Feb. 18, 1941. A. FICKÉNSCHER 2,232,600

POLYTONE KEYBOARD

Filed April 29, 1940 2 Sheets-Sheet 1

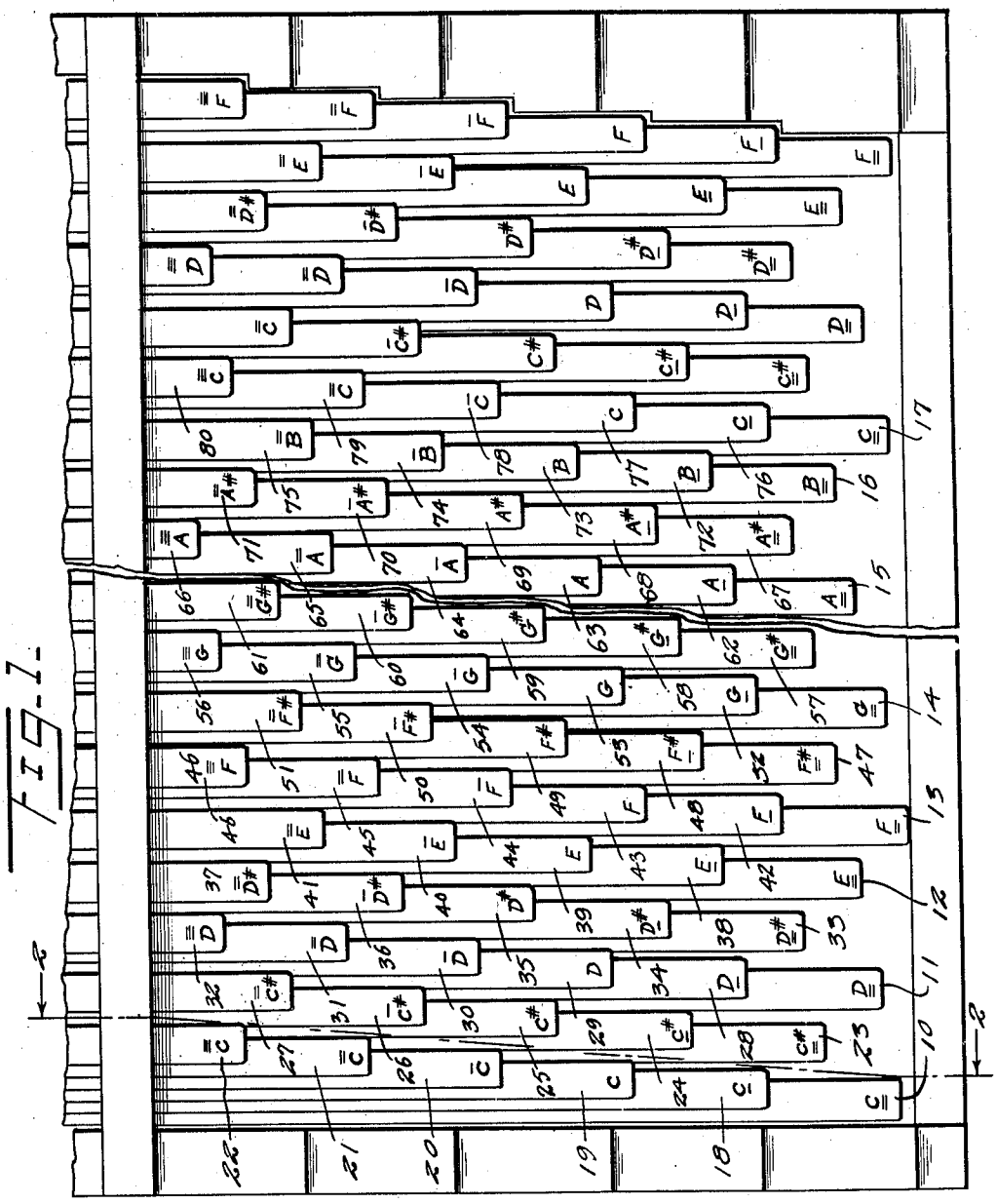


FIG. 1.

