(No Model.) 2 Sheets—Sheet 1.

A. M. & T. R. ROSEBRUGH.

COMBINED TELEGRAPHIC AND TELEPHONIC CIRCUIT.

No. 329,956. Patented Nov. 10, 1885.

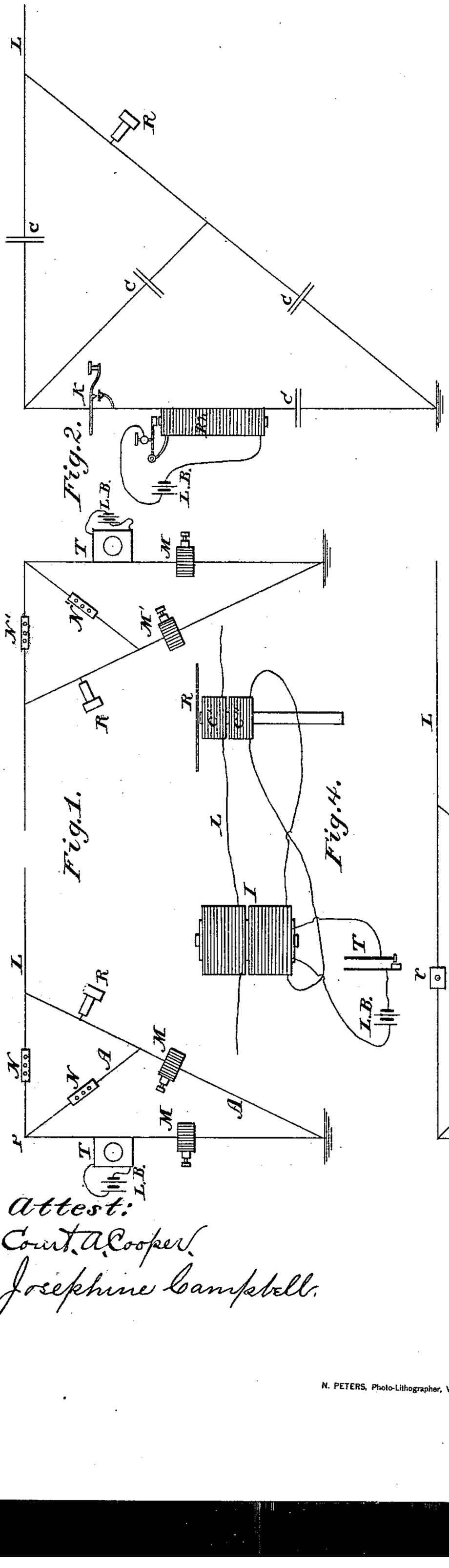

Fig. 2.

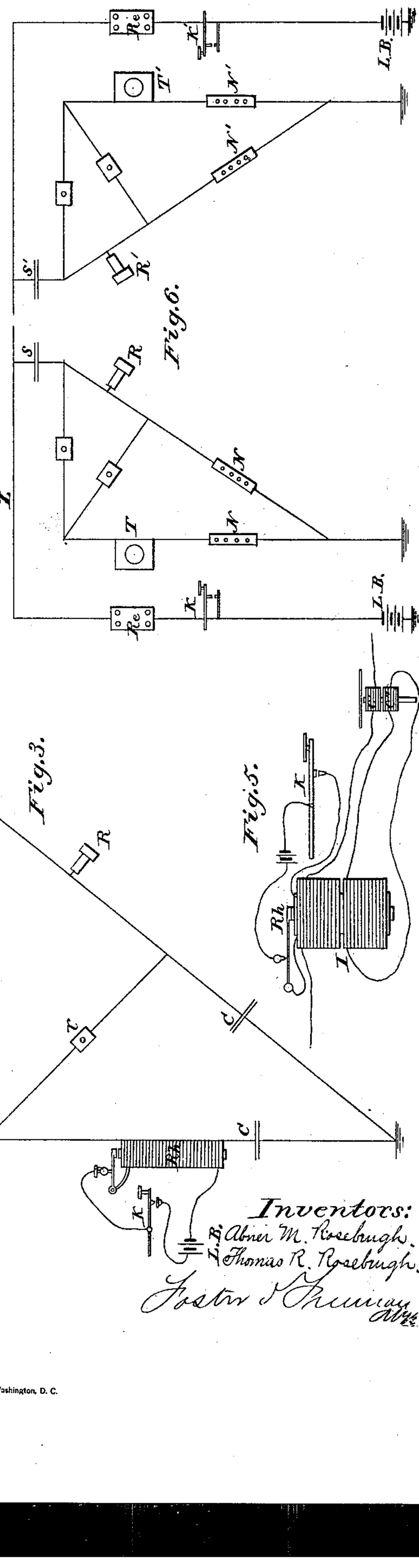

Fig. 6.

