

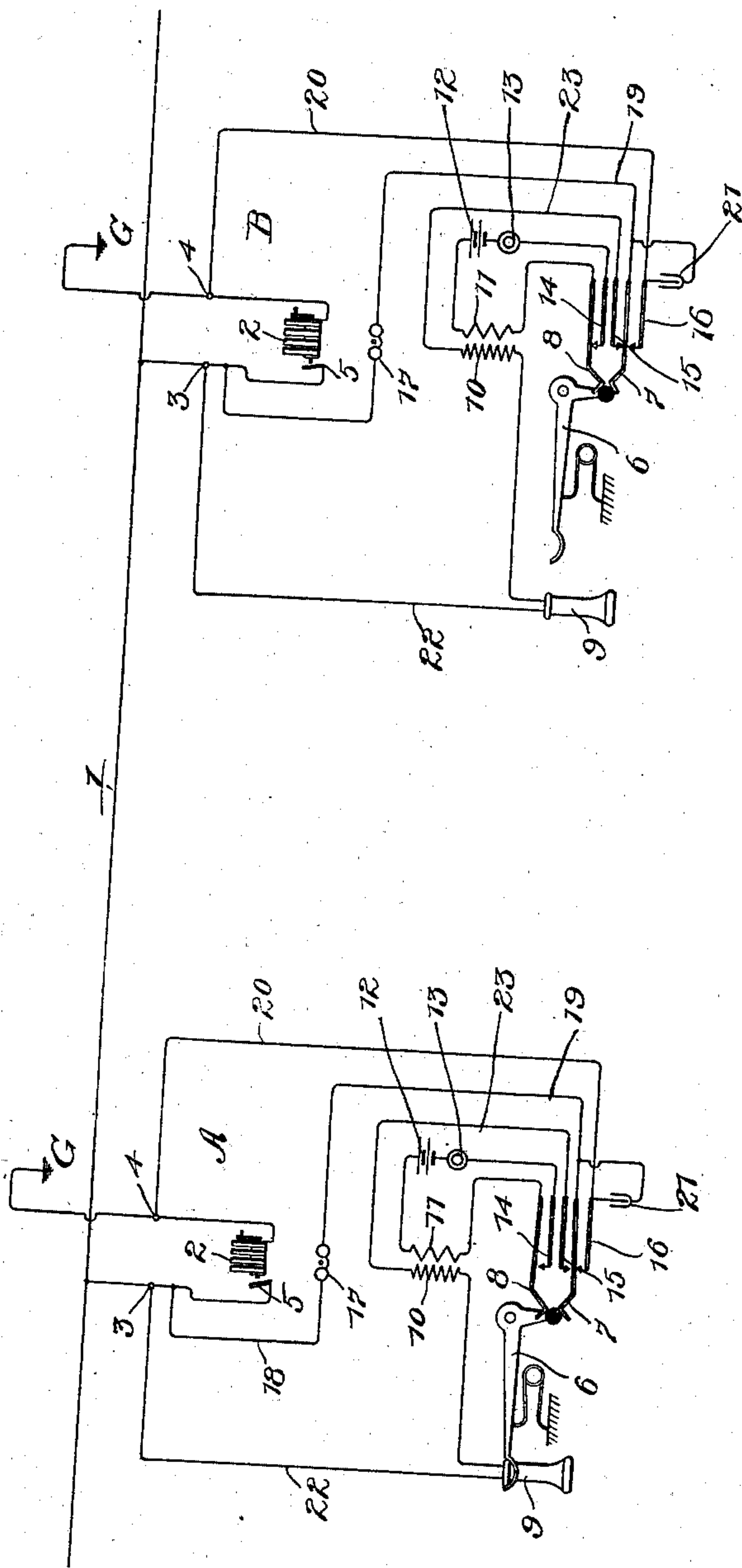
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G. BABCOCK.  
TELEPHONE SYSTEM.

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NO MODEL.



Witnesses,

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## UNITED STATES PATENT OFFICE.

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## TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 743,421, dated November 10, 1903.

Application filed April 27, 1903. Serial No. 154,509. (No model.)

