

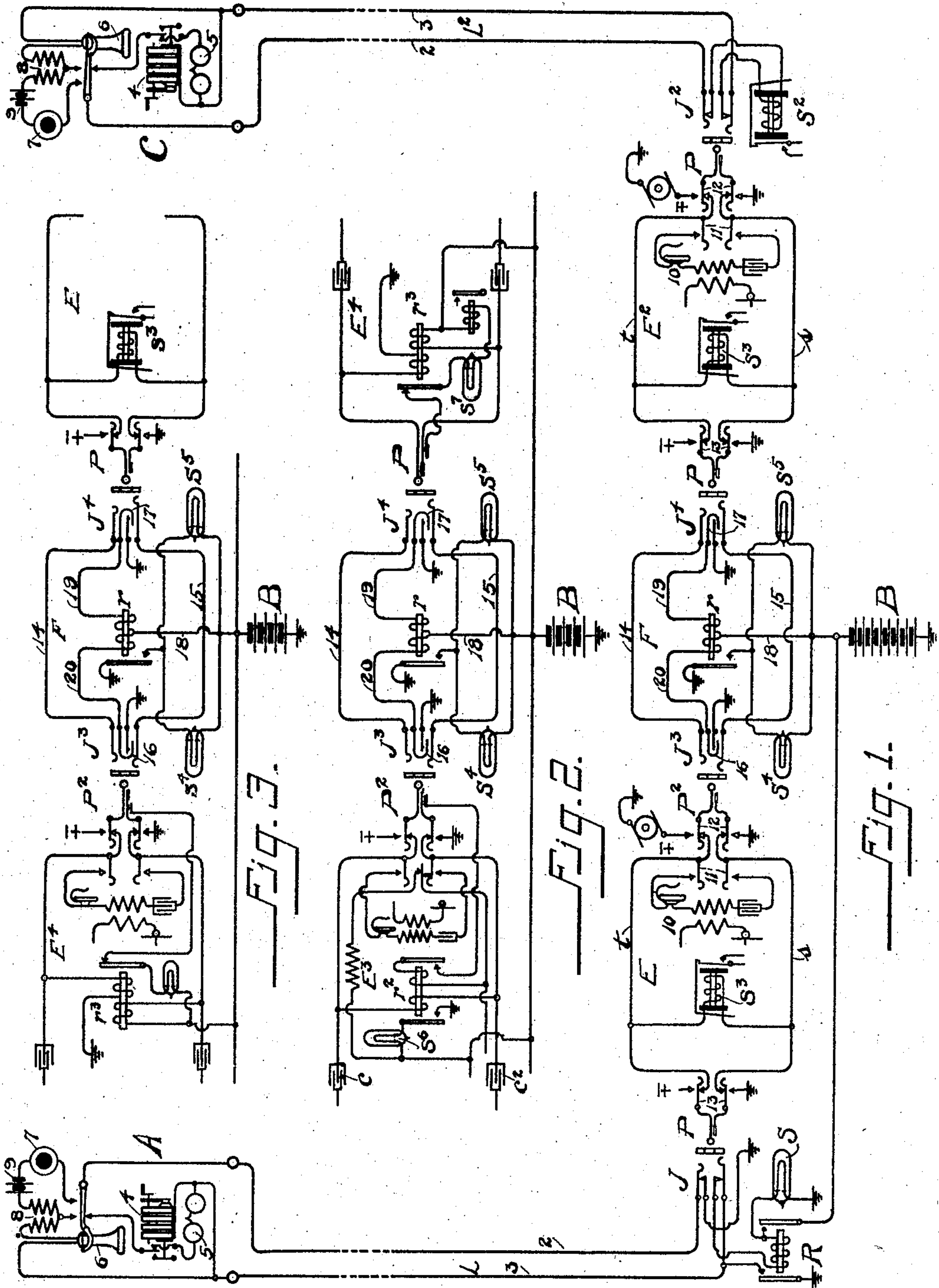
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C. A. SIMPSON.

TRANSFER CIRCUIT FOR TELEPHONE EXCHANGE SYSTEMS.

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Witnesses.

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# UNITED STATES PATENT OFFICE.

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## TRANSFER-CIRCUIT FOR TELEPHONE-EXCHANGE SYSTEMS.

No. 816,131.

Specification of Letters Patent.

Patented March 27, 1906.

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*To all whom it may concern:*

Be it known that I, CHARLES A. SIMPSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Transfer-Circuits for Telephone-Exchange Systems, of which the following is a specification.

