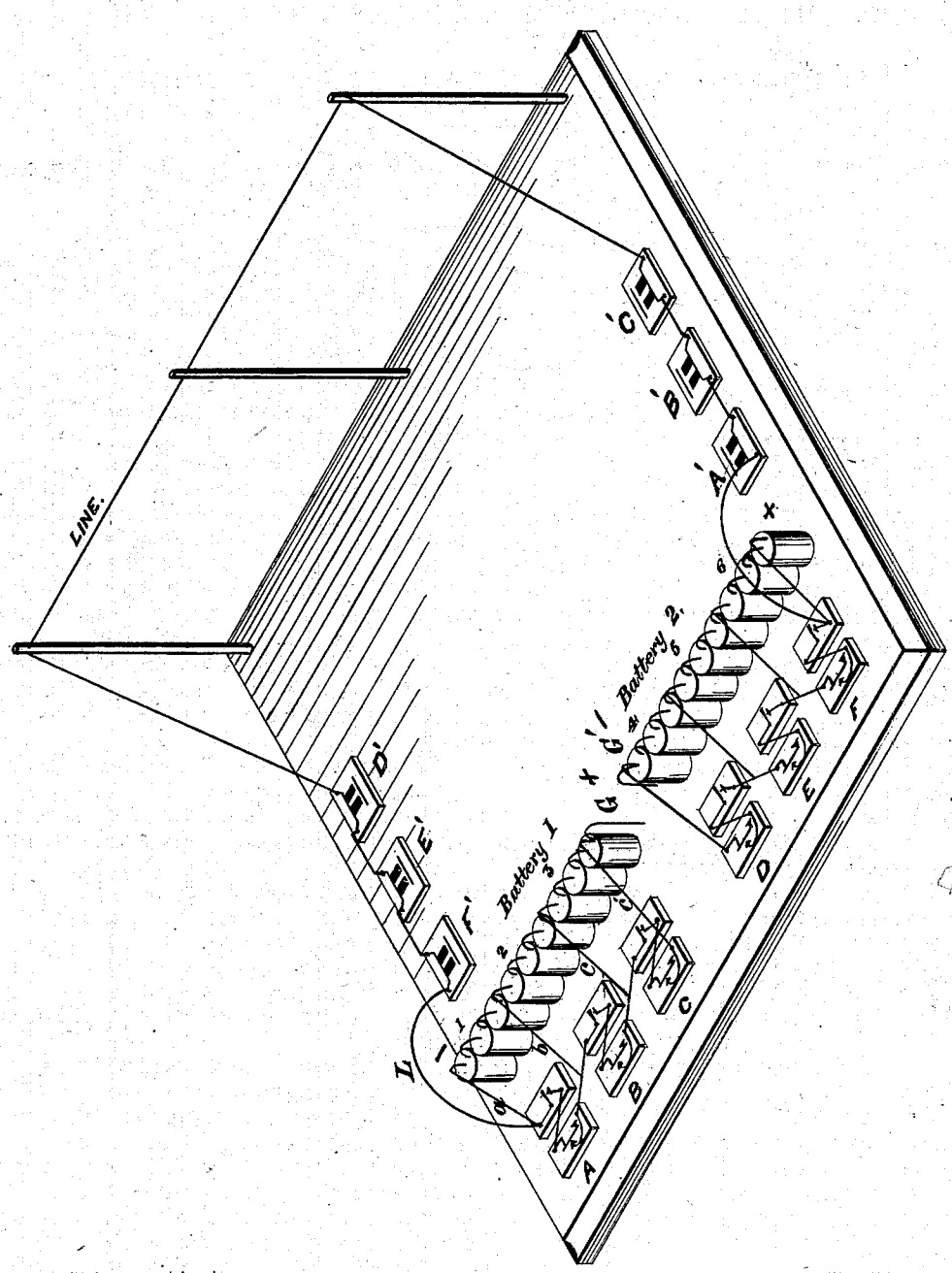
E. GRAY.

