No. 814,878. PATENTED MAR. 13, 1906.

M. L. SEVERY & G. B. SINCLAIR.

ELECTRIC MUSICAL INSTRUMENT.

APPLICATION FILED NOV. 24, 1900. RENEWED AUG. 1, 1905.

2 SHEETS—SHEET 1.

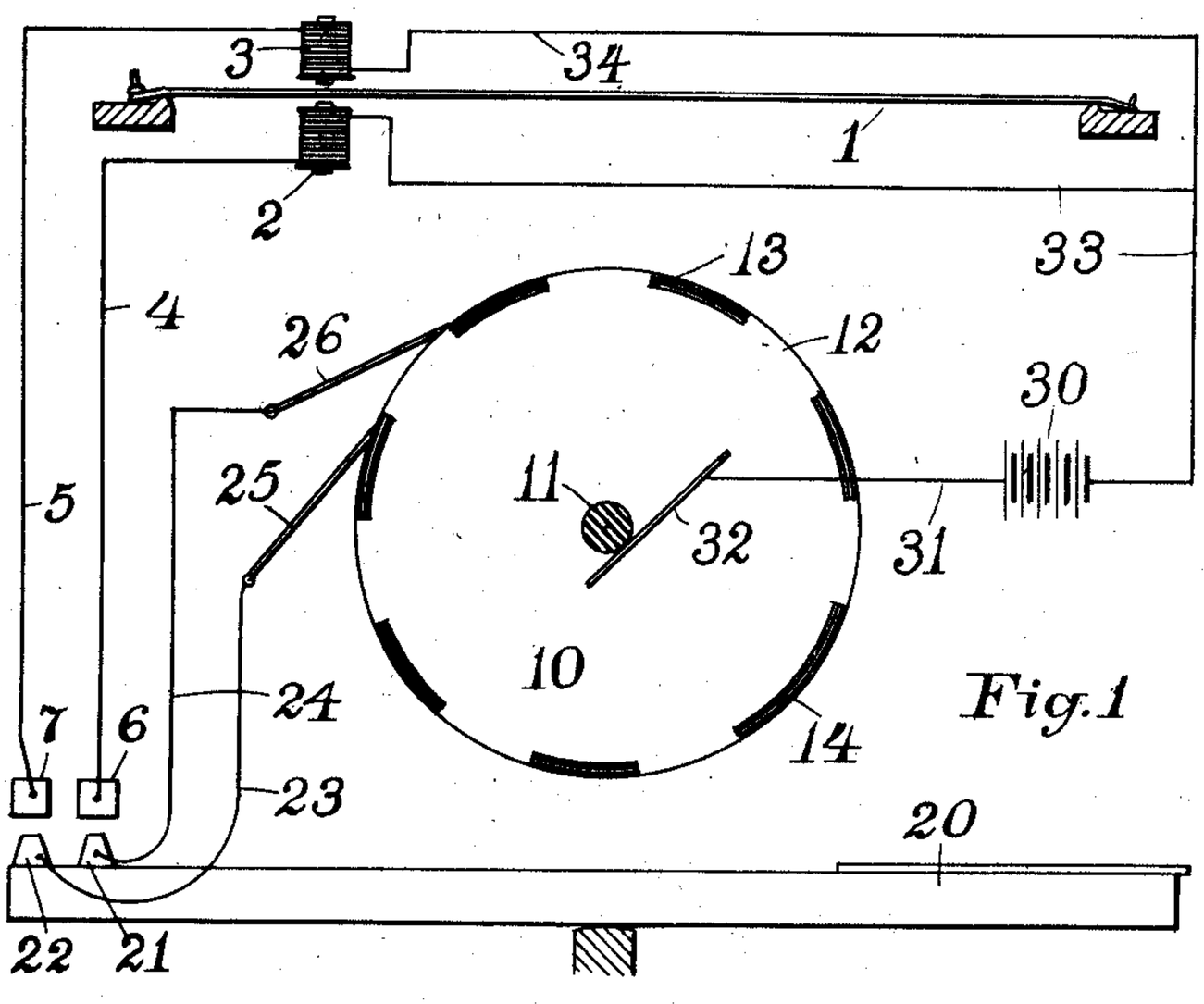


Fig. 1

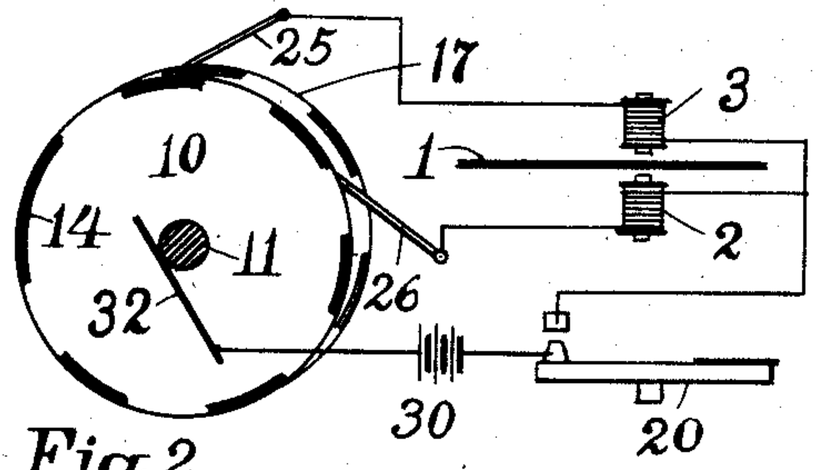


Fig. 2

