

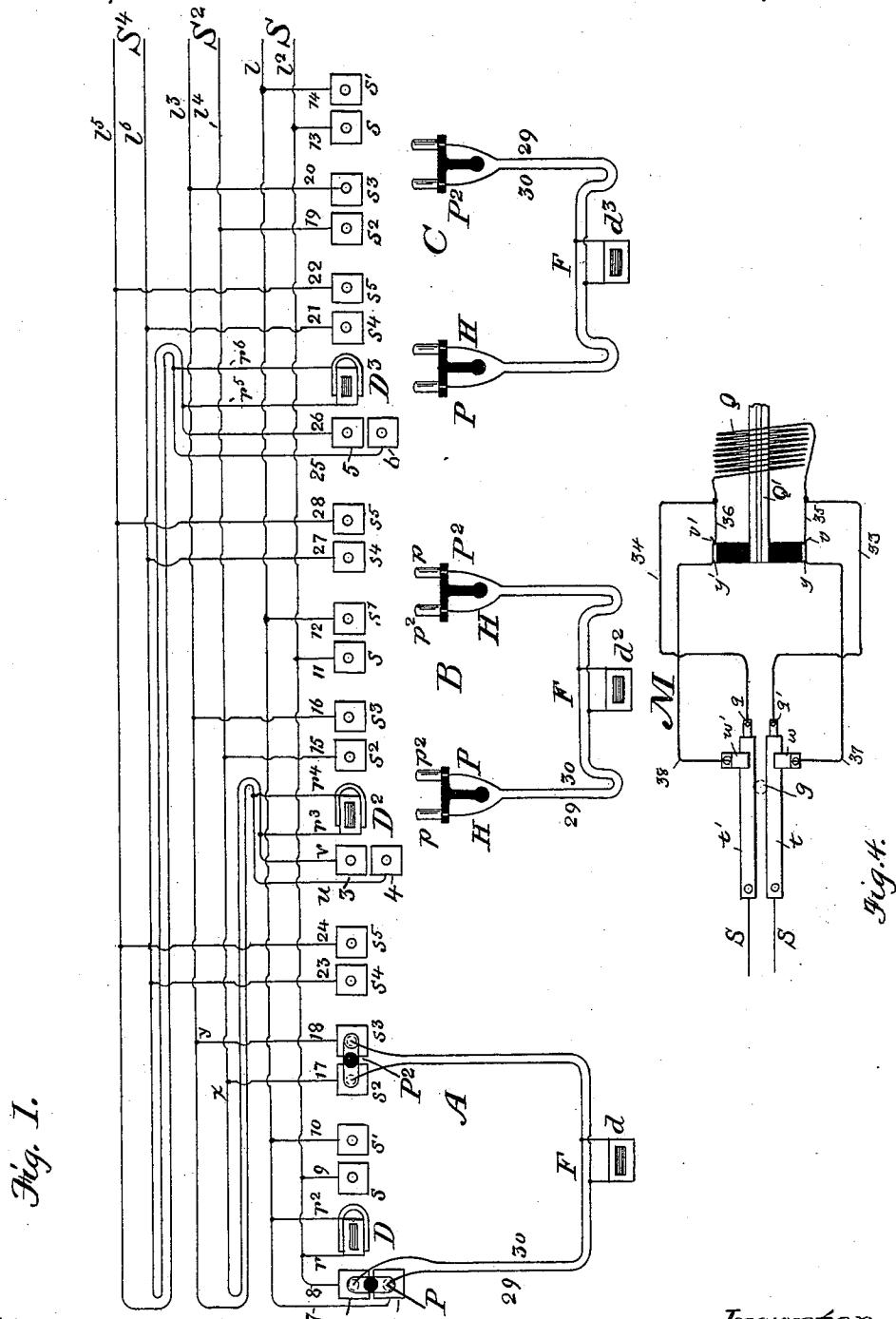
(No Model.)

2 Sheets—Sheet 1.

F. A. PICKERNELL,
MULTIPLE SWITCH BOARD.

No. 463,545.

Patented Nov. 17, 1891.



Witnesses.

