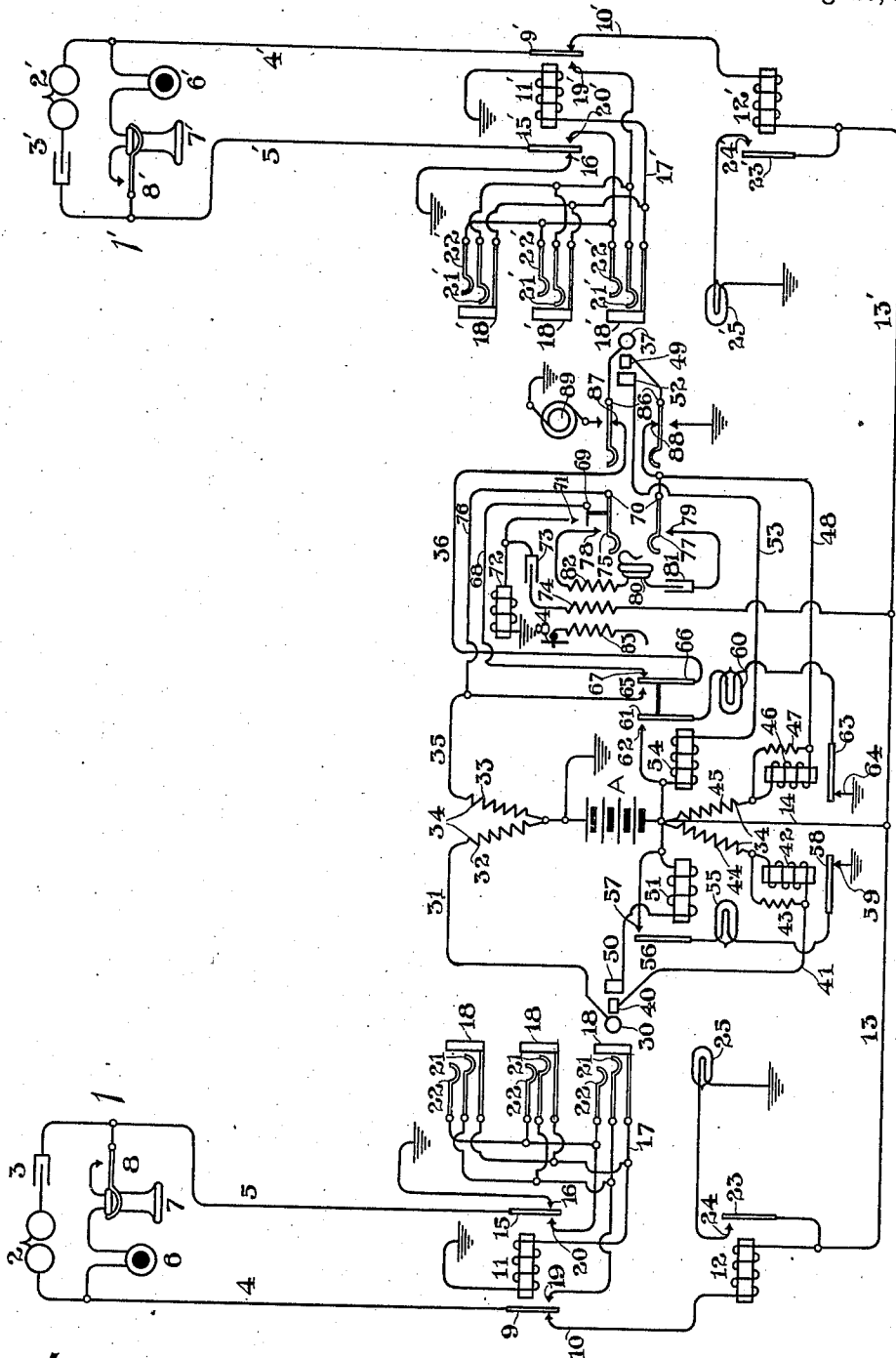


C. S. WINSTON.
 TELEPHONE SYSTEM.
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1,001,723.

Patented Aug. 29, 1911.



