O. C. DENNIS.

TELEPHONE SYSTEM.

APPLICATION FILED OCT. 29, 1904.

965,876. Patented Aug. 2, 1910.

Fig. 1

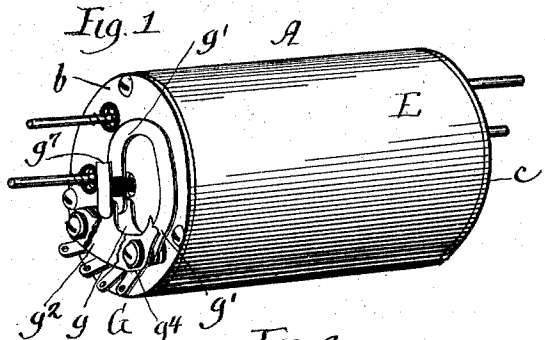


Fig. 3.

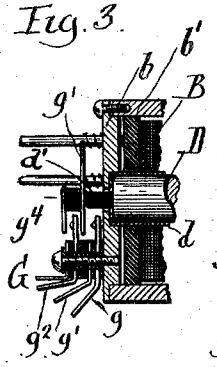


Fig. 2.

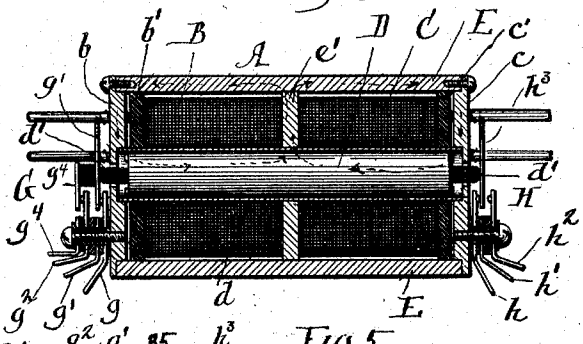


Fig. 4.

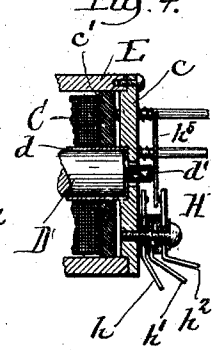
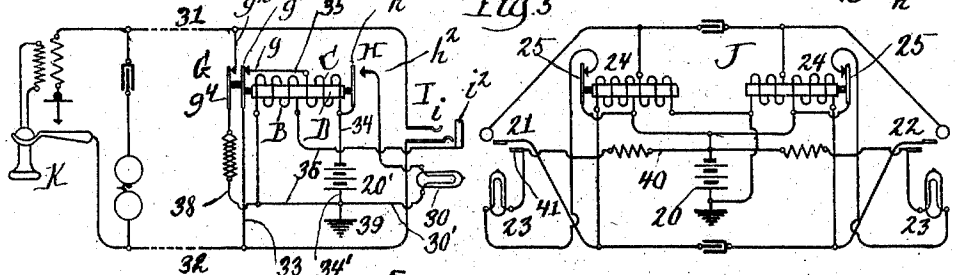


Fig. 5



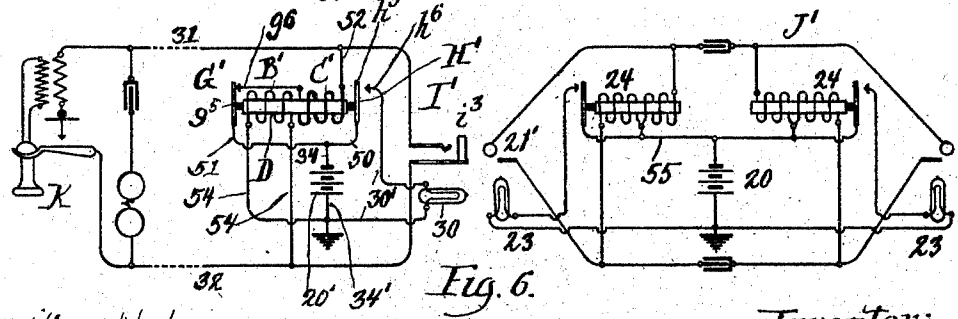


Fig. 6.

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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

965,876. Specification of Letters Patent. Patented Aug. 2, 1910.

Application filed October 29, 1904. Serial No. 230,475.

To all whom it may concern:

Be it known that I, OLIVER C. DENNIS, a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a full, clear, and exact description.

The invention relates to telephone-systems and more particularly to the means for controlling the "line-signal" and the "cut-out switch" for eliminating the line-signal when the exchange-operator responds to a call.

