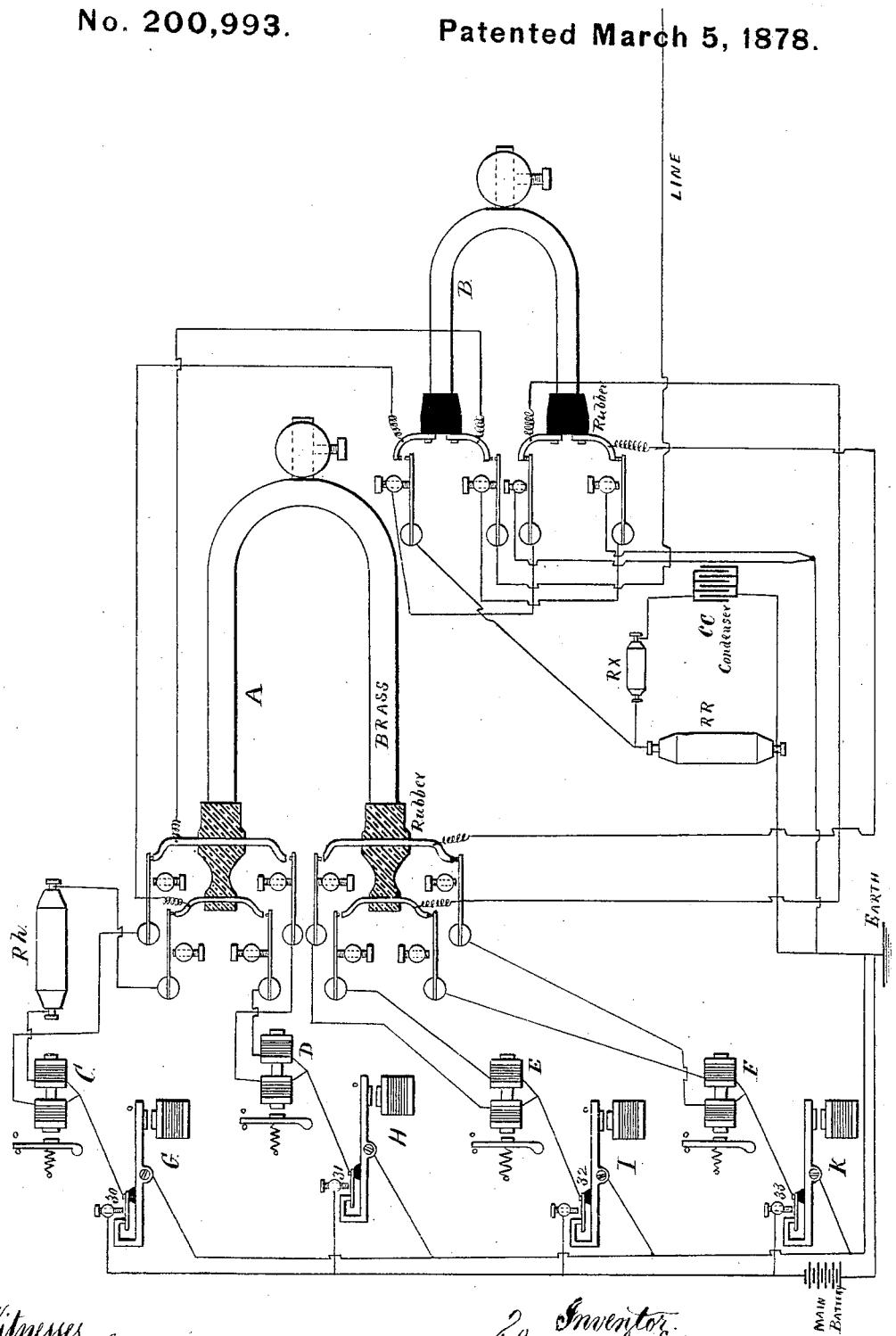
2 Sheets—Sheet 1.

T. A. EDISON.

Acoustic Telegraph.

No. 200,993. Patented March 5, 1878.



Witnesses.
Chas. H. Smith
Harold Serrell

Inventor.
Thomas A. Edison
per Lemuel W. Serrell atty.

2 Sheets—Sheet 2.

T. A. EDISON.

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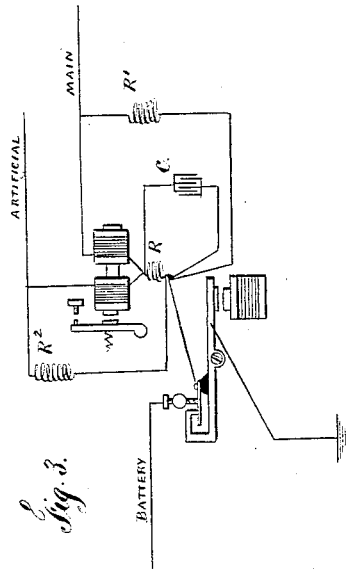

Fig. 3.

