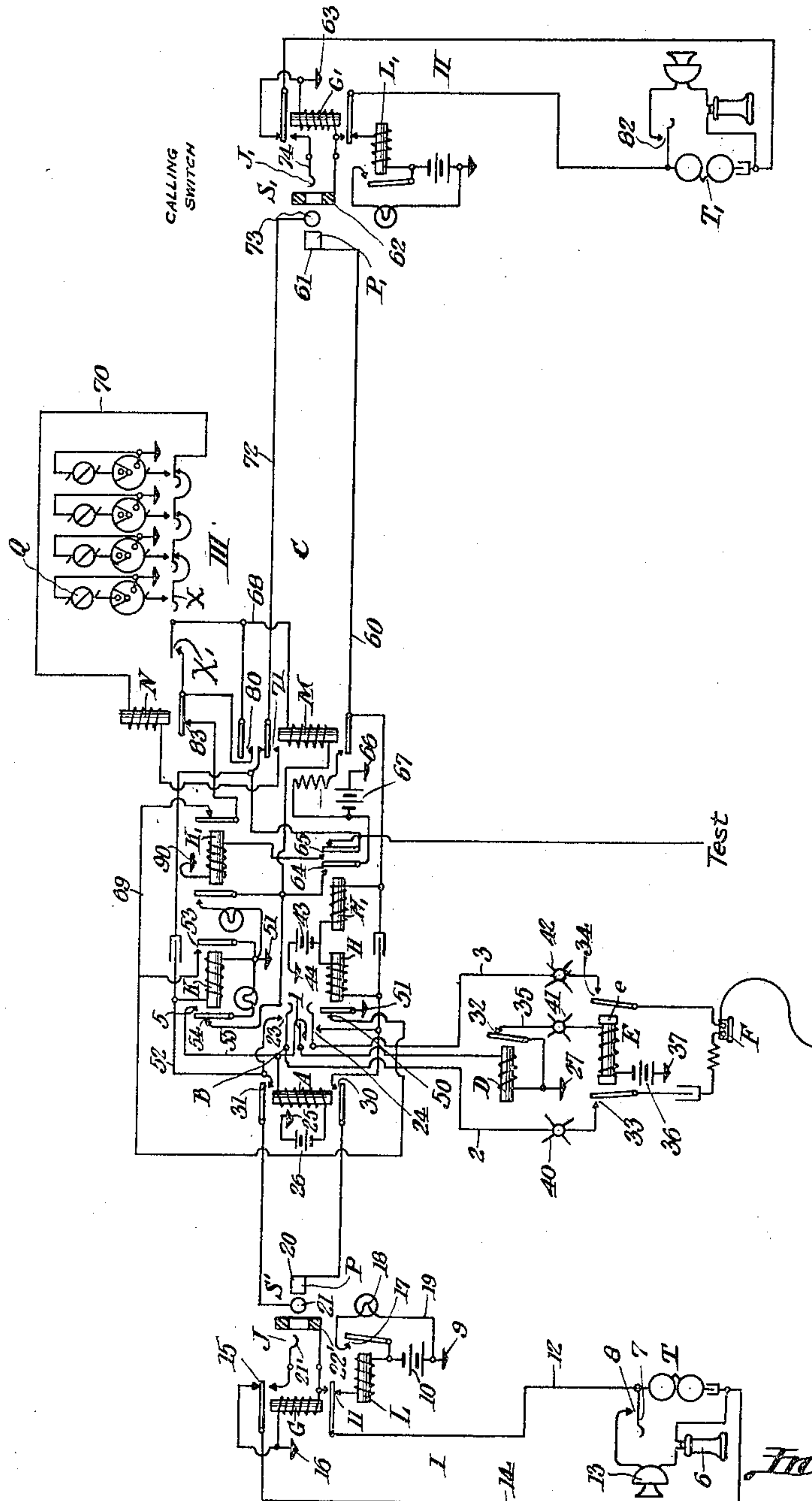


F. M. SLOUGH.
TELEPHONE SYSTEM.
APPLICATION FILED DEC. 22, 1916.

1,320,716.

Patented Nov. 4, 1919.



Inventor:
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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

1,320,716.

Specification of Letters Patent.

