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TELEPHONE SYSTEM.

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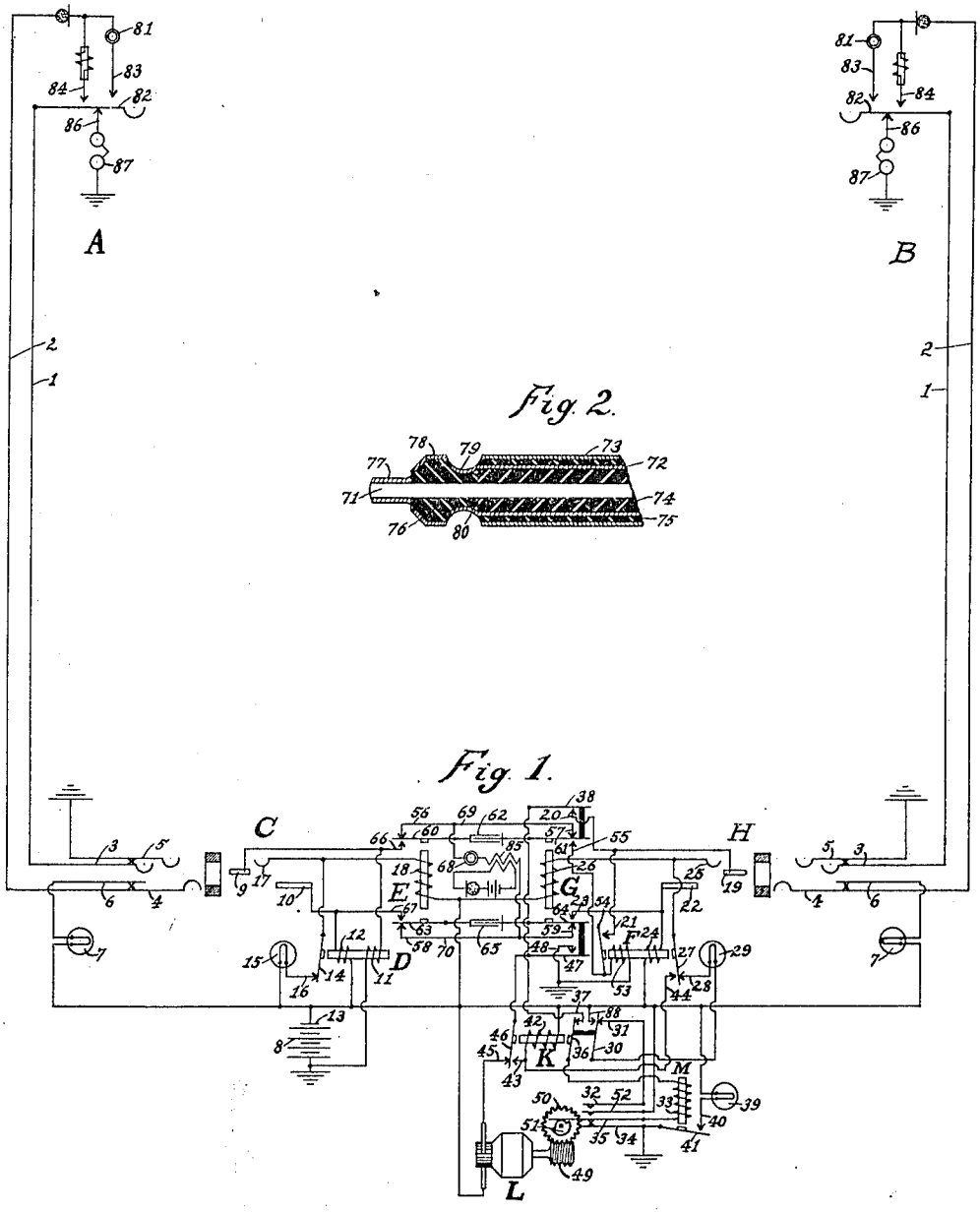


Fig. 2.



Fig. 1.

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## TELEPHONE SYSTEM.

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*To all whom it may concern:*

Be it known that I, ELMER R. CORWIN, 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 telephone systems of the type in which there are no operator's listening or ringing keys employed in connection with the connecting circuits.

The principal objects of my invention are to provide an improved telephone system in which the called party is automatically signaled when connection is made with his line; to provide improved means for controlling the signaling currents sent over the called party's line and for automatically producing intermittent signaling over such lines; to provide improved signaling mechanism and improved means for controlling the operation of same; to provide a signaling pilot in connection with such a signaling system; to provide improved means for automatically controlling the operator's telephonic connection with the various connecting circuits of the system; and to provide improved jack and plug connections for such a telephone system whereby objectionable "clicks" transmitted over the telephone lines to the subscribers' receivers are prevented.

