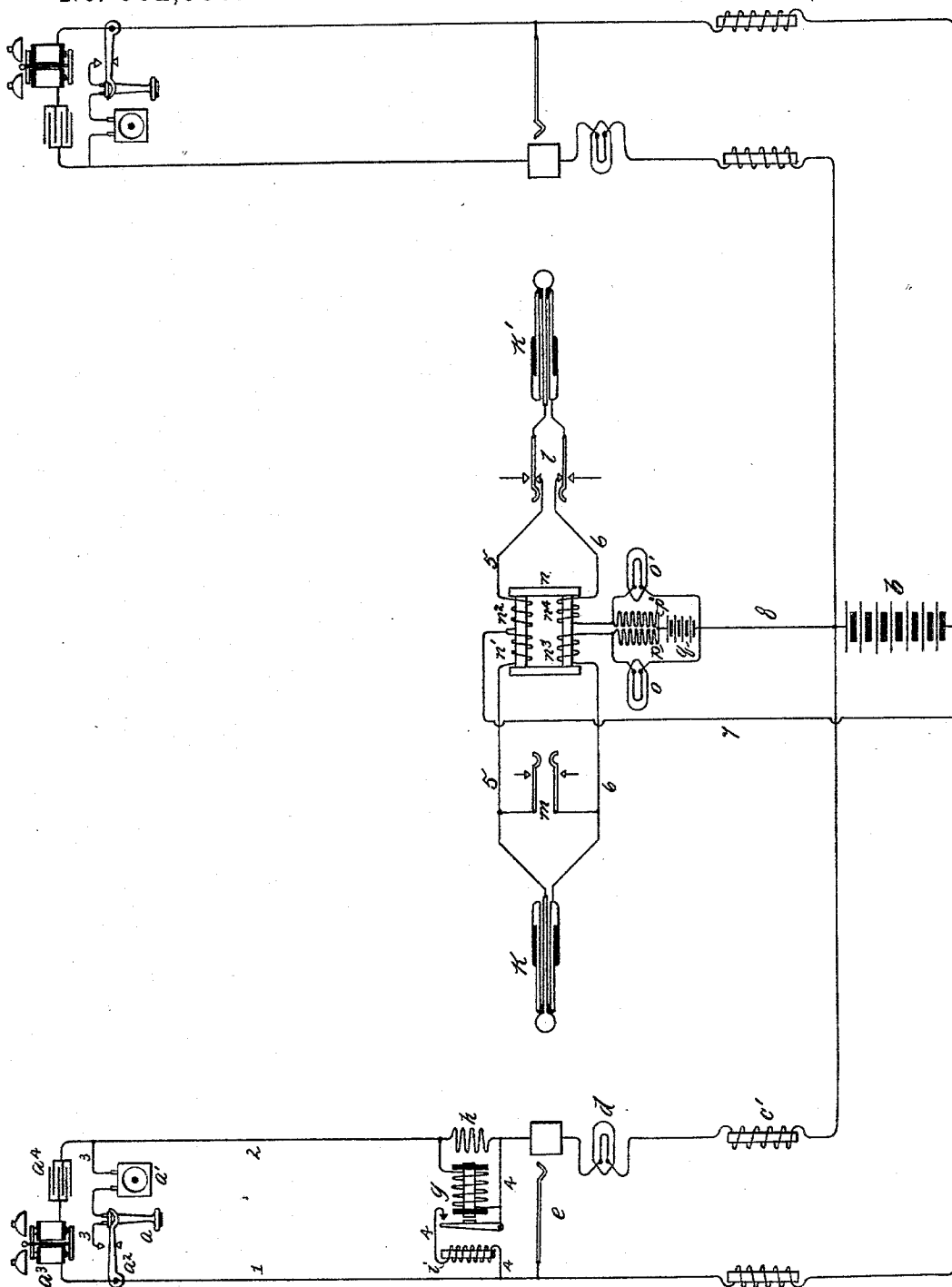


(No Model.)

F. R. McBERTY.
SIGNALING APPARATUS FOR TELEPHONE LINES.

No. 562,906.

Patented June 30, 1896.



Witnesses:
J. W. E. Tamm
John H. Sinclair

Inventor:
Frank R. McBerty,
By Barton & Brown
Attorneys.