Fig. 1.

Fig. 4.

Fig. 3.

Fig. 5.

Attest:
Court. A. Cooper.
Josephine Campbell.

Inventors:
Abner M. Rosebrugh.
Thomas R. Rosebrugh.
Foster & Freeman
Attys.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 8.

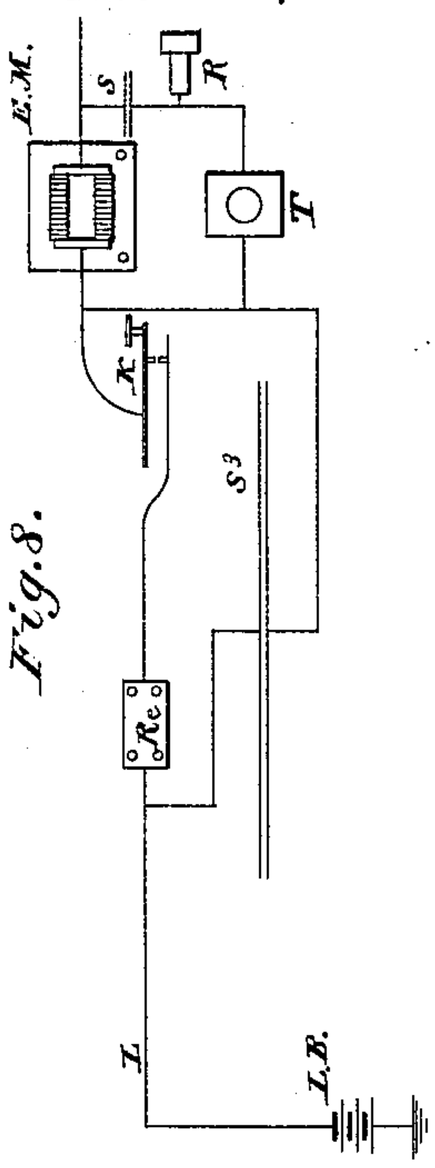


Fig. 9.

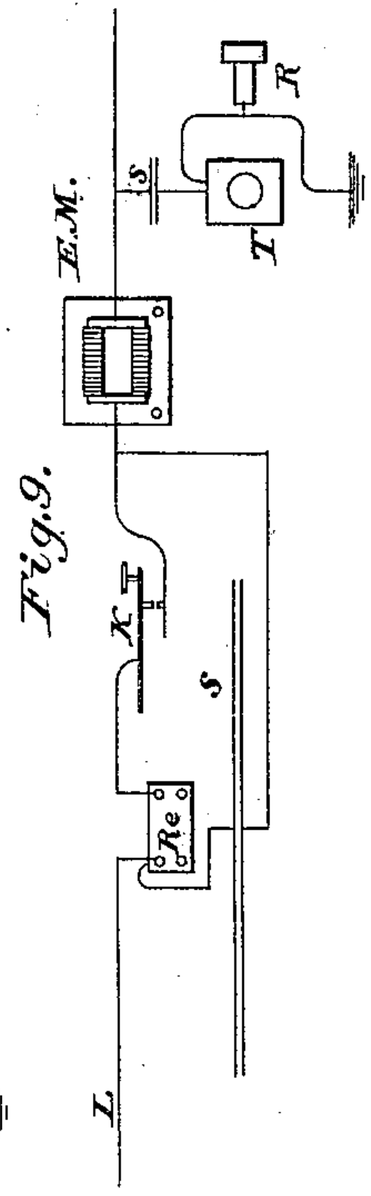


Fig. 10.

