

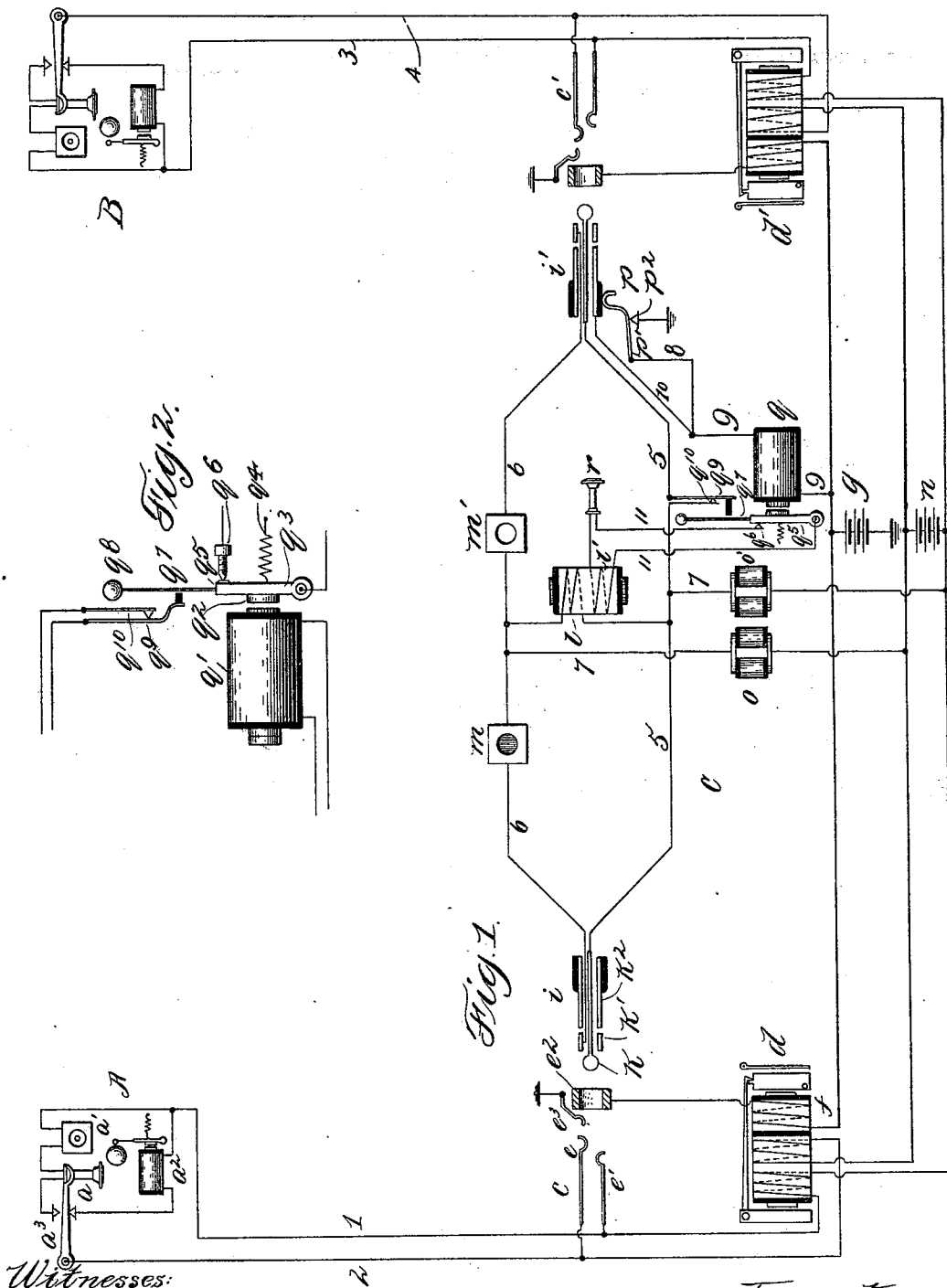
(No Model.)

F. R. McBERTY.

AUTOMATIC SIGNALING DEVICE FOR TELEPHONE SWITCHBOARDS.

No. 544,370.

Patented Aug. 13, 1895.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC SIGNALING DEVICE FOR TELEPHONE-SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 544,370, dated August 13, 1895.

