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W. C. OAKES

1,942,487

TELEPHONE SYSTEM

Filed July 1, 1932

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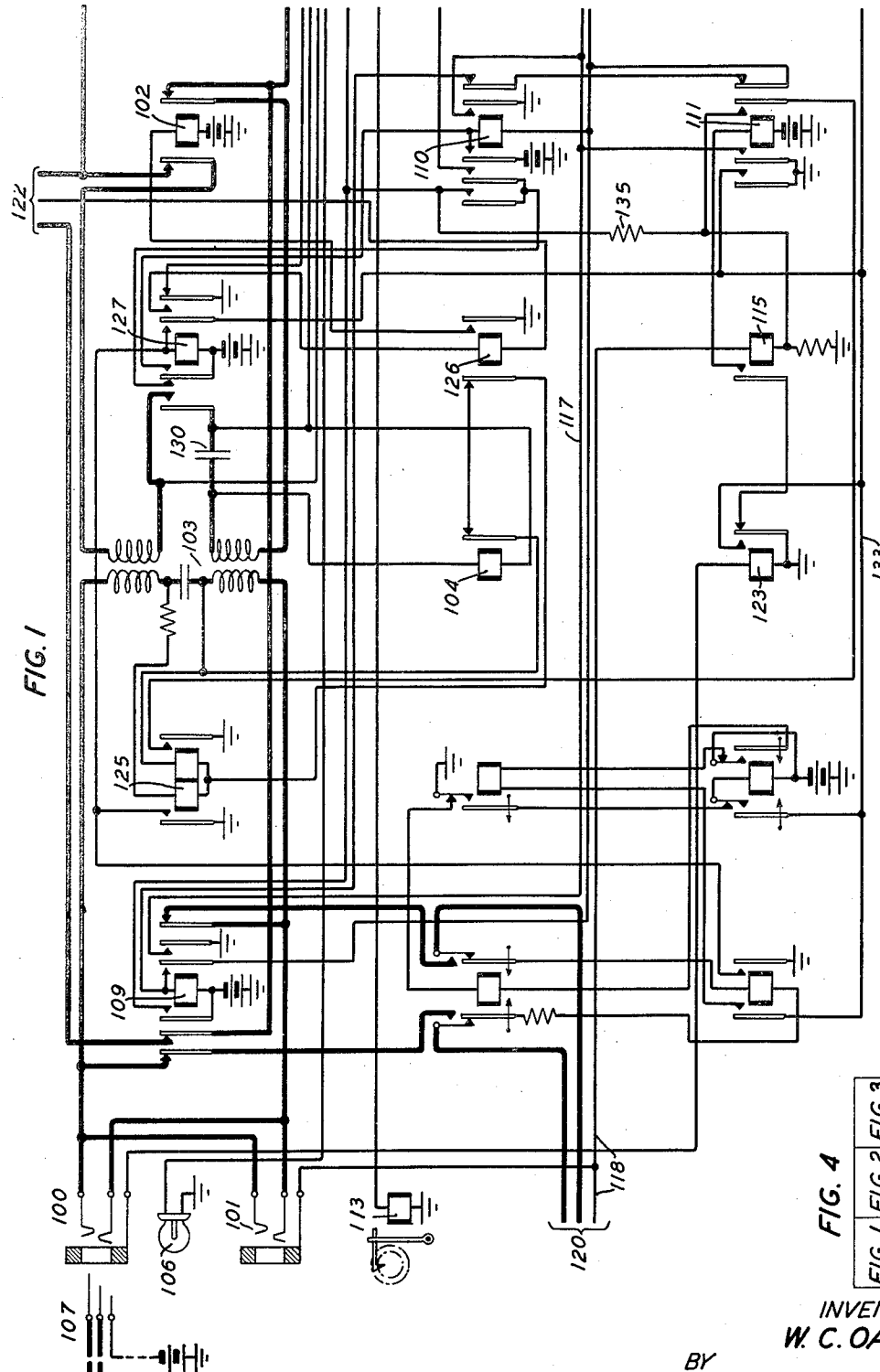