Other objects will be apparent from the following specification.

In this present invention I provide a motor in connection with one or more of the connecting circuits of the system and arrange the apparatus so as to automatically start the motor when connection is made with a called line, and to automatically stop the motor when the called party has been signaled sufficiently. In connection with this motor I provide suitable switching mechanism adapted to be operated by the motor to cause a suitable signaling current to be sent over one or more of the called lines as desired, any suitable form of signaling current in this connection being contemplated in this invention. In connection with the various connecting circuits of the system I also provide one or more operator's telephone sets which are normally disconnected from the various connecting circuits, and provide suitable apparatus for automatically connecting an operator's telephone set with a connecting circuit when either one of the connecting plugs of a pair is connected with a line, and for automatically disconnecting the operator's telephone set from the connecting circuit when both of the connecting plugs of a pair are connected with respective lines; under the latter condition the telephone talking circuit in the connecting circuit being suitably conditioned to permit conversation to be carried on between the connected lines.

In the accompanying drawings, Figure 1 is a diagrammatic view of a pair of telephone lines and a plug-cord connecting circuit therefor, equipped with the necessary apparatus for operating the system; and Fig. 2 is a cross-sectional view of an end portion of one of the connecting plugs of this invention, showing in detail the various contact members of the plug and the construction adapted to accomplish purposes hereinafter described.

Like characters refer to like parts in the several figures.

In the drawings, the telephone line A extends in limbs 1 and 2 from a suitable substation to spring-jack connection terminals 3 and 4, respectively. Terminal 3 is normally connected with a jack-connection terminal 5 to ground as shown, and terminal 4 is normally connected with a contact member 6 which has its circuit extended through line signal lamp 7 and the common battery 8 to ground, as shown. Line B shown upon the right of the sheet of drawings is similar to line A, and like figures of reference are employed to designate like parts. In the plug-cord connecting circuit the answering plug C has its tip contact 9 and sleeve contact 10 connected through respective windings 11 and 12 of supervisory relay D, to ground and to pole 13 of battery 8, respectively, the other pole of battery 8 being grounded, so that when the answering plug C is connected with a telephone line and the circuit of the line is closed, the relay D will be energized, and thus attract its armature 14. The answering supervisory lamp 15 is connected from pole 13 of battery 8 through contact 16 14 of relay D,

so that when the relay D is energized it breaks contact 16 14 in the circuit of supervisory lamp 15. The ring contact 17 of answering plug C is connected through the winding 18 of the operator's relay E to pole 13 of battery 8, and also through contact 14 16 and lamp 15 to pole 13 of battery 8, so that when the answering plug C is connected with a line the plug contact 17 will be connected through jack spring 5 to ground and thus close a circuit of battery 8 through relay 18, and thereby energize same, and also close a circuit of battery 8 through supervisory lamp 15 and thereby light same if the supervisory relay D is not energized so as to open the contact 14 16. The tip contact 19 of calling plug H is connected to contact 20 of the operator's relay G and to contact 21 of the calling supervisory relay F. The sleeve contact 22 of the calling plug H is connected to contact 23 of the operator's relay G and through winding 24 of the calling supervisory relay F to pole 13 of battery 8. The ring contact 25 of calling plug H is connected through the winding 26 of the operator's relay G to pole 13 of battery 8, and also through contact 27 28 of supervisory relay F, calling supervisory lamp 29, and contact 30 31 of locking relay K, to contact 32 of the switching mechanism controlled by the motor L. The winding 33 of the ringing pilot relay M is connected from ground through contact 34 35 of the switching mechanism which is controlled by the motor L, said winding 33, and contact 36 37 of locking relay K, to contact 38 of relay G. The ringing pilot relay M controls the ringing pilot lamp 39 which is connected from pole 13 of battery 8 through said lamp and normally open contact 40 41 of relay M to ground. The winding 42 of locking relay K is connected from pole 13 of battery 8 to contact 43 of said relay K, and also to contact 44 of supervisory relay F. The winding of the motor L is connected from pole 13 of battery 8 through said winding, contact 45 46 of locking relay K, and normally open contact 47 48 of the operator's relay G to ground. The motor L is provided with a screw gear 49 gearing with a pinion 50 which pinion carries a cam 51 adapted to operate the switch member 35 when the motor is started and thereby control the contacts 34 35 52 and 32, as will be hereinafter described, the contact 52 being connected to pole 13 of battery 8. The winding 53 of supervisory relay F is connected from ground through said winding 53 to armature contact 54, and also to contact 55 of the operator's relay G. The operation of all of this apparatus will be hereinafter described in detail in describing a complete connection between two telephone lines such as A and B.

