

M. L. SEVERY & G. B. SINCLAIR.
 PRODUCING MUSICAL TONES.
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1,009,798.

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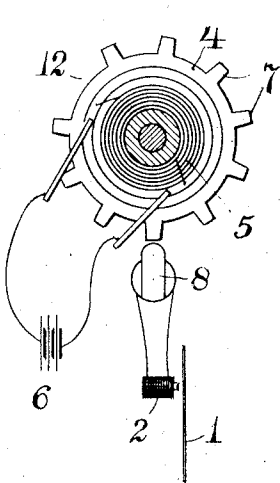


Fig. 2

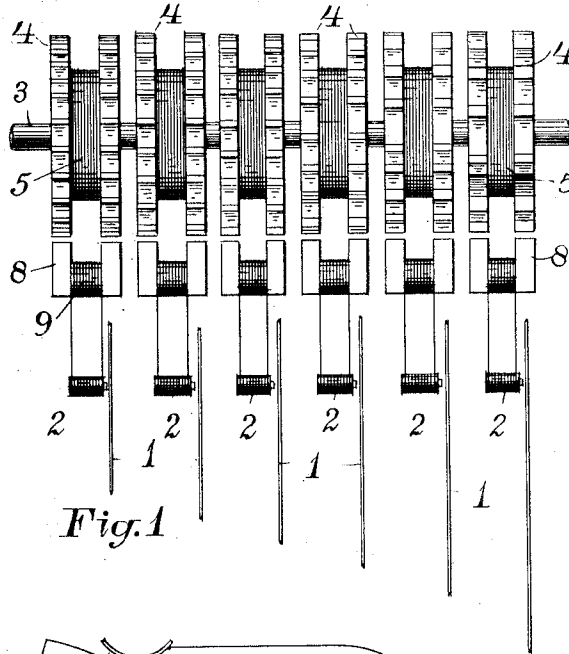


Fig. 1

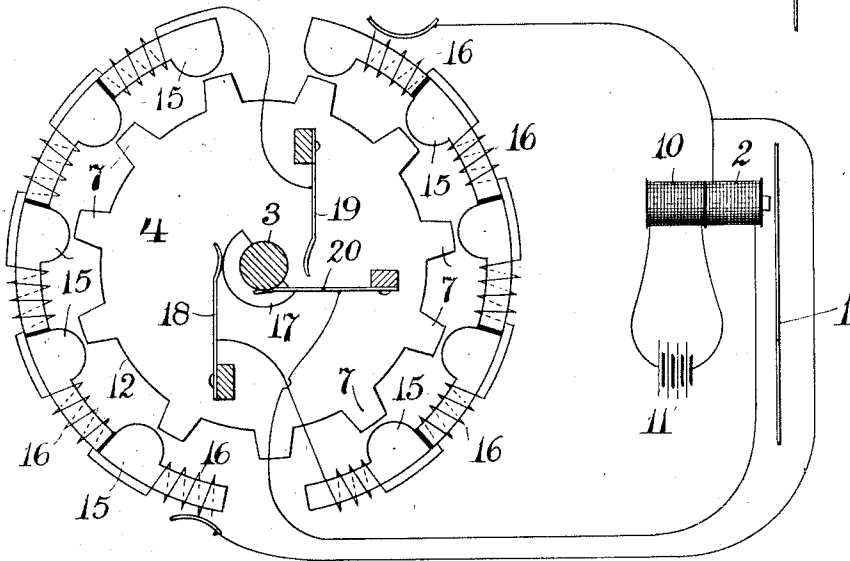


Fig. 3

Attest;

Margaret L. Waite.
 Maria MacLaffin

Inventors,

Melvin L. Severy,
 George B. Sinclair;

By A. B. McPherson,
 Attorney

UNITED STATES PATENT OFFICE.

MELVIN L. SEVERY, OF ARLINGTON HEIGHTS, AND GEORGE B. SINCLAIR, OF MEDFORD, MASSACHUSETTS.

PRODUCING MUSICAL TONES.

1,009,798.

Specification of Letters Patent. Patented Nov. 28, 1911.

