

W. W. DEAN.

SUBSCRIBER'S TELEPHONE CIRCUIT.

APPLICATION FILED MAR. 22, 1901.

NO MODEL.

Fig. 1.

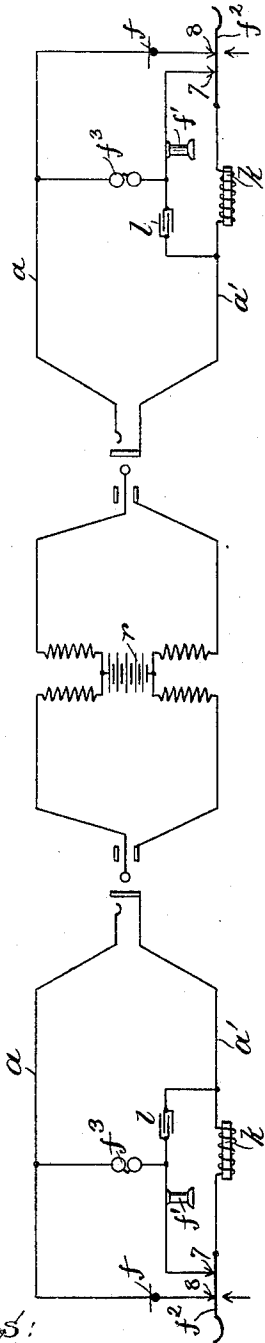
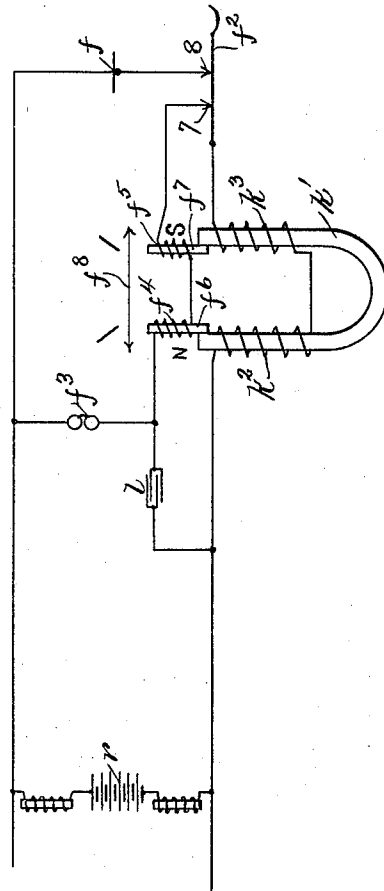


Fig. 2.



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UNITED STATES PATENT OFFICE.

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SUBSCRIBER'S TELEPHONE-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 722,212, dated March 10, 1903.

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To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, 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 Subscribers' Telephone-Circuits, 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 a telephone system, more particularly to the subscriber's circuit at the substation.

In telephone systems of the common-battery or central-energy type, wherein current is supplied from the central station to the microphone at the substation, it has been the common practice to include the telephone-receiver in series with the microphone, so that the energizing-current which traverses the microphone also passes through the coils of the telephone-receiver. This is objectionable for various reasons. It frequently happens that the polarity of the source of energy at the central station is reversed often by the reversal of the line-wires by a lineman, and the energizing-current is thus sent through the coil of the receiver in such a direction as to demagnetize the permanent magnet of the receiver, thereby destroying the efficiency and effective operation of the receiver. Moreover, since the coils of the receiver must carry the energizing-current the coils must be made of wire larger in cross-section than would need to be employed were the coils traversed only by the talking-currents. Due to the employment of the larger wire the coils cannot be as efficiently disposed upon the magnet-cores as would otherwise be possible, and, again, the passage of the energizing-current through the coils subjects the diaphragm to a constant pull or tension. To counteract this constant pull or tension, the diaphragm must be made of increased rigidity or inflexibility, and a considerable air-space must be left between the diaphragm and the ends of the magnet-poles, thereby decreasing the efficiency of the receiver.

It is the object of the present invention to

remove the receiver entirely from the influence of the energizing-current traversing the microphone, whereby the several objections above enumerated are obviated.

In accordance with the present invention the receiver is included in a path which is opaque to the passage of the energizing-current, which is usually continuous, while a parallel path is provided around the receiver which is opaque to the passage of the talking-currents, while permitting the energizing-current to freely pass therethrough. In practice I usually include a condenser in the path containing the receiver and an impedance or choking coil in the path which is parallel thereto.