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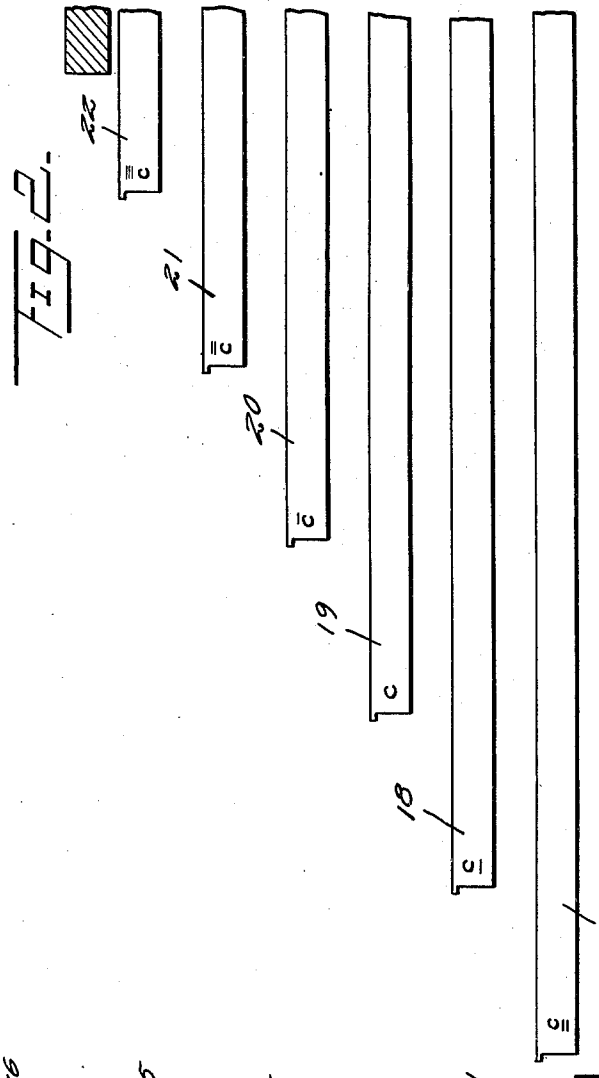


Fig. 2.

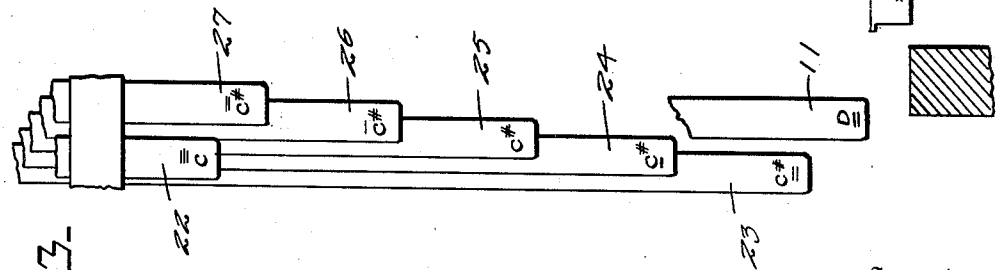


Fig. 3.

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UNITED STATES PATENT OFFICE

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POLYTONE KEYBOARD

Arthur Fickénscher, Charlottesville, Va.

Application April 29, 1940, Serial No. 332,377

3 Claims. (Cl. 84—451)

This invention relates to musical instruments embodying a keyboard such as a piano, organ or like instrument with a more complete harmonic extension than those with the conventional twelve tones to the octave.

It is an object of this invention to provide a keyboard for any instrument which is capable of being tuned practically to a laboratory purity and wherein each octave may be broken up into any desired number of tone fractions.

Another object of this invention is to provide a keyboard which is so arranged that the keys of each tone fraction are arranged in a horizontal plane and are offset laterally from a preceding tone.