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To all whom it may concern:

Be it known that we, MELVIN L. SEVERY, of Arlington Heights, in the county of Middlesex and Commonwealth of Massachusetts, and GEORGE B. SINCLAIR, of Medford, in said county and Commonwealth, both citizens of the United States, have invented certain new and useful Improvements in Processes of Producing Musical Tones, of which the following is a specification.

Our invention has for its object the production of musical tones in musical instruments embracing sonorous bodies, and electromagnetic means for their actuation; the especial features of our invention comprising a process wherein the actuating currents are electric impulses originally generated as such and some of which impulses are incommensurate with others although produced by parts revolving commensurately with each other.

Our process further embraces steps hereinafter set forth.

Referring to the drawings forming part of this specification, Figure 1 is an elevation of a means for carrying our process into effect. Fig. 2 is a cross section of the same. Fig. 3 is a cross section on a larger scale of a similar means but adapted for carrying into effect added steps in our process.

In Fig. 1 is illustrated a considerable number of sonorous bodies, as strings 1, which are designed to be tuned to the successive notes of the musical scale. Each string is provided with an electromagnet 2 to which electric pulsations are to be transmitted for the magnetic actuation of such string; and each electromagnet is in circuit with a pulsation producing means, all which means are rotated commensurately with each other, as by being mounted on a common shaft 3. In previous electrical musical instruments made by us, as those set forth in our companion application No. 443,912, we take a continuous current from any suitable source, and transform the same into pulsations suitable for the various tuned sonorous bodies, by means of current interrupting devices. In this process, however, we generate *de novo* the desired pulsatory or alternating currents adapted for the differ-

ent electromagnets and strings. Each such current generator is here shown as consisting of an electromagnetic spool having heads 4 and windings 5, said windings being in circuit with any suitable source as 6, in Fig. 2. Said heads are formed with peripheral teeth 7, which by moving in the fields of the pole pieces 8, induce intermittent or pulsatory alternating currents in the windings 9 which are immediately shared in by the connected electromagnets 2.

By having the teeth 7 on the spools, or rotors, far enough apart, the current pulsations will have dead intervals between them long enough to permit the strings to recede from their electromagnets and be again attracted thereto; but in case the said teeth are so close together as not to allow such dead intervals, then it is essential to polarize each electromagnet, as illustrated in Fig. 3. One method of such polarization consists in elongating the core of the magnets 2, and mounting thereon windings 10 wired to a source of direct current 11. Then inasmuch as each current alternation consists of one flux in one direction, and another in the reverse direction, one half of each alternation will be of like polarity in the electromagnet 2 to that of the windings 10 and will double the magnetic effect of the magnet; while the other half will be of unlike polarity, and will neutralize the polarity of the magnet and render it dead.

The strings 1 being tuned to the notes of the musical scale, as C, C#, D, D#, etc., the rotor associated with the string C# for instance must have a number of teeth 7 in its heads 4 which will be incommensurate with the number of teeth on the heads 4 of the rotor associated with the string C. We surmount this difficulty by forming a blank space 12 at the section of the head's periphery where the fractional tooth would otherwise occur, and consequently separate each group of correctly timed impulse-generating teeth with an interval differing from the remaining teeth.

As thus far described, our process will consequently be seen to consist in generating electricity in a multiplicity of pulsations of a frequency equal to the vibrations of a

tuned sonorous body, the pulsations being separated into groups by the interposition of an interval differing from the vibrational interval of said body. It will also be seen
 5 that we impress upon the electromagnet controlling a tuned sonorous body electric pulsations equal in frequency to the vibrations of such body, and also electric pulsations unequal thereto, the former being so much more
 10 numerous as to practically overwhelm and render negligible the latter pulsations.

