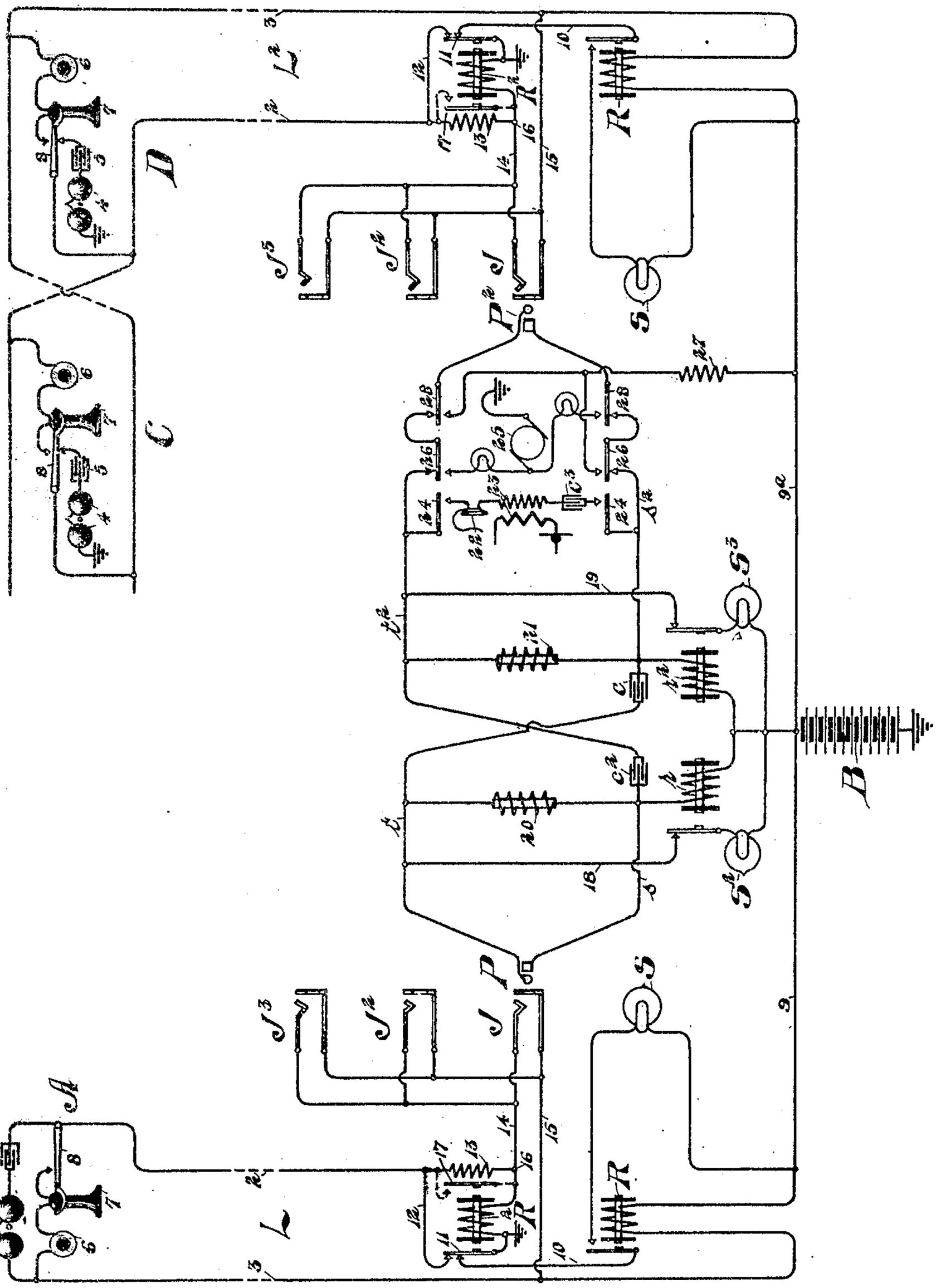
No. 828,693. PATENTED AUG. 14, 1906.

H. G. WEBSTER.

TELEPHONE SYSTEM.

APPLICATION FILED DEC. 15, 1902.



Witnesses.
R. H. Burpins
Gazelle Beder.

Inventor:-
Harry S. Webster,
by Robert Lewis Ames,
Attorney.

UNITED STATES PATENT OFFICE.

HARRY G. WEBSTER, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

No. 828,693. Specification of Letters Patent. Patented Aug. 14, 1906.

Application filed December 15, 1902. Serial No. 135,235.

To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, 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 Telephone Systems, of which the following is a specification.

My invention relates to telephone systems, and more particularly to the type in which a common battery or batteries are provided at the central office to furnish the substations with current for transmission purposes and for the operation of the various relays associated with the lines.

My invention has for its objects to provide a system which is extremely simple and in which the various operations of connecting subscribers for conversational purposes may be carried out in a rapid and efficient manner.

The figure is a diagram of two subscribers' stations and the central-office apparatus associated therewith.

