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TELEPHONE SYSTEM

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Fig. 1.

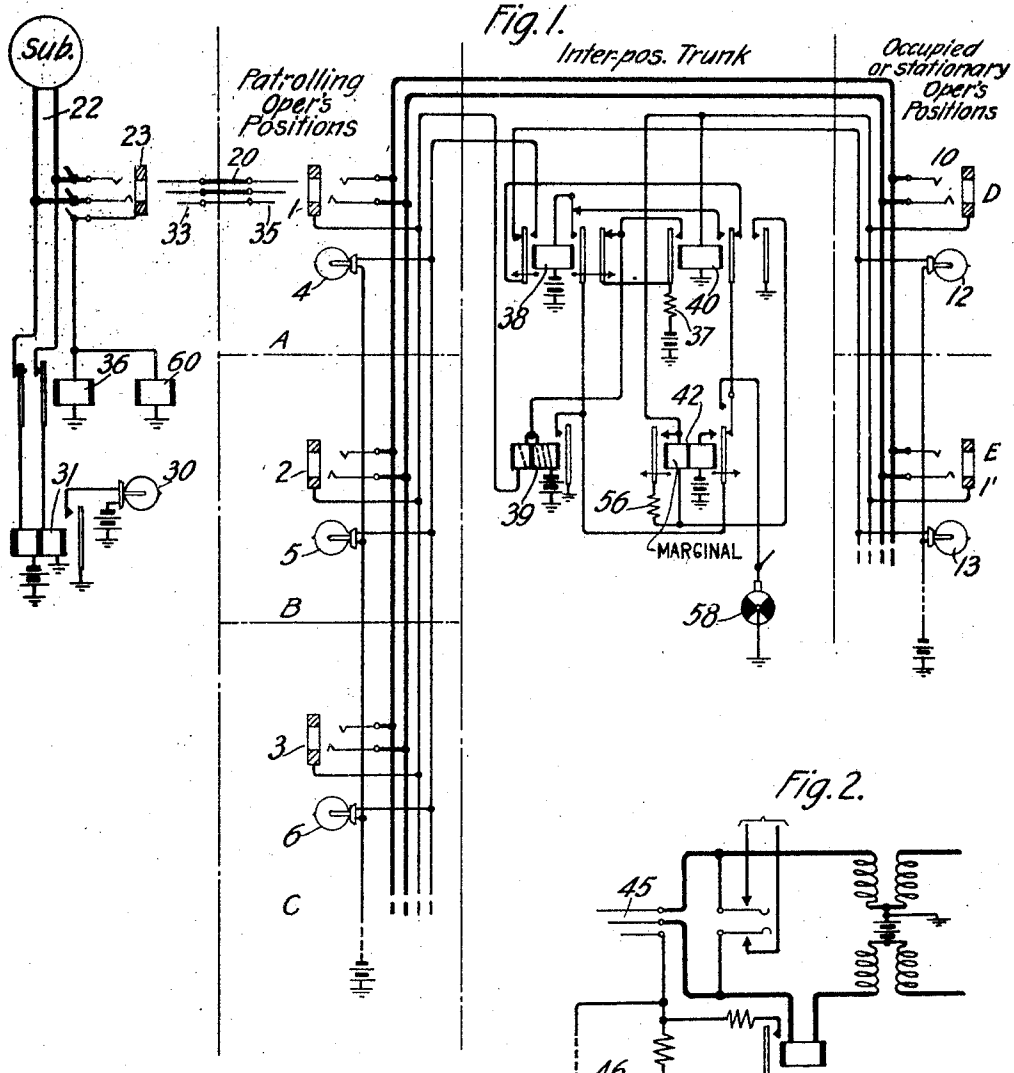


Fig. 2.

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TELEPHONE SYSTEM.

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This invention relates to telephone systems, and more particularly to improvements in trunks for service between different switchboards in the telephone exchange.

In present practice it is customary to employ so-called interposition trunks for handling night traffic or traffic during slack periods. These trunks usually terminate at one end in jacks at so-called patrol operators' positions located at convenient points on the switchboard at the exchange, easily accessible to the patrol operators. The other ends of these trunks terminate in jacks at stationary operators' positions, that is, positions regularly occupied during slack periods.

The duties of the patrol operators are, as the name implies, to patrol during slack periods entire sections of switchboards or groups of positions not occupied by the regular operators. These patrol operators, on noting lighted lamps in any of these switchboards indicating calling subscribers, establish connections from the corresponding subscribers' jacks through interposition trunks terminating in a position or positions where stationary operators are in attendance so that these stationary operators may attend to the calls.