The operator's telephone set is normally bridged from contacts 56 and 57 of relays E and G, respectively, in multiple, to contacts 58 and 59 of relays E and G, respectively, in multiple. Contact 60 of relay E is connected with contact 61 of relay G through a condenser 62, said contacts 60 and 61 being normally connected with contacts 56 and 57, respectively. Contact 63 of relay E is connected with contact 64 of relay G through a condenser 65, said contacts 63 and 64 being normally connected with contacts 58 and 59, respectively. When the relay E is energized it causes contacts 60 and 63 thereof to disengage contacts 56 and 58, respectively, and to engage contacts 66 and 67, respectively. When relay G is energized it causes contacts 61 and 64 thereof to disengage contacts 57 and 59, respectively, and to engage contacts 55 and 23, respectively, the energization of this relay also causing contacts 38 and 47 thereof to engage contacts 20 and 48, respectively, for purposes hereinafter described. Thus it will be seen that when either of the relays E and G is energized, the other being deenergized, the operator's telephone set including a receiver 68 will be bridged from condensers 69 and 70 across the tip and sleeve strands of the plug and cord corresponding with the energized relay, through a circuit similar to 66 60 62 61 57 69 68 70 59 64 65 63 67, or through a circuit similar to 55 61 62 60 56 69 68 70 58 63 65 64 23, provided the contact 21 54 is closed. It will also be seen that when both of the relays E and G are energized, the operator's telephone set is entirely disconnected from the plug-cord talking circuit, because contacts 56 60, 58 63, 57 61, and 59 54, are all open; in this latter case the plug-cord talking circuit being extended on the tip side from tip contact 9 of the answering plug C, through contact 66 60, condenser 62, contact 61 55, and contact 54 21, provided this contact is closed, to tip contact 19 of calling plug H, and on the sleeve side from sleeve contact 10 of answering plug C, through contact 67 63, condenser 65, and contact 64 23, to sleeve contact 22 of calling plug H. Thus it will be seen that the operator's telephone set is normally disconnected from all of the connecting plugs and cords of her position, and that she is also disconnected from the connecting plugs and cords which have both relays E and G of their pairs energized, that is, both plugs connected with respective lines, as will be hereinafter more fully described, in the latter case the talking circuits through the plug-cord circuits being continuous between the pairs of connecting plugs.

The relays D and F are impedance-coil relays, that is, in addition to serving as relays they also serve as impedances through

which the common battery supply is furnished to the telephone lines for conversation between same when connection is made therewith through the connecting circuit.

The connecting plugs C and H are constructed as shown in Fig. 2. Each plug comprises a central metallic rod 71 carrying metal sleeves 72 and 73, suitably insulated from each other by sleeves of insulation 74 and 75 interposed therebetween as shown. The metal sleeve 73 serves as the sleeve contact 10 or 22 of the respective connecting plugs. Over the outer end of the central rod 71 is placed an insulating bushing 76, formed as shown and held in place by a metallic ferrule or end cap 77 which tightly fits the rod 71. The ferrule 77 serves as the tip contact 9 or 19 of the respective connecting plugs. Over the insulating bushing 76 is placed a metal ferrule or cap 78, to protect the bushing 76 and also to provide a substantial bearing surface, the said ferrule 78 being entirely insulated from all of the other metallic portions of the plug. The end of the metallic sleeve 72 is preferably formed inwardly at 79 as shown, to provide the ring contact 17 or 25 of the respective connecting plugs, this formed portion 79 resting upon a neck portion 80 constituting the inner portion of the bushing 76.

When the plug shown in Fig. 2 is inserted into a spring jack of this invention, the ferrule 78 first engages the jack spring 4 and thereby breaks the jack contact 4 6; then the ferrule 78 engages the jack spring 5 and thereby breaks the jack contact 5 3, the tip 77 of the plug in the meantime passing through the jack without engaging any of the spring members therein; then the jack spring 4 passes over the ring contact 79 of the plug without again closing the jack contact 4 6, into position ready to make contact with the sleeve 73 of the plug, in the meantime the jack spring 5 moving to a position ready to make contact with the ring contact 79 of the plug and the jack spring 3 moving to a position ready to make contact with the tip contact 77 of the plug; then as the plug is inserted farther into the jack, the spring members 3, 5 and 4 of the jack all engage the contact portions 77, 79 and 73, respectively, of the plug, at the same instant. This construction is important in this invention because it eliminates any objectionable click from the subscriber's telephone, when connection is made with the subscriber's line.