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UNITED STATES PATENT OFFICE.

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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 of the three-wire central energy type.

10 The object of my invention is to improve the signaling apparatus and circuits associated with the central office of the system, and further, to produce a system which shall be simple to manufacture and install and
15 durable in its operation.

My invention is illustrated in the accompanying drawing in which the calling subscriber's station No. 1 is represented at the left-hand side of the drawing.

20 This subscriber's station is equipped with the annunciator 2 and condenser 3 in a permanent bridge between line conductors 4 and 5, and with the transmitter 6 and receiver 7 in a bridge normally maintained
25 open by contacts of the switch-hook 8. Line conductor 4 is normally connected through contacts 9 and 10 of cut-off relay 11 and through the coil of line relay 12 and conductors 13 and 14 with the live pole of
30 battery A, while line conductor 5 is normally connected through contacts 15 and 16 of cut-off relay 11 with the ground pole of battery A. One terminal of the coil of relay 11 is connected with earth, while the
35 other terminal is connected through conductor 17 with the sleeve or test contact 18 of the answering and multiple jacks. The two normally open contacts 19 and 20 of cut-off relay 11 connect respectively with
40 the ring and tip contacts 21 and 22 of the answering and multiple jacks. Line relay 12 has the normally open contacts 23 and 24 in the circuit of the line lamp 25.

The called subscriber's line No. 1' shown
45 on the right-hand side of the drawing is equipped with apparatus identical with the apparatus of the calling line, like apparatus being designated by like figures with the suffix "'".

50 The cord circuit used in completing conversational connections between the calling and called telephone lines extends from the tip 30 of the answering plug through the tip conductor 31, the windings 32 and 33
55 of the repeating coil 34, and conductors 35

and 36 to the tip contact 37 of the calling plug. The other talking strand of the cord circuit extends from the ring contact 40 of the answering plug through conductor 41, the coil of relay 42 and the associated resistance 43 in parallel, windings 44 and 45 of repeating coil 34, the winding of relay 46 and its associated non-inductive resistance 47 and conductor 48 to the ring contact 49 of the calling plug.

60 Main battery A is connected between the inside terminals of the windings 32, 33, 44 and 45 of the repeating coil 34. The sleeve contact 50 of the answering plug is connected through the coil of supervisory relay 51 with the live pole of battery A and the sleeve contact 52 is connected through conductor 53 and the coil of calling supervisory relay 54 with the live pole of battery A.
65 The answering end of the cord circuit is provided with the supervisory signal 55, relay 51 controlling normally open contacts 56 and 57 and the supervisory relay 42 controlling normally closed contacts 58 and 59 in the circuit of said lamp and the main
70 battery A. The calling side of the cord circuit is similarly provided with the supervisory signal 60 having its circuit similarly controlled by contacts 61 and 62 of relay 54 and contacts 63 and 64 of relay 46. The
75 relay 54, has, in addition to the contacts in the circuit of the supervisory signal 60, the normally open contacts 65 and 66 in the tip talking strand of the cord circuit. Contact 66 normally connects with contact 67
80 and thence through conductor 68 with the auxiliary contact 69 of the operator's listening key 70, the contact 69 being adapted to make connection with the point 71 when the key is thrown to listening position.
85 Contact 71 connects with earth through the impedance coil 72 and with the live pole of battery A through condenser 73 and the tertiary 74 of the operator's induction coil. The tip spring 75 of the operator's listening
90 key 70 is connected through conductor 76 with conductor 35 and the ring spring 77 is connected directly with the ring conductor 48 of the talking circuit. Upon the actuation of the listening key, contact 75
95 makes connection with the point 78 and contact 77 makes connection with the point 79 to place the operator's receiver 80, condenser 81 and secondary 82 of the operator's induction coil in a bridge between the talking
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conductors. The operator's induction coil also has the primary winding 83 in series with the transmitter 84 and any suitable source of current not shown in the drawing.

