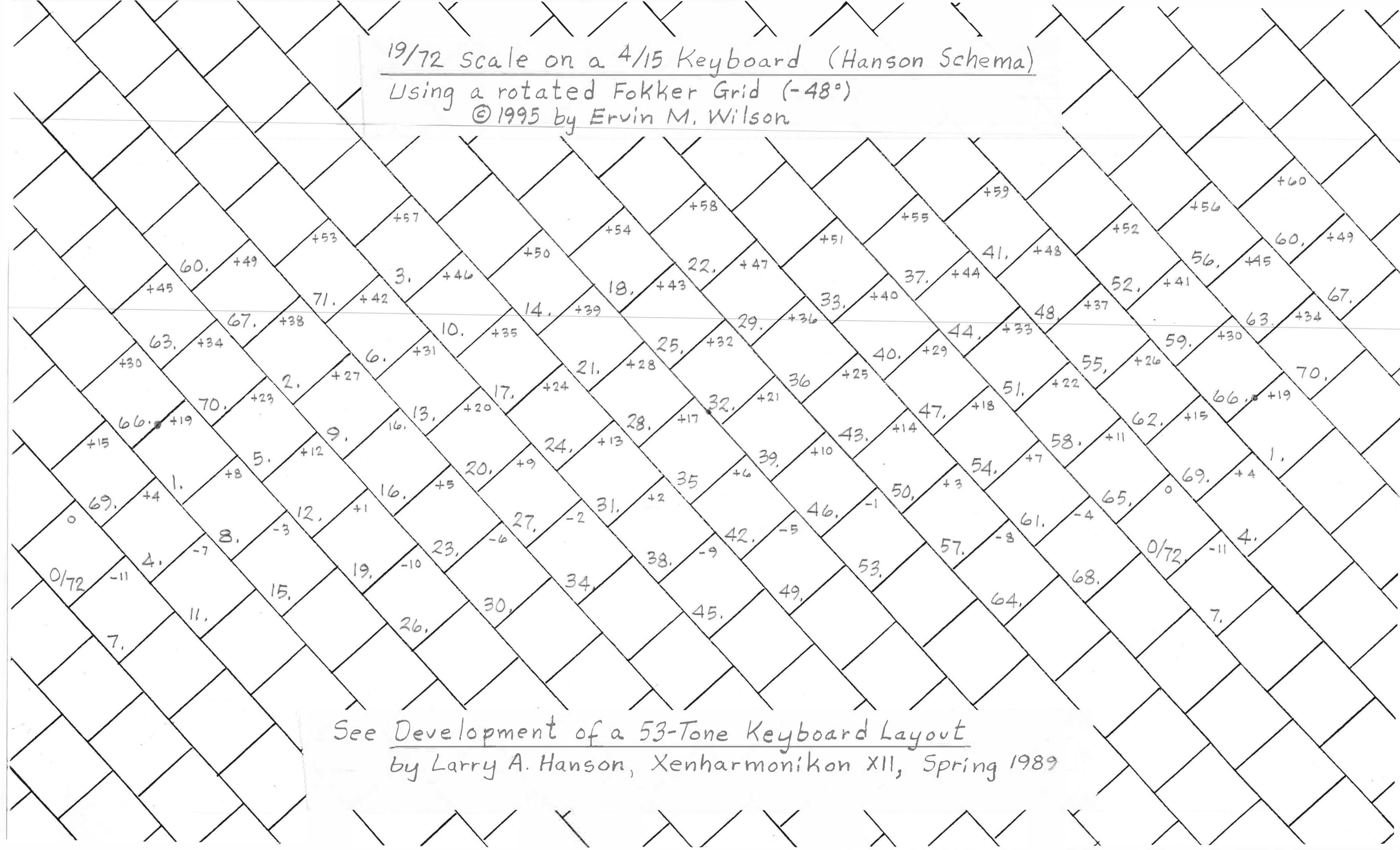
Ref; Genesis of a Music by Harry Partch 1949

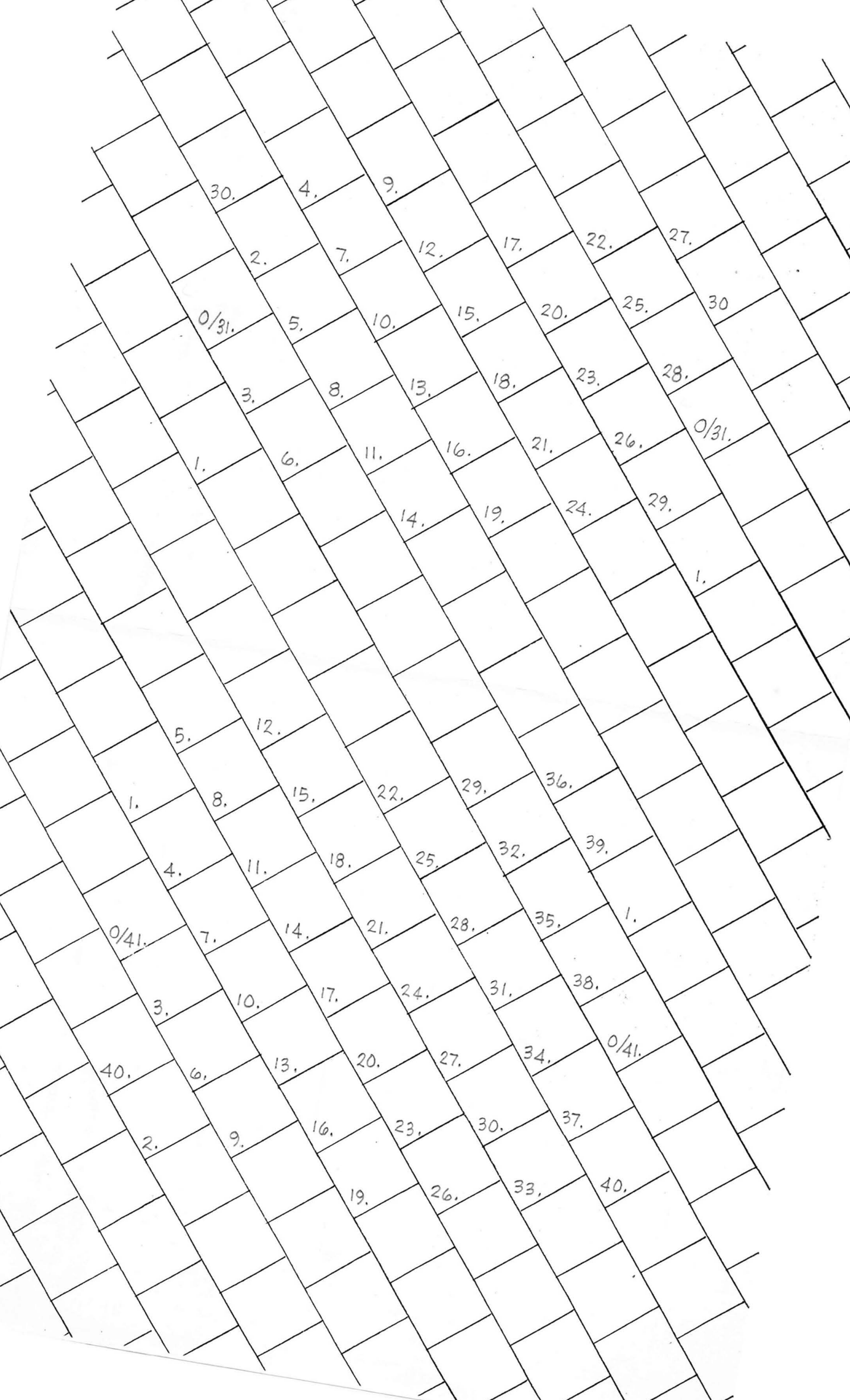
Hebdomekontany-72, Mapped to a 19/72 Scale, 4/15 Kbd (Hanson*)

