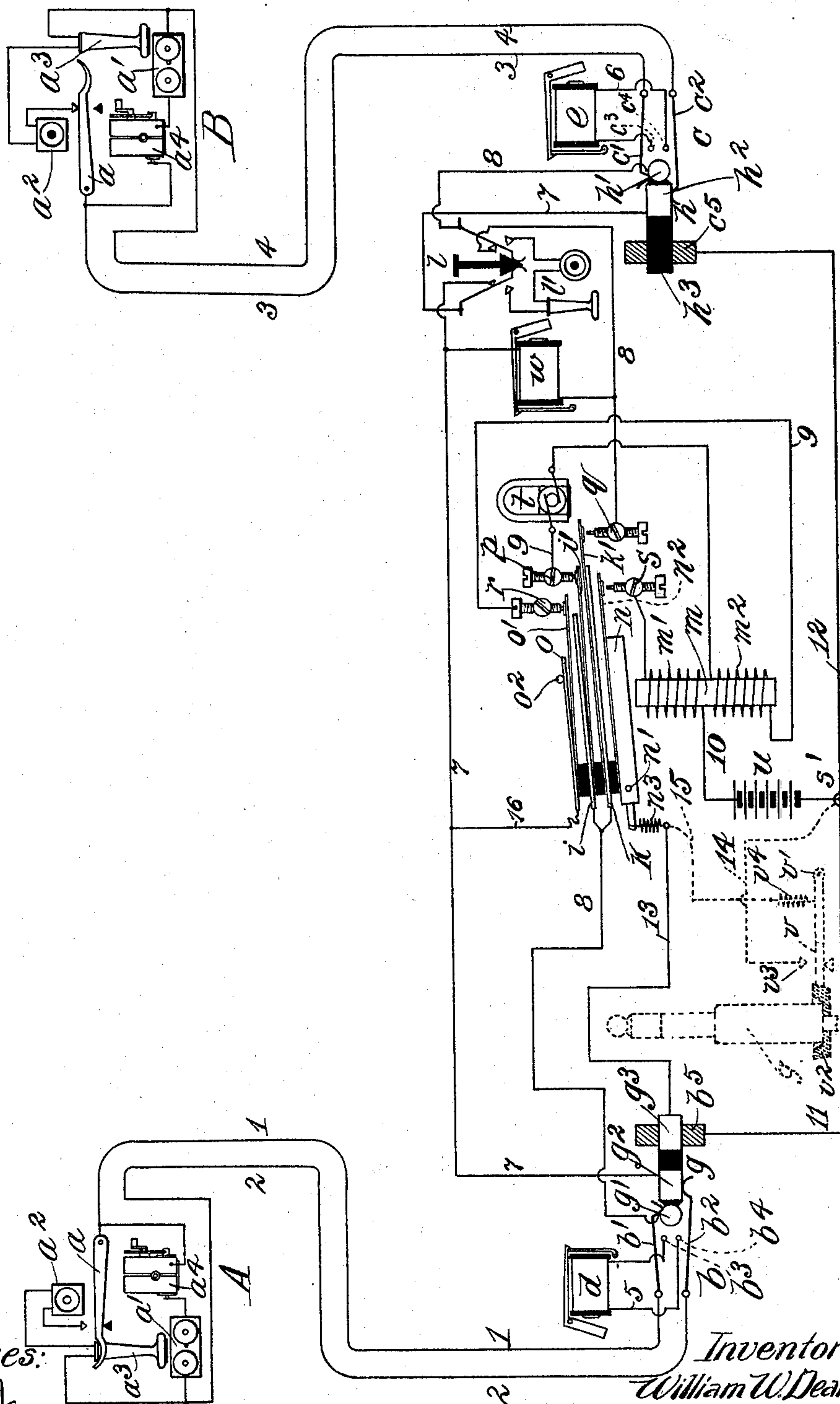


(No Model.)

W. W. DEAN.
TELEPHONE EXCHANGE SYSTEM.

No. 590,136.

Patented Sept. 14, 1897.



Witnesses:

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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 590,136, dated September 14, 1897.

Application filed November 3, 1896. Serial No. 610,901. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Telephone-Exchange Systems, (Case No. 17,) 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.

