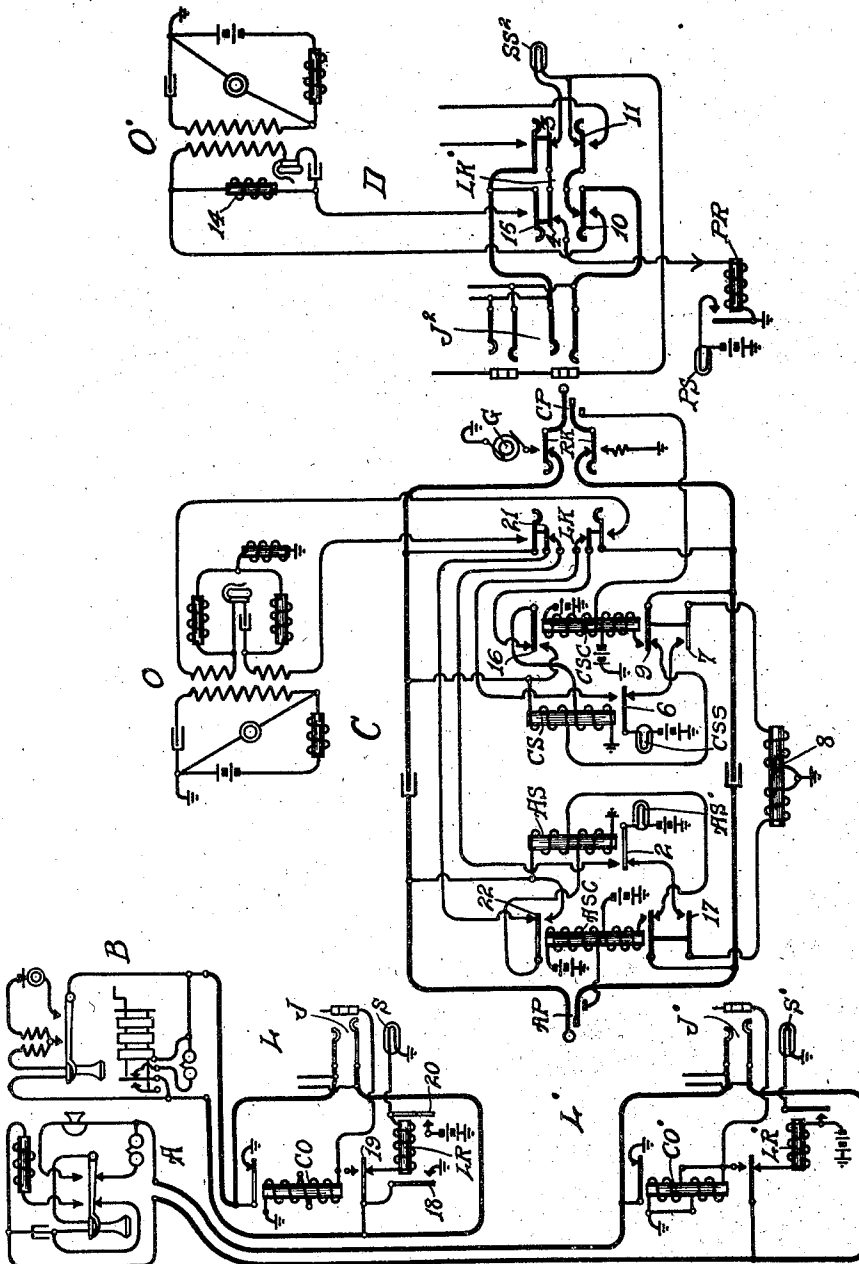


H. N. FARIS.
TRUNK CIRCUITS.
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Witnesses:

Geo. Yanchowski.

Wm. Bergmann.

Inventor:

Harry N. Faris.

By Curtis B. Camp.
Attorney.

UNITED STATES PATENT OFFICE.

HARRY N. FARIS, OF KANSAS CITY, KANSAS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TRUNK-CIRCUITS.

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To all whom it may concern:

Be it known that I, HARRY N. FARIS, a citizen of the United States of America, residing in Kansas City, county of Wyandotte, and State of Kansas, have invented certain new and useful Improvements in Trunk-Circuits, of which the following is a specification.

My invention has to do with telephone systems in general and more particularly to systems in which link and trunk circuits are used for interconnecting subscribers' lines, certain features thereof relating more particularly to systems in which a calling subscriber informs an operator of the connection desired then disconnects, and the operator completes the connection with the desired called-for subscriber before trunking back to the said calling subscriber.

