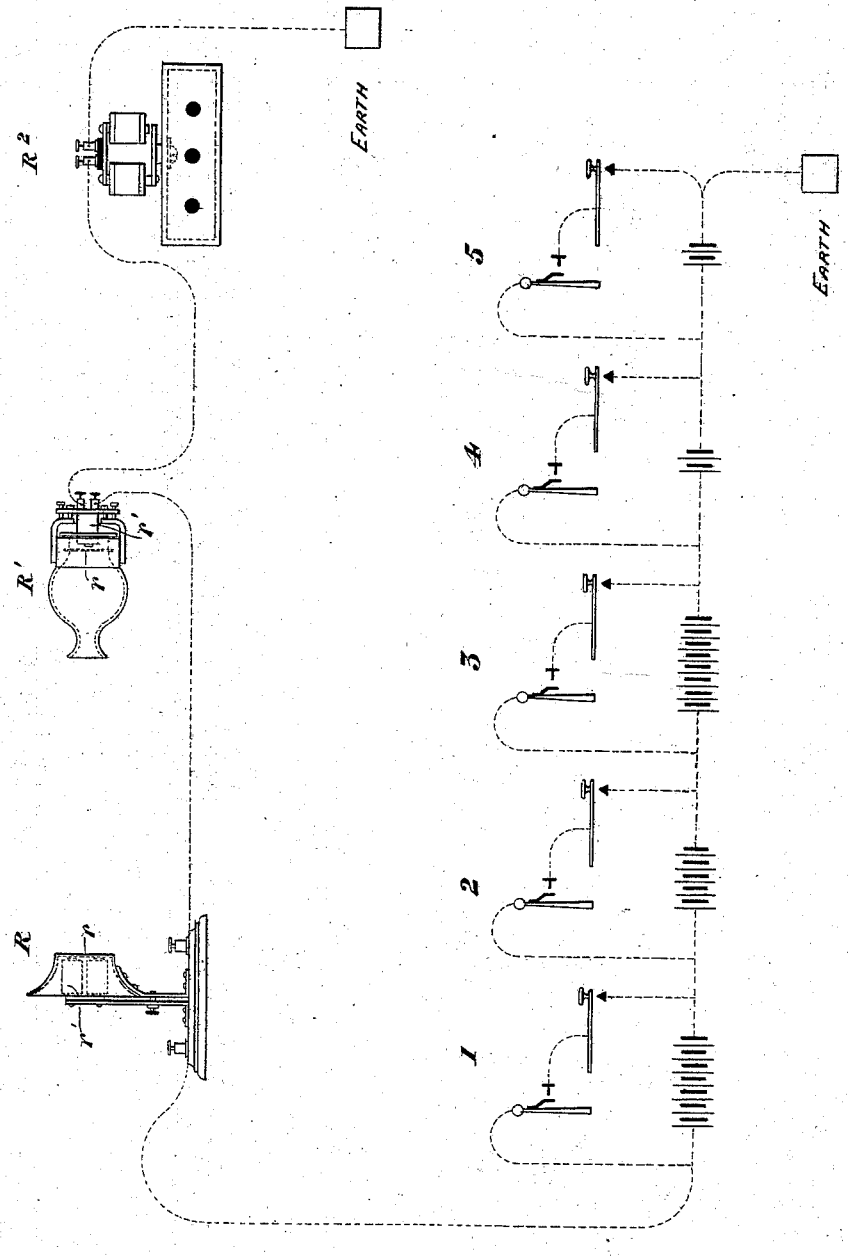
E. GRAY.

Art of Transmitting Rhythmical Vibrations in an Electric Circuit

No. 205,378. Patented June 25, 1878.



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UNITED STATES PATENT OFFICE.

ELISHA GRAY, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN THE ART OF TRANSMITTING RHYTHMICAL VIBRATIONS IN AN ELECTRIC CIRCUIT.

Specification forming part of Letters Patent No. **205,378**, dated June 25, 1878; application filed April 9, 1878.

To all whom it may concern:

Be it known that I, ELISHA GRAY, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful improvements in the art of generating and transmitting through an electric circuit rhythmical impulses, undulations, vibrations, or waves, representing composite tones, musical impressions or sounds of any character or quality whatever, and of audibly reproducing such vibrations; and also in apparatus for so generating, transmitting, and reproducing such impulses, undulations, vibrations, or waves, of which improvements the following is a specification:

In Letters Patent of the United States Nos. 166,095 and 166,096, granted to me July 27, 1875, in the caveat filed by me February 14, 1876, and in sundry applications for Letters Patent for improvements in electric telephony filed October 29, 1877, I have shown devices intended to operate as common receivers and reproducers of all sorts of rhythmical vibrations representing sounds of whatever kind or quality with reference to the number of tones simultaneously transmitted, received, and reproduced, and their relations to each other in respect to amplitude, rate, &c.

In an application for Letters Patent filed by me February 23, 1875, for improvements in the art of transmitting musical impressions or sounds telegraphically, and in apparatus for so transmitting such sounds or impressions, I have shown devices for transmitting musical sounds, and one method of arranging the same on an electric circuit to produce the desired results, including the relation of the main battery to the line and instruments at each end, and described the effects produced.

In Letters Patent No. 186,340, granted to me January 16, 1877, I have shown and described a method of and apparatus for generating, transmitting, and reproducing in an electric circuit rhythmical impulses, undulations, vibrations, or waves, as well as an improved method of connecting the transmitting apparatus to the line and main battery, so that any tone of a series could be transmitted without interference with the power used for transmission of another tone, and so that two or any greater number of tones could simultaneously be transmitted, received, and reproduced, preserving their individuality as perfectly as the same would be preserved in passing through the air. This patent also showed a closed circuit, in which a continuous current from a main battery kept a reproducing and receiving magnet constantly charged, and devices for varying the power or electro-motive force of the current by superposing thereupon the vibrations or undulations generated by the transmitters.

