

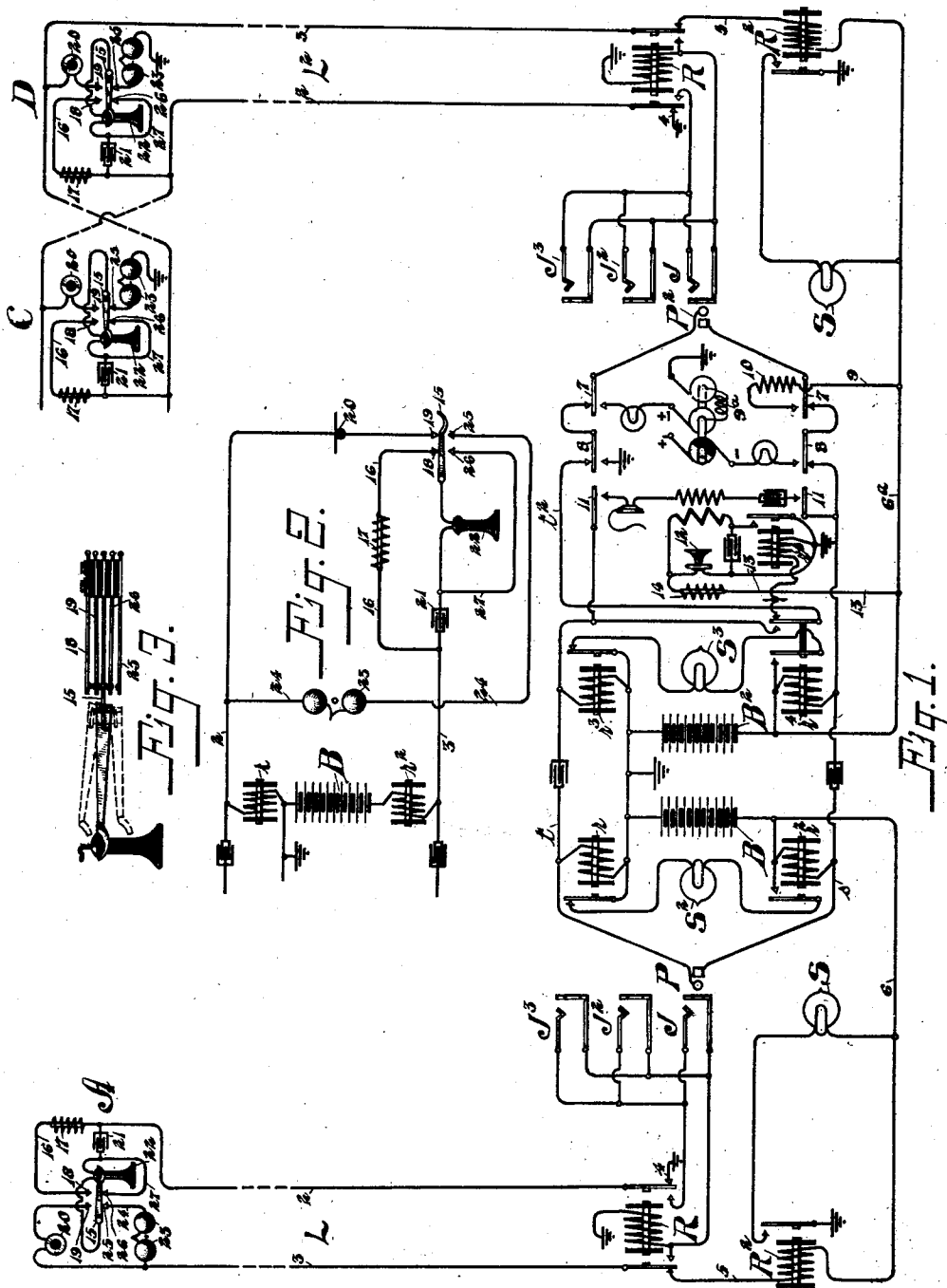
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W. W. DEAN.
SUBSCRIBER'S TELEPHONE CIRCUIT.

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NO MODEL.



Witnesses.

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UNITED STATES PATENT OFFICE.

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SUBSCRIBER'S TELEPHONE-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 747,331, dated December 15, 1903.