In my Patent No. 544,567, of August 13, 1895, I have shown means consisting of two electromagnetic devices and circuits associated therewith, whereby signaling-current is directed over the line of the subscriber called for by the act of the operator in inserting a plug into the called-subscriber's spring-jack at the central office, apparatus at the called-subscriber's station being adapted to remove the signaling-current from the line when a call has been responded to. In my application for United States Letters Patent for improvement in telephone systems, Serial No. 607,126, filed September 28, 1896, I have shown and described a telephone-exchange system in which the line-wires were led from subscribers' stations to suitable switches at the central office, plugs and cords being provided to connect subscribers for conversation, an electromagnetic device being associated with each set of plugs and cords adapted to include the calling-generator in circuit with the subscriber's calling apparatus, and a second electromagnetic device within the control of the called subscriber adapted to remove the calling-generator from line and to prevent the reinclusion of said generator with the subscriber's calling apparatus while connection exists between the subscribers.

In the system disclosed in the aforesaid application two electromagnetic devices were employed to accomplish the desired result—viz., that of preventing the resignaling of a subscriber after the first signal has been responded to during an established connection, this resignaling being a defect inherent in the system disclosed in my aforesaid patent.

My invention herein contemplates the use of a single electromagnet associated with each pair of plugs in combination with circuits associated therewith and controlled thereby,

whereby the calling-generator may be included in circuit with the called-subscriber's signal apparatus, and whereby the generator may be removed from line by means of the called-subscriber's apparatus when the signal is responded to. In accordance with my invention these circuits are further controlled by the apparatus at the called-subscriber's station in a manner to prevent said electromagnet from reincluding the calling-generator in circuit with the signal apparatus after the signal has been responded to.

My invention will be more readily understood by reference to the accompanying drawing, which illustrates a telephone-exchange system equipped with the apparatus of my invention.

Two subscribers' stations A B are shown in the drawing. The apparatus at each station comprises a telephone switch-hook a , a signal-receiving bell a' of, say, five thousand ohms resistance, a transmitter a^2 , telephone-receiver a^3 , and magneto-generator a^4 . The telephone-hook at subscriber's station A is connected with the line-spring b' of the spring-jack b at the central office by the limb 1 of the telephone-line. The receiver a^3 is connected with the line-spring b^2 of said spring-jack by a limb 2 of the telephone-line. When the telephone is hung on the switch, as shown at station A, limbs 1 and 2 of the telephone-line are disconnected through the receiver. The signal-bell a' and magneto-generator a^4 are included in a bridge between the limbs 1 and 2 of the telephone-line. The subscriber B is similarly connected with the central office, limb 3 of the telephone-line extending from the switch-hook to the line-spring c' of the spring-jack c , while the telephone-receiver is connected with the line-spring c^2 of said spring-jack by a limb 4 of the telephone-line. The signal-bell a' and magneto-generator a^4 are likewise included in a bridge between the limbs of the telephone-line.

Back contacts $b^3 b^4$ are engaged by the line-springs $b' b^2$ when said line-springs are not engaged by a plug. These back contacts are connected by a conductor 5, in which is included the helix of the line-drop or annunciator d . Back contacts $c^3 c^4$ are likewise normally engaged with the line-springs $c' c^2$.

These back contacts are connected by a conductor 6, which includes the helix of a line-annunciator e . Metallic thimbles b^5 c^5 are provided in connection with each spring-jack, 5 which are adapted to guide plugs g and h as they are being inserted within the spring-jacks into contact with the line-springs.

The line-signals d and e are adapted to be operated by the magneto-generators a^4 a^4 in 10 the well-known manner, these signals being adapted to be included in circuit with the magneto-generators through the medium of the telephone-lines and the line-springs engaging the back contacts.

15 The plug g is the connecting-plug, while the plug h is the answering-plug. Plug g is provided with three contact-terminals g^1 g^2 g^3 , adapted to engage the line-springs b^1 b^2 and the thimble b^5 , respectively. Plug h is pro- 20 vided with two contact-terminals h^1 h^2 , which are adapted to engage the line-springs c^1 c^2 , respectively. The heel portion h^3 of the answering-plug is preferably of insulating material. Terminals g^2 h^2 of the plugs are con- 25 nected by the conductor 7. The terminals g^1 h^1 are adapted to be connected by a conductor 8, which is adapted to include a contact portion i or a contact portion k , according to the condition of use of the apparatus at the 30 central office, as will be set forth hereinafter.

A telephone-key l is provided for the purpose of bridging the telephone-operator's telephone set l' between the conductors 7 and 8.