*To all whom it may concern:*

Be it known that I, GARRISON BABCOCK, 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 Telephone Systems, (Case No. 3,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to telephone systems, and is particularly well adapted for use in connection with so-called "bridging" telephones.

It is now a frequent practice to connect a number of subscribers' telephone sets each in bridge of a single telephone-line, the subscriber's call-bell or signal at each of the substations connected with a telephone-line being normally connected in bridge of the two line-limbs. Such bridging telephone-bells are usually wound to a comparatively high resistance and impedance. The usual subscriber's telephone set includes a switch-hook, upon which the receiver is hung when not in use, this switch-hook serving under normal conditions to open a local-battery circuit adapted to be used for impressing telephonic voice-currents upon the transmission-line and serving at the same time to disconnect the telephonic receiving instruments from conductive connection with the line. Upon the removal of the receiver from its switch-hook the local-battery circuit is closed and the telephone instruments are connected in bridge of the line-limbs. The signal-bells at the various substations connected with a telephone-line when employed in this manner are each of comparatively high impedance, whereby telephonic voice-currents may be impressed upon the line-limbs and transmitted thereby, without being short-circuited through the signal-bells connected in bridge of the line-limbs, for the reason that the high impedance of the signal-bells chokes and prevents the passage of voice-currents there-through. The removal of a telephone-receiver from its switch-hook at any one substation serves to close a circuit through the telephone instruments between the line-

limbs, this circuit being of comparatively low resistance. The signaling instruments or call-bells of such bridging telephone-lines are adapted to be actuated by current from an alternating or pulsating current generator located at each of the substations or by a current from an alternating-current generator located at the central station and whose terminals are adapted for connection with the line-limbs. As hereinbefore described, the removal of a receiver from the switch-hook of a substation connected with such a bridging telephone-line closes a circuit of low resistance between the line-limbs, this low-resistance circuit serving to shunt alternating signaling-currents which may be impressed upon the line-limbs. Thus the ringing-currents pass through the telephone instruments rather than through the high-impedance and high-resistance call-bells. Thus if by mistake one or more of the subscribers whose substations are connected with a bridging line leaves his receiver off the switch-hook upon having finished a conversation the proper operation of the call-bells by impressed alternating currents is seriously interfered with. A means of overcoming this defect due to the accidental failure to replace a receiver upon the telephone switch-hook consists in the provision at each substation of a condenser through which the telephone instruments are connected with the line. Such condensers prevent the closure of a conductively-continuous circuit through the telephone instruments upon the removal of the receiver from its switch-hook, the continuity of the circuit being interrupted by the condenser, which is non-conductive to the passage of direct currents, but readily conductive to the passage of telephonic voice-currents. The said condensers, however, when connected with the telephone-line, especially if the return-circuit for such a line is through the ground, act as lightning-arresters to convey lightning discharges from the metallic line to the ground, the passage of such a lightning discharge causing a puncture in the condenser, and thereby destroying its useful purpose, as above described.



It is the purpose of my invention to provide improved circuit arrangements at each of the subscribers' substations, such that a condenser may be employed without subjecting it to the danger of puncture and destruction due to lightning discharges. This result I accomplish by means of a switching device associated with the usual hook-switch, whereby a condenser is connected in circuit with the telephone instruments upon the removal of the receiver from the switch-hook and whereby a low-resistance circuit in shunt of the condenser is closed upon the replacement of the receiver upon the switch-hook, thereby protecting the condenser from the destructive effect of lightning discharges.