Application filed December 23, 1902. Serial No. 136,334. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Subscribers' Telephone-Circuits, of which the following is a specification.

My invention relates to a new and improved subscriber's circuit whereby a more efficient operation of the system is secured. In this arrangement I seek to provide means for preventing the direct flow of battery-current through the receiver during conversation or the passage therethrough of the heavy ringing-current in case the receiver is lifted while the generator-current is on the line. I also provide means whereby when the subscriber is "flashing" the supervisory lamp at the central office the battery-current does not make a click or noise in the receiver when the line-circuit is broken. I am also enabled in this invention to use a lower resistance-bell than usual and which does not interfere with transmission.

To the accomplishment of these and such other objects as may hereinafter appear my invention consists in the arrangement and location of the various parts, as hereinafter described, and particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which the same reference characters indicate like parts throughout, and in which—

Figure 1 shows diagrammatically a complete telephonic system embodying my improvements. Fig. 2 is a simplified diagram of a subscriber's line to which the improved substation-circuit is applied, and Fig. 3 is a detailed view of the hook-switch and its contacts.

Referring first to Fig. 1, the telephone-lines are shown extending from the substations to the central office, where they are fitted with the usual apparatus to permit interconnecting them for conversational purposes as well as for suitably supervising and attending the said connections. The line L, for example, extends in two limbs 2 and 3 to the springs of the line-cut-off relay R, the former being grounded through a branch 4 and the latter

being normally connected with a conductor 5, leading to the line-relay R², which is connected upon its opposite side and by means of a conductor 6 with the live pole of a central and common battery B. The line-signal S is controlled by the normally open contacts of the line-relay R². Suitable spring-jacks, such as J, J², and J³, in any desired number are provided with conductors, reaching to the forward contacts of the said cut-off-relay springs, whereby when the said cut-off relay is actuated the said jacks are connected to the external line-circuit. The cut-off relay may be legged to ground from the sleeve-jack conductor, as shown.

The cord-circuit may be of any suitable type, that shown consisting of a pair of plugs P and P², having their contacts connected together by suitable flexible strands. A call coming in over the line L, for example, is answered by the insertion of the plug P, which permits current to flow from the battery B through the sleeve-supervisory relay r², over the sleeve-strand s of the cord-circuit, and through the cut-off relay R, which serves to connect the said jacks, as before stated, with the external line-circuit and to render the line-signal inoperative. The supervisory signal S², associated with the plug P, does not respond, owing to the actuation of tip supervisory relay r over the tip-strand t of the cord-circuit and the metallic telephone-line. Ascertaining that one of the parties located upon the polystation-line L² is desired, the line is tested in the usual manner. If idle, the jack-rings are connected with earth and no click is received; but if busy the said rings are connected with the live pole of either the battery B or B² and a current flows over the tip-strand t² and through the high-resistance and high-impedance test-relay r⁵, which is actuated and serves to close a path for current through the primary winding of the operator's induction-coil, thus giving a click in the operator's receiver. If idle, the calling-plug P² is inserted, and either the springs 7 or 8 are actuated to connect the ringing-generator 9^a with one side or the other of the telephone-line to ring the desired subscriber. When springs 7 of the ringing-key are actu-

ated, the cut-off relay R of the line is maintained actuated over conductor 9 and through resistance-coil, while if the other set of springs be actuated the ringing-current itself, which is preferably negative pulsating in character, serves to maintain the same actuated. It will be understood that by the operation of a set of springs 11 of any suitable listening-key the operator's head-telephone, the secondary of her induction-coil, and a suitable condenser may be bridged across the calling end of the cord-circuit. It will be also apparent that the operator's transmitter 12 is charged from the battery B² over the common lead 6^a and conductor 13, the latter conductor containing the retardation-coil 14. After calling the subscriber the sleeve supervisory relay r⁴ is actuated to complete through its main contact the circuit of the supervisory lamp S³, which is lighted to indicate that the subscriber has not yet responded. The said relay also completes the tip-strand t² for conversation through its auxiliary contact and cuts off the test-relay r⁵. When the called subscriber responds, the tip supervisory relay r³ is energized by current over the metallic line to extinguish supervisory lamp S³.

