

Dec. 14, 1948.

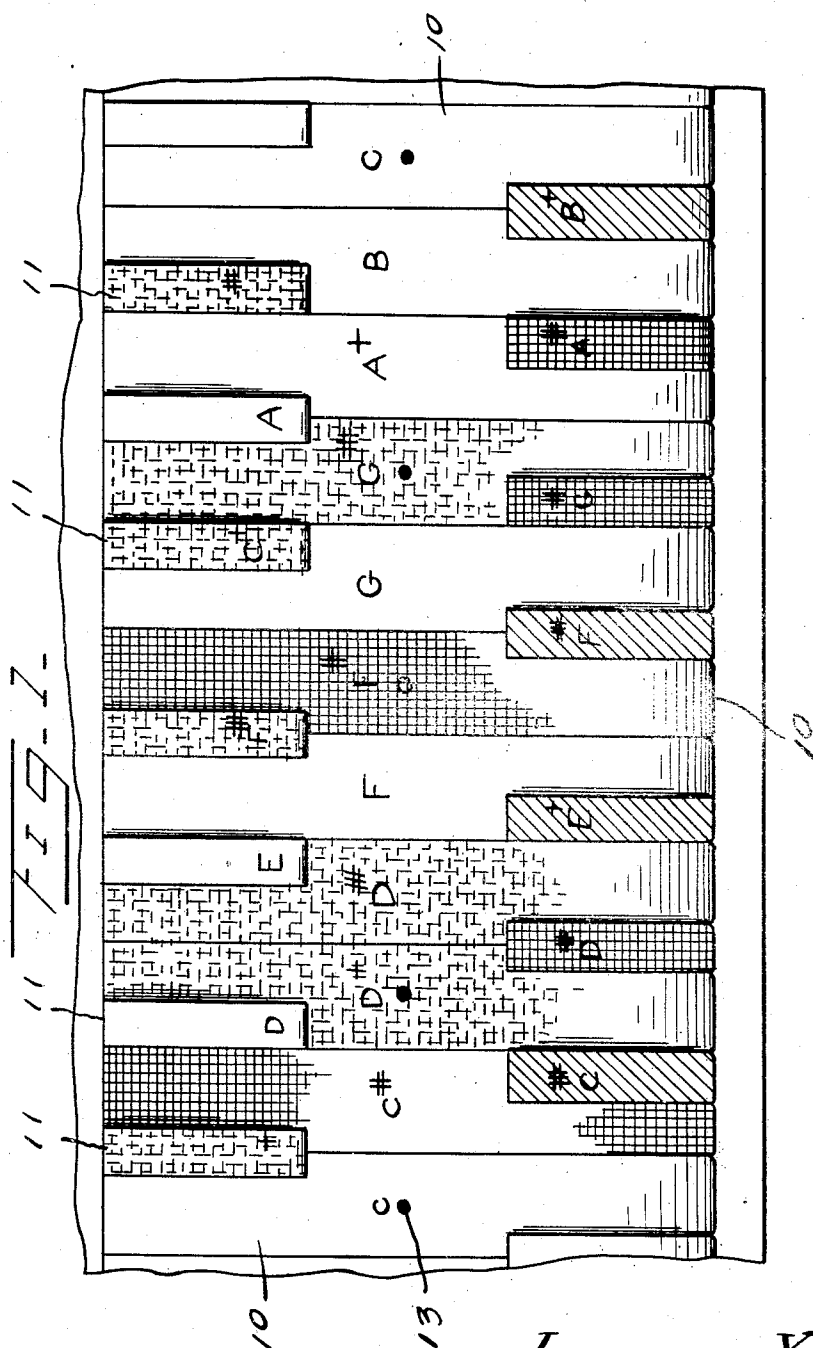
L. YOUNG

2,456,575

DECATONIC KEYBOARD

Filed Dec. 18, 1947

2 Sheets-Sheet 1



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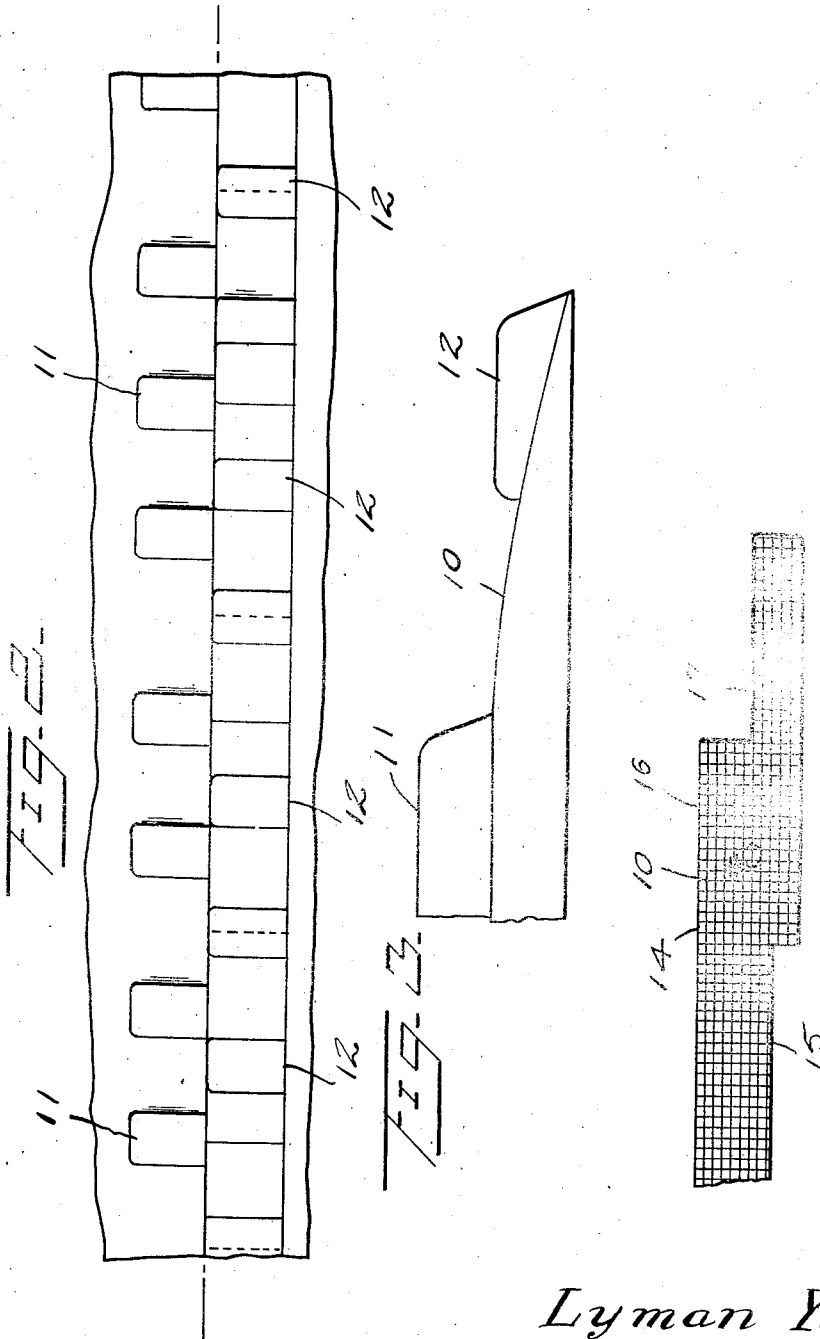
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UNITED STATES PATENT OFFICE

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DECATONIC KEYBOARD

Lyman Young, San Francisco, Calif.

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4 Claims. (Cl. 84-427)

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This invention relates to a keyboard for musical instruments and more particularly to a keyboard adapted for the Equal Quartertone Temperament and the American Quartertone Temperament.

An object of this invention is to provide a keyboard for a musical instrument comprising a 24 tone octave.