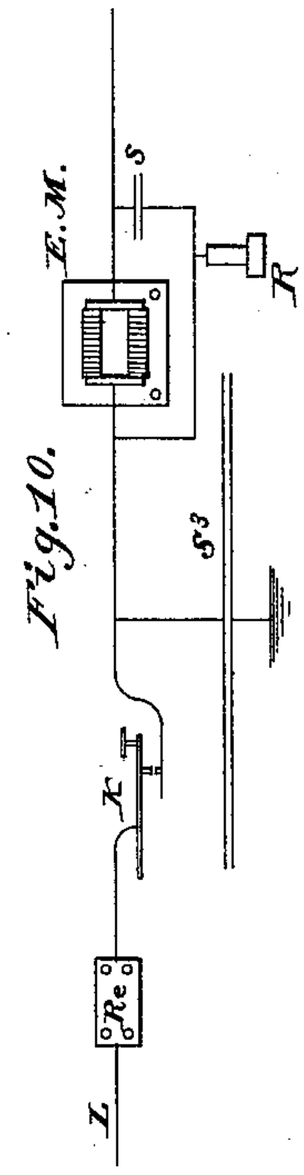


Fig. 12.

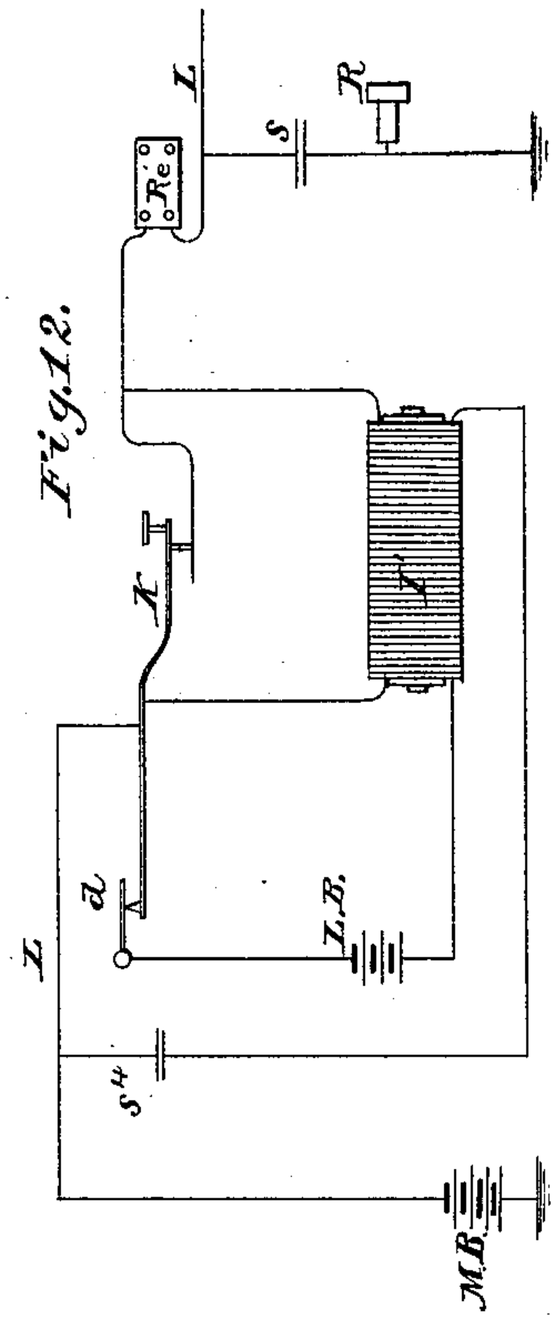


Fig. 7.