As shown by reference to Fig. 2, the hook-switch 15 serves in its raised position to complete a path for steady current over the conductor 3, through branch 16, containing the retardation-coil 17, preferably of about twenty-five ohms resistance, contact 18, thence through the hook, contact 19, and thence through the transmitter 20 and back over line conductor 2 to the central office. At the same time an auxiliary path for varying current is provided over said line conductor 3 through the condenser 21, receiver 22, switch-hook 15, contact 19, through transmitter 20, and back to the central office over conductor 2. Thus during conversation two parallel paths are provided, one opaque to the passage of varying or voice currents, while the other is opaque to the passage of steady currents and permits the passage of the voice-currents. When the receiver is upon the hook 15, as is normally the case, the above-mentioned paths for current are opened and a path for ringing-current through the call-bell 23 is provided. This current may be traced from the line-wire 2, through branch 24, containing the bell 23, to lower contact 25 of the hook-switch, through the switch 15, and thence to lower contact 26 and over conductor 27, through condenser 21, and by the way of line conductor 3 back to the central office. This is the path for ringing-current when the subscriber is called from the central office.

Fig. 3 shows the practical construction of the hook-switch, in which the receiver is shown upon its hook-lever, the lever being indicated in full lines as at an intermediate position, while the dotted lines indicate its uppermost and lowermost positions. The

several springs are bunched, as shown, and are suitably insulated from one another and are secured to a suitable rigid support. The central spring extends beyond the free ends of the other springs and engages a lug upon the switch-hook, whereby said springs are suitably controlled in the vibration of the hook-lever. These springs are preferably given such a normal trend or bias that when the lever is depressed the contacts 18 and 19 do not separate from contact 15 until after the latter engages contact 26. By reference to Fig. 2 the effect of this is clearly seen and which consists in completing the shunt about the receiver 22 to prevent the flow through said receiver of the extra current due to the breaking-of the circuit. Likewise the spring 26 may be adjusted to separate from 15 only after contacts 18 and 19 are made; but this is not essential, since the initial completion of the circuit is not so objectionable in the receiver. By this arrangement direct current from the central-office battery does not flow through the receiver during conversation, nor does the heavy ringing-current pass there-through if the receiver is lifted when the subscriber is being called, since a more ready path is provided through the conductor 16 and low-resistance impedance-coil 17. Moreover, when the subscriber is attempting to attract the attention of the operator at the central office by flashing the supervisory lamp the current at breaking the circuit does not cause a click in the receiver. Again, this circuit permits the use of a low-resistance bell and also one of low impedance, since it performs no function in transmission. In the case of a polystation-line, as shown at stations C and D upon line L², the bells may be connected through the switch-hook from the opposite line conductors to ground. Otherwise the arrangement is substantially the same as described with reference to Fig. 2 and substantially as shown at the station A upon line L.

Although various forms of hook-switches may be employed, one that is found suitable for my purposes is shown in my Patent No. 704,697, dated July 15, 1902.

Various modifications may be made in my invention without departing from its scope or principle, and I therefore do not wish to be limited in all respects to the precise arrangement and combinations shown.

By the term "opaque" as employed herein, defining a circuit in its relation to the energizing-current, I contemplate a circuit containing a condenser or equivalent device which prevents the passage through the circuit of an appreciable or substantial amount of current—that is, a sufficient amount to affect the operation of the system to an objectionable degree, and by the term "opaque" when referring to the talking-currents I contemplate that characteristic of the circuit which will prevent the passage of the talking-currents therethrough in sufficient amount

to materially affect the transmission of the talking-currents through the path containing the telephone-receiver.

The condenser may be replaced by other direct-current interrupters without departing from the scope of my invention.

I claim—

1. The combination with a telephone-line extending to a central station, of an energizing source of electricity at the central station adapted to be connected therewith, a pair of parallel paths in one of the limbs of the telephone-line, a receiver and a condenser included in one of said paths, a choking or impedance coil included in the other path, a call-bell connected between the opposite limb and the path containing the receiver and condenser at a point between said receiver and condenser when the receiver is upon the switch, and means for opening said path containing the bell when the receiver is off its switch, substantially as described.