My invention relates to improvements in transfer-circuits for telephone-switchboards. In the case of multiple switchboards each subscriber's line is multiplied through the various sections thereof, so that each operator has within her reach a multiple jack for each line, so that she may readily establish complete connections for conversation between the subscribers' lines which are answered at her section and any of the other lines of the exchange through the medium of said multiple jacks. In the case of small switchboards, however, where the expense of providing multiple jacks for each of the lines upon the different sections of the switchboard is too great, some other means must be provided to enable the operators to establish talking connections between the various subscribers' lines. This is ordinarily accomplished through the medium of transfer-circuits which are short sections of metallic circuits extending between the sections of the switchboard which they are designed to connect and terminate in a jack at either end. The operator then, when a connection is to be established between a calling party and another party whose line terminates at a different section, connects her cord-circuit between the calling-line and a transfer-circuit which leads to the desired section of the switchboard. The operator at the second section is then notified of the desired connection in some manner and her cord-circuit is employed between the other end of the same transfer-circuit and the line of the wanted party, whereby a complete talking-circuit is established between the two subscribers. To facilitate the making and unmaking of such connections, various methods of signaling have been employed.

My invention relates more particularly to such transfer-circuits and means for readily signaling between the operators to facilitate the handling of such connections from an operating standpoint. Naturally the greatest

field for such invention is in connection with small magneto-switchboards or magneto-lamp switchboards or with small non-multiple common-battery switchboards or in the combination of these various types, where in the changing from one system to the other or in adding a new section of an improved type of line to an old-style switchboard it is necessary to interconnect the various types of lines. It is not intended, however, to limit the invention to these uses, since it is apparent that it may be employed in various relations and under various conditions.

My invention is illustrated in the accompanying drawings, in which the same reference characters are used throughout the various figures to describe like parts, and in which—

Figure 1 is a diagram showing one application of the invention, and Fig. 2 is a similar view showing another application of the same, and Fig. 3 is likewise a diagram showing the invention applied to still different combinations of cord-circuits.

Referring to Fig. 1, L and L<sup>2</sup> indicate subscribers' lines extending in two limbs 2 and 3 from their respective substations A and C to the central office, where they terminate in suitable spring-jacks J and J<sup>2</sup> upon different sections of the switchboard. These lines are of the "magneto" type, so termed for the reason that each subscriber's station is provided with a hand magneto-generator 4 to generate the signaling-current by means of which the subscriber is enabled to call the central office. The usual arrangement of the various parts is shown at the substation, said parts including a call-bell or ringer 5, a receiver 6, a transmitter 7, and an induction-coil 8, a local battery 9 being provided to furnish current for talking purposes. The subscribers' lines may be provided with any suitable type of signaling apparatus at the central office so far as my invention is concerned, and I have shown the line L provided with an incandescent-lamp signal S, whose circuit is controlled by a line-relay R, which is initially responsive to current from the magneto-generator to the substation and is thereafter actuated by current from the central common battery B flowing through its winding, one of the normally closed contacts of the spring-jack and normally open contacts of the relay itself. The line L<sup>2</sup> is shown as pro-



vided with a drop  $S^2$ , which is adapted to be operated by current from the hand-generator 4 at the substation. These types of lines are well known, the former being termed  
 5 "magneto-lamp" lines, while the latter are more commonly known as "magneto-lines." It will be understood that ordinarily the switchboard will be provided with one or the other type, though both types sometimes occur  
 10 upon a switchboard during a change from one to the other or when new sections with later improved apparatus are added to an old installation. The cord-circuits  $E$  and  $E^2$ , located at the two sections of the switch-  
 15 board, are of the usual magneto type, each having an answering-plug  $P$  and a calling-plug  $P^2$ , having contact-surfaces adapted to register with the corresponding contacts of the spring-jacks of the telephone-line, the  
 20 tip-contacts of said plugs being joined by the flexible strand  $t$  and the sleeve-contacts by the similar strand  $s$ , across which is bridged the clearing-out drop  $S^3$ . The usual operator's set 10 is adapted to be connected with  
 25 the cord-circuit through the medium of a suitable listening-key 11, while the ordinary alternating ringing-generator is adapted to be connected with the plug  $P^2$  by means of the ringing-key 12. It is common in this  
 30 type of cord-circuit to provide a second ringing-key 13 in connection with the answering-plug for convenience in ringing the calling subscriber without withdrawing the plug.