The operation of the system is as follows: The party at substation A, desiring to make a call, removes his receiver 81 from the switch hook 82 in the usual manner and thereby closes the circuit of the line at this substation, between contacts 82 83 and 82 84, in a manner well understood. This closes a circuit from pole 13 of battery 8 through line lamp 7, jack contact 6 4 of line A, limb 2 of the line, substation A, limb 1 of the line, and jack contact 3 5, to ground. Current from battery 8 flowing through this circuit lights the line lamp 7 which conveys to the operator the signal for connection. The operator thereupon inserts the answering plug C of a plug-cord connecting circuit into the jack of line A, so that contacts 9, 17 and 10 of plug C engage jack contacts 3, 5 and 4, respectively, as hereinbefore described. This connection opens jack contacts 4 6 and 3 5, and closes a circuit from battery 8 through winding 12 of supervisory relay D, limb 2 of line A, sub-station A, limb 1 of line A, and winding 11 of supervisory relay D, to ground. Current flowing through this circuit energizes relay D and causes same to break contact 14 16 and thus prevent the answering supervisory lamp 15 from displaying a signal. Substation A is now furnished with talking battery from battery 8 through the windings 11 and 12 of the impedance-coil relay D. The connection between the answering plug C and the jack of line A also establishes a circuit from battery 8 through winding 18 of the operator's relay E, and contact 17 5 to ground through a line connection. Current flowing through this circuit energizes relay E and thereby causes its armatures to be attracted and to break contacts 56 60 and 58 63, and to make contacts 60 66 and 63 67. Now the operator's telephone set is bridged across the tip and sleeve strands of answering plug C, through contact 66 60, condenser 62, contact 61 57, conductor 69, receiver 68 and the induction coil 85 associated therewith, conductor 70, contact 59 64, condenser 65, and contact 63 67, so that the operator can converse with the party at substation A and find out from him the number of the line with which connection is desired. Assuming that the party at substation A desires to converse with the party at station B, the operator then inserts the calling plug H into the jack of line B, so that contacts 19, 25 and 22 of the plug H engage contacts 3, 5 and 4, respectively, of the jack of line B, such connection breaking jack contacts 4 6, and 3 5. This connection with line B closes a circuit from battery 8 through winding 26 of operator's relay G, and contact 25 5, to ground through a line connection. Current flowing through this circuit energizes relay G and thereby causes its armatures to be attracted and to break contacts 57 61 and 59 64, and to make contacts 38 20, 61 55, 64 23 and 47 48. Now the operator's telephone set is entirely disconnected from the plug-cord talking circuit because all of the contacts 56 60, 58 63, 57 61 and 59 64, are open. Thus it will be seen that it is impossible for the operator

