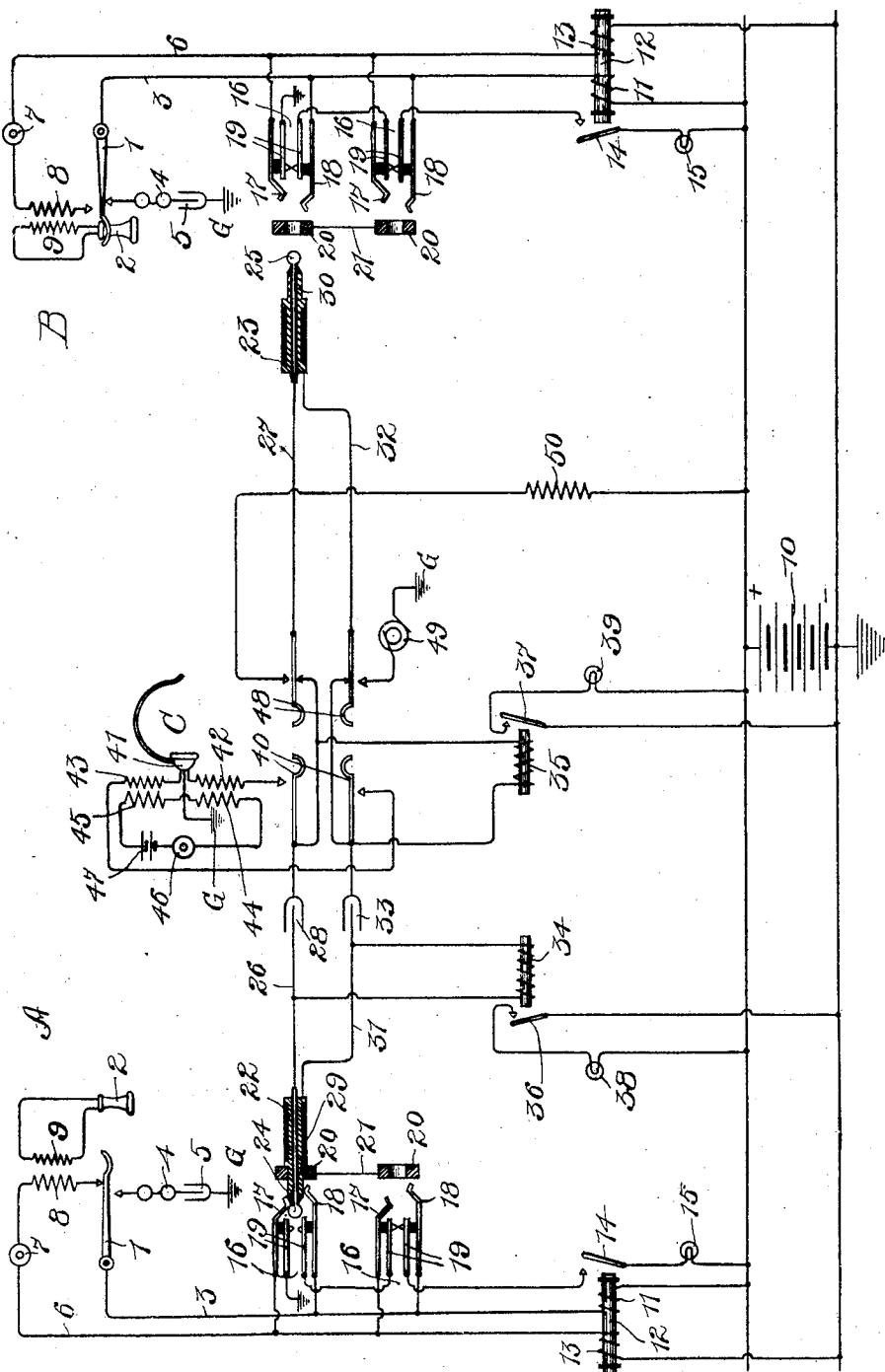


No. 853,287.

PATENTED MAY 14, 1907.

H. G. WEBSTER.
SUPERVISORY SIGNALING SYSTEM.

APPLICATION FILED SEPT. 19, 1903.



Witnesses

Arthur H. Boettcher

Lynn A. Williams

H. G.

Inventor

HARRY C. Webster

Charles A. Brown

Attorney.