Patented Nov. 4, 1919.

Original application filed November 12, 1914, Serial No. 871,665, Patent No. 1,298,588. Divided and this
application filed December 22, 1916. Serial No. 138,303.

To all whom it may concern:

Be it known that I, FRANK M. SLOUGH, a
citizen of the United States, residing at
Rochester, in the county of Monroe and
State of New York, have invented certain
new and useful Improvements in Telephone
Systems; and I do hereby declare the fol-
lowing to be a full, clear, and exact descrip-
tion of the invention, such as will enable
others skilled in the art to which it apper-
tains to make and use the same.

My invention relates to improvements in
telephone systems, and more particularly to
manual common battery systems, though it
is adapted for use in systems of other types.

One of the objects of my invention is to
provide means for preventing unnecessary
disturbances in the operator's telephone
set in telephone systems employing an
"automatic disconnect arrangement." For
example, where the talking strands of
the line connectors are normally discon-
nected and means are provided for com-
pleting the strands, the act of completing
the strands is apt to cause an electrical
disturbance, such as a flow of current
through the operator's receiver, which is
strapped to her head, and which makes a
very unpleasant and disagreeable sensation
in her ear, calculated to interfere with the
proper performance of her duty, and cause
delay and other objectionable happenings in
connection with the operation of the system.

These and other objects of my invention
will appear from a description of an em-
bodiment of the invention.

This application is a division of my ap-
plication Ser. No. 871,665, filed Nov. 12,
1914, patented March 25, 1919, No. 1,298,588.

The figure shows diagrammatically a tele-
phone system embodying my invention.

In the drawing a telephone line is shown
at I, which will hereinafter be spoken of as
the "calling line", and a second telephone
line is shown at II, which will hereinafter be
spoken of as the "called line." It will be
understood that many telephone lines lead
to the exchange, illustrated diagrammati-
cally here at III. I have illustrated but two
of these lines, as they will be sufficient to ex-
plain my invention. Means are provided
at the main station III for connecting tele-
phone lines together, which is here shown
as a cord circuit C. Suitable apparatus is
provided for connecting the means C to the

telephone lines, here shown as switching ap-
paratus S' and S₁. The apparatus S' is
known as the answering switch and S₁ as the
calling switch. In the embodiment shown,
these switches consist of an answering plug
P, a calling plug P₁, a jack J and a jack J₁.

The line relays are shown at L, L₁ and
cut-off relays at G, G₁. The automatic dis-
connect relay is shown at A, the listening
key at B, the sleeve supervisory relays at
H, H₁, the tip supervisory relays at K, K₁,
the ringing relay at M, the ringing discon-
nect relay at N and a ringing generator at
Q. The subscriber's apparatus on the call-
ing line is shown at T and on the called
line at T₁.

In general, the operation of the system
is as follows: The subscriber at T initiates
a call, closing the circuit of his line relay
and operating his line signal. The operator
inserts the plug P into the jack J and oper-
ates the listening key B, closing the contacts
at 1 and completing a circuit for the relays
A and D. The relay A closes its contacts,
completing the cord circuit and the connec-
tion of the leads of the operator's set to the
cord. The relay D opens the circuit of the
relay E, which releases its armature, where-
upon the operator's set F is connected to the
cord. The relay E is slow acting, so that
the operator's set is not connected to the
leads 2 and 3 until after the relay A has
closed its contacts, so that no current can
flow through the operator's set until after
the disturbances caused by the actuation
thereof have subsided. As soon as A has
been operated, both the relays G and H will
be operated; likewise, relay K in a well
known manner. The relays K and H con-
trol the answering supervisory signal.

The operator then learns the subscriber
desired (it being assumed that it is the sub-
scriber at T₁) and inserts the plug P₁ into
the jack J₁, operating a ringing key, for
example, that at X. The relay M will be
energized through contacts of H₁, which
was energized when the calling switch was
operated. The ringing takes place and con-
tinues until the subscriber responds, when
it is interrupted by the relay N. The relay
K₁ will then be energized and conversation
will take place. At the termination of the
conversation the relays K and K₁ will be de-
energized and the operator will disconnect
the cord from the lines. As soon as the

subscriber at T retires, the relay K will be deenergized, opening the circuit of the relay A through the contact 5, and the talking strand of the cord circuit will be automatically interrupted.