The invention designs to provide an improved telephone system embodying a self-contained or composite relay comprising both the line-signal and cut-out switches so in the equipment of an exchange they are combined and can be mounted conveniently with economy of space.

With these objects in view, the invention consists in the several novel improvements hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings: Figure 1 is a perspective of the improved relay employed in the telephone system. Fig. 2 is a central longitudinal section. Fig. 3 is a similar view, showing the armature and switch at one end of the relay, in shifted position. Fig. 4 is a similar view, showing the switch at the other end in shifted position. Fig. 5 is a diagrammatic view of a telephone system embodying the improved apparatus. Fig. 6 is a diagrammatic view of another type of telephone system having the improved apparatus associated therewith.

A denotes a relay comprising a helix B and a helix C, within which is slidably guided a core D, a jacket E and caps b and c and a central disk or pole-piece e'. Insulating ends b' and c' are respectively arranged at the outer ends of helices B and C. The caps, core, disk and jacket are made of iron to provide paths for the magnetic flux resulting from both helices. Core D is guided in tube d and is adapted to operate a switch G at one end of the relay and a switch H at the other end of the relay. Switch G comprises members g, g', g^2 and g^4. Members g' and g^4 each have a resilient portion adapted to be shifted by, and to shift the core. Switch H comprises members h and h' which are normally in contact. Member h' has a resilient portion adapted to be shifted by and shift the core. The armature is provided with studs d' of insulating material whereby the resilient switch members are respectively operated. The core is normally centralized by the resilient switch-members. One portion thereof serves as an armature for the helix B and the other serves as an armature for the helix C. The helices B and C are differentially wound or connected so that passage of current through one coil will operate the armature in one direction while energization of the other coil will operate the armatures in the opposite direction. This differential operation is obtained by passage of current in opposite direction or by reversal of the helix windings, as well understood in the art.

The operation of the relay will be as follows: When the coil C is energized by passage of current therethrough, armature D will be shifted outwardly in direction to operate switch H, the magnetic path resulting therefrom will be through armature D, disk e', jacket E and cap c as indicated in Fig. 2, thus effecting outward movement of armature D in proper direction to operate switch H. When said helix is de-energized, a resilient member h^3 will restore the armature to its normal centralized position. When helix B is energized, the magnetic path will be through armature D, disk e', jacket E and cap b, as indicated in Fig. 2, thus effecting outward movement of armature D in proper direction to operate switch G. When said helix is deënerigized, resilient ends g^3 and g^7 of switch-members g' and g^4 respectively will restore the armature to its normal centralized position.

In Fig. 5 the improved relay is associated with a telephone-system to operate a "line-signal" switch H and a "cut-out" switch G to perform the functions ordinarily performed in systems now in general use by the "cut-out" relay and the line-relay. One of the objects of the invention is to provide a single relay susceptible of use in lieu of both of the said relays. The system comprises a cord-loop J and associated battery 20, switch-plugs 21 and 22, supervisory-signals 23, supervisory-relays 24 and switches 25 controlled by said relays. The switch-board I comprises a spring-jack i and associated therewith is a line-signal 30, for a telephone-line comprising conductors 31 and

32 and extending to a sub-station K which is provided with the usual telephone equipment. Such a system is of the type commonly known as a "three-way" system, as well understood in the art.

The "line-signal" switch controls a local circuit in which "line-signal" 30 is included. Said circuit comprises a conductor 30′ connected to switch-member h^2 and to a wire 34′, connected to a source of potential 20′ which is connected by wire 34 to the other switch-member h' of the "line-signal" switch. Helix C is included in a conductor 35 connected to conductor 34 which is connected to battery 20′ and conductor 34 is connected to switch member g of the "cut-out" switch G. The "cut-out" switch comprises a member g' normally in contact with member g and connected to line-conductor 32 by a conductor 33. Helix B is included in a conductor 36 connected to sleeve-thimble i^2 of spring-jack i and to conductor 34′ which leads to battery 20′. Switch member g^2 is connected to line-conductor 31 and is normally in contact with a switch-member g^4 connected by conductor 38 to conductor 36. Conductors 36 and 34′ are connected to ground 39. It will be understood that the cord-circuit and the line circuit are supplied with potential from a common source as well understood in the art, batteries 20 and 20′ being shown for clearness of illustration.

The operation of the telephone system including the improved relay for operating the "cut-out" and the "line-signal" as shown in Fig. 5 will be as follows: When the telephone at sub-station K is removed from the switch-hook thereat, an electric circuit for switch H to close the local "line-signal" circuit will be established from battery 20′, conductor 34, helix C, switch-members g, g', conductor 33, line-conductor 32 to the sub-station K, thence through line-conductor 31, switch-members g^2 and g^4 and conductors 38 and 36 to battery 20′. Thereupon helix C will be energized in such manner that switch-member h' will be shifted by armature D into contact with switch-member h^2 and thus establish a local circuit for "line-signal" 30 as follows: Battery 20′, conductor 34, switch-members h' and h^2, conductor 30′ in which "line-signal" 30 is included to battery 20′. Switch H will be held in shifted position while current passes through helix C until the exchange-operator inserts a switch-plug into a spring-jack of switch-board I. Then helix B will be energized to operate the "cut-out" switch by establishment of a circuit as follows: battery 20, conductor 40 to sleeve 41 of switch-plug 21, sleeve-thimble i^2, conductor 36 (in which helix B is included), conductor 34′ to ground and battery 20. Thereupon armature D of the relay will be operated in reverse direction and switch-members g and g^2 will be separated from their associated contacts. Thereupon the line-switch will be restored to break the local circuit for the "line-signal" at switch-members h' and h^2, and the "cut-out" switch will be in open position to interrupt the signaling circuit in which helix C is included and the "cut-out" switch will disconnect the relay from the telephone-line so the line will be clear for speech transmission. So long as plug 21 remains in spring-jack i helix B of the relay will be energized so the relay will be disconnected from the telephone-line.

In Fig. 6 there is illustrated diagrammatically a telephone system commonly known as a "two-way" circuit having the improved relay associated therewith for controlling the line-signal and the "cut-out" therefor. Said system comprises a cord-loop J′ a switch-board I′, line conductors 31 and 32, battery 20 and sub-station K. In the said system the local circuit for the operation of the line-signal is similar to that already described. Battery 20′ is connected by conductors 50 and 51 with switch-members h^5 and g^5 respectively. Helix C′ is included in a conductor 52 connected to the line-conductor 31 and to a contact g^6 normally in contact with switch-member g^5 of "cut-out" switch G′. Helix B′ is included in a conductor 54 connected to line-conductor 32 and to conductor 34′. The operation of said system will be as follows: When the receiver is removed from the switch-hook at sub-station K a circuit for closing the local line-signal will be as follows: battery 20′, conductors 34, 51, switch-members g^5 and g^6, conductor 52 in which helix C′ is included, line-conductor 31, sub-station K, line-conductor 32, conductor 54 in which helix B′ is included and conductor 34′ to battery 20′. In this form of the invention helix C′ will be wound so it will have a higher resistance, *e. g.*, 500 ohms and helix B′ will be differentially wound and of lower resistance, *e. g.*, 150 ohms. Therefore said circuit will energize the relay so armature D will be operated to close switch H′ at switch-members h^5 and h^6. The current which passes through the helix B′ is from the sub-station and is not of sufficient amperage to cause the armature D to be influenced by coil B′ against the opposing influence of helix C′. Resultantly switch H′ will be closed. The local circuit for the "line-signal" 30 will be rendered operative so long as such conditions continue, and until the exchange-operator inserts plug 21′ into the spring-jack in response to the call. Then circuit will be established as follows: battery 20, conductor 55, the contact-sleeve of plug 21′, the sleeve-thimble of spring-jack i^3, line-conductor 32 to conductor 54 in which helix B′ is included, thence by conductor 34′ to battery

20′. Current passing through B′ under such conditions will energize said helix and overcome the influence of helix C′ upon armature D and shift said armature to operate "cut-out" switch G′ into open position. Thereupon the telephone-line will be clear for speech transmission. When the exchange-operator withdraws the switch-plug from the spring-jack helices B′ and C′ will both be deënergized, and the resilient switch-members will restore the armature to normal position.

Manifestly the improved relay can be used to advantage in operating switches for purposes other than those specifically set forth.

The invention is not to be understood as restricted to the details described, but may be modified without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a telephone-system, the combination of a combined relay comprising a line-signal switch, a cut-out switch and a pair of inductively opposed helices for respectively operating said switches, a line-signal actuation of which is controlled by said line-signal switch, switch-shifting means operated by the helices in different directions respectively, and suitable means and connections for energizing the helix for operating said line-signal switch when a subscriber makes a call and for energizing the helix for the cut-out switch when the exchange-operator makes a connection with the sub-station in response to a call.

2. In a telephone-system, the combination of a combined solenoidal relay comprising a line-signal switch, a cut-out switch, and a pair of inductively opposed helices for respectively operating said switches, a line-signal actuation of which is controlled by said line-signal switch, switch-shifting means within the helices and operated in different directions by the helices respectively, and suitable means and connections for energizing the helix for operating said line-signal switch when a subscriber makes a call and for energizing the helix for the cut-out switch when the exchange-operator makes a connection with the sub-station in response to a call.

3. In a telephone-system, the combination of a combined relay comprising a pair of helices, a switch-operating armature, a line-signal switch, a cut-out switch for the line-signal, said switches being respectively operated by said helices in opposite directions, a line-signal controlled by said line-signal switch, and suitable means and connections for energizing the helix for operating said line-signal switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange-operator makes a connection with the sub-station in response to a call.

4. In a telephone-system, the combination of a combined relay comprising a "line-signal" switch, a "cut-out" switch, a plurality of helices, and an armature within one of the helices and operated in different directions by the helices to operate both of the switches respectively, and suitable means and connections for energizing the helix for operating said line-switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange operator makes a connection with the sub-station in response to a call.

5. In a telephone-system, the combination of a combined relay comprising a "line-signal" switch, a "cut-out" switch, a pair of helices and an armature operated in opposite directions by the helices respectively and for operating the switches respectively, and suitable means and connections for energizing the helix for operating said line-switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange operator makes a connection with the sub-station in response to a call.

6. In a telephone-system, the combination of a combined relay comprising a "line-signal" switch, a "cut-out" switch, a pair of helices, a jacket forming the magnetic field for both of the helices, a pole-piece between the helices, and an armature-core within one of the helices, and suitable means and connections for energizing the helix for operating said line-switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange operator makes a connection with the sub-station in response to a call.

7. In a telephone-system, the combination of a combined relay comprising a "line-signal" switch, a "cut-out" switch, a pair of helices, a jacket forming the magnetic field for both of the helices, a pole-piece between the helices and a spring-held armature-core within one of the helices, and suitable means and connections for energizing the helix for operating said line-switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange operator makes a connection with the sub-station in response to a call.

8. In a telephone-system, the combination of a combined relay comprising a "line-signal" switch, a "cut-out" switch, and an electro-magnet for operating said switches comprising differential helices, switch-shifting means operated in different directions by the helices respectively, and suitable means and connections for energizing the helix for operating said line-switch when a subscriber makes a call and for energizing the helix for

operating the cut-out switch when the exchange operator makes a connection with the sub-station in response to a call.

9. In a telephone-system, the combination of a combined relay comprising a "line-signal" switch, a "cut-out" switch, and differential helices, switch-shifting means operated in different directions by the helices respectively, the helix for the "cut-out" switch being of such resistance that current passing therethrough from the telephone line will not cause the operation of the latter switch, and suitable means and connections for energizing the helix for operating said line-switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange operator makes a connection with the sub-station in response to a call.

10. In a telephone-system, the combination of a combined relay comprising a "line-signal" switch, a "cut-out" switch, an armature, and a pair of differential helices, switch-shifting means operated in different directions by the helices respectively whereby the "line-signal" switch will be operated by current in one of the helices and when current from the telephone-line passes through the other helix, and suitable means and connections for energizing the helix for operating said line-switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange operator makes a connection with the sub-station in response to a call.

11. In a telephone system, the combination of a relay comprising a line-signal switch, a cut-out switch, a pair of helices for operating said switches respectively, a common jacket around both of said helices, said switches being mounted at the ends of the jacket, and suitable means and connections for energizing the helix for operating said line switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange operator makes a connection with the sub-station in response to a call.

12. In a telephone system, the combination of a relay comprising a pair of helices, a common armature-core for both of said helices and operated in opposite directions by the helices respectively, a line-signal switch, and a cut-out switch respectively operated by the core, and suitable means and connections for energizing the helix for operating said line-switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange operator makes a connection with the sub-station in response to a call.

13. In a telephone system, the combination of a relay comprising a jacket, caps at the ends of said jacket, a pair of helices within the jacket, a line-signal switch, and a cut-out switch respectively operated responsively to the helices, switch-shifting means within the helices and operated in different directions by the helices respectively, and suitable means and connections for energizing the helix for operating the line-switch when a subscriber makes a call and for energizing the helix for operating the cut-out switch when the exchange-operator makes a connection with the sub-station in response to a call.

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