Another object of this invention is to provide a keyboard comprising 24 digitals per octave.

Still another object of this invention is to provide a keyboard comprising 24 digitals per octave arranged with 10 decatonic digitals and 14 prismatic digitals wherein the prismatic digitals are arranged as 7 upper and 7 lower digitals.

To the foregoing objects, and others which may hereinafter more fully appear, the invention consists of the novel construction, combination and arrangement of parts, as will be more specifically referred to and illustrated in the accompanying drawings, 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 view of a keyboard constructed according to an embodiment of this invention,

Figure 2 is a front elevation of the keyboard shown in Figure 1,

Figure 3 is a side elevation of the keyboard shown in Figure 1, and

Figure 4 is a top plan view of a typical key for this keyboard.

This invention is a keyboard for musical instruments such as the piano, pipe organ, and electric organ. Its 24 digitals per octave are designed for fingering the harmonies of either the American Quartertone Temperament defined herein, or the more familiar Equal Quartertone Temperament.

The 24 digitals of the decatonic keyboard are divided into three types—10 decatonic digitals, 7 upper prismatic digitals, and 7 lower prismatic digitals. The term "prismatic" signifies tonal coloring foreign to the decatonic scale. It is analogous to the familiar term "chromatic,"

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which is used to signify tonal coloring foreign to the diatonic scale.

For convenience in describing digital placements, the decatonic keyboard is theoretically divided into horizontal "thirds"—top, bottom, and middle. As indicated in Figures 1 and 3, the top third is farthest from the player, or in the rear, the bottom third is nearest the player, or in front, and the middle third lies between the top and bottom third.

As seen in plan, Figure 1, all of the decatonic digitals 10 extend through the top, middle, and bottom thirds of the keyboard. The letter names for these digitals, which intone the decatonic scale, are—C, C#, D plus, D# plus, F, F#, G, G# plus, A plus, and B.

The upper prismatic digitals 11 which intone a pseudo-diatonic scale, are seen to occupy positions in the top third only. The letter names for these digitals are—C plus, D, E, F plus, G plus, A, and A# plus.

The lower prismatic digitals 12, which also intone a pseudo-diatonic scale, are seen to occupy positions in the bottom third only. The letter names for these digitals are—C# plus, D#, E plus, F# plus, G#, A#, and B plus.

The decatonic digitals 10 are about twice as wide and three times as long as the prismatic digitals 11 and 12.

When a single prismatic digital 11 or 12, either upper or lower, occurs between two decatonic digitals, it is centered between these two decatonic digitals, and superimposed half through one and half through the other in exactly the same way that a black digital on the piano is centered between two white digitals and superimposed half through one and half through the other. Thus, in Figure 1, the upper prismatic digital A is centered between G# plus and A plus. The lower prismatic digital B plus is centered between B and C.

When both an upper and a lower prismatic digital occur between two decatonic digitals 10, the higher-pitched prismatic digital is superimposed through the higher-pitched decatonic digital, and the left hand edges of both digitals are aligned, as G# is superimposed through G# plus,

or as D is superimposed through D plus. Also the deeper-pitched prismatic digital is superimposed through the deeper-pitched decatonic digital, and the right hand edges of both are aligned, as C# plus is superimposed through C#, or as G plus is superimposed through G.

The plane of the keyboard is a horizontal level serving as a hypothetical foundation for digital manipulation. In front elevation, this plane appears in lineal profile as the left-to-right center line of Figure 2, where it is seen defining the bottom level of the upper prismatic digitals 11, and the top level of the lower prismatic digitals 12. The same fact is evident in the side elevation, Figure 1, where the top third only of the decatonic digitals 10 is also seen to lie in the plane.

The level surface of the white digitals might be regarded as the "central plane" of the present day piano.

The side elevation of the decatonic keyboard, Figure 3, shows the three types of digitals in profile. The top level of the upper prismatic digitals 11 is seen to be higher than the rest of the keyboard. These digitals 11 (similar to the black digitals of the piano) are superimposed through the central plane of the keyboard. The top level of the lower prismatic digitals 12 coincides with the central plane.

