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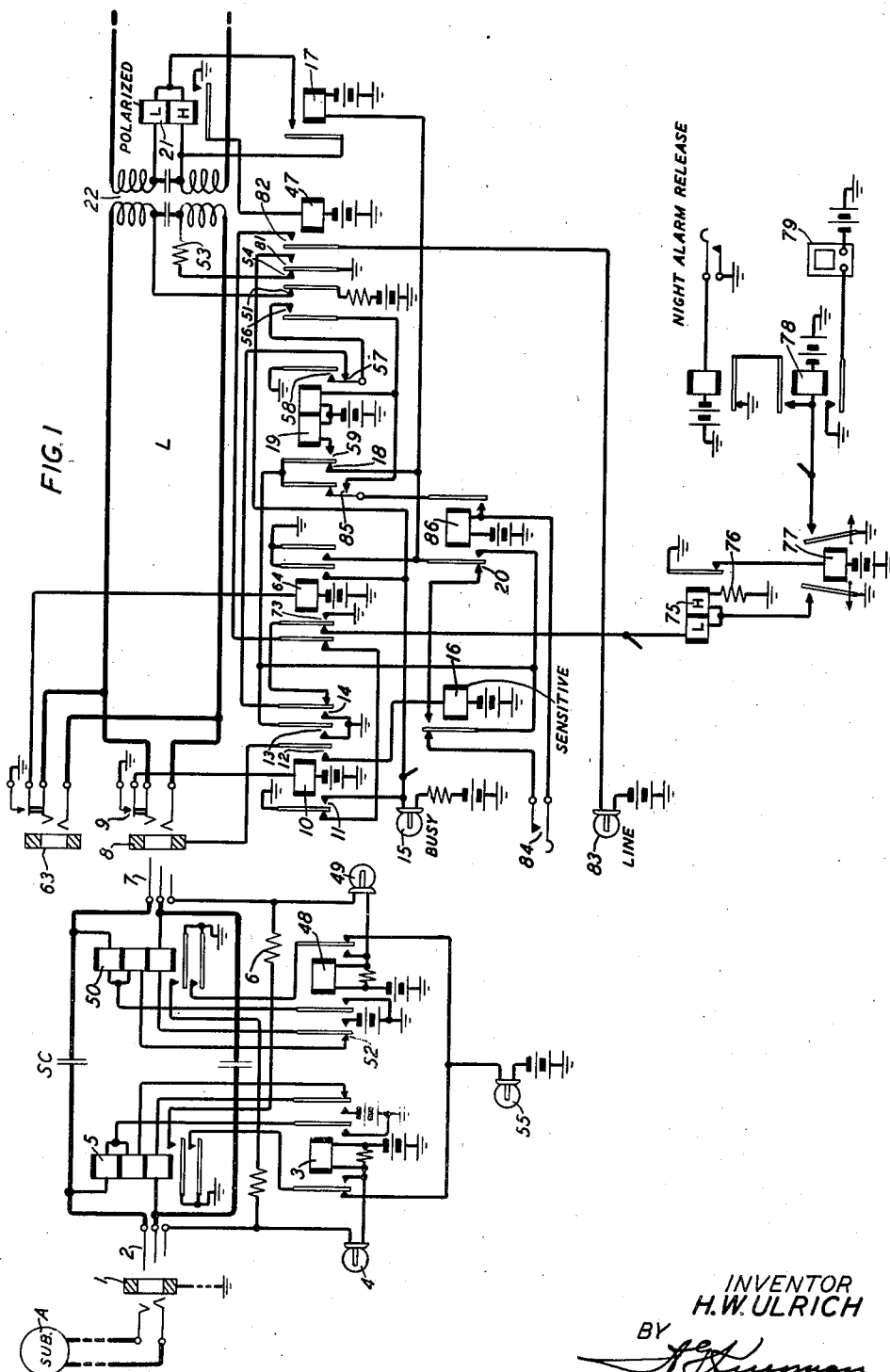
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THROUGH SUPERVISION SYSTEM