L and L^2 indicate subscribers' lines extending in two limbs 2 and 3 from their respective substations to the central office. At the substations—for example, at the station A, located upon the line L—the apparatus includes an ordinary bell 4 and a condenser 5, connected between the line conductors, and a transmitter 6 and a receiver 7, connected in a bridge of the line which is normally open at the switch-hook 8. This arrangement is intended merely to typify any usual or desired common-battery subscriber's outfit.

At the central office the sleeve-conductor 3 includes the winding of the line-relay R and is thence connected by a common lead 9 with the live pole of a battery B. The said relay controls a local circuit of the line-signal S through its normally open contacts, which are joined by conductor 10 with the normal contact of grounded spring 11 of the line-cut-off relay R^2. The tip-conductor 2 of the line is normally grounded by means of a branch 12, extending to a normal contact of the grounded spring 11. This conductor also includes a non-inductive resistance 13 of preferably about two hundred ohms and is thence connected by conductor 14 with the tip-contacts of the spring-jacks of the line of which there is an answering-jack J, together with any suitable number of multiple jacks, such as J^2 and J^3. The sleeves of these jacks are connected by conductor 15 with the sleeve-conductor 3. The cut-off relay R^2 is connected between ground and the tip line conductor at the point 16. The spring 17 of the cut-off relay may be utilized, as indicated in dotted lines, to shunt the resistance 13. The line L^2 is similar to the line L, but is connected at the central office with the same battery by means of a second common branch 9^a and is provided with more than one station. The call-bells at these stations are legged to ground from the different line conductors.

The operator's outfit includes a cord-circuit, consisting of a plug P and a calling-plug P^2, the tip-contact of the plug P being connected by the tip-strand *t*, the condenser *c*, and the sleeve-strand s^2 with the sleeve-contact of the plug P^2, while the sleeve-contact of plug P is likewise joined by the sleeve-strand *s*, the condenser c^2, and the tip-conductor t^2 with the tip-contact of the plug P^2. A supervisory signal S^2 is connected between the tip-strand *t* and the live pole of the battery B by means of conductor 18, which includes the normal contacts of a supervisory relay *r*, which is in turn connected between the sleeve-strand *s* and the same pole of the battery. A supervisory signal S^3, associated with the other plug of the cord-circuit, is similarly connected with the tip-strand t^2 by means of conductor 19 and likewise includes the normal contact of the supervisory relay r^2, which is connected between the sleeve-strand s^2 and the live pole of the battery. Retardation-coils 20 and 21 are connected across the answering and calling ends, respectively, of the cord-circuit and are preferably about three thousand ohms resistance.

The operator's receiver 22, the secondary of her induction-coil 23, and the condenser c^3 are bridged across the calling end of the cord-circuit by means of the springs 24 of any suitable listening-key. Her transmitter and the primary of her induction-coil are charged from any suitable current source. A ringing-generator 25 is adapted to be connected with the tip-conductor t^2 by means of springs 26, simultaneously depressed by means of any suitable ringing-key, while at the same time the sleeve-conductor is connected, through the fifty-ohm coil 27, with the live pole of the battery B. The operation of the

pair of springs 28 serves to connect the generator with the sleeve side of the cord-circuit and the said resistance with the tip side.

While the resistances employed for the various parts are not arbitrary, good results have been obtained with the cut-off relays R^2 of one hundred ohms resistance, the line-relays R of two hundred ohms, supervisory relays r and r^2 of two hundred ohms each, and supervisory lamps of about ten or twelve volts.

