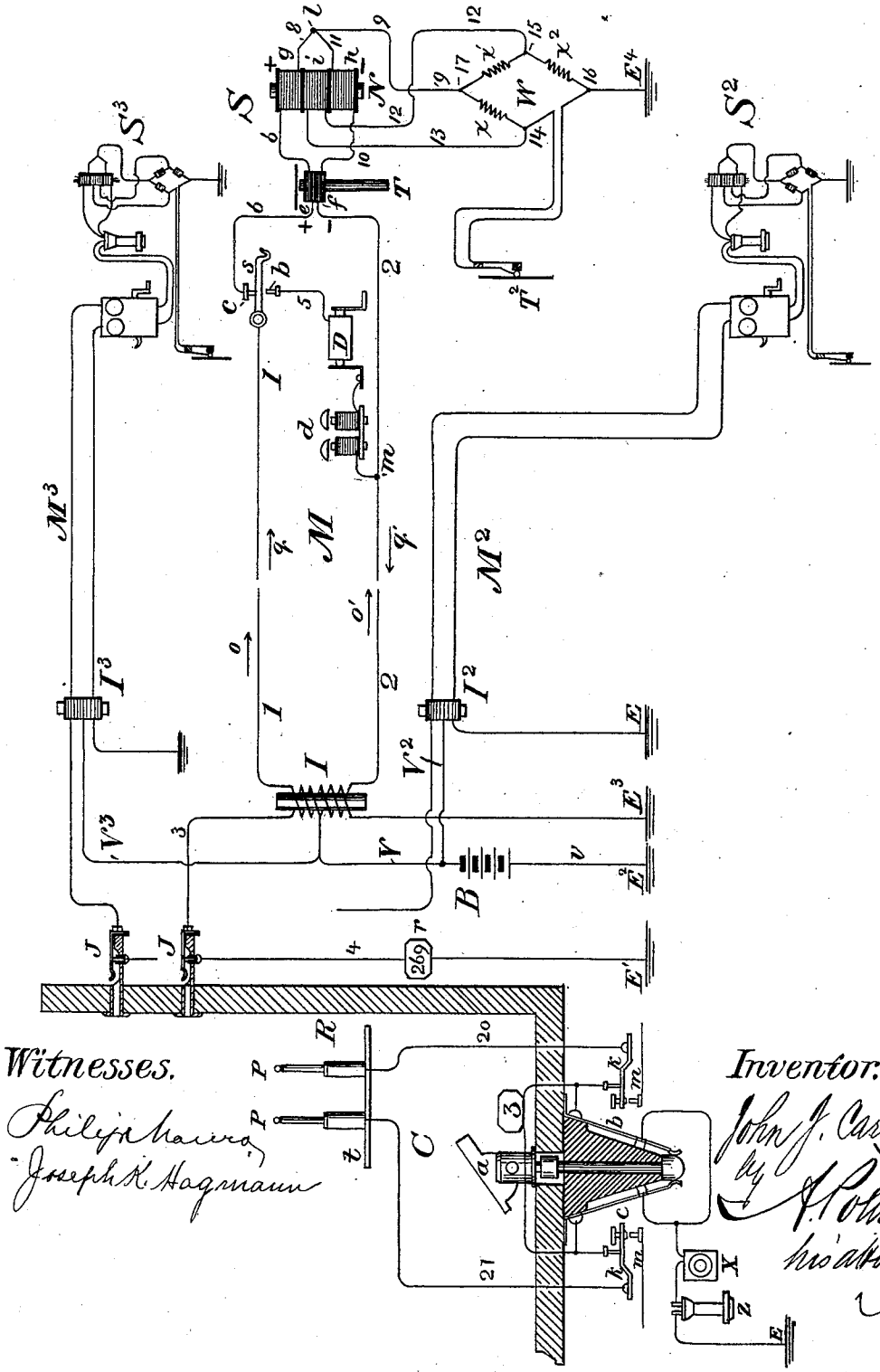
(No Model.)

J. J. CARTY.

TELEPHONE SYSTEM.

No. 425,863. Patented Apr. 15, 1890.



