

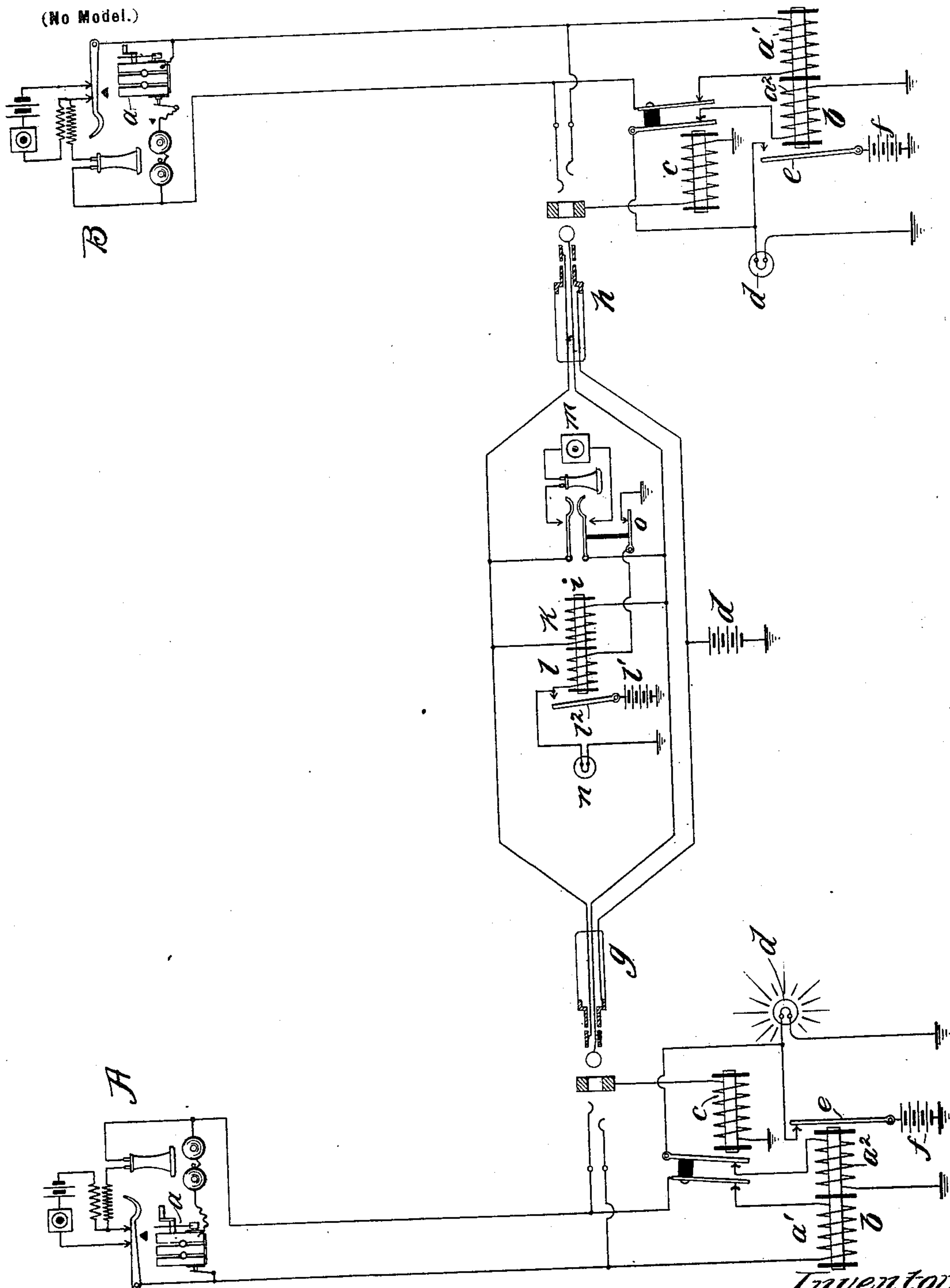
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Patented Oct. 16, 1900.

J. L. McQUARRIE.  
TELEPHONE EXCHANGE SYSTEM.

(Application filed Nov. 10, 1898.)

(No Model.)



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# UNITED STATES PATENT OFFICE.

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## TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 659,759, dated October 16, 1900.

Application filed November 10, 1898. Serial No. 696,029. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES L. McQUARRIE, 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-Exchange Systems, (Case No. 6,) of which the following is a full, clear, concise, and exact description.

My invention relates to telephone-exchange systems, and has for its object the provision of improved signaling apparatus for indicating the condition of use of the subscribers' lines, the invention consisting in a novel arrangement of circuits and apparatus for governing the condition of use of line and clearing-out signals.