I have illustrated my invention in the accompanying drawings, in which—

Figure 1 is a diagram illustrating a system embodying my invention. Fig. 2 is a diagram illustrating a modification thereof.

Like characters refer to like parts in both figures.

I have illustrated in Fig. 1 two telephone-lines embodying my invention in connection with central-station connecting apparatus of well-known form. When the subscribers are connected for conversation, the central battery r is adapted to send current over the limbs a a' of the telephone-line. When the receiver f' is removed from the switch-hook f^2 , the same engages contacts 7 and 8. The microphone f is shown as connected between the contact 8 and the limb a , while the switch-hook f^2 is connected with the limb a' . The receiver f' is connected with the contact 7 in circuit with the condenser 1. An impedance or choking coil k is interposed in the parallel path around the receiver f' . The bell f^3 may be connected between the limb a and the parallel path containing the receiver, so that the bell will be in circuit with the condenser 1.

The condenser 1 renders the path containing the receiver opaque to the passage of energizing-current from the battery r , and consequently the energizing-current does not traverse the coils of the receiver. The energizing-current may, however, freely pass through the parallel path containing the im-

pedance-coil k , since said coil interposes but slight resistance to the passage of a continuous current. The impedance-coil prevents the passage of the talking-currents, which are thus choked back and caused to pass through the condenser 1 and the receiver f' . The bell f^3 should be of high resistance—say of one thousand ohms resistance—so that the talking-currents and the energizing-current will not readily pass therethrough.

When the receiver is upon the hook, the hook f^2 rests out of contact with the contacts 7 and 8, and the circuit through the receiver and the microphone is thus opened. Calling-current sent from the central station will traverse the condenser 1 and bell f^3 . When the subscriber responds and lifts his telephone from the hook, the current from the energizing-battery r is closed over limb a , microphone f , contact 8, switch-hook f^2 , through coil k and limb a' back to the battery. The condenser 1 prevents the passage of the energizing-current through the receiver f' . Talking-currents repeated through the repeating-coil at the central station pass over limb a through microphone f , contact 8, switch-hook f^2 , contact 7, thence through the receiver f' and condenser 1 to limb a' and back to the central station. The impedance-coil k prevents the passage of the talking-currents therethrough, thereby causing the same to follow the path through the receiver.

It will be understood that the arrangement of the microphone, bell, and switch-hook contacts may be varied as desired, the essential feature of my invention being the employment of the two parallel paths, one opaque to the passage of the energizing-current and containing the receiver and the other opaque to the passage of the talking-currents.

In Fig. 2 I have illustrated a modification of my invention wherein the usual permanent magnet of the receiver is replaced by an electromagnet, the coils of said electromagnet being included in the parallel path around the receiver-coils. In this instance the receiver comprises a core of soft iron k' of horseshoe form carrying coils k^2 k^3 , wound upon the core in such a direction that the magnetizing effect of the two coils will be added. The receiver-coils f^4 f^5 are wound upon the pole-pieces f^6 f^7 , which are carried upon the ends of the core k' , and the diaphragm f^8 is held in front of the pole-pieces in the usual manner. The condenser 1 is included in circuit with the coils f^4 f^5 . The current from battery r traversing the coils k^2 k^3 energizes the core k' , and the passage of the talking-current through the coils f^4 f^5 varies the magnetism thus produced to cause the movement of the diaphragm f^8 . The windings k^2 k^3 are so proportioned relatively to the cross-section of the core k' that when the battery r is connected with the longest line of the system the current flowing will be sufficient to saturate the core k' . Accordingly the diaphragm f^8 may be adjusted so that it will withstand

the normal pull due to the passage of this prearranged current through the coils. Any larger current flowing through the coils will not increase the normal pull upon the diaphragm, since such increased current cannot increase the magnetism of the core, since the same will be brought to saturation upon the flow of the current of prearranged value. Consequently when the battery is connected with a shorter line to send a larger current through the coils k^2 k^3 this increased current will not increase the magnetism of the core k' , and the pull upon the diaphragm thus never exceeds the prearranged force.

By the term "opaque" as employed herein in 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.

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

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

2. The combination with a steady source of electricity at the central office included in series in the line to furnish current to the substation for conversational purposes, of a circuit at the substation having two paths, one containing a telephone-receiver, means associated with the path containing the receiver for preventing the passage of steady current therethrough to an objectionable degree, means associated with the other path for preventing the talking-currents from passing therethrough to an objectionable degree, a telephone-transmitter located in the path of said steady current and charged thereby, and a suitable call-bell at the substation connected with the first-named path while the line is not in use for conversation, substantially as described.