A further object of this invention is to provide a keyboard wherein the keys are arranged in stepped relation, tiers or banks, with a succeeding key of the same lettered but differently marked intonations offset from a preceding key, and with one (or more) upper keys of one lettered tier being disposed in alinement with one (or more) of the lower keys of the higher lettered tier. The keys in alinement front to back are at the distance from each other of four (4) and five-twelfth ($\frac{5}{12}$) key lengths and the tonal value of the note represented by the uppermost key (the one farthest back) is equal to, or, according to the system of tuning used, substantially equal to the tonal value of the note represented by the lower key (the one farther to the front) on the next lettered tier.

A still further object of this invention is to provide a stepped keyboard arrangement wherein the keys are arranged in groups in each octave with succeeding keys of each group disposed in the same horizontal plane with the other keys but with the forward edge of a succeeding key offset rearwardly from a preceding key of the same group.

A further object of this invention is to provide a systematic arrangement of keys in a keyboard which are designed for the playing of any musical instrument in practically pure intonation when the instrument is properly connected to the keyboard.

Embodying the aims aforesaid and others which may be hereinafter referred to, the invention consists of the novel construction, combination and arrangement of parts as will be more specifically described and illustrated in the accompanying drawings wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawings:

Figure 1 is a fragmentary top plan of the keyboard of an instrument embodying my invention.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a fragmentary top plan of one row of keys embodied in this invention.

In the tuning of a musical instrument such as the piano, as an example, if a sufficient number of strings or other tonal elements are provided any number of intervals in the octave may be procured. Various systems have been suggested. If practically pure intonation is to be achieved not less than fifty-three (53) tones to the octave should be employed. However, the polytone keyboard can be used for a division which is less than the aforementioned 53 tones to the octave, and for any desired extension over and beyond the 53 tones. At the present time the piano, organ or like instruments embody keys for the playing of so-called whole and half step intervals. It is not the intention of my polytone keyboard to provide for these tempered intervals; but it is designed for the playing of various whole-steps such as ratios 7:8, 8:9, 9:10, etc., and also any number of so-called half-steps, diatonic, chromatic, intermediate and others; also closer intervals which are too close to be classified as half-steps. The closeness of intervals playable would only be determined by the extension of the banks of keys.

In order, therefore, to provide a systematic keyboard arrangement, I have provided a keyboard which is repeated or duplicated for each octave, the drawing showing in Figure 1 slightly in excess of one octave; but it will be understood that the number of octaves embodying this arrangement will depend upon the size of the instrument. It will also be understood that the number of rows or banks of keys will depend upon the number of tones which are desired, or extensions for convenience in handling the instrument.

The lines above and below the letters indicating the keys are used in accordance with Helmholtz intonation designations.

Referring first to Figure 1, the numerals 10—C, 11—D and 12—E designate the lowest main whole-step keys (ratio 8:9) of the different lettered tiers of one group of an octave. The numeral 10 in the present instance designates the key of C and this character has for facility

of reference been shown on the key 10 although in actual practice this character will be omitted.

The numeral 11 designates the key of D following C and the numeral 12 designates the key of E. These keys 10, 11, and 12 are main keys which play intervals that are a whole-step (ratio 8:9) apart. The numeral 13 designates the key of F which plays a note one-half step (ratio 243:256) higher than E which is played by key 12, and the numerals 14, 15, and 16 designate the keys of G, A and B, respectively. Keys F, G, A, B play whole-step intervals (ratio 8:9).

The numeral 17 designates the key of C in the octave above key 10—C. A full octave is considered to be from and including key 10 to and including key 17.

The main key 10—C has associated therewith the keys numbered 18—C, 19—C, 20—$\overline{C}$, 21—$\overline{\overline{C}}$ and 22—$\overline{\overline{C}}$ which are keys of the same lettered, but differently marked intonations as key 10—C and which are adapted to actuate tonal elements progressively higher in frequency of vibration than key 10; the interval between each adjacent key note being approximately ratio 80:81. The keys 18—C, 19—C, 20—$\overline{C}$, 21—$\overline{\overline{C}}$ and 22—$\overline{\overline{C}}$ are stepped rearwardly from key 10—C and are also offset laterally from each other and from key 10. The keys 18, 19, 20, 21 and 22 are offset rearwardly equal distances, and are offset laterally in such a manner that the rearmost key, 22—$\overline{\overline{C}}$, will be disposed in alinement with C#, key 23. $\overline{\overline{C}}$, key 22, represents a tonal value or frequency equal or, dependent upon the system of tuning used, substantially equal to C#, key 23.

