2 Sheets--Sheet 1.

E. GRAY.

Electric Telegraph for Transmitting Musical Tones.

No. 166,096. Patented July 27, 1875.

Fig. 1

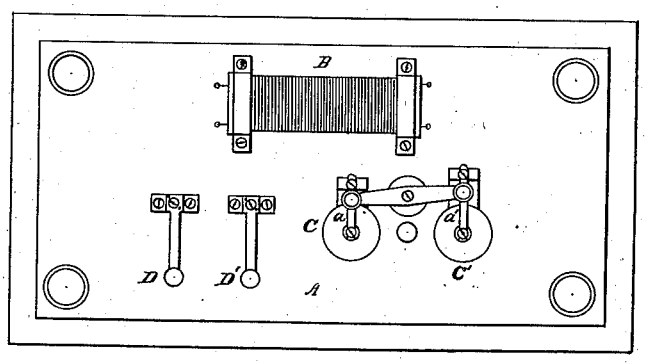
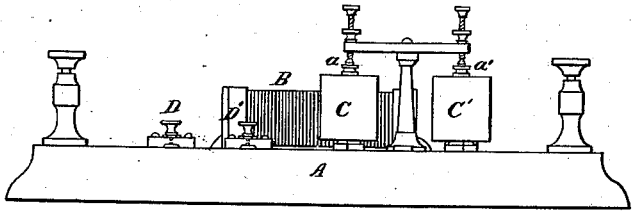


Fig. 2



WITNESSES

F. F. Warner.
N. C. Tinsley

INVENTOR

Elisha Gray

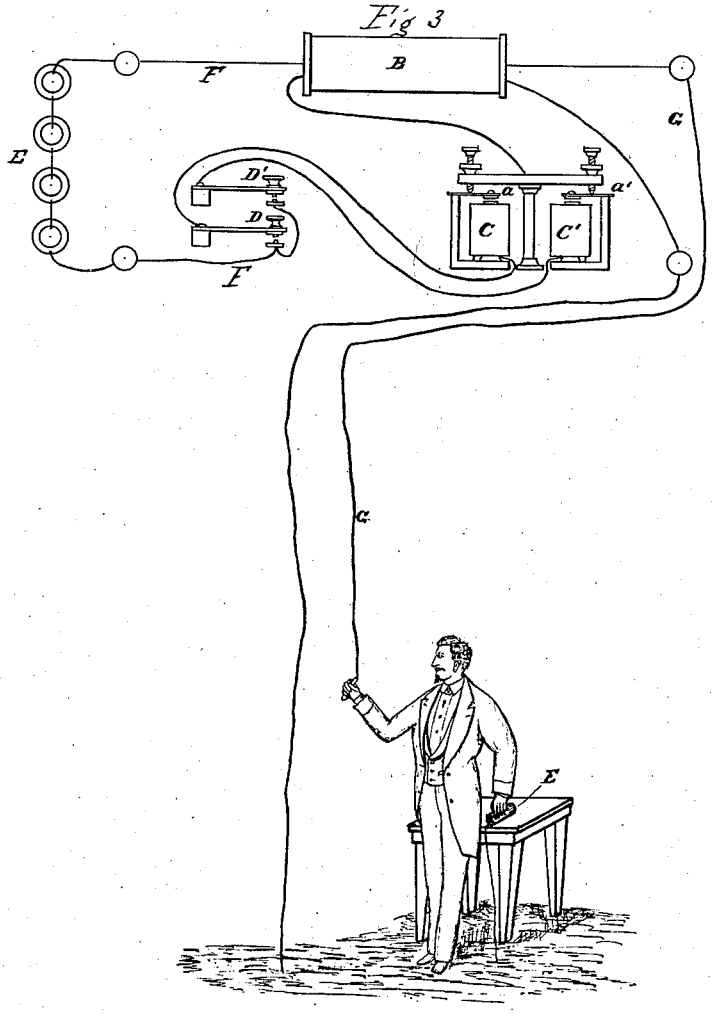
2 Sheets--Sheet 2.

E. GRAY.

Electric Telegraph for Transmitting Musical Tones.

No. 166,096. Patented July 27, 1875.

Fig 3



WITNESSES

F. F. Warner.
N. C. Ridley

INVENTOR

Elisha Gray

UNITED STATES PATENT OFFICE.

ELISHA GRAY, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF HIS RIGHT TO SAMUEL S. WHITE, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN ELECTRIC TELEGRAPHS FOR TRANSMITTING MUSICAL TONES.