In Letters Patent No. 175,971, granted to me April 11, 1876, for improvements in telephonic telegraph apparatus, I have shown a series of receivers so constructed that each receiver, which consists of a resonant box with a magnet having a tuned armature mounted upon it, will only respond to the particular note to which it is adapted, this apparatus, in practice, being arranged upon circuit, as shown in my patent of January 16, 1877, No. 186,340, above mentioned.

By having a number of receivers tuned to all rates of vibration, with correspondently-tuned transmitters, it is possible to transmit and receive composite sounds varying greatly in respect to quality, rate, &c. For instance, the different vowel sounds may be transmitted and received by this apparatus, providing that the receivers are of the proper relation to each other, and all arranged near together, so as to get the composite effect of the tone sent through the wire.

Such an apparatus constitutes the subject-matter of a division of this application, filed May 18, 1878.

To render the vowel sound A, for instance, I would transmit a composite tone, the simple elements of which would bear the following relations to each other. The amplitude of vibration of any simple tone which goes to make up the composition of a vowel or any sound is determined in this case by the number of cells of the battery used by the transmitter of that particular tone. Let us assume, as a basis for the fundamental or lowest tone in the clang or composition of tones one hundred vibrations per second. The vowel A is composed of five simple tones. If, as we have assumed, the first or fundamental tone have one hundred vibrations per second, the second tone will have two hundred, the third

three hundred, the fourth four hundred, and the fifth five hundred. These tones, however, to producet he desired effect, must not all have the same amplitude or loudness; the second tone should be rather moderate in strength, which will be accomplished by giving it fewer cells of battery; the third, much greater amplitude, as this is the characteristic note of the clang, to accomplish which we add a greater number of cells of battery; while the fourth and fifth are added with a feeble amplitude. It will be seen that by this arrangement we are able to control not only the number of tones transmitted, but their relations with respect to rate and amplitude.

My present invention constitutes an improvement upon the invention set forth in the patents and applications above recited, and contemplates the combination, in an apparatus for generating and transmitting vibrations, impulses, or waves representing composite tones of a closed circuit, a series of transmitters vibrating at such relative speeds as to produce the fundamental and harmonics of the tone to be transmitted, a main battery so arranged as to give each transmitter the desired relative amplitude of vibration, and a common receiver, or one capable of reproducing tones of every variety and quality.

The subject-matter claimed will hereinafter specifically be designated.

The accompanying diagram represents an arrangement upon circuit of generating, transmitting, and reproducing apparatus for carrying out my improvement, three different varieties of common receivers or reproducers being shown.

The different sections, 1 2 3 4 5, of the main battery, it will be observed, are arranged, as to number of cells or electro-motive force, with respect to the amplitude of vibration or wave desired in each of the tones of the composition.

The diagram shows three different kinds of receivers, R R^1 R^2, each capable of reproducing composite tones or sounds of every character. It is deemed unnecessary to describe in detail the construction of the apparatus employed, more than to say that it comprises main and local batteries, an apparatus for generating and transmitting vibrations representing the composite tone to be transmitted, a receiving apparatus capable of reproducing such tones, and a closed circuit through which a continuous current flows to keep the magnets permanently charged. The arrangement of circuit is similar to that shown in my patent of January 16, 1877, above mentioned, while the transmitters represented in the diagram are similar to those shown in Letters Patent No. 165,728, granted to me July 20, 1875. Each transmitter is operated by its respective local battery, omitted for convenience of representation. The receivers R R^1 are similar to those shown in sundry applications for Letters Patent of the United States filed by me October 29, 1877, and consist (speaking generally) of a diaphragm, *r*, adjustably arranged relatively to an electro-magnet, *r'*. The receiver R^2 consists of an electro-magnet mounted upon a sounding-box in a way that will be readily understood from the drawings, and (like the others) is capable of reproducing tones of all varieties and qualities.

It will be observed that my arrangement of batteries and transmitters admits of an unlimited variety of adaptations and combinations in respect to number and character of tones as to amplitude, rate, &c., so that when the quality of any tone is once determined by analysis it may be reproduced by my combination by the organization of the several parts relatively to each other.

The operation of my invention will readily be understood from the accompanying description. When it is desired to transmit a composite tone of a particular clang, I depress the keys which bring into operation such batteries and transmitters as an analysis of such clang dictates we should use. To transmit a sound of different quality, depress a different set of keys, arranged, as before stated, with reference to the necessities of the case.

It is unnecessary to go into a detailed analysis of a great variety of sounds, as the principle involved is fully set forth in the case already given.

From the above it is easy to conceive that composite tones may be mechanically transmitted by a proper arrangement of transmitters, batteries, &c.

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

The combination, substantially as hereinbefore set forth, in an apparatus for generating and transmitting vibrations, impulses, or waves representing composite tones, of a closed circuit, a series of transmitters vibrating at such relative speeds as to produce the fundamental and harmonics of the tone to be transmitted, a main battery so arranged as to give each transmitter the desired relative amplitude of vibration, and a common receiver, or one capable of reproducing tones of every variety and quality.

In testimony whereof I have hereunto subscribed my name.

ELISHA GRAY.

Witnesses:
GEO. B. CUMMINGS,
D. M. ERSKIN, Jr.