to cut in on either of the lines while both of the connecting plugs of a pair are connected with the lines. The operation of relay G as just described closes a circuit from battery 8 through motor L, contact 45 46, and contact 47 48 to ground. Current flowing through this circuit starts the motor L immediately and causes the screw 49 thereof to turn the pinion 50 and thus rotate the cam 51 which is associated with the pinion 50, and thereby operate the switch member 35 which alternately opens contact 34 35 and closes a double contact 35 52 32, intermittently. When the double contact 35 52 32 is closed, a circuit is established from battery 8 through contact 52 35, the winding 33 of ringing pilot relay M, contact 36 37, contact 38 20, contact 19 3, limb 1 of line B, contact 82 86 of substation B, and ringer 87 to ground. Current flowing through this circuit operates the ringer 87 at substation B and thus signals the party at substation B for a connection, the current in this circuit also energizing relay M and thereby closing a circuit of battery 8 through ringing pilot lamp 39 which lights and thereby shows to the operator that the ringing circuit is completed through the called line. When the double contact 35 52 32 is closed, another circuit of battery 8 is closed from battery 8 through contact 52 32, contact 31 30, calling supervisory lamp 29, contact 28 27, and contact 25 5, to ground through a line connection of line B. Fluctuating current flowing through this circuit lights the supervisory lamp 29 which shows, by a positively distinct preferably fluctuating characteristic signal of another character from the supervisory or disconnect signal, to the operator that the ringing is being carried on over this particular calling plug H. This is of great importance at times when the operator has several calling plugs connected with respective lines to signal the several parties at the substations of the respective lines all at the same time. The ringer 87 at substation B is rung until the cam 51 of the motor L turns sufficiently to cause the switching member 35 to separate the contact members 35, 52 and 32, when the ringer 87 stops ringing because the supply of battery thereto is then cut off at contact 52 35. Now the cam 51 closes the contact 35 34, but at this stage of the connection this latter contact does not cause the operation of any of the apparatus. It will be readily understood that at the instant the ringer 87 stops ringing the lamps 29 and 39 are also extinguished, due to the fact that contact 32 52 is now open and that relay M is deënergized. Now when the cam 51 turns farther around it again closes the double contact 35 52 32, which causes the ringer 87 to again ring and the lamps 29 and 39 to be again lighted, as just described. The ringer 87 is rung until the cam 51 again breaks the double contact 35 52 32, which stops the operation of the ringer 87 and extinguishes the lamps 29 and 39, as just described. This intermittent ringing is carried on until the party at substation B answers his call, provided the operator leaves the calling plug H connected with the line B. When the party at substation B answers his call he removes his receiver 81 from the switch hook 82 in the usual manner and thereby opens contact 86 82 which prevents the ringer from being operated thereafter, and closes contacts 82 83 and 82 84. Now when the motor L turns the cam 51 far enough to cause contact 35 34 to be again made, a circuit is established from battery 8 through winding 24 of the calling supervisory relay F, contact 22 4, limb 2 of line B, substation B, limb 1 of line B, contacts 3 19, 20 38 and 37 36, winding 33 of relay M, and contact 35 34 to ground. Current flowing through this circuit energizes relay F and thereby causes its armatures to open contact 27 28 and close contacts 27 44 and 54 21. Contact 54 21 being now closed closes a circuit from battery 8 through winding 24 of relay F, contact 22 4, limb 2 of line B, substation B, limb 1 of line B, contact 3 19, contact 21 54, and winding 53 of relay F to ground, thus supplying the line B with current for talking purposes through both of the windings 53 and 24 of impedance-coil relay F, when contact 37 36 of relay K is opened as will be hereinafter described. This contact 21 54 of relay F is for the purpose of permitting the ringing currents to be transmitted over a clear circuit to the ringer 87 at substation B without a portion of the current passing through winding 53 of relay F to ground as would be the case if this winding 53 were connected direct to the tip strand 19 of calling plug H instead of through the contact 21 54 to the said tip strand 19. Contact 27 44 now being closed closes a circuit from battery 8 through the winding 42 of the locking relay K, contact 44 27, and contact 25 5 to ground. Current flowing through this circuit energizes relay K and thereby causes same to break contacts 45 46, 37 36, and 31 30, and to make contacts 88 30 and 43 46. Contact 45 46 being now open stops the operation of the motor L, provided the circuit of the motor L is not closed through any of the other connecting circuits of the system. Contact 37 36 being now open disconnects the ground connection from the tip strand of the plug-cord talking circuit and thereby permits the line B to be supplied with talking current through both of the windings 53 and 24 of the impedance-coil supervisory relay F as hereinbefore stated. Contact 88 30 being closed supplies battery to the calling supervisory

