Nov. 17, 1936. H. LUEDTKE 2,061,364

DESIGN OF KEYBOARDS OR FIELDS OF SOUNDING BODIES

Filed July 16, 1935 4 Sheets-Sheet 1

Fig. 1

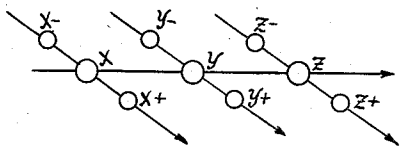


Fig. 2

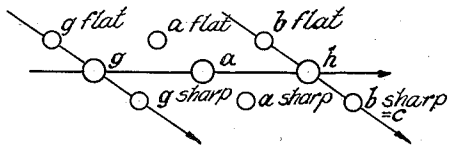


Fig. 3

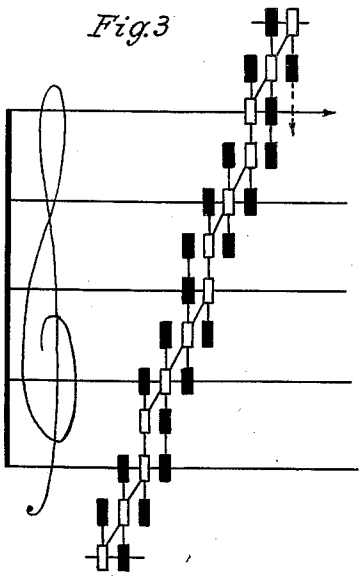


Fig. 6

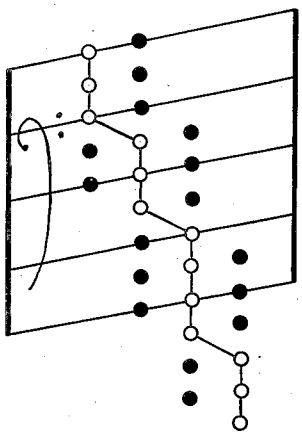
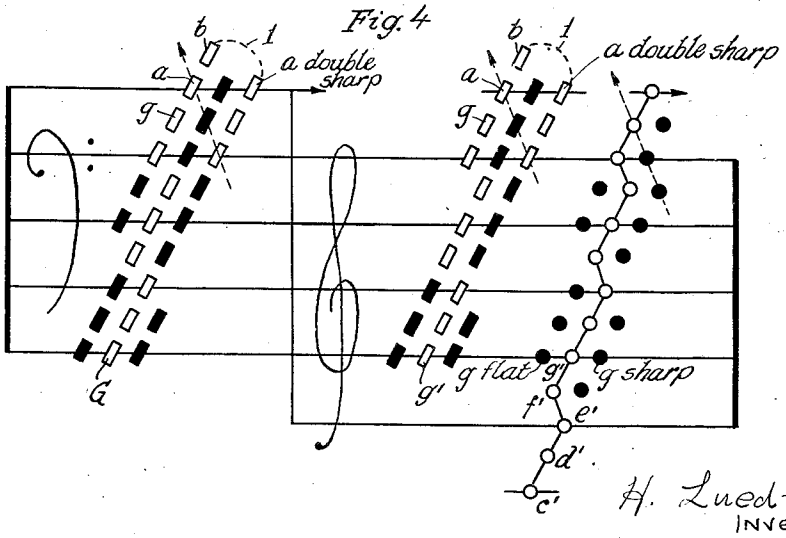