The ends nearest the player of both the upper and lower prismatic digitals slant downward and forward toward the player in the same manner as the ends of the black digitals on the standard piano. However, in the case of the lower prismatic digitals 12 only, the ends farthest from the player slant downward and rearward. The sloping surface of these nether ends thus presented for manipulation is less in area than the forward ends of the same digitals.

The most distinctive feature of the keyboard is the partial curvature of the decatonic digitals 10, as shown in side elevation in Figure 3. The contour along the top third of these digitals coincides with the central plane. The contour then falls forward, toward the player, and downward, below the central plane, at a gently slanting curvature through the middle third of the keyboard. Continuing forward, the contour of the decatonic digitals slopes down at a more acute straight slant through the bottom third of the keyboard.

Two main logical approaches, complementary in nature, are implicit in the 24-tone octave. One of these is integral, the other dual. On the decatonic keyboard, the integral logic is expressed in the digital arrangement, while the colors of the digitals display the dual logic.

In the integral logic, the 24 tones of the octave are regarded as derived from a single closed cycle of 24 medial sixths. The principal scale of the integral quartertone system is the decatonic scale, intoned by the 10 decatonic digitals 10, supplemented by 14 "coloring" tones, intoned by the prismatic digitals 11 and 12.

On the other hand, the 24-tone octave is regarded in the dual logic as derived from two separate closed cycles of 12 fifths. The tones of each of these cycles are interposed between the tones of the other, in alternate order. The principal scale for each of these 12-tone chromatic octaves is a 7-tone diatonic scale supplemented by 5 chromatic tones.

The color logic of the decatonic keyboard is simplified by the fact that the 12 white and black digitals intone the same pitches as the white and black digitals of the present day piano. The

white digitals intone a diatonic scale, and the black digitals a pentatonic scale. This white and black set of digitals constitutes the "primary" keyboard, on which the white digitals are primary diatonic digitals, and the black are primary chromatic digitals.

In contradistinction to the primary keyboard of 12 tones is a similar "secondary" keyboard of 12 tones. As shown in Figure 1, the digitals of this secondary keyboard are interposed between the digitals of the primary keyboard. The digitals of the secondary keyboard are distinguished by colors other than white and black, such as buff and brown. The buff digitals, which intone a diatonic scale, are called secondary diatonic digitals. And the brown digitals, which intone a pentatonic scale are called secondary chromatic digitals.

The traditional Ionian Mode (key of C) is intoned by the primary diatonic digitals, starting with C—C, D, E, F, G, A, B, and C.

The same Ionian Mode is intoned by the secondary diatonic digitals (paralleling the foregoing scale a medial third or semi-fifth more acute in pitch), starting with D# plus—D# plus, F plus, G plus, G# plus, A# plus, C plus, D plus, and D# plus.

While the decatonic digitals include all four colors, as shown in Figure 1, the upper prismatic digitals include only diatonic (primary and secondary) digitals, and the lower prismatic digitals include only chromatic (primary and secondary) digitals. In other words, only white and buff digitals occur in the top third of the keyboard, and only black and brown in the bottom third.

Four contraction points exist in the American Quartertone Temperament. A dot 13 is inlaid at the center of each of the four decatonic digitals defining these points of contraction. Black dots mark the white digital C and the buff digitals D plus and G# plus; a white dot marks the black digital F#. This is illustrated in Fig. 2.

In the table of vibration rates which follows, dotted digitals are specified by asterisks in the right hand margin.

Equal Quartertone Temperament, in contradistinction to American, may be defined as the simple division of the octave (ratio 1:2) into 24 equal intervals, or just double the number of equal intervals occurring in an octave of the present day piano. These intervals may be mathematically defined as powers (from 0 to 24) of the 24th root of 2.

While the American Quartertone Temperament is more complex than the Equal, it is also less "tempered." As shown in the following table, its 24 tones are mathematically "spaced" by selected powers of the 130th root of 2—ratio 1: 1.00535 or 187: 188. This ratio is the "Interval Unit" of the American system.