At the central office I have shown an elec- 35 tromagnet comprising a core m , about which is placed two helices m^1 m^2 and an armature n , pivoted at n' , which is adapted to be attracted by said core when energized. This armature carries plates i , k , and o , which carry springs i' , 40 k' , o' , respectively, which are adapted to make contact with adjustable contact-anvils p , q , and r , respectively, while the armature carries a contact-spring n^2 , adapted to make contact with adjustable contact-anvil s . The electro- 45 magnet is normally deenergized, whereby the armature and parts mounted thereon are caused to assume the normal position shown by the spring n^3 , a stop o^2 being provided which engages the plate o to limit the upward move- 50 ment of the armature and contact parts carried thereby. When the parts are in this position, the conductor 8 is broken at q and contact-spring n^2 is removed from anvil s , while the anvils p and r are in contact, respectively, 55 with the springs i' and o' .

The calling-generator t , which is preferably constructed to generate alternating currents, is included in circuit with a conductor 9, which includes the helix m^2 and which terminates 60 in the anvils p and r . The helix m^1 is included in the conductor 10, which has one of its terminals in the anvil s , the other terminal s' of said conductor being connected with the thimbles b^5 c^5 of the spring-jacks by conductors 11 and 22, respectively. Conductor 65 10 also includes in its circuit a battery u .

When the armature n is attracted, as will

be hereinafter set forth, circuit through the battery u and the helix m^1 is closed by the en- 70 gagement of spring n^2 , electrically connected with armature n and contact-anvil s . Armature n is connected with heel-piece g^3 by a conductor 13, this heel-piece serving to close the circuit through the battery u when it is in contact with metallic thimble b^5 . 75

Instead of employing metallic thimbles b^5 c^5 and the metallic heels g^3 of the connecting-plugs for closing circuit through the battery u and helix m^1 , I may employ the device shown in dotted lines, which consists of a lever v , 80 pivoted at v' and carrying at its free end a socket v^2 , adapted to receive the connecting-plug. A contact-anvil v^3 is connected by a conductor 14 with the terminal s' of conductor 10, while the lever is connected by a conduc- 85 tor 15 with the spring n^3 . When the connecting-plug is removed from its socket, the lever v is elevated by the spring v^4 , whereby contact is made between said lever and the anvil v^3 . 90

The clearing-out indicator w , of high retardation, is included in a bridge between the conductors 7 and 8, which is adapted to be operated by the magneto-generator at either 95 subscriber's station when conversation between connected subscribers has been finished.

The helix m^2 is in a bridge between the cord-strands, this helix thus offering no im- 100 pedence to the voice-currents.

Having thus specifically set forth the apparatus of my invention, I will now particularly describe the manner by which signaling-current is transmitted over the telephone- 105 lines to the call-bells at the subscribers' stations.

Subscriber B, desiring communication with subscriber A, operates his magneto-generator a^4 , thereby actuating his line-signal e . The operator, in response to the signal, inserts the 110 answering-plug h into the calling-subscriber's spring-jack and depresses her listening-key l to include her telephone set in circuit with the calling-subscriber's telephone set. The operator having ascertained the connection 115 desired inserts a connecting-plug g into the spring-jack b of the called subscriber. The operator by this act includes the generator t in circuit with the called-subscriber's signal apparatus, which circuit may be traced from 120 anvil p through said generator, conductor 9, helix m^2 , included in said conductor, anvil r , spring o' , and contact-plate o , thence by conductor 16 and conductor 7 to the contact-terminal g^2 upon plug g , thence through line- 125 spring b^2 , limb 2 of the telephone-line, high-resistance signal-bell a' , limb 1 of the telephone-line, line-spring b' , contact g' , conductor 8, contact-plate i , and contact-spring i' back to contact-anvil p . The bell a' , being 130 of high resistance, serves to reduce the current emanating from generator t sufficiently to prevent the necessary energization of the core m required to attract the armature n .

The bell at the called-subscriber's station will respond to the current from generator t until the called subscriber removes his telephone-receiver from its hook, whereby the high resistance included in the bell a' will be shunted by the path of low resistance through the telephone-receiver, this path of low resistance serving to increase the current from generator t , whereby the core m is energized sufficiently to attract the armature n . The local circuit, including the battery u , which was previously opened, is now closed by the contact between anvil s and spring n^2 , whereby the armature is maintained in its attracted position during the time that a connection exists between the two subscribers.

The connection of the generator t with the calling apparatus at the called-subscriber's station is broken at p and r when the armature is attracted, and it is obvious cannot be reincluded in circuit with the called-subscriber's bell while the subscribers are connected.

The springs o' , i' , k' , and n^2 are so mounted and constructed that anvils q and s are brought into contact with the springs k' and n^2 , respectively, before anvils p and r are removed from contact with springs i' and o' , respectively, whereby the circuit through battery u and helix m' may be closed before circuit through helix m^2 is opened.

