(No Model.)

2 Sheets—Sheet 1.

W. W. DEAN.

TELEPHONE SYSTEM.

No. 593,372. Patented Nov. 9, 1897.

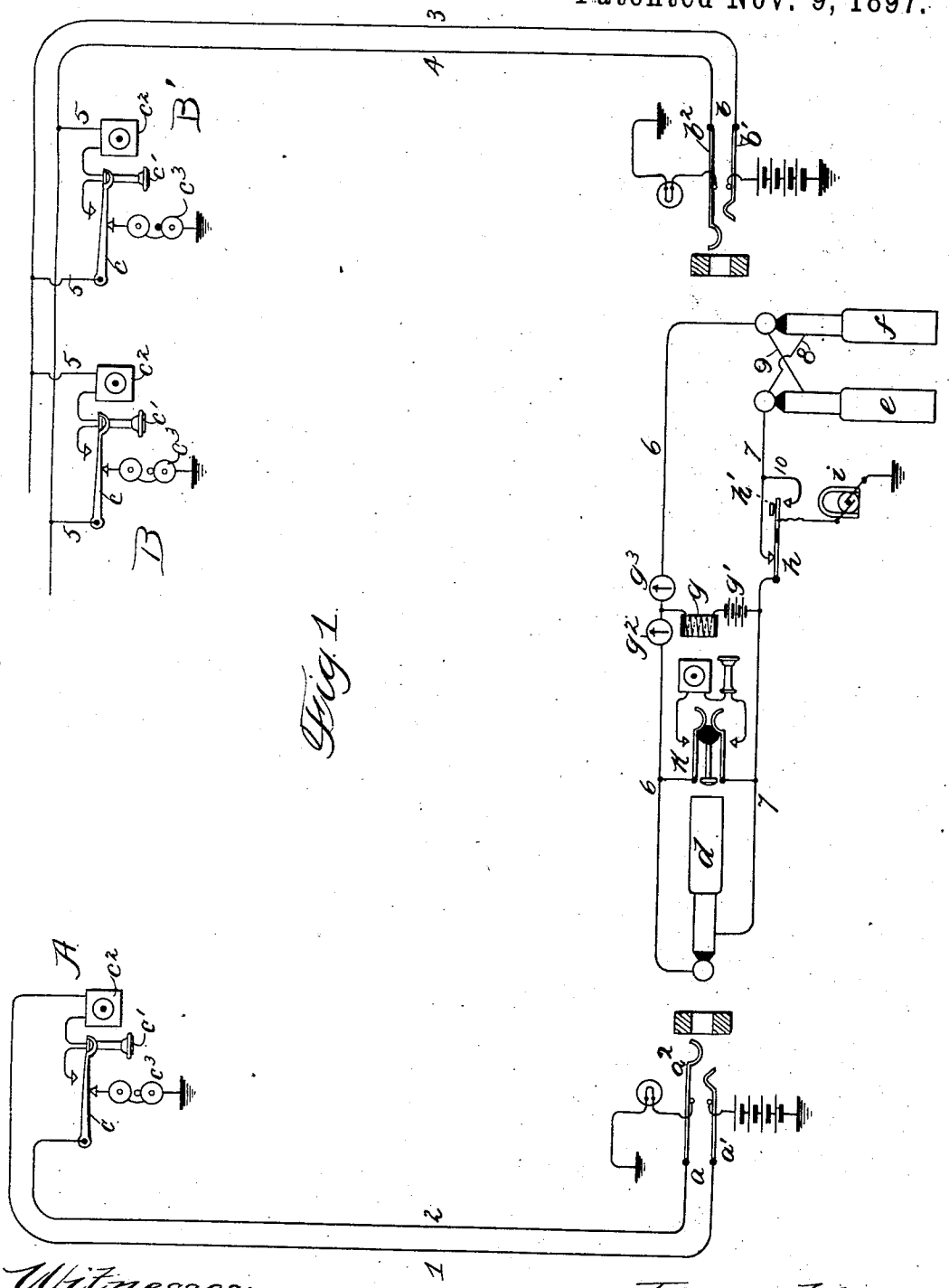

Fig. 1.

Witnesses:
George L. Cragg.
John W. Sinclair.

Inventor
William W. Dean.
By Burton Brown,
Attorneys.

(No Model.) 2 Sheets—Sheet 2.