My invention is particularly designed for use in connection with those telephone-exchange systems having magneto-generators at the subscribers' stations, the prime object of the invention being to adapt relay signaling apparatus now commonly employed for use in connection with established telephone-lines having magneto calling-generators at the subscribers' stations. The most highly-perfected relay-switchboards employ signal-lamps associated with the telephone-lines and cord-circuits, these lamps being automatically controlled by relay switching apparatus. Centralized batteries are commonly employed for supplying current to the various telephone instruments, including the aforesaid relay switching apparatus, circuit including the battery being closed through a relay upon the removal of a telephone at a calling subscriber's station to cause a lamp corresponding to the calling-line to glow. The telephone-switches at the subscribers' stations, also through the agency of the centralized battery, control the clearing-out lamps included in the cord-circuits. The switching apparatus at the central exchange serves automatically to restore the normal or idle condition of the signal-lamps and relay mechanism, the operator being thereby relieved of giving manual attention to the different visual-signal appliances. In adapting the relay-switchboards for use in connection with telephone-lines having magneto calling-generators great difficulty has been experienced in so arranging the relay mechanism that the lamps,

which are necessarily delicate, would not be prematurely destroyed. It has been heretofore proposed to provide a line-relay having two helices upon a common core, one, the main-line coil of high resistance, in circuit with the telephone-line through which current from the magneto-generator could be passed to energize the core, while the second helix was included in series with the signal-lamp, a pair of normally-separated relay-contacts, and a battery, the armature of the relay serving to close the local circuit at said relay-contacts upon the energization of the core. This arrangement is objectionable for the reason that upon the closure of said local circuit current would be induced from the main-line coil into the local circuit, whereby the lamp would be subjected to a current of highly-excessive voltage, the lamp being thereby quickly burned out.

My invention consists in a signaling appliance having two parallel circuits, in one of which a helix of a relay is included, while in the other a signal, preferably a glow-lamp, is included, a switch controlled by the relay being employed to open and close both parallel circuits, a suitable source of current being associated with the relay-switch for this purpose. The cord-circuit is also associated with a signal appliance having generally the characteristics of the line-signal apparatus.

The appliance of my invention is adapted particularly for use in connection with telephone-lines having magneto-generators at the substations, in which case the relay is provided with a second line-helix. I do not wish, however, to be limited to the particular use to which I have put the invention nor to the precise form of visual signal employed.

I will explain my invention more particularly by reference to the accompanying drawing, which illustrates, with the aid of conventional symbols, two subscribers' telephone-lines terminating at the central office in the usual spring-jacks and an operator's cord-circuit for connecting them in conversation, the arrangement of the circuits being an embodiment of my invention.

Two telephone-lines, each having a magneto-generator and other telephonic apparatus, as illustrated, are shown, each telephone-



line being included in series with a line-helix  $a'$ , surrounding the core of a relay  $b$ . The core of each relay  $b$  is also surrounded by a retaining-coil  $a^2$ , included in a local circuit.

5 A cut-off relay  $c$  is provided for opening the circuits, including the helices  $a'$   $a^2$ . Two pairs of serial contacts are controlled by the relay  $c$ , a pair being included in circuit with each of the coils  $a'$   $a^2$ . Upon establishing

10 connection between subscribers a grounded battery  $d$  is included in circuit with the relay  $c$ , whereby the serial contacts controlled thereby are separated. The individual indicator associated with each line, in this in-

15 stance a signal-lamp  $d$ , is connected in parallel with the coil  $a^2$ . A relay-switch  $e$  is governed by the relay  $b$  and serves when the relay is energized to include the battery  $f$  in circuit with the coil  $a^2$  and lamp  $d$ . The

20 cord-circuit or line-connecting apparatus is provided with an answering-plug  $g$  and connecting-plug  $h$ , each having three contacts adapted to engage corresponding contacts of the line-jacks, the similar contacts of each

25 plug being electrically connected, as shown, by cord conductors.

A relay  $i$  is provided with a coil  $k$  of high retardation, included in a bridge between the tip and sleeve strands of the cord-circuit, a

30 retaining-coil  $l$  being included in a normally-open circuit with a battery  $l'$ , the telephone-key serving to interrupt the local circuit when operated to bridge the operator's telephone in circuit. In parallel with the helix

35  $l$  I provide an indicating-lamp  $n$ , through which current from battery  $l'$  finds passage when the relay-switch  $l^2$  is attracted. It will be observed that the relay-switches  $e$  and  $l^2$ , together with the batteries associated there-

40 with, form parts of conductors common to the parallel circuits including the retaining-coils and visual indicators.