The musical intervals, or "quartertones," between adjacent digitals are of two kinds—(1) the semihemitone of 5 interval units and (2) the demisemitone of 6 interval units.

Without propounding the theory of this new temperament, following is a table of vibration rates for the octave pictured in Figure 1.

It will be observed that International Pitch is adhered to, with the value for A very faintly sharpened (435.64 vibrations per second).

By a transposition, not explained here, the fundamental generator of the system is pitched at 100 V. P. S., as indicated in the value, two octaves higher, assigned to G plus—400 V. P. S.

Table of vibration rates for the American
Quarternote Temperament

Primary white and black digitals	Vibrations per second	Secondary buff and brown digitals	Interval Units (or powers of the 130th root of 2)
C	259.72 266.74	C plus (or) D♭ minus	0 * 5
C♯ D♭	275.40		11
	282.84	C♯ plus D minus	16
D	292.04 299.93	D plus E♭ minus	22 * 27
D♯ E♭	308.04		32
	318.05	D♯ plus E minus	38
E	326.63 337.26	E plus F minus	43 49
F	346.42 355.73	F plus G♭ minus	54 60
F♯ G♭	367.29		65 *
	377.23	F♯ plus G minus	70
G	389.47 400	G plus A♭ minus	76 81
G♯ A♭	413.02		87
	424.16	G♯ plus A minus	92 *
A	435.64 449.80	A plus B♭ minus	97 103
A♯ B♭	461.92		108
	476.96	A♯ plus B minus	114
B	489.84 503.08	B plus C minus	119 125
C'	519.44		130 *

Figures 3 and 4 represent a typical construction of the decatonic digitals 10. The digital 10 is formed with an elongated body 14, with a rectangular cutout 15 extending along one-third of one edge at one end of the body 14, a full width section 16 extending along the center one-third of the body 14 and a second rectangular cutout 17 extending along one-third of the opposite side at the opposite end of the body 14.

The exact configuration illustrated is regarded as the optimum, but some of the desirable results inherent in this disclosure may be obtained by various slight modifications including some departure from the exact configuration shown, and it is therefore requested that the scope of the invention should be regarded as limited only by the terms of the claims.

What I claim is—

1. A keyboard formed of a plurality of elongated digitals each of said digitals formed with a rectangular cut-out on one side at one end thereof,

and a second rectangular cut-out along the opposite side at the other end of said digital, said digitals so arranged that the cut-out of one digital cooperates with the cut-out of the adjacent digital to form wider openings between said digitals, a row of short digitals extending upwardly from said wider openings along one end of said first digitals and another row of short digitals extending upwardly from said wider openings along the other end of said first digitals.

2. A keyboard formed of a plurality of elongated digitals, each of said digitals formed with a rectangular cut-out along one side at one end thereof, and a second rectangular cut-out along the opposite side at the other end of said digital, a row of short digitals extending upwardly from said openings at one end of said first digitals and a second row of short digitals extending upwardly from said openings at the other end of said first digitals, said first digitals tapering downwardly toward the forward end thereof whereby the upper edge of the digitals of the forward row will lie in a plane above the forward edge of said first digitals and below the plane of the upper edge of the rear row of short digitals.

3. A keyboard formed of a plurality of elongated digitals, a row of short digitals extending upwardly from between said first digitals at one end thereof and a second row of short digitals extending upwardly from between said first mentioned digitals at the other end thereof, said first mentioned digitals tapering downwardly and forwardly from the forward end of said first row of short digitals and below the forward end of said second row of short digitals.

4. A keyboard formed of a plurality of elongated digitals, each of said digitals formed with a rectangular cut-out on one side at one end thereof, and a second rectangular cut-out along the opposite side at the opposite end of said digital, a row of short digitals extending upwardly in said cut-outs along one end of said first digitals and a second row of short digitals extending upwardly from said opening at the other end of said first digitals.

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