FIG. 4

FIG. 1 FIG. 2 FIG. 3

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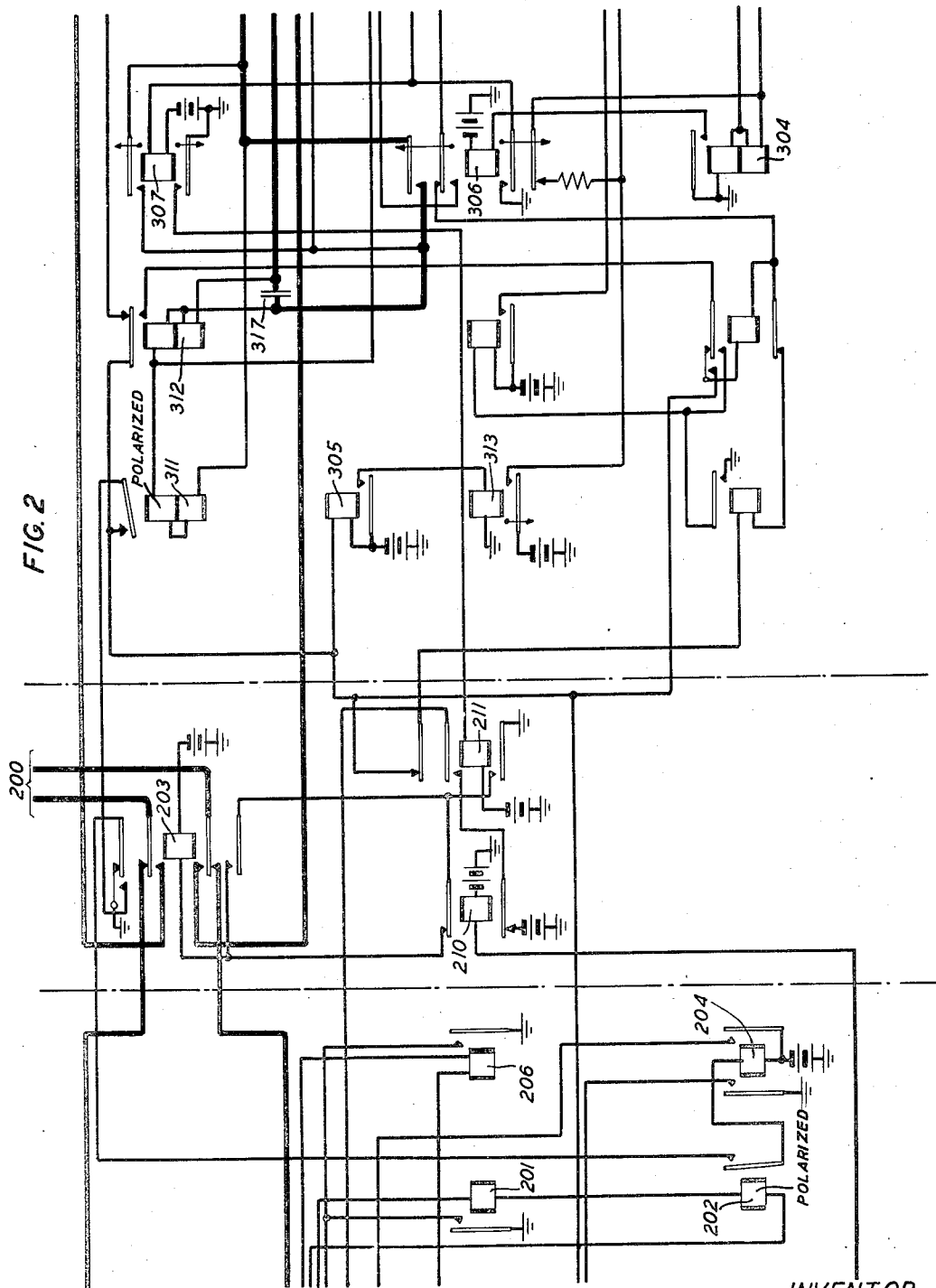
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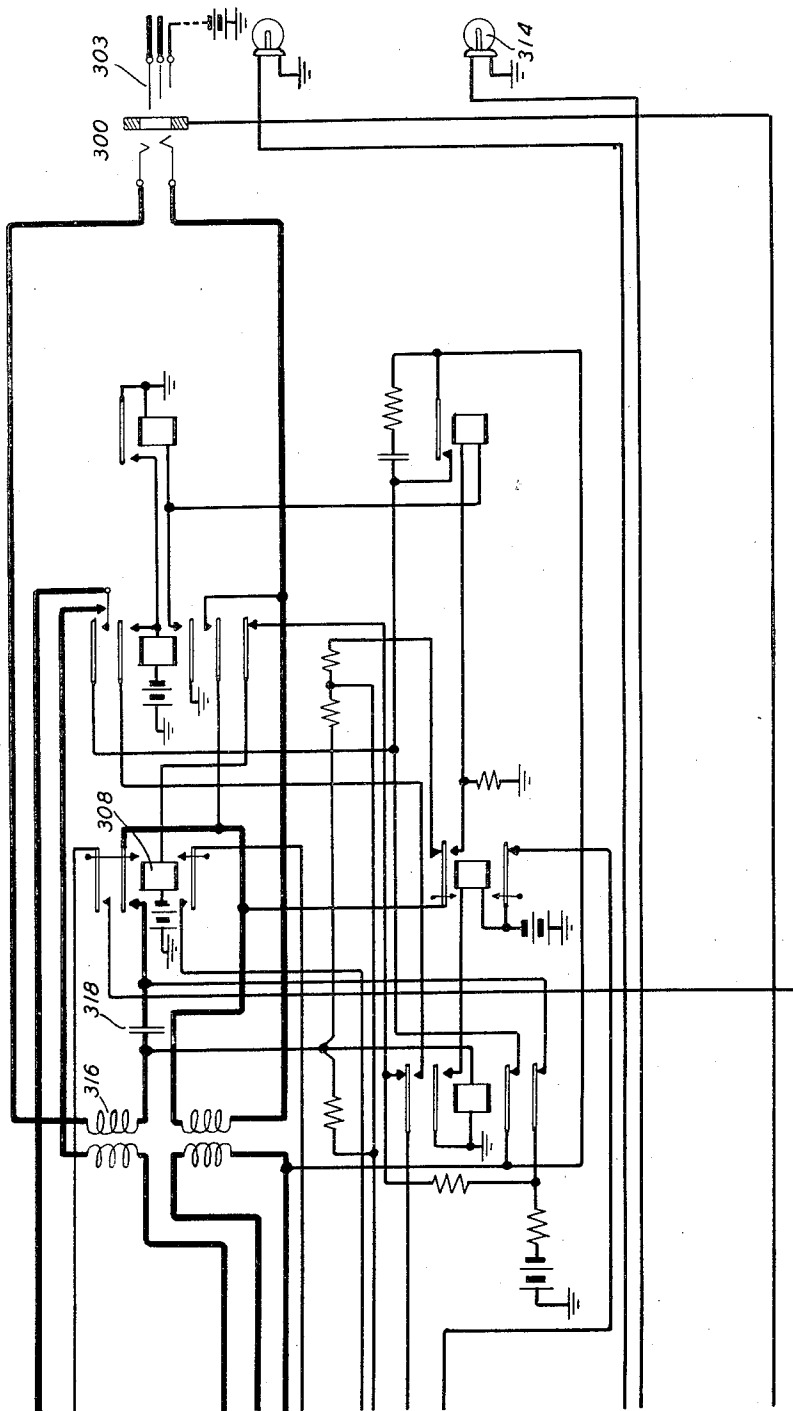
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FIG. 3