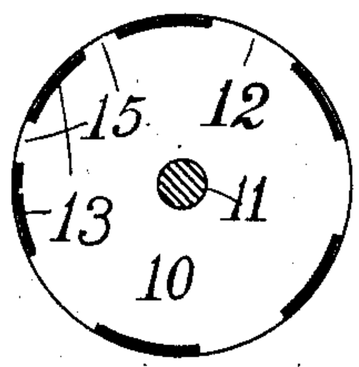


Fig. 3

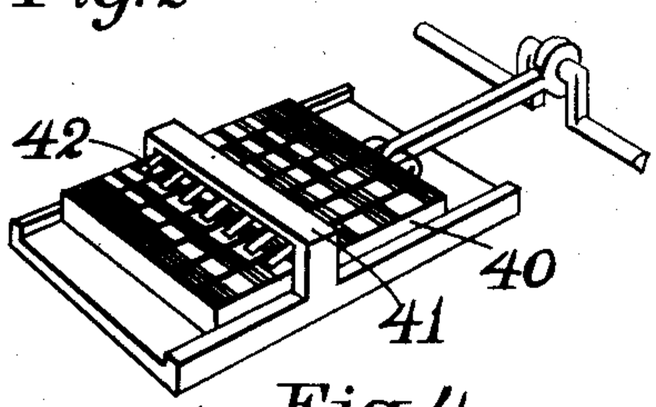


Fig. 4

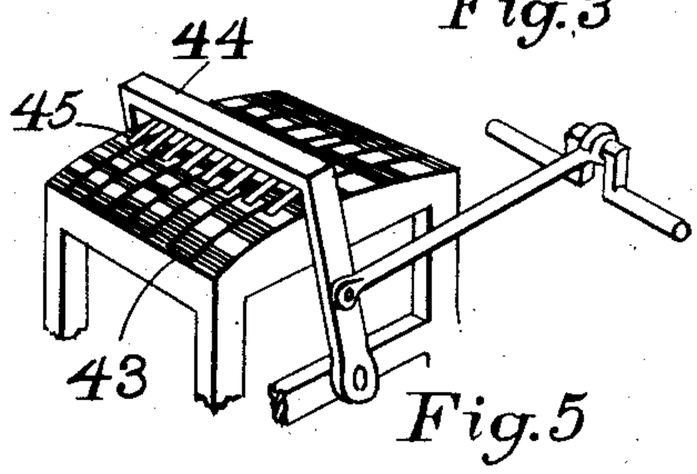


Fig. 5

Attest;

Fred G. Fitch,

J. F. L. Daudé

Inventors;

Melvin L. Severy,

George B. Sinclair;

By A. B. Upham,

Att'y.

No. 814,878. PATENTED MAR. 13, 1906.