UNITED STATES PATENT OFFICE.

HARRY G. WEBSTER, OF CHICAGO, ILLINOIS, ASSIGNOR TO STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

SUPERVISORY SIGNALING SYSTEM.

No. 853,287.

Specification of Letters Patent.

Patented May 14, 1907.

Application filed September 19, 1903. Serial No. 173,772.

To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Supervisory Signaling Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone exchange systems, and its object is to provide such a system which will be of great simplicity and reliability in operation.

In the accompanying drawing I have illustrated a preferred embodiment of my invention.

In this drawing I have illustrated at each of the substations A and B well known instrument sets, in each of which there is provided a switch hook 1, which when in its normal depressed condition, due to the weight of the receiver 2, serves to connect between the line limb 3 and the ground G a call-bell 4 and a serially connected condenser 5. In its upper position, due to the removal of the receiver 2, the switch hook serves to connect between the line limb 3 and the line limb 6 a battery transmitter 7 and the primary 8 of an induction coil whose secondary 9 is included in circuit with the receiver 2. Any other suitable instrument circuit may, of course, be employed. The line limbs 3 and 6 lead to the central exchange C and to the positive and negative terminals of a common battery 10, the negative terminal being shown as grounded. Between the positive pole of the battery 10 and the line limb 3 there is serially included a winding 11 of a line relay 12, whose other accumulative winding 13 is serially included in the circuit between the line limb 6 and the negative grounded pole of the common battery 10. It will be seen that the circuit between the common battery 10 and the line limbs 3 and 6 is at all times continuous and includes no relay or jack contacts.

As will hereinafter more fully appear, a talking current is supplied to the substation apparatus wholly through the line relay 12, the windings of which may be made of substantially the same resistance and impedance and inductively balance the telephone line circuit. The line relay 12 controls by means

of its armature 14 a local illuminating circuit through a line signal 15, which is shown as a small incandescent lamp. Multiple jacks 16 16 are provided, the tip spring 17 of these jacks being connected with the line limb 6, while the sleeve springs 18 are all permanently connected with the line limb 3. Each jack is also provided with switching mechanism, whereby the insertion of a plug within a jack causes a break in the continuity of the local illuminating circuit through the associated line signal. In this instance each jack is shown as provided with a pair of contacts 19, these contacts being serially connected through all of the multiple jacks associated with one line and the last spring of the series is connected with the opposite pole of the common battery from that with which the lamp at 15 is connected, in this instance the last spring being shown as connected by means of a ground return with the negative pole of the common battery 10. Each of the jacks is provided with a testing thimble 20, all of the test thimbles of the multiple jacks connected with any one line being connected together by means of a conductor 21.

The operator's cord circuit comprises an answering plug 22 and a calling plug 23, the tip contacts 24 and 25 of these plugs being connected by means of a tip strand which comprises two conductively insulated portions 26 and 27. These conductively insulated portions of the cord strands, however, are inductively related for the transmission of telephonic voice currents either by means of a repeating coil or a condenser 28, as shown herewith. The sleeve contacts 29 and 30 of the cord connecting plugs are similarly connected by portions of a sleeve strand 31 and 32, these portions of the sleeve strand being connected through a condenser 33. It will thus be seen that a portion of the cord circuit which is conductively connected with a calling line is never conductively connected with the called line so that the two lines are conductively insulated for direct currents so far as the cord connecting apparatus is concerned.

Connected in bridge of the cord strands 26 and 31 is a supervisory relay 34, which is desirably of comparatively high resistance and of some impedance. The supervisory

relay 35 is similarly connected in bridge of the cord strands leading to the calling plug. The supervisory relays each control by means of an armature 36 or 37 a supervisory signal lamp 38 or 39, as the case may be.

The usual operator's listening key 40 is provided, the manipulation of which serves to connect the operator's telephone 41 in bridge of the cord circuit. For testing purposes, which will more fully hereinafter appear, I have shown the operator's telephone as provided with two coils, the common terminal of which is connected to the ground G. The induction coil is provided with a divided secondary comprising coils 42 and 43, and with a correspondingly divided primary having coils 44 and 45. The operator's transmitter 46 may be connected with the primary winding through a local battery 47. The ringing key 48 is provided to connect the ringing generator 49 between the sleeve strand 32 and the ground G. The manipulation of this ringing key also connects the resistance 50 between the positive pole of the battery and the tip strand 27, whereby the coil 13 of the line relay of the called line is energized, and during the manipulation of the ringing key.