Filed Nov. 25, 1938

2 Sheets-Sheet 1



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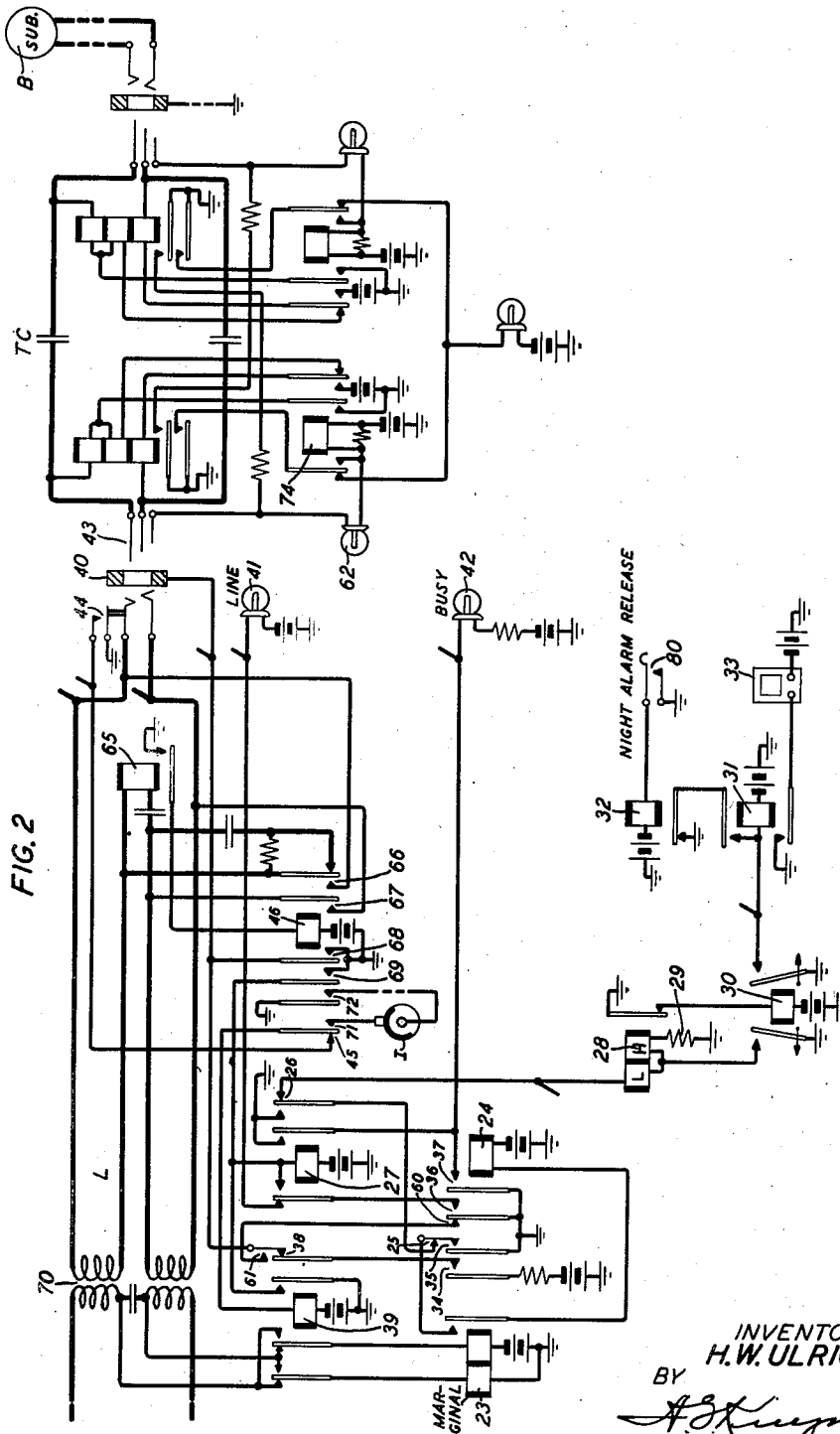
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2 Sheets-Sheet 2



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THROUGH SUPERVISION SYSTEM

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8 Claims. (Cl. 179—41)

This invention relates to telephone systems and more particularly to two-way trunk circuits between two exchanges, as between a toll office and a tributary central office serving both local battery (magneto) and common battery subscribers.

An object of the invention is to provide through supervision over the trunk to the toll operator between a calling common battery subscriber served by the tributary office and the toll office, regardless of the direction of the call.

A feature of the invention whereby the foregoing object is attained resides in terminating the trunk at the tributary exchange in a jack and so arranging the circuits of the trunk and the tributary office cord circuit that when both ends of the trunk are connected, a tributary common battery subscriber will, when connected to the trunk, control the supervision to the toll operator.