In systems of the above described character, which are used generally in connection with toll work, a toll board is provided with recording operator's positions in which terminates so-called recording trunks, the opposite ends of which terminate at local offices. A calling subscriber desiring to make a toll call first connects to a recording operator's trunk through the medium of automatic or manual link circuit apparatus, then informs the recording operator of the toll connection desired and thereafter replaces his receiver causing the apparatus to be restored to normal. The recording operator, or a toll operator that has received instructions from the recording operator first effects connection with the desired called-for subscriber and then trunks back to the calling subscriber that originated the call and informs him that the connection with the called subscriber may now be had. In systems of this character it has been necessary to use two or more relays in connection with each of the toll recording trunk circuits in order to obtain the necessary supervision. One of the features of my invention is the provision of a simplified toll recording trunk; to the accomplishment of which I provide a novel circuit arrangement for accomplishing the desired result without the use of relays.

It is an object of my invention to produce an improved system that will embody desirable features of construction and circuit arrangements in a simple, efficient and economical manner; and to the accomplish-

ment of this object my invention consists in the novel details of construction and circuit arrangements as hereinafter described and pointed out in the appended claims.

Referring to the accompanying drawing, I have illustrated one embodiment of my invention which shows a so-called universal cord circuit C for connecting a common battery subscriber A or a local battery subscriber B to the recording operator's trunk D. The cord circuit C may also be used for interconnecting local battery and common battery lines. The subscriber's lines A and B terminate at the central office in convertible line circuits L and L' respectively, these circuits comprising similar apparatus differing only in the connections. Referring first to the local battery line B, it comprises the usual cut-off relay CO, line relay LR, and line signal S, this circuit being so arranged that when the substation generator is operated the line relay LR is energized and locked up over a local circuit, maintaining the line signal S lighted until an answering plug is inserted and the cut-off relay energized. The line circuit is so arranged that it may be readily converted into a common battery line by simply changing the connections of the line and cut-off relay as shown. The common battery substation A is of a well-known type and is connected to the exchange through the medium of the line circuit L' which terminates in the central office in the line relay LR' and cut-off relay CO'. In connection with the cut-off relays CO and CO', when used for magneto service the relay CO has its windings connected in series so as to provide a high resistance path for the jack sleeve to ground but when used for common battery service its windings are connected in multiple so as to provide a lower resistance path from the jack sleeve. This variation of resistance of the cut-off relays is for the purpose of effecting the operation and non-operation of the answering and calling sleeve control relays ASC and CSC.

The operator's link circuit C comprises answering and calling plugs AP and CP connected by the heavily marked talking conductors. Associated with the answering plug AP and connected to the sleeve conductor thereof is the answering sleeve controlling relay ASC which energizes when

connection is made with a common battery line so as to connect one winding of the answering supervisory relay AS to one side of the connected line. When connection is made with a magneto line, the answering sleeve control relay is not operated, thereby leaving the magneto winding of the answering supervisory relay AS bridged across the circuit of the calling magneto line. As previously referred to the cut-off relays of the magneto and common battery lines are preferably of a different resistance, relay CO being sufficiently high to prevent the operation of the switching or control relay, relay CO¹ of the common battery line being of low enough resistance to permit the operation of the switching or control relay, but in either case the cut-off relay of the subscriber's line circuit operates. Associated with the calling plug CP is a calling sleeve control relay CSC and a calling supervisory relay CS similar to the answering sleeve control relay ASC and answering supervisory relay AS associated with the answering plug AP. I also provide the customary answering and calling supervisory signals AS¹ and CSS, respectively. A listening key LK is provided for connecting the operator's telephone set O with the strands of the cord circuit and a ringing key RK is provided for connecting the generator G to the tip and ring conductors of the calling plug CP.

The recording trunk D terminates at the local exchange in multiple jacks J² which appear before the different local operators; its opposite end terminates in a two-way listening key upon the recording position of the toll board. If the listening key LK¹ is operated in one direction, the operator's set O¹ is connected to the trunk circuit and if operated in the opposite direction a second operator's telephone set (not shown) may be connected to the recording trunk circuit. I provide a line and supervisory signal SS² for denoting calls that come in over this trunk circuit. A pilot relay PR and a pilot supervisory lamp PS is provided common to the trunks that appear before the recording operator's position.

