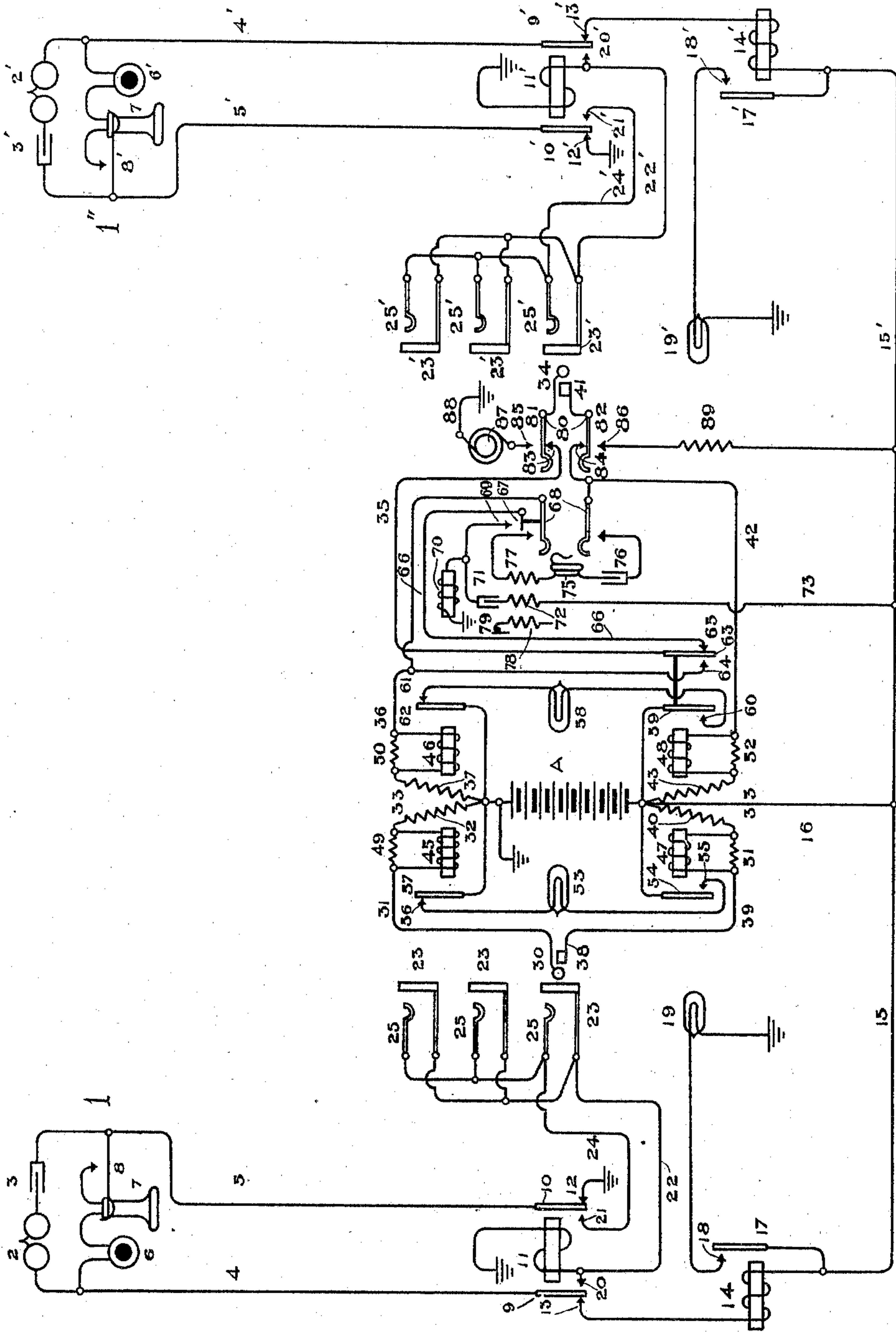


C. S. WINSTON.
TELEPHONE SYSTEM.
APPLICATION FILED NOV. 22, 1907.

967,475.

Patented Aug. 16, 1910.



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Specification of Letters Patent. Patented Aug. 16, 1910.

Application filed November 22, 1907. Serial No. 403,289.

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 central energy two-wire multiple type.

10 The object of my invention is to produce a system having a high efficiency for voice transmission and one which shall be positive in its operation, economical to manufacture and install and simple to maintain.