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TELEPHONE SYSTEM

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Application July 1, 1932. Serial No. 620,418

8 Claims. (Cl. 179—43)

This invention relates to telephone systems and particularly to interoffice trunks for such systems.

An object of this invention is to improve the facilities for establishing telephone connections over trunks between offices.

Heretofore trunks have been provided in which calls incoming over a trunk to an office may be transferred from one called subscriber to another.

10 A feature of the present invention is the provision in a two-way office trunk of a so-called "joint trunk" operation arrangement. The incoming end of this trunk is provided with two branches, one terminating at a local board which may be termed "a local trunk", and the other at a toll board which may be termed "a toll trunk". Means is provided for transferring incoming calls answered at one of these boards to the other board. This arrangement may be such that incoming calls will be answered normally at the local board and then if it is found that a toll connection, that may be extended from the toll board, is desired the local operator calls up the toll operator and asks her to connect with the toll trunk at her board. When the toll operator has made this connection the local operator disconnects from the local trunk and the transfer of the call is thereby completed to the toll trunk.

Another feature of this invention is an arrangement whereby busy signals are provided at the two boards to indicate trunk busy conditions. When the call is first answered by the local operator the busy condition is established at the toll operator's position for the toll trunk and when the toll operator answers the call a busy condition is established at the local operator's position for the local trunk.

Another feature is an arrangement whereby if the call is answered by the local operator the toll operator cannot interfere with this connection and likewise after the connection has been transferred to the toll operator the local operator cannot interfere with the connection, should the busy condition be disregarded and an attempt be made to break in on an established connection.