Application filed December 28, 1894. Serial No. 532,910. (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 Automatic Signaling Devices for Telephone-Switchboards, (Case No. 22,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to connecting and signaling appliances for telephone-switchboards, its object being to provide apparatus for automatically controlling the connection to the operator's telephone with the plug-circuits of the switchboard and transmitting call-signals to lines with which connection is made by means of the plugs. As is well known in the art of telephony, each telephone-line of an exchange system of the type generally in use terminates in a spring-jack or connection-socket upon the telephone-switchboard, and the switchboard is furnished with a number of plugs constructed to fit the spring-jacks and electrically connected in pairs. The uniting of two telephone-lines for conversation between their sub-stations is effected by inserting the two members of a pair of plugs into the two terminal spring-jacks of the lines to be connected. In addition to these simple appliances, switching apparatus is provided for connecting the attendant's telephone with any plug-circuit, and also for connecting a source of signaling current with the plug which is designed to be used in completing the connection with the line called for. These switch-keys have in practice been adapted for manual operation, and their manipulation has constituted a considerable part of the operator's work in establishing connection between lines.

In my invention I equip each sub-station with a bell of the single-stroke type, and I provide at the central station, in circuit with each pair of connecting-plugs on the switchboard, a relay or electromagnetic switch which is automatically operated in the act of inserting the connecting-plug into a spring-jack and acts to produce in the line a limited number of periodic pulsations of current. Each

pulsation of current in the line-circuit obviously causes the sub-station bell to strike a single stroke on its gong. Hence the act of making connection with a line automatically causes the ringing of the sub-station bell during a limited time.

It has heretofore been proposed to provide a relay for each pair of plugs for controlling the connection of the operator's telephone with the corresponding plug-circuit, the relay being itself controlled by circuit connections completed in inserting the corresponding plug into a spring-jack. I find that a single relay can be advantageously employed to perform both functions of disconnecting the operator's telephone and transmitting the signaling-current to the line with which connection has been made. For this purpose a single armature of an electromagnet is permitted to control both the switch-contacts in the circuit with the operator's telephone and the switch-contacts which produce the pulsations of current in the line-circuit for the purpose of ringing.

It is common in telephone-exchange systems to provide a battery or other source of continuous current in circuit with each pair of connecting-plugs, the circuits being so arranged that the battery creates a current in the lines with which the plugs are connected, which current is variously employed as a source of supply for the sub-station microphones and for operating signaling-instruments to indicate at the switchboard the condition or position of the apparatus at the sub-stations. In applying my invention I may make use of a battery so connected with the plug-circuits to operate the sub-station bells, in which case I construct the relay to interrupt the plug-circuit periodically a limited number of times. Hence a suitable form of my invention may be constructed as follows: A source of electric current, as a battery, is connected in a bridge between the two conductors of each plug-circuit, impedance-coils being included in the bridge-circuit to prevent the short-circuiting of the plug-circuit as to telephonic currents. A relay is provided whose armature is adapted to close together a pair of contacts, which determine the connection of the operator's telephone with the

plug-circuit when the relay is unexcited, and which has a weighted vibrating tongue which is adapted while in vibration to actuate switch-contacts in the plug-circuit to interrupt the circuit periodically. The relay is placed in a local circuit which is divided into two branches, one of which is controlled by a plug-seat switch in the normal resting-socket of the plug, the other of which is controlled by co-operating contacts in the plug and the spring-jack into which it is to be inserted. The branch of the local circuit, including the relay, is normally closed through the plug-seat switch, and the relay, being excited, severs the connection of the telephone with the plug-circuit. When the plug is withdrawn from the socket, in order to make connection with the line, the relay becomes demagnetized, the local circuit being then open at the plug-seat switch, and the telephone is connected with the plug-circuit. Finally, when the operator inserts the plug into a spring-jack to complete the connection the relay-magnet is again excited, the path of the current through it being then completed through an auxiliary contact-piece upon the plug and co-operating contact-pieces in the spring-jack. It again disconnects the telephone and at the same time throws the weighted reed or tongue into vibration, and thus causes the periodic interruption of the circuit of the battery through the line with which connection has just been established. The sub-station bell is thus caused to sound until the vibration of the reed has diminished, so that it no longer actuates the switch-contacts in the plug-circuit.

My invention is illustrated in the accompanying drawings, which represent apparatus substantially of the character described in this general description.

In Figure 1 of the drawings two sub-stations A and B are shown, connected by lines with appropriate apparatus of a telephone-switch-board at the central station C. Fig. 2 is a view of the special relay used.