lamp 29 to light same when the calling supervisory relay F is deënergized as will be hereinafter described. Contact 43 46 being closed closes a circuit from battery 8 through the winding 42 of locking relay K, contact 43 46, and contact 47 48 to ground. Current flowing through this circuit will keep the locking relay K energized and its armatures attracted even after the armatures of the calling supervisory relay F are released as will be hereinafter described. This arrangement keeps contacts 45 46 and 36 37 open so that the motor L cannot again ring the ringer 87 at substation B after the subscriber at substation B has hung his receiver upon the switch hook, relay K remaining energized through contacts 43 46 and 47 48 until the calling plug H is removed from the line jack. Now the talking circuit is extended from line A to line B through the plug-cord connecting circuit, on the tip side from contact 9 of the answering plug through contact 66 60, condenser 62, contact 61 55, and contact 54 21 to contact 19 of the calling plug H, and on the sleeve side from contact 10 of answering plug C through contact 67 63, condenser 65, and contact 65 23 to contact 22 of calling plug H, this talking circuit being now entirely clear from the operator's telephone set and from the ringing circuit. Now the parties at substations A and B can converse with each other through the plug-cord connecting circuit. When the conversation is completed and the party at substation B hangs his receiver 81 upon the switch hook 82, he breaks the circuit of his metallic line at contacts 82 83 and 82 84 and thereby stops the flow of current through the calling supervisory relay F which thereby releases its armatures and closes contact 27 28 which closes a circuit from battery 8 through contact 88 30, supervisory lamp 29, contact 28 27, and contact 25 5 to ground. Current flowing through this circuit lights the supervisory lamp 29 which gives to the operator a signal for the disconnection of line B. It will be understood that contacts 27 44 and 54 21 of relay F are now open. When the party at substation A hangs his receiver upon the switch hook he stops the flow of current through his supervisory relay D as just described in connection with line B and supervisory relay F, and thereby causes relay D to close contact 14 16 and thus close a circuit from battery 8 through supervisory lamp 15, contact 16 14, and contact 17 5 to ground. Current flowing through this circuit lights the supervisory lamp 15 which gives to the operator a signal for the disconnection of line A. If the party at substation A now desires to signal the operator, he may do so by operating his switch hook which alternately opens and closes a circuit of battery 8 through his supervisory relay D and thereby causes same to cause an intermittent flashing of the supervisory lamp 15. Now the operator disconnects the connecting plugs C and H from the respective lines A and B and thereby opens the circuits of battery 8 through the operator's relays E and G, allowing their armatures to release and thereby open contacts 66 60, 67 63, 38 20, 55 61, 23 64 and 48 47, and close contacts 56 60, 58 63, 57 61 and 59 64. Contact 48 47 being now open opens the circuit of battery 8 through the locking relay K and thereby deënergizes same and allows its armatures to open contacts 43 46 and 88 30, and close contacts 45 46, 37 36 and 31 30. The motor L will not now be started by the operation of relay K because contact 47 48 is now open. Thus it will be seen that all of the relays are now deënergized and that all of the circuits and apparatus are now restored to their normal condition, ready for another connection to be made.

I wish it to be understood that the ringing arrangement shown in connection with the calling plug H may be utilized in connection with both of the plugs of a pair, if desired, by duplicating the apparatus shown in connection with the plug H. It will be readily understood that the motor L, the ringing pilot relay M, and the ringing pilot lamp 39, may be used in common with a number of plug-cord connecting circuits. The ringing pilot lamp 39 can be used in this invention because the ringing circuits are broken when not in use. It is well understood that common pilot lamps or signals cannot be used with a plurality of circuits which are shunted or switched in some manner without being entirely opened and closed during their use.

I wish it to be understood that ringing currents of various characters, such as direct, alternating, intermittent, or interrupted currents, may be used in this invention.

I do not wish to limit this invention to all of the particular details or to all of the particular types of apparatus herein shown, as many modifications of same may be utilized without departing from the scope of the appended claims.

What I claim as my invention is:

1. The combination with a telephone system having lines, of a connecting circuit therefor, a motor associated with the connecting circuit, switching mechanism under control of the motor for sending a ringing current over a line when connection is made therewith, a relay for closing the circuit of the motor when connection is made with an idle line, to start the motor, and a relay for opening the circuit of the motor when the circuit of the line is closed while connection is made therewith, to stop the motor, the last mentioned relay closing its own circuit

when operated whereby it remains energized until connection is disestablished with the line.

2. The combination with a telephone system having lines, of a connecting circuit therefor, a motor associated with the connecting circuit, switching mechanism under control of the motor for sending a ringing current over a line when connection is made therewith, a cam controlled by the motor for operating the switching mechanism intermittently to send the ringing current over the line intermittently, a relay for closing the circuit of the motor when connection is made with an idle line, to start the motor, and a relay for opening the circuit of the motor when the circuit of the line is closed while connection is made therewith, to stop the motor, the last mentioned relay closing its own circuit when operated whereby it remains energized until connection is disestablished with the line.

3. The combination with a telephone system having lines, of a plurality of connecting circuits for the lines, a motor associated with the connecting circuits and common thereto, switching mechanism controlled by the motor for supplying the lines with ringing current when connection is made therewith, means whereby the motor operates the switching mechanism intermittently to send ringing current over the lines intermittently, means for starting the motor when connection is made with a line, and means for stopping the motor when the circuit of the line is closed while connection is made therewith.

4. The combination with telephone lines and connecting circuits therefor, of substations on the lines, a motor associated with the connecting circuits and common thereto, switching mechanism under control of the motor, means whereby the motor causes the switching mechanism to be operated intermittently to send a ringing current over a line intermittently when connection is made therewith, means for starting the motor when connection is made with a line, and means for stopping the motor when the party at the called substation answers his call.

5. The combination with telephone lines and connecting circuits therefor, of substations on the lines, a motor associated with the connecting circuits and common thereto, switching mechanism under control of the motor, means whereby the motor causes the switching mechanism to be operated intermittently to send a ringing current over a line intermittently when connection is made therewith, means for starting the motor when connection is made with a line, means for stopping the motor when the party at the called substation answers his call, and means for preventing the motor from again sending ringing current over the line when the party at the substation hangs his receiver upon the switch hook.

