

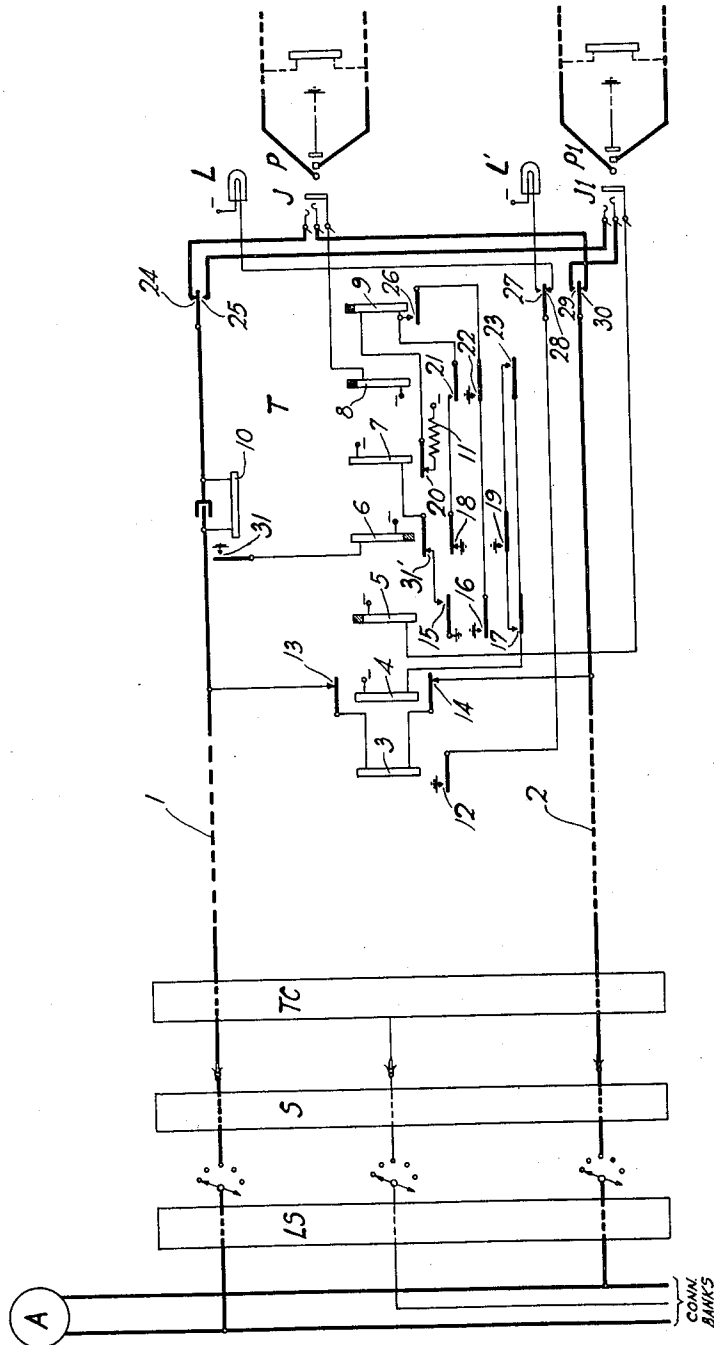
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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This invention relates to telephone systems in general, and is concerned particularly with trunk circuits for use in such systems. The object of the invention is to increase the efficiency of circuits of this type by arranging them so that they cannot be unnecessarily withheld from service when not actually in use.

The trunk circuit comprising the invention is particularly suitable for interconnecting an automatic exchange and a manual exchange or toll switchboard. It is desirable, of course, that trunks used for this service be freed immediately upon the termination of each call so that the trunks can be used efficiently. According to the usual practice, in handling this type of traffic, the manual operator is given disconnect supervision by the subscribers' hanging up at the termination of a call. The operator is expected to pull down the connection immediately and release the trunk, but, during busy periods, she may be unable to respond promptly to the disconnect signals, with the result that trunks are unnecessarily tied up at a time when they are most needed.

The unnecessary busying of trunks in the above manner has been overcome in the past by arranging the cord circuits so that the tip, ring, and sleeve conductors were opened automatically upon the termination of a call. An arrangement of this kind is shown in Gardner Patent No. 1,727,592, of September 10, 1929. Although arrangements of this kind have proven generally satisfactory, they are not entirely practical when connection is to be made from a new automatic exchange to an old manual exchange,—particularly when the two exchanges are under different ownership. Further, the modification of the cord circuits may not be economical when relatively few trunks are involved, as is the case in many systems. The present invention, on the other hand, contemplates the use of existing cord circuits without modification while still providing the automatic release feature. This is accomplished by associating the release apparatus with the trunks rather than with the cord circuits, and constitutes the main feature of the invention.