Fig. 4



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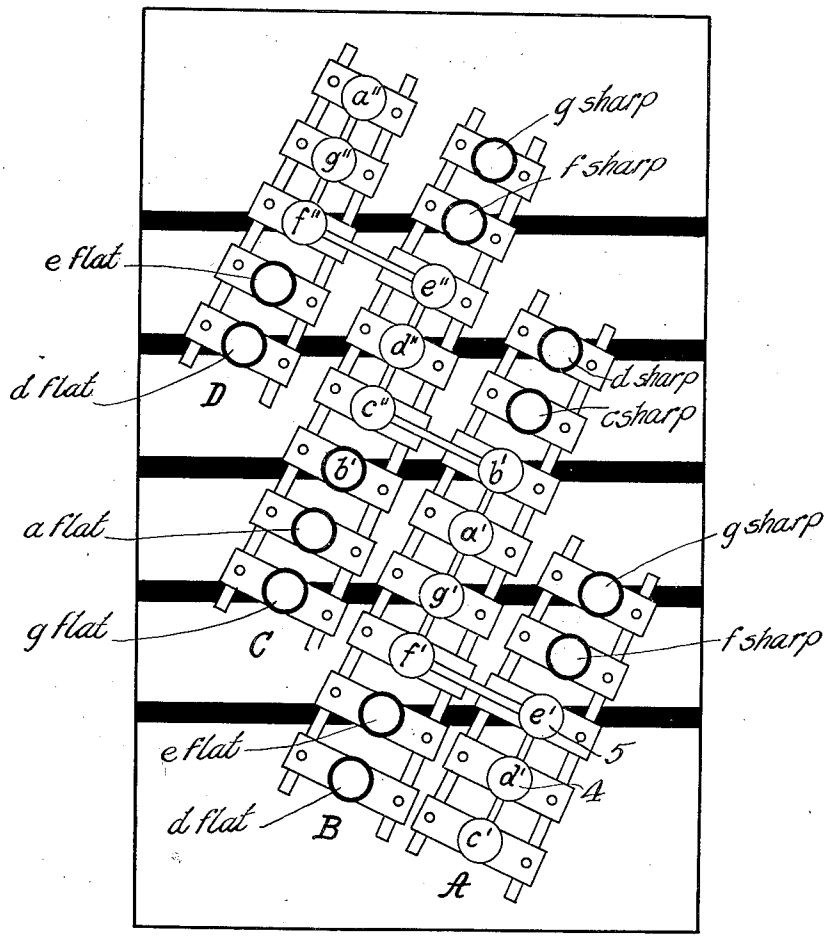
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DESIGN OF KEYBOARDS OR FIELDS OF SOUNDING BODIES

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Fig. 5



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DESIGN OF KEYBOARDS OR FIELDS OF SOUNDING BODIES

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Fig. 7

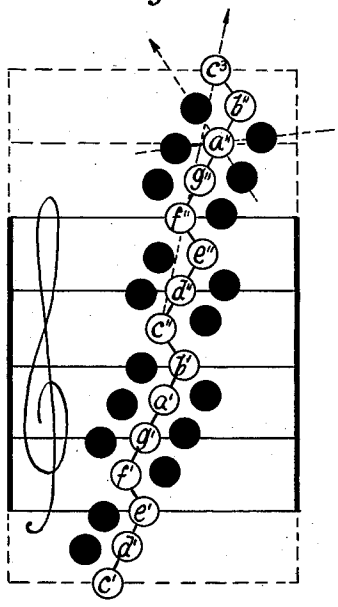
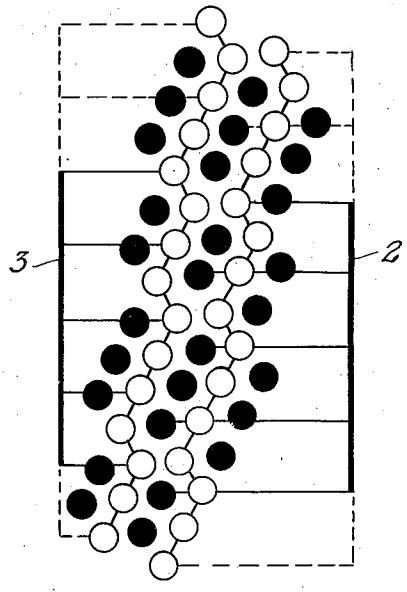
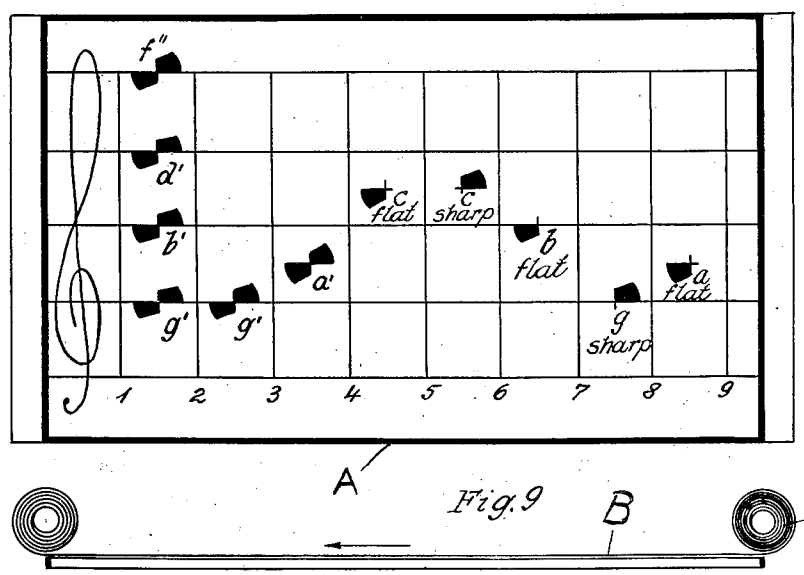