As shown in Fig. 1, the sub-station apparatus may comprise a telephone *a* and microphone *a'*, a single-stroke signal-bell *a²*, and an automatic telephone-switch *a³*, which is adapted to switch the telephonic appliances and the signaling apparatus alternately into connection with the line as the telephone is removed from or replaced upon the switch-hook. The bell *a²* should be of high resistance—say, three thousand ohms. At the central station the lines terminate in spring-jacks *c* and *c'*, respectively, and are connected with line-annunciators *d* and *d'*. A signaling-battery is looped into the circuit of the annunciator, the battery being common to all the lines of the exchange. The spring-jack shown is of the well-known type. It consists of two line springs or contacts *e* and *e'*, a thimble *e²*, and a line-spring *e³* opposite it, the latter two contacts constituting the normally-separated terminals of a local circuit, which includes the restoring or resetting magnet *f* of the line-an-

nunciator, together with a battery *g*. It will be understood that the operator has a number of pairs of connecting-plugs, as usual, but only one pair, with its accessory mechanism for circuit connections, is here shown.

The plugs *i* and *i'* are adapted to be inserted in the spring-jacks *c*, being provided with two line-contacts *k* and *k'* in position to register with the line-contacts *e* and *e'* of the spring-jack when the plug is inserted into it, and with a sleeve *k²*, which makes connection with thimble *e²* and spring *e³*, crossing them together. The line-contacts *k* of the plugs *i i'* are united by conductor 5, and the remaining line-contacts *k' k'* by conductor 6. One helix *l* of a repeating-coil is connected in a permanent bridge between the conductors 5 and 6. The circuit of the operator's telephone is not to be connected directly with the plug-circuit, but is brought into connection with it through the medium of the repeating-coil to bring the operator into telephonic communication with the subscribers whose stations are united by the plug-circuit. Two signals *m* and *m'* are included in conductor 6 of the plug-circuit. A source of current *n* is connected in a bridge-circuit 7 between the conductors of the plug-circuit, two impedance-coils *o* and *o'* being included in the circuit to prevent the passage of telephonic current across it.

A plug-seat switch *p* is provided for the plug *i'*. It consists of a spring *p'*, which is pressed aside by the plug while the latter rests in its socket, and an anvil *p²*, with which the spring makes contact when in this position. The contact-pieces *p' p²* control the continuity of a branch 8 of a local circuit 9, which includes the battery *g* and the magnet of a relay *q*. Another branch 10 of the same local circuit, in parallel with branch 7, terminates in sleeve *k²* of plug *i'*.

The relay *q* is represented in Fig. 2 of the drawings. A magnet *q'* is provided with an armature *q²*, which is carried on a pivoted lever *q³*, the armature being normally withdrawn from its magnet by a retractile spring *q⁴*. The lever *q³* carries a contact-point *q⁵*, which is adapted to come to rest against an anvil *q⁶* when the armature is unattracted. The lever also carries a light flexible tongue or reed *q⁷*, which is weighted by a ball *q⁸* at its upper extremity. Before this reed, in position to be struck by it when it is vibrating with a large amplitude, is a light spring *q⁹*, which normally rests upon a contact-anvil *q¹⁰*. In its position of rest the armature is retracted from magnet *q'* and contact-points *q⁴ q⁶*, and contacts *q⁹ q¹⁰* are closed together. When the magnet becomes excited and draws its armature to it, the momentum of weight *q⁸* sets the reed into vibration. At each forward movement the reed strikes a stud carried by the spring *q⁹* and presses the spring away from its anvil. The energy of the reed is soon expended, however, and the vibration ceases and contact-spring *q⁹* again comes to rest upon its anvil *q¹⁰*. While the armature is in

this position the contact q^5 is also separated from its anvil q^6 .

Referring again to Fig. 1 of the drawings, the contact-points q^5 q^6 of relay q are included in a local circuit 11, containing the operator's telephone r and the remaining helix l' of the repeating-coil. In practice several such repeating-coil helices may be connected in parallel with one another, the connection of each coil with the telephone being controlled by the switch-contacts of its own relay. The other switch-contacts q^9 and q^{10} of the relay are included in conductor 5 of the plug-circuit between plug i' and the connection of battery n with the same conductor.

For the purpose of tracing the process of establishing connection between two sub-stations and the operation of the special apparatus herein shown, assume that subscriber at sub-station A wishes to communicate with subscriber at station B. When the telephone a is removed from the switch-hook a^3 at station A, a path of low resistance is closed between conductors 1 2 of the line-circuit. The battery n now finds circuit through the line-coil of annunciator d , and the current set up through the low-resistance path being sufficient in amount, the annunciator is operated and displays its signal. The attendant at the switchboard perceiving this signal inserts plug i into spring-jack c of the corresponding line. By this act line-conductors 1 and 2 are connected with the corresponding conductors 5 and 6 of the plug-circuit, while at the same time the local circuit, including the restoring-magnet of the annunciator, is closed and the signal of the annunciator is effaced. It will also be noted that the battery n now has circuit through conductors 5 and 6 of the plug-circuit to line to station A and through the low-resistance path formed by the telephone there. The current thus set up through conductor 6 excites the electromagnetic signal m , and the position which it therefore assumes indicates to the operator that the telephone at station A is removed from its switch-hook. It will be understood that the signal m is so adjusted as to the current which is necessary to operate it that it shall not be actuated by the small current which might find circuit through the high-resistance bell at the sub-station. The operator then raises the remaining plug i' of the pair from its resting-socket. The spring p' of the plug-seat switch then separates from its anvil, opening the local circuit through relay q , and thus demagnetizing this instrument. By the release of armature q^3 contacts q^5 q^6 are closed together, and the circuit 11, including the operator's telephone and the helix l' of the repeating-coil, is completed. The operator is thus enabled to communicate with subscriber at station A.