One embodiment of the invention is disclosed in the accompanying drawing, which represents a connection set up over a switch train in an automatic exchange to a trunk terminating in an operator's position in a manual exchange. The subscriber's line A, which may be of any well-known type commonly used in automatic telephone systems, terminates in the lineswitch

LS. Lineswitch LS has access to selectors such as the selector S, and the selector in turn has access to local trunks and the trunks extending to the manual exchange. The trunk terminates in a simple trunk circuit TC at the automatic exchange, which may be of the type disclosed in Wicks, Patent No. 1,583,240 of May 4, 1926. The equipment T, terminating the trunk at the manual exchange, is shown in detail and will be described hereinafter. It may be noted that the trunk is provided with two jacks, J and J1, which are located on the face of the switchboard, and, if desired, may be multiplied in a plurality of positions.

When the subscriber at substation A extends a call over the switch train to trunk circuit TC, battery is connected to the trunk conductor 1, and, since trunk conductor 2 is normally connected to ground, relay 3, which is bridged across the distant end of the trunk line by way of contacts 13 and 14, energizes. Relay 3 completes a circuit by way of contacts 12 and 28 for lamp L. The lamp glows to notify the operator of the call awaiting attention. The operator answers the call by inserting the plug P of a cord circuit into jack J, thereby closing a bridge across the two talking conductors of the trunk and completing a circuit over the sleeve conductors of the plug and jack for relay 8. Relay 8 is slightly slow to operate, and, before it actuates its armatures, relay 10 operates over the newly-completed loop circuit and completes a circuit for relay 6 at contacts 31. Relay 6 operates, opens contacts 18 to prevent the operation of relay 9, and prepares a circuit at contacts 19 for relay 4. Relay 8 now operates, prepares a circuit for relay 9 at contacts 21, prepares a locking circuit for relay 9 at contacts 22, and completes the circuit for relay 4 at contacts 23. Relay 9 does not operate at this time due to the opening of contacts 18. Relay 4 operates and disconnects relay 3 from the trunk at contacts 13 and 14. The operator may now converse with the calling subscriber, and extend the connection over the cord circuit in any well-known manner.

At the termination of the connection, it may be assumed that the calling subscriber restores his receiver in the usual manner, thereby causing the opening of the battery feed circuit at the trunk circuit TC. Relay 10 accordingly deenergizes and opens the circuit of relay 6. Relay 6 restores, opens the circuit of relay 4 at contacts 19, and completes the circuit of relay 9 at contacts 18. Relay 9 operates and locks by way of contacts 26 and 22. The trunk is accordingly

disconnected from jack J by the opening of contacts 24 and 30, and connected to jack J1 by way of contacts 25 and 29. The signalling circuit is also disconnected from lamp L at contacts 28 and connected to lamp L' at contacts 27. Relay 9 is now locked up under control of relay 8, which, of course, will remain operated as long as the plug P remains in jack J. The supervisory relay of the cord circuit will, of course, restore and give the usual disconnect supervision responsive to the subscriber's hanging up. As soon as the connection is pulled down, relay 8 restores and opens the circuit of relay 9, which likewise restores, and transfers the trunk back to its normal connection to jack J.

In case the operator should delay in pulling down the connection, a second call may come in over the trunk, in which case relay 3 will again operate, and at contacts 12 complete a circuit for lamp L'. Lamp L' glows to notify the operator of the incoming call, and the fact that this call comes in over the auxiliary jack indicates the failure to pull down the connection previously completed over the regular jack. The operator, however, may answer this call by inserting the plug P1 of a cord circuit into jack J1, thereby completing a loop circuit for operating relay 10, and also a circuit over the sleeve conductors of the plug and jack for operating relay 5. Relay 10 operates quickly and completes the circuit for relay 6, which also operates, opens a point in the circuit of relay 7 at contacts 31 and prepares the circuit of relay 4 at contacts 19. Relay 5 is slightly slow to operate, and after an interval actuates its armatures, completes an additional holding circuit for relay 9 at contacts 16 and completes a circuit for relay 4 at contacts 17. Relay 4 operates as in the previous connection, and disconnects relay 3 from the trunk. The operator may now converse with the calling subscriber and complete the connection as required.

