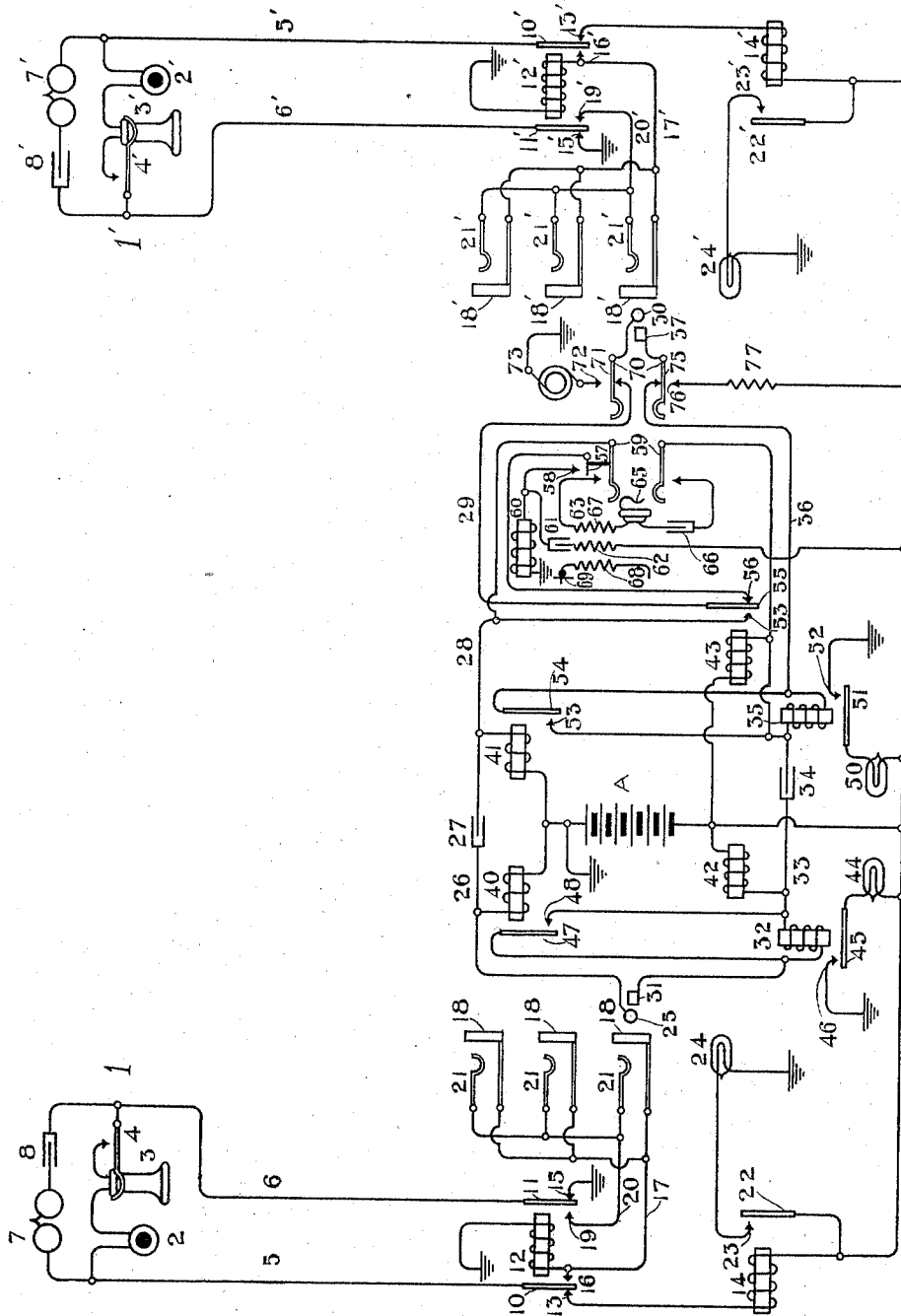


C. S. WINSTON.
TELEPHONE SYSTEM.
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967,476.

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Witnesses

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TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems, and particularly to that type having a central battery to supply current for the operation of the transmitters at the various substations.

The object of my invention is to simplify the circuits of the signal-controlling apparatus at the central office to produce a system which shall be inexpensive to manufacture and install and simple to maintain.