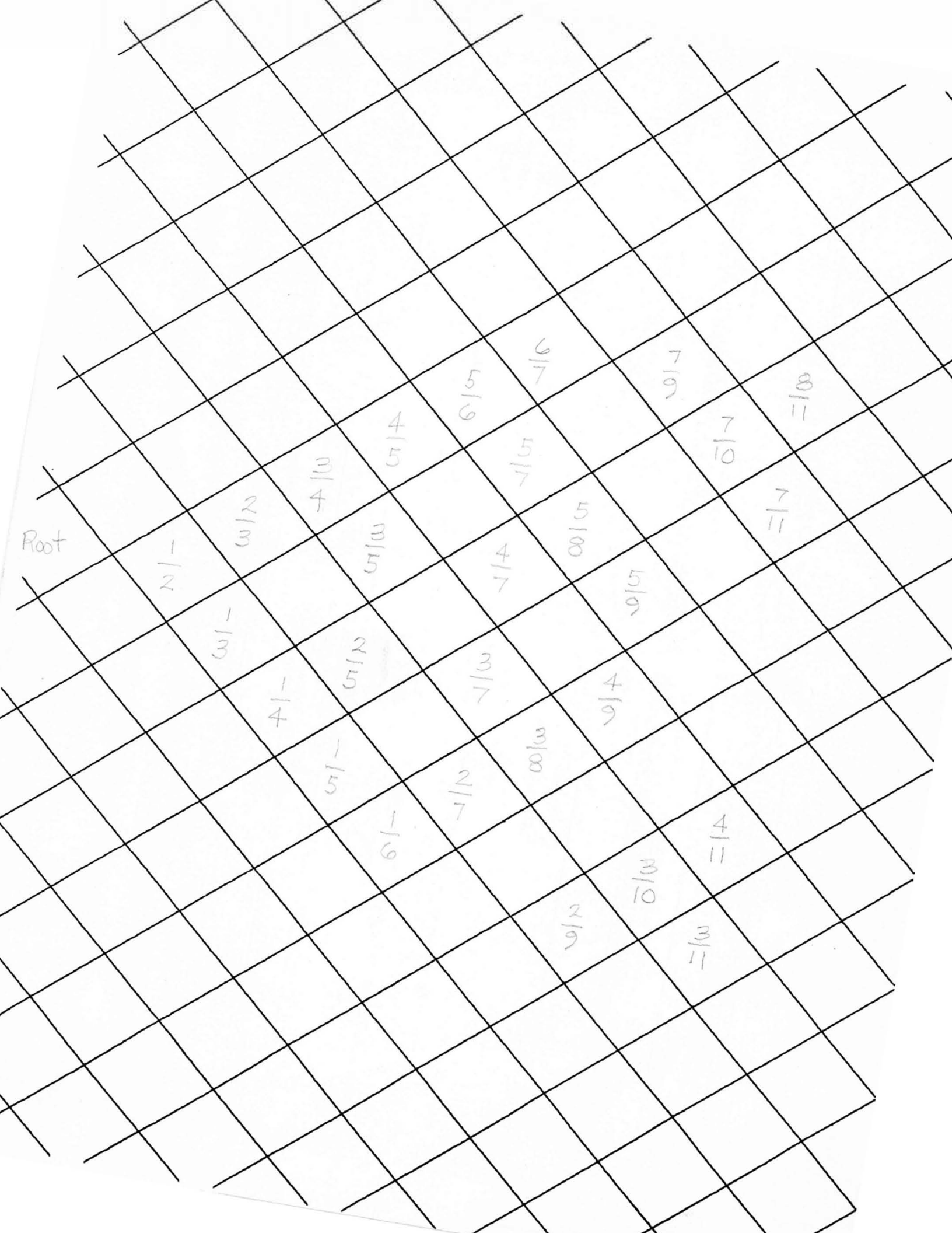
Using a rotated Fokker Grid (-48°)
© 1995 by Ervin M. Wilson