As previously stated, the arrival of the call over the auxiliary jack indicates the failure to pull down a connection established over the regular jack, and it is expected that the operator will take the necessary steps to have such connection taken down. As soon as the subscriber in the present connection hangs up, the trunk will, therefore, be transferred back to the regular jack so that the failure to pull down the connection over the auxiliary jack will not busy the trunk. The transfer in this case is effected by the release of relays 10 and 6, the latter relay completing a circuit by way of contacts 15 and 31 for relay 7. Relay 7, by opening contacts 20, permits relay 9 to restore and transfer the trunk from jack J1 and lamp L' to jack J and lamp L. A new call coming in at this time will, therefore, cause the lighting of lamp L, and the call will be answered over jack J in the usual manner.

What is claimed is:

1. In a telephone system, a trunk terminating in a jack, an auxiliary jack for the trunk, an operator's cord circuit adapted to be connected to said first jack to answer a call extended over the trunk, and automatic means for transferring the trunk from the first jack to said auxiliary jack responsive to the calling party disconnecting from the trunk prior to the disconnection of the cord circuit from said first jack.

2. In a telephone system, a trunk, two jacks adapted to be connected to the trunk one at a time, cord circuits for connection with said jacks in answering calls extended over the trunk, and

means controlled by the trunk becoming idle while a connection to one jack exists for disconnecting the trunk from said one jack and for connecting it to the other jack.

3. In a telephone system, a trunk having talking conductors terminating in a jack, means for extending a call over the conductors of said trunk from a calling party to said jack, manual means for answering and further extending the call by connecting the conductors of said trunk to said manual means by way of said jack and means controlled by the calling party upon hanging up his receiver for disconnecting the talking conductors of said trunk from said manual means.

4. In a telephone system, a trunk circuit having talking conductors terminating in a jack, a calling line and means for connecting it with the conductors of said trunk circuit, means including an operator's link for connecting the conductors of said trunk circuit with a called line to complete a talking connection by way of said jack, and means in the trunk circuit controlled over the calling line for disconnecting the talking conductors of the trunk circuit from said link.

5. In a telephone system, a trunk having two branches at one end, means for extending a call over the trunk and one of said branches, means for answering the call, and means responsive to the calling party terminating the call for switching the trunk from said one branch to the other branch.

6. In a telephone system, a trunk having two branches at one end, means for extending a call over the trunk and one of said branches, means for answering the call, and means responsive to the calling party terminating the call for conditioning the trunk so that a succeeding call will be extended over the trunk and the other of said branches.

7. In a telephone system, a temporary connection extending from a calling station over a trunk and one of two branches thereof to an operator's link circuit, means controlled from said station for terminating the connection, and means responsive to the termination of the connection for temporarily connecting the trunk to the other of said branches pending the disconnection of the link circuit from said one branch.

8. In a telephone system, a trunk having two branches at one end, means for extending a connection to the other end of the trunk, means for connecting with one branch of the trunk to further extend said connection, means for terminating the connections to both the trunk and said branch, and means responsive to the termination of the connection to the other end of the trunk prior to the termination of the connection to said one branch for disconnecting the trunk from said one branch and for connecting it to the other branch.

9. In a telephone system, a trunk connecting two exchanges, a normally connected branch and a normally disconnected branch for the trunk at one exchange, means for extending a call to the trunk at the other exchange, an operator's link and means for connecting it to said first branch to answer the call, and means controlled over the trunk line for disconnecting the trunk from said first branch and for connecting it to said second branch pending the disconnection of the link circuit from said first branch.

10. In a telephone system, a trunk connecting two exchanges, a normally connected branch and a normally disconnected branch for the trunk at one exchange, a signal associated with each

branch, means for extending a call to the trunk at said other exchange, means responsive to the call for operating the signal associated with said first branch, a link circuit and means for connecting it to said first branch to answer the call, means for terminating said call and for extending a second call to the trunk at said other exchange, and means responsive to said second call for operating the signal associated with said second branch provided said link circuit is still connected to said first branch.

11. In a telephone system, a trunk circuit, two branches at one end of said trunk, a separate operator's link circuit for each of said branches, means for extending a call over said trunk and one of its branches to a link circuit, and means responsive to the termination of said call for connecting the other branch of said trunk to said other link circuit.

12. In a telephone system, a calling line, a trunk circuit, separate branches in which said trunk terminates, an operator's link circuit for

each of said branches, means for extending a call from said calling line over said trunk circuit and one of said branches to one of said link circuits, means controlled from said calling line for releasing said call, and means automatically responsive to the release of said call for connecting said trunk to the other of said branches so the next call over the trunk will be extended over said other link circuit.

13. In a telephone system, a trunk, a jack normally terminating the talking conductors of said trunk, operator controlled means including a plug and cord circuit for establishing a connection over said trunk and jack between a calling and a called party, and means in said trunk controlled by the calling party in response to hanging up his receiver for opening the talking conductors of said trunk to break the talking connection to said jack while said plug of the cord circuit is maintained connected to said jack.

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