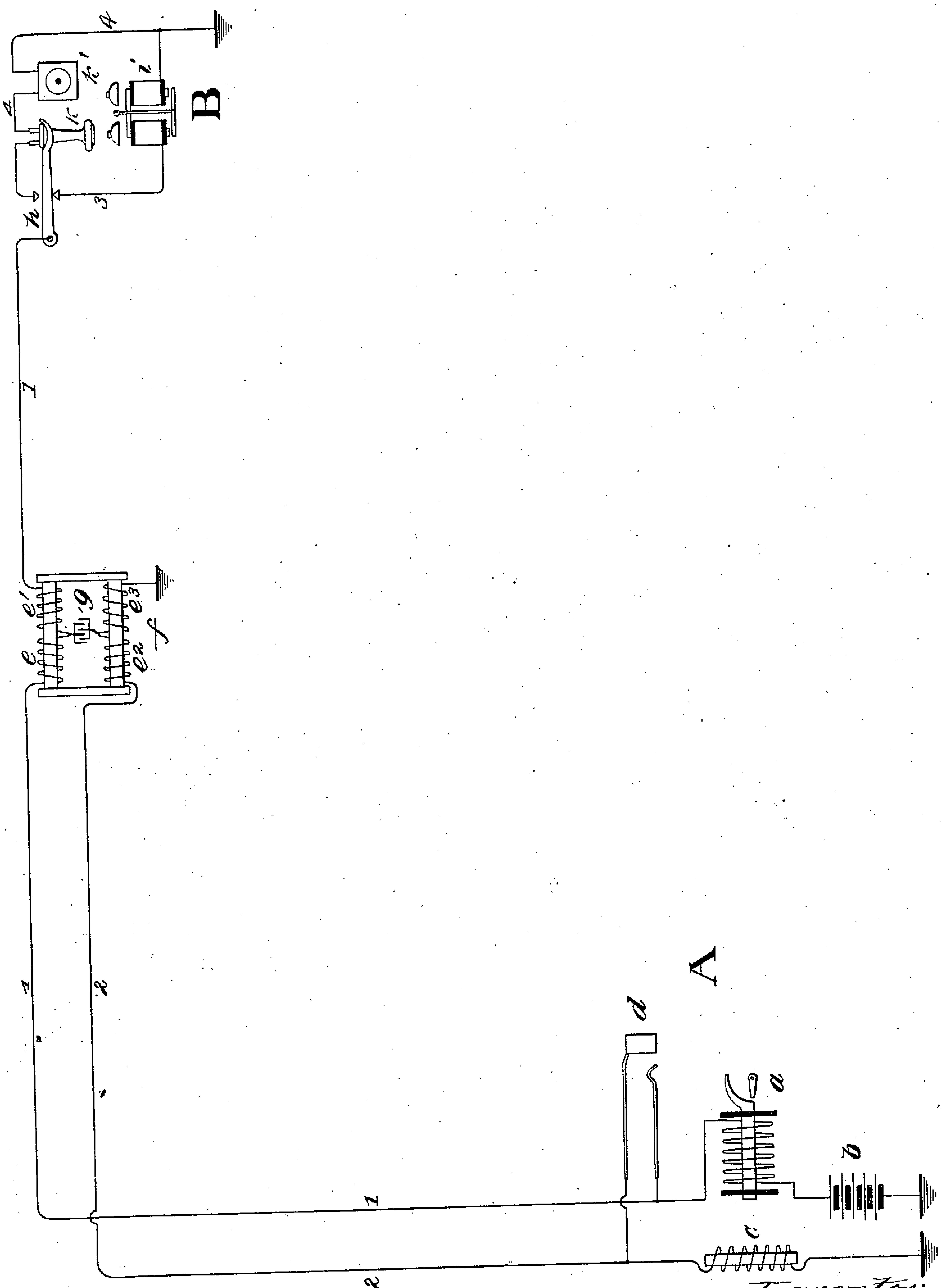
(No Model.)

C. E. SCRIBNER.

APPARATUS FOR TELEPHONE LINES.

No. 557,153. Patented Mar. 31, 1896.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 557,153, dated March 31, 1896.

Application filed August 17, 1895. Serial No. 559,626. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Apparatus for Telephone-Lines, (Case No. 395,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention applies to combined metallic and ground return telephone-lines, being a device for permitting the use, with such circuits, of automatic signals or annunciators at the central station controlled by the switch-hook at the telephone substation.

In telephone-exchange practice it is frequently necessary to construct a composite or compound telephone-line comprising a metallic-circuit portion and a ground-return portion, the two parts of the circuit being inductively connected together through the medium of a repeating-coil. This is required, for instance, in cases where a part of the telephone-line parallels or extends in proximity to electric railways or other sources of troublesome induction. The electric continuity of the line-circuit—that is, the continuity of the circuit as to continuous currents—between the central station and the substation is of course interrupted in such lines, the two portions of the circuit being electrically distinct and permitting the transmission of varying currents only through the repeating-coil. It is thus not practicable to apply to such circuits an automatically-operated signal at the central station. My present invention provides a mode of arranging the circuits and apparatus of such a telephone-line which avoids the difficulty and permits the use of the signals mentioned. It involves the use of a repeating-coil having four helices. Two of these helices are connected serially in one conductor of the complete circuit, and the other two in the other line conductor of the circuit. The points of junction of the two pairs of serially-connected helices are united through a condenser. The metallic-circuit portion of the line then finds a complete and perfectly balanced circuit as to telephonic currents through one helix of the repeating-coil, thence through the condenser, and thence through the other helix of the repeating-coil. Telephonic currents in the grounded portion of the line likewise find circuit through one helix, through the condenser, and thence to earth through the other helix of the repeating-coil. Continuous currents originating at the central station, however, find circuit through one conductor of the metallic line, thence through two of the serially-connected helices of the repeating-coil and the line conductor of the grounded portion, and thence through the substation to ground. In applying the signaling apparatus in this circuit, any suitable form of visible signal or annunciator may be connected, together with a source of current, in a ground branch from one side of the metallic circuit at the central station, and the telephone-switch at the substation may be arranged to interrupt the connection of the line with earth during the disuse of the telephone, closing it only when this instrument is brought into use. The signal at the central station will thus be excited or displayed when the telephone is removed from its switch-hook for use.