My invention is illustrated in the accompanying drawing, certain parts of which are shown in rather more conventional form than would be used in actual practice, it being understood that these parts form no part of my invention, and that many other forms of apparatus may be substituted in lieu thereof.

The calling subscriber's station 1 is equipped with the usual transmitter 2, receiver 3 and switch-hook 4, in a normally open bridge between the line conductors 5 and 6. In a permanent bridge between these conductors are connected an annunciator 7 and a condenser 8, the latter being in series and adapted to be placed in parallel with the transmitter and receiver when the switch hook is moved to its abnormal position. Line wires 5 and 6 extend respectively to the spring contacts 10 and 11 of the cut-off relay 12 located at the central office. The spring 10 normally makes contact with the point 13 which is connected through the coil of line relay 14 with the live pole of battery A. The spring 11 of the cut-off relay is normally connected through the contact 15 with the ground pole of battery A. The normally open contact 16 of cut-off relay 12 is connected with the coil of said relay and through conductor 17 with the test contacts 18 of the multiple jacks which are individual to the line of subscriber No. 1. The other normally open contact 19 of cut-off relay 12 is connected through conductor 20 with the tip contacts 21 of the multiple jacks. Line relay 14 controls the normally open

contacts 22 and 23 in the circuit of line lamp 24 such that upon the actuation of relay 14 the said lamp is lighted.

The answering substation No. 1' shown upon the left is equipped with similar apparatus to that of line No. 1, and corresponding apparatus associated with this line both at the substation and at the central office is represented by like figures with the suffix "'".

The cord circuit used by the operator for connecting the calling line with a called-for line is provided with the answering plug having the tip contact 25 connected through the conductor 26, condenser 27, conductors 28 and 29 with the tip contact 30 of the calling plug. Similarly, the sleeve contact 31 of the answering plug is normally connected through the coil of relay 32, conductor 33, condenser 34, coil of relay 35 and conductor 36 with the sleeve contact 37 of the calling plug. The main battery A is connected in a bridge of the talking strands of this cord circuit by the coils of the tip supervisory relays 40 and 41 and the retardation coil 42 and the coil of relay 43.

The answering end of the cord circuit is provided with the supervisory lamp 44 in a circuit normally maintained open by the contacts 45 and 46 of relay 32. The tip supervisory relay 40 controls normally-open contacts 47 and 48 adapted when closed to complete a non-inductive shunt of low resistance about the coil of relay 32. The calling end of the cord circuit is similarly provided with the supervisory lamp 50 in a circuit maintained normally open by contacts 51 and 52 of relay 35, the tip supervisory relay 41 similarly controlling the contacts 53 and 54 in the normally open shunt about the relay 35. The tip contact 30 of the calling plug is normally connected by conductor 29 and the normal contacts 55 and 56 of relay 43 to the normally open contacts 57 and 58 of the operator's listening key 59. Contact 58 is connected with one terminal of the impedance coil 60 and with the condenser 61, the other terminal of the impedance coil being connected with ground, and the other terminal of the condenser being connected through the tertiary winding 62 of the operator's induction coil 63 with the live pole of battery A. Relay 43 also has the normally open contact 53 adapted to be engaged by the

spring 55 to disconnect the contact 56 and complete the circuit between conductors 28 and 29. The actuation of the operator's listening key 59 also places the operator's head receiver 65 in a shunt between the talking conductors of the cord circuit, this shunt also including the condenser 66 and the secondary 67 of the operator's induction coil 63. This induction coil 63 also has the primary winding 68 connected with the transmitter 69 and with any suitable source of current not shown.

The operator's ringing key 70 has normally closed contacts in the circuit of each strand of the talking circuit adapted to be broken by the actuation of the key to prevent ringing current from passing back over the cord circuit to the calling subscriber. When the key is fully actuated the tip spring 71 makes contact with the ringing current contact 72 which connects with a suitable source of current 73. The sleeve spring 75 of the operator's ringing key when fully actuated connects with the contact 76 which is in turn connected by the non-inductive resistance 77 with the live pole of battery A.