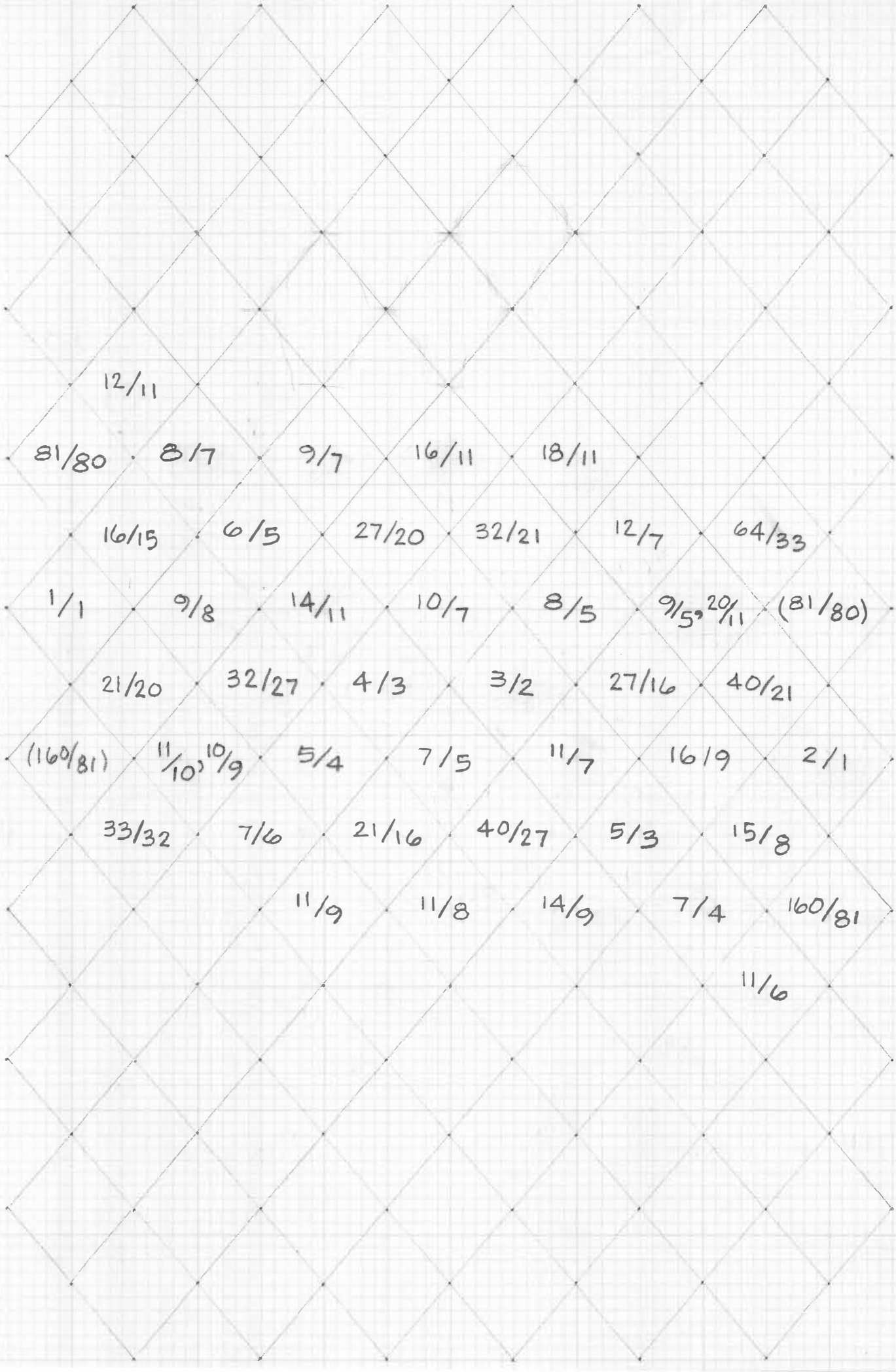


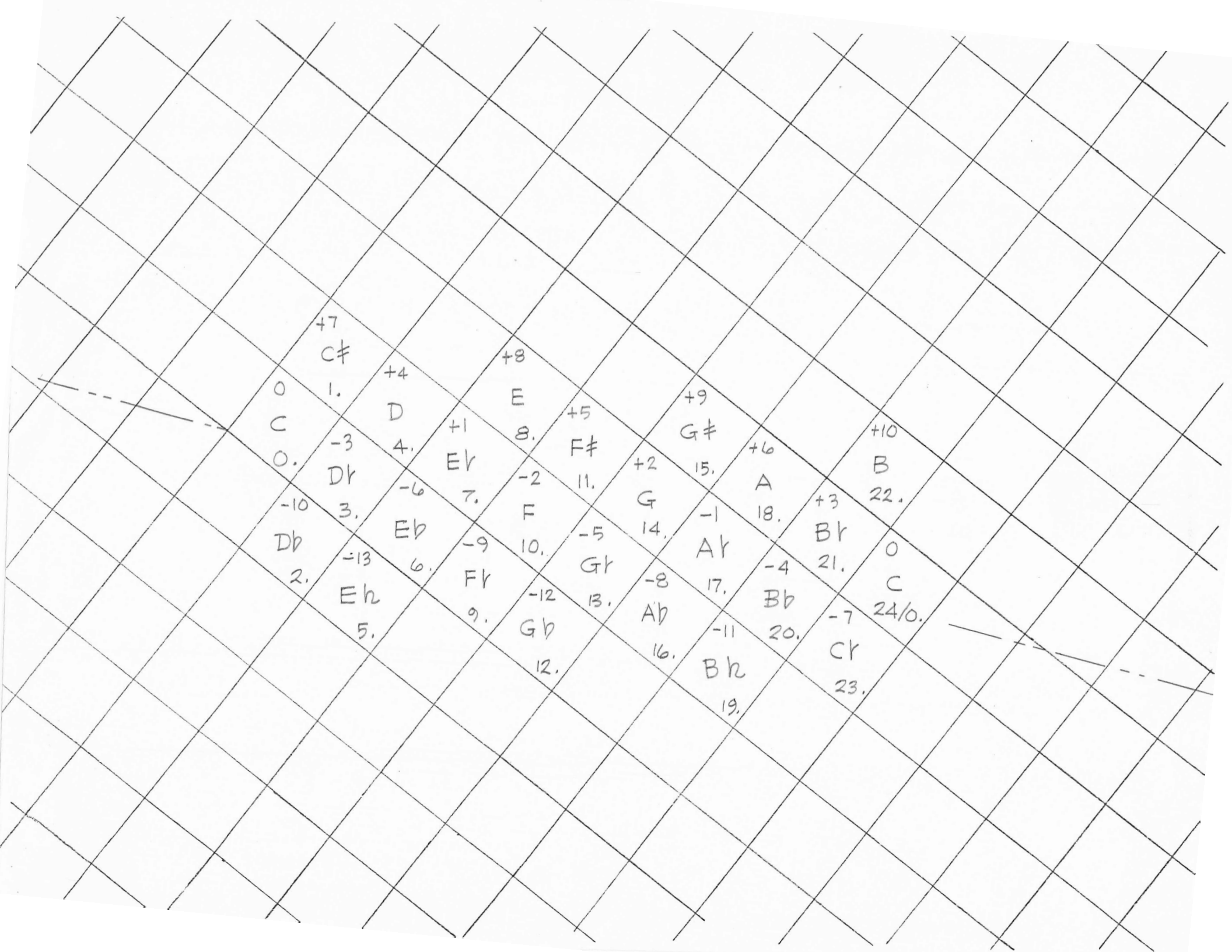
* See Development of a 53-Tone Keyboard Layout
by Larry A. Hanson, Xenharmonikon XII, Spring 1989

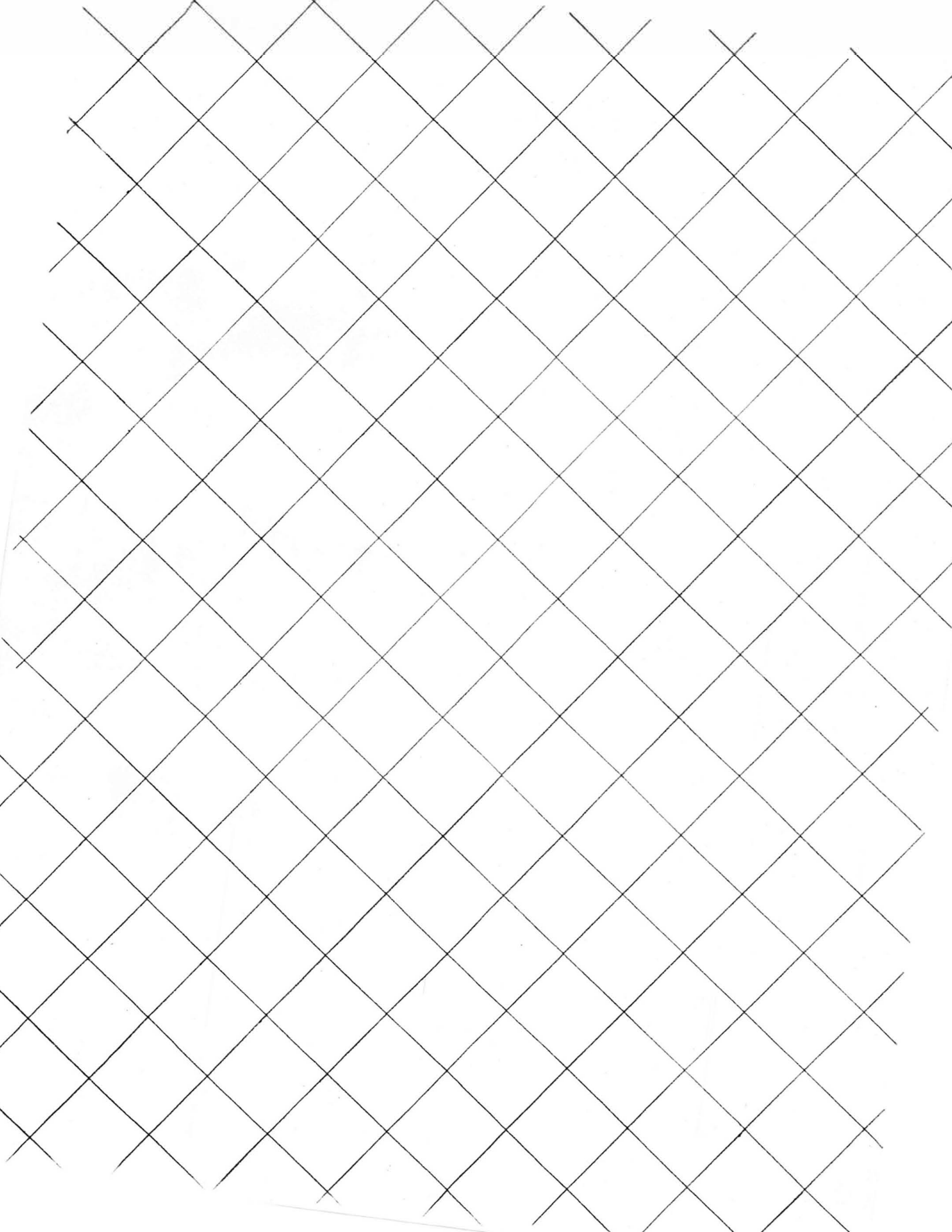

19/72 Scale on a 4/15 Keyboard (Hanson Schema)
Using a rotated Fokker Grid (-48°)
© 1995 by Ervin M. Wilson
0/72
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.
37.
38.
39.
40.
41.
42.
43.
44.
45.
46.
47.
48.
49.
50.
51.
52.
53.
54.
55.
56.
57.
58.
59.
60.
61.
62.
63.
64.
65.
66.
67.
68.
69.
70.
71.
See Development of a 53-Tone Keyboard Layout
by Larry A. Hanson, Xenharmonikon XII, Spring 1989