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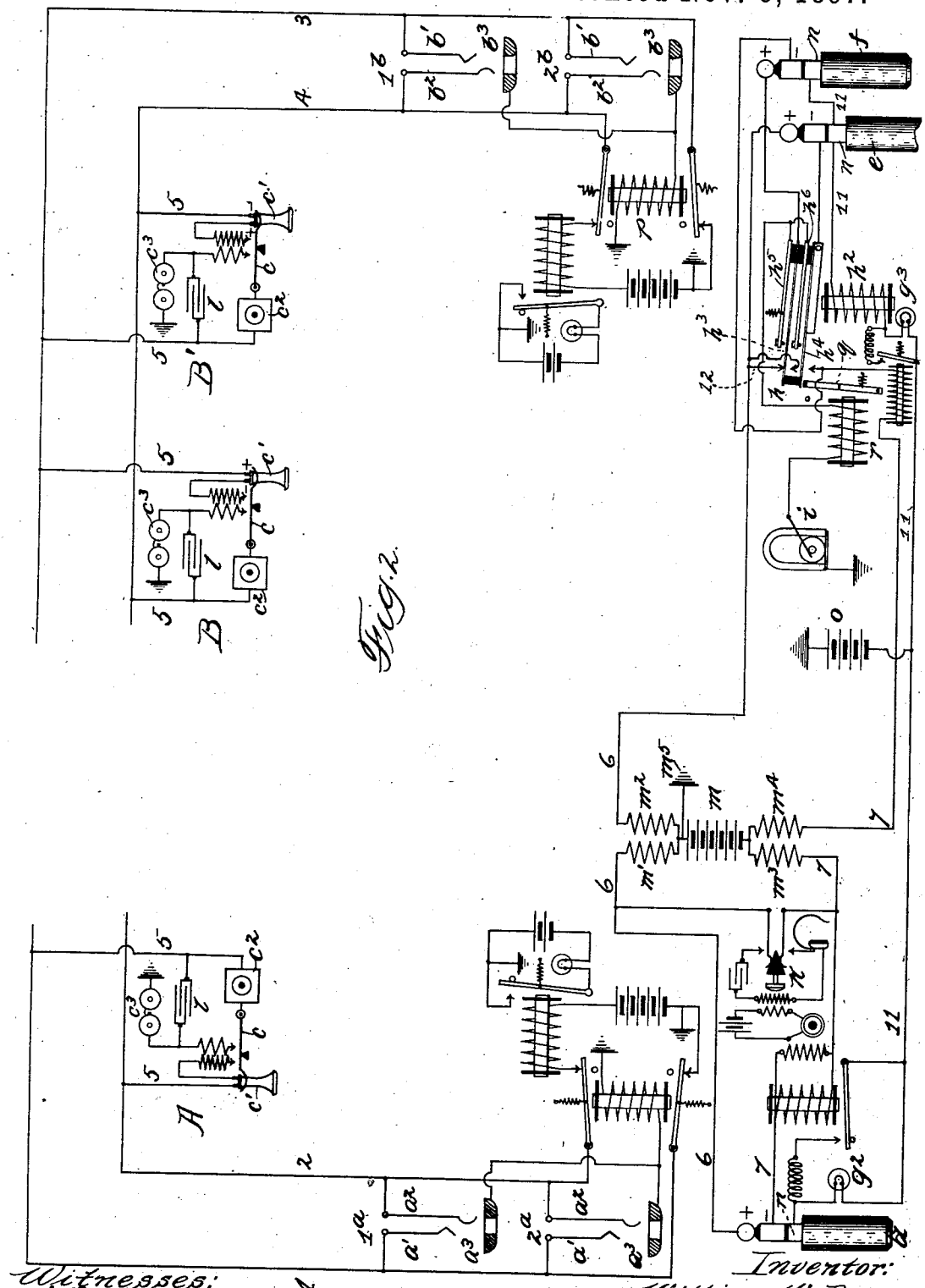

Fig. 2.

Witnesses:
D. H. Evans.
George L. Cragg.

Inventor:
William W. Dean,
By Barton & Brown.
Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM W. DEAN, OF ST. LOUIS, MISSOURI, ASSIGNOR TO THE BELL TELEPHONE COMPANY OF MISSOURI, OF SAME PLACE.

TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 593,372, dated November 9, 1897.

Application filed July 12, 1897. Serial No. 644,239. (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 Systems, (Case No. 23,) 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 telephone-exchange apparatus adapted particularly for use in connection with party telephone-lines.

The principal feature of my invention relates to switching mechanism under the control of the operator for including the calling-generator in circuit with the signal of the selected subscriber.