Fig. 8





A

Fig. 9

B

Fig. 11

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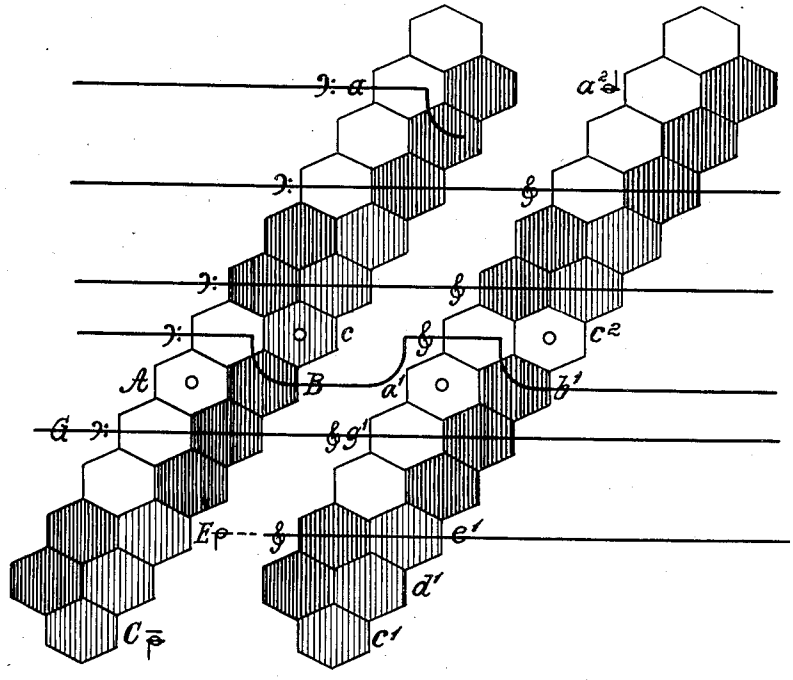
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DESIGN OF KEYBOARDS OR FIELDS OF SOUNDING BODIES

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Fig. 10



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UNITED STATES PATENT OFFICE

2,061,364

DESIGN OF KEYBOARDS OR FIELDS OF SOUNDING BODIES

Hans Luedtke, Berlin, Germany

Application July 16, 1935, Serial No. 31,683
In Germany March 26, 1934

16 Claims. (Cl. 84—423)

The present invention relates to the design of keyboards for musical instruments or the imitations thereof and the object of the invention is that the eye when reading the notes, and the fingers when touching the keys have the same direction of movement so that musical instruments built on this system can be learned more readily or played directly in accordance with the notes. These instructional advantages as based on the comprehensible representation of the usual system of musical notes will on principle be obtained in any kind of musical key instrument, chiefly pianos, organs, chimes or carillons, accordions or the like.