The operation of the system may be generally described as follows: Subscriber A, de-

45 siring communication with subscriber B, rotates the crank of his generator  $a$ , thereby energizing the core of the relay  $b$ , whereupon the relay-switch  $e$  is operated to close circuit through the coil  $a^2$  and the lamp  $d$ . The bat-

50 tery  $f$  being of small resistance, the induced alternating current will find the easiest path through the circuit including the coil  $a^2$ , switch  $e$ , and battery  $f$  to the exclusion of the lamp  $d$ , which is preferably a four-volt

55 lamp of twenty ohms resistance, so that the lamp will not be injured upon the continued operation of the magneto-generator at the calling subscriber's station. The operator in response to the signal inserts the answer-

60 ing-plug within the jack of the calling subscriber, thereby operating the relay  $c$ , which serves to interrupt the circuit including the coils  $a'$   $a^2$ , whereby the switch  $e$  is released and the circuit through the lamp  $d$  and coil

65  $a^2$  interrupted. A similar interruption of the circuits including the helices of the relay  $b$ , associated with the called subscriber's line,

takes place when the connecting-plug is inserted within the spring-jack of said line to prevent the operation of his line-indicator 70 when he rings off. When either subscriber rings off, alternating current finds passage through the helix  $k$ , whereupon the switch  $l^2$  is operated to include the battery  $l'$  in circuit with the helix  $l$  and signal  $n$ . The operator 75 in order to ascertain the nature of the signal actuates her listening-in key. A key  $o$ , mechanically connected with the listening-key, is actuated upon the operation of the listen-

80 ing-key to open the circuit including the retaining-helix  $l$ , whereupon the switch  $l^2$  is released and the circuits through lamp  $n$  and helix  $l$  are opened.

While I have herein shown and particularly described the preferred embodiment of 85 my invention, I do not wish to be limited to the precise system and apparatus shown.

Having described my invention, what I claim as new, and desire to secure by Letters 90 Patent, is—

1. The combination with a telephone-line extending from a subscriber's station to a central office, of a relay device at the central office having two windings, means at the subscriber's station for determining the flow of 95 current through one of the said windings, a local circuit having two branches in parallel with one another, each of said branches being controlled by the relay-switch, one of the branches being connected with the other winding of said relay device, an indicator 100 connected with the other branch, and a source of current, substantially as described.

2. In a telephone-exchange system, the combination with a telephone-line extending 105 from a subscriber's station to a central office, of a relay device at the central station having a helix included in a circuit controllable by apparatus at the subscriber's station, a local circuit including a second helix of the relay device controlled by the relay-switch, a visual indicator in parallel with said local circuit, and a source of current, said source 110 of current and the relay-switch forming parts of a conductor common to both of said parallel circuits, substantially as described. 115

3. In a telephone-exchange system, the combination with a relay associated with a telephone-line at the exchange and having a retaining-helix included in a circuit, of a 120 visual indicator connected in parallel with said circuit, a source of current, a relay-switch adapted to open and close the parallel circuits including the said helix and visual indicator, said relay-switch and source of current forming parts of a conductor common to 125 both of said parallel circuits, means controlled at a subscriber's station for energizing the core of said helix to operate said relay-switch to close circuit through the helix and visual indicator, a cut-off relay controlling contacts 130 included in series with said helix, and line-connecting apparatus adapted to operate said cut-off relay to open circuit through the re-



retaining-helix of the first aforesaid relay to release the switch controlled thereby and thereby open the circuit including the visual indicator, substantially as described.

5 4. In a telephone-exchange system, the combination with a relay associated with a telephone-line at the exchange and having a retaining-helix included in a circuit, of a  
10 said circuit, a source of current, a relay-switch adapted to open and close the parallel circuits including the said helix and visual indicator, said relay-switch and source of current forming parts of a conductor common to  
15 both of said parallel circuits, a second helix upon said relay in circuit with the telephone-line, a magneto-generator at the substation of said line adapted when being operated to send current through said second helix, a cut-  
20 off relay controlling contacts included in series with said retaining-helix, and line-connecting apparatus adapted to operate said cut-off relay to open circuit through the retaining-helix of the first aforesaid relay to re-  
25 lease the switch controlled thereby and thereby open the circuit including the visual indicator, substantially as described.

5. In a telephone-exchange system, the combination with a relay associated with a  
30 telephone-line at the exchange and having a retaining-helix included in a circuit, of a visual indicator connected in parallel with said circuit, a source of current, a relay-switch forming a part of said relay adapted  
35 to open and close the parallel circuits includ-

ing the said helix and visual indicator, said relay-switch and source of current forming parts of a conductor common to both of said parallel circuits, a second helix upon said relay in circuit with the telephone-line, a mag- 40  
neto-generator at the substation of said line adapted when being operated to send current through said second helix, and means controlled by the line-connecting apparatus for opening the circuit including the retaining- 45  
helix, substantially as described.

6. In a telephone-exchange system, the combination with two telephone-lines united for conversation at the central office, of a relay having a retaining-helix associated with 50  
the united telephone-lines, a second helix also provided upon the core of the relay and connected with the united telephone-lines, a magneto-generator at a subscriber's station for directing current through the latter helix to 55  
energize the relay, a visual signal, a switch controlled by said relay for connecting the visual signal and the retaining-helix in parallel circuits with a source of current, said  
switch and source of current forming parts 60  
of a conductor common to said parallel circuits, and means controlled by the operator for opening the circuit including the retaining-helix, substantially as described.

In witness whereof I hereunto subscribe my 65  
name this 25th day of July, A. D. 1898.

JAMES L. MCQUARRIE.

Witnesses:

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WINFIELD W. W. LEACH.