6. The combination with a telephone system having lines, of a plurality of connecting circuits for the lines, a motor associated with the connecting circuits and having individual circuits for the respective connecting circuits, switching mechanism under control of the motor whereby the latter causes a ringing current to be sent over any of the lines when connection is made therewith, said switching mechanism having individual ringing circuits for the respective connecting circuits, means associated with each of the connecting circuits for closing the individual circuits of the motor when connection is made with idle lines, the said motor being thereby started when connection is made with any one of the idle lines, means associated with each of the connecting circuits for opening the individual circuits of the motor when the respective parties connected with the respective connecting circuits answer their calls, the latter said means also opening the individual circuits of the said switching mechanism whereby ringing currents are prevented from flowing over the respective lines after the parties on the lines answer their calls, the motor being stopped when all of the individual circuits thereof extending to the several connecting circuits which are connected with respective lines, are open, and means whereby the said means which open the individual circuits of the motor are prevented from again closing the individual circuits of the motor or the individual circuits of the switching mechanism, as the parties on the respective lines with which connection is made hang their receivers upon the respective switch hooks.

7. The combination with a telephone system having lines, of a plurality of connecting circuits for the lines, a motor associated with the connecting circuits and having individual circuits for the respective connecting circuits, switching mechanism under control of the motor whereby the latter causes a ringing current to be sent over any of the lines when connection is made therewith, said switching mechanism having individual ringing circuits for the respective connecting circuits, a ringing pilot signal common to the individual ringing circuits, a supervisory signal for each of the connecting circuits and arranged to be operated by the said switching mechanism whereby they are rendered active when the respective individual ringing circuits are closed over respective lines, means associated with each of the connecting circuits for closing the individual circuits of the motor when connection is made with idle lines, the said motor being thereby started when connection is

made with any one of the idle lines, means associated with each of the connecting circuits for opening the individual circuits of the motor when the respective parties connected with the respective connecting circuits answer their calls, the latter said means also opening the individual ringing circuits whereby ringing currents are prevented from flowing over the respective lines after the parties on the lines answer their calls, the motor being stopped and the said pilot signal being rendered inactive when all of the individual circuits extending to the several connecting circuits which are connected with respective lines, are open, and means whereby the said means which open the individual circuits of the motor and the individual ringing circuits, are prevented from again closing the individual circuits of the motor and the individual ringing circuits, as the parties on the respective lines with which connection is made hang their receivers upon the respective switch hooks.

8. The combination with a telephone system having lines, of a plurality of connecting circuits for the lines, individual ringing circuits for the respective connecting circuits, a pilot signal common to the individual ringing circuits, supervisory signals for the respective connecting circuits, a motor associated with the several connecting circuits, switching mechanism under control of the motor and adapted to be operated intermittently thereby, and suitable circuit arrangements whereby the said switching mechanism intermittently closes the individual ringing circuits and simultaneously causes the various supervisory signals which are associated with the connecting circuits connected with respective called lines, to display signals to show that the respective ringing circuits are closed over the lines, the said pilot signal being displayed when any of the individual ringing circuits is closed through a called line.

9. The combination with a telephone system having lines, of connecting circuits therefor, an operator's telephone set associated with connecting circuits, a ringing motor associated with the connecting circuits and common thereto, switching mechanism under control of the motor for sending ringing current over a called line when connection is made therewith, relays associated with the respective connecting circuits for starting the motor when connection is made with an idle line, said relays controlling the operator's circuit and being operated when connection is made with a line, supervisory relays associated with the respective connecting circuits and arranged to be operated when called parties with whom connections are made answer their calls, locking relays associated with the respective connecting circuits and adapted to open the respective circuits of the motor when the called parties with whom connections are made answer their calls, the said locking relays also controlling the ringing circuits and being under control of the supervisory relays, and means whereby the locking relays close their own circuits when operated whereby they are held in operated position until the connections are disestablished with the lines.

10. In a telephone system having lines, connecting circuits for the lines, a motor associated with the connecting circuits and common thereto, ringing switching mechanism associated with the motor and adapted to be operated intermittently thereby, a relay for each connecting circuit for closing a circuit of the motor when connection is made with a line, whereby the motor may be started, a supervisory relay for each connecting circuit and adapted to be operated when the circuit of a line is closed while connection is made therewith, a locking relay for each connecting circuit, under control of the corresponding supervisory relay and adapted to open a circuit of the motor, when operated, whereby the motor may be stopped, each locking relay closing its own circuit when operated whereby it is held in operated position until connection is disestablished with the line.

