

Patented Jan. 28, 1866.

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United States Patent Office.

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Letters Patent No. 73,753, dated January 28, 1868.

IMPROVED ENHARMONIC KEY-BOARD FOR ORGANS, &c.

The Schedule referred to in these Letters Patent and making part of the same.

The object of the Enharmonic Key-Board is to enable the player to execute all his melodies and harmonies in perfect tune, or without any temperament; in other words, that every interval shall be taken in the exact mathematical ratio which theory assigns to it; and furthermore, to do this without the necessity of assisting-pedals or mechanism which has heretofore been resorted to. All these sounds, within their limits, are shown in the accompanying drawings, together with the keys by which they are produced.

To give what theorists in general have called the diatonic scales, are needed two series of notes bearing the name of the same letter. For example, the key-note of the natural key is C, and the third of the key of four flats is also called by the same letter, while it is really lower, by a comma ratio, 80:81, or a ninth of a major tone. I distinguish these by giving to the key-note a Roman capital, (thus, C,) and to that which is a major third to some key-note, the letter of the lower case, (as c.) In like manner with every other key-note and third. The key-notes are tuned, each a perfect fifth (2:3) from each other, and consequently their thirds (major 4:5) are in a similar series of fifths, but distinct from the series of key-notes. In this key-board all the key-notes are played by broad keys of white ivory, of about the usual size, and all exactly alike in form and position; and all the thirds by raised black keys, like those of the common organs. Their position is peculiar, and derived from the nature of the related keys, and is uniform in all transpositions of the scale.

An octave on an organ key-board is limited by the stretch of the fingers. Six and a half inches is generally adopted by the makers of organs and piano-fortes, and is taken the same in the enharmonic key-board. This space is divided into four ivory keys, of about an inch in width for half this length, and a little more than three-quarters for the remainder, and into three black keys, of the width and height of the usual key-boards, and three-fourths of the length of the white keys. They are placed (see Fig. III) so as to allow easy fingering, and with ample room for the shifting of the fingers. Although there may be 100 keys in the octave, which is the number of sounds contained in the table in Fig. V, there will be no crowding or confusion of finger-keys in any required scale; only the width of the board from front to back will be increased. The four white keys named give the key-note, second, fourth, and fifth of the scale, the three last being key-notes of other scales, and the three black raised keys give the third, sixth, and seventh, the two last being also thirds of other scales. A simpler form of this key-board is shown in Fig. VIII, "key-board No. 2," which is sufficient for the diatonic scale just described, in every key, and also for another, called the "double diatonic scale." This is different from that commonly mentioned in theory, which is distinguished by the name of triple diatonic, from its derivation from three roots or chords, while the double diatonic springs from the harmonies of the tonic and dominant alone. For the double diatonic scale is needed an additional sound for each key or scale, namely, the perfect or harmonic seventh, in the ratio of 4:7 on each key-note or dominant. In the double diatonic, much used in practical music, although, by chance, first described by myself, the dominant seventh and dominant ninth replace the fourth and sixth of the scale of the triple diatonic, which there come from the sub-dominant harmony. By reference to Fig. VIII, taking C as key-note, the F and a are replaced by the F⁷ and A of the double diatonic scale. Both scales are given by this key-board No. 2, which is sufficient for a great portion of good music, and recommendable where economy is necessary. It gives all music which is in the major key.

Besides the three series of sounds already mentioned, the minor keys require two more series, namely, the major thirds and perfect sevenths, or their dominants. These additional series are provided in the key-board shown in

Figure I, where the perfect sevenths are colored red, the dominant thirds blue, and the dominant sevenths of minors yellow. These five series of sounds are given in the following table, with their signs, colors, &c.

Series I. Key-notes,	White,	Roman capitals: example,	C A.
II. Thirds, (major,)	Black, elevated $\frac{1}{16}$ inch,	Roman lower case: example,	c a.
III. Perfect sevenths, (major key,)	Red, elevated $\frac{2}{16}$ inch,	Egyptian capitals, with 7: ex.,	C ⁷ A ⁷ .
IV. Dominant thirds (major) of minors,	Blue, elevated $\frac{3}{16}$ inch,	Italic lower case: example,	c a.
V. Dominant sevenths, of minor,	Yellow, elevated $\frac{4}{16}$ inch,	Egyptian lower case, with 7: ex.,	c ⁷ a ⁷ .

According to these colors and forms of letters, the several sounds are marked on the drawings.

Figure II represents a portion of the key-board in perspective, and shows the relative position of the several keys.

Figure III shows, in half scale, the finger-keys, which, in any key or signature, give the triple and double diatonic scales, and

Figure IV a section of Fig. III, made through the third quarter of the key-note, which is the space specially belonging to the key, and contains all of its sounds, which is the case with every key-note. The keys are here marked according to the sounds do, re, &c., by which are indicated the invariable relations of the several notes of the scale, which are here expressed by their relative vibrations and the ratios of their intervals, and as they will be given by the corresponding finger-keys.

In connection with the plan and section, Figs. III and IV, is given a table, Figure V, of the notes and scales which such a section would give in the signatures, from nine flats to nine sharps, both inclusive, and which table contains one hundred different sounds. In practical construction, however, twenty-two of these pipes may be dispensed with in an organ, as the notes coincide so closely that there need not be a difference of one-hundredth of a comma, which is well within the limits of "sympathy," and draws into perfect tune, were it five times as great. The notes B $\flat$ to G (series I) thus serve for a to f $\times$ (series II,) and $\mathcal{A}$ to b (series II) serve for c $\sharp$ to a $\times$ (series IV,) eleven in each series.