In the following the invention will be described with reference to the accompanying drawings, in which—

Fig. 1 shows the subdivision of the musical scale (full tones).

Fig. 2 shows a further subdivision referred to the points of reference of the first subdivision.

Figure 3 shows the application of the invention to a system of musical notes with twelve half intervals wherein a full tone direction, which is designated as first direction of coordinates, extends from the staff system on the left below to the right above while an intermediate tone direction, which is designated as second direction of coordinates, approximately or completely coincides with the direction of the lines of the staff and a second intermediate tone direction, which may also be designated as third direction of coordinates, is arranged vertically to the staff system.

Fig. 4 shows the arrangement of a tempered scale with 12 half intervals as above but with inclined coordinates for the seminotes, which arrangement also comprises the same keyboard brought into connection with the bass and treble clefs respectively.

Fig. 5 shows the design of a musical instrument as based on the arrangement shown by Fig. 4, and further the particular characterization of the points of touch rendered identical with the signs of the notes, and of the C-major scale as a zigzag band, the desired characterization being obtainable by a suitable formation or coloration of the points of touch which is represented diagrammatically by the thin and thick circles.

Fig. 6 shows how the margin of or the section through the keyboard is parallel to the direction of the coordinates of the full notes so that the staves appear in an inclined direction.

Fig. 7 shows how all notes comprised in the keyboard form equilateral triangles in which the notes of the C scale are cut by the staves in their centers whereas the minor and major semitones are disposed somewhat deeper and higher respectively.

Fig. 8 shows the combination of two systems of staves on a single keyboard with keys enharmonically doubled.

Fig. 9 shows how the note diagram of Fig. 7 or 8 is moved along the system A by means of a roller B.

Fig. 10 shows two rows of full tones displaced by a semitone with respect to each other the same rows being disposed side by side in the bass and treble clefs.

Fig. 11 is a plan view showing the arrangement of the tape on rollers.

The fundamental idea of the present invention will now be explained with reference to the accompanying Fig. 1. The latter shows a horizontal line on which a row of keys x, y, z should be imagined and which correspond to definite notes of the musical scale having equal distances. As the simplest example the interval of a full tone will be assumed.

All the notes lying behind one another in the horizontal direction indicated will always have the same interval irrespective of whether they are on the same line or on another line parallel thereto. The said keys x, y, z form points of reference for other keys and notes respectively. In accordance with the usual musical instruments the interval lying between the notes and the points of reference is chosen as a semitone as corresponding to the chromatic scale comprising 12 intervals. It is a matter of course that the inventive idea may also be applied to any other system.

A note which e. g. differs by a semitone from the note of reference y is coordinated to a key which is situated on one or another side of the key of reference. So e. g. the key $y+$ would mean a note which is by a semitone higher than y while the key $y-$ would correspond to a note by a semitone lower than y.

According to the invention one of the coordinates here given is used as one of the staves of the usual system of notes. This is shown by Fig. 2 in which the points of reference are designated as the tones g, a, b, it being a known fact that with the treble clef the a' note is not on a line but between two lines. The notes g and b of Fig. 2 thus correspond to the notes x and z of Fig. 1. The two staves of Fig. 2 are completed to five the usual five lines of the staff in Fig. 3.

The tracing of the staves on a keyboard can

in some cases be dispensed with viz. when these staves are but parallel straight lines, which is normally the case, so that the eye is in a condition to complete itself this note system imagined. This is particularly feasible when the staves imagined coincide with one of the directions of the coordinates for the semitones as in such a case the buttons of the key-board as disposed behind one another (e. g. on an accordion) by themselves furnish, so to speak, a representation of the staves.

But also in the case of an inclined position of the staves imagined as referred to the keys or rows of buttons (see Fig. 7) the staves can be completed in mind provided that it is the question of parallel staves only.

The position of the second direction of the coordinates of the semitones, viz. of that not coinciding with the staves, can be chosen at will when a complete keyboard comprised in a stave system is to be designed. In Fig. 3 the direction of the second semitone coordinates is vertical.