3. The combination with an energizing source of electricity at the central office included in the line to furnish current for conversational purposes, of parallel paths at the substation one containing a telephone-receiver and a condenser, and the other containing an impedance or choking coil, a transmitter included in the path of said energizing-current, and a call-bell at the substation connected while the line is not in use for conversation with said receiver-path at a point between the receiver and condenser and with a suitable return-conductor, substantially as described.

4. In a telephone system, the combination with an energizing source of electricity at the central station to furnish current to the substation for talking purposes, of a telephone-line adapted to be connected therewith during a connection and having at the substation two parallel paths, a receiver in one of said paths, means for preventing the energizing-current from passing through the path containing the receiver to an objectionable degree but permitting the passage of the voice-currents, means contained in the other path for preventing the talking-currents from passing therethrough to an objectionable degree, while permitting the passage of energizing-current, a transmitter at the substation in the main telephone-line through which both steady and voice currents pass, and a call-bell at the substation also in a path opaque to steady current but permitting the passage of ringing-current, substantially as described.

5. 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 condenser included in one of said paths, a choking or impedance coil included in the other path, and a high-resistance bell connected between the opposite limb and the path containing the receiver and the condenser at a point between said receiver and said condenser, substantially as described.

6. 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 with said line, said telephone-line having at the substation two parallel paths, a receiver and a condenser included in one of said paths, an impedance-coil included in the other path, and switch-contacts in each of said paths controlled by the subscriber, substantially as described.

7. The combination with an energizing source of electricity, of a circuit containing two parallel paths, one including a condenser and the coils of the telephone-receiver which are responsive to the talking-currents, and coils for energizing the magnet of the receiver included in the other path and constituting

an impedance or reactive resistance, substantially as described.

8. The combination with a plurality of telephone-lines extending to the central station, of an energizing source of electricity adapted to be connected at will with said telephone-lines to send energizing-current thereover, the telephone-lines each having at the substation two parallel paths, one opaque to the passage of the energizing-current and the other opaque to the passage of the talking-currents, said first-mentioned path containing the coils of a telephone-receiver which are responsive to the talking-currents, and the other path containing the energizing-winding of the magnet of the receiver, the energizing-windings of the several receiver-magnets being so proportioned and disposed relatively to the core of the magnet that said core will be brought to saturation upon the passage of current from said energizing source through the telephone-line of the exchange having the lowest resistance, substantially as described.

9. A telephone-substation apparatus comprising the main circuit, said circuit having two parallel paths, one path being opaque to voice-currents, a condenser in the other path to render the same opaque to steady current, a receiver in the path opaque to steady currents, a call-signaling bell, and means for normally including only said bell in circuit with said condenser whereby the said condenser is employed for both talking and signaling to permit the passage of varying currents while preventing the flow of steady currents, substantially as described.

10. A telephone-substation circuit and apparatus comprising the main circuit, said circuit having two parallel paths, an impedance-coil in one path to render it opaque to voice-currents, a condenser in the other path to render it opaque to steady currents, and a receiver in the latter path, a signaling-bell permanently connected with said latter path between the condenser and receiver and thence with the other side of the main-line circuit, means for normally opening the main-line circuit through said parallel paths beyond the path containing the bell whereby said condenser is used both for signaling and for talking, substantially as described.

11. The combination with an energizing source of electricity, of a circuit in which the source is adapted to be included and containing two paths, one opaque to the passage of steady currents but permitting the passage of voice-currents and the other path opaque to voice-currents but permitting the passage of steady currents, a telephone-receiver in the path opaque to steady currents, said receiver being responsive to voice-currents through its path, a transmitter located in the path of steady currents from said source and adapted to vary said currents to produce the voice-currents, and a hook-switch automatic-

ally controlling the circuit of said paths in the use of the receiver, substantially as described.

12. The combination with an energizing source of electricity, of a circuit containing two paths and including said source in series with both paths, one opaque to the passage of steady currents but permitting the passage of voice-currents and the other path opaque to voice-currents but permitting the passage of steady currents, a telephone-receiver in the path opaque to steady currents, said receiver being responsive to voice-currents through its path, a resistance-varying device located in the portion of the circuit common to said parallel paths to vary the current from said source and thereby produce voice-currents, and means for opening the circuit of said paths controlled by the subscriber, substantially as described.