In the operation of the system here described the subscriber in charge of substation No. 1 removes his receiver from its hook, thereby completing a circuit from the live pole of battery A through the coil of line relay 14, contacts 13 and 10 of relay 12, conductor 5, transmitter 2, receiver 3, switch-hook 4, conductor 6 and springs 11 and 15 of relay 12 to earth. The current in this path actuates relay 14 closing contacts 22 and 23 and completing the circuit of the line lamp 24. The operator seeing line lamp 24 displayed, inserts her answering plug in the jack indicated by the display of lamp 24 and thereby completes a circuit from the live pole of battery A through the retardation coil 42, coil of relay 32, sleeve contact 31 of the answering plug, contact 18 of the jack, conductor 17 and the coil of cut-off relay 12 to ground. Current in this path actuates relays 32 and 12, the latter changing its springs 10 and 11 to their abnormal positions whereby they make contact with the points 16 and 19. The momentary energization of relay 32 may close the contacts 45 and 46 in the circuit of the supervisory lamp 44 and thereby tend to display the lamp. However, immediately upon the actuation of cut-off relay 12 the circuit of relay 14 is broken by the separation of contacts 10 and 13 of relay 12 and a new circuit is completed from the live pole of battery A through the retardation coil 42, coil of relay 32, sleeve contacts of the plug and jack, contacts 16 and 10 of the cut-off relay, the line wire 5, transmitter 2, receiver 3, switch-hook 4 and line wire 6 through the now closed contacts 11 and 19 of relay 12, tip contacts 21 and 25 of the jack and plug and the coil

of relay 40 to the ground pole of battery A. Current in this path immediately actuates relay 40, closing its contacts 47 and 48 and placing a shunt about the coil of relay 32 and causing that relay to be immediately de-energized which prevents the lamp 44 from being more than just momentarily actuated if its circuit is kept closed long enough to display the lamp at all. The operator now throws her listening key 59 and places her head receiver 65 in a bridge of the talking circuit between the tip and sleeve conductors and inquires the desired number. Upon obtaining the desired number and before releasing her listening key, the operator raises her calling plug and touches the tip 30 to the test contact 18' of one of the multiple jacks of the desired line. If the desired line is busy the contact 18' will be at a potential higher than ground and current will therefore flow over the tip through the normally-closed contacts of the ringing key, conductor 29, contacts 55 and 56 of relay 43, contacts 57 and 58 of the listening key through the impedance coil 60 to ground. This sudden flow of current will alter the potential at the terminal of the impedance coil 60 and produce a partial discharge of condenser 61, causing a disturbance in the tertiary winding 62 of the operator's induction coil 63. This disturbance causes a click in the operator's head receiver indicating to the operator that the line is busy. If the line is not busy no click will be heard and the operator will insert the plug in the jack of the desired line.

Assuming the line to have been idle, and the calling plug inserted in the desired line, the operator now throws her ringing key 70 in order to call the desired subscriber. When this key is thrown current from the live pole of battery A flows through the non-inductive resistance 77, contacts 76 and 75 of the ringing key 70, sleeve contacts 37 and 18' of the plug and jack, conductor 17' and the coil of relay 12' to ground. Current in this path actuates relay 12' closing its springs 10' and 11' against the normally open contacts 16' and 19'. The actuation of the ringing key 70 also connects the tip spring 71 with the ringing current contact 72, thus closing a path for ringing current from the generator over the tips 30 and 21' of the plug and jack, over conductor 20', contacts 19' and 11' of relay 12', conductor 6', condenser 8', annunciator 7', line conductor 5', and contacts 10' and 16' of relay 12', conductor 17', sleeve contacts 18' and 37 of the jack and plug, spring 75 and contact 76 of the ringing key 70, non-inductive resistance 77, through the battery A to ground and thence back to the generator 73. This current operates the annunciator 7' and calls the desired subscriber to his telephone. Upon the release of key 70 the cir-