Matthew Allen
H. W. Sorenson

Inventor:
Frank A. Pickernell,
by D. L. Mauro,
his attorney

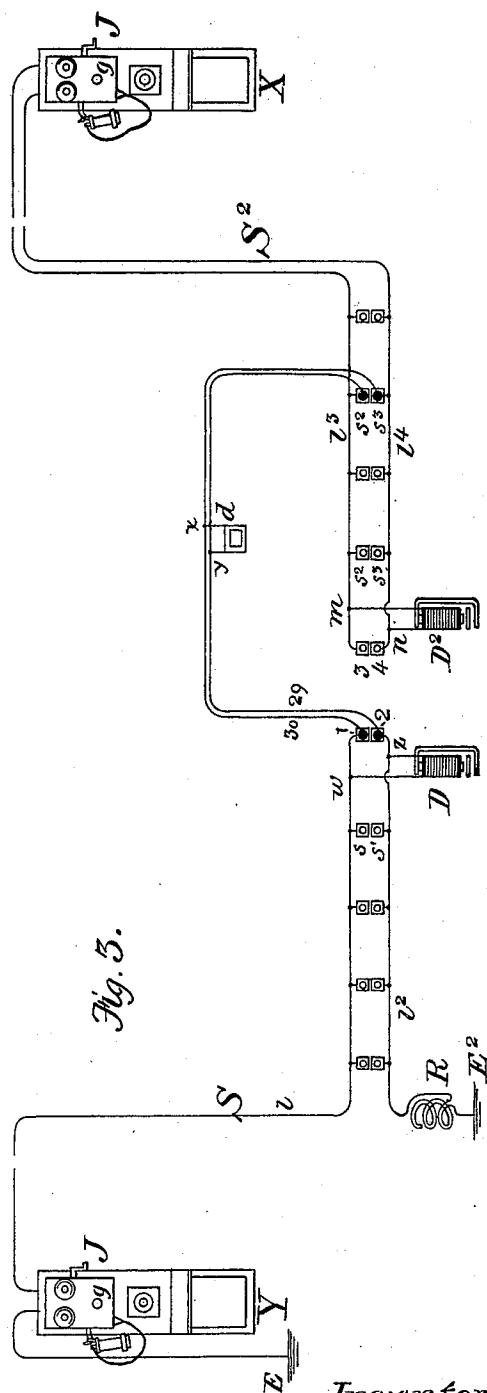
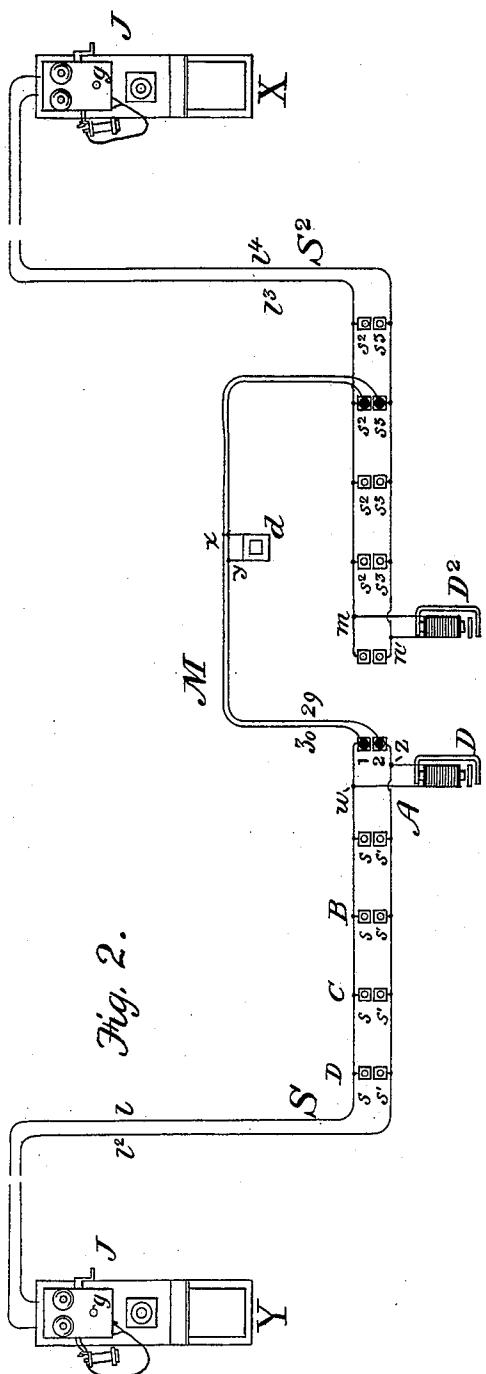
(No Model.)