5 The springs of operator's ringing key 86 normally maintain the continuity of the tip and ring strands of the cord circuit by their connection with contacts 87 and 88. The actuation of the ringing key is adapted to
10 sever the connection of the tip and sleeve talking strands and connect the ringing generator 89 in a bridge between the tip and ring contacts of the calling plug.

The apparatus thus described is shown
15 throughout in its normal unactuated condition.

In order to obtain a connection between the sub-stations 1 and 1' the calling subscriber removes his receiver 7 from the hook-
20 switch 8 and thereby completes a circuit from the live pole of battery A over conductors 14 and 13, through the coil of the line relay 12, contacts 10 and 9 of cut-off relay 11, line conductor 4, transmitter 6,
25 receiver 7, switch-hook 8, line conductor 5 and the contacts 15 and 16 of cut-off relay 11 to earth. Current through the coil of relay 12 actuates that relay closing its contacts 23 and 24 and displaying line lamp 25.
30 Upon observing the display of the lamp 25, the operator inserts her answering plug into the jack thus indicated and thereby completes a circuit from the live pole of battery A through the coil of relay 51, sleeve contacts 50 and 18 of the plug and jack, conductor 17 and the coil of relay 11 to ground.
35 This actuates relays 51 and 11 and moves the springs 9 and 15 into connection with contacts 19 and 20, thereby opening the circuit of line relay 12, allowing its contacts to fall back to interrupt the circuit of line lamp 25. The actuation of relay 51 closes the contacts 56 and 57 which would tend to display the lamp 55. However, a second
40 circuit is completed from the live pole of battery A through the winding 44 of induction coil 34, the coil of relay 42, conductor 41, the ring contacts 40 and 21 of the plug and jack, contacts 19 and 9 of the cut-off relay 11, line conductor 4, transmitter 6,
45 receiver 7, switch-hook 8, line conductor 5, contacts 15 and 20 of cut-off relay 11, the tip contacts 22 and 30 of the jack and plug, conductor 31 and the winding 32 of repeating coil 34 to the ground pole of battery A. Current in this path actuates relay 42 and therefore opens its contacts 58 and 59 which prevent the display of the supervisory signal 55. The operator now throws her listening
50 key 70 and inquires the desired number of the calling subscriber. Having learned that the desired number is that of subscriber No. 1', the operator raises the calling plug and touches its tip contact 37 to the test contact 18' of one of the multiple jacks of the
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desired line. If the desired line is busy its test contact 18' will be in connection with the sleeve contact of another cord circuit and therefore will be at a potential higher than that of earth. Current will therefore
70 flow from the test contact 18' over the tip contact 37 through conductor 36, contacts 66 and 67 of relay 54, conductor 68, the now closed auxiliary contacts 69 and 71 of the operator's listening key 70 to earth through the
75 impedance coil 72. Current in this path will cause a change of potential at the terminal of the condenser 73 which connects with the impedance coil 72 and therefore will cause a slight discharge of that condenser which will in turn cause a disturbance in the tertiary winding 74 of the operator's induction coil, this disturbance being inductively transmitted through the secondary to the operator's head receiver. Assuming, however, that the desired line is not
80 busy, and that no click is heard by the operator, her plug is inserted into the jack of the called line completing the connections between the tip ring and sleeve contacts of that plug and the tip ring and sleeve contact of the jack of the desired line. Upon the insertion of the plug, a circuit is formed from the live pole of battery through the coil of supervisory relay 54, conductor 53,
85 sleeve contacts 52 and 18' of the plug and jack, conductor 17' and the coil of relay 11' to ground. Current in this path actuates relays 54 and 11'. The actuation of relay 54 closes contacts 65 and 66, thus completing the tip strand of the cord circuit and also closes contacts 61 and 62 in the circuit of the supervisory signal 60, thus displaying that signal. The actuation of relay 11' connects its contacts 9' and 19' and its contacts 15' and 20',
90 thus completing the connection of the tip and ring contacts of the jack with the line conductors 5 and 4 respectively. The operator now throws her ringing key 86 and sends ringing current out over the line conductors and through the annunciator and condenser 2' and 3'. Upon the response of the called subscriber, a circuit is completed from the live pole battery A through the winding 45 of repeating coil 34, the coil of relay 46, conductor 48, the ring contacts 49 and 21' of the calling plug and jack, contacts 19' and 9' of cut-off relay 11', line conductors 4' and 5', transmitter 6', receiver 7',
95 switch-hook 8', line conductor 5', contacts 15' and 20' of relay 11', the tip contacts 22' and 37 of the jack and plug, conductor 36, contacts 66 and 65 of relay 54, conductor 35 and the winding 33 of repeating coil 34 to the ground pole of battery A. Current in this path actuates the relay 46 and opens the circuit of the supervisory signal 60 at contacts 63 and 64.

