

United States Patent

[11] 3,621,106

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 [45] Patented **Nov. 16, 1971**

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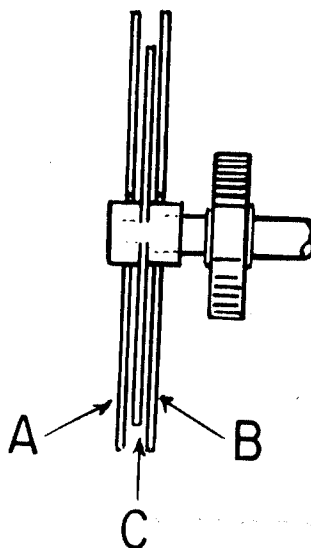
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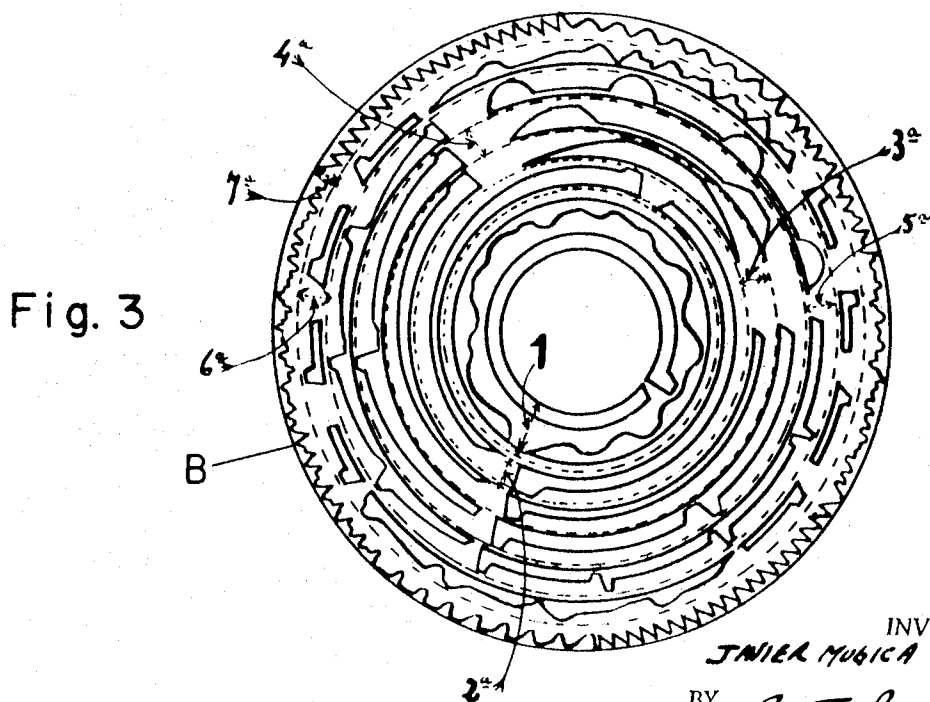
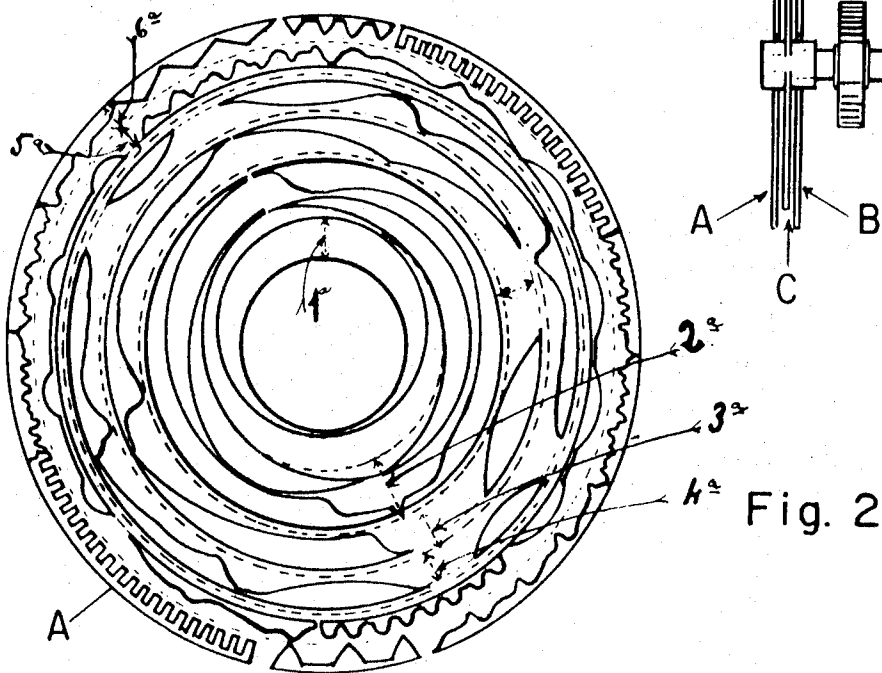
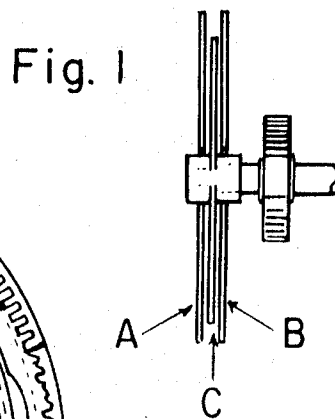
[54] **ELECTRONIC TONE GENERATOR**
4 Claims, 5 Drawing Figs.

