(No Model.)

J. S. STONE.

TELEPHONE CIRCUIT.

No. 560,761. Patented May 26, 1896.

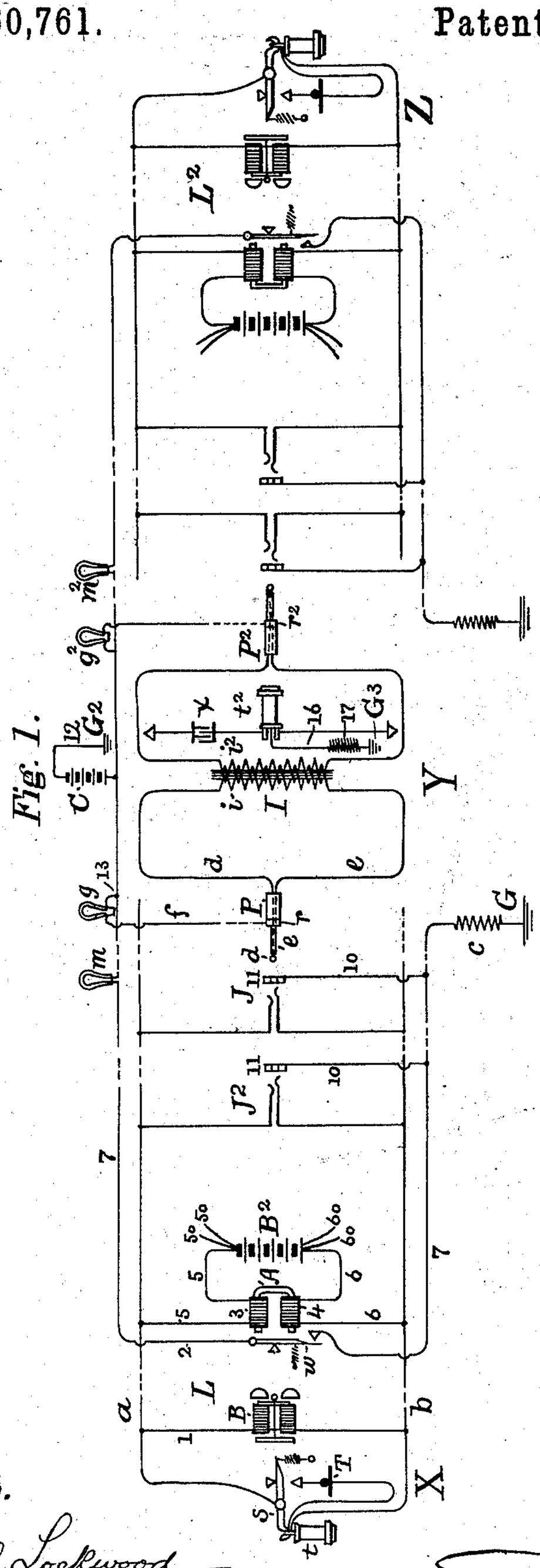

Fig. 1.

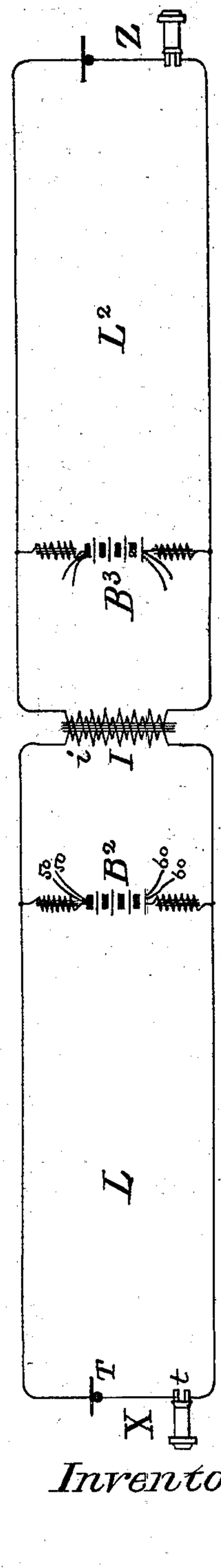

Fig. 2.

Attest.

Frank C. Lockwood

Geo. Willis Pierce

Inventor;

John S. Stone

UNITED STATES PATENT OFFICE.

JOHN S. STONE, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE AMERICAN BELL TELEPHONE COMPANY, OF SAME PLACE.