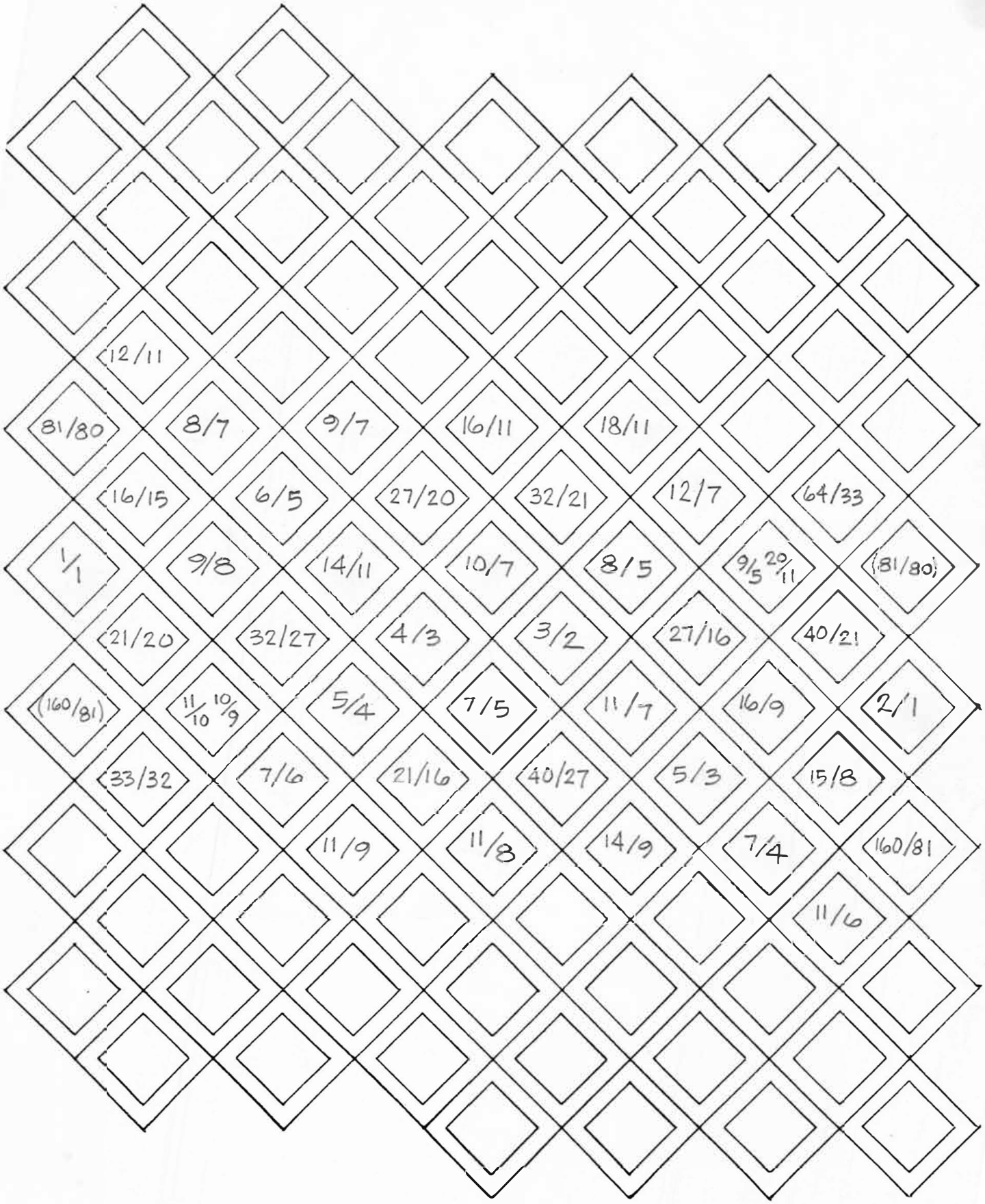

30.
4.
9.
2.
7.
12.
17.
22.
27.
0/31.
5.
10.
15.
20.
25.
30
3.
8.
13.
18.
23.
28.
1.
6.
11.
16.
21.
26.
0/31.
14.
19.
24.
29.
1.
5.
12.
1.
8.
15.
22.
29.
36.
4.
11.
18.
25.
32.
39.
0/41.
7.
14.
21.
28.
35.
1.
3.
10.
17.
24.
31.
38.
40.
6.
13.
20.
27.
34.
0/41.
2.
9.
16.
23.
30.
37.
19.
26.
33.
40.


Root
1/2
2/3
3/4
4/5
5/6
6/7
7/9
8/11
1/3
2/5
3/7
4/9
5/9
1/4
1/5
2/7
3/8
1/6
4/11
3/10
2/9
3/11
5/8
4/7
7/10
7/11


12/11
81/80 8/7 9/7 16/11 18/11
16/15 6/5 27/20 32/21 12/7 64/33
1/1 9/8 14/11 10/7 8/5 9/5, 20/11 (81/80)
21/20 32/27 4/3 3/2 27/16 40/21
(160/81) 11/10, 10/9 5/4 7/5 11/7 16/9 2/1
33/32 7/6 21/16 40/27 5/3 15/8
11/9 11/8 14/9 7/4 160/81
11/6


0
C
0.
+7
C♯
1.
-3
D♭
3.
-10
D♭
2.
+4
D
4.
-6
E♭
6.
-13
E♮
5.
+1
E♭
7.
-9
F♭
9.
+8
E
8.
-2
F
10.
-12
G♭
12.
+5
F♯
11.
-5
G♭
13.
+2
G
14.
-8
A♭
16.
+9
G♯
15.
-1
A♭
17.
-11
B♮
19.
+6
A
18.
-4
B♭
20.
+3
B♭
21.
-7
C♭
23.
+10
B
22.
0
C
24/0.