15 My invention is illustrated in the accompanying drawing which represents the apparatus of a calling and a called telephone line, and the cord circuit for placing the lines in connection for conversation. All of
20 the apparatus is shown in its normal or unactuated condition.

The calling subscriber's station No. 1 is equipped with the annunciator 2 and condenser 3 in a bridge between the line conductors 4 and 5, and with the transmitter 6 and receiver 7 in a bridge maintained normally open by contacts of the hook switch 8.

At the central office the limbs 4 and 5 terminate respectively in the springs 9 and 10
30 of the cut-off relay 11, the spring 10 being normally connected through contact 12, and the spring 9 being normally connected through contact 13, the coil of line relay 14, and conductors 15 and 16 with the live
35 pole of battery A. This line relay 14 controls the normally open contacts 17 and 18 in the circuit of the line lamp 19. Cut-off relay 11 also has the normally disconnected contacts 20 and 21, contact 20 being connected through the coil of relay 11 with
40 earth and also through conductor 22 with the sleeve contacts 23 of the answering and multiple jacks which are individual to subscriber's station 1. Contact 21 is connected
45 through conductor 24 with the tip contacts 25 of the answering and multiple jacks. The answering subscriber's station No. 1' shown at the right of the drawing is similarly equipped, the apparatus, both at the
50 substation and at the central office corresponding to the apparatus of the calling line, being indicated by like figures with the suffix "'".

The cord circuit for connecting the call-

ing and called lines for conversation is provided with the tip contact 30 which is connected by conductor 31 and the winding 32 of repeating coil 33 with the ground pole of battery A. The tip contact 34 of the calling plug is connected through conductors 35 and
60 36 and the coil 37 of the repeating coil 33 with the same pole of the central battery A. Likewise, the sleeve contact 38 of the answering plug is connected through conductor 39, and the coil 40 of repeating coil 33
65 with the live pole of battery A, and the sleeve contact 41 of the calling plug is connected through the conductor 42 and the coil 43 of repeating coil 33 with the live pole of battery A. 70

Interposed within the conductors 31, 36, 39 and 42 are the supervisory relays 45, 46, 47, and 48, each of these relays being respectively shunted by the non-inductive resistances 49, 50, 51 and 52. The supervisory
75 lamp 53 is associated with the answering end of the cord circuit and has its circuit controlled by the normally open contacts 54 and 55 of relay 47 and the normally closed contacts 56 and 57 of the relay 45. Super-
80 visory lamp 58 is associated with the calling end of the cord circuit and has its circuit controlled by the normally open contacts 59 and 60 of supervisory relay 48 and the normally closed contacts 61 and 62 of the super-
85 visory relay 46.

In addition to its contacts 59 and 60, supervisory relay 48 has the normally open contacts 63 and 64 adapted when closed to complete the connection between the talking
90 strands 35 and 36. Relay 48 has also the contact 65 which is normally in connection with the spring 63 and which is connected through conductor 66 with the contact 67 of the operator's listening key 68. Contact 67
95 is adapted to connect with the point 69 when the key is actuated, this latter point being connected with earth through the impedance coil 70 and also being connected through the condenser 71, tertiary 72 of
100 the operator's induction coil and conductor 73 with the live pole of battery A. The actuation of the operator's listening key 68 also connects the operator's receiver 75, condenser 76 and the secondary 77 of the op-
105 erator's induction coil in a bridge between the talking strands of the cord circuit. The operator's induction coil also has the pri-

mary winding 78 connected in series with the transmitter 79 and with any suitable source of current not shown in the drawing.

The operator's ringing key 80 is provided with the tip spring 81 and sleeve spring 82 normally in contact with the points 83 and 84 and adapted when actuated to be separated from these points and connected with the points 85 and 86, contact 85 being connected with the ringing generator 87 which is in turn connected with ground through conductor 88. Point 86 is connected through the non-inductive resistance 89 and conductors 15' and 16 with the live pole of battery A.