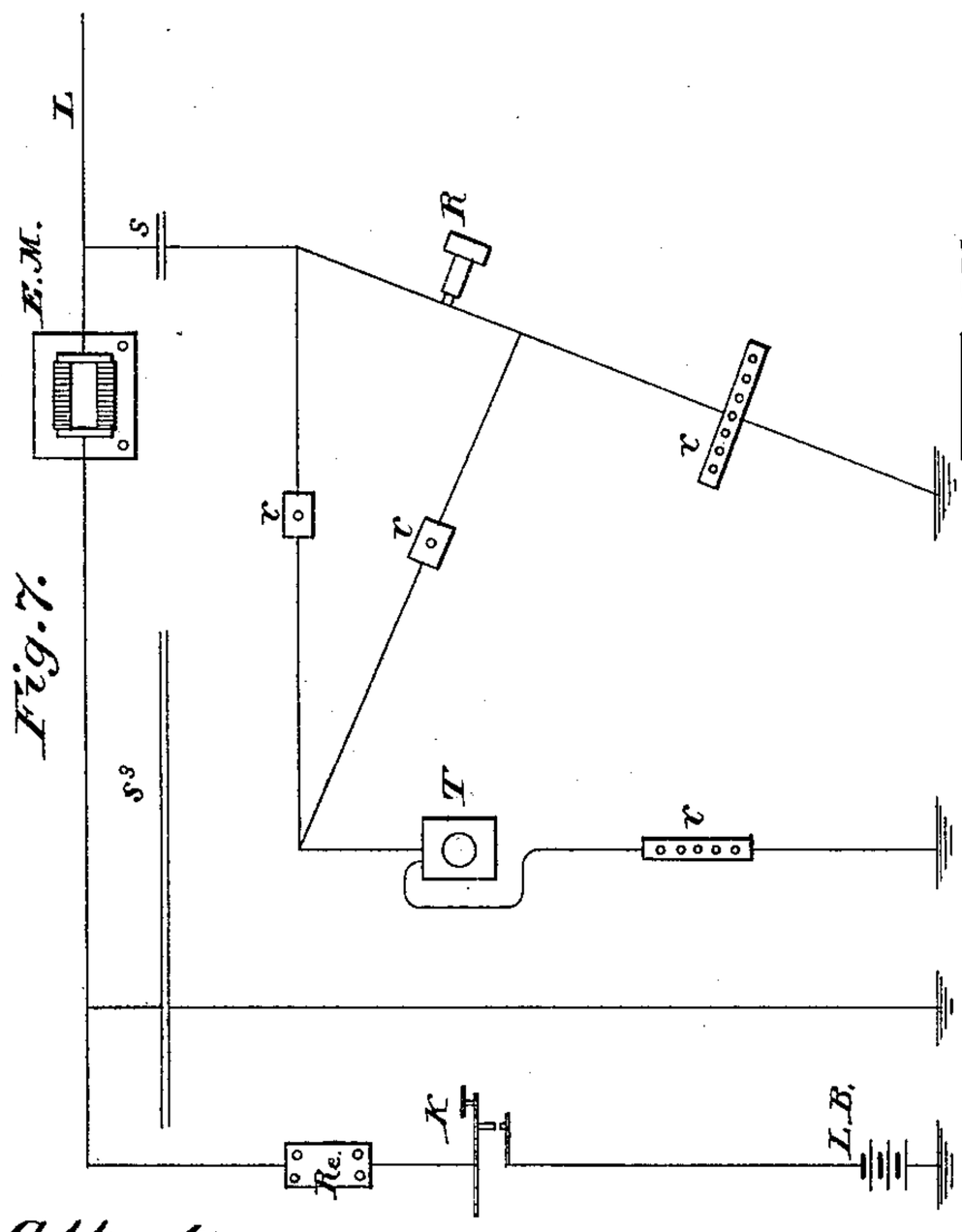
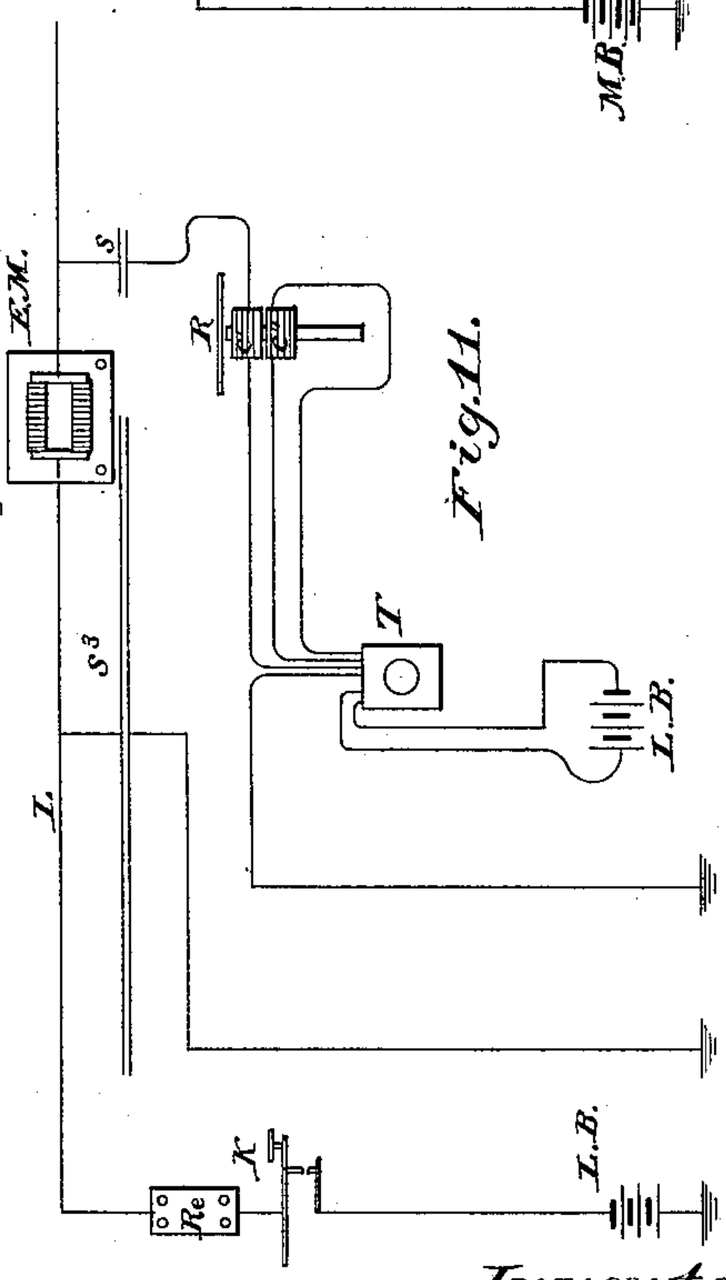