Specification forming part of Letters Patent No. **166,096**, dated July 27, 1875; application filed January 19, 1875.

CASE 1.

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 a new and useful Art of Transmitting Musical Impressions or Sounds Telegraphically, as well as certain new and useful Improvements on Apparatus for so Transmitting such Impressions or Sounds; of which art and apparatus I hereby declare the following to be a full, clear, and exact description.

My invention relates to a novel art of transmitting musical impressions or sounds telegraphically; which impressions or sounds may be utilized as signals for the transmission of intelligence.

My invention is based upon the well-known law of acoustics that bodies vibrating with different rapidity produce tones of different pitch; and upon my own discovery that such vibrations can be transmitted through a telegraphic circuit and reproduced in a musical tone or note of a pitch corresponding with that originally transmitted, by including in the circuit animal tissue or other equivalent substance, which will cause a slight resistance to the electrical current at the point of contact between such animal tissue and some resonant conductor of electricity.

My improvement consists in a new and useful art of producing musical impressions or sounds at the transmitting end of a telegraphic circuit, by causing interruptions in the electric currents of sufficient frequency to produce musical tones, transmitting said tones through an electric circuit composed in part of animal tissue, and reproducing them at the receiving end of the line by means of a resonant body, which is also a conductor of electricity.

My improvement farther consists in a new and useful apparatus for carrying out the objects of my invention; which apparatus consists of the combination of a telegraphic circuit, composed in part of animal tissue; a circuit-breaker capable of producing a musical tone; and a receiver capable of reproducing that tone at the receiving end of the circuit.

My improvement further consists of the combination, in an apparatus such as described, of a series of circuit-breakers capable of producing musical tones of different pitch, and a series of keys for simultaneously or successively throwing the circuit-breakers into or out of operation, whereby several tones simultaneously or successively may be transmitted through a single wire.

The subject-matter claimed will hereinafter specifically be designated.

In the accompanying drawings, Figure 1 represents a plan or top view of a portion of the transmitting apparatus. Fig. 2 is a front elevation of the same, and Fig. 3 a diagram, showing an arrangement of parts and circuits which advantageously may be employed in working my invention.

The transmitting apparatus is mounted, as usual, upon a base-board, A. An induction-coil, B, is provided with primary and secondary helices of the usual construction. A common vibrating electrotome, C, having its circuit-breaking spring *a* of such length, thickness, and adjustment that its vibration produces a musical tone of a certain pitch, forms part of the circuit.

It is obvious that the apparatus may be worked with a single electrotome, the pitch of which may be varied by adjustment; but where a series of tones of different pitch is desired, I prefer to employ a series of electrotomes having different rates of vibration.

Two electrotomes, C C′, of identical construction but differing in pitch, are shown in the drawings, but I propose, under some circumstances, to use a series of electrotomes which will give tones extending through one or more octaves. These electrotomes are, by preference, placed in the primary circuit of the induction-coil, and, when in operation, induce secondary currents or impulses in the secondary circuit of said coil equal in number to the vibrations of the circuit-breaking spring of the electrotome.

An ordinary telegraph-key situated in the primary circuit opens or closes the connections of the battery. Each electrotome must have a corresponding key. In the drawings, two keys, D D′, are shown, both of which, as well

as the electrotomes, are situated in the primary circuit, which is divided or branched in order to pass through them.

Fig. 3 shows the arrangement of the circuits. The primary circuit F connected with the battery E passes through the keyes D D′, the magnets of the electrotomes, and the primary circuit of the induction-coil B. One terminal of the secondary circuit G extends from the induction-coil to the receiving-station through animal tissue to a suitable resonant conductor of electricity, which is, in this case, a hollow metallic cylinder, H, which is connected with the ground; the other terminal, I, of the induction-coil passes directly to the ground in the ordinary way.

The animal tissue interposed between the wire and the resounding receiver to complete the circuit is shown in the drawings as consisting of the body of the receiving operator, who must be insulated from the ground; but other substances may be employed which must possess the specific characteristics of being conductors of electricity; of being yielding and elastic; and of having a surface of greater electric resisting capacity than its interior.

These characteristices are found in the skin of the human body; in leather moistened with acidulated water; in animal flesh covered with a membraneous coating; in bacon-rind; in pork-skin, especially pieces taken from the ear or tail; in kid gloves; and in other substances which need not be enumerated, as they do not operate so perfectly as those above given.

