E. GRAY.

Morse-Telephonic System of Telegraphy.

No. 198,378. Patented Dec. 18, 1877.

Fig 1.

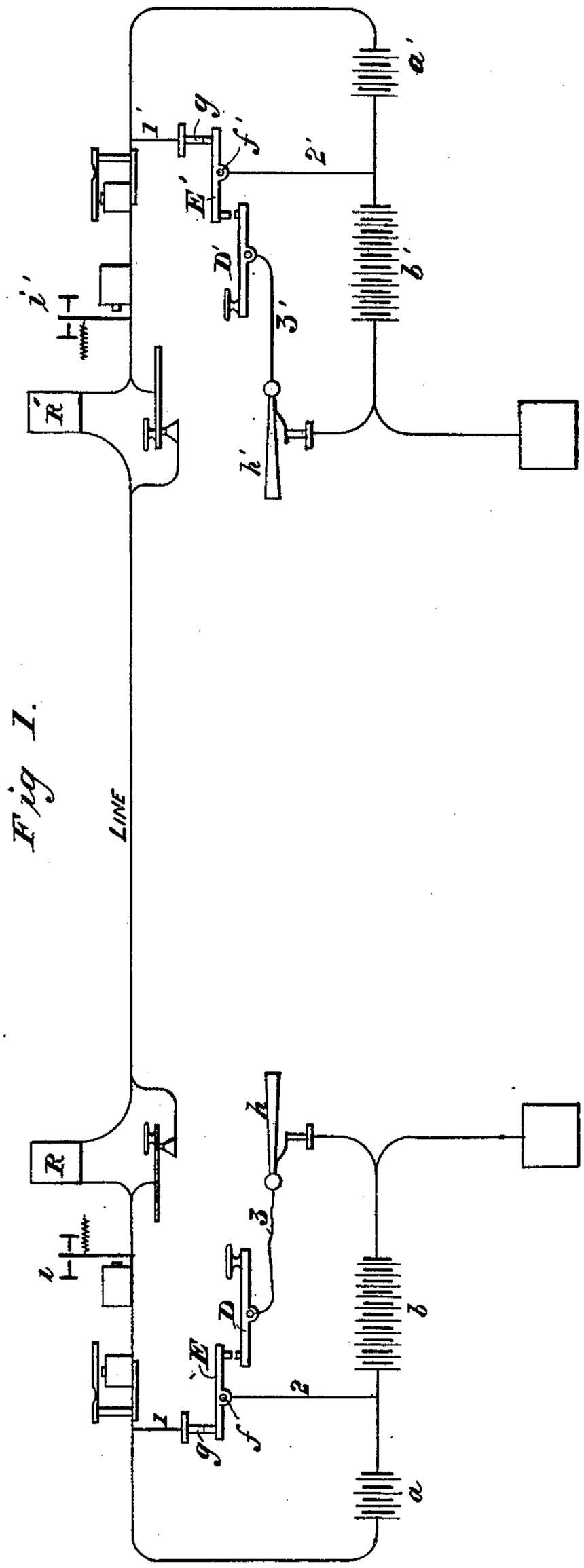


Fig 2.

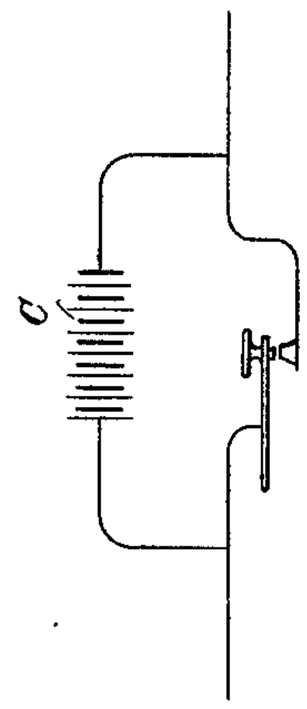
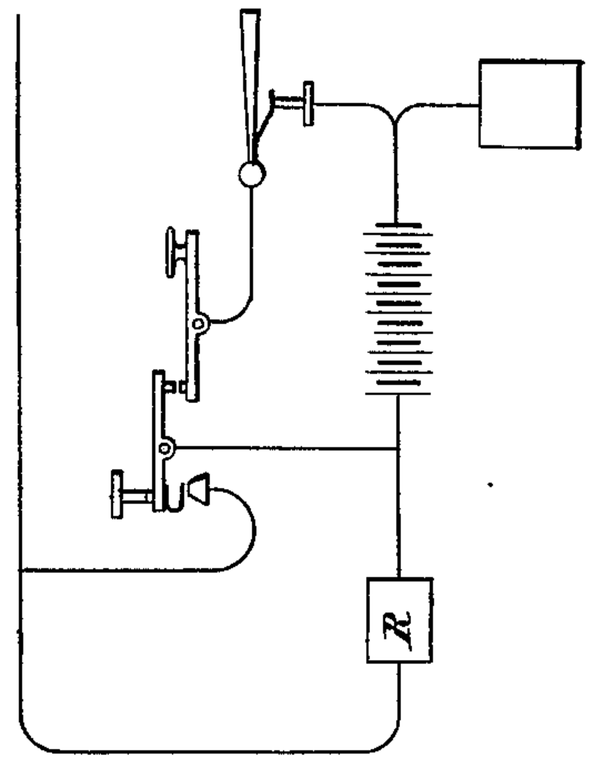


Fig 3



WITNESSES

Wm. a. Stinkle

Geo. W. Breck

INVENTOR

Elisha. Gray.