12/11
81/80
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9/8
14/11
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9/5 20/11
(81/80)
21/20
32/27
4/3
3/2
27/16
40/21
(160/81)
11/10 10/9
5/4
7/5
11/7
16/9
2/1
33/32
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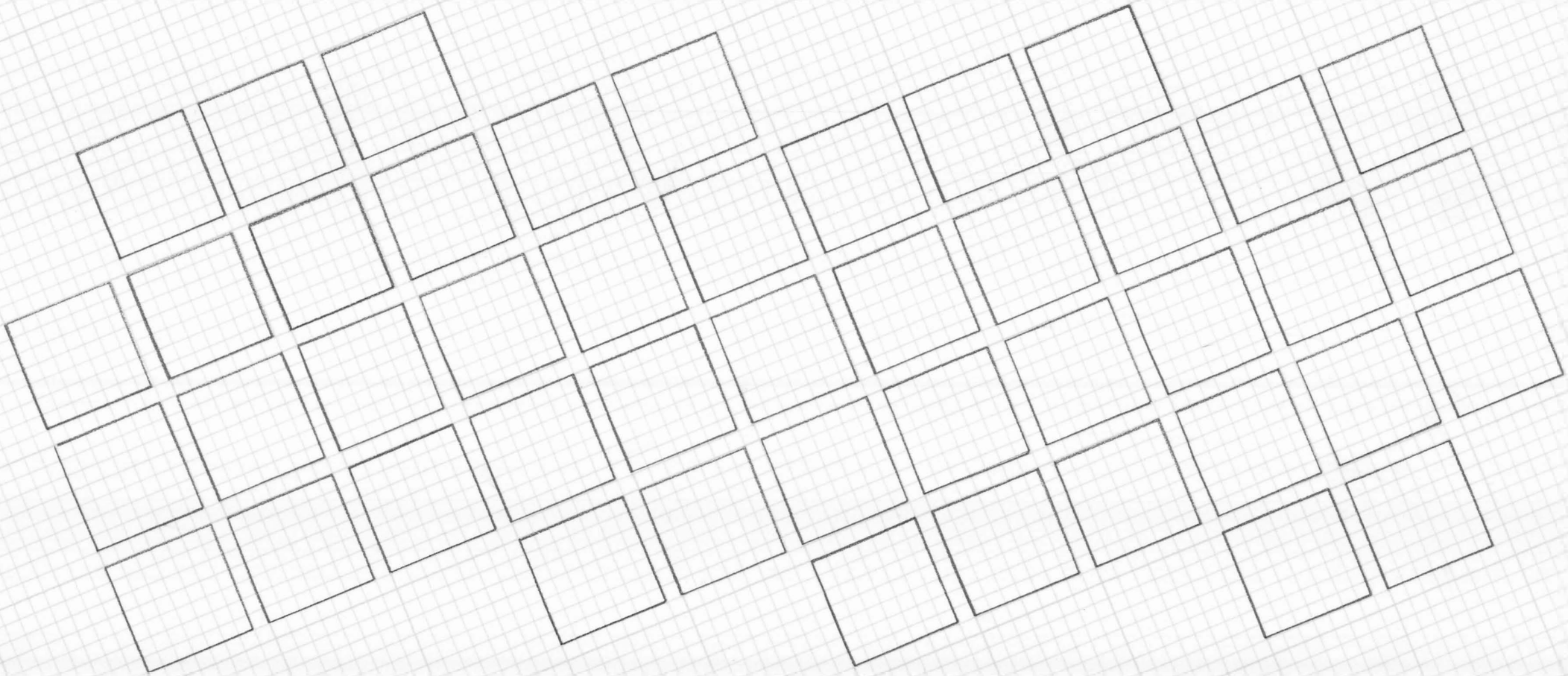
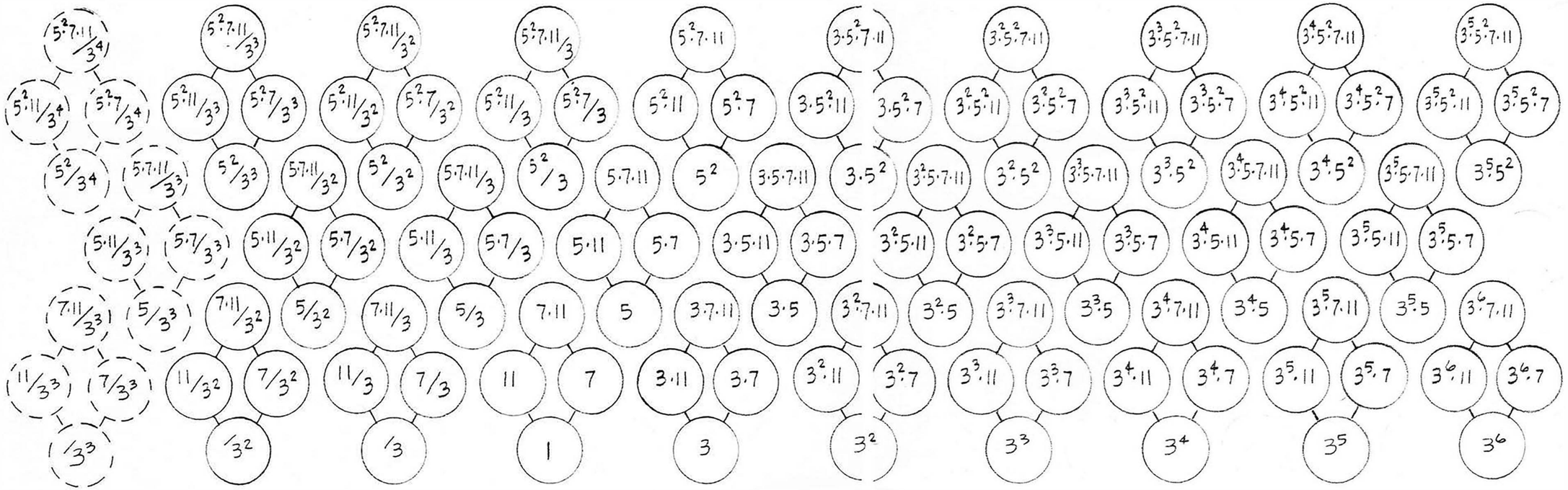
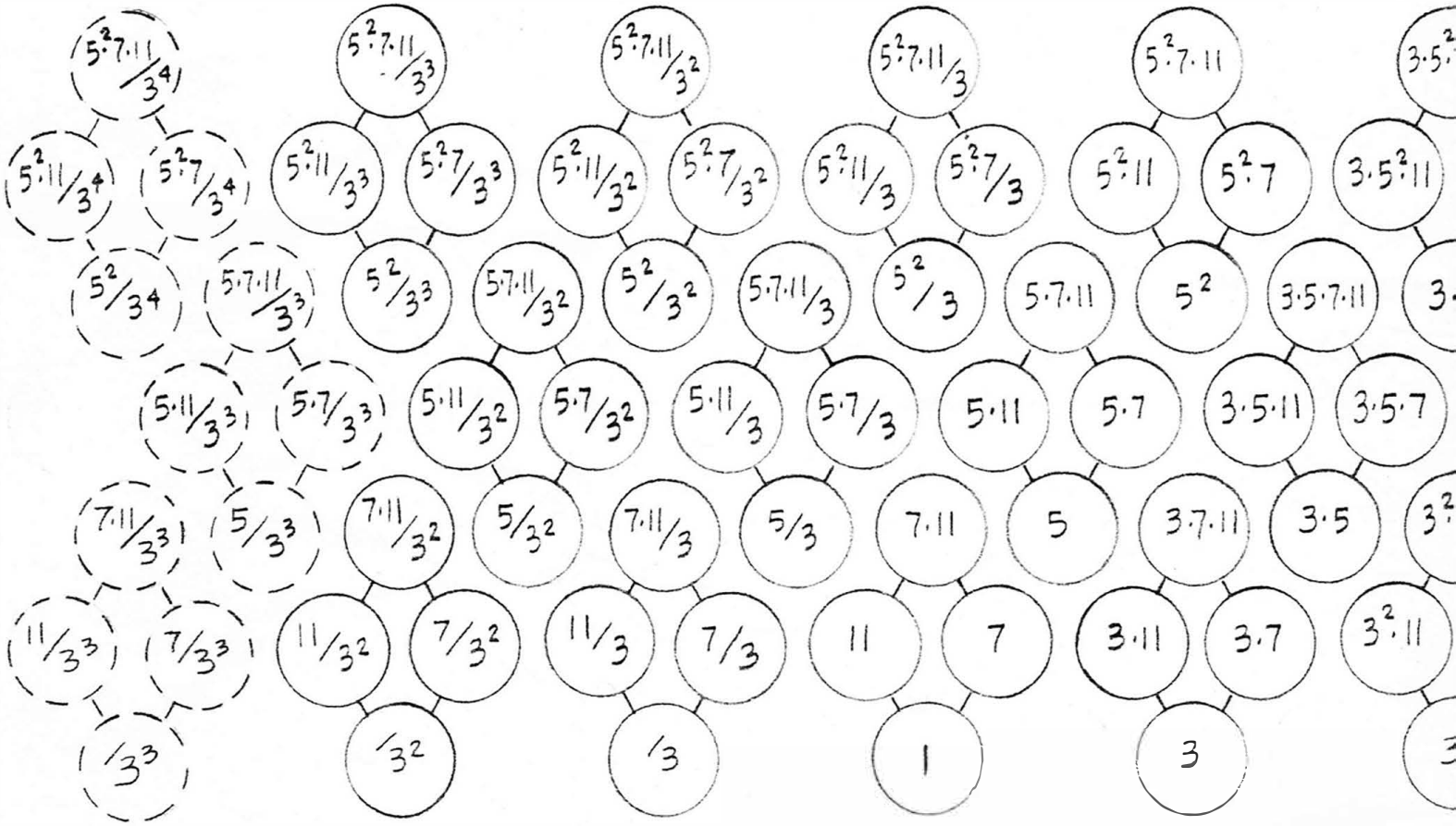
15/8
11/9
11/8
14/9
7/4
160/81
11/6





"HELEN"