In Fig. 4 however the second direction of the semitone coordinates forms an acute angle with both the staves and the coordinate of the full tones which latter runs in an inclined direction to the right and towards the top both in Figures 3 and 4. The magnitude of the angle included by the full-tone coordinate and the second semitone coordinate is of no concern.

This arrangement shown by Fig. 4 thus permits of the system of coordinates of the full and semitones respectively being used at will for disposing an unvaried disposition of keys within any system of staves or of marking a keyboard with such a system of staves also in order that interchangeable templets or stencils can be made and arranged. If, for example, the key system is to be played in the bass clef instead of in the treble clef, one removes the stencil corresponding to the treble clef and replaces it by the corresponding bass clef stencil. In the case of a large keyboard, several stencils for treble and bass clefs may be arranged side by side. The same arrangement of keys can be read and used for playing optionally with the treble or bass clef in accordance with printed notes.

In order that the keyboard is rendered as convenient as possible for playing, each row of keys will be broken off at a suitable point. Otherwise the denomination of the keys and notes respectively would be correct from a theoretical point of view only but practically result in an intricate double system of sharp and flat notes as Fig. 4 shows, where e. g. the dotted connection *l* of the uppermost note at the left and situated above the system of staves shows that the note normally called *b* is identical with the note having the same enharmonic sound but which according to its position within the system of coordinates should be called a double-sharp.

It is therefore recommendable to go to an adjacent parallel line which is subsequently also broken off at a suitable point. A clear picture is obtained by the C-scale being marked by "white" keys in contrast to the "black" keys marking the notes raised or lowered by a semitone. The zigzag band of the C-scale thus forms the line of reference, the skeleton of the whole key-board and at the same time provides for the agreement with the ordinary piano, the C-scale keys of which are also white, and with the usual system of notes in which the C-scale has no signatures.

Now as all scales are identical in their structure, from the above arrangement there will result an optical, and therefore an instructional advance and also an advance with reference to the playing technique when the whole is applied to the manufacture of musical instruments: All scales, all arpeggios, all harmonies, also right and left hands are similar, fingering for the right and left hands may be symmetrical. On account of the playing technique it may be desirable, as Fig. 8 shows, to have the C-scale or other "black" keys in double sets. Thus Fig. 4 only shows the juxtaposition of the base and treble clefs as a pedagogical and educational advantage whereas the accentuation of the C-scale indicated in Figure 8 also produces an accentuation of the staff system as shown in Figure 8, wherein the staff system **2** corresponds to the right C-scale and the staff system **3** corresponds to the left scale. By this arrangement an improvement of the conditions of the playing technique is obtained, the double line system and the accentuation of the C-scale being particularly intended for a clearer disposition of the whole picture.

Fig. 5 shows the design of a musical instrument composed of sounding bodies **4** and the directions of the coordinates are chosen according to Fig. 4 the points of touch **5** of the said sounding bodies being, according to the invention arranged as a note system. The rectangular shape of the sounding bodies illustrated is to show here (the same as in Fig. 3) that xylophone or chime bars or vibraphone plates etc. could be used in this connection.

According to the invention provision is made that in the case of sounding bodies, which as in Fig. 5 are directly grouped in a system of stave, the sounding bodies proper are rendered as invisible as possible to the eye by a non-luminous color or a color which is not high discernable (mimicry) while the points of touch of the said sounding bodies are rendered conspicuous optically in the form of the round heads resembling notes. It is true that according to the invention the general impression to be produced is that it concerns an instrument but preferably a design of musical notes, a keyboard design or plan of note pitches.

Figure 5 also shows that a technical advancement is thus obtained over, for example, the actual keyboard of pianos because the latter extends preferably in one longitudinal direction. However, in the keyboard design according to the invention there is far greater concentration of space which feature obviously constitutes an advancement in the technique of playing such as an increased extent of chords capable of being played with one hand.