ELECTRO-HARMONIC TELEGRAPH.

No. 186,340. Patented Jan. 16, 1877.



WITNESSES.

Wm A Skinkle

Baltis DeLong.

By his Attorney

INVENTOR

Elisha Gray

Wm D. Baldwin.

UNITED STATES PATENT OFFICE

ELISHA GRAY, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE HARMONIC TELEGRAPH COMPANY, OF NEW YORK CITY.

IMPROVEMENT IN ELECTRO-HARMONIC TELEGRAPHS.

Specification forming part of Letters Patent No. **186,340**, dated January 16, 1877; application filed January 27, 1876.

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 improvement in the art of transmitting and analyzing musical impressions or sounds, and in apparatus for so transmitting and analyzing such sounds, of which the following is a specification:

My invention more especially relates to an electro-harmonic system of multiple telegraphy heretofore invented by me, and secured by sundry Letters Patent of the United States, in which composite musical tones are transmitted through a single wire, and analyzed or separated at the receiving end of the line by vibrating reeds, bars, or strings, tuned correspondently with the respective transmitters of the composite tones.

In an application for Letters Patent of the United States filed by me February 23, 1875, for transmitting musical vibrations by electricity, I have shown not only the various devices for transmitting or receiving the musical impressions; but also one method of arranging the electric circuit for producing the desired result, including the relation of the main battery to the line and instruments at both ends, and described the effects produced.

In my prior patents and application above-mentioned, the full force of the battery was at all times exerted upon the line—that is to say, when one transmitter was employed, and the others were at rest, it worked with the full force of the whole main battery, and when all the transmitters were employed, the same force was necessarily divided among them; consequently the amplitude of the vibrations of any given tone would diminish or increase, according to the number of tones simultaneously sent to line, thus rendering analysis at the receiving end of the line more difficult.

My present improvement contemplates the avoidance of this objection, by insuring the transmission of tones of uniform amplitude of wave, whether a greater or less number of tones be transmitted simultaneously, which end I attain by combining each transmitter with its respective section of the main battery, by a short or shunt circuit, in such manner that each section is utilized for the transmission of the vibrations for its own tone, without interfering or drawing upon the other section of the battery, or opening the main circuit, and when not transmitting, the unemployed sections of the battery flow steadily to line, without affecting the working transmitters of the other sections.

My improvement thus possesses two distinguishing characteristics: first, that of a main circuit always closed; and, second, the passage through this circuit of a smooth current, so to speak, when all the transmitters are quiescent, each transmitter when in operation throwing its respective portion of said current into vibration, so that there may be a smooth current, and one or more vibratory waves simultaneously transmitted through the circuit, or the entire current may be thrown into vibration.

The subject-matter claimed hereinafter will specifically be designated.

The accompanying drawings represent a perspective diagram of so much of my improved apparatus as is necessary to illustrate the subject-matter claimed.

I have shown this apparatus as constructed in the best way now known to me; but it is obvious that the details of construction of its various parts may be varied within certain limits, in ways well known to skillful electricians.

I have shown three transmitters with their batteries, and corresponding receivers at each end of the line, so arranged as to transmit three messages each way simultaneously; but a greater or less number of transmitters and receivers may be employed, and they might be so arranged as all to transmit one way instead of in opposite directions.

It is deemed unnecessary to describe in detail here the construction of the battery, as it forms no part of the subject-matter claimed, and any of the well-known batteries of the present day will work effectively with my improved apparatus.

The construction of the transmitters and receivers is fully set forth and described in my Letters Patent and application above-mentioned, and needs no reiteration here.

Each battery is connected with its respective transmitter by a short circuit or shunt wire. Starting with battery No. 1, G is the ground-wire connected at the plus (+) pole of the battery, which battery is connected up in the ordinary way and runs to line at the other or minus (—) end, through the analyzing-receivers F′ E′ D′. The line connects at the other end through the analyzing-receivers C′ B′ A′ to the plus (+) pole of battery No. 2, and passes through in the ordinary way to the ground-wire G′ at the minus (—) pole of said battery.