Other features of the invention will appear and be understood from the following description and accompanying drawings of which

Fig. 1 illustrates a common battery subscriber A adapted to be connected by a cord circuit SC, of a so-called toll tributary exchange, to a two-way trunk line L extending to a so-called toll center; and

Fig. 2 shows the toll center end of the trunk line L and a toll cord circuit TC adapted to extend the trunk line L to a subscriber B.

A description of the operation of the circuit of the invention will now be given first assuming that the subscriber A (Fig. 1) has placed a call for a subscriber such as B (Fig. 2) which subscriber is reached over the trunk line L.

When subscriber A lifts his receiver to initiate a call, his line lamp (not shown) is lighted in the usual manner. The operator inserts plug 2 of cord circuit SC in jack 1 of the subscriber's line, whereupon answering sleeve relay 3 of the cord operates from ground on the sleeve of jack 1 in series with the supervisory lamp 4. Relay 3 closes its right-hand front contact thereby connecting ground and battery through the upper and lower windings of supervisory relay 5, to the subscriber's line which is now closed due to receiver having been removed from the switchhook, whereupon relay 5 operates. The operation of relay 3 also opens its outer right back contact thereby disconnecting the middle winding of relay 5, which winding is normally in series with the upper and lower windings across the cord. Operation of relay 5 connects ground at its inner lowermost front contact to short-circuit supervisory lamp 4 and prevents it from lighting at this time. Relay 5 also closes its inner lower front contact thereby connecting ground, through high resistance 6, to the sleeve of the front or calling plug 7. The value of resistance 6 is such, however, that the front or calling supervisory relay 48 is

not operated at this time nor is lamp 49 lighted.

When the operator inserts plug 7 into jack 8 of the trunk line L, the auxiliary jack spring contacts 9 are immediately closed thereby completing an obvious circuit to operate the trunk sleeve relay 10 which operates and closes its contacts 11, 12, 13 and 14. The closure of contact 11 lights the busy lamp 15, and multiples thereof, and closure of contact 12 connects relay 16 to the sleeve of jack 8 which is now connected to ground in the cord by way of resistance 6 and the lower front contact of relay 5. Relay 16 which is ultrasensitive operates in series with the high resistance.

When the tip and ring contacts of the plug 7 are in engagement with the corresponding springs of the jack 8, relay 50 operates in a circuit including battery, contact 51 of relay 47, upper left winding of repeating coil 22, tip contact of the jack and plug, all three windings of relay 50 which are connected in series over contact 52 of relay 48, ring contact of the plug and jack, lower winding of repeating coil 22 and resistance 53 to ground at contact 54 of relay 47. Relay 50 in operating closes its lowermost contact and connects ground, over the right-hand back contact of relay 48 to light lamp 55 in the cord circuit.

Closure of contact 13 of relay 16 connects ground to relay 17 over a path including contacts 18 of relay 19. While relay 17 operates immediately following the closure of contact 13, in the path just traced, which includes contact 18 of relay 19, the operation of relay 16 and the consequent closure of its left front contact, completes a short circuit around contact 18 which includes contact 20 of relay 86 so that a subsequent operation of relay 19 will not release relay 17. When relay 17 operates due to operation of relay 10, it short-circuits the high resistance (lower) winding of the polarized relay 21 which is bridged across the condenser in the right-hand side of transformer 22. This reduction in resistance in bridge of the line causes marginal relay 23 (Fig. 2) at the toll office to operate which in turn closes the following circuit: battery, winding of relay 24, front contact of relay 23, contact 25 of relay 24, contact 26 of relay 27, and both windings of relay 28 to ground through high resistance 29. The left-hand winding of relay 28 is of low resistance but its right-hand winding is sufficiently high so that relay 24 can not operate in series therewith. Relay 28, however, is sufficiently sensitive to operate in this circuit, whereupon it releases the normally operated relay 30 which closes its right-hand back contact to operate the night alarm relay 31 which locks up the relay 32 under the control of key 80. Relay 31 operating, closes a circuit to energize the night alarm buzzer 33. Release of relay 30 also

closes its left-hand contact which short-circuits the right-hand high resistance winding of relay 28 and the high resistance 29 thereby lowering the resistance of the previously traced circuit for relay 24 to a point where it can operate. Operation of relay 24 closes its contacts 34, 35, 36 and 37. The closure of contacts 34 connects battery, over contact 38 of relay 39 to the sleeve of jack 40 and multiples thereof to hold the line busy to calls in the opposite direction. Closure of contact 35 and the subsequent opening of contact 25 locks relay 24, operated under the control of relay 23, and opens the previously traced circuit for operating relay 28 which thereupon releases thereby permitting relay 30 to re-operate. Closure of contact 36 lights the line lamp 41 and multiples thereof over the left back contact of relay 27 and closure of contact 37 lights the busy lamp 42 and its multiple.