The calling and called subscribers' stations are now in connection for talking and all
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signals are effaced, the transmitter current being furnished to the calling and called lines through the windings of the repeating coil 34 and the tip and ring strands of the cord circuit. Upon the termination of the conversation the parties replacing their receivers upon the switch-hooks interrupt the circuits of supervisory relays 42 and 46, thus allowing contacts 58 and 59, and 63 and 64 to again complete the circuits of supervisory signals 55 and 60. The display of these signals informs the operator that the conversation has been terminated and the connection is again taken down which again opens the circuits of relays 11 and 51 and relays 11' and 54 allowing all of the apparatus to assume its normal condition and placing it in readiness for a second call.

In order to facilitate the passage of voice currents, relays 42 and 46 are provided with non-inductive shunts, the resistance of these shunts being low enough not to materially interfere with the passage of voice currents but high enough to not interfere with the energization of the relays.

While I have here shown and described my telephone system in combination with certain specific forms of apparatus, it is to be understood that any other well known apparatus may be used without departing from the spirit or scope of my invention.

I claim:

1. In a telephone system, the combination with a pair of telephone lines, of a cord circuit to connect therewith, cut-off relays for the lines, a pair of supervisory relays for the cord circuit actuated through the coils of said cut-off relays and independent of the talking circuit when the cord is connected with the lines, a pair of supervisory relays for the cord circuit in one of the talking strands and under the control of the subscribers, and a pair of supervisory signals, each having its circuit controlled solely by the conjoint action of two of said relays, each said signal circuit including contacts of its control relays, substantially as described.

2. In a telephone system, the combination with a telephone line, of a jack at the central office having contacts normally disconnected from the line, a cut-off relay for the line having its coil connected with a contact of said jack independent of the talking contacts, a relay for the cord circuit operated over a path including the coil of the cut-off relay, a second relay in one of the talking strands of the cord circuit, and a signal hav-

ing a circuit including contacts of said relays and controlled by the conjoint action of said relays, substantially as described.

3. In a telephone system, the combination with a pair of telephone lines, of a cord circuit to connect therewith for conversation, a source of current in a bridge of said cord circuit, a repeating coil having windings in series with said source and the limbs of the telephone line, a pair of relays, each having its coil in series with said source and a telephone line during connection, a second pair of relays for the cord circuit actuated over paths independent of the talking circuit when the cord is connected with the lines, and a pair of signals, each controlled solely by the conjoint action of two of said relays, the circuit for each signal including contacts of its control relays substantially as described.

4. 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 actuated over a local path independent of the talking circuit, and the other of said relays being located in the talking circuit and being actuated over the telephone line, and a signal having a circuit including contacts of said relays and controlled solely by the conjoint action of said relays, said signal remaining effaced until the calling end of the cord circuit is connected with the desired line, 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 actuated over a local path independent of the talking circuit, and the other of said relays being located in the talking circuit and being actuated over the telephone line, a supervisory signal, the circuit of said signal including normally open contacts of one of said relays, and normally closed contacts of the other of said relays, said relays jointly controlling the operation of said signal by opening and closing the circuit of said signal, 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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