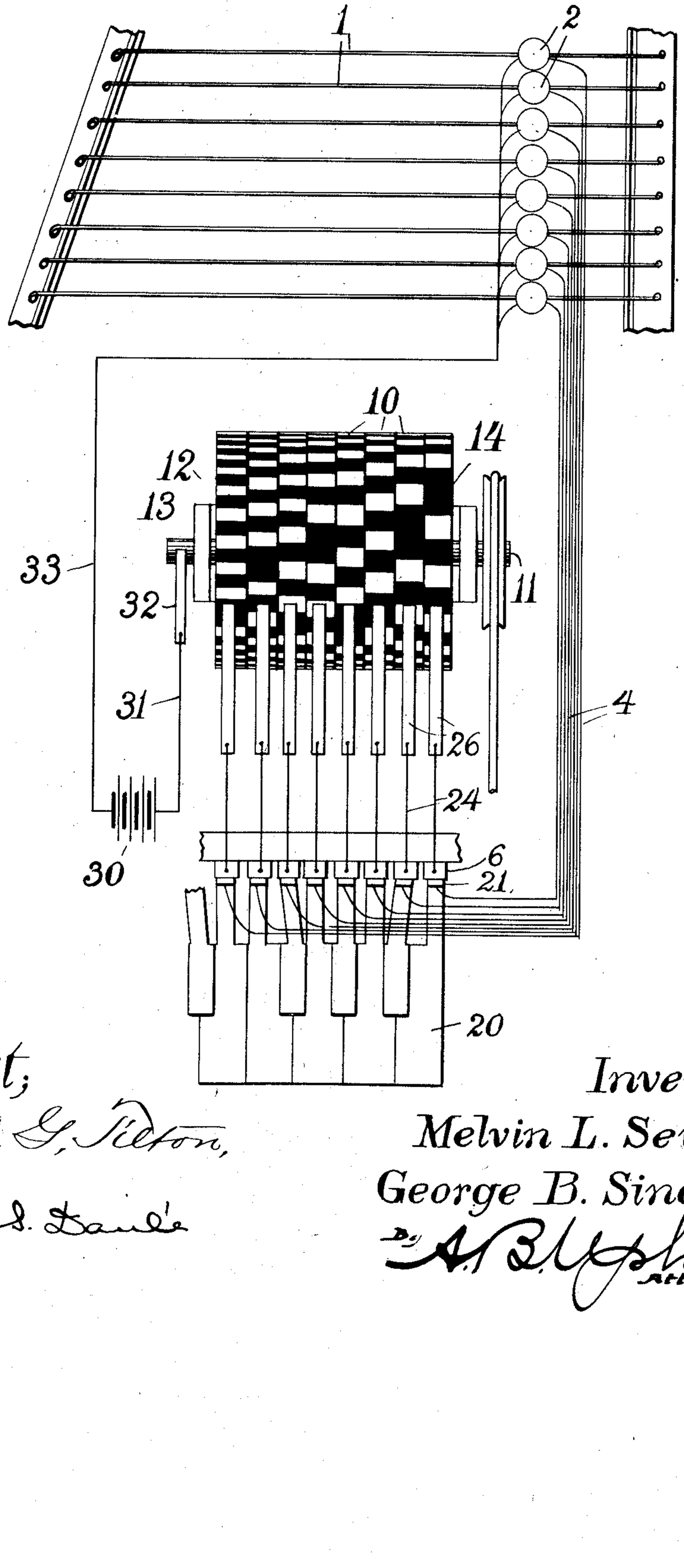
M. L. SEVERY & G. B. SINCLAIR.

ELECTRIC MUSICAL INSTRUMENT.

APPLICATION FILED NOV. 24, 1900. RENEWED AUG. 1, 1905.

2 SHEETS—SHEET 2.

Fig. 6



Attest;

Fred G. Fidton,

J. F. S. Lamb

Inventors;

Melvin L. Severy,

George B. Sinclair;

by A. B. Upham, Att'y

UNITED STATES PATENT OFFICE.

MELVIN L. SEVERY, OF ARLINGTON HEIGHTS, AND GEORGE B. SINCLAIR, OF WINTHROP, MASSACHUSETTS, ASSIGNORS TO CHORALCELO MANUFACTURING COMPANY, A CORPORATION OF MAINE.

ELECTRIC MUSICAL INSTRUMENT.

No. 814,878. Specification of Letters Patent. Patented March 13, 1906.

Application filed November 24, 1900. Renewed August 1, 1905. Serial No. 272,193.

To all whom it may concern:

Be it known that we, MELVIN L. SEVERY, of Arlington Heights, in the county of Middlesex, and GEORGE B. SINCLAIR, of Winthrop, in the county of Suffolk, Commonwealth of Massachusetts, citizens of the United States, have invented certain new and useful Improvements in Electric Musical Instruments, of which the following is a full, clear, and exact description.