More particularly, the operation of the system is as follows: When the subscriber at T takes the receiver 6 from the hook 7, the switch 8 will be closed, completing a circuit for the magnet L from ground 9—to battery 10—relay L—switch 11—line conductor 12—switch 8—13—6—line conductor 14—switch 15—to ground 16. The magnet of L will be energized, closing a switch 17 and completing a circuit for the line lamp 18 through the battery 10, the switch 17—lamp 18 and conductor 19. The lamp 18 is placed on the switchboard at the station III before the operator and its illumination attracts the attention of the operator, who inserts the plug P into the jack J, the contacts 20 and 21 of the plug registering with the contacts 21' and 22', respectively, of the jack. The operator then operates the key B, closing the switches 1—23 and 24. The closing of the switch 1 completes a temporary circuit for the magnets of the relays A and D, as follows: ground 25—battery 26—A—switch 1—D—to ground at 27. The energization of the magnet A will close the switches 30 and 31 in the talking strands of the cord circuit and connect the operator's leads 2 and 3 through the now closed switches 23 and 24 to the calling line. The energization of the magnet of the relay D will cause it to open the switch 32 in the normally closed circuit of the relay E, causing the deenergization of the relay E, which will release its armature, whereupon the switches 33 and 34 will be closed and connect the operator's set F to the leads 2 and 3.

The relay E is made slow acting, such as by the employment of suitable means, such as a piece of copper *e*. The relay E is normally energized over a circuit from ground at 27—through the switch 32—conductor 35—winding of E—battery 36—to ground 37. The relay E being relatively slow acting, does not release its armature and consequently the switches 33 and 34 do not open until after the expiration of an appreciable period of time during which the disturbances in the circuit connections caused by the operation of A or B, or the closing of the switches 30 and 31 have been dissipated, so that they do not flow through the operator's receiver, which is not connected to the leads 2 and 3 at the switches 33 and 34 until after such disturbances have been dissipated.

At 40, 41 and 42 I illustrate junction points at which the leads of other cord circuits are connected to the set F. When the switches 30 and 31 of the relay A were closed, circuits were completed for the relays G, H and K. The circuit of the relays

G and H is as follows: ground 16—winding of G—22'—20—30—H—43—to ground at 44. The cut-off relay opens the switches 15 and 11, disconnecting the line relay and lamp from the line and completing the limbs of the line to the contacts of the jack J. The relay H opens a switch 50. Current will flow through the magnet of the relay K over the following circuit: ground at 51—magnet of K—conductor 52—switch 31—contact 21—contact 21'—14—substation set at T—12—22'—20—30—winding of H—43—to ground 44. The relay K will close the switches 53 and 5, opening the switch 54. The closing of the switch 5 completes a circuit for the magnet of relay A independently of the switch 1. This circuit is as follows: 25—26—A—conductor 55—switch 5—to ground 51. This circuit will be maintained as long as the relay K is energized, which will be as long as the subscriber T is on his line.

The operator learns from the subscriber at T that it is the subscriber at T₁ that is desired, and after testing the called line in the usual manner, inserts the plug P₁ into the jack J₁, assuming that the called line was idle. A circuit will be completed for the relay H₁ as follows: 44—43—winding of H₁—conductor 60—contact 61—contact 62—winding of G₁—to ground 63. The energization of the winding of H₁ closes the switches 64 and 65, completing the circuit of the magnet of the ringing relay M, as follows: ground 66—battery 67—switch 64—winding of M—conductor 68—contact X₁—conductor 69—switch 50—to ground 51. The relay M will be energized, connecting the ringing current to the plug P₁, as follows: through Q—X—conductor 70—winding of N—switch 71—conductor 72—contact 73—contact 74—the called line and back through the conductor 60—battery 67—to ground at 66. The winding of M also closes a switch 80, locking its circuit independently of the contact X₁.