$5^2 \cdot 7 \cdot 11 / 3^4$
$5^2 \cdot 7 \cdot 11 / 3^3$
$5^2 \cdot 7 \cdot 11 / 3^2$
$5^2 \cdot 7 \cdot 11 / 3$
$5^2 \cdot 7 \cdot 11$
$3 \cdot 5^2$
$5^2 \cdot 11 / 3^4$
$5^2 \cdot 7 / 3^4$
$5^2 \cdot 11 / 3^3$
$5^2 \cdot 7 / 3^3$
$5^2 \cdot 11 / 3^2$
$5^2 \cdot 7 / 3^2$
$5^2 \cdot 11 / 3$
$5^2 \cdot 7 / 3$
$5^2 \cdot 11$
$5^2 \cdot 7$
$3 \cdot 5^2 \cdot 11$
$5^2 / 3^4$
$5 \cdot 7 \cdot 11 / 3^3$
$5^2 / 3^3$
$5 \cdot 7 \cdot 11 / 3^2$
$5^2 / 3^2$
$5 \cdot 7 \cdot 11 / 3$
$5^2 / 3$
$5 \cdot 7 \cdot 11$
5^2
$3 \cdot 5 \cdot 7 \cdot 11$
$5 \cdot 11 / 3^3$
$5 \cdot 7 / 3^3$
$5 \cdot 11 / 3^2$
$5 \cdot 7 / 3^2$
$5 \cdot 11 / 3$
$5 \cdot 7 / 3$
$5 \cdot 11$
$5 \cdot 7$
$3 \cdot 5 \cdot 11$
$3 \cdot 5 \cdot 7$
$7 \cdot 11 / 3^3$
$5 / 3^3$
$7 \cdot 11 / 3^2$
$5 / 3^2$
$7 \cdot 11 / 3$
$5 / 3$
$7 \cdot 11$
5
$3 \cdot 7 \cdot 11$
$3 \cdot 5$
$11 / 3^3$
$7 / 3^3$
$11 / 3^2$
$7 / 3^2$
$11 / 3$
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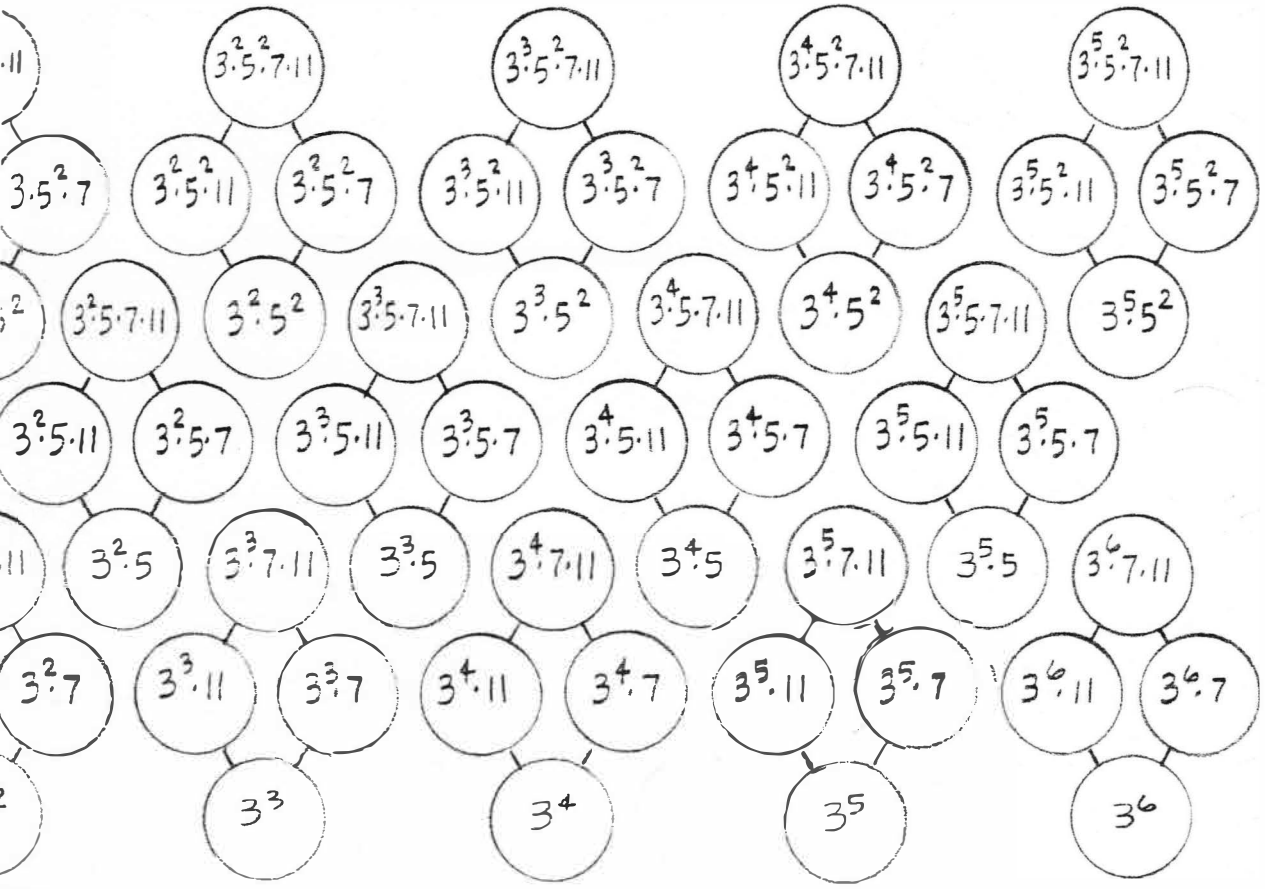
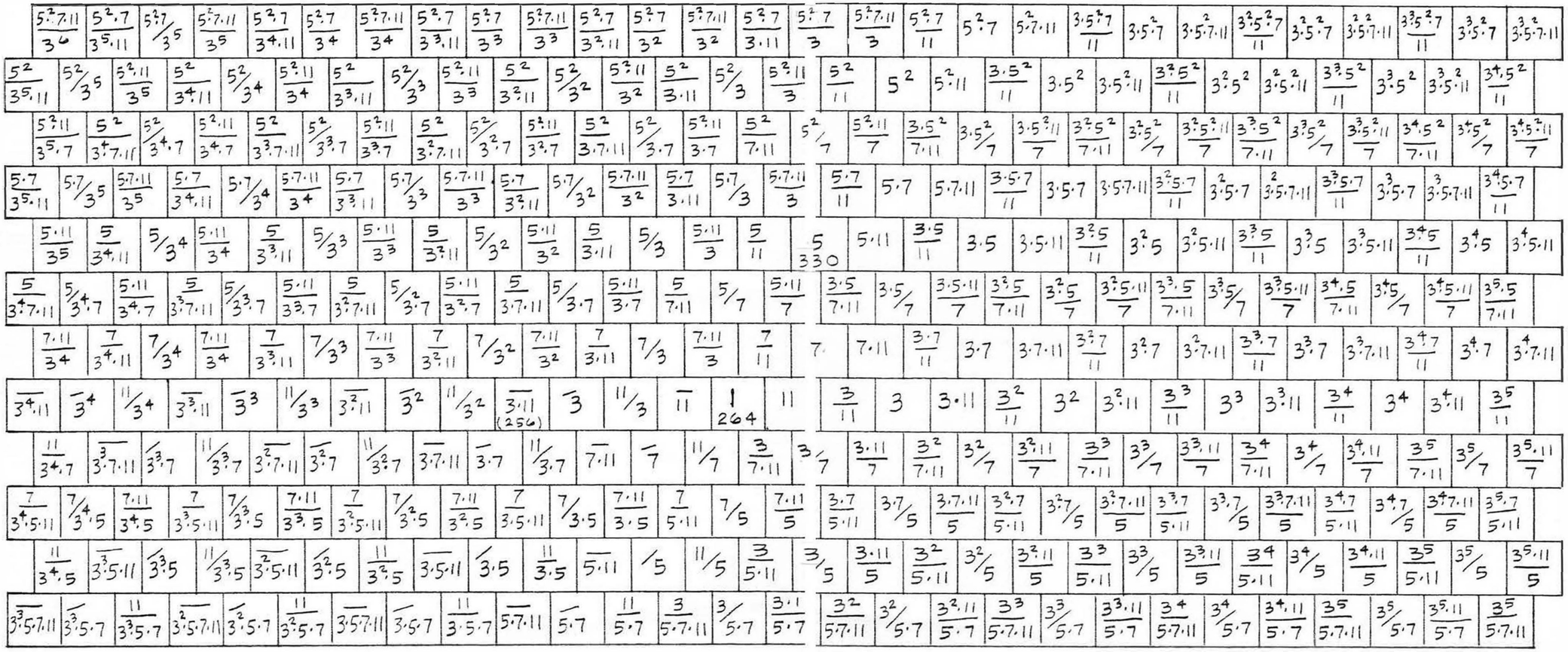
11
7
$3 \cdot 11$
$3 \cdot 7$
$3^2 \cdot 11$
$1 / 3^3$
$1 / 3^2$
$1 / 3$
1
3