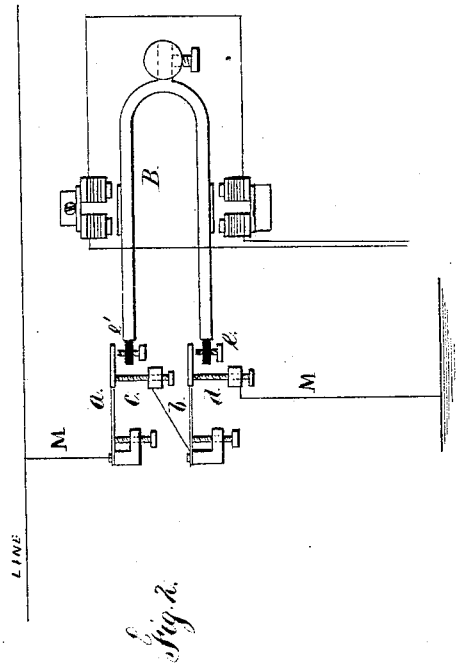

Fig. 2.

Witnesses.
Chas. H. Smith
Harold Serrell

Inventor
Thomas A. Edison.
per Samuel W. Serrell
Atty.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY.

IMPROVEMENT IN ACOUSTIC TELEGRAPHS.

Specification forming part of Letters Patent No. **200,993**, dated March 5, 1878; application filed September 18, 1876.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the State of New Jersey, have invented an Improvement in Acoustic Telegraphs, of which the following is a specification:

The object of this invention is to transmit eight different messages at the same time over a single circuit without interference with one another.

The invention relates, primarily, to the method fully described in my application No. 122, by which one single circuit is transferred from one set of instruments at both ends of the line to several other sets, one after the other, alternately, thus creating four distinct signaling-circuits.

The present invention more particularly relates to a method by which each signaling-circuit so created can be again doubled by a manipulation of the currents, thus allowing of the transmission of four messages in one direction at the same time that four messages are sent in the opposite direction.

The diagram illustrates the connections at one terminal station only, the connection at the distant station being precisely the same.

A is the large transfer tuning-fork, making thirty vibrations per second, and kept in constant vibration by the interception of the local circuit, in which its magnets (not shown) are placed by the main-line tuning-fork upon the controlling-line, as in aforesaid application No. 122. B is another fork, placed in the same local circuit, but making double the number of vibrations of A—*i. e.*, sixty per second.

The method by which these local tuning-forks at both terminals are kept in accurate unison is fully described in my aforesaid application, and the contact-points, instruments, and connections are arranged exactly as shown in that application, excepting that both A and B are provided with an extra set of springs, and the receiving-magnets with extra coils, and to which extra springs, connections, and coils is attached an artificial line of about the same resistance and of about the same electro-static capacity as that of the real line, so that when the line is being transferred from one set of instruments to the other the artificial line is at the same time transferred to the same instruments, which object is attained by causing the relay-magnets to have two sets of coils, one through which the main-line current passes in one direction, while through the other the current of the artificial line passes in the opposite direction. The latter, when its resistance is properly adjusted, allows of the transmission of current through the signaling-relays to the distant station without affecting such relays, which are free to receive the message from the distant station, and the same action takes place on all the instruments at both terminals.

C, D, E, and F are the double-coil relays, C being connected to the spring 30 of the transmitter G, D to 31 of H, E to 32 of I, and F to 33 of K, the levers of all of the transmitters being connected to earth.

Immediately over these springs are contact-points connected to the main battery. Either spring is brought in contact with its contact-point upon closing the key (not shown) of a local circuit, in which the electro-magnet of the transmitter is placed. At the same time that the point comes in contact with the spring it separates the spring from the earth-wire. This puts the battery in connection with the double spool of the relay. At the moment when the main line is connected at both ends by the vibration of the forks the current from the battery passes through one of the coils to the distant station, and would tend to close the relay; but at the same time the battery-current passes through the other coil (in an opposite direction) over the artificial line; and as the resistance of that is such that the current strength in each coil is the same, but the tendency opposite, and as the static charge and discharge are the same on both, the relay remains unaffected, and is ready to receive signals from the distant station. The high fork B serves to split the main line into two parts, and also the artificial line into two parts, allowing both the main line and the artificial line to remain in contact with the earth for a short period of time after it has been connected to one split, and disconnecting it from the earth just before it is placed in contact with the other split. R R is the resistance-coil, which serves to create the artificial line. c' c' is the condenser, which serves to give the artificial line the proper electro-static capacity, while $R^{\times}$ is an adjustable resistance, which serves to increase or decrease the discharging

time of the condenser to meet the various discharging times of different circuits.