Having described in general the apparatus shown upon the accompanying drawing, I will now describe more in detail the establishment of a circuit connection between a calling subscriber and a recording toll operator at the toll board. Assuming that the subscriber at the common battery substation A is a calling subscriber, upon the removal of the receiver at the substation a circuit is closed through the line relay LR¹ over the metallic telephone line. The line relay LR¹, upon energizing, closes a circuit through the line signal S¹, which notifies the local operator that a connection is desired. The operator upon noting the glowing of the line lamp S¹ inserts the answering

plug AP of the cord circuit C into the jack J¹ that is connected with the calling line. Upon the insertion of the plug AP into the said jack a series energizing circuit is closed for relays CO¹ and ASC extending from battery through the upper winding of the answering control relay ASC, through the sleeve contacts of jack J¹ and plug AP and through the two windings of the cut-off relay CO¹ in multiple to ground, both relays energizing over this circuit. The relay CO¹ upon energizing, disconnects the line relay LR¹ thereby extinguishing the line signal S¹, and answering control relay ASC, upon energizing, connects battery through its lower winding to the ring conductor and connects ground through the lower winding of the answering supervisory relay AS to the tip conductor, thereby furnishing the calling subscriber with talking battery. The answering supervisory relay is energized over the subscriber's metallic line circuit and operates to prevent a premature glowing of the answering supervisory signal AS¹ by opening its normal contact 2.

The operator now actuates listening key LK to connect her telephone set O across the strands of the cord circuit C and inquires of the calling subscriber the connection desired. Upon learning that a toll connection is desired the operator restores her listening key to normal and inserts the calling plug CP into a multiple jack J² of the recording trunk circuit D, having first tested to ascertain whether the recording trunk circuit D is in an idle or busy condition. Upon the insertion of the calling plug into the multiple jack J², a circuit is closed extending from battery through the upper winding of the calling sleeve control relay CSC, through the sleeve contact of the calling plug CP and jack J², the line lamp SS², normal contacts 3 and 4 of listening key LK¹ and through the pilot relay PR to ground. The calling control relay CSC and pilot relay PR are energized over this circuit but the resistance of the winding of the calling control relay CSC is such as not to permit sufficient current to flow through the line and supervisory lamp SS² to cause it to glow. The pilot relay PR, upon energizing causes the pilot lamp PS to glow, thereby notifying the recording operators that a call has been extended to the recording position of the toll board. The calling sleeve control relay, upon energizing, connects battery through its lower winding to the ring conductor of the cord circuit C and connects ground through the lower winding of the calling supervisory relay CS to the tip conductor of the cord circuit. A further result due to the energization of the calling sleeve control relay CSC is the closing of a circuit through the calling sleeve supervisory lamp CSS, extending from battery through the said lamp,

through normal contact 6 of relay CS, alternate contact 7 of relay CSC and through the right hand winding of the coil 8 to ground. The connection of battery through the lower winding of the relay CSC to the ring contact of the jack J² closes a supplemental circuit through the lamp SS² extending from battery through the lower winding of said relay CSC, alternate contact 9 thereof, ring conductor of the plug CP and jack J², normal contacts 10 and 11 of listening key LK¹ through lamp SS², normal contacts 3 and 4 of said key and through the pilot relay PR to ground. The line lamp SS² receives sufficient current over this circuit to cause it to glow, thereby designating to the recording operators the particular trunk over which the connection has been extended. The idle one of the recording operators now actuates the listening key LK¹ to connect her telephone set O¹ across the tip and ring conductors of the recording circuit D. Bridging the operator's set O¹ across the trunk circuit closes a circuit through the calling supervisory relay CS, which circuit extends from battery through the lower winding of the relay CSC, ring conductor of the plug CP and jack J², alternate contact 10 of key LK¹, retard coil 14 of the operator's set O¹, alternate contact 15 of key LK¹, tip conductor of the jack J² and plug CP, alternate contact 16 of CSC and through the lower winding of relay CS to ground. The relay CS, upon energizing, causes the calling supervisory signal CSS to be extinguished by opening its normal contact 6, thus notifying the local operator at the cord circuit C that the recording operator at the trunk circuit D has connected to the calling line. A further result due to the operation of the listening key LK¹ is that lamp SS² is extinguished by opening its circuit at normal contact 4 of the said key LK¹.