In the apparatus illustrated in Fig. 3, we set forth a process whereby we superpose upon the electromagnet 2 a plurality of
 15 simultaneously produced electric pulsations, and consequently affect its associated sonorous body 1 with a correspondingly greater strength. In doing this the rotor heads 4 are each surrounded by pole pieces 15 equal
 20 in number to the teeth 7 and separated from each other by angular spaces equal to those between the teeth. These pole pieces are shown as arranged in two groups, but we do not restrict ourselves to this number, the
 25 windings 16 of each group being wired together tandem, but they may be wired in multiple. Inasmuch as when the abnormal space 12 is presented toward either said group, more or less of the pole pieces thereof
 30 will not be in phase with juxtaposed teeth, we arrange to cut out of the circuit to the electromagnet 2 each said group when said abnormal space reaches it, and switch into the circuit the group from which said space has
 35 just departed. In this manner we superpose upon the electromagnet a number of simultaneous current pulsations substantially equal to one half of the teeth. To thus cut in and out said pole piece windings 16, the
 40 shaft 3 is provided with a semi-circular contact 17 having in position to touch the same two oppositely located stationary brushes 18, 19. Each brush is wired to one terminus of one group of windings 16, while the opposite
 45 terminus of each group is wired to the electromagnet 2; and the shaft 3 has a brush 20 wired to said electromagnet. As the rotor revolves, said contact 17 automatically cuts out one group of windings and switches in the other group, and so keeps the electro-
 50 magnet constantly supplied with vigorous resultant pulsations, separated into groups as shown by phase displacements.

What we claim as our invention and for
 55 which we desire Letters Patent is as follows, to wit:—

1. The herein described process of educating a musical tone, which consists in generating electricity in a multiplicity of series of re-
 60 current cycles of pulsations, most of said series of cycles having in each cycle thereof a plurality of frequencies of pulsations the majority of said pulsations being in each case of the vibrational frequency of an as-
 65 sociated sonorous body, but the remainder

of said pulsations being of a different frequency and causing said pulsations to vibrate said sonorous body.

2. The herein described method of educating a musical tone, which consists in generating
 70 electricity in cycles of current pulsations, all but a few of the pulsations of each cycle being equidistant in time each from its preceding and following pulsations, but some thereof being separated from certain of their
 75 associated pulsations by intervals different from those intervening between the majority of said pulsations, and impressing said pulsations upon means adapted to vibrate a sonorous body.

3. The herein described method of educating a musical tone, which consists in generating electricity in cycles of impulses most but not all of which impulses in each of most of the cycles are equidistant from each other in
 85 point of time, and impressing said impulses upon means adapted to vibrate a sonorous body.

4. The herein described method of educating a musical tone, which consists in generat-
 90 ing electricity in a plurality of trains of impulses all but a few of the impulses in each train being equidistant from each other in point of time and the impulses of some trains being of a frequency per unit of time in-
 95 commensurate with that of some of the other trains, the said trains being generated by rotary motions commensurate with each other, and impressing said impulses upon means adapted to vibrate a sonorous body.

5. The herein described method of educating a musical tone which consists in generat-
 100 ing a plurality of series of electric impulses, some of the alternations in some of the series being out of tune relative to their neighboring impulses, each said series having a majority of its impulses timed to the vibrations of a note of the musical scale and the frequencies of the majority of the impulses composing some of the series being incom-
 105 mensurate with the frequencies of a majority of the impulses composing some of the other series, and impressing said impulses at will upon means adapted to vibrate a sonorous body.

6. The herein described process of producing a musical tone, which consists in generating electricity in pulsations equal in frequency to the vibrations of a sonorous body, and also generating other electrical pulsations
 120 of a different frequency, and impressing both kinds of pulsations upon said sonorous body, the proportion of the first named pulsations being in sufficient excess over that of the other pulsations as to overpower them
 125 and render negligible their effect.

7. The herein described process of educating a musical tone, which consists in generating electricity in a multiplicity of pulsations
 130 of a frequency equal to the vibrational fre-

quency of a sonorous body, the said pulsations being separated into groups by the interposition of an interval differing from the vibrational intervals of said sonorous body, and utilizing the said pulsations to vibrate said sonorous body.

In testimony that we claim the foregoing

invention, we have hereunto set our hands this 27th day of January, 1910.

MELVIN L. SEVERY.
GEORGE B. SINCLAIR.

Witnesses:

A. B. UPHAM,
CHARLES GARRISON.