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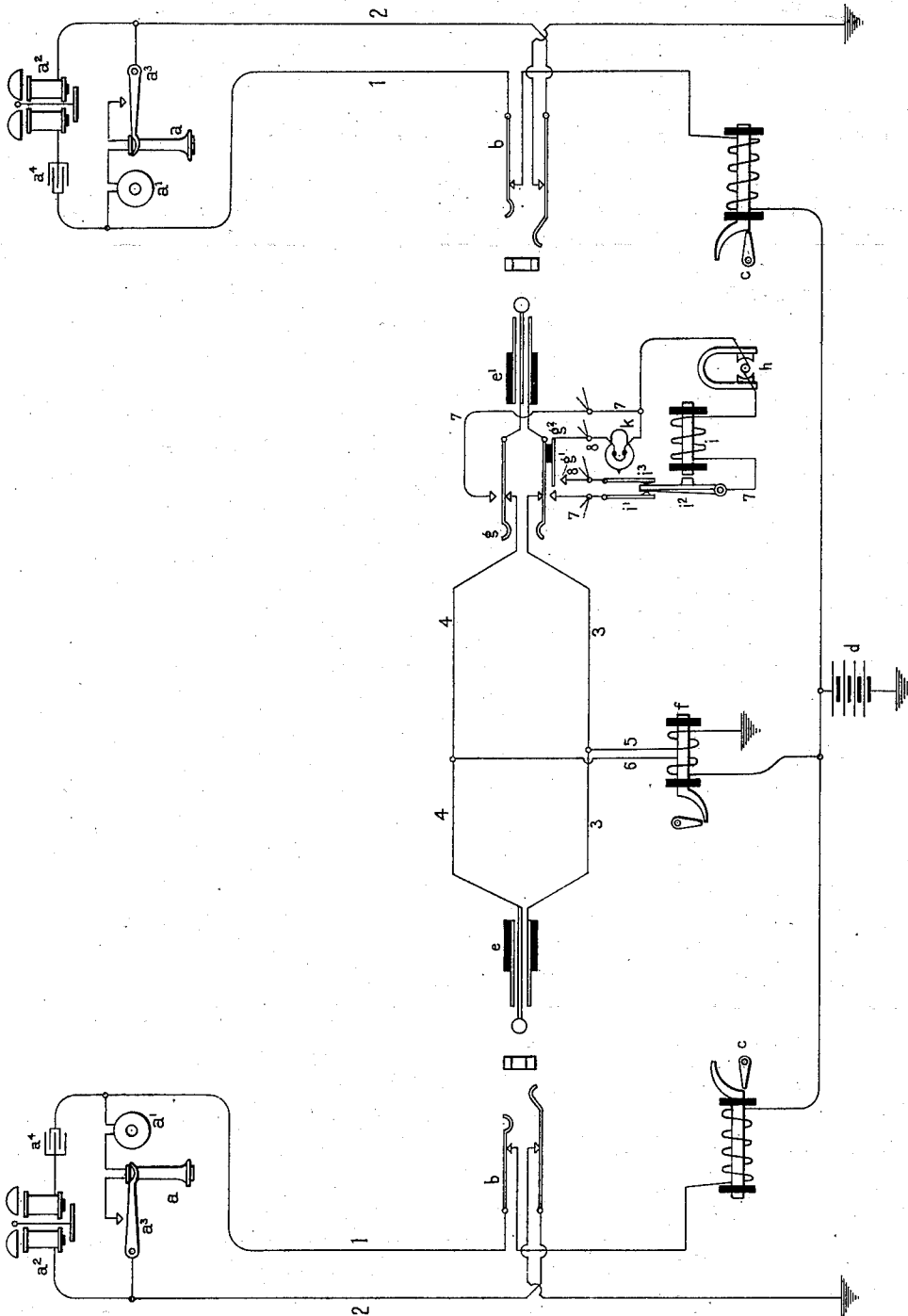
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SIGNAL APPLIANCE FOR TELEPHONE SWITCHBOARDS.

(Application filed Nov. 22, 1897.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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SIGNAL APPLIANCE FOR TELEPHONE-SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 654,749, dated July 31, 1900.

Application filed November 22, 1897. Serial No. 659,493. (No model.)