The operation of the apparatus is as follows: The closing of either of the keys completes the primary circuit from the battery through the electrotome connected with the key depressed, and the circuit-closing spring of said electrotome will immediately be thrown into rapid vibration, and a musical tone of a certain pitch dependent upon the length, thickness, and adjustment of the spring will be given forth, while at each vibration the current in the primary circuit of the induction apparatus will be interrupted. These interruptions produce corresponding secondary currents or impulses in the secondary circuit of the induction apparatus, and these secondary induced currents or impulses are transmitted to the receiving-station. Thus, for example, if the circuit-breaking spring of the electrotome vibrates one hundred and twenty-eight times per second, the tone given forth is that known as the "fundamental C," while one hundred and twenty-eight terminal secondary currents or impulses will be induced in the secondary circuit of the induction apparatus, and transmitted through the animal tissue above mentioned, forming part of said circuit, to the resonant receiver, and will, from some cause not understood or explicable in the present stage of the art, vibrate the same synchronously with the transmitting-electrotome, and thus give forth a musical tone of the same pitch.

A metallic plate stretched by metallic strings above a sounding-board, such, for instance, as the body of an ordinary violin, may be used with good effect to receive the vibrations, instead of the hollow cylinder above described.

From the foregoing description it will be seen that musical tones produced at the transmitting-station can simultaneously be produced at the receiving station however distant. When two or more keys are simultaneously or successively depressed, corresponding tones will simultaneously be transmitted, thus producing harmony or melody.

The interruptions in the primary circuit, which cause the induced secondary currents or impulses, may be produced by a mechanical circuit-breaker having the requisite rapidity of motion, such as a revolving wheel or revolving brush; or they may be produced by providing the vibrating reed or reeds of an organ with contact-points, so that, as the reed vibrates, it will transmit impulses corresponding in number per second to the number of vibrations per second of the notes sounded by the organ-pipe.

I prefer to use the impulses of the induced secondary currents as the transmitting medium, as such use affords the most convenient way of obtaining electricity of high tension, which is that best adapted for penetrating a slightly-resisting medium, such as the animal tissue hereinbefore mentioned.

The secondary coil is not essential, as the secondary circuit induced in the primary coil may be utilized for transmitting the signals.

My improvement enables me to operate with a very slight amount of current, as the battery power required to produce and transmit the vibrations is less than one-hundredth part of the battery power now required to transmit signals over long land-lines.

My improved method can advantageously be substituted for the Morse telegraph-alphabet now in general use, as an alphabet can be constructed on the principle of using tones of different pitch for the different letters, which will admit of great rapidity of transmission.

By means of my improved apparatus not only may a tune be transmitted by a single operator to a distant point, but the different parts of such tune simultaneously may be reproduced at a common point from different places, a separate part of the tune being played at each place.

The apparatus can also advantageously be employed in studying acoustics and the physical theory of music.

The combination, with a main line, of an intermittent circuit-breaker, or a series thereof, each adapted to throw upon the line a definite number of electrical impulses per unit of time, and a key or keys, one for, and controlling, each such circuit-breaker, are not broadly claimed herein, as they constitute a part of the subject-matter of another application for Letters Patent of the United States, filed by me February 23, 1875.

I claim as my invention—

1. The hereinbefore-described art of transmitting musical impressions or sounds telegraphically, by producing musical impressions or sounds at the transmitting end of a telegraphic circuit by causing interruptions in the electric currents of sufficient frequency to produce musical tones, transmitting said tones through an electric circuit composed in part of animal tissue, and reproducing them at the receiving end of the line by means of a resonant body, which is also a conductor of electricity, substantially as set forth.

2. The electro-harmonic telegraph apparatus, hereinbefore set forth, consisting of the combination of a telegraph-circuit, composed in part of animal tissue, a circuit-breaker capable of producing a musical tone, and a resonant conductor of electricity capable of reproducing that tone at the receiving end of the circuit.

3. The combination, substantially as hereinbefore set forth, of a telegraphic circuit composed in part of animal tissue, a resonant receiver, which is also a conductor of electricity, a series of circuit-breakers capable of producing musical tones of different pitch, and a corresponding series of keys for throwing the circuit-breakers into or out of operation, whereby several tones simultaneously may be transmitted through a single wire.

ELISHA GRAY.

Witnesses:
WM. J. PEYTON,
E. C. DAVIDSON.