By his Attorneys,

Baldwin, Hopkins & Peyton

UNITED STATES PATENT OFFICE.

ELISHA GRAY, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN MORSE TELEPHONIC SYSTEM OF TELEGRAPHY.

Specification forming part of Letters Patent No. **198,378,** dated December 18, 1877; application filed May 19, 1877.

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 Multiple Telegraphy, of which the following is a specification:

My invention relates to that system of multiple telegraphy which combines the Morse and the telephonic or electro-harmonic systems, as exemplified, for instance, in an application for Letters Patent of the United States filed May 12, 1877, by Charles H. Haskins, of Milwaukee, Wisconsin.

In working the Haskins system I discovered that when a bar is thrown into vibration—that is, when connected as shown in Letters Patent No. 186,349, granted to me January 16, 1877—about forty per cent. of the working effect on a Morse relay placed in the line is lost. In other words the steady attractive force of the magnet is not as great by forty per cent. when vibratory currents are employed as when non-vibratory currents are employed.

This difference between the electric force of the steady and of the vibratory currents creates a tendency in the Morse relay to respond to a harmonic key as well as its own—a serious drawback to this method of working, as it causes unsteadiness in the adjustment of the Morse relay. To avoid this difficulty I introduce into the circuit a compensating-battery, having a strength equal to about forty per cent. of the regular main battery.

I have also discovered that the same result may be attained by substituting a resistance for the compensating-battery, and working the line in the manner hereinafter set forth.

Instead of the common Morse key, I use, to work the telephonic part of the system, a key known in duplex telegraphy as the "continuity-preserving key," by which means the compensating-battery is shunted in or out of circuit.

In the accompanying drawings, Figure 1 is a diagram representing the arrangement upon circuit for carrying out the object of my invention. The apparatus being the same at either end of the line, a description of one will be sufficient. Fig. 2, a view of a supplemental battery employed instead of a resistance-coil, R, shown in the Morse part of the system, Fig. 1; and Fig. 3 represents the arrangement on circuit when the resistance-coil is used instead of the compensating-battery of the telephonic system.

a represents the compensating-battery; *b*, the main battery; C, Fig. 2, the supplemental battery, which takes the place of the resistance-coil in the Morse part of the system. D represents the continuity-preserving key. It is well known in the art that on the depression of the lever of such a key contact is made with a second lever, E, which, being pivoted at *f*, breaks contact at the point *g*.

It will be noticed that when the line is at rest the compensating-battery *a* is shunted off the line through the wires 1 2, break-point *g*, and lever E. Now, if the telephonic key D be depressed while its transmitter *h* is in vibration, the main battery *b* will be thrown into vibration by contact between the two levers D E of the continuity-preserving key, which will diminish the effect on the Morse relays *i i'* about forty per cent. But at the same instant the two levers D E make contact, the shunt-wire 1 is opened at the break-point *g*, thus allowing the compensation-battery *a*, which in strength is equal to about forty per cent. of the main battery *b*, (before it was thrown into vibration,) to flow to line.

By this means an even strength is kept on the line, and the adjustment of the Morse relay is not in the least disturbed by the working of the telephonic keys.

Instead of the compensation-battery a resistance may be used. In that case the above-described arrangement of the keys would be reversed, leaving the break-point *g* open when the line was at rest, and the resistance in the line in the place of the battery, as shown at R in Fig. 3. The resistance should be sufficient to reduce the battery effect upon the line forty per cent.

When the telephonic key is depressed it throws the main battery into vibration, as before, affecting it in the same manner; but the working margin on the line is kept up by cutting out the resistance, which would reduce it forty per cent. On some lines and under some circumstances it is desirable to introduce a battery instead of a resistance-coil in the Morse part of the system.

When placed in that position and shunted off and on the line with a key, it is obvious that the effect would be substantially the same as cutting in and out resistance. There is this difference, however, which in some cases is advantageous: the resistance-coil works the wire by weakening the current below its normal strength, while the battery C increases its strength when let in by the key without at the same time adding to any appreciable extent to the resistance of the line.

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

1. The improvement in the art of multiple telegraphy under the Morse telephonic system, which improvement consists in keeping an even electric force upon the line, whether the battery or any portion of it is in vibration or at rest, by compensating the variations in the electric force caused by throwing the telephonic system on or off the line.

2. The combination, substantially as hereinbefore set forth, in an electric circuit, of a Morse transmitting and telephonic transmitting apparatus, a main battery, and a compensating adjustment, whereby the disturbance of equilibrium caused by the throwing of the telephonic apparatus into and out of line is instantaneously and automatically compensated.

3. The combination, substantially as hereinbefore set forth, in a telegraphic circuit, of a main battery, a compensating-battery, a resistance-coil, a telephonic transmitter or continuity-preserving key, and a shunt-circuit, whereby the equilibrium of the electric force is preserved.

In testimony whereof I have hereunto subscribed my name.

ELISHA GRAY.

Witnesses:

JOHN S. MALTMAN,

WM. D. BALDWIN.