This invention pertains to that class of musical instruments in which sonorous bodies, such as steel or iron strings, are vibrated through the effect of electric pulsations; and the object of our invention is the construction of improved devices for accurately producing such electric pulsations.

Referring to the drawings forming part of this specification, Figure 1 is a side elevation in diagram showing a piano-string and our improved pulsation devices for its actuation. Fig. 2 is a diagram of a modified form of our invention. Fig. 3 is a side view of a current-interrupting disk having its teeth arranged differently from that of our preferred form. Fig. 4 is a perspective view of a current-interrupting device which is reciprocated instead of rotated. Fig. 5 is a perspective view of a form in which the make-and-break teeth are stationary and the contacting brushes are oscillated. Fig. 6 is plan view of a plurality of strings and pulsators made in accordance with our invention.

In said drawings the reference-numeral 1 designates a piano-string having an electromagnet located to present its pole at the proper striking-point of the string. A wire 4 connects this magnet to the fixed contact-point 6, and a wire 33 puts such magnet into circuit with the source of electricity 30. Between said source of electricity and said contact-point 6 is the make-and-break device and a key for closing the circuit. The make-and-break device consists of the uniformly-rotating disk 10, having its periphery formed with alternate sections or teeth of conducting and non-conducting material 12 and 13, engaged by the brush 26, joined by the wire 24 to the contact-point 21, moved by the depression of the key 20 into touch with the fixed contact 6. Said disk and its shaft 11 being of conducting material and a brush 32 contacting therewith and joined by a wire 31 to the proper pole of said source of electricity 30, the electric pulsations produced by the passage of said teeth or sections beneath said brush 26 can at will be delivered to said electromagnet 2. The magnetic pulsations thus produced instantly communicate to the spring 1 the acoustic vibrations desired. To produce the best results, it is essential to have the frequency of pulsations delivered to the electromagnets correspond accurately with the vibrations per unit of time for which the strings are designed. To thus insure exact correspondence between each string and its operating-magnet, there must be an accurate spacing of the teeth on the rotating disk by which the pulsations are produced. The most practical arrangement of make-and-break device requires that a considerable number of the disks 10 shall be carried by a single rotating shaft, and the differences in rate of pulsations are produced by spacing the teeth differently on the various disks. The difficulty is, however, that among the twelve notes of an octave there are several which vibrate in numbers per unit of time which can only be expressed fractionally, and inasmuch as one cannot produce a fraction of a vibration by a fraction of a tooth exact correspondence cannot be obtained by forming a disk with a certain number of whole teeth and the fraction of a tooth. Some inventors have made no attempt to obtain this exact correspondence, but have simply neglected the fraction—that is, if the desired number of vibrations per unit of time were one hundred and twenty-five and two-fifths they would cut the disk with either one hundred and twenty-five or one hundred and twenty-six teeth. This is highly objectionable for the reason that there is never any true correspondence between the pulsations of the mag net and its string, one being faster or slower than the other, and the string never being vibrated with its full power, while the note produced is uneven in tone. We have discovered that by leaving a blank space in the disk at the point where a fractional tooth would otherwise occur when the remainder of the disk was cut in accurate correspondence with its string's vibrations, we obtain the desired perfect correspondence through practically the entire rotation of the disk and with no disagreeable alteration in the tone at any point.

This, we reason, is due to the ability of the string to immediately change its phase of vibration at the passage of said blank space and so continuously maintain its uniformity of vibration. Whatever the reason, however, the results accomplished by this simple expedient are wonderful, far beyond in volume and beauty of tone anything before done in this line. There are two ways in which this can be accomplished, one consisting in simply leaving a blank or non-conducting space where the fractional tooth would otherwise occur and the other consisting in omitting some of the correctly-spaced teeth adjoining the fractional space and substituting therefor a few teeth so arranged as to better bridge over the space between the correct teeth and so taper the vibrations of the string more gradually in their change of phase. The former method is illustrated in Figs. 1 and 2, where 12 designates the conducting-teeth; 13, the non-conducting spaces, and 14 the elongated non-conducting space occupying the place which would otherwise be taken by a space and the fractional tooth. The second method is shown in Fig. 3, where 12 and 13 are the correctly-proportioned teeth and spaces, while 15 indicates two fractional teeth separated by normal spaces and designed to accomplish the results described. The construction illustrated in Fig. 6 is practically identical with the one shown in Fig. 1, the only exceptions being that but a single electromagnet 2 is shown for each string 1, and these magnets are represented as above instead of below, as in Fig. 1. The other difference consists in wiring the brushes 26 to the fixed contact-points 6 instead of to the movable contacts 21 and wiring the electromagnets 2 to said movable contacts instead of to the fixed contacts 6. The operation of the instrument is the same, however, the difference in showing being only for the sake of clearness in illustration.