The operation of the invention will now be traced: Taking up the receiver at station A completes a path for current from the battery B, over conductor 9, through the line-relay R, over the sleeve-conductor 3, through the substation instruments, back to the central office, over tip-conductor 2, and thence over branch 12 and spring 11 to ground. This operates the line-relay, which closes the local circuit of the lamp S, said local circuit being completed through the contacts of the relay R and the normal contacts of the cut-off relay R^2. In response to this signal the operator inserts the answering-plug P in the corresponding jack J, thereby completing a path for current through the cut-off relay R^2 from the live pole of the battery B. This current-path may be traced as follows: through the supervisory lamp S^2, the normal contacts of supervisory relay r, branch 18, the tip-conductors of the cord-circuit and to the jacks, and thence through the winding of the relay to ground. The cut-off relay is thus energized to open the circuit of the lamp S and to cut off the ground from the tip side of the line. Owing to the fact that the line-circuit is closed at the substation and the path to current through the cut-off relay from the tip side of the line is open, current now flows in the same direction over the tip-strand 2, through the resistance 13, to the point 16, and thence through the winding of the cut-off relay to ground. A path for current is thus provided through the supervisory relay r, which is energized and opens the circuit of the supervisory lamp S^2. The resistance 13 serves in the first instance to enable the cut-off relay R^2 to operate, since with the grounded conductor 12 a short circuit of said relay from the point 16 would otherwise result. Upon learning the order the operator tests the condition of the wanted line. Normally it will be seen that the test-rings of the jacks and the tip-conductors of the calling ends of the cord-circuits are at the same potential, so that the testing of an idle line would not result in a flow of current and no click would be received by the operator. During conversation, however, the said test-rings are of substantially less potential, but the tip-conductor of the testing-cord is at the same potential, owing to the presence of the impedance-coils 20 and 21. A click is therefore received when a busy line is tested. The insertion of the calling-plug closes a path for current through the supervisory lamp S^3 and over the tip-strand of the cord-circuit and through the cut-off relay R^2 to ground, the resistance 13 preventing the shunting of said current around through the grounded spring of the said relay. This prevents the operation of the line-signal during the remainder of the connection. The depression of ringing-springs 28 connects the calling-generator with the sleeve-conductor of the line, and thereby rings the bell at station C. The tip-spring 28 is connected through the low-resistance path, including coil 27, thereby maintaining said relay operated during ringing. The depression of springs 26 of the ringing-key connects generator 25 with the tip-conductor, which sends current out over the line to operate the bell at station D, a low-resistance path being now completed over the sleeve-strand through said coil 27. The ringing-current if pulsating in character will maintain the cut-off relay operated during ringing; but if it is alternating in character the said relay should be so constructed as to respond thereto and remain actuated. After ringing and before the subscriber's response the supervisory signal S^3 is lighted through the cut-off-relay path, and thus indicates the fact to the operator that the called subscriber has not yet responded. The response of the subscriber closes a path for current through the supervisory relay r^2, thence over the sleeve side of the line, through the substation instruments, and back to the central office, over the tip-conductor, thence through the cut-off relay to ground, thereby energizing said supervisory relay to open the circuit of the supervisory signal S^3. During conversation the said resistances 13 are cut out of the circuit by the spring 17 of the cut-off relay, if they be used. The path for transmission-current is first over the sleeve-conductors of the lines, and thence back to the central office, over the tip-conductors, and through the cut-off relays to ground, and thence back to the other pole of the battery. The impedance-coils 20 and 21 prevent short-circuiting the voice-currents. The transposition of the strands of the cord-circuit results in legging one cut-off relay from one side of the through-circuit and the other cut-off relay from the other side of said circuit, by which arrangement a balanced line is secured. The several grounds mentioned may be one and the same or the common office return. Other changes may be made in the invention without departing from its scope or principle.

I claim—

1. In a telephone system, the combination with a telephone-line, of a cut-off relay legged to ground from one side of the line, a ground branch connected from the same side of the line through the normal contacts of said relay, and an artificial resistance between the

connections of said cut-off relay and said branch with the line whereby when a connection is established with said line, said relay is caused to operate, substantially as described.

2. In a telephone system, the combination with a telephone-line, of a cut-off relay therefor, a resistance in the line to cause current to pass through the cut-off relay, and means for cutting out said resistance when the relay operates, substantially as described.

3. In a telephone system, the combination with a telephone-line, a line-relay connected with one side of the line, a cut-off relay connected with the other side of the line, and a supervisory relay connected in parallel with said line-relay when a connection is established, substantially as described.

4. In a telephone system, the combination with a telephone-line having two limbs extending continuously through to the contacts of the spring-jacks upon the switchboard at the central office, a line-signaling device and a source of current connected with the line at the central office, a cut-off relay for the line permanently connected therewith, a shunt of said cut-off relay for current in the line from said source when the subscriber is calling the central office, said shunt being controlled by the relay itself, and means for operating said relay by current over a portion of the talking-circuit when a connection is established with the line for conversation to open said shunt and to render the line-signal inoperative, substantially as described.

5. In a telephone system, the combination with a telephone-line, of a line-signaling device and a battery normally connected with the line, a cut-off relay to render the line-signal inoperative during connections, a shunt of said cut-off relay maintained only through its own normal contacts, whereby said relay is out of the path of current in the line from said source when the subscriber is calling the central office, a cord-circuit, and means for including said source in the metallic line to furnish current to the substation for talking when a connection is established by said circuit with the line, said cut-off relay being in the path of the latter current and adapted to be operated thereby during conversation, whereby no current is wasted for the operation of said relay, substantially as described.

6. In a telephone system, the combination with a telephone-line, of a central source of current, a line-relay adapted to be maintained operated by current in the line whenever the circuit is closed at the substation, a cut-off relay for the line having its coil permanently connected between one limb of the line and one pole of said source, a shunt for said cut-off relay maintained by its own normal contacts, whereby current in the line, after the subscriber has removed his telephone from the hook and before connection has been established with the line, will not pass through the coil of said cut-off relay, means to actuate said cut-off relay when a connection is established with the line and to maintain the actuation by current in the line after the subscriber removes his telephone from the hook, substantially as described.

7. In a telephone system, the combination with a telephone-line, of a cut-off relay associated with said line, a shunt of said cut-off relay maintained by its own normal contacts, a central source of current one pole of which is permanently connected with one limb of said line through the coil of a line-relay, and the other pole of which is permanently connected to the other limb of the line through the coil of said normally shunted cut-off relay, means for actuating said cut-off relay when a connection is established with the line, and thereafter for maintaining the actuation thereof by current in the line, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 10th day of December, 1902.

HARRY G. WEBSTER.

Witnesses:

ROBERT LEWIS AMES,

GAZELLA BEDER.