When the subscriber at T₁ responds, the closing of his substation bridge 82 reduces the resistance of the ringing circuit so that sufficient current flows to operate the magnet N, which opens the switch 83 in the circuit of the magnet of M, which releases its armature and the contacts controlled thereby are restored to the condition illustrated in the drawing. The relay K₁ will now be energized over a circuit including the called line, which is as follows: 90—winding of K₁—switch 65—conductor 72—over the called line and back to the conductor 60—through the winding of H₁—43 to ground at 44. The relay K₁ controls the supervisory signal and the circuit of the relay M.

The system is now in condition for conversation between the subscribers at T and T₁ and this takes place. When the sub-

scriber at T hangs up his receiver hook, the circuit of the relay A, previously described, will be interrupted at the switch 5 and the magnet of the relay A deenergized, whereupon the talking strands of the cord circuit are again interrupted at 30 and 31, and the line relay and line signal of the line I returned to the condition where they can be controlled by the subscriber T independently of the fact that the plug P is still in the jack J.

I have shown this particular embodiment of my invention and the details thereof for the purpose of describing the invention. I do not wish to be limited to such embodiment or to such details, as numerous and extensive departures may be made from the form and details illustrated without departing from the spirit of the invention.

I claim:—

1. In a telephone system, a cord circuit including talking strands, operators' set leads normally disconnected from said strands, switch means for connecting said leads to said strands, an operator's set normally disconnected from said leads at normally open contacts, a relay magnet for causing said contacts to close to connect said set to said leads, a circuit local to the cord circuit adapted to be closed when said switch means is closed to cause said magnet to cause the connection of said set to said leads, and apparatus to delay the connection of said set to said leads until after said leads are connected to said strands.

2. In a telephone system, the combination of an operator's set and means to connect the operator's set to the connecting means, apparatus to cause a flow of an electrical charge in said means, a slow acting relay normally maintaining the operator's set disconnected from the connecting means, a circuit for the slow acting relay and means to automatically deenergize the slow acting relay when a call is answered and after the flow of electrical charge has ceased.

3. In a telephone system, the combination of a telephone line, a cord circuit having talking strands, an operator's set and leads to connect said set to said strands, a slow releasing relay adapted when energized to operatively disassociate said set from said leads, an operator's key adapted when operated to connect said leads to said strands, said slow releasing relay being always actuated when said leads are thus connected to said strands, and a relay having a circuit with contacts controlled by said key controlling said slow releasing relay and adapted when said key is closed to cause a delayed operative association of said set with said leads.

4. In a telephone system, the combination

of a cord circuit provided with normally open talking strands, a relay for controlling said strands, a listening key controlling said relay, an operator's set whose connection to said strands is controlled by said key and means for delaying the connection of the operator's set to the talking strands until after said relay has closed said strands.

5. In a telephone system, the combination of link connectors provided with normally open strands, a relay for controlling said strands, an operator's set normally disconnected from said strands, a second relay controlling the connection of the operator's set to said strands, said second relay being slow in action in comparison with the first named relay and a listening key controlling both said relays.

6. In a telephone system, the combination of link connectors provided with talking strands, an operator's set and leads to connect the operator's set to the talking strands, a relay having contacts in said leads, a second relay having normally open contacts in the leads of the operator's set, a switch controlling both said relays, said second named relay being slow acting with respect to the first-named relay, a locking circuit for the first-named relay and a subscriber-controlled relay controlling said locking circuit.

7. In a telephone system, the combination of a cord circuit provided with talking strands, a relay having normally open contacts in said strands, an operator's set and means to connect said set to said strands, apparatus to delay the connection of said set to said strands until after said relay has been operated and a subscriber-controlled relay controlling the circuit of said relay.

8. In a telephone system, the combination of a cord circuit, automatic disconnect means for making and interrupting the cord circuit, an operator's set adapted to be connected to said cord, means to delay the connection of said set to said cord until the cord is completed and subscriber-controlled apparatus controlling said disconnect means.

9. In a telephone system, the combination of a cord circuit, provided with talking strands, a relay having normally open contacts in said strands, an operator's set and leads to connect the set to said strands, a second relay, slow acting as compared with the first relay, having normally open strands in said leads, a listening key controlling both said relays, a circuit for the first named relay independent of said key and a supervisory relay controlling said circuit.

In witness whereof I have signed my name hereunto this 4th day of December, 1916.

FRANK M. SLOUGH.