To all whom it may concern:

Be it known that we, FRANK R. MCBERTY, residing at Downer's Grove, in the county of Du Page, and JAMES L. MCQUARRIE, residing at Chicago, in the county of Cook, State of Illinois, citizens of the United States, have invented a certain new and useful Improvement in Calling and Signaling Appliances for Telephone-Switchboards, (Case No. 56-4,) 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.

This invention concerns the calling apparatus for an operator in a telephone-switchboard and means for permitting her to supervise established connections.

This object of the invention is to facilitate the operator's work of transmitting calls to subscribers' stations and of determining the subscriber's response to such calls and to employ therefor apparatus cheaper and more simple than has heretofore been provided.

In a certain type of switchboard used with lines provided with means for producing current in the lines during the use of the telephones supervisory signals have been associated with each plug-circuit or link conductor for uniting lines, responsive to current in the lines, and designed to indicate to the attendant in charge of them the condition of use or disuse of the substation appliances. The signal associated with the calling plug, which is used in making connection with the line called for, serves primarily to show the operator when the subscriber at the station called has responded to the signal, and failure to respond promptly calling for a second signal. The present invention aims to dispense with the supervisory signals associated with each pair of plugs and to use in place of them a single clearing-out signal for each plug-circuit, together with a general supervisory signal for an operator's entire equipment of plug-circuits, a key for bringing this signal and the calling generator simultaneously into connection with any desired calling plug, and means for preventing the transmission of the call-signal in the event of the subscriber having responded to the first call.

In operating this mechanism it is designed that the attendant, having established connection with several lines, shall depress the key associated with each of the calling plugs after a short interval from the completion of the connection, whereupon if the subscriber has not responded to the call first sent a second calling current will be transmitted to the substation, or if he has responded the generator of calling current will be automatically disconnected from the calling plug and the general supervisory signal will indicate the fact of his response to the operator.

To this end the invention consists in the combination, with several calling plugs and their respective plug-circuits, of a calling key for each plug, a generator of calling current, a relay, and a general supervisory signal, any calling key being adapted to connect the generator of current and the relay with a called line with which the corresponding plug is connected, the relay being adapted to respond to current of special character through the line determined by the position of use of the subscriber's telephone and serving in its response to disconnect the generator of calling current from the calling plug and to cause the display of the general supervisory signal. Either of the two functions of the relay before mentioned may be solely employed—that is, the relay may serve merely to control a general supervisory signal to show the operator, upon the depression of a special key, that the called subscriber has responded, or it may serve only to disconnect the calling generator in the event of the subscriber's response; but inasmuch as the complete appliance as generally described is of much more efficient assistance to the operator than the relay would be used in but one of its functions we prefer to describe the complete mechanism.

The invention is illustrated in the attached drawing, which represents two substations connected by telephone-lines with a switchboard in the central office, together with a pair of connecting-plugs for uniting lines in the switchboard, the plug-circuit being provided with our improved supervising and calling appliances.

Receiving-telephones *a* and transmitting- 100

telephones a' , call-bells a'' , and telephone-switch a^3 are provided at the substations, the call-bells being in permanently-closed bridges of the line-circuits in which condensers a^4 are interposed and the telephones being in other bridges which are normally open at the contact-points of the telephone-switches. The line conductors 1 and 2 lead from these appliances at each substation to a spring-jack b and thence through an individual signal c to the poles of a battery d in the central office. The spring-jack is adapted to break the connection of the line-signal with the line when a plug is inserted in the jack. A pair of plugs e and e' are shown for uniting lines into a complete circuit by means of the spring-jacks of the lines. Like contact-pieces of the two plugs are united by conductors 3 and 4, which constitute the system of conductors which we designate the "plug-circuit." The plug e is designed to be used in making connection with calling lines, while plug e' is reserved for use in making connection therefrom to a line called for.

It will be understood that a large number of telephone-lines are grouped in the switch-board before each operator and that each operator is furnished with a considerable number of pairs of plugs, with their plug-circuits and associated appliances.