The recording operator now inquires of the calling subscriber the toll connection desired. After having received this information the calling subscriber A is instructed by the operator to replace his receiver upon the switch-hook, the operator notifying him that she will call him back as soon as she is able to establish connection with the desired line, the operator at the recording trunk D at the same time restores her listening key LK¹ to normal. The replacement of the receiver at the calling substation A opens the circuit of the lower winding of the answering supervisory relay AS, thereby allowing it to deenergize and close a circuit through the answering supervisory signal AS¹. The circuit for the signal AS¹ extends from battery through the said signal, normal contact 2 of AS, alternate contact 17 of ASC and through the left hand winding of coil 8 to ground. The return of the listening key LK¹ to normal opens the circuit of the calling

supervisory relay CS, thereby allowing it to deenergize and return to normal, thus closing the hereinbefore traced circuit through the calling sleeve supervisory lamp CSS at its normal contact 6. The local operator at the cord circuit C noting the glowing of the supervisory lamps AS¹ and CSS removes the answering plug AP and calling plug CP from jacks J¹ and J² respectively, thereby restoring the apparatus to normal.

As my invention relates only to the apparatus used in extending a connection from a calling subscriber to a recording operator's position, it is thought unnecessary to further describe how the toll recording operator or the service operator at the toll board completes the connection between the called subscriber's line and the originating calling subscriber's line.

Assuming now that the local battery subscriber B wishes to initiate a call, the generator at the substation B is operated, thereby causing the line relay LR to energize and to lock up over a local circuit extending from ground through alternate contact 18 of LR, said relay LR, normal contact 19 of relay CO, alternate contact 20 of relay LR to battery. Relay LR, upon energizing, also closes a circuit through the line signal S. The operator, upon noting the glowing of the line signal S inserts the answering plug AP of cord circuit C into the jack J of the calling subscriber's line thus closing a circuit extending from ground through the windings of the cut-off relay CO in series, sleeve contact of the jack J and plug AP and through the upper winding of relay AS to battery. As before mentioned the resistance of the two windings of the cut-off relay CO in series is such as not to permit sufficient current to flow to operatively energize relay ASC. However, the cut-off relay CO energizes over this circuit and operates to open the local maintaining circuit for relay LR at its normal contact 19, thus allowing line relay LR to deenergize and efface line lamp S. Relay ASC having failed to energize the magneto winding of the answering supervisory relay AS is left bridged across the talking conductors of the cord circuit C. The operator now, as hereinbefore described, connects her telephone O to the strands of the cord circuit C and inquires of the calling subscriber the connection desired. The connection from hereon is the same as hereinbefore described up to the point where the magneto subscriber signals for disconnection. The magneto subscriber, having informed the recording operator the connection desired operates the generator at the substation B, thereby causing the answering supervisory relay AS to energize causing it to close a locking circuit for itself in series with answering supervisory signal

AS¹, extending from battery through the said lamp AS¹, alternate contact 2 of AS, normal contact 21 of listening key LK, normal contact 22 of ASC and through the lower winding of said relay AS to ground. The glowing of the answering supervisory lamp AS¹ is continuous and notifies the operator at the cord circuit C that the subscriber at the substation B desires disconnection. The operator at cord circuit C now removes plugs AP and CP from jacks J and J² respectively and operates the listening key LK to open its normal contact 21 a sufficient length of time to permit the answering supervisory relay AS to deenergize thereby extinguishing the supervisory signal AS¹.

As the apparatus associated with the calling end of the cord circuit is substantially the same in its operation as that associated with the answering end of the cord circuit, it is thought unnecessary to go into detail to explain the manner in which the cord circuit C may be used to establish connection between common battery lines, local battery lines, a common battery and a local battery line, or between a local battery and a common battery line.

From the foregoing it will be seen that I have provided a system in which the local operator connects direct to a recording trunk, which recording trunk is not provided with individual relays as has heretofore been used.

Although I have shown only one link circuit used in connecting the calling subscriber with the toll recording trunk, it is obvious that any number of link or trunk circuits may be used for extending a call from a calling subscriber to a recording operator. It is to be understood that I do not wish to limit my invention to the specific circuits illustrated as it is evident that it is applicable to a variety of systems and it is to be understood that I contemplate employing my invention in other ways than that shown, as for example, the jacks J² may terminate in the banks of automatic apparatus in which case automatic apparatus would be used for extending a call from a calling subscriber to the recording operator's trunk. Therefore, I do not desire to be limited to the exact structure as shown and described but I aim to cover broadly all such changes and modifications as come within the spirit and scope of the appended claims.

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

1. In a telephone system, a link circuit provided with terminal contacts, a trunk circuit also provided with terminal contacts, a signal device associated with said trunk circuit, means for connecting the said link

circuit to the said trunk circuit through the medium of their terminal contacts, a circuit for the said signal device including terminal contacts of said trunk and link circuits, and a supplemental operating circuit for said signal device including others of said terminal contacts.