Figure VI shows the method of laying off the key-board, Fig. I. Spaces are drawn from right to left, the width of the key-board, and of such width as is desired, which may be less, to keep the board narrow, or more, to give greater surface of key. Here this space is taken at nine-tenths of an inch, and this is the space in front of the black keys on the common organs, &c. Sufficient such spaces are laid off by parallel lines, or as many as the keys which the instrument is intended to play, with two or three extra at each limit, to complete the outer finger-keys. The octave is fixed at six and a half inches, and perpendiculars are drawn at this distance apart, as *a e*, Fig. VI. This may be considered as the left side of any key, say that of C. The place of C, from the front to back, being fixed, in its centre, lengthwise, make an offset to the left, perpendicular to the last-drawn line, and along one of the first-described lines, of the length of 0.225 inch from its right end, runs a straight line towards the front, for the distance (if there is room) of seven of the spaces, equal to *a d*, or 0.9 inch, and from the left end, in like manner, a line runs forward seven spaces, as *d e*. Here is another offset to the right, and perpendiculars drawn always parallel to each other. Along *a b* the offset is prolonged, the line *a e*, in length 5.993 inch, the width of the white key. Through this point, *c*, parallel with *a e*, is drawn towards the front, for the distance of two spaces, a line, *c g*, an offset to the left, and through that left extremity the line drawn parallel toward the front; *g c* is extended to *f* five spaces, an offset always made to the right, and the line prolonged forward. Such parallels are drawn until the octave is divided equally and uniformly, as it will be, and diagonal rows of the offsets cover the board, which may thus be extended to any number of signatures. Next the black keys are introduced, with their rear ends placed before each of the offsets, as seen at *h*. They extend three spaces in length. The three spaces at the left of the black key are filled by the series III, red keys in front, the yellow keys of series V next, and then the blue keys of series IV, according to the plan in Fig. I, in which each is marked.

The question of introducing the minor third to the key-notes has been considered and provided for, by inserting a vertical wire, with a flat round head, raised three-tenths of an inch above the black key, which can be inserted at pleasure, and removed, if found to interfere with other movements. This is shown in the Fig. VIII, at the end of the key *e*, and in Fig. II, at the end of the lower *b*, which, in such case, would give a *bb* minor third to G, and may be marked with a Gothic letter; or this sound, if afterwards decided to be of sufficient importance, may be given to the yellow keys, which, by being taken out and reversed, end for end, would act upon a different lever, and give another sound. This double action can be effected by having one end of the key only touch the action below, and by having two levers, one at each end of the space below the key. This is mentioned as indicating the possibility of introducing other sounds, which are not now considered as essential, but which, at a future day, may be wanted, at least for experimental purposes. Among these may be the harmonic or prime eleventh, in the ratio 8 : 11.

All the keys will have motion in vertical right lines. This is effected in several ways, one of which is shown, Figure IX. A finger-key, C, is secured to two guiding-rods 1 1, passing through two tables, 2 3, firmly fixed by pillars, 4, and these rods are again fixed in a parallel piece below, 5, which last acts upon the instrument-valves, &c., in the usual manner. It is thus immaterial on what part of the key the force is applied to put it down. Although the guiding-rods are drawn square, they will probably be round, and the key C, the two tables 2 3, and the piece 5, will be placed in contact, and the whole bored truly and uniformly. The keys will afterwards be cut apart and covered with ivory, &c. Although the key-board will, perhaps, be placed level, yet, if carried to very many signatures, it may be placed on a plane inclining forward thirty degrees, more or less, and be more easily reached at its back keys.

Figure VII represents a pedal key-board for the organ, played by the manuals described, arranged with reference to convenient management of pedal-bases. The first row of pedals give key-notes, each a fifth above that at the left. Between these, further back, and raised, are the thirds (major) of the keys, in front and to the left. Directly behind each key-note, and raised above the thirds, is the perfect seventh of this key-note. The thirds are colored black, and the sevenths red, as in the finger-keys. The front row has those keys most wanted, but the thirds are sufficiently in use, being also tonics and dominants of the minor scales. Diatonic scales can also be played, without having to pass from a note to the next, further than to the second key to the right or left, a distance of five inches, as from C to D, or a to b.

Having, as I believe, described the theory and construction of this improvement with sufficient minuteness

that hereafter it may be made useful without difficulty, I desire to claim only the key-boards for managing the sounds described, and no further mechanism pertaining to musical instruments.

I claim as my invention, and desire to secure by Letters Patent—

1. The four broad white keys, and the three elevated black keys, in each octave and in each signature, arranged in the positions and relations substantially as described and shown.
2. The arrangement of keys divided into the five series of key-notes; thirds, perfect sevenths, dominant thirds, and dominant sevenths, each series being uniform in shape, color, and size, but different from the other series, substantially as described and figured.
3. The pedal key-board, containing the three rows of pedals for the three series of sounds, key-notes, thirds, and sevenths, arranged in a series of fifths, substantially as shown and described.

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Witnesses:

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