[52] U.S. Cl. 84/1.28
 [51] Int. Cl. G10h 3/04
 [50] Field of Search..... 84/1.01,
 1.18, 1.28, DIG. 29; 179/1 M; 340/200, 384

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ABSTRACT: An electrostatic tone generator is provided which includes at least one subelement having a rotary disk and a pair of adjacent stators. Each stator has concentrically arranged tonal patterns which are read by analyzers which are distributed in matching concentric areas. While the tonal patterns included on the matching stators are not symmetrical the analyzer arms for the outermost concentric tonal areas are symmetric and are identically sized and shaped.





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 BY *[Signature]*

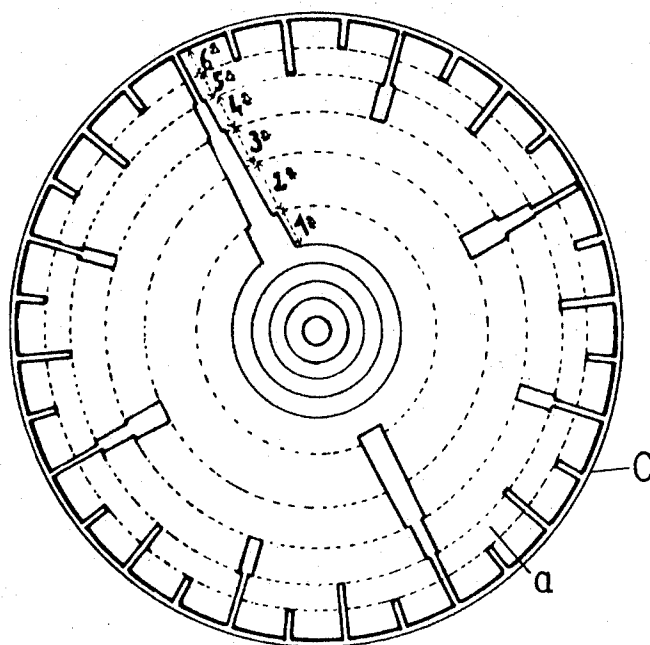


Fig. 4

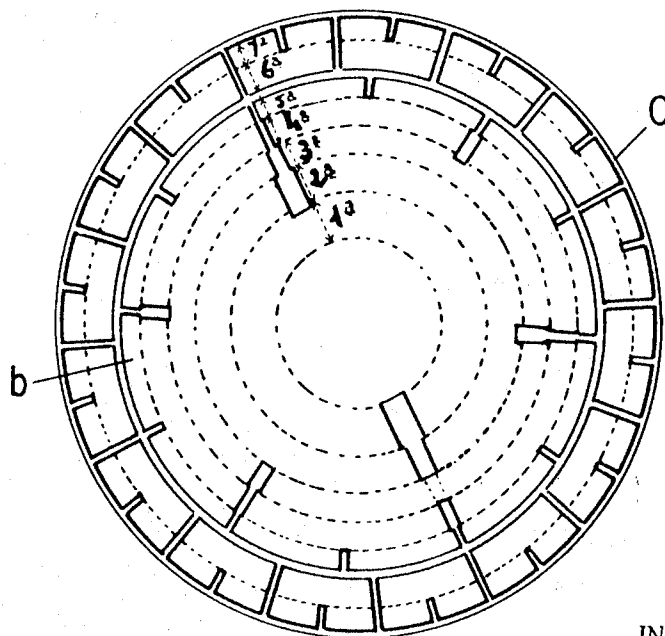


Fig. 5

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ELECTRONIC TONE GENERATOR

Electrostatic sound generators for musical instruments have been available for some time with generating subelements, each composed of a rotating disc or analyzer turning between two stator plates with recordings of sounds at a number of musical pitches.

Some generators of this type require that the stator plates be symmetrical with respect to the rotary disc or analyzer so that a better reading can be obtained by compensation; others require this only in the peripheral area, for it is there that the formats representing the high-pitched sounds are usually read. To get a good reading in this area, it is therefore desirable that compensation be made therein by means of the aforementioned symmetrical arrangement, which moreover makes available more space for the various formats on the rest of the middle, central area of the plate. To obtain simplified mechanical operation and a reduction in the turning speed of their components, other generators use five, six, or seven generating subelements, as the case may be, on which the sound reading is otherwise compensated for, generally by a 180° opposition on the given plate; a limit is imposed, however, on the number of recordings since less surface is available than in generators with twelve subelements. Other generators use arrangements that are combinations of the above, but all are characterized by a defect that is an inherent feature of the system itself, viz, the rigidity of the phases, a defect that is obvious when the various tones or formats of a given generating subelement are juxtaposed, for the harmonics of a tone on each note coincide with the harmonics of other tones on the same note, as do the harmonics of their octaves. This happens numerous times and results in tones that are, musically speaking, lifeless and without warmth, which is the reason why musicians reject these recordings, or if they accept them, they do so for lack of a better alternative.