The circuit, thus far, is similar to an ordinary Morse circuit closed, and without a key or other means of making or breaking the circuit.

A B C D E F represent six sets of transmitters, each set being composed of a common open circuit, Morse telegraphic key, and a musical-tone transmitter, such, for instance, as that described in Letters Patent No. 165,728, granted to me July 20, 1875, for improvement in transmitters for electro-harmonic telegraphs. These transmitters are all alike in construction, but each one is tuned to a different pitch, and has a receiver, A′ B′ C′ D′ E′ F′, correspondently tuned, at the other end of the line.

Each battery is divided into sections 1 2 3 4 5 6, not by separating or disconnecting its cells, but by throwing a short circuit or shunt wire around each section. For instance, the first short circuit of battery 1 consists of the wires *a b*, the second of the wires *b c*, and the third of the wires *c c′*, and so on. The number of cells in each section is determined by the distance the tone is to be transmitted.

Each shunt-wire runs through its own key and vibrating transmitter. For instance, in section 1 of battery 1, which is at the line end of the battery, a wire, *a*, passes from the minus (—) pole of the battery to one binding-screw of the transmitter A, at which point the circuit divides, one branch connecting to line L, and the other to the vibrating bar of the transmitter through the break-point, which is in this instance a shunting-point. The circuit then passes to the other binding-screw, and thence to the key-lever.

The anvil or lower point of the key is connected directly with the ends of the wire *b*, which forms the dividing-line between sections 1 and 2, forming part of the short circuit of each section, and so on. Now, if the reed or bar of transmitter A be vibrated by its local battery, (which is omitted from the drawing to avoid complication, but the operation of which is well understood,) and the key belonging to it and in the same circuit with it be depressed, the shunt-circuit around section 1 will be completed every time the vibrating bar or reed makes contact with its break-point, thus producing a set of waves or electrical vibrations throughout the line, the waves succeeding each other at the rate per second corresponding to the vibrations of the transmitting reed or bar, which waves will induce corresponding impulses in all the magnets of a power approximating one-sixth of the whole battery.

Although these magnetic impulses are induced in all the magnets in the circuit, one only will make an audible response, except to a very delicate test, which one, in this instance, will be the receiver marked A′, as one whose reed or ribbon (or reed and box, as the case may be) is tuned correspondently to the transmitter in operation. All the other sections of the apparatus are connected up and operated in a manner precisely similar, each operating on its own section of battery. Each transmitter differs in pitch from every other one, and has its complement in its corresponding receiver.

It will be observed that by working with this improved system the main circuit is never opened, owing to which fact the integrity of each set of waves is preserved intact, thus rendering analysis easy at the receiving end of the line.

The utility of the device has been amply demonstrated by practical operation.

I claim as of my own invention—

1. The improvement in the art of telegraphically transmitting composite tones, hereinbefore set forth, which consists in working a closed circuit with a continuous current from a main battery, portions of the whole of which current are thrown into vibration at will by the transmitters.

2. The improvement in the art of telegraphically transmitting and analyzing composite tones, hereinbefore set forth, which consists in working a closed circuit with a continuous current from a main battery, portions of the whole of which current are thrown into vibration at will by the transmitters, each set of vibrations being audibly reproduced by a corresponding receiver.

3. The combination, substantially as hereinbefore set forth, of a series of transmitters, each operated by a local battery, a main battery, an electric circuit, through which a continuous current flows from said battery, and shunt or short circuits between the main battery and transmitters.

4. The combination, substantially as hereinbefore set forth, of a series of transmitters, a main battery connected therewith by short or shunt circuits, a closed electric circuit, through which a current continuously passes from the main battery, and a series of analyzing-receivers, included in the circuit.

In testimony whereof I have hereunto subscribed my name.

ELISHA GRAY.

Witnesses:
WM. J. PEYTON,
JOSEPH S. PEYTON.

2,000