TELEPHONE-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 560,761, dated May 26, 1896.

Application filed March 13, 1896. Serial No. 583,113. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. STONE, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephone-Circuits, of which the following is a specification.

This invention relates to multiple common battery switchboards, and particularly to the means for signaling, testing, and conversation. It is associated with the type of switchboards which are provided with open-terminal spring-jacks on each section and in which incandescent lamps are employed for the line and clearing-out signals. The substations are provided with the usual instruments employed in common battery systems—*i. e.*, a high-resistance call-bell in a permanent bridge, a receiving and transmitting telephone, and a hook-switch. A common generator for operating the signal-circuit and for energizing the substation telephone-transmitters is located between the coils of a relay and in a permanent bridge between the line conductors of each substation-circuit. The relay-armature operates to close and open a combined signal and test circuit, which is grounded at one end through a resistance and at the other end through a line lamp-signal and battery, there being branch connections to the test-contacts of each spring-jack. The coils of the relay act as impedances. The operators' cord-circuits are conductively divided, but inductively united by a repeating-coil, and a clearing-out or disconnecting lamp-signal is located in each plug-circuit in a branch connection extending from a metal ring on the plug to the conductor of the signaling and test circuit. When a call is made from a substation, the common generator energizes the relay-coils and the armature closes the signaling-circuit, the line lamp-signal is supplied with energy from the battery in the said circuit, and is lighted. The insertion of the answering-plug in the line-socket brings the metal ring thereof into engagement with the test-contact piece of the socket, thereby bringing the disconnecting lamp-signal into parallel circuit with the line-signal. The current in the signaling-circuit is approximately constant, owing to the resistance therein, and consequently the two lamp-signals shunt each other to such an extent as to extinguish the line-signal and prevent the disconnecting-signal from lighting; but the relay-armature remains attracted to its cores. The testing is done in the usual way. When two substation-circuits are looped together, each circuit is thus provided with a battery for signaling and conversation purposes, and the impedances on each side thereof prevent the sound-waves from being short-circuited therethrough. When two substation-circuits are of the same or of approximate resistance, the same battery may be connected to both; but if they are of widely-varying resistance two separate batteries are employed.

In the drawings which form part of this specification, Figure 1 is a diagram illustrating the invention, showing two substation-circuits in association with an operator's cord-circuit; and Fig. 2 is a diagram showing schematically two substations looped together for conversation.

X and Z represent the substations, and Y the central station.

B is the high-resistance bell in a bridge 1 between the line conductors *a* and *b*, which are adapted for connection with telephones *t* and T, the former being shown upon the hook-switch *s*, so that the branch through the said telephones is normally open.

J J^2 are branch terminal-plug sockets or jacks upon the switchboard-sections.

A is a relay, whose coils 3 and 4 are in the bridge 5 between the conductors *a* and *b*, the generator B^2 being interposed between the said coils. The relay-armature *w* controls the combined signal and test circuit 7, from which branches 10 extend to the test-rings 11. One end or side of the circuit is grounded through the resistance *c*. The opposite end or side serially includes the line lamp-signal *m* and is grounded through the battery C.

The operator's cord-circuits are inductively united by the repeating-coil I, the windings terminating in the tip *d* and sleeve *e* of the plugs P and P^2, respectively. The windings are of sufficient resistance to prevent the operation of the relay when the cord-plug is in a spring-jack and the substation-circuit is open at its hook-switch.

There is a disconnecting lamp-signal in each

plug-circuit, which is included in a branch conductor *f*, connecting a metal ring *r* on each plug with the signal and test circuit conductor at point 13.

The operator's apparatus is the same as usual, and only the receiving-telephone t^2 in circuit with the condenser *x* and grounded at the center of its coil through a resistance 17 is shown.

In the operation of the invention, when the telephone *t* is removed from its hook-switch and the circuit is closed, the current of the generator B^2 energizes the relay A, and its armature closes the normally open signal-circuit 7, permitting current from battery C to flow therein and to light the lamp *m*.

When the answering-plug P is inserted in the socket of jack J, its tip makes contact with the upper spring thereof and its sleeve with the lower spring. At the same time the ring *r* engages the test-contact piece 11, making a circuit from ground G, resistance *c*, branch 10, by wires *f* and 7 and 12, battery C to ground G^2, thereby placing the disconnecting lamp-signal in parallel with the line lamp-signal, and as the current from the battery C is substantially constant, owing to the presence of resistance *c*, the two lamps shunt each other, and the line lamp-signal is extinguished. There is, however, sufficient current through the relay A to hold the armature *w* attracted.