Heretofore a plurality of push-keys equal in number to the subscribers' stations upon a party-line have been employed for signaling purposes. Such a system is illustrated in my application, Serial No. 622,264, filed February 6, 1897. In said system eight ringing-keys are employed in connection with each cord-circuit in addition to a master-key adapted to connect said keys with the cord-circuit. Each key upon being depressed is adapted to include current of a particular character to which the calling apparatus at the station corresponding to said key is responsive.

In party-line systems as equipped heretofore the operator and calling subscriber are both occasioned annoyance and delay if for any reason the called subscriber has to be signaled again, as upon the failure of said subscriber to respond to the first signal, since the operator after having made the connection and signaled the called subscriber immediately forgets the particular key that she has depressed and the particular subscriber of the party-line that has been called, and in order to signal the called subscriber again this information has to be refurnished to the operator.

The principal feature of my invention consists in providing a plurality of connecting-plugs each connected or adapted to be connected in the cord-circuit and each adapted to direct signaling-current over the party telephone-line through a signal-bell at one of the subscribers' stations thereof, a master-key being preferably employed to connect the plugs with the source of calling-current. With such a system the operator after knowing the subscriber of a party telephone-line with whom communication is desired inserts one of the plurality of connecting-plugs which is adapted to include signaling-current to which the bell at the called-subscriber's station will respond and then depresses the master-key to connect the calling-generator in circuit with the plug. If, now, for any reason the calling subscriber should wish to have the called subscriber resignaled, the operator merely depresses the single key—the master-key.

There are other features of my invention which will be set forth hereinafter.

I will explain my invention in connection with the accompanying drawings, in which—

Figure 1 represents two metallic telephone-lines connected with the central office, one of which is a party-line, and switching apparatus constructed in accordance with my invention. Fig. 2 illustrates a multiple-switch-board exchange with metallic-circuit telephone-lines connected therewith, one of which is a party-line, and a modified form of my improved switching apparatus at the central office.

Like letters and numerals refer to like parts in both of the views.

Referring now more particularly to Fig. 1, subscriber A is connected with the central office by a single metallic-circuit line whose limbs 1 and 2 are connected with the short and long line springs a' a^2 of spring-jack a at the exchange. Subscribers B and B' are connected with the party-line metallic circuit whose limbs 3 and 4 are connected with the short and long line springs b' b^2 of the spring-jack b at the exchange. Each of the substations is provided with an automatic telephone-hook c, receiver c', transmitter c^2, and call-bell c^3.

A well-known type of line-indicator is shown at the exchange, which is operated in a well-known manner upon the removal of the receiver from any switch-hook at the subscribers' stations, which serves to complete

the bridge-conductor 5, provided at each station between the limbs of the corresponding telephone-line.

The telephone-switch hooks at stations B and B′ are connected, respectively, with the limbs 4 and 3 of the party telephone-line, the grounded bells at said stations being connected, respectively, with said limbs when the receivers are supported by their hooks.

At the central office I have illustrated a cord-circuit comprising an answering-plug *d* and connecting-plugs *e* and *f*. The tips of the answering-plug and connecting-plug *f* are connected by strand 6. The sleeves of said plugs are connected by the strand 7, tip of connecting-plug *e*, and the cross-conductor 8. The tip of answering-plug *d* is connected with the sleeve of plug *e* by the strand 6, tip of plug *f*, and the cross-conductor 9. Thus the tips and sleeves of plugs *d* and *f* are respectively connected, while the tip and sleeve of the answering-plug are connected, respectively, with the sleeve and tip of the connecting-plug *e*. In a bridge between the strands 6 and 7 I have included a retardation-coil *g* and battery *g′*. Between said bridge and the answering-plug I have shown a clearing-out indicator g^2 in the strand 6 responsive to the switching apparatus at the calling-subscriber's station. Between said bridge-conductor and connecting-plugs I have included a second clearing-out indicator g^8 in strand 6 responsive to the switching apparatus at the called-subscriber's station. A key *h* is included in the strand 7. The key is provided with a contact portion *h′*, insulated therefrom and connected with the calling-generator *i*. The operator is provided with a listening-key *k* in a bridge between the cord strands. Upon the depression of the key *h* the generator is connected with the branch 10, extending from the strand 7 between the normal contact-anvil of the key *h* and the connecting-plugs. Upon the operation of the key or switch *h* the generator is thus connected with the tip of plug *e* and sleeve of plug *f*.