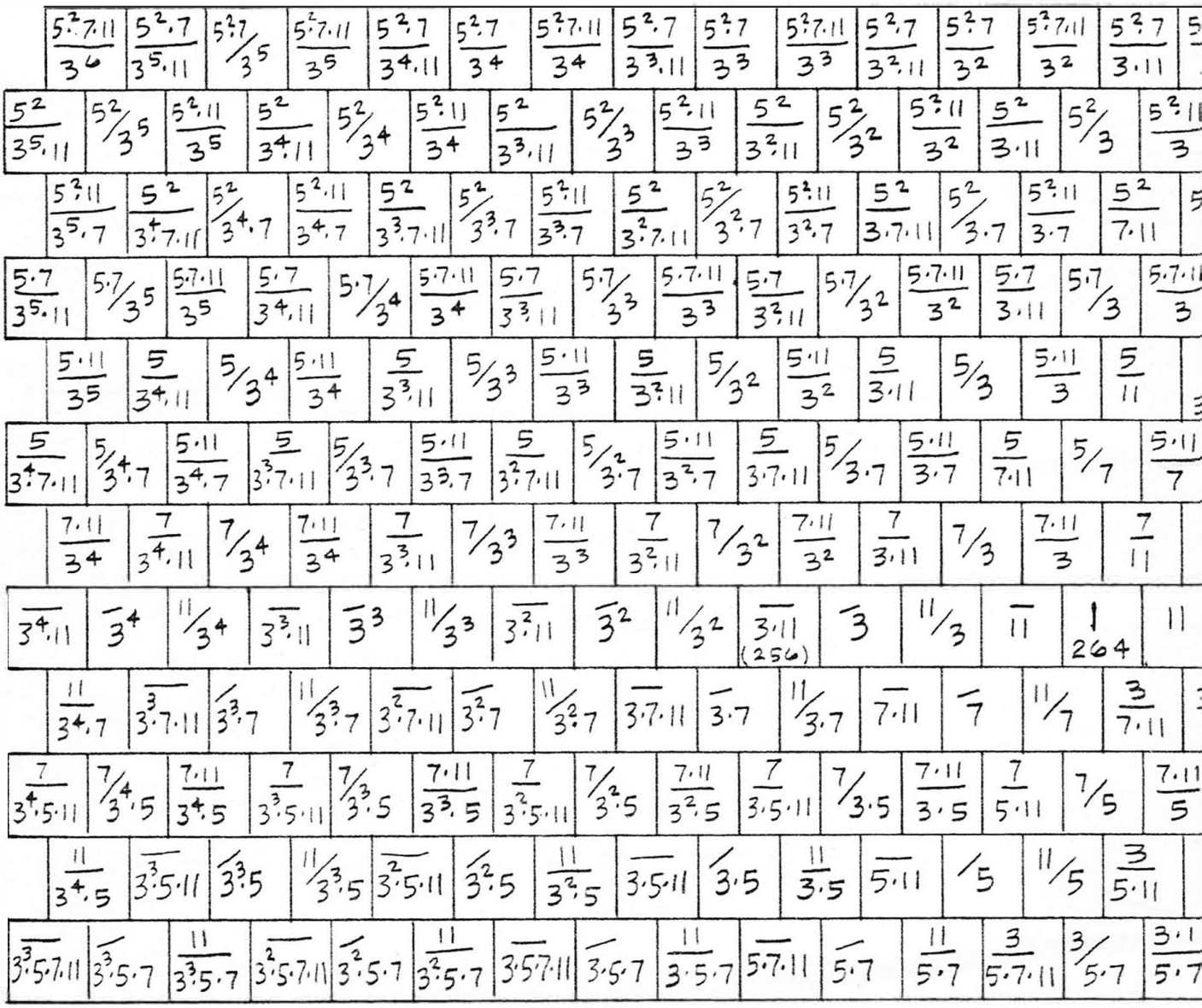


"HELEN"

"KRISTOFER TWO"