The transfer-circuit with which my invention is more directly concerned is indicated  
 35 at  $F$  and extends between the two sections of the switchboard at which the lines  $L$  and  $L^2$ , respectively, terminate. It is provided at one end with a spring-jack  $J^3$  and at the op-  
 40 posite end with a spring-jack  $J^4$ , placed before the operators upon their respective sections of the switchboard. The tip-springs of the jacks are directly connected by a conductor 14 and their sleeve springs or contacts by  
 45 the conductor 15. The spring  $J^3$  is provided with a pair of normally open contacts 16, and a similar pair of normally open contacts 17 are located in the jack  $J^4$ . A relay  $r$ , provided with windings differentially disposed  
 50 with reference to current in parallel, is provided for each transfer-circuit, said windings having a common terminal connected by a conductor, such as the branch 18, to the live pole of the central common battery  $B$ , while  
 55 the other terminal of one of the windings is joined to a conductor 19, leading to one of the normally open contacts of the spring-jack  $J^4$ , the other of which contacts is grounded. The second terminal of the other wind-  
 60 ing of said relay  $r$  is similarly joined by conductor 20 with the ungrounded normally open contact 16 of the jack  $J^3$ . This relay  $r$  is provided with normally open contacts, one of which is grounded and from the other  
 65 of which parallel branches containing the

signals  $S^4$  and  $S^5$ , associated, respectively, with the jacks  $J^3$  and  $J^4$ , lead to the live pole of the battery  $B$ . A call coming in over the telephone-line  $L$ , for instance, is answered by the operator in the usual man-  
 70 ner by the connection of the cord-circuit  $E$  with the said line, who then inserts the other plug  $P^2$  of her cord-circuit into the jack  $J^3$  of the transfer-circuit extending between her section of the switchboard and the  
 75 section of the switchboard upon which the wanted line—as, for instance, the line  $L^2$ —ends. In the case of the use of order-circuits between the operators, which are common, the operator at the first section informs the  
 8 operator at the second section what trunk to use and what party is desired by the calling subscriber, in which case the second operator connects her cord-circuit  $E^2$  with the jack  $J^4$   
 85 of said transfer-circuit and with the jack  $J^2$  of the wanted subscriber and proceeds to call the latter subscriber through the medium of her ringing-key 12. In case the order-circuit is not employed, the insertion of the plug  
 90  $P^2$  in the jack  $J^3$  of the transfer-circuit  $F$  closes the normally open contacts of said jack, thereby causing current to flow through the left-hand winding of the relay  $r$  to energize the same, which completes the circuit of the parallel signals  $S^4$  and  $S^5$ , which are re-  
 95 spectively associated with the opposite ends of the trunks, thereby attracting the attention of the operator at the second section, who connects her cord-circuit with the transfer-circuit to receive the order either from the  
 100 initiating operator or from the subscriber direct, who is asked to repeat the same. The insertion of the answering-plug of the cord-circuit  $E^2$  causes current to flow through the second half of the relay  $r$ , thereby de-ener-  
 105 gizing the same and causing it to open the circuit of the signals  $S^4$  and  $S^5$ , which are retired. A through talking connection is thus established between the subscribers, at the  
 110 end of which the subscribers give the clearing-out signal by operating their magneto-generators, which causes the operation of one or both clearing-out drops  $S^3$ , when the cord-circuits  $E$  and  $E^2$  are withdrawn and all parts restored to normal condition. In case but  
 115 one of the clearing-out drops is operated, the withdrawal of the cord-circuit at that end of the transfer-circuit causes the signal-lamps  $S^4$  and  $S^5$  to be lighted, which operates as a clearing-out signal for the second operator, who  
 120 takes down her cord-circuit, thereby restoring all parts to normal condition.

In Fig. 2 this transfer-circuit is shown as adapted for use between magneto-lamp cord-circuits, such as the circuit  $E^3$ , and common  
 125 battery cord-circuits, as at  $E^4$ . The former cord-circuit is provided with a relay, such as  $r^2$ , bridged across its talking-strands upon opposite sides of the condensers  $c$  and  $c^2$ , included in said strands. The corresponding  
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relay at the end of the cord-circuit connected with the subscribers' line receives the clearing-out current from his hand-generator and serves when thus energized to close the circuit of the clearing-out lamp corresponding to lamp S<sup>6</sup>. At the same time the locking-circuit of the other winding of said relay is completed to maintain the lamp operated after the clearing-out current has ceased.

This type of cord-circuit is particularly adapted for use with magneto-lamp lines, such as the line L, except with the jack-rings grounded. Its further arrangement and operation are thought to be obvious, and therefore do not require an extensive description. The cord-circuit at the opposite end of the trunk is of the type that is commonly employed with small common-battery switchboards, in which the relay r<sup>3</sup> is provided with windings upon opposite sides of the common battery B to furnish current to the substation for talking. This relay controls the circuit of the supervisory signal S<sup>7</sup>. The operation of the transfer-circuit in connection with these two cord-circuits is the same as before described, except that the clearing-out signal would necessarily be given the other operator by the withdrawal of a plug from one end of the same. As in the former figure, it is obvious that the signals S<sup>4</sup> and S<sup>5</sup>, associated with the opposite ends of said transfer-circuit, are lighted whenever a plug is inserted in one of the jacks only, and at all other times are rendered inert. The cord-circuit E<sup>4</sup> is adapted for use with lines provided at the central office with apparatus like that shown in connection with the line L when changed to common battery.

