

UNITED STATES PATENT OFFICE.

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TELEPHONE TRUNK-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 657,316, dated September 4, 1900.

Application filed May 25, 1900. Serial No. 17,981. (No model.)

To all whom it may concern:

Be it known that I, DAVID S. HULFISH, residing at Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Telephone Trunk-Circuits, of which the following is a specification.

The present invention relates to telephone trunk-circuits, and especially to the automatic operation of the visual signals employed therewith to instruct the operators in charge at the several switchboard-sections as to the various changes taking place in the trunk-circuit or in the circuits connected thereto during the organization or disorganization of a main circuit for conversational purposes.

The purpose of the invention is to provide a trunk-circuit with one visual signal located at the switching-plug terminal thereof, which is adapted to automatically operate, first, as a connection-signal when a connection-plug is inserted in the spring-socket terminal of the circuit, and, second, to automatically operate as a disconnection-signal upon the removal of said connection-plug from said spring-socket; and the invention provides means to automatically give and remove the busy-test conditions to and from the operator's telephone at the switching-plug terminal.

In carrying out the invention means (as a plug-connector) are provided, when a call is made for a station which necessitates the use of a trunk-circuit for connecting the calling circuit with the switch-socket of the trunk-circuit, which causes a lamp-signal to be lighted at the opposite or plug end of the said circuit to attract the attention of the switching operator there, who, after taking the call over an order-circuit, inserts the plug-terminal connector of the trunk-circuit into the switch-socket of the called-for circuit. The insertion of the plug-connector into the switch-socket of the called-for circuit operates to efface or extinguish the lamp-signal, and upon the termination of the use of the circuit thus organized and the withdrawal of the plug-connector from the trunk-circuit switch-socket the same lamp-signal is again lighted or displayed to indicate to the switching operator this time that a disconnection is desired. When the switching operator is notified of the circuit wanted over the order-

circuit, she proceeds to make a test to ascertain whether the circuit is in use or not, which is done in the usual manner, and at this stage of the circuit arrangement her telephone is in circuit with the tip of the trunk-plug; but when said plug is inserted in the switch-socket of the called-for circuit the telephone is automatically switched out of circuit.

Referring to the diagram which illustrates the invention, L is a trunk-circuit extending between the telephone-stations X and Y, and P at the former station represents one of a pair of switch-plugs A employed for connecting two circuits together, of which 1 and 2 are the conductor-cords connected, respectively, to the front sleeve contact-surface b^2 and to the tip contact-surface a^2 , the rear contact-surface c^2 being grounded by the wire 3.

The trunk-circuit L consists of three conductors 4, 5, and 6, joined at station A to the springs a b and the test-ring c , respectively, of the spring-socket J. While at the station Y the conductor 4 terminates at the front contact-surface a^4 of the plug P^2 , the conductor 5 extends to the tip contact-surface b^4 of said plug, while the conductor 6 is grounded through the windings of relay R and battery B. The rear sleeve contact-surface c^4 of said plug is grounded through the conductor 8, the windings of relay R^2 , and battery B. The relay R^2 is provided with armatures f and g , one at each end of the core, the rear contact 10 of the armature f is connected to point h on conductor 6 by the wire 7, and the conductor 17 connects the said armature with point k on the conductor 8 and includes in its circuit the visual lamp-signal S, and the rear contact 16 of armature g connects with conductor 5 at the point i by means of the conductor 9, while the armature is grounded through the operator's telephone T by the conductor 15.

L^2 represents a substation or other circuit provided with one or more switch-sockets J^2 , adapted to be connected by the plug P^2 to the trunk-circuit L, and its conductors are at the socket J^2 provided with the normally-open contact-springs a^3 and b^3 and the test-ring c^3 , grounded by the conductor 18 through the resistance r .

In the operation of the invention, the opera-

tor at station A, having received a call requiring connection with a substation-circuit beyond her reach or with one whose terminal switch-socket is not upon her switchboard-section, but which is located upon the switchboard-section of the switching operator at switchboard or station Y, and having upon her section the switch-socket J of the trunk-circuit L, which may be multiplied to other operators' switchboard-sections, proceeds to insert the calling-plug P of a pair of switching cords and plugs into the switch-socket J, its conductors 1 and 2 making connection with conductors 4 and 5, respectively, and the rear contact-surface c^2 completing a circuit with the test-ring c , and current flows from battery B, conductors 14 and 17, lamp-signal S, armature f of relay R², conductors 7, 6, and 3 to grounds G and G², and the lamp-signal is lighted. At the same time current flows from battery B, conductor 6, and winding of relay R to ground G, energizing the relay and causing the attraction of armature e , which remains attracted while the plug P is in the socket J. The switching operator at Y in response to the signal listens into an order-circuit (not shown) and receiving the call for a connection of the trunk-circuit with substation circuit L² first touches the tip of plug P² to the test-ring c^3 of switch-socket J², and a circuit is completed from ground G³, conductor 15, telephone T, armature g of relay R², conductors 9 and 5, tip b^4 of plug P², test-ring c^3 , conductor 18, and resistance r to ground G⁴, and if there is no connection at another switching switchboard-section there will be no click in the telephone, and conversely, whereupon she pushes the plug into the switch-socket, and the conductors 4 and 5 are in electrical circuit with the conductors of the circuit L², and the rear contact-surface joining the test-ring c^3 completes a circuit from battery B, conductor 8, winding of relay R², conductor 18 to grounds G⁴ and G², and the relay is energized and attracts its armatures f and g from their back or resting contacts 10 and 16, and an unobstructed talking-circuit is provided between sections X and Y. The plug P at the termination of conversation is withdrawn from the switch-socket J, thereby opening the circuit through relay R and battery, and the armature e falls upon its resting-contact 14 and a circuit is completed from battery B, conductor 17, lamp-signal S, armature f of relay R², its forward contact 11, conductor 12, armature e , and conductor 13 to ground G⁵, and the lamp-signal lights to indicate to the switching operator a disconnection, and she then withdraws the plug P² from the switch-socket J² and the circuits resume their normal condition. There will be no confusion in the mind of the operator when the lamp is lighted as to whether it is for a connection or disconnection signal, as she will be aware of the position of the plug P² whether it is upon the keyboard or within a switch-socket J².