2 Sheets—Sheet 2.

F. A. PICKERNELL.
MULTIPLE SWITCH BOARD.

No. 463,545.

Patented Nov. 17, 1891.



Witnesses.
Jonathan Clegg
H. W. Lott

N^o Inventor.
Frank C. Pierson
by Donald Mauro
his attorney

UNITED STATES PATENT OFFICE.

FRANK A. PICKERNELL, OF NEWARK, NEW JERSEY.

MULTIPLE SWITCH-BOARD.

SPECIFICATION forming part of Letters Patent No. 463,545, dated November 17, 1891.

Application filed August 17, 1891. Serial No. 402,903. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. PICKERNELL, residing at Newark, in the county of Essex and State of New Jersey, have invented certain Improvements in Multiple Switch-Boards, 5 of which the following is a specification.

Multiple switch-boards for telephone-exchange central stations are of two general classes, namely: first, those of which the form 10 shown in Letters Patent of the United States No. 305,021, granted September 9, 1884, to Charles E. Scribner is a type, in which the main circuits pass to the several switch-board sections in successive loops, and then to a 15 suitable calling device, on each switch-board section of this class the loop-terminals of the several circuits being each provided with a plug-socket or other attachment, including separable spring-contacts, whereby on the insertion of a plug-connector the circuit may be 20 broken, cutting off its normal route through the call-instrument and connecting the outgoing end or ends with a new path or paths through a conductor or conductors (according 25 to whether the circuit is earth-completed or metallic) leading from the said plug to any other such circuit similarly arranged for the purpose of interconnection; second, those of the type illustrated and described in Letters 30 Patent of the United States No. 252,576, granted to Leroy B. Firman, January 17, 1882, in which the main circuits pass to the several switch-board sections by independent normally-discontinuous branches, which are represented on the said sections by terminals in 35 the form of plug-sockets or similar connections of a simple character in which separable spring-contacts are not required, whereby any two such circuits may be united through 40 any suitable conductor, such as a flexible conducting-cord, provided with a plug-connector at both ends.

My present invention relates to multiple switch-boards of the latter class. Switch-boards of this class have heretofore not 45 largely been used for the reason that when the several main circuits connected therewith have been worked in connection with call-annunciators, (they being simply branched to the switch-sections,) no simple plan has presented itself whereby the insertion of a connecting-plug for the purpose of making con-

nnection between two lines has been enabled also to effectuate the breaking of the original route of the circuit through the call-receiving device, which, if unbroken, would ordinarily constitute a shunt or derived circuit to the through talking-circuit, introducing several features decidedly objectionable in practice and materially interfering with the 60 efficient operation of the circuits—such, for example, as dropping the annunciator of a line wanted at the answering - switch section of said line in sending a call to the sub-station connected therewith—a partial short-circuiting of the voice-currents through the call device or normal-circuit route of two connected lines; and, finally, the reception of a disconnecting-signal not only by the disconnecting-annunciator at the point where any two lines 70 were connected, but also by the original call-indicating devices of both lines concerned, and the consequent misunderstanding which such a multiplication of signals would involve. These difficulties have usually been avoided 75 where switch-boards of this class have been employed by adopting the expedient of the Firman patent, to which reference has been made, which is to dispense altogether with a call device included in the working-circuits, 80 thus enabling such circuits to remain normally open, and to send the calls over a distinct circuit.

The object of my invention is to permit the use of closed circuits and call-annunciators, 85 as usual, avoiding the necessity of extra call-circuits, and at the same time to overcome the difficulties which have been recited.

In my invention I employ, to receive and indicate the subscriber's initiatory call-signal, 90 a form of annunciator or other electro-magnetic call-receiving device which is not responsive to the alternating currents ordinarily generated and transmitted by the sub-station call-generator.

The said invention then consists in combining with a multiple switch-board, in which the several main circuits (preferably metallic) branch to the several switch-board sections, electro-magnetic call-receiving appliances responsive to currents of uniform direction only, clearing-out or disconnecting annunciators responsive to alternating currents, and sub-station generators adapted at will to de-

velop and transmit either alternating currents or straight currents having a direction to which the central office call-receiver can respond.