Referring now to the drawings, Figs. 1, 2 and 3 may be connected as shown in Fig. 4 and the invention is illustrated in these figures with the principal parts of a local trunk terminating at the local switchboard shown in Fig. 1, and the principal parts of a toll trunk terminating in a toll board shown in Fig. 3, while in Fig. 2 the remaining circuit arrangements of these two trunks are shown terminating in a trunk incoming from an automatic office.

As this invention is concerned primarily with calls incoming over a trunk from an automatic office, descriptions will be made of such a call incoming over the trunk 200 from an automatic office to the local trunk terminating in jacks 100 and 101 to be answered by a local operator and how through jack 100 this call answered at the local operator's position may be transferred to the toll trunk to be answered by the toll operator through jack 300.

Referring now to the drawings when the trunk 200 incoming from the automatic office is seized at this office the battery and ground, normally connected to the tip and ring conductors and causing relay 202 to be in operated condition, are reversed to cause the operation of the polarized relay 201 and the release of relay 202 while relay 104 remains operated. The circuit for these relays may be traced from battery over the ring conductor, lower inner armature and back contact of relay 203, contact of relay 102, lower right-hand winding of repeating coil 103, winding of relay 104, windings of relays 202 and 201 in series, upper right-hand winding of repeating coil 103, contacts of relay 102, inner upper armature and back contact of relay 203 to the ring conductors back to the ground at the distant automatic office. Relay 201 in operating connects ground to the circuit for lamp 106 to cause this lamp to light to indicate to the local operator that a call is incoming over trunk 200. The release of relay 202 causes the operation of relay 204 over a circuit from battery, winding of this relay, armature and back contact of relay 202 to ground at contacts of relay 203. Relay 204 in operating closes a circuit for the operation of relay 109 from battery through the winding of this relay, contacts of relays 110 and 111, left-hand armature and front contact of relay 204 to ground. Relay 204 also closes a circuit for the operation of a busy signal 113 from battery, right-hand armature and front contact of relay 204, winding of the busy signal 113 to ground. This signal is associated with the jack 101 which is used for outgoing calls over the local trunk and serves to warn that the local trunk is busy. Relay 109 in operating closes a holding circuit for itself through its inner right-hand armature and front contact to ground at relay 204. Relay 109 in operating also connects at its middle right-hand armature and front contact a ground for the lead 117. This ground extends to the sleeve terminal of the toll trunk jack 300 to make this trunk busy. The circuit may be traced from the ground at relay 109, lead 117, winding of relay 305 to battery. Relay 305

operates and in turn closes an obvious circuit for the operation of relay 313. This latter relay makes the sleeve terminal of jack 300 busy by connecting battery thereto at its armature and front contact and also lights the trunk signal 314. The operation of relay 109 also connects battery at its inner left-hand armature and front contact, resistance 135, winding of relay 115 to lead 118 which causes the jack 101 to test busy on its sleeve. This battery connection is also extended to the sleeve of the connection from this local trunk to outgoing toll connections that may be established through the tip and ring conductors and sleeve at 120. This is to prevent calls incoming at this point 120 through this local trunk from outgoing over the trunk 200 to the distant automatic office. Relay 109 also at its middle left-hand armature and back contact opens a connection for the ring conductor through the leads at 122 that may extend to multiple outgoing trunk jacks at other toll positions which, as far as this invention is concerned, is of no importance. It also opens at its outer left-hand armature and back contact the tip connection of the trunk outgoing to the toll office at 120.

When the local operator inserts plug 107 into jack 100 to answer this call relay 123 is operated over a circuit from battery, sleeve terminals of plug 107 and jack 100, winding of relay 123 to ground. Relay 123 in operating closes a circuit for relay 210 from battery, winding of relay 210, lead 133 to ground at relay 123. Relay 210 in operating prevents the call from being transferred at this time should the toll operator insert the plug 303 into jack 300, and to make the transfer depend on the local operator first removing the plug 107 from jack 100 as will hereinafter be described. After plug 107 has been fully seated in the jack 100, a circuit is closed through the cord circuit associated with the plug for relay 125 from battery, the tip terminals of plug 107 and jack 100, upper left-hand winding of repeating coil 103, windings of relay 125, lower left-hand winding of repeating coil 103 over the ring terminals of jack 100 and plug 107 to ground. This causes the operation of relay 125 which in turn closes an obvious circuit for the operation of relay 127. Relay 127 closes a holding circuit for itself from battery through the winding of this relay, inner right-hand armature and front contact to ground at the armature and front contact of relay 123. Relay 127 in operating short-circuits relays 201 and 202 at the outer left-hand armature and front contact. Relay 201 releases and opens the circuit for the call signal 106. The condenser 130 is also connected by relay 127 across the right-hand windings of repeating coil 103 for talking purposes. Relay 127 also connects battery at its inner left-hand armature and front contact for the operation of relay 110 over a circuit to ground at relay 204. Relay 110 now locks under control of relay 204 independent of relay 127.