The operation of my improved system will now become apparent. The subscriber at substation A when desiring telephonic connection removes his receiver 2 from the switch hook 1 thereby closing a conductively continuous path between the line limbs 3 and 6. The circuit thus closed through the line relay 12 causes an attraction of the armature 14 to actuate the line signal, which in this instance is shown as the small incandescent lamp 15. The illumination of this lamp, due to current flowing through the local circuit including the armature 14 and the line signal controlling contacts of the jacks 16 notifies the operator of a call. She thereupon inserts her answering plug 22 within an answering jack associated with the line to substation A. The insertion of this plug in the first place causes a break in the connection between the local signal controlling springs 19, whereupon the circuit through the line signaling lamp 15 is broken to cause the extinguishment of this lamp. The insertion of the answering plug within the line jack 16 causes a connection of the supervisory relay 34 in bridge of the line limbs 3 and 6 to substation A. The circuit through the substation apparatus is of comparatively low resistance, while the resistance of the supervisory relay 34 is desirably quite high. At any rate, the adjustment of this supervisory relay is made such that when it is connected in shunt or multiple with a subscriber's instrument set this relay is not sufficiently energized to cause the attraction of its armature 36. The supervisory signaling lamp 38 is, therefore, not caused to glow

upon the insertion of the plug within a jack connected with a substation in which the telephone circuit is conductively closed for the passage of direct currents. The operator after thus inserting the answering plug manipulates her listening key 40 to connect her telephone set in bridge of the cord circuit and by conversing with the calling subscriber she learns the number of the desired connection. Learning that substation B is desired, the operator then inserts her calling plug 23 within a line jack 16 associated with the line to substation B. The insertion of this plug at once causes a break in the local illuminating circuit having the line signal 15 associated with the line to substation B, whereupon the subsequent energization of the relay 12 cannot cause the illumination of the associated lamp 15. The insertion of this plug also serves to at once connect the supervisory relay 35 with the poles of the common battery 10, this circuit being traced as follows: from the positive pole of common battery 10 through winding 11 of the line relay 12, line limb 3, to sleeve spring 18, sleeve contact 30 of plug 23, sleeve strand 32, supervisory relay 35, tip strand 27, tip contact 25, tip spring 17 of the jack 16, line limb 6, winding 13 of the line relay and thence back to the grounded negative pole of the common battery 10. There is as yet no path afforded through the substation apparatus at B in shunt or multiple of the supervisory relay 35. Sufficient current is, therefore, caused to pass through the supervisory relay 35 to energize the same to cause the attraction of the armature 37, whereupon the supervisory signaling lamp 39 is caused to glow to indicate that the line circuit at substation B is not completed.

After inserting the calling plug, the operator manipulates her ringing key 48 to connect the generator 49 between line limb 3 and ground G, whereupon the signal bell 4 at substation B is actuated to call the subscriber to his 'phone. At the same time the resistance 50 is connected with the tip strand 27, whereby a flow of current through the line relay 12 is maintained. It is of course apparent that the attraction of the armature 14 of the relay 12 will have no effect upon the line lamp 15, for the reason that its local circuit has already been broken between the springs 19 upon the insertion of the plug within one of the multiple jacks. The subscriber at substation B in answering the call removes his receiver from the switch hook thereby closing the conductively continuous path between the line limbs 3 and 6. This path is of comparatively low resistance and, being in shunt of the supervisory relay 35, this relay is deprived of the greater part of its current. The resulting partial deenergization permits the retraction of the armature 37 to open the circuit through the associated

supervisory lamp 39, thereby indicating to the central station operator that the call has been answered.