My invention is shown in the accompanying diagram.

In the figure a telephone-line is represented extended between a central station A and a substation B, a portion of the telephone-line having a metallic circuit and the remainder a ground-return.

At the central station a branch from line conductor 1 extends through the magnet of a visible signal *a* and through a battery *b* to earth. Line conductor 2 is also led to earth, an impedance-coil *c* being interposed in it for the purpose of maintaining the electrostatic balance of the line. The signal *a* may be of any well-known type. That shown has a prolonged curved pole-piece, near which a shutter of magnetic material is pivoted. The shutter or target, when the magnet is not excited, lies in a horizontal position and is concealed; but when the magnet becomes excited the target is drawn into a vertical posi-

tion and is displayed. The contact-springs of a spring-jack *d* in the switchboard are connected with the line conductors 1 and 2.

At some distance from the central station the metallic return of the line-circuit is discontinued. At this point line conductor 1 is led through the two helices *e* and *e'* of the repeating-coil *f* and thence to the substation B. Line conductor 2 extends through the other helices e^2 and e^3 of the repeating-coil and thence to earth. The point of junction of helices *e* and *e'* and that of helices e^2 and e^3 are united through a condenser *g*.

At the substation line conductor 1 terminates, as usual, in the switch-lever of a telephone-switch *h*. The normal resting-contact of this switch is the terminal of a grounded conductor 3, which includes a signal-bell *i*. The other switch-contact is the terminal of a similar ground connection 4, including the receiving-telephone *k* and the transmitting-telephone *k'*. The bell *i* should be of such high resistance as to practically interrupt the current from battery *b* at the central station, so as not to permit the operation of signal *a* by current through the bell. The resistance of the telephonic appliances is, however, comparatively low.

When the telephone is removed from the switch-hook at station B, current finds circuit from the line conductor 1, including two helices of the repeating-coil *f*, and thence through the telephone at the substation to earth. The visible signal at the central station is thus displayed and calls the attention of the operator.

Telephonic currents originating at the substation find circuit from earth through line conductor 1 and through helix *e'* of the repeating-coil, condenser *g*, and helix e^3 to earth. Corresponding currents are induced in helices *e* and e^2, which find circuit through condenser *g* and circulate in the metallic line-circuit 1 2, finding a path at the central station through any of the usual apparatus which may be connected with the line by means of spring-jack *d*—as, for example, another telephone-line.

It will be obvious that the junction-points of the helices could not be connected together in a group, since the signal-operating current could then find circuit through the return-conductor to earth or through the helix e^3 to earth. Nor could the condenser be included in any other portion of the circuit with satisfactory results, since its presence in any other position than at a neutral point of the line-circuit would disturb the electrostatic balance of the line and would render the metallic portion of the line liable to inductive disturbances. When the condenser is interposed in the circuit in accordance with my invention, however, the balance of the line and the efficiency of transmission remain unimpaired, while a continuous conductor, devoid of ground branches, is obtained for the purpose of transmitting signals.

I claim as new—

1. The combination with a repeating-coil having four helices, arranged in two pairs whose members are serially connected, of a condenser included in a bridge between the points of junction of the members of the two pairs, as described.

2. The combination with a repeating-coil having four helices, of a telephone-circuit each of whose line conductors includes two of the helices in series, a branch or bridge including a condenser connected with each line conductor at a point intermediate of the two helices therein, as described.

3. The combination with a telephone-line having metallic-circuit and ground-return portions, of a repeating-coil having four helices, two of the helices being connected serially in the complete line conductor, and the other two being included serially in a ground branch from the other conductor of the metallic circuit, and a condenser interposed in a bridge connecting the points of junction of the serially-connected helices in the different line conductors, as described.

4. The combination with a continuous line-circuit from a central station to a substation, of a source of current and a responsive instrument in the line conductor at the central station, and means for closing the circuit at the substation, a branch from the line conductor extending to one plate of a condenser, a ground branch from the other plate of the condenser including one helix of a repeating-coil and a metallic return-circuit branch from the same plate of the condenser through the other helix of the repeating-coil and extending to the central station, and means for producing and receiving telephonic currents in either the metallic-return portion or in the ground-return portion of the circuit, as described.

5. The combination with a telephone-line circuit having a partly-metallic and partly-grounded return-circuit, of a repeating-coil having four helices, two of the helices being included serially in a continuous conductor of the circuit, and the other two helices being included serially in a ground branch from the extremity of the metallic return-circuit, a condenser in a bridge uniting the points of junction of the serially-connected helices, a responsive device and a source of current in a ground branch from the continuous line conductor at a central station, and means for closing a ground branch to the same conductor at the substation, as described.

In witness whereof I hereunto subscribe my name this 12th day of July, A. D. 1895.

CHARLES E. SCRIBNER.

Witnesses:

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