In order to establish the connection between the calling subscriber's station No. 1 and the called station No. 1' the subscriber removes his receiver 7 from the switch-hook 8 and thereby completes a circuit from the live pole of battery A over conductors 16 and 15 through the coil of line relay 14, contacts 13 and 9 of cut-off relay 11, line conductor 4, transmitter 6, receiver 7, switch-hook 8, line conductor 5 and the contacts 10 and 12 of the cut-off relay 11 to earth, and thence to the ground pole of battery A. Current in this path actuates the line relay 14 and closes its contacts 17 and 18 which complete the circuit of the line signal 19. The operator upon seeing the signal 19 displayed inserts her answering plug in the jack indicated by the display of the lamp and thereby brings contacts 30 and 38 of the plug into registry with contacts 23 and 25 of the plug and jack. This completes a circuit from the live pole of battery A through the coil 40 of repeating coil 33, the winding of relay 47 and the non-inductive resistance 51 in parallel, conductor 39, contacts 38 and 23 of the plug and jack, conductor 22 and the coil of relay 11 to earth. The current in this path actuates relays 11 and 47 also. The actuation of relay 11 moves the armatures 9 and 10 to their abnormal positions and opens the circuit of line relay 14, allowing its contacts 17 and 18 to separate, thereby effacing the line lamp 19.

Upon the actuation of relay 11 a new circuit is completed from the live pole of battery A through the coil 40 of repeating coil 33, relay 47 and non-inductive shunt 51 in parallel, conductor 39, contacts 38 and 23 of the plug and jack, conductor 22, contacts 20 and 9 of relay 11, line conductor 4, transmitter 6, receiver 7, switch hook 8, line conductor 5, contacts 10 and 21 of relay 11, conductor 24, tip contacts 25 and 30 of the jack and plug, conductor 31, coil of relay 45 and the non-inductive shunt 49 in parallel and the winding 32 of the repeating coil 33 to the ground pole of battery A. The current in this path actuates relay 45 separating contacts 56 and 57 and thereby prevents the display of the signal 53 which would

otherwise have been displayed through the closing of contacts 54 and 55 of relay 47. The operator now throws her listening key 68 and places her receiver 75 in a bridge between the talking strands of the cord circuit. She then asks the desired number and upon finding it to be that of line No. 1', raises her calling plug and touches the tip contact 34 to one of the test contacts 23' of the multiple jacks associated with the desired line. If the desired line is busy the sleeve contacts of all of the multiple jacks will be at a potential higher than that of earth. Therefore, when the tip 34 is touched to the sleeve 23' current will flow over the tip of the plug through contacts 81 and 83 of the ringing key, over conductor 35, contacts 63 and 65 of relay 48, conductor 66, contacts 67 and 69 of the listening key and through the impedance coil 70 to earth. This will slightly raise the potential of the terminal of the impedance coil 70 and will cause a partial discharge of the condenser 71. This discharge will produce a slight current in the tertiary winding 72 of the operator's induction coil and will thereby induce a slight click in the operator's head receiver 75, indicating to the operator that the desired line is busy. Assuming, however, that no click is heard, the operator then knows that the desired line is not busy and inserts her calling plug completely into the jack, causing contact 34 to register with the contact 25', and contact 41 to register with contact 23'. The operator now throws her ringing key 80 and separates the springs 81 and 83 which prevents ringing current from passing back over the calling subscriber's line and connects the ringing current contact 85 with the tip 34 of the calling plug. At the same time the spring 82 is deflected and connects with the contact 86. This causes current to flow from the live pole of battery A, over conductors 16 and 15', through the non-inductive resistance 89, contacts 86 and 82 of the ringing key 80, sleeve contacts 41 and 23' of the plug and jack, conductor 22' and the coil of relay 11' to earth. This actuates relay 11' and changes its contacts to their abnormal position. The ringing current now passes from the generator 87 through the contacts 85 and 81 of the ringing key over tip contacts 34 and 25' of the plug and jack, conductor 24', contacts 21' and 10' of cut-off relay 11', line conductor 5', condenser 3', annunciator 2', line conductor 4', contacts 9' and 20' of cut-off relay 11', conductor 22', sleeve contacts 23' and 41 of the jack and plug, contacts 82 and 86 of the ringing key 80, non-inductive resistance 89 and conductors 15' and 16 through the battery A to earth, and thence back to the ground pole of generator 87. This current rings the bell and calls the answering subscriber to his phone.

Immediately upon the release of the ringing key 80 a new circuit is formed from the live pole of battery A through the winding 43 of repeating coil 33, the coil of relay 48 and the non-inductive shunt 52 in parallel, conductor 42, contacts 80 and 82 of the ringing key 80, sleeve contact 41 and 23' of the plug and jack, conductor 22 and the coil of relay 11' to earth. Current in this path maintains the actuation of relay 11' and now actuates relay 48 closing its contacts 59 and 60 and completing the circuit of the lamp 58, displaying this lamp to indicate to the operator that the subscriber has not yet answered his call. The actuation of relay 48 also disconnects contact 65 from contact 63 and completes the connection between contacts 63 and 64, which completes the connection of the tip strand of the cord circuit between conductors 35 and 36.