While it forms no essential part of my present invention, I have shown means whereby the operator before attempting to call the subscriber at substation B may test the condition of his line. It will be seen that the insertion of a plug within a jack causes the connection of the testing thimble 20 with the sleeve spring 18, by means of the sleeve contact with the plug test. In this manner the test thimble of a busy line is connected with the positive pole of the battery 10 and is thus charged to a potential only slightly less than that of the positive pole of this battery. Before inserting a calling plug within the jack of a called line, the operator manipulates her listening key 40 to connect her telephone set in bridge of the cord strands and then applies the tip contact 24 of the calling plug to the test thimble of the desired line. If this line is not in use no effect is produced for the reason that the test thimbles are normally disconnected both from current and from the battery 10. If, however, the test thimbles have been connected with the positive battery of the pole by the insertion of a plug at some other section of the multiple switchboard, the application of the testing tip contact 25 to a test thimble will cause the closure of the following circuit: from the positive pole of the battery 10 through the winding 11, line limb 3, sleeve spring 18, the sleeve contact of the already inserted plug at some other section of the switchboard, the test thimble 20, tip contact 25 of the calling plug, tip strand 27, thence through coil 42 of the induction coil, one winding of the operator's telephone 41, and thence to ground G, which is connected with negative pole of the common battery 10. The click produced in the operator's telephone by the closure of this circuit will indicate to her that the line is in use. The subscribers upon completing their conversation, either one or both replace their receivers upon the substation switch hooks. In placing his receiver upon the switch hook the subscriber breaks the conductively continuous path in shunt of the connected supervisory relay. The full current flowing through the line relay is thus caused to pass through the connected supervisory relay whereupon the same is energized to cause the attraction of its armature and the consequent illumination of the supervisory lamp, whereby the operator is notified of the desired disconnection. The supervisory arrangement herein shown is double whereby each subscriber controls his own supervisory signal.

I do not wish to be limited to the precise construction herein shown, as many changes may be made by those skilled in the art with-

out departing from the spirit and scope of my invention, but

Having described my invention I claim as new and desire to secure by Letters Patent:—

1. In a telephone exchange system, the combination with a telephone line extending by its limbs from a substation to an exchange, of a source of current at the exchange permanently connected with both limbs of said line and adapted to supply talking and signaling currents to said line, a line relay included in said line circuit, spring jacks connected with said line, a line signal circuit controlled by said line relay, contacts in said spring jacks normally serially included in said line signal circuit, actuation of substation apparatus causing completion of the line signal circuit, a cord circuit at the central exchange for connecting lines together for conversation, a supervisory relay connected in bridge of the cord strands, and a supervisory signal circuit controlled by said supervisory relay, connection of the cord circuit plug with any spring jack causing connection of said supervisory relay with the source of current, connection of said cord circuit with a spring jack also mechanically causing interruption of said line signal circuit.

2. In a telephone exchange system, the combination of a telephone line extending from a central exchange to a substation, of a source of current at the central exchange connected with the line limbs of the telephone line, a line relay in said line circuit, a spring jack having line contacts connected with the limbs of said line, normally closed auxiliary contacts for said spring jack, a line signal circuit controlled by said line relay and normally including said closed auxiliary contacts, actuation of substation apparatus causing energization of said line relay to cause closure of the line signal circuit, a cord circuit at the central exchange, a supervisory relay connected in bridge of the cord strands, and a supervisory signal circuit controlled by said supervisory relay, connection of the cord circuit plug with any spring jack causing connection of said supervisory relay with the source of current, connection of the cord circuit plug with said spring jack also causing said auxiliary contacts to be opened whereby said line signal circuit is opened.

3. In a telephone exchange system, the combination with a telephone line extending from a substation to a central exchange, of a source of current at the exchange permanently connected with both limbs of said line, a line relay included in said line circuit, a line signal circuit controlled by said line relay, spring jacks having line contacts connected with the line limbs, auxiliary normally closed contacts for said spring jacks normally serially included in said line signal circuit.

4
 5 cuits, a cord circuit at the central exchange,
 and a supervisory relay connected in bridge
 of the cord strands, actuation of substation
 apparatus causing energization of said line
 10 relay to close the line signal circuit, a con-
 nection of the cord circuit plug with any
 spring jack causing said supervisory relay to
 be connected in bridge of the line limbs and
 said source of current, connection of said
 15 plug with said spring jack also causing separa-
 tion of the corresponding auxiliary con-
 tacts whereby the line signal circuit is
 opened.