Conductors 5 and 6 lead from wires 3 and 4 of the plug-circuit to the poles of the battery d or other suitable source of current. These conductors include the magnet-windings of a clearing-out signal f . These windings should be characterized by great impedance in order that the shunting of telephonic current through the bridge-circuit formed by wires 5 6 may be prevented. The switch-contacts of a calling key g are interposed in the conductors 3 and 4 of the plug-circuit. The normal resting anvils of the switch-springs of this key form the terminals of the portions of conductors 3 and 4 going to the plug e , so that the separation of the switch-springs from their resting anvils breaks the continuity of the plug-circuit. The alternate contact-anvils of these switch-springs form the terminals of a generator h of calling current. This generator may give an alternating current of usual character as employed for ringing bells of telephone-substations. The magnet-winding of a relay i is included in the circuit 7 of the generator. This relay should be so adjusted that the current finding circuit from the generator over a telephone-line and through the condenser and high-resistance bell at the station thereof will be insufficient to draw up the armature, but that the current through the telephones, which are of comparatively-low resistance, should cause the attraction of the armature. This armature, with its normal resting contact, controls the continuity of the circuit 7, including the calling-generator, being adapted to break the circuit between the generator and the conductor 3 of the plug-

circuit when the armature is drawn toward the magnet, the portion of wire 7 extending to conductor 3 being for this purpose connected with the resting anvil i' of the armature-lever i^2 and the other of the severed terminals of the wire being connected with the armature-lever. The forward contact i^3 of the armature-lever forms the terminal of a wire 8, leading to the wire 7 at a point between the conductor 4 of the plug-circuit and the generator. The continuity of this wire 8 is controlled by auxiliary switch-contacts g' and g^2 , connected with the key g , which become closed together in the use of the key for calling. When the armature i^2 is drawn against this forward contact-piece, there is in effect a local circuit of the generator h made up of portions of wire 7 and the wire 8, including the magnet i , the switch-contacts i^2 i^3 , the switch-contacts g' g^2 of the key, and the general supervisory signal k . The signal k may be an incandescent lamp and should be of such character as to become illuminated with the current flowing in this closed local circuit.

Each plug-circuit of an operator's equipment is to be furnished with a clearing-out signal f and with a calling key g . There is to be but one source of current h , one relay i , and one general supervisory signal k for each group of plug-circuits, however. The normally-open terminals of the wires 7 and 8 will extend to the contact-pieces of the different keys g in multiple, as indicated by the short lines emanating from the wires, in a manner which will be apparent to those versed in the construction of telephone-switchboards. The subscriber at station A, for example, may call for connection with another line by removing his telephone from its switch, whereupon current will flow from battery d through the signal c and the closed circuit at the substation, bringing about the display of the signal, and thus calling the attention of the operator. Complying with the signal, the operator will insert plug e into the spring-jack b of the calling line, at the same time bringing her telephone into connection with the plug-circuit to learn the subscriber's order. Having received his instruction, she will insert plug e' into the spring-jack b of the line called for and will depress the plunger of the calling key g to thrust the switch-springs thereof against the terminals of the generator-circuit, and thus to ring the bell at the station to be signaled. Inasmuch as the circuit at the called station is completed only through the high-resistance bell and the condenser there, the current through relay i will be insufficient to operate that relay and the generator will be permitted to perform its function. Having transmitted a call-signal of momentary duration, the operator may release the key g and attend to other work. After a short interval she should return to the connection thus established and again depress the key g . If the subscriber called for

has not yet responded, the current from generator *h* will flow as in the initial call, being insufficient to work the relay *i*, and the bell at the substation will be rung a second time.

5 If, however, the subscriber has answered the first call and removed his telephone for use, the increased current permitted to flow through relay *i* in virtue of the diminished resistance of the circuit at the substation will
10 excite the relay and draw its armature forward. The movement of this armature will break the circuit 7 to the plug-circuit between the contact-pieces *i'* and *i''*, and thus will instantly cut off the calling current, so
15 as to avoid annoying the subscriber. In its further movement it will close upon contact-piece *i'''*, completing the local circuit, including the generator, the magnet, and the general supervisory signal *k*, whereby the operator will be informed as to the condition, of
20 the apparatus at the called station. On noting the indication of this signal she will release the key *g* and give no further attention to the united lines.

25 In practice it is found that an operator has ample leisure for manipulating keys while attending to calls by means of her telephone. Hence in the employment of the apparatus herein described she may easily depress the
30 key *g* of a plug recently inserted in a line, whereby a tardy subscriber will be signaled a second time or the prompt response of the subscriber will be indicated. Thus a supervision which is substantially identical in character with that furnished by special supervisory signals, one for each plug-circuit, is provided by our improved mechanism with
35 great economy of apparatus.

Various changes in the arrangement of parts
40 and the nature of the instruments employed may be made without departing from the spirit of our invention.

The invention is defined in the following claims.