2. The combination with a telephone-line extending to the central station, of an energizing source of electricity at the central station adapted to be connected therewith, a pair of parallel paths in one of the limbs of the telephone-line, a receiver and a steady-current interrupter included in one of said paths, a choking or impedance coil connected in the other path, and a call-bell normally connected between the opposite limb and the path containing the receiver and condenser at a point between said receiver and condenser, and means for opening said bell branch during conversation, substantially as described.

3. A telephone-substation apparatus comprising the main circuit, said circuit having two parallel paths, one path being opaque to voice-currents and the other opaque to steady currents, a receiver in the path opaque to steady currents, a condenser also in said path, a call-signaling bell, and means for normally including only said bell in circuit with said condenser, and only the receiver in circuit therewith during conversation, whereby in an organization of the type described the condenser is used for both signaling and talking and the bell is cut out during conversation, substantially as described.

4. The combination with a telephone-line extending to the central station, of an energizing source of electricity at the central office adapted to be connected therewith, a pair of parallel paths in one of the limbs of the telephone-line, a receiver and direct-current interrupter included in one of said paths, an impedance-coil included in the other path, a call-bell connected to the path containing the receiver and interrupter and at a point between them, and means for opening the circuit of the bell during conversation, substantially as described.

5. The combination with a telephone-line extending to the central station, of an energizing source of electricity at the central of-

fice adapted to be connected therewith, a pair of parallel paths in one of the limbs of the telephone-line, a receiver and condenser included in one of said paths, an impedance-coil included in the other path, and a call-bell connected with the path containing the receiver and condenser at a point between them and having its circuit normally closed through contacts controlled by the hook-switch of the subscriber's set, substantially as described.

6. The combination with a telephone-line extending to the central station, of an energizing source of electricity at the central office adapted to be connected therewith, a pair of parallel paths in one of the limbs of the telephone-line, a receiver and direct-current interrupter included in one of said paths, an impedance-coil included in the other path, and a call-bell connected upon one side with the path containing the receiver and interrupter at a point between them and upon the other side with a suitable return, the circuit of said bell being completed through contacts normally closed by the hook-switch of the subscriber's set, substantially as described.

7. The combination with a telephone-line, of an energizing source of electricity at the central office included in the line to furnish current to the substation for conversation, a substation apparatus including two paths, one containing a steady-current interrupter to make the path opaque to the passage of steady currents, and the other path being opaque to the passage of voice-currents, a transmitter in the path of the steady currents, a telephone-receiver in the path that is opaque to the passage of the steady currents, a signaling-bell normally connected with the latter path so as to include the said interrupter in its operating-circuit, and means to cut out the said bell during conversation, substantially as described.

8. The combination with a telephone-line extending to the central station, of an energizing source of electricity at the central station adapted to be connected therewith, a pair of parallel paths in one of the limbs of the telephone-line, a receiver and direct-current interrupter included in one of said paths, a choking or impedance coil included in the other path, and a low-resistance bell normally connected between the opposite limb and the path containing said receiver and interrupter, and means to prevent said bell from shunting the telephonic currents to an objectionable degree from the talking instruments, substantially as described.

9. The combination with a telephone-line, of an energizing source of electricity at the central office included in the line to furnish current to the substation for conversation, a substation apparatus including two paths, one containing a condenser and the other a retardation-coil, a transmitter in the path of steady currents, a telephone-receiver in cir-