Subscriber A, desiring communication with subscriber B, signals the operator, who after having inserted the answering-plug in the calling-subscriber's spring-jack and depressed her listening-key to ascertain the connection desired inserts the connecting-plug—in this instance plug *f*—into the spring-jack of the party-line and depresses the ringing key or switch *h*, whereby the calling-generator *i* is included in circuit with the signal-bell at the called station, the path taken by the calling-current following conductor 10, a portion of conductor 7, tip of plug *e*, cross-conductor 8, sleeve of plug *f*, line-spring b^2, limb 4 of the telephone-line, the portion of the bridge-conductor 5 connecting the switch-hook with the limb 4 of the party-line, the switch-hook, and the grounded bell. The signaling-current can follow no other path, since the strand 7 is broken.

If the calling subscriber should desire communication with subscriber B′ of the party-line, the operator inserts the connecting-plug *e* into the spring-jack of said line, whereby upon the depression of the ringing-key current from the calling-generator is directed over conductor 10, a portion of conductor 7, tip of the connecting-plug *e*, limb 3 of the telephone-line, a portion of the bridge-conductor 5 at station B′, the telephone-switch, and grounded call-bell at said station. The current from generator *i* can follow no other path, since the strand 7 is broken and since the sleeve of the remaining connecting-plug *f*, connected with the tip of plug *e* in its normal position, has no other electrical connection when said plug is idle.

If the calling subscriber should desire to have the called subscriber resignaled—as, for example, in case the called subscriber should fail to respond to the first signal—or if the calling subscriber after having finished one conversation should immediately desire to speak again to the called subscriber, he vibrates his switch-hook to rapidly operate his clearing-out signal g^2, which indicates to the operator that it is desired to have the called subscriber resignaled.

In systems heretofore in use where the called subscriber was connected with a party-line it was necessary that the operator be again informed of the particular subscriber of the party-line who was to be resignaled. In the present system the operator merely depresses the ringing-key upon the rapid operation of the calling-subscriber's clearing-out signal, the proper connecting-plug being inserted to direct calling-current to the called-subscriber's signal-bell.

Referring to Fig. 2, I have illustrated a multiple-switchboard system employing a cord-connecting apparatus embodying my invention. The instruments employed at the substations are similar to those employed in the system shown in Fig. 1, the bells being, however, preferably of high resistance. The circuits are somewhat modified, the bells being included in ground branches permanently connected with the bridge-conductors 5, while condensers *l* are included in the bridge-conductors, whereby battery-current from the centralized battery *m* is directed through the transmitters.

The line-signals shown form no part of my present invention, their operation being well understood by those skilled in the art.

The spring-jacks 1^a and 1^b are disposed at one board, while the spring-jacks 2^a and 2^b are disposed at another board. Jacks 1^a and 2^a are provided with metallic thimbles a^3 a^3, while jacks 1^b and 2^b are provided with metallic thimbles b^3 b^3, these thimbles being connected in multiple and grounded. The spring-jacks are connected in multiple with their respective telephone-lines. Cord strand 6 contains repeating-coils m' m^2, while cord strand 7 includes repeating-coils m^3 m^4. The

battery m is connected at one terminal between the coils m' m^2 and at the other terminal between the coils m^3 m^4. This arrangement is well-known to those skilled in the art. A third strand 11 connects the third contact portions n of the plugs, which engage the metallic thimbles when the plugs are inserted in the jacks. Clearing-out indicators g^2 g^3 are included in this strand.

I do not deem it necessary to describe the operation of the clearing-out annunciators, as they form no part of my present invention. The battery o is included in the ground branch from strand 11.

I preferably operate the ringing-key h automatically by means of an electromagnetic circuit-controlling device, such as is shown and described in my application, Serial No. 607,126, filed September 28, 1896. For this purpose I include an electromagnet h^2 in circuit with the conductor 11, the armature of the magnet supporting the ringing key or switch h, this magnet being energized upon the insertion of one of the connecting-plugs into a spring-jack. When the plug is inserted, current is directed from the battery o through the said magnet, contact portion n of the inserted connecting-plug, through the relay p, constituting a portion of the line-indicating apparatus, to ground. In this instance the key h is composed of two strips h^3 h^4 of spring metal insulated from each other. Strip h^3 is connected with tip of plug f, while strip h^4 is connected with sleeve of plug e. Upon the attraction of the armature of the magnet h^2 the key h is limited in its downward movement by the post q, the strips h^3 h^4 being thereby brought into engagement with the generator-contacts h^5 h^6, respectively, whereby the generator or source of calling-current i is included in circuit with the inserted connecting-plug and the corresponding limb of the telephone-line engaging the terminal of said plug connected with the generator, whereby the bell at the selected station is operated. When the ringing-switch is thus engaged by the post q, the strips h^3 h^4 are freed from all contacts except the generator-contacts to open the cord-circuit between the connecting-plugs and battery m, whereby current from the generator is prevented from passing over the remainder of the cord-circuit and by way of battery m to the bell at the remaining and uncalled station of the party-line or to prevent the generator from being short-circuited by ground m^5.