If the incoming call from the automatic office that has been answered by the local operator is to be completed by a toll operator through the toll trunk shown in Fig. 3 the local operator will, as stated, communicate with the toll operator in the usual manner by means of an order wire or recording trunk commonly used in automatic exchanges for transmitting instructions between operators. The toll operator will be instructed to handle the call and she in turn will insert the answering plug 303 of a toll cord into the jack 300 of this toll trunk and the local operator may

remove plug 107 from jack 100 whereupon the transfer will take place. The first effect of the insertion of plug 303 into jack 300 is the operation of relay 304 from ground through the upper winding of this relay, the sleeve terminals of jack 300 and plug 303 to battery on the sleeve of the toll cord. Relay 304 in operating closes an obvious circuit for the operation of relay 306. Relay 306 closes obvious circuits for the operation of relays 307 and 308. Relay 307 closes an obvious circuit for relay 211. The operation of relay 211 provides a ground at its lower armature and front contact for subsequent operation of relay 203 and other circuits, the purpose of which will become apparent hereinafter. Relay 306 short-circuits the winding of relay 311 and the upper winding of relay 312.

If now the local operator removes plug 107 from jack 100 relays 125 and 123 will release and these relays in turn release relay 127. Relay 123 by removing ground from the conductor 133 releases relay 210. Relay 210 in releasing completes a circuit for the operation of relay 203 from battery, winding of this relay, upper armature and back contact of relay 210, lower armature and front contact of relay 211 to ground. Relay 210 also provides at this time a substitute busy battery potential on lead 118 from battery, lower armature and back contact of this relay, upper inner armature and front contact of relay 211, resistance 135, relay 115 to lead 118. Relay 203 in operating locks through its outer lower armature and front contact to the ground at contacts of relay 211 independent of relay 210, so that in case the local operator should attempt to override the busy condition she cannot cut off the toll trunk from the toll operator by causing the operation of relay 210 and release relay 203. Relay 203 in operating transfers the tip and ring conductors of the trunk 200 to the tip and ring conductors of the toll trunk from the tip and ring conductors of the local trunk. It also removes the ground from the lead holding relay 204 operated. Relay 204 is now released and thereby causes the release of relays 109 and 110 and opens the circuit for the busy signal 113. Relay 109 in releasing causes ground to be removed from conductor 117. Relay 203 in operating also applies ground at its make-before-break contacts to the lead 212 and as relay 311 is short-circuited by relay 306 a circuit is now completed for maintaining relay 305 operated. It will be seen now that the toll trunk is completely connected through the repeating coil 316 to the distant office, the connection to the tip and ring conductors from the distant office over trunk 200 extending through contacts of relay 306, condenser 317 and the left-hand windings of repeating coil 316, while the right-hand side of the repeating coil is connected through the tip and ring conductors to the toll operator through the condenser 318 and contacts of relay 308. The toll operator may now receive the desired information from the distant automatic office and extend the connection to the desired party in the usual manner.

If the local operator disconnects before the toll operator has taken up the toll trunk, the line lamp 106 will relight at the local operator's board showing her that this is the case. When the call is taken up by the toll operator the lamp 106 will be extinguished.

When the toll operator at the close of the conversation withdraws her plug 303 from jack 300, the circuit will return to normal by the

release of relays 304, 306, 307, 308, 211, 203, 305 and 313.

What is claimed is:

1. In a telephone system, a two-way trunk, a local trunk, a toll trunk, said last mentioned two trunks being associated with one end of said two-way trunk, means for normally answering calls incoming to said end of the two-way trunk over the local trunk, means for answering incoming calls over the toll trunk, and means for transferring incoming calls answered over the local trunk for answering over the toll trunk operative on the seizure of the toll trunk and release of the local trunk.

2. In a telephone system, a two-way trunk, a local trunk, a toll trunk, said last mentioned two trunks being associated with one end of said two-way trunk with the local trunk normally connected to the two-way trunk and the toll trunk normally disconnected from said two-way trunk, and means for disconnecting the local trunk and connecting the toll trunk to the two-way trunk, responsive to the seizure of the local trunk followed by the seizure of the toll trunk and then by the release of the local trunk.