4. In a telephone exchange system, the
 15 combination with a telephone line extending
 by its limbs from a substation to an exchange,
 of a source of current at the exchange con-
 nected in bridge of the line limbs, a line relay
 included in said line limbs, a line signal local
 20 circuit partially controlled by said line relay,
 spring jacks having line contacts perma-
 nently connected with said line limbs, auxil-
 iary normally closed contacts for each spring
 jack, said contacts being normally serially
 25 included in the line signal circuit, a cord cir-
 cuit at the central exchange, a supervisory
 relay connected in bridge of the cord strands
 and normally disconnected from any source
 of current, and a supervisory signal circuit
 30 controlled by said supervisory relay, connec-
 tion of the cord circuit plug with any spring
 jack causing said supervisory relay to be con-
 nected in bridge of the line limbs and of the
 source of current, connection of said plug
 35 with said spring jack also causing separation
 of the associated auxiliary contacts whereby
 the line signal circuit is opened.

5. In a telephone exchange system, the
 40 combination with a telephone line extending
 from a substation to an exchange, of a source
 of current at the exchange for supplying talk-
 ing and signaling currents to the line, a line
 relay controlled by the line circuit, a local
 circuit at the central exchange controlled by
 45 said line relay, a signal in said local circuit,
 main spring jack contacts at the central ex-
 change connected with the telephone line,
 auxiliary spring jack contacts entirely insu-
 lated from the main jack contacts and from
 50 the telephone line and adapted normally to
 complete the local circuit upon actuation of
 the line relay, a cord circuit at the exchange,
 a supervisory relay controlling a supervisory
 signal circuit connected in bridge of the cord
 55 strands, and means upon connection of the
 cord apparatus with the spring jacks for
 causing said supervisory relay to be connect-
 ed with the source of current and for causing
 actuation of the auxiliary contacts to open
 60 the line signal circuit.

6. In a telephone exchange system, the
 combination with a telephone line extending
 from a substation to an exchange, of a source
 of current at the exchange for supplying talk-
 65 ing and signaling currents to the line, a line

relay controlled by the line circuit, a local
 circuit partly controlled by the line relay, a
 signal in said circuit, spring jacks having
 main contacts connected with the line, auxil-
 iary contacts independent of the line, said 70
 auxiliary contacts completing the control of
 the local circuit, a cord circuit at the central
 exchange, a supervisory relay connected in
 bridge of the cord strands, and means where-
 by said supervisory relay may be energized 75
 and said auxiliary contacts may be actuated
 to interrupt the line signal circuit upon the
 connection of said cord circuit with any
 spring jack.

7. In a telephone exchange system, the 80
 combination with a telephone line extending
 from a central exchange to a substation, of a
 source of current at the exchange for supply-
 ing talking and signaling currents to the line,
 a line relay controlled by the line circuit, a 85
 line signal controlled by the line relay, spring
 jacks at the exchange, contacts for said
 spring-jacks normally included serially in the
 line signal circuit, actuation of substation ap-
 paratus causing actuation of the line relay to 90
 complete the local circuit to cause actuation
 of the line signal, a cord circuit at the central
 exchange, a supervisory relay connected in
 bridge of the cord strands, and means where-
 by said supervisory relay may be energized 95
 and said auxiliary spring jack contacts may
 be actuated to open the local circuit upon
 connection of said cord circuit with any
 spring jack.

8. In a telephone exchange system, the 100
 combination with a telephone line extending
 from a central exchange to a substation, of a
 source of current at the exchange for supply-
 ing talking and signaling currents to the line,
 a line relay controlled by the line circuit, a 105
 local signal circuit including a signal con-
 trolled by said line relay, spring jacks at the
 exchange having main contacts connected
 with the telephone line, auxiliary contacts
 for the spring jacks having only mechanical 110
 association with the main jack contacts and
 normally disposed to complete the local sig-
 nal circuit when the line relay is actuated, a
 cord circuit at the central exchange, and a
 supervisory relay controlling a supervisory 115
 signal circuit connected in bridge of the cord
 strands, connection of a plug of the cord cir-
 cuit with the spring jack mechanically caus-
 ing actuation of the auxiliary contacts to
 open the local signal circuit to destroy the 120
 signal connection of said plug also causing
 the energization of said supervisory relay.

In witness whereof, I hereunto subscribe
 my name this 2nd day of September A. D.,
 1903.

HARRY G. WEBSTER.

Witnesses:

LYNN A. WILLIAMS,
 JOHN STAHR.