2. In a telephone system, the combination with a plug ended link circuit connected to a jack ended trunk circuit, a signal device for said trunk circuit, a circuit for said signaling device including a contact of said jack and said plug, and means controlled over said circuit for closing a supplemental circuit for said signaling device including a second contact of said jack and plug.

3. In a telephone system, a link circuit provided with a three-conductor terminal, a trunk circuit provided with a three-conductor terminal, a signal associated with said trunk circuit, means for connecting the terminal of said link circuit to the terminal of said trunk circuit thereby closing a circuit for said signal including a contact of each of said terminals, and means responsive to the closure of said circuit to close a supplemental circuit for said signal including other contacts of said terminals.

4. In a telephone system, a manual link circuit, a trunk circuit extending to an operator's board, a visual signal and a manually operated switching device for said trunk circuit, means for connecting said link circuit to said trunk circuit thereby closing a circuit through said visual signal including a terminal contact of said link and trunk circuits, means associated with said link circuit responsive to said connection for closing a supplemental operating circuit for said visual signal including other terminal contacts of said link and trunk circuits, and means for operating said switching device to efface said visual signal.

5. In a telephone system, a calling subscriber's line, a link circuit for connection thereto, a trunk circuit extending to an operator's board provided with a visual signal, said trunk circuit including only contact springs and connecting conductors, means for connecting said link circuit to said trunk circuit thereby closing an operating circuit for said visual signal including a conductor of said link and trunk circuits, manually controlled switching means located at said operator's board for connecting an operator's telephone to said trunk circuit, and means responsive to the operation of said switching means for effacing said visual signal.

6. In a telephone system, a calling subscriber's line, a link circuit for connection thereto, a trunk circuit terminating at an operator's board provided with a visual signal, said trunk circuit including only con-

tact springs and connecting conductors, means for connecting said link circuit to said trunk circuit thereby closing a circuit for said visual signal; and means for subsequently opening the circuit of said visual signal by manually operating said contact springs.

7. In a telephone system, a calling subscriber's line circuit, a link circuit connected thereto, a trunk circuit extending to an operator's board, said trunk circuit being provided only with a visual signal, contact springs and connecting conductors, means for connecting said link circuit to said trunk circuit thereby operating said visual signal over a conductor of said trunk and link circuits, and manually controllable means located at said operator's board for operating said contact springs to efface said signal.

8. In a telephone system, a link circuit provided with a multi-contact terminal, a magnet provided with a winding connected to one of said contacts, a trunk circuit provided with a multi-contact terminal, a signal for said trunk circuit connected to a contact of said trunk terminal, means for connecting said link terminal to said trunk terminal thereby including said magnet winding and said signal in series circuit, and means responsive to the energization of said magnet for closing a supplemental circuit for said signal through another contact of said link and trunk terminals.

9. A telephone system including a plug-ended link circuit, a jack-ended trunk circuit provided with only contact springs, a visual signal and connecting means, manual means for connecting said plug to said jack thereby closing an operating circuit for said signal including a conductor, a contact of said link plug and trunk jack, and manual means for operating said contact springs to efface said visual signal.

10. A telephone system including a plug-ended link circuit provided with a signal, a jack-ended trunk circuit provided with only contact springs, a visual signal and

connecting conductors, a relay for said link circuit for controlling said signal, a circuit for said link circuit relay and for said trunk signal including contacts of said plug and jack, and means controlled by the energization of said relay for closing a supplemental circuit for said signal.

11. A telephone system including a link circuit provided with a connection terminal, a trunk circuit appearing in a plurality of trunk operators' positions and also provided with a connection terminal, a signal individual to said trunk circuit, a circuit for said signal including a contact of the terminals of said link circuit and said trunk circuit, and means located at each of said trunk operators' positions for effacing said signal.

12. A telephone system including an A-operator's link circuit, a B-operator's trunk circuit appearing in a plurality of trunk operators' positions, manual means for connecting said link circuit to said trunk circuit, a signal individual to said trunk circuit, and means located at any one of said trunk operators' positions for effacing said signal.

13. A telephone system including an A-operator's link circuit, a B-operator's trunk circuit appearing in a plurality of trunk operators' positions, a signal individual to said trunk circuit, means for connecting said link circuit to said trunk circuit to operate the said signal, a trunk operator's telephone set at each of said trunk operators' positions, and means located at each of said trunk operators' positions for connecting the associated trunk operator's telephone with said trunk circuit and for effacing said signal.

Signed by me at Kansas City, county of Wyandotte and State of Kansas in the presence of two witnesses.

HARRY N. FARIS.

Witnesses:

W. F. THROCKMORTON,
E. A. BENSON.