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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 425,863, dated April 15, 1890.

Application filed November 13, 1889. Serial No. 330,126. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. CARTY, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Centralization of Transmitter-Batteries, of which the following is a specification.

This invention relates to telephone-exchange work, and provides a plan whereby a battery located at the central station is enabled to energize the transmitters at a plurality of sub-stations without the necessity of employing a special battery-wire extending from the said central station to all of the sub-stations which are to be supplied.

Although battery-transmitters are of course capable of being operated with their working electrodes included together with a battery directly in the main telephone-circuit, it has been found usually more economical and efficient, except where the said main circuits were very short or of particularly low resistance, to include the transmitter-electrodes at each sub-station with one or two cells of battery in the primary or coarse-wire helix of an induction-coil, the secondary helix whereof was included in the main-line circuit. The variations of current produced by the operation of the transmitter in the primary helix have thus been inductively transferred to the secondary helix and main line, over which they have passed to the distant receiving-telephone. Heretofore a plan has been devised by Charles E. Scribner, for which Letters Patent No. 243,165, and dated June 21, 1881, have been issued, whereby a battery located at the central station may be caused to supply without mutual interference the transmitters of a number of sub-stations, thus dispensing with the separate battery at each subscriber's station which had been required, and thereby effecting a considerable economy in time, labor, and expense. This plan, briefly stated, is carried out by placing the current-varying part of the transmitter in one of the arms of a Wheatstone bridge organized at the subscriber's station, and by connecting the primary helices of an induction-coil also located at said sub-station and associated with said transmitter in the cross-wire of said bridge system. The battery-current is conveyed to the transmitters at the various sub-stations of a group by means of an extra wire extended between them and the central station. In any case, however, an extra supply-wire is not a desirable adjunct, and becomes very burdensome when the actual telephone-circuit is itself a metallic circuit, by reason both of its additional cost, which is not materially less than that of the local batteries which it displaces, and also by reason of the inconvenience attending the leading into the sub-station of so many conductors.

The object of this invention is wherever metallic circuits are employed to dispense with the local transmitter-batteries at the subscriber's stations by supplying the sub-station transmitters with current from a common battery located at the central station, and to do this without adding in place thereof an extra battery-wire. I am enabled to do this by utilizing the two wires of each metallic circuit considered and connected as a single conductor of increased cross-section, as the conducting-circuit of the energizing battery-current. By using the same two wires as the two sides of a metallic circuit for a conversation-circuit, and by the use of a suitable induction-coil (preferably of the class known in the art as repeating-coils) in each sub-station metallic circuit at the central station, the said repeating induction-coil being connected by a wire leading from the center of one of its helices (that connected with the main-line wires) to earth through the energizing-battery. I retain the use of the bridge arrangement at the sub-stations.

The drawing, which illustrates and forms a part of this specification, is a diagram of the electrical connections necessary to carry out my invention in the operation of metallic circuits centering at a telephone central station.

In the drawing, C denotes a central telephone-station, and S a subscriber's station. At the former R is an ordinary switch-board, of any preferred construction, provided with the regular operator's connecting, calling, and supervising outfit of devices in a manner well understood in the art. At the sub-station S is shown the subscriber's apparatus—viz., his call sending and receiving appliances, the transmitting and receiving telephones, and

the primary current-controlling devices, hereinafter to be more fully described.

M is the metallic circuit subscriber's line, composed of the two wires 1 and 2. Tracing line-wire 1, it passes on, entering the subscriber's station to the automatic telephone-switch *s*, which makes contact with point *b* when the the receiver is at rest and in place and with contact-point *c* when the telephone-receiver is removed from the switch, as shown. From *b* a branch wire 5 passes, connecting through call-sending generator D and call-bell *d* with line-wire 2 at *m*. This is the normal or calling circuit of the metallic-circuit telephone-line. From the point *c* a wire 6 extends, continuing the circuit through one helix *e* of the receiving-telephone T and one helix *g* of the inductorium N and by wire 8 to a point *l*. From the point *l* the circuit extends by wire 11 through the other helix *h* of the inductorium N, and then by wire 10 through the second coil *f* of the receiving-telephone T and to the line-wire 2.