UNITED STATES PATENT OFFICE.

FRANK R. McBERTY, OF DOWNER'S GROVE, ILLINOIS, ASSIGNOR TO THE
WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

SIGNALING APPARATUS FOR TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 562,906, dated June 30, 1896.

Application filed October 29, 1895. Serial No. 567,240. (No model.)

To all whom it may concern:

Be it known that I, FRANK R. McBERTY, a citizen of the United States, residing at Downer's Grove, in the county of Du Page and State of Illinois, have invented a certain new and useful Improvement in Signaling Apparatus for Telephone-Lines, (Case No. 31,) 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 concerns signaling systems for telephone-lines in which annunciators or responsive instruments included in the line are operated by current derived from a source located at the central station. It applies particularly to lines of such high resistance as to prevent the flow of sufficient current through the line for the proper excitement of the signaling instruments, its purpose being to provide an additional or subsidiary path controlled by the current to the substation, for permitting the normal signal-exciting current to flow.

In certain arrangements of telephone-lines, small incandescent lamps are interposed in the line-circuits to act as signals, being illuminated by current from a central source flowing through the lines to the substations while the telephones there are in use. This constitutes a satisfactory and effective mode of signaling, but its use in this simple form is limited to comparatively short lines of low resistance, since the provision of a source of current of sufficiently high electromotive force to light the lamps in long lines is prohibited by various practical considerations. Nevertheless, the proportion of long and high resistance lines in an exchange of ordinary character is so small that this system of signaling may be economically applied in the exchange, provided that some subsidiary or auxiliary contrivance be furnished to permit the operation of the lamps or other similar signals in the long lines. It is to this phase of the problem that the present invention is addressed.

This invention aims, as before mentioned, to provide a subsidiary path for the necessary

exciting-current for the lamps, controlled by the current in the line to the substation as determined by the use of the telephone there.

It consists in the connection with the line of a relay responding to currents in the line to the substation, and a local branch or return circuit of the line, of moderate resistance, controlled by the relay; the other circuits remaining undisturbed, so that merely the addition to the line of the relay and the subsidiary circuit which it controls, in proper relation to the other apparatus, is required to permit the operation of lines of great resistance in a similar manner to that of lines of low resistance.

I prefer to interpose the magnet of this relay directly in the line-circuit, the magnet being shunted or practically short-circuited as to telephonic currents by a non-inductive resistance-coil; and to provide a local branch or return circuit for the line, having a resistance about equal to that of a short telephone-line, including the switch-contacts of the relay.

In the signaling system before alluded to, the line-signal, displayed in the act of bringing the station-telephone into use, is rendered inoperative when connection is made with the line in compliance with the call-signal, a "supervisory" or "clearing-out" signal being temporarily substituted for it adapted to light in response to the cessation of the current in the line, that is, in response to the return of the station-telephone to its position of disuse. This supervisory signal also is of course subject in its use to the same restrictions as to line-resistance as the line-signals. The present invention permits the operation of these signals also, independently of the resistance of the line-circuit.

The invention is illustrated in the drawing herewith in combination with a signaling system of the type alluded to. The figure is a diagram of two line-circuits terminating in a telephone-switchboard furnished with line and supervisory signals and with switching appliances, one of the lines, assumed to be of high resistance, being equipped with the invention.

At the substation are placed a receiving-telephone a and a transmitting-telephone a' , a telephone-switch a^2 , a signal-bell a^3 , and a condenser a^4 . The bell and condenser are included permanently in the line-circuit 1 2, but the condenser obviously interrupts the line, so as to prevent the flow of continuous currents. The switch a^2 controls the continuity of a bridge 3 of the line including the telephones.

At the central station the line conductors are extended to the poles of a source b of current, which may be common to the different lines of the exchange, impedance-coils c and c' being interposed in the lines near the battery b to prevent the shunting of telephonic currents through the battery.

A signal-lamp d is included in the line conductor 2, and located adjacent to the lamp is a spring-jack or connection terminal e connected as usual with the line conductors. The mode of operating these lamp-signals will be obvious. The removal of the receiving-telephone from its switch at a substation will, if the line be of low resistance, permit sufficient current to flow from battery b through the line-circuit to illuminate the signal-lamp and thus to indicate the call.