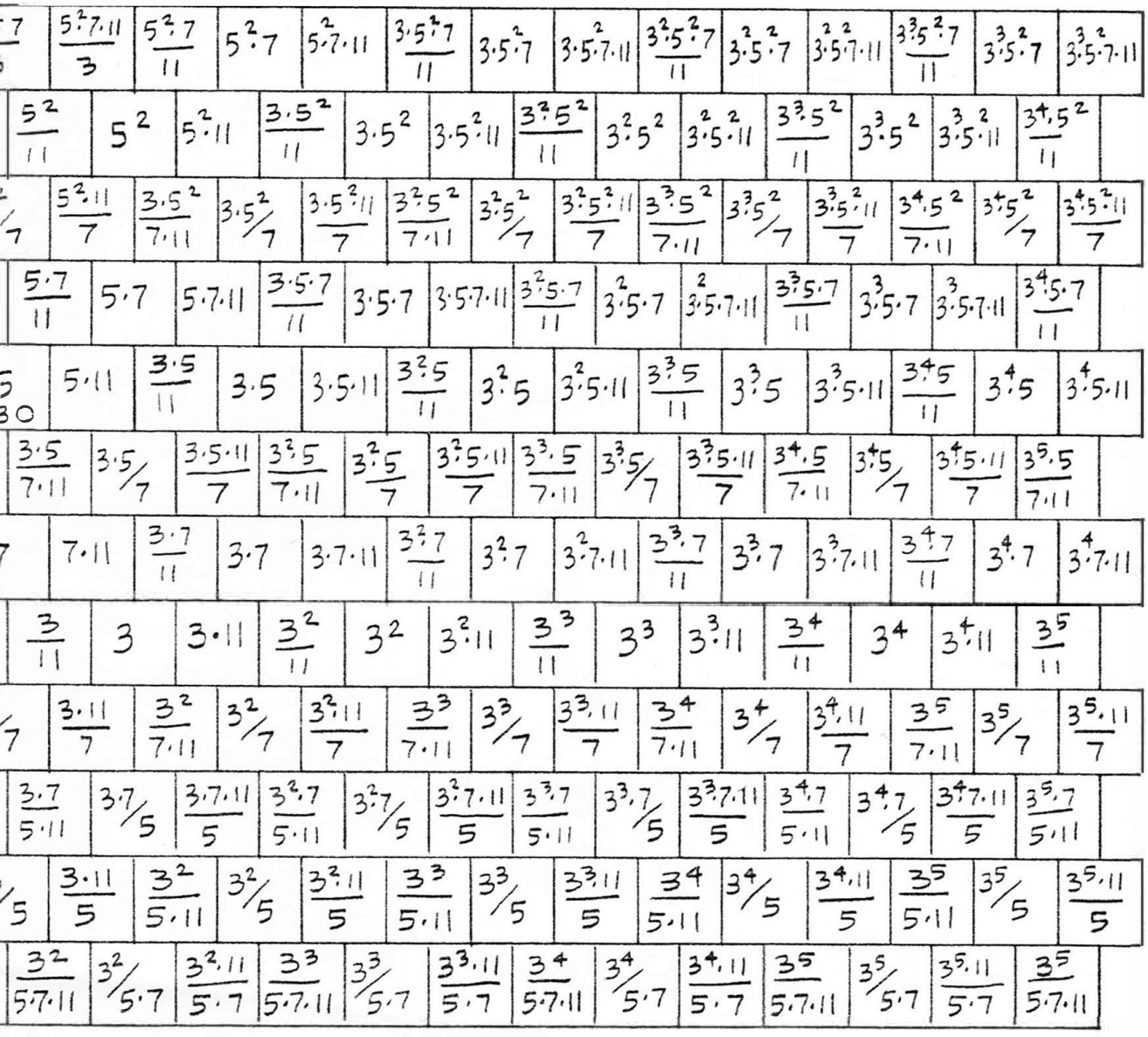


"KRISTOFER

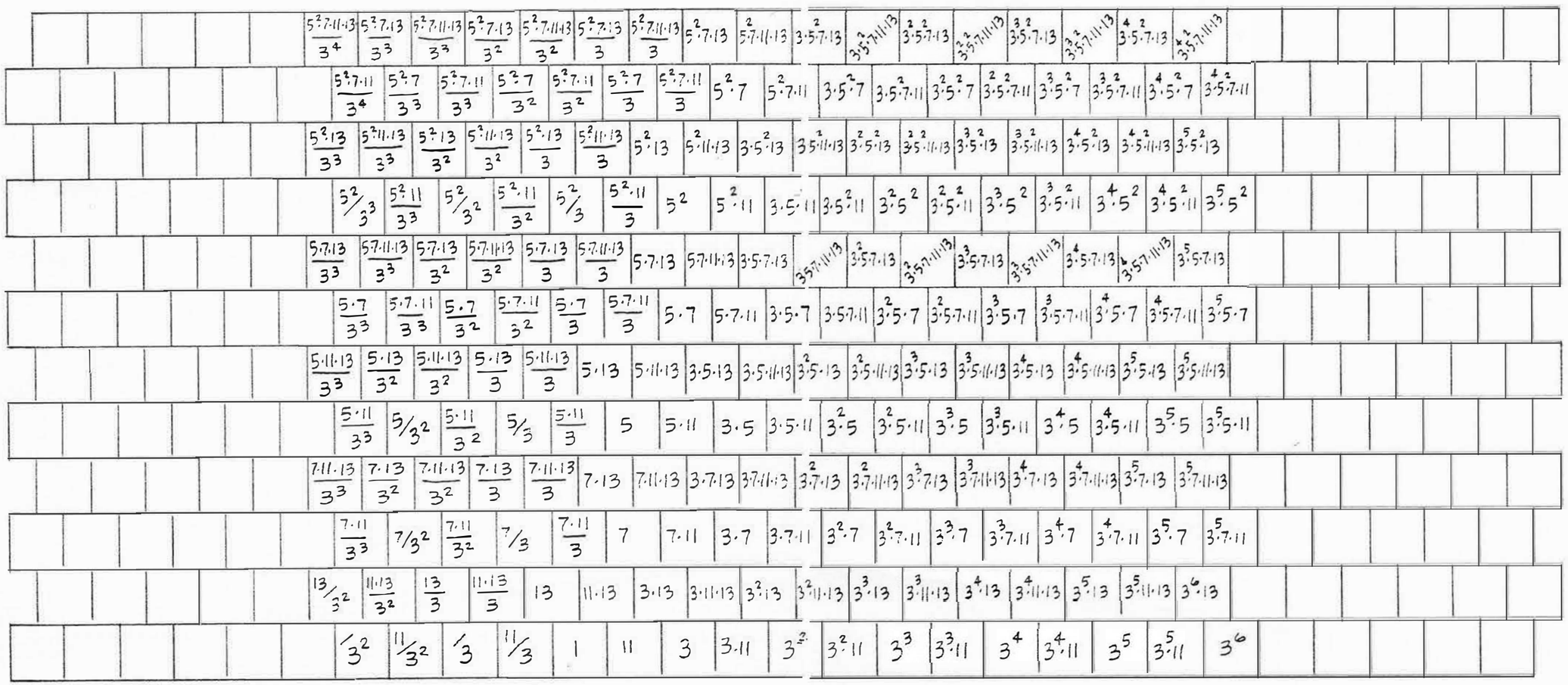


Two"

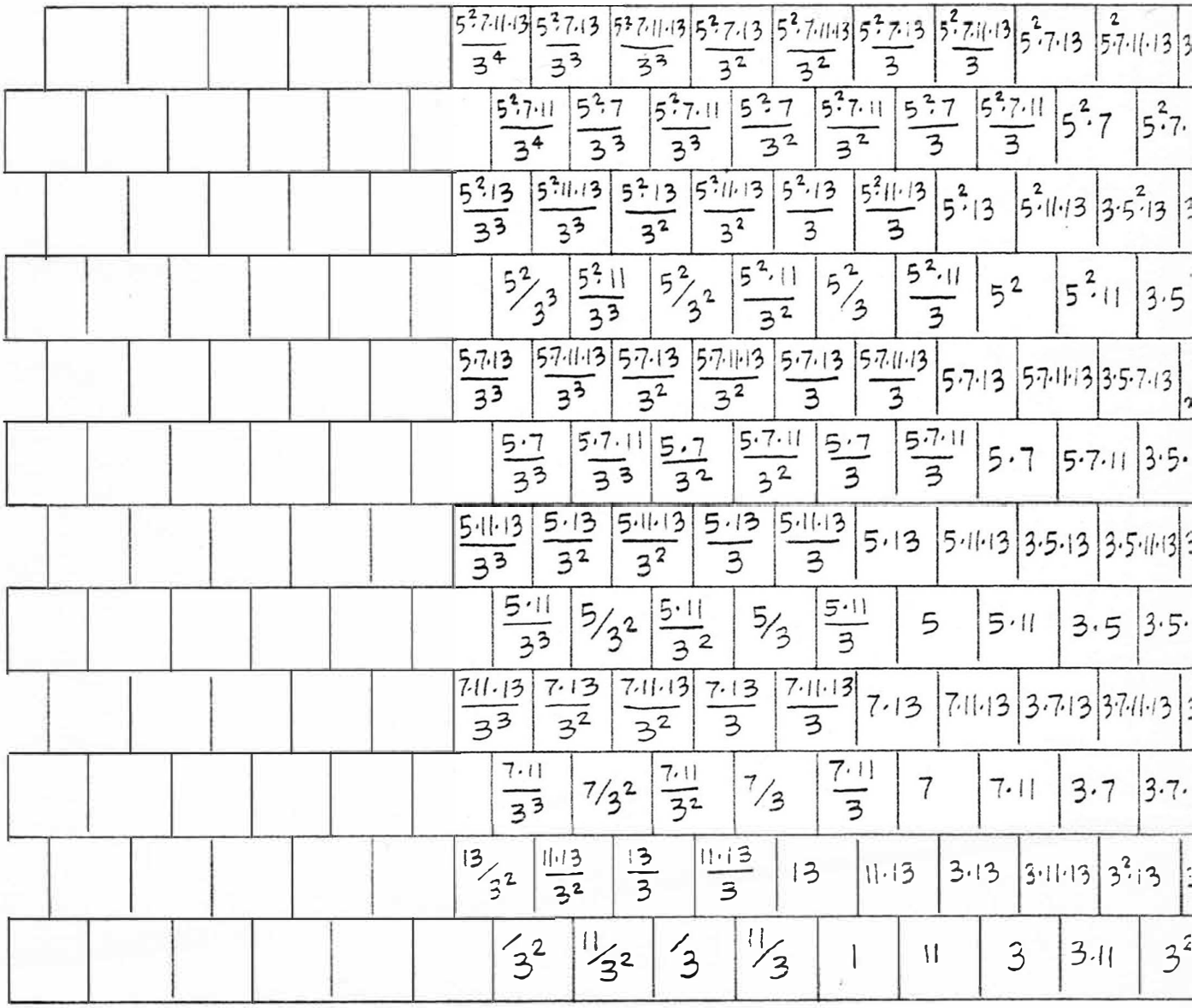
wilson



"LEILA" modulation matrix



"LEILA" modu



lation matrix

v Wilson