The receiving-telephone and inductorium-helices are differentially wound—that is to say, *e* is wound in opposition to *f*, and *g* is wound in opposition to *h*—so that they tend to determine magnetic neutrality in their respective cores so far as the primary effect of the battery B is concerned, and it is preferable to have coils *e* and *f* of equal resistance and coils *g* and *h* likewise of equal resistance.

The helices *g* and *h* of the induction-coil N have a common primary helix *i*, which is included by means of wires 12 and 13 in the cross or bridge wire of the Wheatstone bridge system W. One of the junction-points 16 of the second system is grounded at E^4, and the other junction-point 17 is connected by wire 9 with the point *l* of the subscriber's metallic circuit. Care should be taken to have the two sides 1 and 2 of the metallic talking-circuit balanced with respect to resistance and capacity.

The operative parts of the transmitter—viz., its current-varying electrodes, which are controlled by the diaphragm—are included in one of the arms of the bridge, and suitable resistances, as indicated at *x*, *x'*, and x^2, are included in the remaining arms of the bridge, as well understood. In this respect I adopt the construction of Scribner's Patent No. 243,165, hereinbefore cited.

At the central station is an ordinary repeating induction-coil I, such as the standard repeating-coil, which has its two wires substantially alike in size and number of convolutions. The two ends of one of these helices are joined, respectively, to the central-station ends of the two sides 1 and 2 of the metallic subscriber's circuit. A wire V is attached to the center of this helix and from thence leads to one pole of the supply-battery B, the other pole of which by wire *v* is connected to earth at E^2. The other helix of this repeating-coil is connected at one of its ends with a ground-wire E^3 and at the other with a wire 3 leading to the line spring-jack J, and thence through the said jack by wire 4 to the annunciator-drop *r* and ground at E'.

The operator's apparatus being of any ordinary and well-known character, need not here be described.

Instead of terminating both ends of the central station repeating-coil helix to earth, as shown, if desired, two spring-jacks may be provided, and the two ends of said helix run to their respective springs. In that case the two fixed contacts of the two jacks would be united by a wire having the annunciator *r* in its circuit. The operation of signaling over this circuit will readily be understood. Incoming calls transmitted by means of the generator D traverse the metallic circuit and acting inductively through the coil I actuate the annunciator *r*, while outgoing calls are sent, as usual, by means of the operator's calling appliances, which are brought into connection with the line by means of the plug P, which may be inserted in the spring-jacks J, the signals thus sent also acting inductively upon the line through the coil I.

The operation of the subscriber's transmitter is as follows: The actuating-battery B is already described located at the central station, and thus is always under the control of the said station. When the telephone at the sub-station is on the switch, the circuit of said battery is open. When the receiving-telephone is removed from the switch, but before the transmitter is being used, the current from the battery B divides and flows partly through the wire 1 and partly through the wire 2 to the sub-station S, as indicated by the arrows *o* and *o'*. These currents, after passing through the receiving and transmitting helices *e* and *f* and *g* and *h*, unite once more at the point *l* and pass on through a single conductor 9 through the bridge W and to earth. Unless the bridge organization is perfectly balanced some portion of the current necessarily passes by the way of the bridge-wire, which includes the primary helix *i* even when the transmitter is at rest. When, however, the transmitter is being operated, its resistance is caused to vary continually, and a corresponding variation of current occurs in the primary coil *i* of the inductorium, which induces the varying currents in the secondary coils, which currents circulate in the line-wires 1 and 2 and are at any given moment in the two wires of a direction indicated by the arrows *q* and *q'*—that is, they are of opposing direction in the two wires. It will be noted that *q'* tends to oppose *o'*, and consequently at the moment we are considering the resultant current in 2 is of smaller volume; but it may also be noted that the current in 1 is correspondingly increased by the coincident and co-operative presence of the two currents of like direction, represented by the arrows *o* and *q*, and as a consequence the total current developed by the secondary helices and flowing in the metallic circuit is

not affected by nor does it affect the primary current, and since the repeating-coil I, concerned in the transmission of the voice-currents, is operated solely by the said currents, developed by the sub-station inductorium secondary, and circulating in the metallic circuit composed of the two wires 1 and 2, it is evident that no detrimental effect can occur from the apparent conflict of the original and induced currents. On the contrary, the useful effect may be regarded as being proportionate to the difference between the electrical state of the two sides of the metallic circuit when at rest and that when the transmitter is being operated.