It may be assumed that line to station B is such a line of low resistance, but that line to station A is of such high resistance as to prevent the direct working of the signals in this way. The invention is therefore applied to line to station A. This consists in a relay g , having its magnet interposed in line conductor 2, or, preferably, in shunt of a non-inductive resistance-coil h directly in the line, and a bridge or "return-circuit" 4 between line conductors 1 and 2, controlled by the relay. This bridge includes a resistance or impedance coil i , whose function is to prevent the short-circuiting of currents in the line.

The usual connecting-plugs k and k' are furnished for uniting lines, connected by a plug-circuit 5 6. The conductors of the plug-circuit extend through the switch-contacts of the usual calling-key l , and to the contacts of a listening-key m for connecting a telephone with the plug-circuit. The conductors include also the helices of a transformer n , wire 5 extending through helices n' and n^2 , and wire 6 through helices n^3 and n^4 . The helices n^3 and n^4 are united through supervisory lamps o and o' , which are associated with the corresponding plugs k and k' . In shunt of lamps o and o' are two local circuits containing non-inductive resistances p and p' , and leading to a battery q . The united terminals of helices n' and n^2 are connected through wire 7 with one pole of battery b , and the point of junction of lamps o and o' are connected through a wire 8 with the other pole of the same battery.

While no part of the apparatus is in use the line-lamps d are inert, the bridges 3 and

4 of the line-circuits being interrupted, the former at the telephone-switch and the latter at the relay, in line to station A. The supervisory signals o and o' are, however, lighted by current from battery q through the two local circuits, including the resistance-coils.

If the receiving-telephone be removed from its support at the station A, a current will be set up by battery b in the line-circuit 1 3 2, too feeble to illuminate lamp d but sufficient to excite the relay g . The branch or return circuit 4 is thereby closed, whereby the current in the circuit from battery b through wires 1 4 2 is increased sufficiently to light the lamp and give the signal.

The insertion of plug k into spring-jack e brings portions of the conductors 5 and 6, including coils n' and n^3 of the transformer, into shunt of the portions of lines 1 and 2 leading to battery b , and, by diverting the current from these shunted conductors, brings about the extinguishment of line-lamp d . At the same time the current from battery b , through wire 8, helix n^3 of the induction-coil, conductor 6 of the plug-circuit, line-wire 2, and the return-circuit produces or tends to produce a condition of no potential difference between the terminals of lamp o , so that this lamp also is extinguished. The lamps remain in this condition until the line-circuit is again interrupted at the substation by the replacement of the telephone on its switch. Then the relay g permits its switch-contacts to interrupt the bridge 4. The null condition at the terminals of lamp o being thus disturbed, this lamp becomes lighted and gives its signal.

I do not deem it necessary to describe the operation of the signals of line to station B, nor the process of actually making connection between the lines, since these will be obvious from the foregoing description.

I define my invention as follows:

1. The combination with a telephone-line having a switch at its substation controlling the continuity of the line, and a signaling instrument and source of current in the line, of a subsidiary bridge or return circuit of the line between the signaling instrument and the substation, and means for controlling the continuity of the bridge from the substation, as described.

2. The combination with a telephone-line including a switch at a substation and a signal-lamp and source of current at a central station, of a subsidiary bridge or branch of the line adapted to form a local circuit for the lamp and source of current, and a relay connected with the line controlling the said bridge, as described.

3. The combination with a telephone-line having a switch in the line at the substation and a signal-lamp and a source of current in the line at the central station, of a relay in the line and a bridge of the line in-

cluding an impedance-coil controlled thereby,
as described.

4. The combination with a telephone-line
of high resistance containing a source of cur-
rent and connected with signal-lamps requir-
5 ing for their operation current greater than
the said source of current is able to produce
in the line, of a subsidiary return-circuit of
lower resistance and a relay controlled from

the substation controlling the said subsidiary 10
circuit, as described.

In witness whereof I hereunto subscribe my
name this 14th day of September, A. D. 1895.

FRANK R. McBERTY.

Witnesses:

ELLA EDLER,
LUCILE RUSSELL.