The principal objects of this invention are to provide simplified interposition trunks of this general type, whereby the processes of establishing and handling connections thereover between a calling subscriber's line and a stationary operator's position are at all times properly an expeditiously supervised; whereby the freeing of the calling subscriber's line from such a connection is accomplished without delay, that is, without waiting for the patroling operator to break down the connection and whereby the subscriber's charge on either the so-called flat rate or the so-called message rate basis may be attended to with equal expedition.

To attain these and other objects which will hereinafter appear, there is provided in accordance with the preferred form of the invention, in a specific aspect, an interposition trunk circuit having supervisory means whereby, on the connecting or patching of the interposition trunk to a calling subscriber's line, this subscriber's line lamp is extinguished; whereby this subscriber's line is made to test busy; whereby signals are given at the position or positions where the free end of the interposition trunk employed terminates to notify the stationary operators thereat that a connection over this particular interposition trunk is desired and whereby on the answering of this call by a stationary operator by the insertion of a plug into a jack of this interposition trunk, these signals are extinguished.

Other features of the invention are:—a supervisory circuit means, whereby, in response to the termination of the conversation between the calling and called subscribers and the disconnection of the stationary operator's cord from the interposition trunk, the calling subscriber's line is freed from the interposition trunk, that is, in this sense that the calling subscriber may again call the patrol operator by lighting his line lamp before the previous connection between the calling subscriber and the interposition trunk employed has been taken down, or that the calling subscriber may himself be called under these circumstances; and means whereby in response to the disconnection of the stationary operator's cord from the connection, a signal is given at the patrol operator's position to indicate to her that the conversation between the subscribers is terminated.

Another feature of the invention is the provision of supervisory means whereby, if the calling subscriber is to be charged for the call on the flat rate basis, the signal at the patrol operator's position is steadily lighted on the disconnection of the stationary operator's cord from the interposition trunk employed and whereby, if the calling subscriber is to be charged for the call on the message rate basis, the patrol operator is notified by the stationary operator of this fact by the flashing operation of this signal. The interposition trunk circuits for this latter purpose are so arranged that on the operation by the stationary operator of the usual message register key, in the usual cord circuit employed by her for extending the connection to a called subscriber, the signal at the operator's position is caused to flash.

The invention in its preferred specific form has been illustrated in the accompanying drawings, in which Figure 1 shows an ordinary subscriber's line equipped with the usual message register; a patching cord for

the use of the patrol operator and an interposition trunk arranged in accordance with this invention for extending a connection to a stationary operator's position; while Fig. 2 illustrates a portion of an ordinary standard cord circuit equipped with a message register circuit.

Referring now to Fig. 1, the interposition trunk illustrated may be arranged so that jacks 1, 2 and 3 and the corresponding lamps 4, 5 and 6 are located, respectively, at patrol positions A, B and C. These patrol positions may be arranged at strategic points throughout the exchange in the sections or groups of switchboards to be patrolled by the patrol operators while jacks 10 and 11 and the corresponding lamps 12 and 13 may be located, respectively, at stationary operators' positions D and E. These positions may be assigned for night work and during slack periods and, therefore, attended by stationary operators at all times.

The patching cord 20 may be used by a patrol operator to connect a subscriber's line such as 22, through jack 23 to jack 1 of the interposition trunk, while the cord circuit shown in Fig. 2 may be used either by a patrol operator when a call is to be charged on the message rate basis or by a stationary operator for establishing a call over an interposition trunk to a called subscriber's line and when a call is to be charged on either the flat rate or the message rate basis.

To more clearly set forth the features of this invention as embodied in the interposition trunk circuit shown under different conditions, descriptions will be made in the following text of the specification, first, of a call extended over this trunk when the calling subscriber of line 22 is to be charged on the flat rate basis, followed by a description of the functions thereof when the calling subscriber is to be charged on the message rate basis.

Referring now to the establishing of a call to be extended on the flat rate basis, the subscriber of line 22, on lifting his receiver from the hook, causes the lighting of lamp 30 by the operation of relay 31. The patrol operator, on noticing the lighting of this lamp, extends the call to a stationary operator's position by inserting plug 33 of patching cord 20 into jack 23 of line 22 and plug 35 of this patching cord into jack 1 of the interposition trunk. This jack is located at the patrol operator's position A, it being assumed that this position is located at the shortest distance from the position where the line lamp 30 is lighted and the corresponding jack 23 is located. It should be understood that if either position B or C is located nearer than position A to jack 23, the corresponding jacks 2 or 3 may be employed for extending the connections to a stationary operator's position. The first result of this patching of the connection from the subscriber's line 22 to the interposition trunk is that line lamp 30 is extinguished by the operation of the cut-off relay 36 over a circuit as follows: battery, resistance 37, outer right-hand armature and back contact of relay 38, left-hand low resistance winding of relay 39, sleeve terminals of jack 1 and plug 35, sleeve conductor of the patching cord 20, sleeve terminals of plug 33 and jack 23, winding of cut-off relay 36 to ground. Relay 39 also operates in this circuit and closes a circuit for the operation of lamps 12 and 13 at the stationary operator's positions D and E as follows: battery, lamps 12 and 13 in parallel, left-hand armature and back contact of relay 38, right-hand inner armature and back contact of relay 40, right-hand armature and back contact of relay 42, armature and front contact of relay 39 to ground.