Fig. 11.



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Atty

UNITED STATES PATENT OFFICE.

ABNER M. ROSEBRUGH AND THOMAS R. ROSEBRUGH, OF TORONTO, ONTARIO, CANADA.

COMBINED TELEGRAPHIC AND TELEPHONIC CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 329,956, dated November 10, 1885.

Application filed October 12, 1883. Renewed April 15, 1885. Serial No. 162,382. (No model.)

To all whom it may concern:

Be it known that we, ABNER M. ROSEBRUGH and T. REEVE ROSEBRUGH, of the city of Toronto, county of York, and Province of Ontario, Canada, have invented certain new and useful Improvements in Telegraphy and Telephony, of which the following is a specification.

Our invention relates to duplex or multiplex telegraphy or telephony, whereby two or more messages may be sent over the same line at the same time without interference; and it consists in the arrangements of circuits and instruments in the manner more particularly hereinafter set forth, whereby secondary or induced currents are sent to line, and the home receiver is so connected as not to respond to messages sent from the home transmitters, but will respond to messages sent from the distant station at the same time the home transmitter is in operation, and in the combination of a duplex secondary or induction system with an ordinary Morse system.

In the accompanying drawings, to more clearly illustrate our invention, are shown diagrammatically various connections and arrangements of devices whereby the objects of the invention may be attained, and which will be referred to in detail hereinafter.

In Figure 1 we have shown one of the simplest forms of carrying out our invention, wherein the arrangement is represented diagrammatically. In the main line L is placed a transmitting-instrument, T, producing secondary or induced currents on the line, represented as the ordinary Blake or other telephonic transmitter. At a point, P, the line is branched, one portion extending to the distant station and the other to the artificial line A. In each of these branches is placed a resistance, N, and in the bridge-wire connecting the branches is placed the receiving-instrument, in this instance represented as a magneto-telephone receiver, R. Between the transmitter and receiver and the ground are placed the electro-magnets M M, having adjustable cores, made adjustable by means of a clamp or screw, which may be used in properly balancing the line. When the line is properly balanced, messages transmitted by the transmitter T, producing secondary or induced currents, will not be heard at the home receiver R, but will be heard at the distant receiver R′ in a manner well understood, and at the same time messages transmitted from the distant transmitter T′ will be received at R.

In Fig. 2 we have shown a similar arrangement of lines; but instead of the resistances N N and electro-magnets M M, to balance the line, condensers C C, of low capacity are used; and instead of a telephone-transmitter a rheotome, R*h*, and key K are used. The rheotome is arranged so that the makes and breaks in the primary circuit thereof will cause secondary or induced currents in the line-wire, and when the key K is opened and closed these secondary currents may be sent to line, or not, as required to produce the desired signal at the distant station.