To remedy this defect, a procedure has been developed to make it possible to obtain a number of tones at the same musical pitch, but with a constantly varying phase ratio (see French Pat. No. 1,485,542 or Spanish Pat. No. 307,905).

This procedure is not, however, free of defects, some of which are the result of the excessive capacity of the analyzing disc, which is caused by the fact that the analyzing arms on either side of the disc do not coincide, as they do for the most part, especially along the periphery, in the systems used heretofore. This excessive capacity is a result of the fact that the ground of the analyzing disc surrounds the entire reading surface, including the analyzing arms. When the analyzing arms do not coincide, i.e., when they do not face each other, some capacity is shunted to the ground, which is detrimental to proper reading of the high-pitched notes. Moreover, some tones rich in harmonics which are obtained from the peripheral formats require extremely accurate reading conditions, which make advisable a symmetrical arrangement with respect to the rotating disc in order to compensate for whatever deflection might exist in the said disc, such that 180° reversal of the recordings placed on a given stator face would not be sufficient to make compensation in the reading, or at least to prevent them from being repeated inversely on the other side with their existing opposition. Other tones, particularly ones not rich in harmonics, such as those of bass strings and round flutes, may, on the other hand, be read even without compensation. All that is required is that the image be repeated several times; this means the advantage of needing only a single connection for excitement.

A new reading system has therefore been developed in which the stator plates can be read with analyzers whose arms are equal in number and shape at the periphery on either side, but do not have these characteristics in the other analyzer reading areas, except in the initial areas, starting at the center, where the number of arms is the same on either side, but their shape is different.

