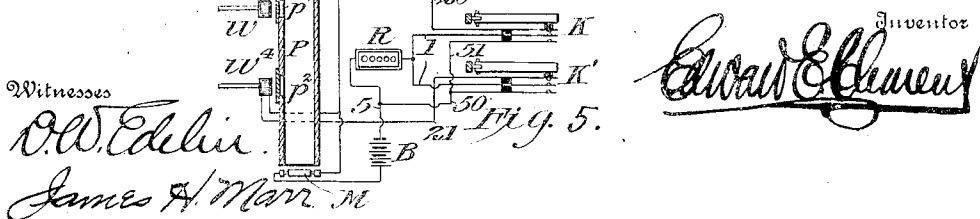
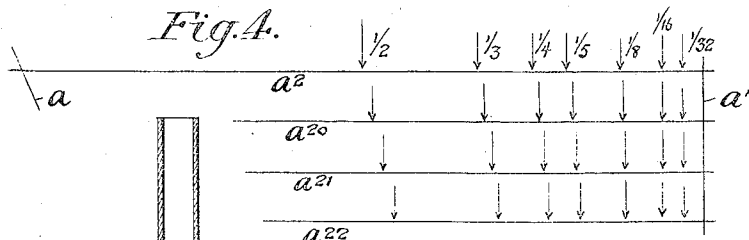
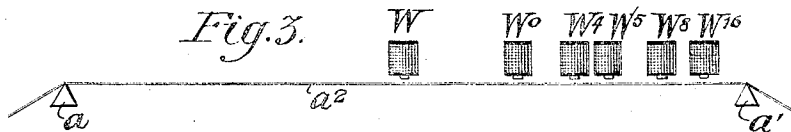
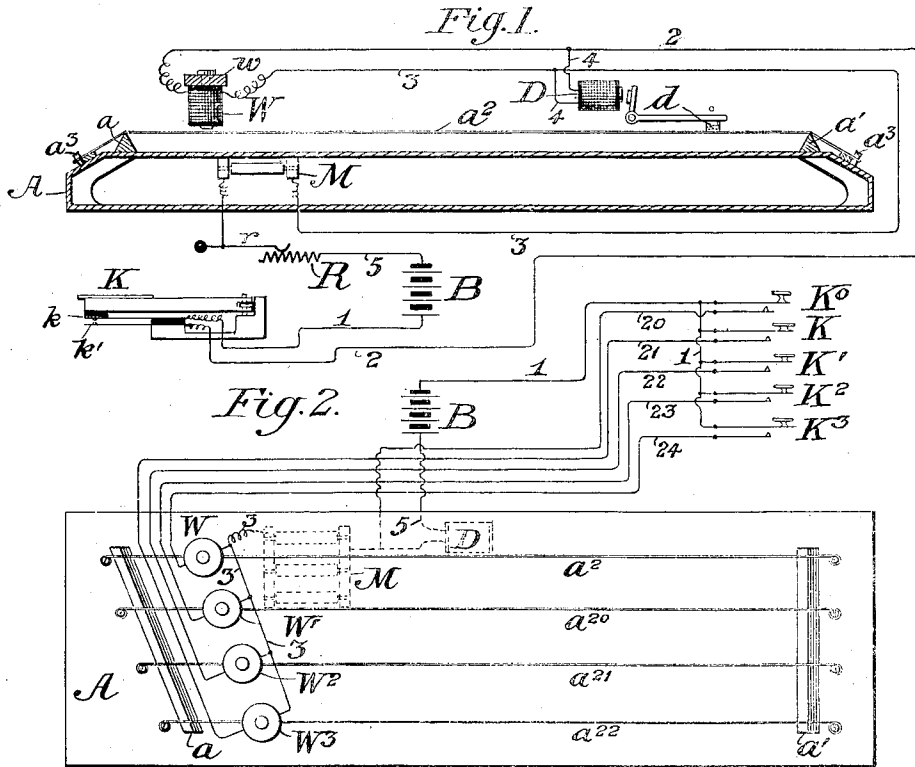


E. E. CLEMENT.
ELECTRICAL SOUND PRODUCING DEVICE.
APPLICATION FILED AUG. 11, 1905.

1,002,036.