In Fig. 3 a similar arrangement is shown, wherein resistances *r r* are used in the branches forming part of the bridge-circuit, and condensers C C are used in the main and artificial ground-lines.

In Fig. 4 we have shown a manner of sending induced currents to line, wherein the line forms part of the coil of both the transmitter and receiver. In the circuit of the local battery are placed electrodes of a transmitter, T, which circuit forms the primary of a double induction-coil, I, one of the secondary circuits of which is in the main line and the other is connected to a coil upon the magnet of the home receiver. These circuits are so arranged and proportioned that any variations in the primary circuit producing secondary or induced currents in the line will also produce equal but opposed currents in the compensating-circuit, including one of the coils of the receiver. Thus any message or signal sent from the home station by the transmitter T will send induced currents over the main line L through the coil *c′* of the receiver, and at the same time a similar induced current, but of opposite direction, will be sent by the second coil on the transmitter to the coil *c″* of the receiver, so as to neutralize the effect of the outgoing current therein.

In Fig. 5 we have shown a similar arrangement as that just described, wherein a rheo-

tome is employed to produce the secondary currents, and the compensating-circuit therefrom is connected to the coil c'' of the receiver, so as to neutralize the effects of the currents in the main line in coil c'.

In Fig. 6 we have shown the combination of the duplex secondary or induced current circuit with an ordinary Morse line, constituting a multiplex system. To accomplish this, the induced-current line is arranged as heretofore described, but instead of going directly to the distant station it is connected to the ordinary Morse line by means of condensers S S'. These condensers are preferably placed between the bridge and the line, but may be between the bridge and the ground. We have shown in the drawings a simple form of the Morse telegraph, but any other form—as a duplex or quadruplex—may be used in connection with the induced-current apparatus without interference therewith. Thus L B is the battery; K, the key R, the relay, and L the main line of one end of a Morse line. S is a condenser in a branch line, one pole of which is connected with the Morse line and the other pole with the duplex induced-current circuit, arranged as already described. The condenser S prevents "grounding" of the Morse line, but allows the induced current from the telephonic apparatus to go to line. The induced currents are superimposed upon the Morse currents without interference. The currents generated by the transmitter T are received by the receiver R', while the currents generated by the transmitter T' are received by the receiver R. The transmitter may be a rheotome or it may be a magneto-electric generator.

When the duplex induced circuit is used in this connection for speaking purposes, it is necessary to place a condenser, S^3, as shown in Fig. 7, between the line and ground, and an electro-magnet, M, is also interposed between the Morse instruments and the point of juncture of the induced-current circuit. The best results are obtained when the condenser S^3 in this arrangement is of much greater capacity than the condenser S—say six to one, or more—and the magnet M in the main line should have a long soft iron or steel core with a coil of about two hundred ohms resistance. This magnet prevents the escape of the induced currents to ground through the large condenser, which latter neutralizes the induction on the line and prevents it interfering with the instruments. In some instances the condensers S S^3 are placed in bridges around the magnet and key, as shown in Figs. 8, 9, and 10.

In Fig. 8 the telephonic apparatus, with a small condenser, S, forms a bridge around the electro-magnet E M, while the large condenser S^3 forms a bridge around the key and relay of the main line. By this arrangement there is less induction from parallel wires in the receiving-telephone, and the Morse system can be operated more rapidly.

In Fig. 9 the large condenser S^3 bridges the key and relay of the Morse line, while the telephonic apparatus, with the small condenser in circuit, is placed in a grounded branch line.

In Fig. 10 the telephonic apparatus bridges the electro-magnet E M, while the large condenser S^3 is inserted in a ground-wire between the electro-magnet and the key and relay.

By the use of large condensers S^3, breaking the circuit by the key or other device does not affect the telephone-receiver inserted in the line containing the small condenser S, as the primary galvanic current is not of sufficient tension to act inductively through the condenser to affect the telephone.

In Fig. 11 is shown the combination of the compensating secondary-circuit system and the Morse system. L is the Morse line, with the electro-magnet E M in circuit between the Morse instruments and the line. T is a transmitter, with a double or compensating coil, as shown at I, Fig. 5. R c' c^2 is a duplex receiver; L B, the transmitter local battery, and S a condenser of low capacity. The latter is in the branch line with the compensating secondary-circuit system, and may be inserted between the apparatus and the line, or between the apparatus and the ground. A condenser, S^3, is inserted in a branch between the electro-magnet and the Morse instruments. The other end of this line is grounded; but it may simply form a bridge around the Morse instruments, as represented in Figs. 8 and 9. The receiver R, having a compensating-coil, is a duplex receiver, and works independently of and does not affect the Morse system.