11. In a telephone system having lines, connecting circuits for the lines, a motor associated with the connecting circuits and common thereto, ringing switching mechanism under control of the motor for sending ringing current over the various lines when connection is made therewith, means for starting the motor when connection is made with an idle line, and means for stopping the motor when the party with whom connection is made answers his call.

12. In a telephone system having lines, connecting circuits for the lines, a motor associated with the connecting circuits and common thereto, ringing switching mechanism under control of the motor for sending ringing current over the various lines when connection is made therewith, means for starting the motor when connection is made with an idle line, means for stopping the motor when the party with whom connection is made answers his call, and means whereby the motor is prevented from causing a ringing current to be sent over a line with which connection is made, after the party on the line has hung his receiver upon the switch hook.

13. The combination with a plurality of telephone lines, of a connecting circuit for the lines, said connecting circuit terminating in a pair of connecting cords and plugs, an operator's relay for each of the connecting plugs arranged to be operated when connec-

tion is made with respective lines, a pair of loop circuits and an operator's telephone set connected from one to the other, said loop circuits being normally disconnected from the cords and plugs, means whereby either of the said relays when operated breaks the said loop circuits and connects portions thereof with the corresponding connecting cord and plug, whereby the operator's set is bridged across said corresponding connecting cord and plug, said relays when both operated breaking each of the said loop circuits at two places whereby the operator's set is entirely disconnected from the cords and plugs and whereby portions of the loop circuits are made to constitute a part of the plug-cord talking circuit between the said plugs.

14. A connecting circuit for telephone lines, terminating in a pair of connecting plugs, an operator's telephone set normally disconnected from the connecting plugs, a relay for each of the connecting plugs under control of the operator alone and controlling the operator's connection with the connecting circuit, means whereby the operation of either of the said relays connects the operator's telephone set with the corresponding connecting plug, and whereby the operation of both of the said relays disconnects the operator's telephone set from both of the said connecting plugs.

15. A connecting circuit for telephone lines, terminating in a pair of connecting plugs, an operator's telephone set normally disconnected from the connecting plugs, a pair of loop circuits normally connected with the operator's telephone set, a relay for each of the connecting plugs arranged to be operated when connection is made with respective lines, means whereby the operation of either of the said relays connects the operator's telephone set with the corresponding connecting plug, and whereby the operation of both of the said relays disconnects the operator's telephone set from both of the connecting plugs and includes portions of the said loop circuits in the talking circuit extending between the connecting plugs.

16. A connecting circuit for telephone lines, terminating in a pair of connecting plugs, an operator's telephone set normally disconnected from the connecting plugs, a pair of loop circuits normally connected with the operator's telephone set, each loop circuit including a condenser therein, a relay for each of the connecting plugs arranged to be operated when connection is made with respective lines, means whereby the operation of either of the said relays connects the operator's telephone set with the corresponding connecting plug, and whereby the operation of both of the said relays disconnects the operator's telephone set from both of the connecting plugs and includes portions of the said loop circuits, with the said condensers, in the talking circuit extending between the connecting plugs.

17. A telephone system having a plurality of lines extending from substations to a central exchange, a source of calling current at the exchange, a supervisory signal, and interrupter mechanism for applying calling current to a line periodically when connection is made therewith, the said interrupter mechanism at the same time producing a periodic operation of the supervisory signal for purposes substantially as described.

18. A telephone system including a plurality of telephone lines extending from sub-stations to an exchange, connecting circuits for uniting lines, a source of calling current at the exchange, supervisory or disconnect signals individual to the connecting circuits, and means whereby a supervisory or disconnect signal associated with a connecting circuit connected with a called line may convey a characteristic signal positively distinct from a supervisory or disconnect signal and of another character, consequent upon the inclusion of the source of signaling current in circuit with the called line.

19. A telephone system including a plurality of telephone lines extending from sub-stations to an exchange, connecting circuits for uniting lines, a source of calling current at the exchange, supervisory or disconnect signals individual to the connecting circuits, and means whereby a supervisory or disconnect signal associated with a connecting circuit connected with a called line may convey a fluctuating signal, consequent upon the inclusion of the source of signaling current in circuit with the called line.

As inventor of the foregoing I hereunto subscribe my name in the presence of two subscribing witnesses, this 3rd day of August, 1908.

ELMER R. CORWIN.

Witnesses:
FREDERICK R. PARKER,
HARRY B. DAVIS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."