Having received the order for the connection desired, the operator inserts the plug i' into the spring-jack c' of line to station B. The metallic circuit from lines 1 and 2 is thus extended through the plug-circuits 5 6 to con-

ductors 3 and 4 of the corresponding line. By the act of inserting plug i' into this spring-jack the circuit through conductor 10 is completed through the thimble f^2 and spring f^3 of the spring-jack to battery g , whereby the local circuit 9 is again closed and the magnet of the relay is excited. The reed q^7 is thus thrown into vibration, as described with relation to Fig. 2, and the conductor 5 of the plug-circuit is interrupted as long as the vibration of the reed continues. The current which has been set up by battery n through the plug-circuit and the conductors 3 and 4 of line to station B is thus periodically interrupted. At each pulsation of current through it the bell a^3 is caused to strike its gong. It therefore rings as long as the vibration of reed q^7 continues. By the movement of the armature q^3 the circuit 11, including the telephone, is again broken.

When the subscriber at station B has responded to the signal thus transmitted and has removed his telephone from its switch-hook, sufficient current is established in the circuit to excite signal m' , and this indicates to the attendant that the subscriber has responded. When, after the completion of the conversation, both telephones have been replaced upon their switch-hooks, both signals return to their normal condition, and, upon perceiving this, the operator withdraws the plugs from the spring-jacks and returns the apparatus to its normal position.

In accordance with the foregoing description I define my invention in the following claims:

1. The combination with a connecting plug of a telephone switchboard, of a source of electric current, a pair of switch contacts adapted to connect the source of current with the terminal contact piece of the plug and to disconnect it therefrom, mechanism adapted to separate said switch contacts periodically a limited number of times, an electromagnet controlling the mechanism, and means for exciting the electromagnet to operate the mechanism in the act of establishing connection with the line, substantially as described.

2. In combination with a telephone line provided at a substation with a single-stroke signal bell and terminating in a springjack in the telephone switchboard, of a connecting plug adapted to be inserted into the spring-jack, a pair of switch contacts controlling the connection of a source of electric current with the said plug, mechanism adapted to separate the switch contacts periodically a limited number of times, an electromagnet controlling the said mechanism, and circuit connections including the electromagnet adapted to be closed by the insertion of the plug in the springjack, whereby the signal bell at the substation of the corresponding line is caused to ring.

3. The combination with a connecting plug of an electromagnet, a flexible weighted tongue or pendulum carried by the armature

thereof, a switch spring adapted to be struck by said tongue in its vibration and to be separated thereby from its anvil, a normally open local battery circuit including the said magnet and co-operating switch contacts in the connecting plug and the springjack into which it may be inserted to close the local circuit when the plug is inserted into the springjack, and a source of electric current whose connection with the terminal plug is controlled by the switch contacts of the relay, substantially as described.

4. The combination with a pair of connecting plugs of a conductor uniting the plugs, a source of electric current permanently connected with the conductor, an electromagnet and the armature thereof, a pair of contact points adapted to be closed together by the armature when in its unattracted position, a weighted reed or pendulum carried by the armature, a switch spring adapted to be struck by said reed when the same is thrown into vibration by the movement of the armature and to be separated from its normal resting

anvil thereby, the switch spring and its anvil being included in the conductor of the plug circuit, a telephone and a connection therefrom to the said conductor of the plug circuit through the said switch contacts, a local battery circuit including the electromagnet and divided into two parallel branches, a plug-seat-switch operated by one of said plugs controlling one of said branches of the local circuit, and registering contact pieces in the said plug and in the springjack adapted to receive it controlling the other of said parallel branches of the local circuit, whereby the telephone is disconnected and the current in the plug circuit is interrupted to sound the substation bell when one of the connecting plugs is inserted into the springjack of a telephone line.

In witness whereof I hereunto subscribe my name this 20th day of November, A. D. 1894.

FRANK R. MCBERTY.

Witnesses:

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