R *h* is a resistance-box, which, in practice, I shall probably insert in each of the splits passing to the artificial line, for the purpose of obtaining a more perfect balance of the two circuits, as it has been found difficult to construct differential magnets so that all coils shall produce the same amount of magnetism in their cores.

In addition to the apparatus shown, I propose to insert a fork or forks making the same number of vibrations as B at various stations along the line, and keep them in motion by acoustic relays in the controlling-line, passing through the same stations, and arranging the contact-points as shown in Fig. 2, for the purpose of discharging the wire between each wave or vibration, which will enable me to work very long circuits. A shunt, *m*, passes to the spring *a*, and connects it to earth, (and at that particular period of time when neither prong is in contact with *a* or *b*.) The spring *a* rests upon *c*, and is connected to *b*, thence through *d* to earth; but when the fork is a little over the center of point of rest, either on one side or the other, the continuity of the earth-connection is interrupted either by the separation of *a* from *c*, or *b* from *d*.

This action of putting the line to earth outside of the instruments between each vibration takes place, or may take place, at both terminals, and at any number of way-stations.

On very long lines more perfect signaling is attained by connecting the receiving-instrument as in Fig. 3.

R is a large resistance, shunted with a condenser, *c'*. R^1 and R^2 are two smaller resistances in shunts to lessen the total resistance of the circuit, and to provide a circuit for the discharge of the condenser-current, which, by its action upon the relay, serves to neutralize, to some extent, the static discharge from the line due to the passage of the distant signaling-current.

I do not wish to confine myself to any particular relay, or the use of single currents, as polarized relays and reversed circuits may be used; neither do I wish to confine myself to the use of differential-coil relays for balancing the outgoing current, as the whole arrangement may be placed in a Wheatstone bridge, and which will be the subject of another application; neither do I wish to confine myself to the transmission of eight messages, as each of the four circuits (obtained by the rapid transfer of the line upon the several instruments) can be split up again by employing another set of higher and lower forks, and each of the eight circuits so obtained can be doubled in the same manner as those already described by a mere duplication of springs and points; or, instead of splitting the wire up into eight wires, it can remain as in this application, and each of the four splits may contain two signaling-instruments, one responding to positive and negative currents independent of their tension, and the other to strong and weak currents independent of their polarity, the connection being made to each split in the same manner as they would if such split were an actual wire.

Upon reference to my aforesaid application No. 122, it will be understood that the forks B vibrate exactly in time with each other at the two ends of the line, that the forks A also vibrate in time with each other at the two ends of the line, but at half the speed of the forks B.

In the vibrations of a musical fork, the prongs both move away from each other, and then both move toward each other, and this feature and the synchronous movements cause the circuit-closers to be operated exactly in harmony, so that when the key G is operated the circuit from the battery, which is thereby closed, will only reach the corresponding receiving-instrument at the distant station, and so on of all the other signaling-instruments, the circuits being simultaneously opened and closed to each instrument at both ends of the line at each vibration of the fork, and also closed to the artificial line, and all the circuit-closers are similar to circuit-preserving keys, so that the circuit is not entirely broken at any time.

I claim as my invention—

1. In a transmitting telegraph-instrument, two tuning-forks, extra contact-points, and circuit-connections to the main and artificial lines, substantially as and for the purposes set forth.

2. The combination, with the several tuning-forks or equivalents composing the transferring mechanism, of a main line and an artificial line with devices connected to the latter to create proper conditions, and receiving-instruments, for the purpose set forth.

3. The combination of several continuity-preserving transmitting-instruments, differential-coil relays, resistance-coils, and condensers, substantially as shown, with the vibrating tuning-forks, or equivalent devices, at both terminals, with the main line and artificial line, for the purposes set forth.

4. The tuning-fork B, Fig. 2, spring *a b*, points *c d*, and line and earth wire *m*, all arranged and operated substantially as set forth, and for the purposes specified.

5. The shunts R^1 and R^2, Fig. 3, resistance R, condenser *c'*, in combination with the electro-magnet or other receiving-instrument, for the purposes set forth.

Signed by me this 26th day of August, A. D. 1876.

THOS. A. EDISON.

Witnesses:
GEO. T. PINCKNEY,
GEO. D. WALKER.