M^2 and M^3 are similar subscribers circuits extending to sub-stations S^2 and S^3, the sub-station transmitters of which are energized by the same battery B, from which the wires V^2 and V^3 branch, each to its own metallic circuit. The several metallic circuits each have their own repeating-coils I^2 and I^3, and the branches V^2 and V^3 connect with their metallic circuits at the center of the main-line helices of such coils. The other helices of the repeating-coils are, as in the case of the first circuit, adapted for connection with a spring-jack J and call device I.

Having now fully described my invention, I claim—

1. In a system for telephonic communication, the combination, with a telephone-transmitter at one station and an energizing-battery therefor at another station, of a double-wire circuit extending between the two stations and including said transmitter in a metallic circuit, both of said wires being in connection with the same pole of said battery, thereby constituting jointly a single conductor of relatively high conductivity for the battery-currents, substantially as described.

2. In a telephone system, the combination of a series or group of metallic telephone-circuits extending each from a central station to a separate sub-station, a telephone-transmitter at each sub-station included in its own metallic circuit, and an energizing-battery for the said transmitters common to the group and connected with all of the said metallic circuits, the two wires of each of the said circuits being connected with one pole of said battery, thereby constituting jointly a practically single conductor for the battery-current in multiple arc or parallel circuit with the other similarly-constituted single conductors of the group, substantially as described.

3. The combination, substantially as hereinbefore described, of a metallic circuit extending between a central and a sub station, with an induction-coil at the central station having one of its helices included in a local circuit, with the switch-board connecting and signaling devices, and having its other helix included in the said metallic circuit, and a battery included in a branch circuit extending from a point at the center of the metallic circuit helix to earth, together with a transmitting and receiving telephone and induction-coil for the former, and a Wheatstone bridge, all at the sub-station, the receiver-helix and the secondary helix being each formed of two coils, one in each wire of the metallic line-circuit and differentially wound or connected, the Wheatstone bridge being included in a branch circuit extension from a neutral point on the said metallic circuit to earth, the primary helix of the induction-coil being in the cross-wire of said bridge and the variable resistance of the transmitter being connected in one of the arms of said bridge, whereby the two wires of the metallic circuit in connection with the terminal earth branches may jointly constitute the transmitter-battery circuit, while they may severally form the two sides of the conversation-current circuit.

4. The combination of a metallic circuit, an earth branch therefor at each terminal station thereof, a Wheatstone bridge at one of the said stations included in the said earth branch, a telephone-transmitter and its induction-coil, the secondary helix of said coil being composed of two equal parts, one part in each wire of the said metallic circuit (the said circuit being assumed to terminate at the junction-point of its earth branch) and the primary helix of said coil being included in the cross-wire of said bridge, and a battery included in the earth branch at the other station, substantially as described, and for the purpose set forth.

5. A metallic telephone-circuit, extending between a central and a sub station, an earth branch united to the said metallic circuit at each terminal station at such central points as to balance the two sides of said circuit, a telephone transmitter and receiver at the sub-station and an induction-coil for the former, the receiver-helix and the main-line helix of said induction-coil being halved between the two sides of the circuit, as defined by the point of connection of the earth branch, and a Wheatstone bridge included in said earth branch, the primary helix of the induction-coil being in the cross-wire, and the transmitter being in one of the arms of said bridge, in combination with a battery in the central-station earth branch, a repeating-coil connected as described and having one of its helices in the metallic circuit and the other in a local switch-board circuit, including a spring-jack and a call-annunciator, substantially as hereinbefore set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 9th day of November, 1889.

JOHN J. CARTY.

Witnesses:
HERBERT LAWS WEBB,
O. A. BELL.