- cuit with the condenser and out of the path of steady currents, a signaling-bell normally connected with the path containing the receiver and condenser and so as to include said condenser in its operating-circuit, and a hook-switch to cut out said bell during conversation and to change the circuits from signaling to talking position and vice versa, substantially as described.
10. The combination with a telephone-line, of a central source of current connected therewith, a telephone-receiver at the substation, and a shunt-circuit at the substation closed around the said receiver before the main-line circuit is broken, whereby the opening of the main-line circuit does not objectionably affect the receiver, substantially as described.
11. The combination with a telephone-line, of a central source of current connected therewith, a telephone-receiver at the substation, and a shunt-circuit at the substation closed around the said receiver before the main-line circuit is broken at the substation, whereby the opening of the main-line circuit does not objectionably affect the receiver, substantially as described.
12. The combination with a telephone-subscriber's station-circuit, of a receiver connected therewith, and means controlled by the switch-hook at the said station for preventing noise in the receiver during the operation of the hook-switch, substantially as described.
13. The combination with a telephone-subscriber's station-circuit, of a receiver connected therewith, and means controlled by the switch-hook at the said station for preventing noise in the receiver in the alteration of the circuit arrangement by the hook-switch, substantially as described.
14. The combination with a telephone-line, of a source of current at the central office, a substation apparatus comprising a transmitter charged by said source, a receiver, a hook-switch, and means controlled by the hook-switch for preventing undue noise in the receiver when the circuit arrangement is altered by the hook-switch, substantially as described.
15. The combination with a telephone-line, of a source of current at the central office, a substation apparatus comprising a transmitter charged by said source, a receiver, a hook-switch, and means at the substation for preventing undue noise in the receiver when the circuit of said source is opened, substantially as described.
16. The combination with a telephone-line, of a source of current at the central office, a substation apparatus comprising a transmitter charged by said source, a receiver, and a hook-switch at the substation to control the circuit of said source through the transmitter, and means controlled by said hook-switch for preventing undue noise in the receiver when the circuit of said source is opened, substantially as described.
17. The combination with a telephone-line, of a source of current at the central office, a substation apparatus comprising a transmitter charged by said source, a receiver, a hook-switch, and a shunt of the receiver controlled by the hook-switch, substantially as described.
18. The combination with a telephone-line, of a source of current at the central office, a substation apparatus comprising a transmitter charged by said source, a receiver, a hook-switch, the normal contacts of said hook-switch being closed before the alternate contacts are opened whereby noise in the receiver is prevented, substantially as described.
19. The combination with a telephone-line, of a source of current connected therewith at the central office, a subscriber's station-circuit including a receiver connected therein, a switch-hook to change the circuits from signaling to talking condition and vice versa, and means controlled by the switch-hook for preventing noise in the receiver when the circuit of the receiver is closed, substantially as described.
20. The combination with a telephone-line, of a source of current connected therewith at the central office, a subscriber's station-circuit, a receiver connected therewith, a switch-hook to change the circuits from signaling to talking condition and vice versa, and means controlled by the switch-hook for preventing noise in the receiver when the circuit thereof is opened or closed, substantially as described.
21. The combination with a telephone-line, of a source of current connected therewith at the central office, a subscriber's station-circuit, a receiver connected therewith, and means for preventing noise in the receiver when its circuit is closed at the substation, substantially as described.
22. The combination with a telephone-line, of a source of current connected therewith at the central office, a subscriber's station-circuit, a receiver connected therewith, and means for preventing noise in the receiver when its circuit is open or closed at the substation, substantially as described.
23. The combination with a telephone-line, of a source of current connected therewith at the central office, a substation apparatus comprising a transmitter charged by said source, a receiver, a hook-switch, and a shunt of the receiver controlled by the hook-switch to prevent noise in the receiver when its circuit is closed, substantially as described.
24. The combination with a telephone-line, of a source of current at the central office, a substation apparatus comprising a transmitter charged by said source, a receiver, and a shunt of the receiver controlled by the hook-switch, said shunt being closed before the circuit through the receiver is opened and said circuit being closed before the shunt is opened in the operation of the hook-switch, substantially as described.

25. The combination with a telephone-line,
of an energizing source of electricity at the
central office included in the line to furnish
current to the substation for conversation a
5 substation apparatus including a transmitter
in the path of said current from the central
office, a telephone-receiver, a hook-switch to
change the circuits from normal condition to
talking condition and vice versa, a signaling-
10 bell in a branch conductor connected on one
side with the circuit through said receiver,
and on the other side with a suitable return,
said bell branch including normal contacts

of the hook-switch, the portion of said branch
between said normal contacts and the con- 15
nection thereof with the said receiver-circuit
constituting a shunt about the receiver in
the operation of the hook-switch, substan-
tially as described.

Signed by me, at Chicago, county of Cook, 20
State of Illinois, this 19th day of December,
1902.

WILLIAM W. DEAN.

Witnesses:

GAZELLE BEDER,
ROBERT LEWIS AMES.