Upon the response of the called subscriber a circuit is completed from the live pole of battery A through the winding 43 of repeating coil 33, the coil of relay 48 and the non-inductive shunt in parallel therewith, conductor 42, contacts 84 and 82 of the ringing key 80, sleeve conductors 41 and 23' of the plug and jack, conductor 22', contacts 20' and 9' of the cut-off relay 11', line conductor 4', transmitter 6', receiver 7', switch-hook 8', line conductor 5', contacts 10' and 21' of cut-off relay 11', conductor 24', the tip contacts 25' and 34 of the jack and plug, contacts 81 and 83 of the ringing key 80, conductor 35, contacts 63 and 64 of relay 48, conductor 36, the coil of relay 46 and its associated shunt 50 in parallel, and the winding 37 of repeating coil 33 to the ground pole of battery A. Current in this path actuates relay 46 separating its contacts 61 and 62 and opening the circuit of signal 58 to efface that signal, which indicates to the operator that the two subscribers are now in conversation.

Upon the completion of the conversation the subscribers hang up their receivers and thereby open the circuits of relays 46 and 45 through the paths previously described. When the circuits of these relays are broken the contacts 56 and 57, and 61 and 62 are completed and the supervisory signals 53 and 58 are again displayed. When the signals 53 and 58 are both displayed the operator removes the plugs and thereby interrupts the circuits of relays 47 and 48 allowing those relays to fall back to their normal positions and again interrupt the circuits of supervisory signals 53 and 58, thus placing all of the apparatus again in its normal unactuated condition.

The object of placing the non-inductive shunts 49, 50, 51 and 52 about the supervisory relays is to facilitate the talking conditions and furnish a path of non-inductance to the voice currents, which in passing from

subscriber's station 1' to the main battery A must pass through the windings 32 and 40 of repeating coil 33, thereby inducing similar voice currents in the windings 37 and 43 which are connected with the subscriber's station No. 1'.

While my invention is described in connection with certain details and combinations, it is to be understood that they are not all essential to my invention and that it is quite possible to use other forms of apparatus without in any sense 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 said lines for conversation, calling and answering supervisory signals for said cord circuit, four relays, one located in each end of each talking strand of the cord circuit, the circuit of each of said signals being completed through contacts of two of said relays, switches under the control of the operator in the circuit of two of said relays, the actuation of said relays being adapted to close the circuits of said supervisory signals, switches under the control of the subscribers in the circuits of the other two of said relays, said relays being adapted when actuated to open the circuits of said supervisory signals, substantially as described.

2. In a telephone system, the combination with a pair of telephone lines, of a cord circuit to connect said lines for conversation, calling and answering supervisory signals for said cord circuit, four relays, one located in each end of each talking strand of the cord circuit, switches under the control of the operator in the circuit of two of said relays, the actuation of said relays being adapted to cause the display of said supervisory signals, switches under the control of the subscribers in the circuits of the other two of said relays, the actuation of said relays being adapted to efface said signals, all four of said relays being actuated during conversation, substantially as described.

3. In a telephone system, the combination with a pair of telephone lines, of a cord circuit to connect said lines for conversation, a calling supervisory signal for said cord circuit, a pair of relays, one located in each of the talking strands of said cord circuit, the sleeve supervisory relay being adapted when actuated to close a normal break in the tip talking strand and to close the circuit of said signal, said relay being actuated over a local circuit when the cord is connected with the called line, the tip supervisory relay being adapted when actuated to open the circuit of said signal, said relay being actuated over the telephone line when the called subscriber answers his call, substantially as described.

4. In a telephone system, the combination
with a cord circuit, of a calling supervisory
signal for said cord circuit, a pair of relays,
each located in one of the talking strands
5 of said cord circuit, said signal being effaced
when the calling end of the cord circuit is
not in use, one of said relays being adapted
to be actuated over a local circuit as long as
the cord is connected with a called telephone
10 line, the actuation of said relay being adapt-
ed to cause the display of said signal, the

tip supervisory relay being adapted to be
actuated while the called line is closed at the
substation, said relay being adapted to efface
said signal, substantially as described. 15

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

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Witnesses:

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