Figs. 6 and 7 show that this concentration in the space is the better, the steeper the coordinate of the full notes is chosen relatively to the system of notes. Thus a further advantage is secured according to the invention when the keys of the octaves are disposed at right angles or nearly so to the staves.

Then the longitudinal edges of the key board will be chosen exactly or almost parallel to the direction of the octaves. In the case of accordions etc. this holds true particularly for the keyboard of the right hand (see Fig. 7).

It is however also possible to make the edges of the key board parallel to the direction of the full tones (see Fig. 6) which is in the case of accordions recommendable particularly for the left hand.

Fig. 7 further shows an inclination of 60 de-

grees each for the two semitone coordinates while the full-tone coordinate is approximately vertical. Thus all notes or keys of the keyboard form equilateral triangles **6**. In this case the second semitone coordinate and the system of staves need not be parallel. This arrangement is claimed as novel invention and results in such notes or keys, which have the same height of notation in the usual system, being represented directly by their position relatively to the staves (or spaces between them) without the use of signatures (sharp or flat). Thus a new system of notes is created which however agrees with the usual system as to its meaning and the legibility.

For instance in Fig. 7 the note *g'* pertaining to the **C** scale and therefore having no signature is cut exactly in its center by the second stave. But the lower *g'* flat, which is as usually written with a flat but also on the second stave, is in this case not symmetrical thereto but preferably below this stave, while *g'* sharp is chiefly above it, etc.

This novel system of notes is also utilized in Fig. 9 which shows a note-key system of the character shown in Fig. 7 or 8 but in combination with a device intended for writing down the notes. This device for writing down the notes may resemble a typewriting machine and be provided with a note keyboard arranged as in Figure 7 or 8. By operating the keys of the said device for writing down the notes, the notes are punched in a tape which carries a staff system, as shown diagrammatically in Figure 9. The tape A may be wound on rollers B, as in a typewriting machine or a film for moving pictures, and moved past the device for writing down the notes, as shown diagrammatically in Figure 11. In this case it will be recommendable to choose a system of notes which as much as possible approaches the picture of the keyboard. Such a system of notes is shown in Fig. 9 by way of example. A note which in the usual system of notes is provided with a flat signature is in the system according to Fig. 9 below the stave so as to appear suspended therefrom. Inversely a note increased by a semitone appears standing on the same stave. For notes having no signature both symbols are used at the same time to indicate the note is natural. The same logically also applies to notes ordinarily written between two staves, e. g. the notes *f*, *a* etc. When the tape with the arrangement according to Fig. 7 is intermittently moved in equal intervals of time over the system of staves the intervals of time between the stations (**1**, **2**, **3**, **4** etc.) could be a basis for the representation of the value of the notes, so that when crotches are counted a minim would be equal to two stations, so that the next minim would be noted but on the third station.

Fig. 10 shows two rows of full tones which are displaced relatively to each other by a semitone the same row of keys being represented for both the treble and bass clefs, in this case one of the five staves appears broken or as having a knee. This interruption of the lines of the staff is not necessary because in the arrangement shown in Figure 10, for example, the notes *b* and *c* in the right half of the figure are of the same height so that the line cannot be passed straight through at this point for otherwise a misrepresentation would result therefrom. The line must therefore have such a break at the said point that it extends on the one hand through the keys *b* and on the other hand through the upper part of the key *b'*, which corresponds to the note *a* sharp or *b* flat. All keys belonging to the same stave on account of their enharmonic notation are cut by such a stave, and all keys or notes lying above or below such a stave are also in the usual system of notes above or below.

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

1. The design of fields of sounding bodies for musical instruments and the like, in which sound related members disposed behind one another in the main direction of coordinates and corresponding to equal sound intervals constitute points of reference for other sound related members associated with intermediate notes which last members are, together with their points of reference, disposed behind one another in a second direction of coordinates other than the first direction, in which the system of coordinates of the field of members includes a definite angle with an imagined system of staves comprising straight lines only, in which the main direction of coordinates corresponds to the full-tone intervals and the other direction to the semitone intervals in the case of the tempered scale system comprising twelve intervals, in which the lower note is disposed below and the higher note above the points of reference, the meaning of below and above being determined by the staves, and in which there are provided exchangeable stencils of notation which are, optionally single or several together, disposed below or on the system of keys.