The relative proportions of the apparatus employed depend largely upon the potential of the battery B. If a four-volt battery is used, the signal S would be a four-volt lamp of such resistance and candle-power as to give a satisfactory signal, there being no resistance in series with it, or should an electromagnetic signal be used it may be of such resistance as to operate upon the full voltage of the battery, and with such a battery the relay R may be of forty ohms resistance and that of relay R² about ten ohms, and the resistance-coil r is arranged for the substation-circuit L², and therefore forms no part of the proportions of my invention, but varies from thirty to forty-five ohms, according to the special kind of circuit, and therefore accords very well with the dimensions herein given for the trunk-circuit.

I claim—

1. In a telephone-exchange apparatus, the combination with a trunk-circuit extending between two switching-stations and provided at each with switch devices; of an independent signaling-circuit normally open at both stations, comprising a visual signal, a source of signaling-current, and two circuit-closing relays controlled by the said switch devices at the two switching-stations adapted to be operated serially by the said switch devices to, first, complete a circuit through one relay and the source of current and simultaneously therewith complete a second circuit through the source of current and cause the display of said signal; and second, to complete a circuit through the second relay and the source of current and open the signal-circuit, as set forth.

2. In a telephone-exchange apparatus, the combination with a trunk-circuit extending between two switching-stations and provided at each with switch devices; of an independent signaling-circuit normally open at both stations, comprising a visual signal, a source of signaling-current, and two circuit-closing relays controlled by the said switch devices at the two switching-stations; and a busy-test circuit normally closed by one of said relays; the said relays adapted to be operated serially by the said switch devices to, first, complete a circuit through one relay and the source of current and simultaneously therewith complete a second circuit through the source of current and cause the display of said signal; and, second, to complete a circuit through the second relay and the source of current and open signal-circuit and also the test-circuit, as set forth.

3. In a telephone-exchange apparatus, the combination with a trunk metallic circuit extending between two switching-stations and provided at each end with switch devices; of an independent signaling-circuit normally open in the switch-socket and plug terminals of the trunk-circuit at the said stations comprising a single conductor branching first through the windings of one relay to a source

of current and ground, and second, through the switching-armature of a second relay, a visual signal and the source of current to ground; the windings of the second relay being in circuit with a contact-surface of the plug-terminal to ground through the source of current; and a test-circuit normally closed and grounded through the switching-armature of the second relay to the tip of the terminal plug, whereby when the switch-socket terminal is grounded the visual signal is lighted, and when the tip of the terminal plug is in touch with the test-ring of a telephone-circuit the test-circuit is completed, as set forth.

4. In a telephone-exchange apparatus the combination with a trunk metallic circuit extending between two switching-stations and provided at each end with switch devices; an independent signaling-circuit normally open in the switch-socket and plug terminals of the trunk-circuit at the said stations, comprising a single conductor branching first through the windings of one relay to a source of current and ground, and second, through the switching-armature of a second relay a visual signal and the source of current to ground; the winding of the second relay being in circuit with a contact-surface of the plug-terminal to ground through the source of current; and a test-circuit normally closed and grounded through the switching-armature of the second relay to the tip of the terminal plug; whereby when the switch-socket terminal is grounded the visual signal is lighted, and when the circuit of the second relay is

grounded at the plug-terminal the signal is extinguished, as set forth.

5. In a telephone-exchange apparatus the combination with a trunk metallic circuit extending between two switching-stations and provided at each end with switch devices; an independent signaling-circuit normally open in the switch-socket and plug terminals of the trunk-circuit at the said stations, comprising a single conductor branching first through the windings of one relay to a source of current and ground, and second through the switching-armature of a second relay, a visual signal and the source of current to ground; the winding of the second relay being in circuit with a contact-surface of the plug-terminal to ground through the source of current; and a test-circuit normally closed and grounded through the switching-armature of the second relay to the tip of the terminal plug; whereby when the switch-socket terminal is grounded the visual signal is lighted, and when the circuit of the second relay is grounded at the plug-terminal the signal is extinguished, and when the ground is removed from the switch-socket terminal the visual signal is relighted, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of May, 1900.

DAVID S. HULFISH.

Witnesses:

BERNARD D. WILLIS,
J. B. MCMEER.