When the toll operator answers by inserting plug 43 in jack 48, relay 39 is operated due to the closure of auxiliary contact 44, the circuit including normally closed back contact 45 of relay 43. Relay 39 in operating operates relay 27, locks up over its left-hand contact and contact 36 of relay 24. Relay 39 opens its contact 38 thereby disconnecting the busy potential applied over contact 34 of relay 24 as the sleeve of plug 43 now supplies such a busy potential to the multiples of jack 40. Further, relay 39 in operating reverses at its left-hand contact the connection of relay 23, and its battery supply, to the line whereupon polarized relay 21 at the tributary office (Fig. 1) which up to this time has been released due to the direction of the current flowing in its winding, now operates, and in turn operates relay 47. Relay 47 in operating opens its contacts 51 and 54 thereby disconnecting battery and ground from the transformer 22 and thence to the line which causes relay 50 of the cord to release thereby extinguishing lamp 55. Relay 47 also closes its contact 56 thereby closing a circuit to operate relay 19 which can be traced from battery, right-hand winding of relay 19, contact 58 of relay 47, contact 57 of relay 19, and contact 14 of relay 10 to ground. Relay 19 operates and locks itself at contacts 58 under control of contact 56 of relay 47 which in turn is controlled from the distant toll office. Relay 19 also closes its left contact 59 thereby completing a second locking circuit for itself including its left-hand winding which can be traced from battery, left winding, contact 59 of relay 19 and contact 13 of relay 10 to ground. Relay 10 being under control of the plug 7 of the tributary office, it will be noticed that relay 19 is now held operated until both ends of the trunk line become idle.

When relay 19 operated it opened its contact 18 over which relay 17 was first operated. Relay 17, however, does not release as it is still held operated over a path in parallel with contact 18 which is due to the left-hand front contact of relay 16 and contact 20 of relay 86. It will now be noted that control of relay 17 which in turn controls supervision over the lines to the distant toll office is now under control of both the plug 7, i. e. its controlled relay 10, but also under control of the calling supervisory relay 5, which, while operated maintains ground on the sleeve of the plug 7 and jack 2 of the trunk line to hold relay 15 operated. It will therefore be obvious that during the existence of the connection to the trunk line, any movement of the calling subscriber's switchhook will release relay 5, in turn

releasing relay 16 which in its turn will release relay 17. The release of relay 17 will reconnect the lower high resistance winding of relay 21 in the bridge across the line thereby causing relay 23 at the toll office to release. The release of relay 23 releases relay 24 which closes its contact 60 thereby grounding the sleeve of jack 40 in a circuit including contacts 61 of relay 39. Ground on the sleeve of jack 40 lights the toll cord supervisory lamp 62.

In case the toll operator wishes to recall the tributary operator before that operator has disconnected from the trunk by removing plug 7, the toll operator actuates the cord circuit ringing key (not shown) thereby connecting ringing current to the trunk circuit and operating relay 65 which in turn operates relay 46. Relay 46, at its contacts 66 and 67, short-circuits the respective upper and lower right-hand windings of repeating coil 70, thereby preventing ringing current from passing through the repeating coils to the lines. At contacts 69, relay 46 connects ground to hold relay 27 operated when relay 39 releases, to be later referred to, and at contacts 68 it connects ground to the sleeve of jack 48, to keep supervisory lamp 62 lighted as it is assumed that the calling subscriber A has disconnected and consequently relay 24 is released as previously mentioned.

Operation of relay 46 also opens its contact 45 and immediately closes contact 71 and also closes contact 72 thereby placing relay 39 under control of interrupter I which alternately disconnects and connects ground thereto thereby causing that relay to alternately release and re-operate. The release of relay 39 reverses the current flowing back over the trunk and releases relay 21 which in turn releases relay 47 which reconnects battery and ground at the mid-point of the left-hand side of repeating coil 22 which causes supervisory relay 50 in the cord circuit to operate to light supervisory lamp 55. As the interrupter I alternately releases and operates relay 39, the lamp 55 in the cord circuit is flashed as long as the toll operator continues to ring.