45 We claim--

1. The combination with telephone-lines and plugs and plug-circuits for making connection therewith, each telephone-line being provided with a switch at its station for changing
50 the resistance of the line-circuit in the use of the telephone, of a key in each plug-circuit, a general supervisory signal and a source of current, each key being adapted to connect the general signal and source of current temporarily with the corresponding plug-circuit to determine the condition of use or
55 disuse of the substation instruments, as described.

2. The combination with telephone-lines,
60 each provided at its station with a switch for changing the resistance of the line in response to a call-signal, of calling plugs and plug-circuits therefor for making connection with the line, a supervisory signal and a
65 source of current, a key in the plug-circuit and circuit connections of the key and su-

pervisory signal, whereby the signal and the source of current may be temporarily connected with a plug-circuit to determine the condition of the appliances at the substation, 70 as described.

3. The combination with telephone-lines, each provided at its station with means for changing the resistance of the line in response to a call, of several calling plugs and
75 plug-circuits therefor, a general supervisory signal and a source of current, a key in each plug-circuit and circuit connections therefor, said key being adapted to break the connection of the plug with the other appliances of
80 the plug-circuit and to complete it with the said general supervisory signal and source of current, as described.

4. The combination with telephone-lines, each provided at its station with a telephone-
85 switch adapted to change the resistance of the line in the use of the telephone, pairs of plugs and plug-circuits therefor, a source of current and a clearing-out signal connected with each pair of plugs, a general supervisory signal for the group of plugs, and a key in each
90 plug-circuit, each key being adapted to break the connection between the plugs and to connect one of them in circuit with the said general supervisory signal, whereby an operator
95 may determine the condition of use or disuse of the telephone at a substation, as described.

5. The combination with telephone-lines, each provided at its substation with a call-
100 bell in a closed bridge of high resistance, a bridge of low resistance, and a switch for closing the bridge of low resistance, of plugs and their plug-circuits for making connection with the lines, a single generator of calling
105 current for the group of plugs, an electromagnetic switch for the group of plugs, a key for each plug in the plug-circuit thereof adapted to connect the generator of signaling-current and the magnet of the electromag-
110 netic switch with the corresponding plug, the electromagnetic switch being adapted to respond to current produced in the line when the said low-resistance bridge thereof is closed, the switch-contacts of the switch being in-
115 terposed in the circuit of the generator to break the circuit when the magnet so responds, as described.

6. The combination with telephone-lines, each provided at its station with a signal-re-
120 ceiving instrument and a switch adapted to change the circuits of the line in response to a call, of plugs and plug-circuits therefor to make connection with the lines, a generator of signaling-current and an electromagnetic
125 switch for the group of plugs, a key for each plug in the plug-circuit thereof adapted to connect the source of signaling-current and the magnet of said switch with the corresponding plug, the switch being adapted to operate
130 by current in the line produced through the agency of said circuit connections as changed

by the switch, said switch controlling the application of current of the generator to the line, as described.

7. The combination with telephone-lines,
5 each provided at its substation with a call-bell and a switch for changing the circuit connections of the line in response to a call, of plugs and plug-circuits for making connection with the lines, a source of calling current,
10 an electromagnetic switch, and a general supervisory signal, a key associated with each plug adapted to connect the electromagnetic switch, together with a source of current, to the line, said electromagnetic switch being
15 adapted to respond to current determined by the condition of the line-circuit at the substation as changed by said switch, said switch being adapted to connect the generator of calling current with the line in one position
20 and to cause the display of the supervisory signal in its other position; whereby the depression of a calling key will result in the transmission of a call-signal, or in the display of said supervisory signal, according to the
25 position of the said switch at the substation, as described.

8. The combination with telephone-lines, each provided at its substation with a call-bell in a closed bridge of the line of high resistance, a bridge of the line of low resistance, 30 and a switch for closing the said last-mentioned bridge in response to a call, of plugs and plug-circuits for making connection with the lines, a source of calling current and a relay, and a calling key for each plug, the 35 calling key being adapted to connect the source of current and the relay with a line, the relay being responsive to current through the low-resistance bridge at the station of the line and having its switch-contacts interposed 40 in the calling circuit to interrupt the calling current in its response, and a general supervisory signal controlled by the relay, substantially as described.

In witness whereof we hereunto subscribe 45 our names this 29th day of September, A. D. 1897.

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Witnesses:

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