The test is made in the usual way by touching the test-contact 11 of the circuit wanted with the tip of the calling-plug P^2. If the line is busy, there will be a circuit from ground G^3, wire 16, telephone t^2, tip *d* of plug P^2, ring 11, branch 10, wires 7 and 12, battery C to ground G^2, and the usual click will be heard in the telephone t^2 due to the charging of the condenser *x* by the battery. If the line is not busy, no circuit is formed and the plug is inserted in the socket of the line.

When the telephone at each substation is returned to its hook-switch, the circuit is thereby opened and the armature *w* falls back, opening the signal-circuit, whereupon the whole current from battery C passes through the circuit previously described and lights the disconnecting lamp-signal *g*, and upon the withdrawal of the plugs P the lamps are extinguished.

Fig. 2 illustrates two substation-circuits looped together for conversation. Each circuit is represented by a battery B^2 B^3 in a bridge between the circuit-conductors, which may be the same, or a separate battery with the relay impedance-coils 3 and 4 on each side thereof, and each circuit repeating into the other by means of the repeating-coil I. Wires 50 50 and 60 60 from the poles of the batteries indicate that these batteries are common to other circuits.

By the use of separate generators in each substation-circuit conversation-circuits of varying resistances can be better served and the use of a condenser in the cord-circuit, which heretofore has been requisite, is avoided, and by means of the relay A, operated by the said generator, the operation of the line and disconnecting lamp-signals are distinctly individualized, so that the signals in one circuit are not disturbed by the manipulations taking place in other circuits.

Having now fully described my invention, I claim—

1. The combination with a telephone-circuit, of a generator and a relay in a permanent bridge between the circuit-conductors, the generator being interposed between the coils of the relay; and a local circuit including a battery, a line lamp-signal controlled by the relay, and means for shunting the signal when connection is made with the line, as set forth.

2. The combination with a telephone-circuit provided with means at the substation for closing the circuit, of a generator and relay in a permanent bridge between the circuit-conductors, the generator being interposed between the coils of the relay; and a local circuit including a battery, and a line lamp-signal controlled by the relay, and means for shunting and extinguishing the signal when connection is made with the line as set forth.

3. The combination with a telephone-circuit provided with means at the substation for closing the circuit, of a generator and a relay in a permanent bridge between the circuit-conductors the generator being interposed between the coils of the relay; a normally open local circuit grounded at both ends adapted to be closed by the relay; test-contacts in open-terminal spring-jacks and branches from the contacts to the local circuit; whereby when the circuit is closed at the substation the electrical condition of the test-contacts is changed as set forth.

4. The combination with a telephone-circuit provided with means at the substation for closing the circuit; of a generator and a relay in a permanent bridge between the circuit-conductors, the generator being interposed between the coils of the relay; a normally open local circuit including a resistance, a battery, and a line lamp-signal controlled by the relay; test-contacts in open-terminal spring-jacks having branch connections to the local circuit; and a plug provided with a contact-ring connected to a disconnecting lamp-signal and to the local circuit; whereby when the plug is inserted in a jack the line lamp-signal is extinguished, and the electrical condition of the test-contacts is changed, as set forth.

5. The combination of two telephone-circuits looped together for conversation by plugs and cords which are inductively united by the two windings of a repeating-coil; each circuit having in a permanent bridge between its conductors a generator and a relay whose helices serve as impedances; a local circuit closed by the said relay; and a shunted disconnecting lamp-signal in each plug-circuit;

whereby upon the opening of either circuit at its substation the disconnecting lamp-signal will be lighted, as set forth.

6. The combination with a substation telephone-circuit and a circuit-changer located at the substation, and a battery and relay responsive to said circuit-changer bridged at the central station between the circuit-conductors; of a local signaling-circuit at the central station having two branches one containing the call-signal and leading through contacts controlled by the said relay, and the other containing the disconnecting-signal, and leading through switch-plug and socket contacts; whereby when both branches are closed, the disconnecting-signal may be set when in response to the substation circuit-changer the relay branch contacts are separated, substantially as specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 7th day of March, 1896.

JOHN S. STONE.

Witnesses:
GEO. WILLIS PIERCE,
JOSEPH A. GATELY.