The abnormal space 14 is made non-conducting instead of permitting such elongated arc to be a lengthy tooth for the reason that the non-conducting space being negative as to effect upon the string the latter is left free to vibrate during such instant of time, while the elongated tooth would cause the string to continue to be drawn down by its magnet even when tending to swing away therefrom. Hence the tone would be injuriously affected were not the fractional space occupied by non-conducting material.

A further improvement is that by which the string 1 is operated by means of two electromagnets located at opposite sides of the same and alternately energized. As shown in Fig. 1, the electromagnet 3 is fixed at the opposite side of the string 1 from the magnet 2 and is connected to the make-and-break devices similarly to the magnet 2, with the exception that its brush 25 is located to contact with a different part of the periphery of the disk 10 just a tooth's distance from the brush 26. Consequently when one magnet is imparting a pull to the string the other magnet is dead. In other words, the string is positively attracted in both directions of its vibration. Said electromagnet 3 is similar to its companion joined by a wire 5 to a contact-point 7 and by the wire 34 33 to one pole of the source of electricity 30, and the movable contact-point 22 operated by the same key 20 is joined by a wire 23 to the brush 25. The same function can be performed by the modification illustrated in Fig. 2, where two different disks are used for the two brushes, the brush 25 being in contact with the disk 17 and the brush 26 with the disk 10; but the same arrangement is preserved of having one magnet alive the instant the other is dead.

Although we prefer rotating disks for our make-and-break device or pulsator, our arrangement of blank spaces permits us to use reciprocated toothed bars as well, as shown in Fig. 4, where 40 designates a group of toothed bars suitably reciprocated beneath a fixed brush-support 41, holding brushes 42 in contact with said bars. By having the elongated non-conducting spaces at the ends of these bars the change in the latters' direction at each end of the stroke does not affect the tone injuriously. The same advantage is obtained when the toothed bars are fixed in position and their brushes reciprocated over them, even when such bars are curved and the brushes oscillated, as shown in Fig. 1, where 43 represents the toothed bars, 44 the brush-carrier, and 45 the brushes.

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

1. In an electric means for vibrating sonorous bodies, the combination of a plurality of toothed members operating a plurality of sonorous bodies tuned to contiguous notes of the scale, brushes for said members, and means for producing relative motion between said members and brushes; one or more members having equally-spaced teeth throughout the greater part thereof but not for the entire relative traverse of the member and its brush, substantially as described.

2. In an electric pulsator for vibrating sonorous bodies, the combination of toothed members, brushes therefor, and means for producing relative motion between said members and brushes; one or more members having teeth the majority of which are equally spaced but some of which are spaced in nonconformity to the remainder, substantially as described.

3. In a pulsator for electrically-vibrated sonorous bodies, the combination of a plurality of uniformly-rotated toothed disks, and brushes therefor; one or more of said disks having the majority of the teeth there-

of spaced to correspond to the number of the vibrations of the associated sonorous body, but a portion of the periphery of such disk or disks not being so spaced.

4. In a pulsator for electrically-vibrated sonorous bodies, the combination of a plurality of uniformly-rotated toothed disks, and brushes therefor; one or more of said disks having the majority of the teeth thereof spaced to correspond to the number of the vibrations of the associated sonorous body, but the remaining teeth of said disk or disks being differently spaced and adapted to change the phase of the vibrations of the sonorous body between the terminations of the equally-spaced teeth.

5. In an electrically-operated musical instrument, the combination with a string, of a pair of pulsatory magnets located at opposing sides of said string, and means for supplying electric pulsations to said magnets alternately whereby the energized intervals of one magnet occur during the demagnetized intervals of the other, and the string is thereby given a positive pull in each direction of its vibration, substantially as described.

6. In an electrically-operated musical instrument, the combination with a sonorous body, of a plurality of pulsatory magnets located upon opposing sides of said body and energized alternately, substantially as described.

In testimony that we claim the foregoing invention we have hereunto set our hands this 21st day of November, 1900.

MELVIN L. SEVERY.
GEORGE B. SINCLAIR.

Witnesses:
A. B. UPHAM,
F. E. CALLER.