2. The design of fields of sounding bodies for musical instruments and the like, in which the sound related members disposed behind one another in the main direction of coordinates and corresponding to equal sound intervals constitute points of reference for other sound related members associated with intermediate notes which last members are, together with their points of reference, disposed behind one another in a second direction of coordinates other than the first direction, in which the system of coordinates of the field of sound related members includes a definite angle with an imagined system of staves comprising straight lines only, in which the main direction of coordinates corresponds to the full-tone intervals and the other direction to the semitone intervals in the case of the tempered scale system comprising twelve intervals, in which the lower note is disposed below and the higher note above the points of reference the meaning of below and above being determined by the staves, and in which sounding bodies are used for the production of music which are grouped directly in a system of staves and the points of touch of which are rendered conspicuous as picture of notes.

3. The design of fields of sounding bodies for musical instruments and the like, in which sound related members disposed behind one another in the main direction of coordinates and corresponding to equal sound intervals constitute points of reference for other sound related members associated with intermediate notes which last members are, together with their points of reference, disposed behind one another in a second direction of coordinates and adapted to at the same time represent corresponding notes by staves inscribed on them, and in which in the case of a tempered scale system comprising twelve intervals the main direction of coordinates corresponds to the full-tone intervals and the other direction to the semitone intervals with at least two rows of full tones, staves being provided therefor which intersect all the keys belonging to one and the

same stave according to their enharmonic notation.

4. The design of fields of sounding bodies for musical instruments and the like, in which sound related members disposed behind one another in the main direction of coordinates and corresponding to equal sound intervals constitute points of reference for other sound related members associated with intermediate notes which last members are, together with their points of reference, disposed behind one another in a second direction of coordinates and adapted to at the same time represent corresponding notes by staves inscribed on them, and in which in the case of a tempered scale system comprising twelve intervals the main direction of coordinates corresponds to the full tone intervals and the other direction to the semitone intervals, the note-key system being provided with a note recording device.

5. The design of keyboards or fields of sounding bodies for musical instruments or the imitations thereof, in which the keys or sounding bodies disposed behind one another in the main direction of coordinates and corresponding to equal sound intervals are points of reference for other keys or sounding bodies associated with intermediate notes which last keys or sounding bodies are, together with their points of reference, disposed behind one another in a second direction of coordinates and adapted at the same time represent corresponding notes by staves inscribed on them, in which further in the case of a tempered scale system comprising twelve intervals the main direction of coordinates corresponds to the full tone intervals and the other direction to the semitone intervals, and in which the note-key system is provided with a note recording device, the enharmonic notation of all notes being represented by the position of the particular note relatively to the stave so that signatures can be dispensed with.

6. The design of keyboards or fields of sounding bodies for musical instruments or the imitations thereof, in which the keys or sounding bodies disposed behind one another in the main direction of coordinates and corresponding to equal sound intervals are points of reference for other keys or sounding bodies associated with intermediate notes which last keys or sounding bodies are, together with their points of reference, disposed behind one another in a second direction of coordinates other than the first direction, and in which the system of coordinates of the field of keys or sounding bodies includes a definite angle with an imagined system of staves comprising straight lines only, the direction of coordinates of one set of semitones coinciding with the staves of the usual note system while the direction of coordinates of the other set of semitones is inclined relatively thereto.

7. An arrangement of a music playing field comprising a plurality of points of touch, certain of said points representing notes having a full tone difference and being relatively arranged to present a first direction of reference, the other points representing notes having an intermediate tone difference being arranged to present a second direction of reference, the first direction of reference extending substantially upward and the second direction of reference extending substantially from left to right while the first direction of reference, which corresponds to the full tones, extends at an angle and on the left of the second direction of reference so that the playing movements of the hand conform with the reading movements of the eye in accordance with the usual notations and the resulting position for higher and lower notes, whereupon the succession of full tones is interrupted at such points that the lateral boundary of the playing field extends substantially parallel to the direction of the scale.

8. An arrangement of a music playing field comprising a plurality of points of touch, certain of said points representing notes having a full tone difference and being relatively arranged to present a first direction of reference, the other points representing notes having an intermediate tone difference being arranged to present a second direction of reference, the first direction of reference extending substantially upward and the second direction of reference extending substantially from left to right while the first direction of reference, which corresponds to the full tones, extends at an angle and on the left of the second direction of reference so that the playing movements of the hand conform with the reading movements of the eye in accordance with the usual notations and the resulting position for higher and lower notes, whereupon the succession of full tones is interrupted at such points that the lateral boundary of the playing field extends substantially parallel to the direction of the scale, and whereupon the lowered intermediate note of each tone of reference is arranged on the left of the corresponding tone of reference and higher than the tone of reference which is lower to the extent of a full tone, and the raised intermediate note of each tone of reference is arranged on the right of the corresponding tone of reference and lower than the tone of reference which is higher to the extent of a full tone whereby the higher and lower position is determined by the staves of an imaginary staff system extending through the playing field.

9. An arrangement of a music playing field comprising a plurality of points of touch, certain of said points representing notes having a full tone difference and being relatively arranged to present a first direction of reference, the other points representing notes having an intermediate tone difference being arranged to present a second direction of reference, the first direction of reference extending substantially upward and the second direction of reference extending substantially from left to right while the first direction of reference, which corresponds to the full tones, extends at an angle and on the left of the second direction of reference so that the playing movements of the hand conform with the reading movements of the eye in accordance with the usual notation and the resulting position for higher and lower notes, whereupon the succession of full tones is interrupted at such points that the lateral boundary of the playing field extends substantially parallel to the direction of the scale and whereupon the lowered intermediate note of each tone of reference is arranged on the left of the corresponding tone of reference and higher than the tone of reference which is lower to the extent of a full tone and the raised intermediate note of each tone of reference is arranged on the right of the corresponding tone of reference and lower than the tone of reference which is higher to the extent of a full tone whereupon the higher and lower position is determined by the staves of a staff system extending through the playing field.

10. An arrangement according to claim 7, wherein the lowered note is below on the left of the point of reference and the raised note is above on the right of the point of reference, the higher and lower position being determined by the staves of a staff system.

11. An arrangement according to claim 7, wherein the second direction of reference coincides with the staves of an ordinary staff system while the other intermediate note direction is perpendicular thereto.

12. An arrangement according to claim 7, wherein the keys and sounding bodies in the direction of their octave intersect a normal staff system substantially perpendicular upwards.

13. An arrangement according to claim 8, wherein the lowered intermediate note of each tone of reference is arranged at the same distance on the left of the corresponding tone of reference which is lower to the extent of a full tone, and the raised intermediate note of each tone of reference is arranged at the same distance on the right of the corresponding tone of reference and below the tone of reference which is higher to the extent of a full tone whereupon the upper and lower position is determined by the staves of a staff system so that the connecting lines of the tones of reference form equilateral triangles with the corresponding intermediate notes and the preceding or following tones of reference in the scale.

14. An arrangement according to claim 9, wherein the lowered intermediate note of each tone of reference is arranged at the same distance on the left of the corresponding tone of reference and above the tone of reference which is lower to the extent of a full tone and the raised intermediate note of each tone of reference is arranged at the same distance from the corresponding tone of reference and below the tone of reference which is higher to the extent of a full tone whereupon the upper and lower position is determined by the staves of a staff system so that the connecting lines of the tones of reference form equilateral triangles with the corresponding tones of reference and the preceding or following tones of reference in the scale.

15. An arrangement according to claim 7, wherein the keyboard is so arranged that the staves of a staff system imagined as extending through the playing field are parallel to the player.

16. An arrangement according to claim 7, wherein the keyboard is so arranged that the staves of a staff system extending through the playing field are parallel to the player.

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