5 It further consists in such a construction of the switch-board and its appliances that whenever any two circuits are interconnected at any section the compound circuit thus constituted has at the central, bridged between 10 its two conductors, the two call-receiving appliances of the lines concerned, these being responsive to straight currents of uniform direction, and also in a third bridge, the disconnecting appliance. For the initiatory call- 15 receiving appliance I prefer to use polarized annunciators, and they will be arranged to operate, as stated, with a current of determined and uniform direction. Their resistance may be that now ordinarily employed.

20 The disconnecting-signal device I prefer to use is that now in ordinary use—*e. g.*, the regular form of tubular magnet-annunciator wound to a resistance of five hundred ohms.

The generator at the sub-station must be so 25 constructed that it will develop either uniformly directed or alternating currents according to its manipulation. Such a one, for example, is described in United States Patent No. 327,886, granted to Albert H. Low, October 6, 1885. It would include a button circuit-changer to be pressed in sending currents either of the alternating or single-direction type, whichever might be the most convenient, but preferably arranged to be employed 30 in sending that of uniform direction for the initiatory call. The said current must of course be of such uniform and single direction as will correspond to the polarity of the call device at the central station.

40 In the drawings which illustrate and form a part of this specification, Figure 1 is a diagram of a series of main circuits extending by normally-discontinuous branches to a series of operative sections of a multiple switch-board, where are arranged interconnecting devices, and each closed at but one of the said sections through a polarized call-receiving appliance. Fig. 2 is a detail diagram indicating a compound metallic circuit extending 45 between two sub-stations through a central station in accordance with my invention; and Fig. 3 is a similar diagram indicating a compound circuit between two sub-stations, formed, however, by the union at a central station of a metallic and an earth-completed circuit. Fig. 4 is a diagram illustrative of the type of generator employed at the sub-stations.

In Fig. 1 I have shown my invention as being embodied in a multiple switch-board M, of three sections A, B, and C, to each of which the main circuits S, S², and S⁴, supposedly leading from sub-stations, are brought by normally-discontinuous branches. I have shown but three main circuits, this being a number sufficient to fully illustrate the invention. Each main circuit is closed at some

one of the switch-board sections through a polarized annunciator D, on which are indicated the call-signals sent from the sub-station. 70 Thus the circuit S, entering, passes through the switch-board, and is closed at section A through the wires r and r², and the polarized annunciator capable of giving the signal only when actuated by the passage through its 75 coils of a current of uniform and proper direction. The same circuit also has answering connection terminals 1 and 2, located likewise at the section at which is located its annunciator D, these being joined, respectively, to the direct and return conductors l and l² of the main circuit by branch conductors 7 and 8 and constituting therewith normally-discontinuous branch terminals, at which by a suitable intervening or link conductor the said circuit may be connected with 80 any other circuit represented at the said switch-board by like branch terminals. Furthermore, the same circuit S has branch terminal connections s s' at each of the other 85 switch-board sections of the multiple board, these being in like manner united with the main conductors l and l² by the branch conductors 11 12 and 13 14. For convenience of operation I also preferably provide each main 90 circuit with an additional pair of branch terminal connections at the section where its call-annunciator is located, although this is not an essential provision. Thus at section A circuit S has the terminals s and s' 95 united with the circuit-conductors 9 and 10. Main circuit S² is shown as being provided with and closed through its polarized call-annunciator D² at switch-section B, to which it leads by wires r³ and r⁴, and as being 100 at such section furnished with answering terminals 3 and 4, joined to its main conductors l³ and l⁴ by wires u and v, and also with extra connection terminals s³ s³, united with the main conductors by wires 15 16. It 105 is represented at section A and at section C by single pairs s² s³ of branch terminals, connecting with their main conductors l³ l⁴, respectively, by branch conductors 17 18 and 19 20. Main circuit S⁴ connects permanently 110 through its main conductors l⁵ l⁶ and wires r⁵ r⁶ with its polarized annunciator D³ at section C, through which it is closed. It has also its answering and extra pairs of terminal connections 5 6 and s⁴ s⁵ at its call-answering section C, united by branch conductors 25 26 and 21 22, respectively, with the mains l⁵ l⁶, and its terminal connections s⁴ s⁵ at sections A and B are united with its main 120 conductors by branches 17 18 and 27 28, respectively. 125

I have in the drawings indicated the several circuit-terminals as being in the form of plates perforated by holes for the reception of plug-connectors. This form need not, however, necessarily be employed, and in some cases I may prefer to employ the construction shown and described in the United States Patent No. 267,747, granted to James F. Gil-

liland, November 21, 1882, in which metal pins serve as the fixed terminal connections which may be grasped by springs mounted on plug-connectors.