13. The combination with an energizing source of electricity, of a circuit containing two paths and including said source in series with both paths, one opaque to the passage of steady currents but permitting the passage of voice-currents and the other path opaque to steady currents but permitting the passage of steady currents, a telephone-receiver in the path opaque to steady currents, said receiver being responsive to voice-currents through its path, a transmitter located in the main line in advance of said parallel paths and charged by current from said energizing source, a call-bell at the substation, and a hook-switch to automatically control the circuits through the said paths in the use of the instrument, substantially as described.

14. A telephone-substation circuit and apparatus comprising a main circuit, said circuit having two parallel paths, one path opaque to voice-currents but permitting the flow of steady currents, and the other opaque to steady currents but permitting the flow of voice-currents, a receiver in the latter path responsive to the voice-currents thereover, a transmitter in the main circuit outside of said parallel paths, and a switch-hook automatically controlling the circuit through the said paths in the use of the apparatus, substantially as described.

15. A telephone-substation circuit and apparatus comprising the main circuit, said circuit having two parallel paths, one path being opaque to voice-currents, a device in the other path to render the same opaque to steady currents, a receiver in the path opaque to steady currents, a call-signaling device, and means for including said signaling device in circuit with said first-named device when the apparatus is not in use for conversation, whereby the said first-named device is employed for both talking and signaling to permit the passage of varying currents while preventing the flow of steady currents, substantially as described.

16. A telephone-substation circuit and ap-

paratus comprising the main circuit, said circuit having two parallel paths, an impedance-coil in one path to render it opaque to voice-currents, a condenser in the other path to render it opaque to steady currents, a receiver in the latter path, a signaling-bell connected with said latter path at a point between the condenser and receiver and thence with the other side of the main circuit, a transmitter connected in the main circuit, a switch-hook to automatically change the circuit, and apparatus from signaling position to talking position in the use of the telephone, said bell and condenser being included in circuit and the receiver and transmitter being cut out of circuit when the telephone is not in use, substantially as described.

17. A telephone-substation circuit and apparatus comprising the main circuit, said circuit having two parallel paths, an impedance-coil in one path to render it opaque to voice-currents, a condenser in the other path to render it opaque to steady currents, a receiver in the latter path, a signaling-bell connected in said latter path between the condenser and receiver upon one side, and with a suitable return-circuit on the other side, means for normally opening the main-line circuit through said parallel paths and beyond the path containing the bell whereby said condenser is used both for signaling and talking, substantially as described.

18. In a telephone-substation circuit and apparatus comprising the main circuit, said circuit having two parallel paths, an impedance-coil in one path to render it opaque to voice-currents, and a condenser in the other path to render it opaque to steady currents, a receiver in the latter path, a signaling-bell connected with said latter path at a point between the condenser and receiver and thence with a suitable return-circuit, a transmitter connected in the main circuit, a switch-hook to automatically change the circuit and apparatus from signaling position to talking position in the use of the telephone, said bell and condenser being included in circuit and the receiver and transmitter being cut out of circuit when the telephone is not in use, substantially as described.

19. A telephone-substation circuit and apparatus comprising the main circuit, said circuit having two parallel paths, an impedance-coil in one path to render it opaque to voice-currents, a condenser in the other path to render it opaque to steady currents, a receiver in the latter path, a signaling-bell permanently connected with said latter path at a point between the condenser and receiver, and thence with the other side of the ringing-circuit, a transmitter connected in the main circuit, a switch-hook to automatically change the circuit and apparatus from signaling position to talking position in the use of the telephone, said bell and condenser being included in circuit and the re-

ceiver and transmitter being cut out of circuit when the telephone is not in use, substantially as described.

20. The combination with a main-line circuit, of a central source of steady current connected therewith and adapted to send current over the metallic line for conversational purposes, a pair of parallel paths at the substation included in said main circuit, an impedance-coil in one of said paths to prevent the passage of voice-currents, a condenser in the other path to prevent the passage of steady current, a receiver also in the latter path, a signaling-bell connected upon one side of the latter path at a point between said condenser and the receiver and upon the other side with a suitable return-path for the

ringing-current, a transmitter included in the portion of the main circuit that is common to said parallel paths and a switch-hook to close said paths and the main circuit during conversation and to open said paths and the main circuit while the telephone is not in use and the receiver is hung on said hook, the said bell and the condenser being connected in circuit while said telephone is not in use, substantially as described.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

WILLIAM W. DEAN.

Witnesses:

MELANCTHON R. NYMAN,
W. CLYDE JONES.