C# key 23 is disposed between keys 10 and 11 and is rearwardly offset therefrom. Specifically it is seven-twelfths ($\frac{7}{12}$) of a key-length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: for instance: C, key 10 to C, key 18.

The interval between C key 10 and C# key 23 represents tonally practically the diatonic half-step, ratio 15:16. Keys 24, 25, 26 and 27 represent tonal values pitched up from C# key 23 with the same relative values between each of the adjacent notes as those between the notes of the keys 10, 18, 19, 20, 21 and 22 and these keys are also offset rearwardly progressively and are also progressively offset laterally. $\overline{C}$# key 27 represents a tonal value or frequency equal to, or, dependent upon the system of tuning used, very close to the frequency of D key 11.

D key 11 is disposed between keys 23 and 33 and is forwardly offset therefrom. Specifically it is two-twelfths ($\frac{2}{12}$) of a key length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: that is, for example—C, key 10 to C, key 18. The interval between C# key 23 and D key 11, represents tonally a half-step about midway between that of the chromatic half-step and the diatonic half-step, the ratio being for a polytone instrument approximately 243:256. Keys 28, 29, 30, 31 and 32, represent tonal values pitched up from D, key 11 with the same relative values between each of the adjacent notes as those between the notes of the keys numbered 10, 18, 19, 20, 21 and 22 and these keys are offset rearwardly progressively and are also progressively offset laterally. $\overline{\overline{D}}$, key 32, represents a tonal value or frequency equal to or, dependent upon the system of tuning used, very close to the frequency of D#, key 33.

D#, key 33, is disposed between keys 11 and 12 and is rearwardly offset therefrom. Specifically it is nine-twelfths ($\frac{9}{12}$) of a key-length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: for instance: C, key 10, to C, key 18. The interval between D, key 11 and D# key 33 represents tonally practically the diatonic half-step, ratio 15:16. Keys 34, 35, 36 and 37 represent tonal values pitched up from D#, key 33, with the same relative values between each of the adjacent notes as those between the notes of the keys 10, 18, 19, 20, 21 and 22 and these keys are also offset rearwardly progressively and are also progressively offset laterally. $\overline{\overline{D}}$#, key 37, represents a tonal value or frequency equal to, or, dependent upon the system of tuning used, very close to the frequency of E key 12.

E, key 12, is disposed between keys 33 and 13. It is forwardly offset from key 33 and rearwardly offset from key 13. Specifically it is four-twelfths ($\frac{4}{12}$) of a key-length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: e. g.; C, key 10 to C, key 18. The interval between D# key 33, and E, key 12, represents tonally a half-step about midway between that of the chromatic half-step and the diatonic half-step, the ratio being approximately 243:256. Keys 38, 39, 40 and 41 represent tonal values pitched up from E, key 12, with the same relative values between each of the adjacent notes as those between the notes of the keys numbered 10, 18, 19, 20, 21 and 22, and these keys are also offset rearwardly progressively and are also progressively offset laterally. $\overline{\overline{E}}$, key 41, represents a tonal value or frequency equal to, or, dependent upon the system of tuning used, very close to the frequency of F key 13.

F key 13 is disposed between keys 12 and 47 and is forwardly offset therefrom. Specifically it is one-twelfth ($\frac{1}{12}$) of a key length farther front than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: that is, for example, C, key 10

to C, key 13. The interval between E key 12 and F key 13 represents tonally a half-step about midway between that of the chromatic half-step and the diatonic half-step, the ratio being for a polytone instrument approximately 243:256. Keys 42, 43, 44, 45 and 46 represent total values pitched up from F key 13 with the same relative values between each of the adjacent notes as those between the notes of the keys numbered 10, 18, 19, 20, 21 and 22 and these keys are offset rearwardly progressively and are also progressively offset laterally. F key 46 represents a total value or frequency equal to, or, dependent upon the system of tuning used, very close to the frequency of F# key 47.