Below is a description of an example of a practical application of this invention, which mitigates to a great degree the aforementioned defects and has the advantage of employing essentially the same parts that have been used heretofore, this

invention consisting basically of a new arrangement thereof, which has the advantage of being easily to produce industrially at no additional cost.

For clearer understanding, the following description refers to the attached drawings of the basic parts of one of the 12 equal generating subelements (equal except for the driving pulley which is of a different size in each one) that normally compose a sound generator.

FIG. 1 is an elevational view of an electrostatic sound generator of the present invention.

FIG. 2 is an elevational view of a first stator including concentrically arranged tonal patterns.

FIG. 3 is an elevational view of a second stator including concentrically arranged tonal patterns.

FIG. 4 is an elevational view of a first side of a rotary disk which reads the first stator.

FIG. 5 is an elevational view of a second side of a rotary disk which reads the second stator.

A—is one of the stator plates, which has six concentric areas where the recordings are attached (see FIGS. 1 and 2).

B—is another stator plate with seven concentric areas where the recordings are likewise made (see FIGS. 1 and 2).

C—is the rotary disc or analyzer (see FIG. 3) which has six concentric reading areas on one side (side *a*) and seven on the other (side *b*).

The first concentric area on stator plate A, starting from the center, contains the formats of different tones of a note on the first 16-foot octave. This format is read by a (reference numerals 1a-6a and 1a-7a in FIGS. 4 and 5, respectively, indicate analyzer arms) single rotary disc analyzing arm on side *a*. The second concentric area has formats representing the various tones of a note in the second 16-foot or first 8-foot octave, which are read by the two rotary disc analyzing arms on side *a*, and so on up to the fifth area, where the formats representing the various tones of a note on the fifth 16-foot or fourth 8-foot octave are read.

In the sixth area, although all the formats contained therein are read by 32 analyzing arms, the formats correspond to the various tones of a note on the fifth 8-foot octave, a note on the fifth 4-foot octave, and a note on the fifth 2-foot octave.

Thus, each stator plate of this type contains formats for the various tones of a note in its eight octaves.

Disc B has seven concentric rings, and the first concentric area, starting from the center, contains formats for the various tones of a note on the first 16-foot octave. These formats are read by a single analyzing arm. The second concentric area has formats of the various tones of a note on the second 16-foot octave, which are read by two analyzing arms. The third concentric area has formats representing the tones of a note from the five highest notes of the second 16-foot octave, or the first seven notes of the third 16-foot octave, which are read by three analyzing arms. The fourth concentric area contains recordings of the tones of one of the last five notes of the third 16-foot octave, or one of the first seven notes of the fourth octave, which are read by six analyzing arms. The fifth concentric area has recordings representing the tones of a note from the last five of the fourth 16-foot octave or one of the first seven on the fifth 16-foot octave, which are read by 12 analyzing arms. The sixth concentric area contains recordings representing a note on the full fifth 16-foot octave, which are read by 16 analyzer arms. The seventh concentric area contains recordings of a note on the fifth 8-foot octave, a note on the fifth 4-foot octave, and a note on the fifth 2-foot octave, which are read by 32 analyzing arms. Thus, this type of plate also contains the full eight octaves of the scale.

Analyzing disc C has the following number of arms in the following areas on each of its sides, *a* and *b*: PS TI Side *a* (see FIG. 3)

Side *b* (see FIG. 3)

First area, one arm
Second area, 2 arms
Third area, 4 arms
Fourth area, 8 arms
Fifth area, 16 arms
Sixth area, 32 arms

First area, one arm
Second area, 2 arms
Third area, 3 arms
Fourth area, 6 arms
Fifth area, 12 arms
Seventh area, 32 arms

Thus, only areas 3, 4 and 5 on disc *b* stand in the relationship of a fifth to the corresponding recordings on the other plate *a*; to obtain the right effect, the switchgear is so designed that, when any of the recorded formats contained in areas 3, 4, and 5 is to be excited, this is always done a fifth lower so that the note in question will be played at the same height.