Patented Aug. 29, 1911.



UNITED STATES PATENT OFFICE.

EDWARD E. CLEMENT, OF WASHINGTON, DISTRICT OF COLUMBIA.

ELECTRICAL SOUND-PRODUCING DEVICE.

1,002,036.

Specification of Letters Patent. Patented Aug. 29, 1911.

Application filed August 11, 1905. Serial No. 273,799.

To all whom it may concern:

Be it known that I, EDWARD E. CLEMENT, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Electrical Sound-Producing Devices, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to sound-producing devices, and has for its object the provision of improved means for electrically actuating the same.

Briefly stated, the invention comprises a body such as an organ pipe having a definite pitch, electro-magnets positioned so as to induce vibrations therein having different nodal points, and electrical circuit connections, a source of current supply and circuit controlling means such as keys for the magnets. In order to produce sustained tones, a microphone is connected in the magnet circuit and exposed to the vibrations produced thereby.

My invention is illustrated as to some of its embodiments in the accompanying drawings, wherein the same figures and letters of reference point out the same parts throughout.

In the drawings, Figure 1 is a diagram with parts in section, showing a stringed instrument magnetically controlled. Fig. 2 is a similar diagram with the instrument in plan and with some slight modifications in the circuits. Fig. 3 is a skeleton outline diagram illustrating the subdivision of a string to control the quality of tone as well as the production of the tone itself. Fig. 4 is a still simpler diagram, illustrating the same subdivision, several strings being indicated. Fig. 5 shows an open pipe with regulable resistance in the control circuit and subdivision of the pipe to control the sound as in Figs. 3 and 4.

Referring to Fig. 1, A is a sounding box carrying two bridges a and a' , over which is stretched a string a^2 , whose ends are secured upon two tuning pins a^3 , whereby the string may be stretched taut and tuned. On the sounding box is secured a microphone, which should be fairly sensitive and have a good current carrying capacity, and which I have illustrated here as a Gower or Ader pencil microphone, M, having carbon blocks for side pieces, between which extend pencils of carbon with their reduced

ends housed in holes in the blocks. For convenience I have shown this form of microphone throughout, but it should be understood that I do not by any means limit myself to any particular form of instrument, the granular form being preferable for instance when several magnets are used simultaneously.

Mounted on a bridge w over the sounding box and its string, is a working magnet W, whose pole piece approaches the string at a point determined in accordance with any desired rule, such as that of pianoforte makers that the point of hammer stroke should be from one seventh to one ninth of the length of the string away from the end thereof. At any proper point a damper is provided, as d , controlled by a magnet D which in this case is shown in a branch across the circuit of the working magnet.

The sounding of the string a^2 is controlled by the key K, which when depressed closes together the contacts k and k' , connected respectively by wires 1 and 2 to the battery B and the magnet W. The battery is connected on its other side by wire 5 through a variable regulating resistance R and its sliding arm r , to the microphone M, and from the other side of the microphone wire 3 extends to the working magnet W; and this wire is really common to all the magnet circuits when there are several.

The operation of the arrangement thus disclosed is as follows: Upon depressing the key K an initial pulse of current is sent through the circuit 1, 2, W, 3, 5, and battery B. A portion of this current flows through the shunt 4 and the damper magnet D, which being energized lifts its damper lever and leaves the string free to vibrate. The magnet W, being also energized by this first pulse of current plucks the string a^2 , (which is assumed, of course, to be of magnetic metal) and the string starts to vibrate slightly. This slight vibration or the first pulse is communicated through the sounding box to the microphone M, and this immediately alters its resistance, thereby producing another current pulse, which reacts in the same way, and so on. The steps have here been drawn out as if they were separate, but as a matter of fact the string does not start by separate movements at all, merely starting to vibrate gently and increasing its vibration until the maximum loudness of sound is attained.