The called subscriber in response to the signal removes his telephone from its hook, whereby the current from the generator finds a return path to ground m^5 at the central office, the new path for the generator-current offering less resistance. The obstructing portion q is mounted upon the armature of a magnet r, traversed by the calling-current, and when said magnet is operated by reason of the increased current passing through the same upon the removal of the called-subscriber's telephone from its hook said obstruction q is removed from the path of the key, permitting the springs h^3 h^4 to come in contact with the contact-anvils beneath the same to complete the continuity of the cord-circuit and to disengage the said springs from the generator-contacts to remove the generator from line. The tip of plug e is grounded at m^5. A test-conductor 12 normally connects the tips of the plugs, said conductor terminating in the normal contact of spring h^3, connected with tip of plug f. Both tips of the connecting-plugs are thus grounded, the operator being thereby enabled to use either one for the purpose of testing. If the line called for should be in use at another board, this fact is evidenced upon an application of either connecting-plug to the thimble of the jack at the board where the call is made. In testing the battery o at the board where the line may be in use finds a path through said thimble, the tip of the applied connecting-plug, strand 6, repeating-coil m^2, to ground m^5, the test being manifested by a click in the operator's telephone.

The terms "answering-plug" and "connecting-plug" are well recognized in the art of telephony as descriptive of distinct portions of the cord-connecting apparatus. The answering-plug is that plug used by the operator to establish connection between the calling-subscriber's line and the operator's apparatus and through the medium of which the operator connects her telephone in circuit with the calling-subscriber's telephone, whereby the connection desired by the subscriber may be ascertained. The connecting-plug is the plug by which the called-subscriber's line is included in circuit with the cord-circuit and the calling-subscriber's line and through the medium whereof the ringing-current is included in circuit with the called-subscriber's signal-bell. In the claims I use the terms "connecting-plug" and "answering-plug" in the sense as pointed out above. In the claims I speak of "grounded branches" at the subscribers' stations and "a grounded source of calling-current" in the sense that circuit is completed through them by a grounded return or additional conductor independent of the telephonic circuit.

In the claims I use the term "signal-bell" in the sense of any signal-receiving apparatus located at the subscribers' stations.

It is obvious that my invention may be applied to other systems than those herein shown and that modifications may be readily made without departing from the spirit of my invention. I do not therefore desire to be limited to the precise system of circuits and apparatus herein shown and described; but,

Having thus described my invention, I claim as new, and desire to secure by Letters Patent, together with such modifications as may be made by those skilled in the art, the following:

1. In a telephone-exchange system, the combination with a telephone-line and a party telephone-line extending from the exchange, of a cord-circuit for forming a continuation of the first-aforesaid telephone-line, a plurality of connecting-plugs, each severally adapted to connect the cord-circuit and the first-aforesaid telephone-line with the party telephone-line, signal-bells at the subscribers' stations of the party-line, and a source of signaling-current connected or adapted to be connected with each connecting-plug, each connecting-plug corresponding to a subscriber's station of the party-line and adapted to include signaling-current in circuit with the signal-bell thereat, the bells at the remaining station or stations being irresponsive to the signaling-current thus included in circuit with the bell at the selected station, substantially as described.

2. In a telephone-exchange system, the combination with a telephone-line and a party telephone-line extending from the exchange, of a cord-circuit for forming a continuation of the first-aforesaid telephone-line, a plurality of connecting-plugs, each severally adapted to connect the cord-circuit and the first-aforesaid telephone-line with the party telephone-line, signal-bells at the subscribers' stations of the party-line, a source of signaling-current connected or adapted to be connected with each connecting-plug, each connecting-plug corresponding to a subscriber's station of the party-line and adapted to include signaling-current in circuit with the signal-bell thereat, the bells at the remaining station or stations being irresponsive to the signaling-current thus included in circuit with the bell at the selected station, and switching mechanism for connecting the source of calling-current with or disconnecting it from the connecting-plugs, substantially as described.