It is also evident that not all the recordings on the periphery of the two plates are symmetrical with respect to the analyzing disc, but rather only the ones for which this is an essential requirement.

As mentioned above, the generator in this example has 12 equal generating subelements, and it is therefore clear that the effects achieved can be extended to all the normally used ranges of the musical scale in the various tones recorded on the two above-mentioned plates.

The recordings used in the example described are in series so arranged as to stand in a relationship of a difference of a fifth, but a more pronounced effect can be obtained if they are made to stand in the relationship of a difference of a third; and even more so, if three series are used which stand in the relationship of a third and a fifth to one another. In such cases, the analyzers would have to be adapted to the needs imposed by the requirements for correct reading, in view of which the number of arms and the reading areas would have to be modified accordingly.

The number of areas standing in the relationship of a difference of a fifth (and which may differ by a third in other cases) may be increased or reduced, as the circumstances demand; however, the number in the example described, the ratios are sufficient for the advantageous effects of the system to be apparent.

In a more extreme case, each stator plate could even be given a larger diameter, and consequently, a larger surface area so as to be able to include the series of recordings contained on the two plates, which, as mentioned in the description of the example, have six areas on one face and seven on the other, i.e., a total of 13 areas per stator plate. In this case, the recordings that are reversed must stand in the proper correspondence from side to side, and the analyzer must have 13 reading areas. The number and shape of the reading arms would be the same on either side.

The foregoing constitutes a sufficient description of the nature of this invention, and it is hereby expressly acknowledged all changes and modifications in the details thereof shall likewise be accorded patent protection, provided such changes or modifications do not alter the essential features of the invention.

The essential features of the invention for which patenting is sought are as stipulated in the following set of claims:

1. An electrostatic tone generator comprising a plurality of generating subelements each including a rotary disk member and a pair of stator plates adjacent each side thereof, said pair of stator plates containing a plurality of concentric areas having tonal patterns thereon, one of said stator plates containing a different set of tonal patterns than the set of tonal patterns contained on the other one of said stator plates, and said rotary disk having on either side thereof a plurality of concentric areas matching the respective concentric areas of the adjacent stator plates and including analyzer arms to read the tonal patterns contained in each of the concentric areas of said stator plates, the analyzing arms located in at least the two outermost concentric areas of one side of said rotary disk having the same number, size and shape, and location as the analyzing arms located in at least the two outermost concentric areas of the other side of said rotary disk.

2. An electrostatic tone generator according to claim 1, wherein the number of concentric areas on one of said stator plates and its related rotary disk side is different from the number of concentric areas on the other stator plate and its related rotary disk side.

3. An electrostatic tone generator according to claim 2, wherein the analyzer arms located in at least the two innermost concentric areas of one side of said rotary disk are equal in number but differ in shape, from the analyzer arms located in at least the two innermost concentric areas of the other side of said rotary disk member.

4. An electrostatic tone generator according to claim 3, wherein the analyzer arms located in the concentric areas intermediate said outermost and innermost concentric areas on one side of said rotary disk differ in number from the analyzer arms located in the concentric areas intermediate said outermost and inner concentric areas on the other side of said rotary disk.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,621,106 Dated November 16, 1971

Inventor(s) Javier Mugica Irastorza

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The inventor is Javier Mugica Irastorza
In the Specification

Column 2, lines 68 to bottom cancel and substitute therefor:

-- Analyzing disc C has the following number of arms in the following areas on each of its sides, a and b:

Sida a (see Fig. 3)	Side b (see Fig. 3)
First area, one arm	First area, one arm
Second area, two arms	Second area, two arms
Third area, four arms	Third area, three arms
Fourth area, eight arms	Fourth area, six arms
Fifth area, sixteen arms	Fifth area, twelve arms
Sixth area, thirty-two arms	Sixth area, sixteen arms
	Seventh area, thirty-two arms --

Signed and sealed this 20th day of June 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents