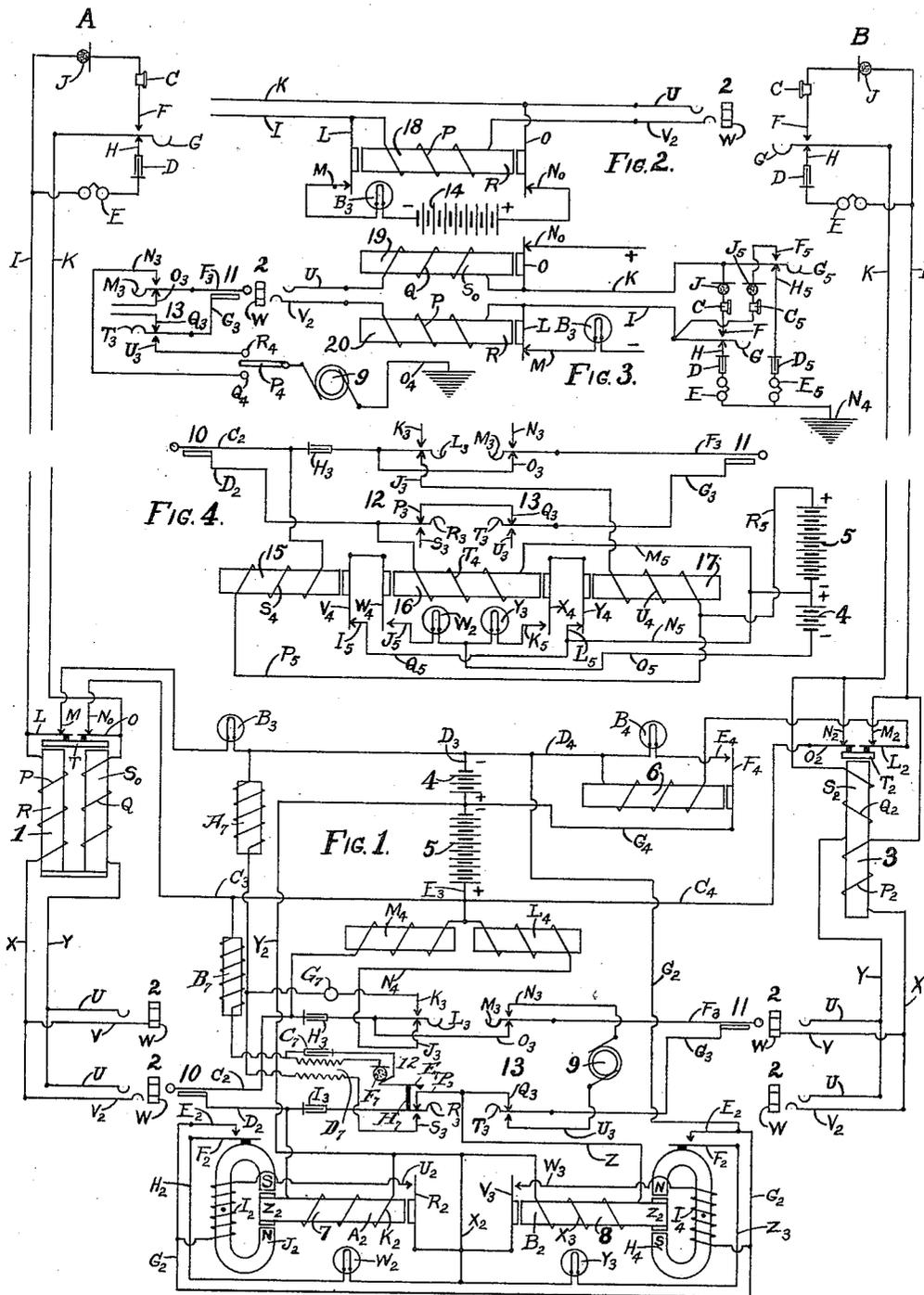


F. R. PARKER.
 TELEPHONE SYSTEM.
 APPLICATION FILED JUNE 20, 1904.

1,090,821.

Patented Mar. 17, 1914.



WITNESSES: *Wm F. Violett,*
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UNITED STATES PATENT OFFICE.

FREDERICK R. PARKER, OF CHICAGO, ILLINOIS.

TELEPHONE SYSTEM.

1,090,821.

Specification of Letters Patent. Patented Mar. 17, 1914.

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To all whom it may concern:

Be it known that I, FREDERICK R. PARKER, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Telephone System, of which the following is a specification, reference being had to the accompanying drawings, illustrating same.

My invention relates to electrical transmitting systems and more particularly to telephone systems.

The principal objects of my invention are, to provide improved means for controlling the subscriber's signaling-in indicator or annunciator; to provide improved means for disconnecting the subscriber's indicator or annunciator and the central station signaling apparatus and source of electrical supply from the line when the latter is in use either for conversation or during the operation of calling a subscriber; to provide improved means for operating and controlling the subscriber's disconnect or supervisory indicator or annunciator; to provide an improved arrangement of the line relays in the system; to provide an improved arrangement of the supervisory relays in the system; and to provide improved means for allowing the subscribers to carry on secret conversation by preventing the operator from "listening-in" on the lines during such conversation.

Other objects will be apparent from the following specification.

In my present invention I have shown a talking telephone line extending direct from the subscriber's station, or stations, to the connection terminals or spring jacks of the central station switchboard, and including the windings, or winding, of a line cut-off relay therein. Then I have shown a signaling circuit extending from the talking telephone line, between the line cut-off relay and the subscriber's station, to signaling apparatus and a central source of electric current. When the cut-off relay is energized, it disconnects the said signaling circuit from the talking telephone line. The cut-off relay is adapted to be operated by any form of electric current, such as a direct, alternating, intermittent, interrupted, or pulsating current.

It has been the usual practice heretofore, to provide a relay included in a local circuit,

for cutting the central source of current and signaling apparatus from the talking telephone line, but it is an object of the present invention to utilize the talking circuit itself for actuating the cut-off relay.

In the subscriber's telephone instrument I employ any suitable circuit arrangement for opening and closing the line circuit or for varying the current over the line. In the plug-cord connecting circuit I employ suitable relays for operating the supervisory or disconnect signals. I have preferably shown the talking battery to be a part of the signaling-in battery, but it is to be understood that the talking source of electric current may be separate from the signaling source of current, if desired. I prevent the operator from listening-in on the lines during conversation between the subscribers, by adapting her listening key to cut the subscribers' lines apart, when depressed.

I have also shown several modifications of my present invention, as will be hereinafter described.

I will now more particularly describe my invention by reference to the drawings, in which—

Figure 1 is a diagram showing two subscribers' lines and the central station signaling and connecting apparatus; Fig. 2 shows the line cut-off relay included in one side only, of the line; Fig. 3 shows separate cut-off relays in the respective limbs of a metallic line, and grounded-return ringing circuits for party-line ringing; and Fig. 4 shows two individual supervisory relays connected to one side of the plug-cord talking circuit, and one supervisory relay for both supervisory signals connected to the other side of the said plug-cord circuit.

Like characters refer to like parts in the several figures.

The line of subscriber A extends in two limbs K and I from a sub-station to the central station where the said limbs pass through the respective windings Q and P of relay 1 and terminate in the respective connection terminals U and V (or U and V₂) of the several spring jacks 2 2 of a multiple switchboard. The thimble W of one of the jacks 2 is normally insulated from the connection terminals U and V₂ and is used simply as a guide for the connecting plug. This jack is preferably used for the answering jack. This insulated thimble W

is described and claimed in the co-pending application of Parker and Corwin, Serial No. 571,846, filed July 13, 1910, on telephone system. Spring members O and L of relay 1 are permanently connected to the limbs K and I, respectively, of the line, and normally engage the respective contacts N₀ and M. Contact N₀ is connected to one pole E₃, preferably the positive, of battery 5, through conductor C₃, and contact M is connected to one pole D₃, preferably the negative, of battery 4, through lamp B₃. Batteries 4 and 5 are connected in series, and it is immaterial which is the positive or negative end pole of battery 4 5. When armature T of relay 1 is attracted to the cores S₀ and R, springs O and L are disengaged from contacts N₀ and M, respectively. In case of a grounded-return or common-return line, the ground or common conductor constitutes one limb of the telephone line.

At the subscriber's station I have shown one of a number of circuit arrangements in which the operation of the switch-hook G connects either the receiver C and transmitter J, or the ringer E and condenser D, for use over the line, depending on whether the switch-hook is raised or lowered. The operation of this instrument circuit is well understood and need not be described here.

For the line of subscriber B, I have shown modified forms of some of the apparatus used in connection with line A. The other parts of line B are similar to corresponding parts of line A and are denoted by like characters, respectively.

The line of subscriber B extends in two limbs K and I from the sub-station to the central station where the said limbs pass through the respective windings Q₂ and P₂ of the double-wound relay 3 and terminate in the respective connection terminals U and V (or U and V₂) of the several spring jacks 2 2 of the switchboard. Contacts N₂ and M₂ are permanently connected to the limbs K and I, respectively, of the line, and normally engage the respective spring members O₂ and L₂ of relay 3. Spring member O₂ is connected to one pole E₃, of battery 5, through conductor C₄, and spring member L₂ is connected to pole D₃ of battery 4, through the winding of relay 6 and conductor D₄. Relay 6 controls the circuit of battery 4 through lamp B₄, as shown. When armature T₂ of relay 3 is attracted to core S₂, springs O₂ and L₂ are disengaged from contacts N₂ and M₂, respectively.

In the plug-cord connecting circuit, the main conductors of the connecting plugs 10 and 11 are connected together through the respective condensers H₃ and I₃, listening key 12, and ringing key 13. Tip strand C₂ of answering plug 10 is connected to pole E₃ of battery 5, through impedance coil M₁. Tip strand F₃ of calling plug 11 is normally

connected to pole E₃ of battery 5, through spring M₃, contact O₃, spring L₃, contact J₃, conductor N₄, and impedance coil L₄. Sleeve strand D₂ of answering plug 10 is connected to the middle pole of battery 4 5, through winding K₂ of relay 7, and conductor Y₂. Sleeve strand G₃ of calling plug 11 is normally connected to the middle pole of battery 4 5, through spring T₃, contact Q₃, conductor Z, winding X₃ of relay 8, and conductor Y₂.

Supervisory relays 7 and 8 are each provided with spring members F₂ and E₂ which are normally disengaged from each other but adapted to be brought into contact with each other. When core A₂ of relay 7 is energized, armature R₂ is attracted thereto and thereby engages contact U₂, which closes the circuit of battery 4 through conductor Y₂, spring R₂, contact U₂, winding I₂ of armature J₂, and conductor G₂. The current from battery 4 now traversing winding I₂, magnetizes the armature J₂ and produces a north pole N and a south pole S therein adjacent to one end Z₂ of core A₂. It will be noticed that whenever the current of battery 4 is closed through winding I₂, the north pole of armature J₂ will always be at the same end thereof, and the south pole will always be at the other end thereof. When an energizing current traverses winding K₂ of relay 7 in one direction, a north pole will be produced in A₂ at Z₂, which will attract the south pole of J₂ and repel the north pole thereof. When, however, an energizing current traverses winding K₂ in the opposite direction, a south pole will be produced in A₂ at Z₂, which will attract the north pole of J₂ and repel the south pole thereof. This latter action causes armature J₂ to close the contact between spring F₂ and member E₂, which closes the circuit of battery 4 through conductors Y₂ and X₂, supervisory signal W₂, spring F₂, contact E₂, and conductor G₂, and causes W₂ to display a signal. When the connecting plug 10 is inserted into a spring jack of a line, and the circuit of the line is open, the current from battery 4 will traverse the winding K₂ in one direction, through conductor Y₂, winding K₂, sleeve strand D₂, jack spring V or V₂, line conductor X, winding P of relay 1, spring L, contact M, lamp B₃, and conductor D₃, and thereby cause core A₂ to operate armature J₂ so as to close the contact between spring F₂ and member E₂. If the circuit of the line is closed while such connection is made therewith, the current from battery 5 will traverse the winding K₂ in the opposite direction, through impedance coil M₄, tip strand C₂, jack spring U, line conductor Y, winding Q of relay 1, line conductor K, substation A, line conductor I, winding P of relay 1, line conductor X, jack spring V or V₂, sleeve strand D₂, winding K₂, and conductor Y₂, and there-

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by cause core A_2 to act on armature J_2 so as to break the contact $F_2 E_2$ or keep such contact from closing. In this manner the supervisory relay 7 operates and controls the supervisory signal W_2 . The operation of relay 8 is similar to that just described for relay 7, but the poles N and S are shown reversed.

The operator's receiver G_7 and one winding of repeating-coil D_7 are bridged from contact K_3 to contact S_3 of listening-key 12. Condenser C_7 , the other winding of repeating-coil D_7 and the operator's transmitter F_7 are connected in a loop as shown and to contact E_7 . The battery current for transmitter F_7 is supplied from battery 5 through impedance coil B_7 . Impedance coil A_7 is preferably connected to the receiver G_7 as shown, to provide means for making a busy-test. When listening-key 12 is depressed, springs L_3 and R_3 are disengaged from contacts J_3 and P_3 , respectively, and engaged with contacts K_3 and S_3 , respectively, and spring E_7 is engaged with contact P_3 .

Ring generator 9, is adapted to give an alternating, pulsating, intermittent, or interrupted current, as required, and is preferably bridged from contact N_3 to contact U_3 , of ringing key 13, as shown. When the ringing key 13 is depressed, springs M_3 and T_3 are disengaged from contacts O_3 and Q_3 , respectively, and engaged with contacts N_3 and U_3 , respectively.

The operation of the system is as follows: If subscriber A desires to talk with subscriber B, he lifts his telephone receiver C from the switch-hook G and thereby closes the circuit of battery 4 through conductor C_3 , contact N_3 , spring O, limb K of the telephone line, sub-station A, limb I of the telephone line, spring L, contact M, and lamp B_3 , thus allowing current to flow through lamp B_3 and light same, and thereby convey to the operator the signal for connection. The operator thereupon lifts answering plug 10 and inserts same into a spring jack 2 of line A, which closes the circuit of battery 5 through impedance coil M_4 , tip strand C_2 , jack spring U, winding Q of cut-off relay 1, limb K of the telephone line, sub-station A, limb I of the telephone line, winding P of relay 1, jack spring V_2 , sleeve strand D_2 , winding K_2 of supervisory relay 7, and conductor Y_2 , thereby energizing relay 1 and causing its armature T to be attracted, thus disengaging springs O and L from contacts N_3 and M, respectively, and thereby disconnecting the central source of signaling current and the line signal lamp B_3 from the talking telephone line. The circuit through lamp B_3 is now broken at contact M and consequently the line signal is extinguished. Supervisory relay 7 is now energized with current from battery 5, as above described,

and thereby keeps the contact $F_2 E_2$ open, thus preventing the supervisory signaling device W_2 from displaying a signal.

The operator then depresses her listening key 12 and thereby connects her telephone set for use, in a manner well understood. In depressing the listening key 12 the operator disengages springs L_3 and R_3 from contacts J_3 and P_3 , respectively, and thereby cuts the central source of current from one talking conductor of the calling plug 11 and breaks the continuity of one of the talking strands, at contact P_3 , which stops conversation from one subscriber's line to another, when the connecting plugs are connected with the respective lines, while the listening key 12 is depressed. It will thus be seen that it is impossible for the operator to "listen in" on the lines while conversation is being carried on therebetween, without breaking the talking circuit between the said lines and thereby stopping conversation between the subscribers.

After learning that subscriber B is the subscriber called for, the operator tests the line of subscriber B, to ascertain whether it is "busy" or not. In making the busy-test herein shown, the operator touches the tip F_3 of calling plug 11 to the ring W of a multiple jack 2 of line B, while the listening key 12 is depressed, which closes a circuit from pole D_3 of battery 4 through impedance coil A_7 , receiver G_7 , contact K_3 , spring L_3 , contact O_3 , spring M_3 , tip strand F_3 , ring W of a jack of line B, conductor X, winding P_2 of relay 3, contact M_2 , spring L_2 , relay 6, and conductor D_4 , back to pole D_3 of battery 4, if line B is not in use. Closing this circuit from pole D_3 of battery 4, through the receiver G_7 and back to the same pole D_3 of battery 4, does not produce an impulse through the receiver G_7 , and line B therefore tests clear, or not busy. If line B is in use, the rings W W of the multiple jacks of line B will not be at the same potential as the tip F_3 of calling plug 11, and hence when the tip F_3 is touched to a ring W there will be a flow of current through the receiver G_7 and hence a click in the receiver which indicates that the line is busy. Assuming that the operator finds the line of subscriber B to be not in use, she inserts the calling plug 11 into a spring jack 2 of line B. She then depresses the ringing key 13 in the usual manner, and at the same time restores the listening key 12 to its normal position. In depressing the ringing key 13, the operator closes the circuit of ringing generator 9 through contact N_3 , spring M_3 , tip strand F_3 , jack spring U belonging to line B, winding Q_2 of relay 3, limb K of the telephone line, switch-hook G, contact H, condenser D, ringer E, limb I of the telephone line, winding P_2 of relay 3, jack contact V, sleeve strand G_3 , spring T_3 , and con-

tact U_3 , thus ringing the ringer E which signals subscriber B, after which the ringing key 13 returns to its normal position.

Relay 3 (or relay 1) is constructed to respond to alternating, pulsating, intermittent, or interrupted currents, as well as to a continuous, direct current. To render this relay thus responsive to these different forms of currents, its armature (or armatures) is made heavy and is pivoted so that it is withdrawn from the core (or cores) of the relay slowly by gravity. The withdrawal of the armature is thus sluggish, and upon the passage of an alternating current through the windings, or winding, of the relay, a succeeding alternation will magnetize the core (or cores) and thereby cause same to re-attract the armature, before said armature has had time to be withdrawn upon the cessation of magnetism due to the immediately-preceding alternation. The action of pulsating, intermittent, or interrupted currents on this relay, is substantially the same as the action of an alternating current. Thus when relay 3 (or relay 1) is energized by a continuous, direct current, the armature (or armatures) thereof is held continuously to the core, (or cores) of the relay by a constant magnetic pull, and when it is energized by an alternating, pulsating, intermittent, or interrupted current, the armature (or armatures) thereof is held continuously to the core (or cores) of the relay by an intermittent magnetic pull, the pulsations of which are too rapid to permit the armature to recede from the core, (or cores) appreciably, between the pulsations.

In sending a calling current over the line of subscriber B, the operator energizes relay 3 thereof by the said current, as above described, and thus causes its armature to be attracted and thereby disengage springs O_2 and L_2 from contacts N_2 and M_2 , respectively, thus disconnecting the central source of current 4 5 and the line signaling apparatus (in this case relay 6) from the telephone line during the sending of the said calling current. When the ringing key 13 is returned to its normal position, relay 3 is de-energized and springs O_2 and L_2 again engage contacts N_2 and M_2 , respectively. Before subscriber B lifts his telephone receiver from the switch-hook, the circuit of the central source of current 4 5 is not closed over his telephone line, but the circuit of battery 4 is closed through conductor Y_2 , winding X_3 of supervisory relay 8, conductor Z, contact Q_3 , spring T_3 , sleeve strand G_3 , jack spring V of one of a number of multiple jacks of line B, conductor X, winding P_2 of cut-off relay 3, contact M_2 , spring L_2 , the winding of relay 6, and conductor D_4 . Battery 4 does not, however allow sufficient current to flow through relays 3 and 6 to actuate their armatures, but it does allow

sufficient current to flow through supervisory relay 8 to actuate same and thereby close the contact between springs F_2 and E_2 , as hereinbefore described, thus closing the circuit of battery 4 through conductors Y_2 and X_2 , supervisory signal lamp Y_3 , spring F_2 , contact E_2 , and conductor G_2 , and lighting lamp Y_3 . When subscriber B answers the call and lifts his telephone receiver C from the switch-hook G, the latter is disengaged from contact H and engaged with contact F, thereby closing the circuit of battery 5 through impedance coil L_4 , conductor N_4 , contact J_3 , spring L_3 , contact O_3 , spring M_3 , tip strand F_3 , jack spring U, of a spring jack 2 of line B, conductor Y, winding Q_2 of relay 3, limb K of the telephone line, switch-hook G, contact F, receiver C, transmitter J, limb I of the telephone line, winding P_2 of relay 3, conductor X, jack spring V, sleeve strand G_3 , spring T_3 , contact Q_3 , conductor Z, winding X_3 of relay 8, and conductor Y_2 , which energizes relay 3 and causes armature T_2 thereof to be attracted to core S_2 and thereby disengage springs O_2 and L_2 from contacts N_2 and M_2 , respectively. The circuit through relay 6 is now broken at M_2 and hence line-signal lamp B_4 is inoperative. The circuit of battery 5 now closed through winding X_3 of supervisory relay 8, energizes this relay and actuates the armature H_4 thereof so as to break the contact between springs F_2 and E_2 , as hereinbefore described, thus opening the circuit through supervisory lamp Y_3 and extinguishing its signal. Subscribers A and B are now connected for conversation with each other, all of the signals being inactive.

When the conversation is completed and subscriber A hangs his telephone receiver C upon the switch-hook G, the latter is disengaged from contact F and engaged with contact H, thereby stopping the flow of or reducing the current of battery 5 over the telephone line, in a manner well understood, preferably by placing condenser D in the circuit, which stops the flow of current through relay 1 and allows its armature to become released. When armature T of relay 1 is released, it causes spring L to engage contact M and thereby close the circuit of battery 4 through conductor Y_2 , winding K_2 of supervisory relay 7, sleeve strand D_2 , jack spring V, of line A, conductor X, winding P of relay 1, spring L, contact M, and lamp B_3 . The current from battery 4 now flowing through relay 7 causes armature J_2 thereof to close the contact between springs F_2 and E_2 , as hereinbefore described, and thereby close the circuit of battery 4 through conductors Y_2 and X_2 , supervisory lamp W_2 , conductor H_2 , springs F_2 and E_2 , and conductor G_2 , and cause lamp W_2 to light and thereby convey to the operator the signal for disconnection.

The current now flowing through relay 1 is not sufficient to attract armature T thereof, nor sufficient to cause lamp B₃ to light. It is obvious that if subscriber A should again take his receiver from the switch-hook while connection is still made with his line, he would cause his supervisory lamp W₂ to become extinguished. Thus by operating the switch-hook the subscriber A may signal the operator for a second connection, through the agency of the supervisory signal. It will be noted that the current which closes the contact between springs F₂ and E₂ of relay 7, traverses the winding K₂ of this relay in a direction opposite to that in which the current which opens the said contact or prevents same from closing, traverses the same winding K₂.

When subscriber B hangs his telephone receiver C upon the switch-hook G, he breaks the circuit of battery 5 over his telephone line, in a manner similar to that just described in connection with line A, and thereby stops the flow of current through relay 3 and allows its armature to become released. When armature T₂ of relay 3 is released, it causes spring L₂ to engage contact M₂ and thereby close the circuit of battery 4 through conductor Y₂, winding X₃ of supervisory relay 8, conductor Z, contact Q₃, spring T₃, sleeve strand G₃, jack spring V of line B, conductor X, winding P₂ of relay 3, contact M₂, spring L₂, the winding of relay 6, and conductor D₄. The current from battery 4 now flowing through relay 8 causes armature H₄ thereof to close the contact between springs F₂ and E₂, as hereinbefore described, and thereby close the circuit of battery 4 through conductors Y₂ and X₂, supervisory lamp Y₃, conductor Z₃, springs F₂ and E₂, and conductor G₂, and cause lamp Y₃ to light and thereby convey to the operator the signal for disconnection. The current now flowing through relay 3 is not sufficient to attract armature T₂ thereof, nor sufficient to cause relay 6 to actuate its armature and thereby light the lamp B₄. It is obvious that if subscriber B should again operate his switch-hook while connection is still made with his line, he would correspondingly operate his supervisory signal Y₃, the same as described above in connection with subscriber A. When the operator receives both disconnect signals from subscribers A and B, respectively, she withdraws the connecting plugs 10 and 11 from their respective spring jacks, thus breaking the battery circuits through the relays 7 and 8, respectively, and thereby releasing their armatures, and at the same time restoring both telephone lines and all central station circuits and apparatus to their normal condition.

It is obvious that subscriber B may be the calling subscriber and subscriber A the

called subscriber, but it is not necessary to give a detailed description of the different operations performed in thus connecting the system, as it would be practically the same as the above description wherein subscriber A is the calling subscriber and subscriber B is the called subscriber. In this case, plug 10 would be connected with line B and plug 11 would be connected with line A, and the order of operations with lines A and B would be reversed.

In Fig. 2 I have shown a single-wound cut-off relay 18 included in one limb only of the talking telephone line. This relay 18 is adapted to disengage springs O and L from contacts N₀ and M, respectively, when the armatures thereof are attracted, and thus cut the line signal B₃ and the central station battery 14 from the talking telephone line.

In Fig. 3 I have shown a single-wound relay in each limb of the telephone line. I have also shown telephone instruments connected to the respective limbs of the line, and have adapted the system for party-line ringing. When the connecting plug 11 is inserted into a spring jack 2, and connection is made between switch contacts P₄ and Q₄, the depression of ringing key 13, as described above, closes the circuit of ringing generator 9, through switch contacts P₄ and Q₄, contact N₃, spring M₃, tip strand F₃, jack spring U, winding Q of relay 19, limb K of the telephone line, switch-hook G₅, contact H₅, condenser D₅, ringer E₅, and ground N₄. This current from generator 9 rings the bell E₅ and simultaneously energizes relay 19 which causes its armature to be attracted, as described above in connection with different forms of energizing currents, and thereby disengage spring O from contact N₀, thus clearing limb K of the telephone line of all other circuit connections and thereby eliminating the possibility of sending a portion of the ringing current through the central battery or circuits other than the direct line ringing circuit. When ringing key 13 is restored to its normal position, relay 19 is deenergized and spring O therefore engages contact N₀. When the subscriber lifts his telephone receiver C₅ from the switch-hook G₅, he causes switch-hook G₅ to disengage contact H₅ and engage contact F₅, and thereby bridge the transmitter J₅ and receiver C₅ across the limbs K and I of the telephone line, for talking purposes. When the line is connected for conversation, relays 19 and 20 are both energized, thereby causing their respective armatures to be attracted and thus disengage springs O and L from the respective conductors N₀ and M. In ringing a subscriber, if contact P₄ of the generator switch is connected with contact R₄, the circuit of ringing generator 9 may be closed through ringer E in a manner

similar to that just described in connection with ringer E_5 , in which case ringer E will operate and relay 20 will simultaneously actuate its armature and thereby disengage spring L from conductor M . Switch-hook G may be operated in a similar manner to switch-hook G_5 , and thus connect its telephone receiver C and transmitter J for conversation over the line, and also operate relays 19 and 20 as above described.

In Fig. 4 I have dispensed with one condenser in the plug-cord circuit and have connected one supervisory relay 16 from this strand of the plug-cord circuit to the middle pole of battery 4 5. Then I have connected supervisory relays 15 and 17 from the other strand of the plug-cord circuit, on respective sides of condenser H_5 , to one pole of battery 5. When either plug 10 or 11 is inserted into a spring jack of an idle telephone line, the current from battery 4 will energize relay 16 and thereby cause springs W_4 and X_4 to engage contacts J_5 and K_5 , respectively, which closes the circuit of battery 4 through conductors N_5 and Q_5 , contact I_5 , spring V_4 , spring W_4 , contact J_5 , supervisory lamp W_2 , and conductor O_5 , and also through conductor N_5 , contact L_5 , spring Y_4 , spring X_4 , contact K_5 , supervisory lamp Y_3 , and conductor O_5 , thus lighting the lamps W_2 and Y_3 . When, however, plug 10 is connected with a telephone line and the circuit of the line is closed, the circuit of battery 5 will be closed through relay 15 and the line, as well understood, and thereby cause relay 15 to actuate its armature and disengage spring V_4 from contact I_5 , which opens the circuit of lamp W_2 and extinguishes its signal or keeps it from displaying a signal. If the circuit of the line is opened while such connection is made therewith, the circuit of battery 5 will be opened through relay 15, and thereby allow spring V_4 to again engage contact I_5 , and by such engagement close the circuit of battery 4 through lamp W_2 , as described, which then displays its signal. Relay 17 controls supervisory signal Y_3 in a manner similar to that just described in connection with relay 15 and signal W_2 , and hence need not be described in detail. From this description it will be readily seen how supervisory relays 15, 16 and 17 operate and control the supervisory signals W_2 and Y_3 . Of course the cord circuit of Fig. 4 may be used in connection with the line circuits of Figs. 1, 2 and 3, as desired. Other cord circuits also, may be used with these various line circuits.

While I have shown lamps for all central station signals, I desire it to be understood that other forms of signaling devices, such as annunciators having visual signals, or various other forms of electrically-operable signaling devices, may be used instead.

While I have illustrated this invention in

connection with particular types of spring jacks, connecting plugs, keys; line cut-off relays, supervisory relays, sources of electric current, and auxiliary apparatus, I desire it to be understood that different types of these several pieces of apparatus may be used.

I have shown and described this invention in connection with multiple switchboard systems, but it is apparent that its features are also applicable to systems of the single, transfer, or divided-board types.

I do not wish to limit this invention to all of the particular details herein set forth, as various modifications thereof may be made or utilized without departing from the scope of the appended claims.

What I claim as my invention is:

1. The combination with a telephone line and connection terminals therefor, of a signal-controlling electromagnet normally connected with the said line, a source of electricity also normally connected with the said line, a relay for disconnecting the said electromagnet and source of electricity from the said line, the said relay being included in the talking limbs of the said line, a cord circuit terminating in a connecting plug and adapted to be conductively connected to the line, a source of electricity associated with the said cord circuit and adapted to be bridged across the metallic circuit of the line, and means for conductively connecting the last-mentioned said source with the said included relay, when connection is made with the line, through a portion of the metallic talking circuit including the talking strands of the cord circuit, the main terminals of the connecting plug, the main terminals of the line, and a portion of the talking limbs of the telephone line, substantially as described.

2. The combination with a telephone line and connection terminals therefor, of a signal-controlling electromagnet normally connected with the said line, a relay for disconnecting the said electromagnet from the line and having windings included in the talking limbs of the line, a cord circuit terminating in a connecting plug and adapted to be conductively connected to the line, a source of electricity associated with the said cord circuit and adapted to be bridged across the metallic circuit of the line, and means for conductively connecting the said source with the windings of the said included relay, when connection is made with the line, through a portion of the metallic talking circuit including the talking strands of the cord circuit, the main terminals of the connecting plug, the main terminals of the line, and a portion of the talking limbs of the telephone line, substantially as described.

3. The combination with a telephone line, of connection terminals connected to the line,

a signal-controlling electromagnet normally connected with said line, a relay for disconnecting said electromagnet from the line and included in both talking limbs of the line, a cord circuit terminating in a connecting plug and adapted to be placed in conductive relation with the line, a source of electricity associated with the said cord circuit and adapted to be connected to the line, and means for conductively connecting the said source with the said included relay, when connection is made with the line, through a portion of the talking circuit including the talking strands of the cord circuit, the main terminals of the connecting club, the main terminals of the line, and a portion of the talking limbs of the telephone line, substantially as described.

4. The combination with a telephone line, of connection terminals connected to said line, a signal-controlling electromagnet normally connected with the line, a relay for disconnecting said electromagnet from the line and having windings included in both talking limbs of the line, a cord circuit terminating in a connecting plug and adapted to be placed in conductive relation with the line, a source of electricity connected to the said cord circuit and adapted to be connected to the line, and means for conductively connecting the said source with the windings of said included relay, when connection is made with the line, through a portion of the talking circuit including the talking strands of the cord circuit, the main terminals of the connecting plug, the main terminals of the line, and a portion of the talking limbs of the telephone line, substantially as described.

5. The combination with a metallic telephone line, of connection terminals at the central station connected to the line, a signaling device normally connected to one limb of the telephone line, a signaling source of electricity normally connected to the opposite limb of the telephone line, a relay winding included in the talking circuit of the telephone line and having a switch under its control adapted to disconnect the said signaling device from the said line, another relay winding included in the talking circuit of the telephone line and having a switch under its control adapted to disconnect the said signaling source from the said line, a cord circuit terminating in a connecting plug and adapted to be placed in conductive relation with the said line, a talking source of electricity associated with the cord circuit and adapted to furnish the subscriber's station and said included relay windings with energizing current when connection is made with the line, and means for connecting the said talking source with the subscriber's station, through the talking circuit including the main strands of the cord cir-

cuit, the main terminals of the connecting plug, the line terminals, the said included relay windings and the limbs of the telephone line, substantially as described.

6. The combination with a telephone line having two limbs extending to the central station, of connection terminals at the central station connected to the line, a signaling device normally connected to one limb of the line, a signaling source of electricity normally connected to the opposite limb of the line, a relay, the windings of which are included in the respective limbs of the telephone line, the said included relay being adapted to remain in an operated condition during conversation over the line, thus disconnecting and to disconnect the signaling device and signaling source from the limbs of the telephone line during conversation, a cord circuit terminating in a connecting plug and adapted to be placed in conductive relation with the line, a talking source of electricity associated with the cord circuit and adapted to furnish the windings of said included relay with energizing current during conversation over said line, and means for connecting the said talking source with the subscriber's station, when connection is made with the line, through the metallic talking circuit including the main strands of the cord circuit, the main terminals of the connecting plug, the line terminals, the windings of said included relay, and the limbs of the telephone line, substantially as described.

7. The combination with a metallic, calling telephone line and connection terminals connected thereto, of a line signaling device normally connected to the said line, a source of electricity also normally connected to the said line, a relay included in both talking limbs of the said line and provided with movable relay members which normally engage respective contacts but which are adapted to disengage the said respective contacts when connection is made with the line and the circuit of the line is closed, the said contacts being adapted to disconnect the said line signaling device and source of electricity from the said telephone line, a cord circuit terminating in a connecting plug and adapted to be conductively connected to the line, a central source of electricity associated with the cord circuit and adapted to furnish the calling line with current when connection is made with the line in response to the call, and means for connecting the last-mentioned said source with the subscriber's station, when connection is made with the line, through the talking strands of the cord circuit, the main terminals of the connecting plug, the main line terminals, the said included relay, and the talking limbs of the telephone line, substantially as described.

8. The combination with a calling telephone line and connection terminals connected thereto, of a line signaling device normally connected to one limb of the said line, a signaling source of electricity normally connected to the other limb of the said line, relay windings included in the respective talking limbs of the said line and having switches under their control adapted to disconnect the said line signaling device and signaling source from the said line, a cord circuit terminating in a connecting plug and adapted to be conductively connected to the line, a central source of electricity associated with the cord circuit and adapted to furnish the line with current when connection is made therewith in response to the call, and means for connecting the last-mentioned said source with the subscriber's station when connection is made with the line, through the talking circuit including the main strands of the cord circuit, the main terminals of the connecting plug, the main line terminals, the said included relay windings, and the limbs of the telephone line, substantially as described.

9. The combination with a calling telephone line and connection terminals connected thereto, of a line signaling device normally connected to the said line, a signaling source of electricity also normally connected to the said line, a relay, the windings of which are included in the respective talking limbs of the telephone line, the said relay being provided with movable relay members which normally engage respective contacts but which are adapted to disengage the said respective contacts when connection is made with the line and the circuit of the line is closed, the said contacts being adapted to disconnect the said line signaling device and signaling source from the said line, a cord circuit terminating in a connecting plug and adapted to be conductively connected to the line, a central source of electricity associated with the cord circuit and adapted to furnish the line with talking current when connection is made therewith in response to the call, and means for connecting the last-mentioned said source with the subscriber's station, when connection is made with the line, through the talking circuit including the main strands of the cord circuit, the main terminals of the connecting plug, the main terminals of the line, the windings of the said included relay, and the limbs of the telephone line, substantially as described.

10. The combination with a telephone line and connection terminals therefor, of a signal-initiating device normally connected with said line, a relay included in said line and adapted to disconnect the said device from the line when in an operated condition,

a cord circuit terminating in a connecting plug and adapted to be placed in conductive relation with the line, a talking source of electricity associated with the cord circuit, a disconnect source of electricity associated with the cord circuit and with the said device, a supervisory disconnect signal, an electromagnet through which the said sources are associated with the cord circuit, said electromagnet being adapted to control the supervisory disconnect signal, and means for closing the circuit of said disconnect source through said electromagnet when connection is made with the line and the latter is not in use, said electromagnet-circuit including a talking strand of the cord circuit, a main terminal of the connecting plug, a line terminal, a portion of a talking limb of the telephone line, the said included relay, and the said signal-initiating device, substantially as described.

11. The combination with a telephone line and connection terminals therefor, of a signal-initiating device normally connected with said line, a relay the windings of which are included in the respective talking limbs of the line, said relay being adapted to disconnect the said device from the line when in an operated condition, a cord circuit terminating in a connecting plug and adapted to be conductively connected to the line, a talking source of electricity associated with the cord circuit, a disconnect source of electricity associated with the cord circuit and with the said device, a supervisory disconnect signal, an electromagnet through which the said sources are associated with the cord circuit, said electromagnet being adapted to control the supervisory disconnect signal, and means for closing the circuit of said disconnect source through said electromagnet when connection is made with the line and the latter is not in use, said electromagnet-circuit including a talking strand of the cord circuit, a main terminal of the connecting plug, a line terminal, a portion of a talking limb of the telephone line, a winding of said included relay, and the said signal-initiating device, substantially as described.

12. The combination with a telephone line and connection terminals therefor, of a signal-initiating device normally connected with the said line, a source of electricity normally connected with said line, relay windings included in the respective talking limbs of the telephone line and having switches under their control adapted to disconnect the said device and source from the line, a cord circuit terminating in a connecting plug and adapted to be placed in conductive relation with the line, a source of electricity associated with the cord circuit and with the said device, a supervisory disconnect signal, an electromagnet through which the last-mentioned said source is associated with the



cord circuit, the said electromagnet being adapted to control the supervisory-disconnect-signal when connection is made with the line, and means for closing the circuit of the last-mentioned said source through the said electro-magnet when connection is made with the line, the said electromagnet-circuit including a talking strand of the cord circuit, a main terminal of the connecting plug, a line terminal, a portion of a talking limb of the line, an included relay winding, and the said signal-initiating device, substantially as described.

13. The combination with a telephone line, of a connection terminal connected thereto, a signaling device and source of electricity normally connected to the line, a relay included in both limbs of the talking circuit of the line and adapted to disconnect the said device and source from the line when in an operated condition, a cord circuit, a central source of electricity associated with the cord circuit and adapted to furnish the line with current for talking purposes when connection is made therewith, means for operating the said relay from the last-mentioned said source during conversation over the line, and means for sending a calling current over either limb of the line in calling a subscriber and thereby operating the said relay and thus clearing the said line of the said signaling device and first-mentioned said source, substantially as described.

14. The combination with a telephone line, of a connection terminal connected thereto, a line signaling device normally connected to the said line, a relay included in both talking limbs of the line and adapted to disconnect the said device from the said line when in an operated condition, closing the circuit of the said line at the telephone thereof being in no way adapted to operate the said included relay when no connection is made with the said line, a cord circuit terminating in a connecting plug and adapted to be electrically connected to the said line, a calling source of electricity, a ringing key for connecting the said calling source with the line, and means for sending a calling current over the line, when connection is made with the line of a called subscriber, and at the same time actuating the said included relay by this said calling current thus sent over the talking circuit including a strand of the cord circuit, a main terminal of the connecting plug, a line terminal, the said included relay, and a limb of the telephone line to the telephone thereof, with a suitable return, and thereby disconnecting the said line signaling-device from the said line, substantially as described.

15. The combination with a telephone line and connection terminals connected thereto, of a line signaling-device and source of electricity normally connected to the said line,

a relay included in both talking limbs of the telephone line and adapted to respond to continuous and to non-continuous currents and disconnect the said signaling-device and source from the line when in an energized condition, a connecting cord terminating in a connecting plug and adapted to be conductively connected to the line, a talking source of electricity normally connected to the said cord, a calling source of electricity adapted to be bridged across the talking strands of the cord circuit, a ringing key adapted to connect the said calling source with the line of a called subscriber and to disconnect the said talking source therefrom, when connection is made with the line, the said calling source being adapted to energize the said included relay when a current therefrom is sent over the line, substantially as described.

16. The combination with a telephone line, of a relay included in the talking limbs of the line, a signaling device connected with the line, a telephone connected with the line, a source of calling current, and means for sending electricity from the said source through either limb of the line and thereby giving a signal at the telephone and simultaneously causing the said relay to disconnect the said signaling device from the line.

17. The combination with a telephone line, of a relay included in both talking limbs of the line, a source of electricity and an electroresponsive device connected with the line, a telephone connected with the line, a source of calling current, and means for closing the circuit of the said calling source through the said relay, a limb of the line, and the telephone, and thereby producing a signal at the telephone and simultaneously causing the said relay to disconnect the first mentioned said source and said electroresponsive device from the line.

18. The combination with a telephone line and connection terminals therefor, of a signaling device normally connected to one limb of the telephone line, a signaling source of electricity normally connected to the other limb of the telephone line, a relay included in the talking limbs of the telephone line and adapted to respond to continuous and to non-continuous currents, to disconnect the said signaling device and signaling source from the limbs of the telephone line when in an operated condition, a cord circuit terminating in a connecting plug and adapted to be conductively connected to the line, a talking source of electricity normally associated with the said cord circuit, a calling source of electricity normally disconnected from the said cord circuit and adapted to transmit a non-continuous current, and a ringing key adapted to connect the said calling source to the limbs of the line of the called subscriber and to disconnect the said talking source therefrom, the said

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calling source being adapted to actuate the said included relay whether sent over either one, or both, of the limbs of the telephone line, with a suitable return, substantially as described.

19. The combination with a metallic telephone line and connection terminals connected thereto, of a signaling device and source of electricity normally connected to the said line, a relay the windings of which are included in the respective talking limbs of the metallic line, the said relay being adapted to respond to both continuous and non-continuous currents and to disconnect the said signaling device and source from the said line when in an operated condition, a cord circuit terminating in a connecting plug and adapted to be placed in conductive relation with the said line, a talking source of electricity normally associated with the cord circuit and adapted to furnish the subscriber's station with current for talking purposes when the line is in use, a calling source of electricity normally disconnected from the said cord circuit and adapted to give a non-continuous current to operate the said included relay when a current therefrom is sent over the line of the called subscriber, a ringing key for disconnecting the said talking source from the limbs of the said line and connecting the said calling source thereto, and means for closing the circuit of the calling source through the called subscriber's station over a circuit including the talking strands of the cord circuit, the main terminals of the connecting plug, the main line terminals, the windings of the said included relay, and the talking limbs of the telephone line, substantially as described.

20. The combination with a metallic telephone line and a relay included in the talking circuit thereof, of talking contacts of a spring jack connected to the respective limbs of the said line, a signaling device normally connected to the said line but arranged to be disconnected therefrom by the said included relay when the latter is in an operated condition, a central source of electricity adapted to be conductively connected with the line and to furnish the sub-station transmitters with current for talking purposes when the line is in use, a plug provided with connection terminals and adapted to be connected with the said spring jack, a cord circuit associated with the said plug and normally connected with the said central source of electricity, a second central source of electricity associated with the said signaling device and cord circuit, and also used for testing purposes, the said sources being both used to operate the said signaling device, and an operator's listening-in key adapted to cooperate with the said cord circuit in its operations, substantially as described.

21. The combination with a telephone line

and relay windings included in the talking circuit thereof, of a signaling device normally connected to the said line but adapted to be disconnected therefrom by at least one of the said included relay windings, a plurality of talking contacts forming connection terminals for the said line, a cord circuit terminating in a connecting plug and adapted to be connected to the said line, a central source of electricity associated with the cord circuit and adapted to furnish talking current to the sub-station transmitters of the line when the said line is in use, a central source of testing current associated with the said cord circuit and with the said signaling device, both of the said sources being used to give the line signal, an operator's telephone set, a key adapted to connect the operator's telephone-set with the said cord circuit, a testing plug provided with a test contact adapted to be placed in conductive relation with the operator's telephone, and means for changing the potential of the said plurality of talking contacts of the line for testing purposes, when connection is made with the line, substantially as described.

22. The combination with a metallic telephone line and windings of a relay included in the talking circuit thereof, of a line signal normally associated with the said line, means for controlling the said line signal by the said included relay, a plurality of talking contacts forming connection terminals for the said line, the said terminals being arranged at the several sections of a switchboard, a plug-cord circuit, a central source of talking current associated with the plug-cord circuit and normally with the said line, a source of testing current associated with the plug-cord circuit and used for operating the said line signal, an operator's telephone set, a key adapted to connect the operator's telephone-set with the said plug-cord circuit, and means for utilizing the said plug-cord circuit in connection with the said talking contacts at the switchboard, substantially as described.

23. The combination with a metallic telephone line including a relay winding in each talking limb thereof, of a plurality of spring jacks, each jack having a spring for each limb of the telephone line and all being connected to the said limbs at the several sections of a multiple switchboard, a subscriber's station, including a switch, connected to the said line and supplied with electricity from electrical sources at the central station, a signal-controlling electromagnet normally connected to the said line but adapted to be disconnected therefrom by current in at least one of the said included relay windings, supervisory-signal-controlling-electromagnets and a supervisory signal under control thereof, a plug-cord circuit with which

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the said supervisory-electromagnets are associated, the said plug-cord circuit being adapted to be connected to the limbs of the said line at the said spring jacks, a central source of current associated with the plug-cord circuit and normally with the line, but adapted to be disconnected from the said line by current in at least one of the said included relay windings, means for testing the condition of the line at any of the said spring jacks, means for operating one of the said supervisory-signal-controlling electromagnets over a circuit including a portion of a talking limb of the line, and means for placing at least one of the said supervisory-signal-controlling-electromagnets under the control of the subscriber when connection is made with the telephone line, all cooperating for the purposes of signaling and talking, substantially as described.

24. The combination with a metallic telephone line, of a relay the windings of which are included in the respective talking limbs of the said line, a line signaling device and source of electricity normally connected with the respective talking limbs of the line but adapted to be disconnected therefrom by the operation of the said included relay, a spring jack having a terminal for each of the limbs of the said line and connected thereto, a cord circuit normally terminating in two connecting plugs and adapted to be connected to respective spring jacks of subscribers' telephone lines, a ringing key through which the limbs of the cord circuit normally extend, a listening-in key through which the limbs of the cord circuit normally extend, and which is adapted for bridging an operator's telephone-set across the talking limbs of the cord circuit and in so doing breaking the continuity of one of the talking limbs of the cord circuit between the said connecting plugs and thereby rendering conversation between the subscribers which are connected to the said cord circuit, impossible, a source of electricity associated with the cord circuit, a calling source of current associated with the ringing key, and means for connecting subscribers for conversation through the said cord circuit when the said connecting plugs are connected to the said subscribers' lines, substantially as described.

25. The combination in a metallic telephone system, of two subscribers' lines extending to the central station, terminating in suitable respective spring jacks and including a winding of a relay in each of the talking limbs of each telephone line, a line signal for each line, controlled by the respective subscribers when no connection is made with the said lines and by their respective relay windings when connection is made with the said lines, a cord circuit terminating in connecting plugs and adapted

to be connected to the spring jacks, a central source of current associated with the cord circuit and adapted to be used for signaling and talking purposes, and means for connecting the said subscribers for conversation with each other through the cord circuit, substantially as described.

26. The combination with a metallic telephone line adapted to be included in a talking circuit, of relay windings included in the respective limbs of said talking circuit and adapted to actuate their armature when conducting a continuous or non-continuous current over a limb of the metallic line, connection terminals for the respective limbs of said line, a cord circuit terminating in a connecting plug and adapted to be connected with said line, a source of calling current, a ringing key adapted to connect said calling source with said cord circuit, and means for connecting said calling source with the subscriber's station, when connection is made with the line, whereby at least one of the said included relay windings operates the said armature and thereby clears both sides of said line of all apparatus and auxiliary circuits not included in the metallic talking circuit, from said connection terminals to said subscriber's station, thus enabling said calling current to be sent out direct over either side of the line, with a suitable return, for party-line ringing, substantially as described.

27. The combination with a metallic telephone line adapted to be included in a talking circuit, of a line signal, a cut-off relay the windings of which are included in the respective limbs of said line, a cord circuit, a source of electricity, a supervisory signal-controlling electromagnet through which the said source is associated with the cord circuit, and means for closing the circuit of the said source through the said electromagnet and the said included windings, when the line is in use, over a portion of the main strands of the cord circuit and the talking limbs of the telephone line, substantially as described.

28. The combination with a telephone line having a limb extending to a central station, of a relay included in the said limb, a signaling device normally connected to the said limb but adapted to be disconnected therefrom by the said included relay, a plug-cord circuit adapted to be conductively connected to the said line, a supervisory signal, supervisory relays associated with the said cord circuit, a divided source of electricity associated with the said cord circuit through the said supervisory relays, means for operating one of the said supervisory relays over a circuit including a portion of the path of talking currents, and means for causing the subscriber to control the operation of the said included relay, by opening and closing

a switch at his telephone station, when connection is made with the line, and also to control the operation of at least one of the said supervisory relays during such connection, by opening and closing the said switch, to operate the supervisory signal at the central station, substantially as described.

29. The combination in a telephone system, of a line extending from a subscriber's station to a central station, a relay the windings of which are included in the respective talking limbs of the line, the said relay being used as a line cut-off relay, line signaling apparatus normally connected to the said line when the latter is not in use, but adapted to be disconnected therefrom by the said included relay when the line is in use, a subscriber's sub-station associated with the said line and including a transmitter, receiver, bells, condenser and switch-hook, line terminals at the central station, in the form of spring jacks, connected to the respective limbs of the said line, a cord circuit terminating in connecting plugs and adapted to be placed in conductive relation with the said line, supervisory signal-controlling electromagnets normally associated with the said connecting plugs, supervisory signals, an operator's listening-in key, a ringing key, a calling source of electricity, and a divided source of electricity associated with the cord circuit and normally with the said line, a portion of said divided source being adapted to furnish current for sub-station transmitters, another portion of said divided source being adapted to operate the supervisory signals, and both portions of said divided source being used for operating the line signaling apparatus and the supervisory signaling apparatus, the supervisory signal-controlling electromagnets being operated over circuits including portions of the talking conductors, all for the purpose of connecting subscriber's stations together and thereby facilitating conversation between the said subscriber's, and for disconnecting the said lines and said stations when same are not in use, substantially as described.

30. The combination with a telephone line extending from a sub-station to a central station, of a relay at the central station included in both limbs of the talking telephone line, said relay being operated only while connection is made with the line, a signaling circuit normally connected to the line but adapted to be disconnected therefrom by the said relay when the latter is in an operated condition, talking apparatus and signaling apparatus connected with the telephone line at the sub-station, a switch-hook at the sub-station, means for sending a calling current through the said relay, the telephone line and the said sub-station signaling apparatus, thereby operating the said relay and

signaling the subscriber, and means for sending a second current through the said relay, the telephone line and the said sub-station talking apparatus, thereby operating the said relay and supplying the subscriber's transmitter with current for talking purposes, substantially as described.

31. The combination with a metallic electrical transmitting line extending conductively to a connection terminal or terminals and having one or more branch connections from the main transmission limb or limbs of the line, of electroresponsive mechanism having energizing means therefor included in both main transmission limbs of the line whereby current in either one or both of the main limbs of the line causes the operation of the said electroresponsive mechanism, the latter controlling the said branch connection or connections from the line, with respect to the main line.

32. The combination with a metallic telephone line extending conductively to a connection terminal or terminals and having one or more branch connections from the talking limb or limbs of the line, of relay mechanism having energizing means therefor included in both talking limbs of the line whereby current in either one or both of the talking limbs of the line causes the operation of the said relay mechanism, the latter controlling the said branch connection or connections from the line, with respect to the main line.

33. The combination with a metallic electrical transmitting line extending conductively to a connection terminal or terminals, of electroresponsive mechanism having energizing means therefor included in both main transmission limbs of the line whereby current in either one or both of the main limbs of the line causes the operation of the said electroresponsive mechanism, and suitable apparatus under control of the said electroresponsive mechanism.

34. The combination with a metallic telephone line extending conductively to a connection terminal or terminals, of relay mechanism having energizing means therefor included in both talking limbs of the line whereby current in either one or both of the talking limbs of the line causes the operation of the said relay mechanism, and suitable apparatus under control of the said relay mechanism.

35. The combination with a telephone line, of electroresponsive mechanism having low-resistance energizing means therefor in the path of talking currents, and suitable apparatus under control of the said electroresponsive mechanism.

36. The combination with a metallic telephone line, of electroresponsive mechanism having low-resistance energizing means therefor in both limbs of the line in the path

of talking currents, and suitable apparatus under control of the said electroresponsive mechanism.

37. The combination with an electrical transmitting line, of electroresponsive mechanism having energizing means therefor included in a main transmission limb of the line, the said mechanism being adapted to be held continuously in an operated condition by either a continuous or a non-continuous current, and suitable apparatus under control of the said electroresponsive mechanism.

38. The combination with a telephone line, of relay mechanism having energizing means therefor included in a talking limb of the line, the said mechanism being adapted to be held continuously in an operated condition by either a continuous or a non-continuous current, and suitable apparatus under control of the said relay mechanism.

39. The combination with a metallic electrical transmitting line, of electroresponsive mechanism having energizing means therefor included in both main transmission limbs of the line, the said mechanism being adapted to be held continuously in an operated condition by either a continuous or a non-continuous current, and suitable apparatus under control of the said electroresponsive mechanism.

40. The combination with a metallic telephone line, of relay mechanism having energizing means therefor included in both talking limbs of the line, the said mechanism being adapted to be held continuously in an operated condition by either a continuous or a non-continuous current in either one or both of the talking limbs of the line, and suitable apparatus under control of the said relay mechanism.

41. The combination with an electrical transmitting line having one or more branch connections from the main transmission limb or limbs of the line, of electroresponsive mechanism having energizing means therefor included in a main transmission limb of the line and adapted to be operated by a calling current sent out over the line whereby the said branch connection or connections are disconnected from the line during the sending of the said calling current.

42. The combination with a telephone line having one or more branch connections from the talking limb or limbs of the line, of relay mechanism having energizing means therefor included in a talking limb of the line and adapted to be operated by a calling current sent out over the line whereby the said branch connection or connections are disconnected from the line during the sending of the said calling current.

43. The combination with a metallic electrical transmitting line having one or more branch connections from the main trans-

mission limb or limbs of the line, of electroresponsive mechanism having energizing means therefor included in both main transmission limbs of the line and adapted to be operated by a calling current sent out over either one or both of the main limbs of the line whereby the said branch connection or connections are disconnected from the line during the sending of the said calling current.

44. The combination with a metallic telephone line having one or more branch connections from the talking limb or limbs of the line, of relay mechanism having energizing means therefor included in both talking limbs of the line and adapted to be operated by a calling current sent out over either one or both of the talking limbs of the line whereby the said branch connection or connections are disconnected from the line during the sending of the said calling current.

45. The combination with a metallic electrical transmitting line having one or more branch connections from the main transmission limb or limbs of the line, of electroresponsive mechanism having energizing means therefor included in both main transmission limbs of the line and adapted to control the said branch connection or connections from the line, the said electroresponsive mechanism being adapted to be operated by calling current sent out over the line whereby the said calling current in either limb of the line causes the electroresponsive mechanism to simultaneously clear the line of one or more of the said branch connections.

46. The combination with a metallic telephone line having one or more branch connections from the talking limb or limbs of the line, of relay mechanism having energizing means therefor included in both talking limbs of the line and adapted to control the said branch connection or connections from the line, the said relay mechanism being adapted to be operated by calling current sent out over the line whereby the said calling current in either limb of the line causes the relay mechanism to simultaneously clear the line of one or more of said branch connections.

47. A telephone line having an electroresponsive device associated therewith, a supervisory signal-initiating device under control of the said electroresponsive device when connection is made with the line, and means for sending calling current out over the line for signaling purposes and to actuate the said electroresponsive device.

48. A metallic telephone line having electroresponsive mechanism associated with the limbs thereof, supervisory signaling mechanism under control of the said electroresponsive mechanism when connection is

made with the line, and means for sending calling current out over either limb of the line for signaling purposes, the said current in either limb of the line simultaneously actuating the said electroresponsive mechanism.

49. The combination with an electrical transmitting line, of electroresponsive mechanism having energizing means therefor included in a main transmission limb of the line, the said mechanism being adapted to be held continuously in an operated condition by either a continuous or a non-continuous current, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said electroresponsive mechanism when connection is made with the line.

50. The combination with a telephone line, of relay mechanism having energizing means therefor included in a talking limb of the line, the said mechanism being adapted to be held continuously in an operated condition by either a continuous or a non-continuous current, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said relay mechanism when connection is made with the line.

51. The combination with a metallic electrical transmitting line, of electroresponsive mechanism having energizing means therefor included in both main transmission limbs of the line, portions of the said mechanism being adapted to be held continuously in an operated condition by either a continuous or a non-continuous current in either one or both of the limbs of the line, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said electroresponsive mechanism when connection is made with the line.

52. The combination with a metallic telephone line, of relay mechanism having energizing means therefor included in both talking limbs of the line, portions of the said mechanism being adapted to be held continuously in an operated condition by either a continuous or a non-continuous current in either one or both of the limbs of the line, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said relay mechanism when connection is made with the line.

53. The combination with an electrical transmitting line having one or more branch connections from the main transmission limb or limbs of the line, of electroresponsive mechanism having energizing means

therefor included in a main transmission limb of the line and adapted to be operated by a calling current sent out over the line whereby the said branch connections are disconnected from the line during the sending of the said calling current, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said electroresponsive mechanism when connection is made with the line.

54. The combination with a telephone line having one or more branch connections from the talking limb or limbs of the line, of relay mechanism having energizing means therefor included in a talking limb of the line and adapted to be operated by a calling current sent out over the line whereby the said branch connections are disconnected from the line during the sending of the said calling current, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said relay mechanism when connection is made with the line.

55. The combination with a metallic electrical transmitting line having one or more branch connections from the main transmission limb or limbs of the line, of electroresponsive mechanism having energizing means therefor included in both main transmission limbs of the line and adapted to be operated by a calling current sent out over either one or both of the main limbs of the line whereby the said branch connections are disconnected from the line during the sending of the said calling current, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said electroresponsive mechanism when connection is made with the line.

56. The combination with a metallic telephone line having one or more branch connections from the talking limb or limbs of the line, of relay mechanism having energizing means therefor included in both talking limbs of the line and adapted to be operated by a calling current sent out over either one or both of the talking limbs of the line whereby the said branch connections are disconnected from the line during the sending of the said calling current, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said relay mechanism when connection is made with the line.

57. The combination with a metallic electrical transmitting line having one or more branch connections from the main transmission limb or limbs of the line, of electroresponsive mechanism having energizing

means therefor included in both main transmission limbs of the line and adapted to control the said branch connection or connections from the line, the said electroresponsive mechanism being adapted to be operated by calling current sent out over the line whereby the said calling current in either limb of the line causes the electroresponsive mechanism to simultaneously clear the line of one or more of the said branch connections therefrom, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said electroresponsive mechanism when connection is made with the line.

58. The combination with a metallic telephone line having one or more branch connections from the talking limb or limbs of the line, of relay mechanism having energizing means therefor included in both talking limbs of the line and adapted to control the said branch connection or connections from the line, the said relay mechanism being adapted to be operated by calling current sent out over the line whereby the said calling current in either limb of the line causes the relay mechanism to simultaneously clear the line of one or more of the said branch connections therefrom, a connecting circuit for the line, and a signal-initiating device associated with the said connecting circuit and adapted to be placed under control of the said relay mechanism when connection is made with the line.

59. A telephone line circuit for signaling a central station, a relay associated with the line, a normally-open branch circuit from the said line circuit containing a winding of the said relay, a line signal under control of the said relay, and means for closing the said normally-open branch circuit when connection is made with the line whereby the said relay winding is then placed in the talking circuit.

60. A telephone line circuit for signaling a central station, a relay associated with the line, a normally-open branch circuit from the said line circuit containing a winding of the said relay, a line signal under control of the said relay, and means for closing the said normally-open branch circuit through a connection terminal when connection is made with the line, to affect the condition of the said relay and place the said relay winding in the talking circuit.

61. A telephone line extending from a substation to a central station, a connecting circuit for the line, a normally non-polarized supervisory relay associated with the connecting circuit exterior of the talking circuit and constructed so that one operation thereof is caused by current therethrough in one direction, and another operation thereof is caused by current therethrough in the op-

posite direction, suitable electrical supply, a signaling device under control of the said relay, and means for supplying current to the said relay over a portion of the line in opposite directions to cause the relay to operate and control the said signaling device.

62. An electrical transmitting line extending from a substation to a central station, a connecting circuit for the line, a normally non-polarized electrically-operable device associated with the connecting circuit exterior of the main circuit and constructed so that current sent therethrough in opposite directions causes different operations thereof, an electroresponsive device under control of the said electrically-operable device, and means for supplying current to the said electrically-operable device over a portion of the line in opposite directions, to control the said electroresponsive device.

63. The combination with a telephone line and a connecting circuit therefor, of a normally non-polarized supervisory relay associated with the connecting circuit exterior of the talking circuit and constructed so that different operations thereof are caused by opposite energizations thereof, a signaling device under control of the said relay, and means for supplying current to the said relay over a portion of the line in opposite directions to cause the relay to operate and control the said signaling device.

64. The combination with an electrical transmitting line and a connecting circuit therefor, of a normally non-polarized electrically-operable device associated with the connecting circuit exterior of the main circuit and constructed so that different operations thereof are caused by opposite energizations thereof, an electroresponsive device under control of the said electrically-operable device, and means for supplying current to the said electrically-operable device in opposite directions, to control the said electroresponsive device.

65. In a telephone system, the combination with a telephone line having a line signal, of a cord circuit for establishing connection with the line for conversation, a cut-off device associated with the line and adapted when operated to render the line signal inoperative, a supervisory relay associated with the cord circuit, a suitable signal adapted to be controlled by the supervisory relay, and means for establishing a path for current through the supervisory relay and the said cut-off device when connection is made with the line, the current in the said path being in one direction when the subscriber's telephone is on its hook, whereby the supervisory relay is caused to display its signal, and in the opposite direction when the subscriber's telephone is in use, whereby the supervisory relay is caused to efface its signal.

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66. A telephone line circuit for signaling a central station, a relay associated with the line, a normally-open branch circuit from the said line circuit containing a winding of the said relay, a signaling device under control of the said relay, and means for closing the said normally-open branch circuit when connection is made with the line whereby the said relay winding is then placed in the talking circuit.

67. A telephone line circuit for signaling a central station, a relay associated with the line, a normally-open branch circuit from the said line circuit containing a winding of the said relay, a signaling device under control of the said relay, and means for closing the said normally-open branch circuit through a connection terminal when connection is made with the line, to affect the condition of the said relay and place the said relay winding in the talking circuit.

68. A telephone line having an electroresponsive device normally associated therewith at a central station, and means for sending calling current out over the line for signaling purposes, the said calling current simultaneously actuating the said electroresponsive device.

69. A metallic telephone line having electroresponsive mechanism normally associated with the limbs thereof at a central station, and means for sending calling current out over the limbs of the line for signaling purposes, the said calling current in either limb of the line simultaneously actuating the said electroresponsive mechanism.

70. The combination with a telephone line, of relay mechanism having low-resistance energizing means therefor in the line in the path of talking currents, and suitable apparatus under control of the said relay mechanism.

71. The combination with a metallic telephone line, of relay mechanism having low-resistance energizing means therefor in both limbs of the line in the path of talking currents, and suitable apparatus under control of the said relay mechanism.

As inventor of the foregoing I hereunto subscribe my name in the presence of two subscribing witnesses, this 16th day of June, A. D. 1904.

FREDERICK R. PARKER.

Witnesses:

R. G. PARKER,

WM. F. VIOLETT.