F# key 47 is disposed between keys 13 and 14 and is rearwardly offset therefrom. Specifically it is six-twelfths ($\frac{6}{12}$) of a key-length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: for instance, C, key 10 to C, key 18. The interval between F key 13 and F# key 47 represents tonally practically the diatonic half-step, ratio 15:16. Keys 48, 49, 50 and 51 represent tonal values pitched up from F# key 47 with the same relative values between each of the adjacent notes as those between the notes of the keys 10, 18, 19, 20, 21 and 22 and these keys are also offset rearwardly progressively and are also progressively offset laterally. F# key 51 represents a tonal value or frequency equal to, or, dependent upon the system of tuning used, very close to the frequency of G key 14.

G key 14 is disposed between keys 47 and 57 and is forwardly offset therefrom. Specifically it is one-twelfth ($\frac{1}{12}$) of a key length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: that is, for example, C, key 10 to C, key 18. The interval between F# key 47 and G key 14 represents tonally a half-step about midway between that of the chromatic half-step and the diatonic half-step, the ratio being for a polytone instrument approximately 243:256. Keys 52, 53, 54, 55 and 56 represent tonal values pitched up from G key 14 with the same relative values between each of the adjacent notes as those between the notes of the keys numbered 10, 18, 19, 20, 21 and 22 and these keys are offset rearwardly progressively and are also progressively offset laterally. G key 56 represents a tonal value or frequency equal to, or, dependent upon the system of tuning used, very close to the frequency of G# key 57.

G# key 57 is disposed between keys 14 and 15 and is rearwardly offset therefrom. Specifically it is eight-twelfths ($\frac{8}{12}$) of a key-length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: for instance: C, key 10 to C, key 18. The interval between G key 14 and G# key 57 represents tonally practically the diatonic half-step, ratio 15:16. Keys 58, 59, 60 and 61 represent tonal values pitched up from G# key 57 with the same relative values between each of the adjacent notes as those between the notes of the keys 10, 18, 19, 20, 21 and 22 and these keys are also offset rearwardly progressively and are also progressively offset laterally. G# key 61 represents a tonal value or frequency equal to, or, dependent upon the system of tuning used, very close to the frequency of A key 15.

A key 15 is disposed between keys 57 and 67 and is forwardly offset therefrom. Specifically it is three-twelfths ($\frac{3}{12}$) of a key length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: that is, for example, C, key 10 to C, key 18. The interval between G# key 57 and A key 15 represents tonally a half-step about midway between that of the chromatic half-step and the diatonic half-step, the ratio being for a polytone instrument approximately 243:256. Keys 62, 63, 64, 65 and 66 represent tonal values pitched up from A key 15 with the same relative values between each of the adjacent notes as those between the notes of the keys numbered 10, 18, 19, 20, 21 and 22 and these keys are offset rearwardly progressively and are also progressively offset laterally. A key 66 represents a tonal value or frequency equal to, or, dependent upon the system of tuning used, very close to the frequency of A# key 67.

A# key 67 is disposed between keys 15 and 16 and is rearwardly offset therefrom. Specifically it is ten-twelfths ($\frac{10}{12}$) of a key-length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: for instance: C, key 10 to C, key 18. The interval between A key 15 and A# key 67 represents tonally practically the diatonic half-step, ratio 15:16. Keys 68, 69, 70 and 71 represent tonal values pitched up from A# key 67 with the same relative values between each of the adjacent notes as those between the notes of the keys 10, 18, 19, 20, 21 and 22 and these keys are also offset rearwardly progressively and are also progressively offset laterally. A# key 71 represents a tonal value or frequency equal to, or, dependent upon the system of tuning used, very close to the frequency of B key 16.