5 The link connections F shown, whereby any two circuits may be connected at any section by uniting their branch terminals, may, as usual, be made in the form of flexible conducting-cords, each with a plug-connector P at both ends.

In the present case, where the main circuits are metallic, each link connection also has two conductors 29 and 30, which in practice are of course inclosed in a single flexible covering. Plug-connectors P and P² are attached to the two ends of each cord, and each plug may comprise a non-conducting handle H and two conducting members p and p², the members p of the two plugs of a pair being united by conductor 29 and the members p² by conductor 30.

The tubular magnet-disconnecting drops d² d³, each of suitable and uniform resistance, are bridged between the two conductors of their own link connection. At each section there are of course in practice a number of such link connections, each being fitted with a disconnecting-annunciator.

At section A main circuits S and S² are united by the double conductor F, the plug-terminals whereof are inserted, respectively, in the sockets of the answering-terminals 1 and 2 of circuit S and the terminals s² and s³ of circuit S². Thus connected a compound conversation-circuit is composed, three bridges being connected at the central station between its direct and return conductors, two of which include the helices of the polarized call devices of the two constituent circuits, while the third includes in its circuit the helix of the disconnecting-annunciator d.

The key-board and conversation-supervising arrangements at the several switch-sections is not detailed, but will be the same in substance as is now being used on the most approved forms of multiple switch-board, and any efficient form of busy-test apparatus may be used in connection with the invention described herein.

50 In Fig. 2 two main metallic circuits S and S², extending from telephone sub-stations, where they are provided with calling and telephone apparatus J to a central station, are at the latter station connected together at a branching multiple switch-board M. The calling apparatus has a button g, which, if pressed while the generator-crank is being turned, enables the said generator to send currents of uniform direction, while, if the crank is turned without pressure on the button, alternating currents will go to line. This will be understood by referring to Fig. 4, in which a suitable arrangement of calling-generator is shown. Q represents the armature-coil of the generator, and Q' a portion of the shaft thereof. Wires 33 34 connect the armature-coil with the contacts q q', against which the line strips or springs t t' normally rest. Consequently the rotation of the armature-shaft would produce the usual alternating current. The armature-coil is also connected by wires 35 36 with the segments y y' of a metallierim carried by the armature-shaft. With these segments brushes v v' make contact, and said brushes are connected by wires 37 38 with the normally-open contacts w w'. By pressing button g the line-springs t t' will be lifted off contacts q q' and brought into contact with w w'. The circuit will then be through the commutator and brushes, and if the armature-shaft be at this rotated currents of uniform direction will be sent to line. Being purely in diagram, no order is observed in the arrangement of the connection terminals at these several switch-sections. It is sufficient to state that the socket-terminals s s' of circuit S are supposed to be distributed among the switch-board sections, as in Fig. 1, and that its answering-terminals 1 and 2, as well as one pair of terminals of each other circuit, including of course s² and s³ of circuit S², which is shown as being united to S, are located at section A, where the polarized call-annunciator D of circuit S is placed. One set of terminals—that is to say, the answering-terminals 1 and 2 of circuit S—are united at section A with one pair of the terminals s² and s³ of circuit S² by the double conductor 29 30, which has plug-connectors at its ends, as described, and which conductors are united through the disconnecting-annunciator d. A through-circuit metallic from one end to the other is thus composed extending from X to Y, and this circuit has, as shown, three bridge-conductors between its two conductors, the first from w to z, including polarized call device D; the second from m to n, including call device D², and the third from x to y, including the disconnecting-annunciator d. These bridges, however, by reason of their resistance and self-induction do not interfere with any of the proper operations of the circuit.