3. In a telephone system, a two-way trunk, a local trunk, a toll trunk, said last mentioned two trunks being associated with one end of said two-way trunk, means for answering calls incoming to said end of the two-way trunk over the local trunk, means for answering incoming calls over the toll trunk, means for transferring incoming calls answered over the local trunk for answering over the toll trunk operative on the seizure of the toll trunk and release of the local trunk, means for normally preventing the incoming call from being answered over the toll trunk after it has been answered over the local trunk, and means for preventing the incoming call from being again answered over the local trunk after the call has been transferred to and answered over the toll trunk.

4. In a telephone system, a two-way trunk, a local trunk having an answering terminal and a calling terminal, a toll trunk having an answering terminal, said last two trunks being associated with one end of said two-way trunk, means responsive to a call incoming over the two-way trunk for establishing a busy condition at the calling terminal of the local trunk and at the answering terminal of the toll trunk, means responsive to the answering of the call over the answering terminal of the local trunk for preventing the answering of the call over the answering terminal of the toll trunk.

5. In a telephone system, a two-way trunk, a local trunk having an answering terminal and a calling terminal, a signal at the answering terminal, a signal at the calling terminal, a sleeve conductor at the answering terminal, a sleeve conductor at the calling terminal, a toll trunk having an answering terminal, a sleeve conductor at the answering terminal of said toll trunk, said last mentioned two trunks being associated with one end of said two-way trunk, means responsive to calls incoming over the two-way trunk for actuating the signal at the answering terminal of said local trunk and for establishing a busy condition on the sleeve conductor at the calling terminal of said local trunk and on the sleeve conductor at the answering terminal of the toll trunk and for actuating the busy signal at the calling terminal of said local trunk, and means responsive to the answering of the call over the local trunk answering terminal for preventing

answering of the call over the answering terminal of the toll trunk.

6. In a telephone system, a two-way trunk, a local trunk having an answering terminal and a calling terminal, a signal at the answering terminal, a busy signal at the calling terminal, a sleeve conductor at the answering terminal, a sleeve conductor at the calling terminal, a toll trunk having an answering terminal, a sleeve conductor at the answering terminal of said toll trunk, said last mentioned two trunks being associated with one end of said two-way trunk, means responsive to calls incoming over the two-way trunk for actuating the signal at the answering terminal of said local trunk and for actuating the busy signal at the calling terminal of said local trunk and for establishing a busy potential on the sleeve conductor at the answering terminal of the toll trunk, means for transferring an incoming call from the answering terminal of the local trunk to the answering terminal of the toll trunk responsive to the seizure of the answering terminal of the local trunk in answering the call followed by the seizure of the answering terminal of the toll trunk and by the release of the answering terminal of the local trunk, and means responsive to said transfer for establishing a busy potential on the sleeve conductor of the calling terminal of the local trunk.

7. In a telephone system, a two-way trunk, a local trunk having an answering terminal and a calling terminal, a sleeve conductor at said calling terminal, a busy signal at said calling terminal, a call signal at said answering terminal, a toll trunk having an answering terminal, a sleeve conductor at said answering terminal of the toll trunk, a busy signal at said answering terminal of the toll trunk, means responsive to a call incoming over the two-way trunk for actuating said call signal and said busy signal and for establishing a busy potential on said sleeve conductors, and means responsive to the answering of the call over the answering terminal of the local trunk for disabling the call signal and for preventing the answering of the call over the answering terminal of the toll trunk.

8. In a telephone system, a two-way trunk, a local trunk having an answering terminal and a calling terminal, a sleeve conductor at said answering terminal, a call signal at said answering terminal, a sleeve conductor at said calling terminal, a busy signal at said calling terminal, a toll trunk having an answering terminal, a sleeve conductor at said answering terminal of the toll trunk, a busy signal at said answering terminal of the toll trunk, means responsive to a call incoming over the two-way trunk for actuating said call signal and said busy signal and for establishing a busy potential on the sleeve conductor at the calling terminal of the local trunk and on the sleeve conductor at the answering terminal of said toll trunk, means responsive to the answering of the call over the answering terminal of the local trunk for disabling said call signal, means for thereafter transferring the incoming call from said answering terminal of the local trunk to the answering terminal of the toll trunk responsive to the seizure of the answering terminal of the toll trunk followed by the release of the answering terminal of the local trunk, and means responsive to said transfer for establishing a busy potential on the sleeve conductor of the answering terminal of said local trunk.