In connection with the combined secondary circuit and the ordinary Morse line an arrangement such as is shown in Fig. 12 is useful, wherein an inductorium, I', is placed with one of its coils in a bridge around the double-contact key K, the other coil being part of a local circuit which is opened and closed at d as the key K is operated. The local circuit, as shown, is operated by the back contact of key K; but this may be accomplished by an electro-magnet, if thought desirable. One pole of the secondary is connected with the line between the key and the relay, while the other pole of the secondary is connected with one pole of the condenser S^4. The opposite pole of the condenser goes to ground either through the main battery or by means of a separate ground-wire. By this arrangement induced currents of alternating polarity are sent to line simultaneously with the opening and closing of the main line by the key K, thereby neutralizing the return or static charge of the line.

Other arrangements will readily suggest themselves to those skilled in the art, so that it will be understood that we do not limit ourselves to the precise arrangement shown or described.

We have shown some well-known and conventional transmitting and receiving instruments; but it is understood that they may be replaced by others without departing from our invention.

The messages or signals by means of induced

currents may be sent in the form of speech or any of the ordinary and well-known codes.

We do not herein claim the combination, with a circuit containing operating-instruments over which primary currents are sent, of a secondary-current line-circuit over which induced-currents are sent and an induced compensating-circuit, nor the combination, with a primary or make-and-break signal-circuit, of an inductorium one coil of which is in a bridge around the transmitter, a local circuit forming the other coil of the inductorium, and a key for opening and closing both circuits, as such are reserved for another application.

Having thus described our invention, what we claim is—

1. The combination, with a single electric circuit, of means, substantially as described, for sending Morse signals, and means, substantially as described, for transmitting signals by induced currents simultaneously in opposite directions, as set forth.

2. The combination, with a primary circuit containing a transmitter, of a secondary circuit going to line and a bridge-circuit containing a receiver arranged to respond to signals from the distant station only, and electrostatic devices arranged in the branches of the bridge-circuit and the ground-connections, as set forth.

3. The combination, with a telegraph-circuit and means for sending Morse signals, of secondary or induced current transmitting and receiving devices connected to said circuit, with condensers arranged between and connecting said circuits, and electro-magnets, as described, arranged in the telegraphic circuit for the purpose of controlling the secondary circuits, substantially as described.

4. The combination, with a telegraphic circuit and means for sending Morse or similar signals, of secondary or induced current transmitter and receiver devices connected to said circuit, a condenser of great capacity in the ground or bridge circuit of the line, and a condenser of small capacity in the line between the induced-current instruments and the main line.

5. The combination, with a telegraphic circuit and means for sending Morse or similar signals, of secondary or induced circuit transmitting and receiving devices connected to such circuit, condensers interposed between said induced-current devices and the line, a condenser in a ground or bridging circuit between the Morse and induced-current instruments, and an electro-magnet of comparatively high resistance, also in the line-circuit, substantially as described.

6. The combination, with a telegraphic circuit and means for sending Morse or similar signals, said circuit containing a magnet of comparatively high resistance, of secondary or induced circuit transmitting and receiving devices connected to such circuit, a condenser of comparatively small capacity interposed between said induced-current devices and the line, and a condenser of greater capacity in the ground or bridging circuit of the Morse instruments, substantially as described.

7. The combination, with a telegraphic circuit and means for sending Morse or similar signals, of secondary or induced current transmitter and receiver devices connected to said circuit, a condenser of great capacity in the ground or bridge circuit of the line, and a condenser of small capacity in the line between the induced-current instruments and the main line.

8. The combination, with a telegraphic circuit and means for sending Morse or similar signals, of secondary or induced circuit transmitting and receiving devices connected to such circuit, condensers interposed between said induced-current devices and the line, a condenser in a ground or bridging circuit between the Morse and induced-current instruments, and an electro-magnet of comparatively high resistance, also in the line-circuit, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

A. M. ROSEBRUGH.
T. R. ROSEBRUGH.

Witnesses:
E. HERVEY JACKES,
FREDK. LOUDON.