The effect is as if a violin or 'cello bow had been drawn very smoothly across the string with increasing pressure. The loudness of the sound may be controlled by pulling the
5 slide r in or out, whereby more or less resistance is introduced, and the current in the circuit augmented or decreased.

Fig. 2 shows a sounding box A, essentially the same as that already described, but with
10 several strings, a^2 , a^{20} , a^{21} , a^{22} , controlled by separate magnets W, W', W², and W³. The damper magnet is shown at D, but no damper, this being supposed to take any desired form and location. The microphone
15 is shown in plan in dotted lines, and a separate key is shown for the damper magnet, whereby the damper may be raised for the purpose of permitting dying vibrations of the strings, without having any other key
20 depressed. This separate key is marked K⁰, and the keys which respectively control the magnets of the several strings are marked K, K', K², and K³. The operation of this apparatus is the same as of that in Fig. 1.

Figs. 3 and 4 illustrate subdivision of the strings. Here a number of work magnets are supposed to be provided for each string, marked W, W⁰, W⁴, W⁵, W⁸, W¹⁶, each at a definite divisional point of the string indicated by its exponent. W when energized,
30 vibrates the whole string; W⁰ stops out all overtones requiring the thirds, or the points at thirds division for nodes; W⁴ vibrates halves, and stops out all overtones requiring
35 its point of attraction for a node. And so on. By energizing one or the other magnet, or any combination of them, and in the latter case by varying the current strength supplied to each of the combinations, various
40 qualities of tone can be produced with the one string, as one or the other overtone is strengthened or eliminated. In Fig. 4 the places of the magnets are indicated by arrows only.

Fig. 5 shows an open pipe with means to regulate the strength of current supplied to each magnet and means to subdivide the pipe so as to alter the tone. The principle is the same as that of subdivision of the
50 strings. In the pipe P, as in all open pipes, the sound waves travel from both ends inward until they meet and then return. The middle point of the column is therefore a node and there are two semi-ventral segments. Opposite the middle point I place
55 a diaphragm or reed, p' . Now, when the pipe gives the octave, by harder blowing, the middle point will cease to be a node,

and will become the middle of a segment while the two points midway between it
60 and the ends will in their turn become nodes. At one of these I then place another diaphragm or reed, p^2 . And so on I may subdivide the tube as far as it may appear desirable to change the tone. By
65 providing separate keys K and K' for the magnets W and W⁴ (which it will be observed correspond to the same magnets in Fig. 3), I may operate one or the other, and by the action referred to I may establish, or
70 prevent the establishing of, a node at the point p' , or p^2 and its complement. Instead of separate keys stops may be provided for groups of pipes, which will operate to change the voice of each group as a
75 whole by cutting in the middle magnets, or the quartering magnets, and so on. Each key will then cause its own tube to speak, but the timber or quality will depend on the stop action. All this is of course detail and is for the organ builder who employs the invention.

In Fig. 5 I have shown each key with two lower contacts instead of one. On each key the upper contact is connected as before to its magnet, the next contact, or the upper one of the lower two, is connected to battery B through wire 1 and rheostat R. The lowermost contacts go directly through the wires 51, 50 and 5 to the battery without going through the resistance. Hence the amount of pressure on the key against the strength of the springs will determine the inclusion or exclusion of the resistance and so the strength of the current supplied to the magnet.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

In a device for producing sound, a body having a definite pitch, an electro-magnet positioned with relation to said body so as to vibrate the same and establish a predetermined nodal point, another magnet or magnets positioned with relation to said body so as to induce vibrations having other nodal points, electrical circuit connections for said magnets, a source of current supply connected thereto, and controlling means for said circuits, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD E. CLEMENT.

Witnesses:

JAMES H. MARR,
E. EDMONSTON, Jr.