3. In a telephone-exchange system, the combination with a metallic party telephone-line circuit connected at the central office with a line or spring jack switch having two substations connected therewith, each limb of the line having a signal-bell connected in circuit therewith at each subscriber's station, a source of calling-current, a cord-circuit for connecting subscribers for conversation having two strands, and connecting-plugs forming a part thereof, each connecting-plug being provided with two dissimilar contact portions as a tip and a sleeve and adapted for insertion in said spring-jack switch, the tip and sleeve of one plug being connected respectively with the sleeve and tip of the other plug, each of said plugs corresponding to one substation and adapted to direct current in circuit with the signal-bell thereat, said plugs being connected or adapted to be connected with the aforesaid source of calling-current, substantially as described.

4. In a telephone-exchange system, the combination with a telephone-line and a party telephone-line extending from the exchange, of a cord-circuit, an answering-plug and a plurality of connecting-plugs connected therewith, the answering-plug being provided for connecting the cord-circuit with the first-aforesaid telephone-line, while each of said connecting-plugs is provided for connecting the party-line with the cord-circuit and the other telephone-line, signal-bells at the subscribers' stations of the party-line, and a source of signaling-current connected or adapted to be connected with each connecting-plug, each connecting-plug corresponding to a subscriber's station of the party-line and adapted to include signaling-current in circuit with the signal-bell thereat, the bells at the remaining station or stations being irresponsive to the signaling-current thus included in circuit with the bell at the selected station, substantially as described.

5. In a telephone-exchange system, the combination with a metallic party telephone-line circuit connected at the central office with a line or spring jack and having two substations connected therewith, each limb of the line having a signal-bell connected in circuit therewith at each subscriber's station, a source of calling-current, a cord-circuit for connecting subscribers for conversation having two strands, two connecting-plugs forming a part thereof, each of said plugs corresponding to one substation and adapted to direct current in circuit with the signal-bell thereat, said plugs being connected or adapted to be connected with the aforesaid source of calling-current, an electromagnetic circuit-controlling device having a ringing-key *h* controlled thereby and adapted to connect the source of calling-current with said plugs, means for closing circuit through said circuit-controlling device whereby said key is operated, a portion *q* interposed in the path of said key whereby the key is limited in its motion and brought into contact with a terminal of the source of calling-current, and a magnet *r* controlled by the apparatus at the called subscriber's station adapted to remove said portion *q* from the path of the ringing-key whereby the source of calling-current is removed from line, substantially as described.

6. In a multiple-switchboard system, the combination with two or more switchboards at the central office, of a telephone-line, and a party telephone-line, each connected with line-jacks at all of said switchboards, a cord-circuit for forming a continuation of the first-aforesaid telephone-line, a plurality of connecting-plugs, each severally being adapted to connect the telephone-line and cord-circuit with the party telephone-line, signal-bells at the subscribers' stations of the party-line, a source of signaling-current connected or adapted to be connected with each connecting-plug, each connecting-plug corresponding to a subscriber's station of the party-line and adapted to include signaling-current in circuit with the signal-bell thereat, the bells at

the remaining station or stations being irresponsive to the signaling-current thus included in circuit with the bell at the selected station, a test portion as a thimble associated with each line-jack connected with the party telephone-line, a portion of a test-circuit connected or adapted to be connected with each of said test portions, and test portions upon each of said connecting-plugs, the remaining portion of said test-circuit being connected with one of the test portions of a connecting-plug, the test portions of the connecting-plugs being or adapted to be electrically connected, substantially as described.

7. In a telephone-exchange system, the combination with a telephone-line and a party telephone-line extending in two limbs from the exchange to two substations, of a grounded branch from each limb of the party-line, one branch being located at each substation, signal-bells included in the grounded branches, a cord-circuit for forming a continuation of the first-aforesaid telephone-line, two connecting-plugs, each, severally, adapted to connect the cord-circuit and the first-aforesaid telephone-line with the party telephone-line, and a grounded source of calling-current connected or adapted to be connected with each connecting-plug, one connecting-plug being adapted to direct the calling-current over one limb of the party-line to operate the signal-bell at one station, while the other connecting-plug is adapted to direct calling-current over the other limb of the party-line to operate the signal-bell at the other station, whereby the signal-bell at either station may be selected and alone operated, substantially as described.

In witness whereof I hereunto subscribe my name this 8th day of July, A. D. 1897.

WILLIAM W. DEAN.

Witnesses:
W. E. HARKNESS,
FRED R. MOTT.