In Fig. 3 a similar arrangement is shown, in which, however, one of the main circuits S is an earth-completed circuit. This circuit, for the sake of obtaining the necessary balance, is provided, instead of a return-wire l², with an earth-wire, including a double-wound resistance-coil R of resistance sufficient to balance the line l and the instruments included therein. The compound circuit formed under these conditions extends from earth E at sub-station Y over l to switch-board connection l, to link-conductor 30, switch connection s³, conductor l⁴ of circuit S², telephone-instruments at station J, conductor l⁵, switch-board connection s², link-conductor 29, switch connection 2, wire l⁶, balancing resistance R, and earth at E². In this case, as before, the polarized call device helices D and D² remain undetached and connected in bridges between

the two conductors of the compound circuit, the helix of the disconnecting-annunciator *d* being connected in the same way.

In operation a call is made from a sub-station by pressing the button *g* and simultaneously turning the generator-crank. This causes the generator to develop and transmit currents of uniform direction and of such direction as will affect the polarized central-office annunciator. This operation causes the said annunciator to respond and give the signal-call. The circuit is then united with that of the station called for, as hereinbefore described. When the conversation is completed, either sub-station rings off without pressing the button, whereupon the generator develops alternating currents which pass over the line and operate the disconnecting-annunciator, but will not operate the polarized call-annunciator.

Polarized devices can readily be made sluggish, so that they will not respond to a momentary impulse of a current even of such direction as will ordinarily operate them if such an impulse be immediately succeeded by one of opposite direction.

I claim—

1. The combination, with a multiple telephone switch-board apparatus comprising main-circuit extensions having normally-discontinuous branches leading to connection terminals at the several sections of said switch-board, a polarized annunciator or like electro-magnetic-call device permanently connected with each such circuit extension at some one of the said sections, a link-connection conductor at each section adapted to unite the connection terminals of any two of the said main-circuit extensions, and a non-polarized disconnecting-signal annunciator included in bridge-circuit therewith, of main circuits connected with the said extensions and extending therefrom each to a distant sub-station, and a call-generator at each sub-station capable of generating and transmitting at will currents of constant and uniform or of alternating direction, whereby either the polarized or non-polarized annunciator at the central station may be operated to the exclusion of the other.

2. A multiple telephone switch-board apparatus comprising main circuits having normally-discontinuous branches leading to connection terminals at its several sections, an electro-magnetic call-signal-receiving device adapted to respond to currents of uniform direction only permanently connected with each main circuit at some one of the said sections, means, substantially as indicated, at each switch-board section for electrically uniting any two circuits by connecting their respective branch terminals, and a disconnecting-annunciator capable of responding to alternating

currents of electricity bridged between the direct and return conductors of any two united circuits in a branch circuit parallel with the said call-signal devices, substantially as described.

3. The combination, substantially as hereinbefore described, of two metallic or partly-metallic circuits, each permanently closed at a central station through the helices of a polarized call-annunciator, a double conductor link connection uniting the direct and return conductors of one of the said circuits with those of the other, and a non-polarized disconnecting-signal annunciator located in a bridge-conductor between the two conductors of said link connection, for the purpose specified.

4. In a telephone-exchange system, two metallic circuits extending from different sub-stations to the same central station and there having their respective direct and return conductors united to constitute a single compound metallic circuit from one of the said sub-stations to the other, in combination with two bridge-conductors, each uniting the direct and return conductors of said compound metallic circuit through the helix of a polarized annunciator, and a third bridge uniting the said direct and return conductors through the helix of a non-polarized or neutral annunciator, the said non-polarized annunciator being responsive to alternating currents and the polarized annunciators being responsive to currents of given and uniform direction transmitted from the said sub-stations.

5. In a metallic circuit multiple switch-board comprising several operative sections, a series of metallic circuits, each branching to paired connection terminal plates or sockets located at every section and each looping through the helix of a polarized call-annunciator at some one of the said sections, a double conductor link connection at each section terminating at both ends thereof in plug-connectors having two conducting surfaces or members and adapted to be inserted, respectively, in the said terminal-sockets of any two circuits and to unite the said two lines without breaking their normal circuits through their respective polarized call-annunciators, and a non-polarized disconnecting-signal annunciator connected by a cross-conductor from one of the conductors of said link connection to the other, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 8th day of August, A. D. 1891.

FRANK A. PICKERNELL.

Witnesses:

S. W. DUNBAR,

C. J. PICKERNELL.