The electromagnet and the armature n , acting in opposition thereto with the parts carried by said armature, constitute the means which I preferably employ for associating and disassociating the generator with the telephonic conductors. Other instrumentalities or devices acting in opposition to the electromagnet may be employed without departing from my invention.

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

1. Two telephone-lines, each provided with a switch at the subscriber's station thereon, and at the central office switching devices for uniting said lines in combination with a signaling-generator adapted to be closed to the called-subscriber's line when the lines are united, an electromagnetic circuit-changing device, provided with two windings or helices, one winding being connected with the generator-circuit and the other being connected in a local circuit containing two openings and a source of current, one of said openings being closed when the lines are connected together, the switch of the called subscriber when operated being adapted to reduce the resistance of the circuit containing the signaling-generator, to increase the current traversing the said coil connected with said generator, to operate the said electromagnetic circuit-changing device, to close the other opening of the local circuit, and immediately thereafter to open the connection between the generator and the coil or winding

of the electromagnetic circuit-changing device connected therewith.

2. Two telephone-lines, each provided with a switch at the subscriber's station thereon, and at the central office switching devices for uniting said lines in combination with a signaling-generator adapted to be closed to the called-subscriber's line when the lines are united, an electromagnetic circuit-changing device provided with two windings or helices, one winding being connected with the generator-circuit and the other being connected in a local circuit containing two openings and a source of current, one of said openings being closed when the lines are connected together, the switch of the called subscriber when operated being adapted to reduce the resistance of the circuit containing the signaling-generator, to increase the current traversing the said coil connected with said generator, to operate the said electromagnetic circuit-changing device, to close the other opening of the local circuit, to open the connection between the generator and the coil or winding of the electromagnetic circuit-changing device connected therewith.

3. In a telephone-exchange system, a local circuit at the central office in combination with connecting apparatus for uniting lines together, and an electromagnetic circuit-changing device connected in said local circuit, said local circuit when not in active use containing two openings, one of which is adapted to be closed by said connecting apparatus when in use, and means for closing the other opening in said local circuit to direct current through said local circuit and thereby lock the electromagnetic circuit-changing device in position during the time the said connecting apparatus remains in service.

4. In a telephone system, the combination with telephone-lines united at the central station, of an automatic telephone-switch and a signal device at each subscriber's station, a signaling-generator, means for including the generator in circuit with the signal device at the called-subscriber's station, an electromagnetic circuit-changing device provided with a single electromagnet, the called-subscriber's switch being adapted to change the circuit including the circuit-changing device to operate the same to remove the generator from line upon the removal of the telephone-receiver, substantially as described.

5. In a telephone system, the combination with two united telephone-lines, each leading from the exchange to a subscriber's station, of an automatic telephone-switch and a signal device at each subscriber's station, a signaling-generator, means for including the generator in circuit with the signal device at the called-subscriber's station, and an electromagnetic circuit-changing device provided with a single electromagnet connected in a bridge of the telephone-circuit extending to

the called-subscriber's station, the called-subscriber's switch being adapted to change the circuit condition of the circuit-changing device to operate the same to remove the generator from line upon the removal of the telephone-receiver, substantially as described.

6. In a telephone system, the combination with the united circuit of two telephone-lines, each provided with a signal device at the subscribers' stations thereof, of a signaling-generator, means for including the generator in circuit with the signal device at the called-subscriber's station, an electromagnetic circuit-changing device, switches at the subscribers' stations, each switch being adapted when its station is the called station to change the electrical condition of the circuit containing the circuit-changing device to operate the same to remove the generator from line, a local circuit which is adapted to be closed by said circuit-changing device through the electromagnet thereof when said device is thus actuated, and switching apparatus at the central office for uniting and disconnecting the telephone-lines, said switching apparatus being adapted to open said local circuit when manipulated or operated to break connection between two telephone-lines, substantially as described.

7. In a telephone system, the combination with the united circuit of two telephone-lines, each provided with a signal device at the subscribers' stations thereof, of a signaling-generator, means for including the generator in circuit with the signal device at the called-subscriber's station, an electromagnetic circuit-changing device, switches at the subscribers' stations, each switch being adapted when its station is the called station to change the electrical condition of the circuit containing the circuit-changing device to operate the same to remove the generator from line, a circuit which is adapted to be closed by said circuit-changing device through the electromagnet thereof when said device is thus actuated, and switching apparatus at the central office for uniting and disconnecting the telephone-lines, said switching apparatus being adapted to open said circuit including the circuit-changing device when manipulated or operated to break connection between two telephone-lines, substantially as described.

In witness whereof I hereunto subscribe my name this 29th day of October, A. D. 1896.

WILLIAM W. DEAN.

Witnesses:

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