The lighting of lamps 12 and 13 indicates to the stationary operators of positions D and E that a connection is desired over this particular interposition trunk. Either one of these operators may now insert a plug, such as 45 of the cord illustrated in Fig. 2, into jack 10 or 11 of the interposition trunk. If it is assumed that the stationary operator at position D is the one that attends to the call, a circuit will now be completed for the operation of relay 40 as follows: battery, supervisory lamp 46, sleeve terminals of plug 45 and jack 10, winding of relay 40 to ground. Relay 40, in operating, causes lamps 13 and 12 to be extinguished by the opening of the circuit for these lamps at the inner armature and back contact of relay 40. A circuit for the operation of relay 38 is also established by the operation of relay 40, as follows: battery, winding of relay 38, make-before-break contact of relay 38, right-hand inner armature and front contact of relay 40, right-hand armature and back contact of relay 42, armature and front contact of relay 39 to ground. Relay 38 in operating closes a locking circuit for itself through its inner right-hand armature and front contact to the ground at the armature and front contact of relay 39. It should be noted that on the insertion of plug 45 into jack 10 and the operation of relay 40, a circuit parallel to the circuit for relay 40 is established through the left-hand winding of relay 42 to ground at the outer right-hand armature and front contact of relay 40, but as the operating characteristics of relay 42 are marginal, this relay does not operate at this time. It should be noted that on the operation of relay 38 the circuit from battery through the resistance 37 and the left-hand winding of relay 39 to operate relay 36 is broken but this is of no importance as this circuit was closed on the operation of relay 40 through the left-hand armature and front

contact of relay 40, so that no change in the circuit takes place at this time as far as the operation of the cut-off relay 36 is concerned. The stationary operator at station D is now connected directly to the subscriber's line 22 and this operator will now inquire from the calling subscriber as to the desired connection, and on obtaining this information, this operator may complete the connection to the wanted subscriber and conversation between the calling and called subscribers may take place in the usual manner.

When the conversation between these two subscribers has terminated, the stationary operator at position D may remove plug 45 from jack 10. This causes the release of relay 40 so that the connection for relay 36 is broken at the left-hand armature and front contact of relay 40. The circuit for this cut-off relay will now therefore be established through the two windings of relay 39 in series to battery, and as the right-hand winding of this relay is of a higher resistance than the resistance 37, relay 36 will release while relay 39 will remain operated. The release of relay 36 causes the calling subscriber's line 22 to be restored to normal condition even though the patching cord 20 has not yet been removed from the connection. The purpose of restoring the line 22 to its normal position is primarily to enable the calling subscriber of this line to be called again quickly, that is, before the patrol operator has opened the connection of this line to the interposition trunk used in the previous connection. This is of particular importance as the patrol operator may not be able to remove the patching cord 20 as quickly as may be desired.

Another effect of the release of relay 40 is the lighting of lamps 4, 5 and 6 to indicate to the patrol operators that conversation between the calling and called subscriber over this particular interposition trunk has terminated. The circuit for these may be traced as follows: battery, lamps 4, 5 and 6 in parallel, left-hand armature and front contact of relay 38, inner right-hand armature and back contact of relay 40, right-hand armature and back contact of relay 42, armature and front contact of relay 39 to ground. The patrol operator at position A, on noting the lighting of lamp 4, removes patching cord 20 from jacks 1 and 23.

In case the calling subscriber of line 22 desires a second connection before the patrol operator has removed the patching cord 20 from jacks 23 and 1, lamp 30 will be lighted and the patrol operator will then understand that a second connection is desired. She will then simply remove plug 35 temporarily from jack 1 to cause the release of relays 39 and 38 and thus restore the interposition office trunk circuit to normal and then reinsert plug 35 into jack 1 a second time. The functioning of the interposition trunk in this case will be the same as hereinbefore described.

It should be noted that on establishing a connection to the interposition trunk as outlined above at the patrol position A, the jacks 2 and 3 at patrol positions B and C will either test busy in the usual manner due to the battery connection on the sleeve of these jacks, or indicate a busy condition due to the lighted corresponding lamp.