B key 16 is disposed between keys 67 and 17. It is forwardly offset from key 67 and rearwardly offset form key 17. Specifically it is five-twelfths ($\frac{5}{12}$) of a key-length farther back than the main key, note C, No. 10. This is considering a key-length to be from its front edge to the front edge of the next same lettered key to the rear: for instance: C, key 10 to C, key 18. The interval between A# key 67 and B key 16 represents tonal-

ly a half-step about midway between that of the chromatic half-step and the diatonic half-step, the ratio being for a polytone instrument approximately 243:256. Keys **12**, **13**, **14** and **15** represent tonal values pitched up from B key **16** with the same relative values between each of the adjacent notes as those between the notes of the keys numbered **10**, **18**, **19**, **20**, **21** and **22**, and these keys are also offset rearwardly progressively and are also progressively offset laterally. B key **15** represents a tonal value or frequency equal to or, dependent upon the system of tuning used, very close to the frequency of C key **17**. C key **17** is disposed forwardly from key **16** and is on a level with the octave C key **10**. The interval between B, key **16** and C, key **17** represents tonally a half-step about midway between that of the chromatic half-step and the diatonic half-step, the ratio being for a polytone instrument approximately 243:256. Keys **76**, **77**, **78**, **79** and **80** are exactly on a level with the lower octave keys **18**, **19**, **20**, **21** and **22** and these keys are also offset rearwardly progressively and are also offset laterally. C, key **80** represents a tonal value or frequency equal to or, dependent upon the system of tuning used, very close to the frequency of C#, the octave above C# key **23**.

The hereinbefore described keyboard arrangement sets forth one complete octave, and it will be understood that this same arrangement will be repeated for as many octaves as are covered by the instrument.

The keys **10**, **11** and **12** comprise one main group and it will be noted that keys **11** and **12** are offset rearwardly from key **10** and key **12** is offset rearwardly slightly from key **11**.

Keys **13**, **14**, **15** and **16** comprise a second main group and keys **14**, **15** and **16** are progressively offset rearwardly from key **13** this latter key being one-twelfth of a key-length farther front than key **10**.

The forward ends of keys **10**, **11**, **12**, **47**, **57**, **67** and **76** are disposed on a line inclined rearwardly from the front of the instrument, and the forward edges of keys **23**, **33**, **42**, **52**, **62** and **72** are disposed on a line parallel with the line designating the front edges of keys **10**, **11**, **12**, **47**, **57**, **67** and **76**. The remaining keys are disposed in similar parallel lines which are inclined to the front edge of the instrument.

It will be understood that each row of keys, reading from the front to the rear and representing tonal values of the same letter or character may be differentiated in any suitable manner as by color or the like so as to make the playing of the keyboard as easy as possible and so that the positioning of the fingers on a particular bank or tier will at once convey to the player the tonal values represented by such bank or tier.

The keyboard arrangement herein disclosed correlates with the present conventional keyboard arrangement only in the arrangement of the octave keys, these being the only intervals theoretically pure in the tempered tuning. Other keys are positioned according to intervallic relationships. The lateral offsetting of the intermediate tonal keys facilitates the playing of the instrument in that the player is able o determine from the relative position of the keys any desired relationships; these always being found in the same relative positions.

The dimensions herein given as to key lengths and spacing thereof are only given as one example, it being understood that these dimensions may be varied to accommodate different keyboard arrangements.

What I claim is:

1. A keyboard formed of a plurality of keys, said keys being arranged in stepped relation and the keys representing similar lettered intonations being arranged in rows from front to rear, the keys of each row being disposed progressively in rearwardly and laterally offset relation with at least one key of one row disposed in alignment with a foremost key of an adjacent row.

2. A keyboard formed of a plurality of keys, said keys being arranged in stepped relation and the keys representing similar lettered intonations being arranged in rows from front to rear, the keys of each row being disposed progressively in rearwardly and laterally offset relation with at least one key of one row disposed in alignment with a foremost key of an adjacent row, the keys in each octave being arranged in at least two groups having the succeeding keys of each group arranged in rearwardly offset relation to a preceding key.

3. A keyboard with staggered parallel rows of keys front to back, each key of each row designating different intonations of the same lettered tone, a rearward key of one tier being substantially of the same intonation as a forward key of another tier and being substantially in alignment with said mentioned forward key.

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