cuit is closed from the live pole of battery A through the coil of relay 43, thence through the coil of relay 35, conductor 36, the closed contacts of the ringing key 70, sleeve contacts 37 and 18' of the plug and jack, conductor 17' and the coil of cut-off relay 12'. Current in this path maintains the actuation of relay 12' and 43 and 35, the latter closing its contacts 51 and 52 which completes the circuit of the supervisory lamp 50. The display of this lamp indicates to the operator that the called subscriber has not yet answered his call. The actuation of relay 43 moves its armature 55 into contact with the point 53, thereby disconnecting the test apparatus and completing the circuit of the tip strand between the conductors 29 and 28. When the called subscriber removes his receiver 3' from the hook switch 4', he completes a circuit from the live pole of battery A through the coil of relay 43, the coil of relay 35, conductor 36, sleeves 37 and 18' of the plug and jack, conductor 17', contacts 16' and 10' of cut-off relay 12', line conductor 5', transmitter 2', receiver 3' and hook-switch 4', line conductor 6', contacts 11' and 19' of cut-off relay 12', conductor 20', tip contacts 21' and 30 of the jack and plug, conductor 29, contacts 55 and 53 of relay 43, conductor 28 and the coil of relay 41 to the ground pole of battery A. Current in this path actuates relay 41, closing its contacts 53 and 54 which complete a shunt about the coil of relay 35 causing the contacts of that relay to fall back to open the circuit of the supervisory signal 50. The system is now in condition for conversation and all signals at the central office are effaced. When either subscriber hangs up his receiver he breaks the circuit of relay 40 or 41 as the case may be, causing that relay to fall back and remove the shunt about the coil of relay 32 or 35 as the case may be. When the shunt is removed from about this relay the circuit is again completed through its coil and the armature 45 or 51 is pulled up, completing the circuit of supervisory lamp 44 or 50. When these lamps are both displayed the operator removes her plugs from the jacks and again severs the circuits of relays 32 and 35 and thereby again effaces the supervisory lamps 44 and 50. The apparatus is then in its normal condition and ready for a second call.

While I have shown and described my invention with respect to certain details and combinations, it is to be understood that I do not wish to be unduly limited thereto, other combinations being quite possible without in any manner departing from the spirit or scope of my invention.

I claim:

1. In a telephone system, the combination with a telephone line, of a cut-off relay for

the line actuated over a portion of the talking circuit and a third conductor, a cord circuit, a source of current associated therewith, a supervisory signal, a relay controlling normally open contacts in the circuit of said signal, said relay being actuated by current over a strand of the talking circuit and through the coil of said cut-off relay when the cord is connected with the line, a second relay in a bridge of the talking strands of the cord circuit actuated over the telephone line when the subscriber's telephone is in use and controlling a normally open shunt about the first relay, whereby said first relay is deprived of current and the supervisory signal is controlled, substantially as described.

2. In a telephone system, the combination with a telephone line terminating at the central office in a two-conductor jack, a two-conductor cord to connect therewith, a relay having its coil normally in one of the strands of said cord circuit and adapted to be actuated when the cord is connected with the line, a second relay in a bridge of the talking strands of the cord circuit controlling a shunt about the first relay and adapted to be actuated when the cord is connected to a line closed at the substation, and a supervisory signal controlled by contacts of the first relay, substantially as described.

3. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith, a relay, a source of current and an impedance coil in a bridge of the talking strands of said cord circuit, a second relay having its coil normally in series with one of the talking strands of said cord circuit, a shunt of said relay controlled by contacts of the first relay and adapted when closed to deprive the second relay of actuating current and to complete a non-inductive path for voice currents about the coil of said second relay, and a supervisory signal controlled by contacts of the second relay, substantially as described.

4. In a telephone system, the combination with a telephone line, of a cut-off relay for the line actuated over a portion of the talking circuit, a cord circuit to connect with the line, a relay, a source of current and an impedance coil in a bridge between the talking strands of said cord circuit, a second relay having its coil normally in series with one of the strands of the cord circuit and adapted to be actuated over a path including a portion of the talking circuit and the coil of said cut-off relay when the cord is connected with the line, normally open contacts of said first relay adapted when closed to complete a non-inductive shunt about the second relay to deprive it of current, and a supervisory signal controlled by contacts of said second relay, substantially as described.

5. In a telephone system, the combination

with a telephone line, of a cord circuit to connect therewith for conversation, a pair of relays for said cord circuit, one of said relays being in series with the talking strand
5 of the cord circuit, and the other of said relays being in a bridge of the cord circuit, and contacts of the latter relay controlling a normally open non-inductive shunt about the first relay, and a supervisory signal con-

trolled by the first relay, substantially as described.

Signed by me at Chicago, county of Cook, and State of Illinois, in the presence of two witnesses.

CHARLES S. WINSTON.

Witnesses:

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EDITH F. GRIER.