If, on the other hand, the subscriber at 22 is to be charged for the call on the message register basis, the stationary operator at position D, noticing that the conversation between the subscribers has terminated, will, before removing plug 45 from jack 10, operate the message register key 50 and thus establish a circuit as follows: battery, position message register 51, message register key 50, sleeve terminals of plug 45 and jack 10, left-hand winding of relay 42, outer right-hand armature and front contact of relay 40 to ground. In this case relay 42 will operate in this circuit as the battery applied through the position message register 51 is of such character as to cause this relay to function. Relay 42, in operating, provides a locking circuit for itself through its right-hand winding, right-hand armature and front contact to ground at the armature and front contact of relay 39. This relay 42 also connects at its left-hand armature and front contact a resistance 56 in parallel with its left-hand winding. This resistance is of such character that sufficient current will now flow through the position message register 51 to cause it to operate and register the call made by this operator at position D.

The message register 51, in operating, closes an obvious circuit for lamp 57 to indicate to the stationary operator at position D that the call has been recorded on register 51 and this operator may now remove plug 45 from jack 10. On the removal of this plug, relay 40 is released and a circuit is now established for the flashing of the signals 4, 5 and 6 over a circuit as follows: battery, lamps 4, 5 and 6, in parallel, left-hand armature and front contact of relay 38, right-hand inner armature and back contact of relay 40, right-hand make-before-break contact of relay 42, interrupter 58 to ground. These signals 4, 5 and 6 are therefore now alternately lighted and extinguished through the operation of the interrupter 58.

This flashing of the lamp 4 will indicate to the patrol operator at position A that the calling subscriber is to be charged on the message rate basis, that is, that this patrol operator must actuate the message register 60 associated with line 22. To do this, the patrol operator must first remove patching cord 20 from the jacks 1 and 23 and employ a cord similar to that shown in Fig. 2 for

the operation of message register 60. To this end she will insert plug 45 of such a cord into jack 23 and by operating key 50, she establishes a circuit over the sleeve terminals of plug 45 and jack 23 from the battery at the message register 51 through the message register 60 to ground. The character of the battery connected at message register 51 is such as to cause the operation of the message register 60. The lighting of lamp 57 will indicate to the patrol operator that message register 60 has operated and she may then remove plug 45 from jack 23. It should be noted that on the removal of the plug 35 of patching cord 20 from jack 1, relay 39 will return to normal and cause the release of relays 38 and 42 which are held operated from the ground at the armature of relay 39 so that the circuits of the interposition trunk will in this case also be restored to normal condition.

What is claimed is:

1. In a telephone system, a subscriber's line, a link circuit, an interposition trunk for the connection of said subscriber's line with said link circuit, a signal associated with each end of said trunk, means responsive to the connection of the subscriber's line with one end of said trunk for making said line test busy and for operating the signal at the other end of said trunk, and means responsive to the disconnection of the link circuit from the trunk for actuating the signal at the said one end of said trunk and for restoring the subscriber's line to a non-busy condition, irrespective of the connection of the trunk with the subscriber's line.

2. In a telephone system, a subscriber's line, a link circuit, an interposition trunk for connecting the subscriber's line with the link circuit, a signal associated with the subscriber's line actuated in response to the initiation of a call by its subscriber, a trunk signal associated with each end of the interposition trunk, means responsive to the connection of the subscriber's line to one end of the trunk for disabling the line signal, for making the subscriber's line test busy and for actuating the trunk signal located at the opposite end of the trunk, means responsive to the connection of the link circuit to said trunk for disabling the trunk signal at the end connected to said subscriber's line, means responsive to the disconnection of the link circuit from the trunk for actuating the trunk signal at the end of the trunk to which the subscriber's line is connected and for restoring the subscriber's line to a non-busy condition irrespective of the connection of the trunk with the subscriber's line.

3. In a telephone system, a subscriber's line, a link circuit, an interposition trunk for the connection of said subscriber's line with said link circuit, a signal associated with said trunk, means responsive to the disconnection of the link circuit from said trunk for actuating said signal in one manner, a source of current associated with said link circuit, and means responsive to the application of current from said source to said trunk followed by the disconnection of the link circuit from said trunk for actuating said signal in a different manner.

4. In a telephone system, a subscriber's line, a link circuit, an interposition trunk for connecting said subscriber's line with said link circuit, a signal associated with said trunk, a marginal relay in said trunk, a source of current associated with said link circuit, means in said trunk responsive to the actuation of said relay on the application of current from said source for partially preparing a circuit for the actuation of said signal, and means thereafter responsive to the disconnection of the link circuit from the trunk for completing said circuit for the actuation of said signal.

In testimony whereof, I have signed my name to this specification this 8th day of March, 1926.

HENRY H. ABBOTT.