A preferred embodiment of my invention will be made clear by reference to the accompanying drawing, in which I have illustrated a metallic line 1, between which and the ground G are connected the bridging telephone sets at substations A and B. The instruments at these two substations are identical, and similar reference characters are applied to each. At each of the substations I have illustrated an alternating-current generator 2, whose terminals are connected with the binding-posts 3 and 4, the binding-post 3 being connected with the line-limb 1, while the binding-post 4 is connected with the ground, as shown. These generators are preferably of the well-known type in which a switch associated with the generator-armature serves to maintain the circuit normally open through the generator-armature, the actuation of the armature serving to cause the closure of the switch to connect the generator-terminals with the transmission-circuit. At each of the substations A and B the generators are illustrated in their normal condition in which the circuit therethrough is interrupted by the automatic switch 5. There is provided at each substation a switch-hook 6, adapted to actuate the spring-contacts 7 and 8. The receiver 9 is serially connected through the secondary 10 of an induction-coil whose primary 11 is, upon the removal of the receiver 9 from the switch-hook 6, serially connected through a local circuit with the battery 12 and the transmitter 13, this circuit being traced through the contact-spring 8 and the associated spring-contact 14. The contact-spring 7 is provided with a front contact 15 and a back contact 16. The receiver at substation A is shown in its normal position upon the switch-hook 6, while the receiver at substation B is shown as removed from its switch-hook, whereby the difference in the circuit relations established by the alternate positions of the receiver 9 may be indicated. At each of the substations there is a high-resistance call-bell 17, normally connected in bridge of the telephone-line limbs. A circuit through a call-bell 17 at a substation in which the receiver 9 is upon the switch-hook 6 may be traced as follows:

from the binding-post 3 through the conductor 18 to call-bell 17, the conductor 19, the contact-spring 7, the contact 16, and the conductor 20 to the binding-post 4. It will thus be seen that under normal conditions the call-bell 17 is connected in bridge of the telephone-line limbs. Under the same normal conditions in which the receiver is upon the switch-hook the local circuit through the transmitter 13 is interrupted by the electrical disconnection of the contact 14 and the contact-spring 8. Under normal conditions also the circuit through the receiver 9 and the secondary 10 of the induction-coil is interrupted by the disconnection of the spring 7 from the contact 15. Between the spring 7 and the contact 16, which is connected with the binding-post 4, there is connected a condenser 21. It will be seen that in the normal condition of the substation apparatus the spring 7 and the contact 16 are in electrical connection, whereby the condenser 21 is short-circuited, thus protecting it from the destructive effects of lightning discharges which might otherwise take place between the line-limb 1 and the ground G through the substation apparatus.

The apparatus illustrated as located at substation B illustrates the circuit connections established upon the removal of a receiver from its switch-hook. The conductive circuit between the binding-posts 3 and 4 through the call-bell 17 is interrupted by the break in the electrical connection between the spring 7 and the contact 16. The electrical connection of the spring 8 with the contact 14 closes a local battery-circuit through the transmitter 13, whereby the sound-waves impressed upon the transmitter may cause variations in the current strength through the primary 11 of the induction-coil, thereby causing the voice-currents set up in the secondary winding 10 to be impressed upon the line-limbs through a circuit which may be traced as follows: from the binding-post 3 through the conductor 22, the receiver 9, the secondary coil 10, the conductor 23, the contact 15, the spring 7, the condenser 21, and the conductor 20 to the binding-post 4. While the condenser 21 is opaque to the passage of direct currents, it readily permits the passage of the rapidly-fluctuating telephonic voice-currents. It will be seen that in this abnormal position of the receiver when removed from its switch-hook the condenser is connected in a circuit between the line-limb 1 and the ground G, where, of course, the condenser would be subjected to the destructive effects of lightning discharges; but as this condition is abnormal and should be maintained only while a subscriber is using his telephone instrument for conversational purposes the liability to destructive effects due to lightning discharges is reduced to a minimum. The replacement of the receiver upon the switch-hook upon the completion of a conversation short-cir-



cuits the condenser and interrupts the circuit therethrough, whereby it is at once protected from lightning discharge.

My invention could of course be equally well applied to telephone-lines comprising two metallic line-limbs, of which one may or may not be connected with the ground.

While I have herein shown and described one preferred embodiment of my invention, it will be apparent to those skilled in the art that many modifications may be employed without departing from the spirit thereof. I do not therefore wish to limit myself to the precise disclosure herein set forth; but,

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

1. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, and switching mechanism adapted when in one operative condition to connect serially said telephone instruments and said condenser between the limbs of a telephone-line and when in another operative condition to close a low-resistance path in shunt of said condenser.

2. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, and hook-switch mechanism adapted when in one operative position to connect serially said telephone instruments and said condenser between the limbs of a telephone-line and when in another alternative operative position to close a low-resistance path in shunt of said condenser.

3. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, and switching mechanism adapted when in one operative condition to connect serially said telephone instruments and said condenser between the limbs of a telephone-line and when in another operative condition to close a low-resistance path in shunt of said condenser and to interrupt the telephonic circuit through said telephone instruments between said line-limbs.

4. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, and hook-switch mechanism adapted when in one operative position to connect serially said telephone instruments and said condenser between the limbs of a telephone-line and when in another alternate operative position to close a low-resistance path in shunt of said condenser and to interrupt the telephonic circuit through said telephone instruments between said line-limbs.

5. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, and switching mechanism adapted when in one operative condition to connect serially said telephone instruments and said condenser between a telephone-line and ground, and when in another alternative operative condition to close a low-resistance path in shunt of said condenser.

6. In a subscriber's telephone set, the combination with telephone instruments, of a con-

denser, and switching mechanism adapted when in one operative condition serially to connect said telephone instruments and said condenser between a telephone-line and ground and when in another alternative operative condition to close a low-resistance path in shunt of said condenser and to interrupt the telephonic circuit through said telephone instruments.

7. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, hook-switch mechanism adapted when in one operative position to connect serially said telephone instruments and said condenser between the limbs of a telephone-line and when in another operative position to close a low-resistance path in shunt of said condenser and a local transmitter-circuit controlled by said hook-switch mechanism.

8. In combination, a telephone-line, a series of substations adapted for bridging connection with said line, telephone instruments at each of said substations, a condenser at each of said substations, and switching mechanism adapted when in one operative condition to connect serially said telephone instruments and said condenser between the limbs of said telephone-line, and when in another operative condition to close a low-resistance path in shunt of said condenser.

9. In combination, a telephone-line, a series of substations adapted for bridging connection with said line, telephone instruments at each of said substations, a condenser at each of said substations, and switching mechanism adapted when in one operative condition to connect serially said telephone instruments and said condenser between the limbs of said telephone-line and when in another operative condition to close a low-resistance path in shunt of said condenser and to interrupt the circuit through said telephone instruments between said line-limbs.

10. In combination, a telephone-line, a series of substations adapted for bridging connection with said line, high-resistance signaling-bells at each of said substations connected in bridge of the limbs of said telephone-line, telephone instruments at each of said substations, a condenser at each of said substations, and hook-switch mechanism adapted when in one operative position to connect serially said telephone instruments and said condenser between the limbs of said telephone-line and to interrupt the circuit through the corresponding signaling-bell and when in another operative position to close a low-resistance path in shunt of said condenser.

11. In combination, a telephone-line, a series of substations adapted for bridging connection with said line, high-resistance signaling-bells at each of said substations connected in bridge of the limbs of said telephone-line, telephone instruments at each of said substations, a condenser at each of said substations, and hook-switch mechanism adapted when in one operative position to connect se-



rially said telephone instruments and said condenser between the limbs of said telephone-line and to interrupt the circuit through the corresponding signaling-bell and when in  
 5 another operative position to close a low-resistance path in shunt of said condenser and to interrupt the circuit through said telephone instruments between said line-limbs.

12. In combination, a telephone-line, a series of substations adapted for bridging connection with said line, high-resistance signaling-bells at each of said substations connected in bridge of the limbs of said telephone-line, telephone instruments at each of said  
 15 substations, a condenser at each of said substations, and hook-switch mechanism adapted when in one operative position to connect serially said telephone instruments and said condenser between the limbs of said telephone-line and to interrupt the circuit  
 20 through the corresponding signaling-bell and to close a transmitter-circuit through a local battery, and when in another operative position to close a low-resistance path in shunt of said condenser.

13. In a subscriber's telephone set, the combination with telephone instruments comprising a receiver and an induction-coil winding, of a condenser, a receiver-hook adapted when  
 30 relieved of the weight of said receiver to actuate switching mechanism to cause the serial connection of said telephone instruments and said condenser between the limbs of a telephone-line and adapted when the receiver is in position thereon to actuate said switching  
 35 mechanism to interrupt the telephonic circuit through said telephone instruments and to close a low-resistance path in shunt of said condenser.

14. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, a receiver-hook adapted when relieved of the weight of said receiver to actuate  
 40 switching mechanism to cause the serial connection of said telephone instruments and said condenser between the limbs of a telephone-line and adapted when the receiver is in position thereon to actuate said switching  
 45 mechanism to interrupt the telephonic circuit through said telephone instruments and to close a low-resistance path in shunt of said condenser.

15. In a subscriber's telephone set, the combination with telephone instruments comprising a receiver and an induction-coil winding, of a condenser, a receiver-hook adapted when  
 55 relieved of the weight of said receiver to actuate switching mechanism to cause the serial connection of said telephone instruments and said condenser between the limbs of a telephone-line and adapted when the receiver is in position thereon to actuate said switching  
 60 mechanism to close a low-resistance path in shunt of said condenser.

16. In a subscriber's telephone set, the combination with telephone instruments, of a con-

denser, a receiver-hook adapted when relieved of the weight of said receiver to actuate  
 70 switching mechanism to cause the serial connection of said telephone instruments and said condenser between the limbs of a telephone-line and adapted when the receiver is in position thereon to actuate said switching  
 75 mechanism to close a low-resistance path in shunt of said condenser.

17. In a subscriber's telephone set, the combination with telephone instruments comprising a receiver and an induction-coil winding, of a condenser, a receiver-hook adapted when  
 80 relieved of the weight of said receiver to actuate switching mechanism to cause the serial connection of said telephone instruments and said condenser between the limbs of a telephone-line and adapted when the receiver is in position thereon to actuate said switch-  
 85 ing mechanism to interrupt the telephonic circuit through said telephone instruments and to close a path in shunt of said condenser.

18. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, a receiver-hook adapted when relieved of the weight of said receiver to actuate switching  
 90 mechanism to cause the serial connection of said telephone instruments and said condenser between the limbs of a telephone-line and adapted when the receiver is in position thereon to actuate said switching  
 95 mechanism to interrupt the telephonic circuit through said telephone instruments and to close a path in shunt of said condenser.

19. In a subscriber's telephone set, the combination with telephone instruments comprising a receiver and an induction-coil winding, of a condenser, a receiver-hook adapted when  
 100 relieved of the weight of said receiver to actuate switching mechanism to cause the serial connection of said telephone instruments and said condenser between the limbs of a telephone-line and adapted when the receiver is in position thereon to actuate said switching  
 105 mechanism to close a path in shunt of said condenser.

20. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, a receiver-hook adapted when relieved of the weight of said receiver to actuate switching  
 110 mechanism to cause the serial connection of said telephone instruments and said condenser between the limbs of a telephone-line and adapted when the receiver is in position thereon to actuate said switching  
 115 mechanism to close a path in shunt of said condenser.

21. In a subscriber's telephone set, the combination with telephone instruments comprising a receiver and an induction-coil winding, of a condenser, a receiver-hook adapted when  
 120 relieved of the weight of said receiver to actuate switching mechanism to cause the serial connection of said telephone instruments and said condenser between a telephone-line and ground, and adapted when the receiver is in  
 125 position thereon to actuate switching mechanism to close a path in shunt of said condenser.



anism to interrupt the telephone-circuit through said telephone instruments and to close a path in shunt of said condenser.

22. In a subscriber's telephone set, the combination with telephone instruments, of a condenser, and switching mechanism adapted when in one operative condition to serially connect said telephone instruments and said condenser between the limbs of a telephone-line, and when in another operative condition to close an electrical path in shunt of said condenser.

23. In a subscriber's telephone set, the com-

bination with telephone instruments, of a condenser, and hook-switch mechanism adapted when in one position to connect serially said telephone instruments and said condenser between a telephone-line and ground and when in another position to close an electrical path in shunt of said condenser.

In witness whereof I hereunto subscribe my name this 24th day of April, A. D. 1903.

GARRISON BABCOCK.

Witnesses:

LYNN A. WILLIAMS,  
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