It often happens that a portion of the switchboard is provided with common-battery lines and another portion with magneto-lines, the most common occurrences of this mixed arrangement being where the lines are in course of change from magneto to common battery or where a new common-battery section is added to an old magneto-switchboard. Fig. 3 indicates how this circuit may, without change, be utilized between sections of a switchboard employing such different types of cord-circuits. In fact, one special advantage of this transfer-circuit, which forms the subject of my invention, is the fact that while extremely simple it is suitable for use without change between various types of lines—

as, for instance, between two magneto-lamp-system positions, between two magneto positions, between one magneto-lamp system and a magneto position, or between a common-battery position and either of the other types of positions.

While I have thus described various applications of my invention and one specific form of the same, it is apparent that it may be used in various other relations and for various purposes and with modified arrangements

without departing from the spirit or scope thereof.

What I claim is—

1. In a telephone system, the combination with subscribers' lines terminating upon different switchboard-sections, of a transfer-circuit extending between said sections, means at each said section to connect the subscribers' lines thereof with the said transfer-circuit to establish a complete talking-circuit between the subscribers, two signals permanently connected in parallel associated one with each end of the said transfer-circuit, and means actuated in making and unmaking connections with the said transfer-circuit for suitably controlling the circuit of said signals, substantially as described.

2. In a telephone system, the combination with subscribers' lines terminating upon different switchboard-sections, of a transfer-circuit extending between said sections, means at each said section to connect the subscribers' lines thereof with the said transfer-circuit to establish a complete talking-circuit between the subscribers, a signal associated with each end of the said transfer-circuit, a relay associated with the said transfer-circuit to control the circuit of said signals, and means for suitably actuating said relay in making and unmaking connections with the said transfer-circuit.

3. In a telephone system, the combination with subscribers' lines terminating upon different switchboard-sections, of a transfer-circuit extending between said sections, means at each said section to connect the subscribers' lines thereof with the said transfer-circuit to establish a complete talking-circuit between the subscribers, a signal associated with each end of the said transfer-circuit, a differential relay controlling the operating-circuits of said signals, and means actuated in making and unmaking connections with said transfer-circuit to control the operation of said relay to thereby suitably control the operation of said signals, substantially as described.

4. In a telephone system, the combination with subscribers' lines terminating upon different switchboard-sections, of a transfer-circuit extending between said sections, means at each said section to connect the subscribers' lines thereof with the said transfer-circuit to establish a complete talking-circuit between the subscribers, a signal associated with each end of the said transfer-circuit, a differential relay associated with the transfer-circuit and controlling the circuit of said signals, one winding of said relay being controlled from one end of the said transfer-circuit and the other from the other end thereof, whereby when a connection is established with either end of the transfer-circuit alone the said signals are operated and when connection exists with both ends of the circuit or



with neither end, the said signals are inert, substantially as described.

5 In a telephone system, the combination with subscribers' lines terminating upon different switchboard-sections, of a transfer-circuit extending between said sections, means  
10 at each said section to connect the subscribers' lines thereof with the said transfer-circuit to establish a complete talking-circuit between the subscribers, a signal associated  
15 with each end of the said transfer-circuit, and means whereby when a connection is established with either end of said circuit said signals are operated and when a connection exists with both ends or with neither end of said  
20 transfer-circuits said signals are inert, substantially as described.

6. In a telephone system, the combination with subscribers' lines terminating upon different switchboard-sections, of a transfer-circuit extending between the said sections and  
25 terminating in a spring-jack at each end, cord-circuits at each said section to connect the subscribers' lines with the said transfer-circuit to establish a complete talking-circuit between the subscribers, a signal associated  
30 with each end of the transfer-circuit, a differential relay controlling the flow of current through said signals, contacts in each spring-

jack of the transfer-circuit controlling one of the windings of said differential relay, whereby when the cord-circuits are not connected with the transfer-circuit or are connected with both ends of the same, the said differential relay is rendered inoperative but when a connection exists with either end of the transfer-circuit the said relay is operated to cause the operation of the said signals, substantially as described. 30 35

7. In a telephone system, the combination with a transfer-circuit extending between different switchboard-sections and terminating in spring-jacks thereon, of signals associated with said spring-jacks, contacts and circuit connections associated with said jacks and transfer-circuit but independent of the talking-circuit thereof for controlling said signals, said contacts being controlled by the making and unmaking of connections with said jacks, whereby the said transfer-circuit is adapted for use with various types of cord-circuits, substantially as described. 40 45 50

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

CHAS. A. SIMPSON.

Witnesses:

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