In case it is desired to retain supervision at the tributary office, i. e. not transmit through supervision to the toll center, the tributary operator will make connection to the trunk line by way of the so-called "plug supervision," jack 63, whereupon relay 64 instead of relay 10 operates. Under this condition the ground on the sleeve of plug 7 is ineffective as the sleeve of jack 63 is not connected to relay 16. Relay 64 closes its right-hand contact, thereby lighting the busy lamp 15 and its multiples and operates relay 17 which short-circuits the high resistance winding of relay 21 thereby operating relay 23 at the toll office as before to light the line lamp 41.

When the toll operator answers, relay 39 operates as before described to reverse the line battery and causes relay 21 at the tributary office to operate which operates relay 47. Relay 47 disconnects at contacts 51 and 54, battery and ground at the mid-point of the left-hand winding of repeating coil 22 thereby releasing relay 50 which extinguishes lamp 55 in the cord circuit. The closure of contact 56 of relay 47 operates relay 19 in a circuit from ground, contact 73 of relay 64, outer right back contact of relay 10, not now operated, contact 57 of relay 19, contact 58 of relay 47 and right winding of relay 19. Relay 19 closes its contact 58 thereby locking itself operated under control of relay 47, i. e. under control of the distant toll office, but does

not find a locking ground for its left-hand winding under control of the tributary cord SC as relay 10, which supplied this ground when jack 8 was in use, is not now operated.

5 As the sleeve or jack 63 is not connected to relay 16, as is the sleeve of jack 18, movement of the calling subscriber's switchhook does not affect relay 17 and hence supervision is restricted to the tributary cord circuit SC and is received on supervisory lamp 4 in the usual manner only. 10 The supervisory lamp 62 in the toll office remaining dark until the tributary operator disconnects from the jack 63 whereupon relays 73 and 17 release in turn releasing relays 23 and 24 which now 15 light lamp 62.

Non-through supervision jack 63 is also used for connecting calling magneto (local battery) stations to this trunk line. In this case due to the fact that magneto station line circuits do not 20 have the jack sleeve grounded, the answering cord sleeve relay 3 does not operate at any time and the answering cord supervisory relay 5 only in response to ringing current occasioned by the subscriber turning the crank of the telephone set 25 generator. Under this condition the tributary operator receives supervisory signals from both ends of the cord on the lamp 55.

Now let us assume a call in the opposite direction, i. e. a call from the toll center (Fig. 2) to 30 a common battery subscriber A which is reached through the tributary office (Fig. 1).

When the toll operator inserts plug 43 in jack 40, relay 39 operates from grounded contact 44 of the jack which reverses the battery supplied to 35 the line and causes polarized relay 21 of the tributary end of the trunk to operate.

Relay 39 also closes its inner right contact to operate relay 27 and by closing contact 61 connects ground, supplied over contact 60 of relay 40 24, to the sleeve of the jack 40 and plug 43 which causes cord supervisory lamp 62 to light and sleeve relay 74 to operate. Operation of relay 27 closes its inner right contact to light the busy lamp 42 and multiples thereof. Operation of 45 relay 21 at the tributary end of the trunk operates relay 47 which causes the delayed operation of relay 19 as follows: closure of contact 56 of relay 47, operates relays in the following circuit; battery, right winding of relay 19, contacts 56 of relay 47, contacts 57 of relay 19, outer right back contact of relay 10, back contact of relay 64, both windings of relay 75, and high resistance 76 to ground. Relay 75 operates in this circuit but 50 due to the high resistance of the right-hand winding of relay 75 and resistance 76, relay 19 does not receive sufficient current to cause its operation at this time. Operation of relay 75 opens its contacts and permits normally operated slow release relay 77 to deenergize. When relay 77 60 releases it closes its right-hand contact and operates relay 78 which closes a circuit to operate the night alarm buzzer 79 which locks up under control of a release key. The closure of the left-hand contacts of relay 77 short-circuits the right-hand winding of relay 75 thereby decreasing the resistance of the circuit including relay 19, which relay now operates and locks up the ground at its contact 58 under control of contact 56 of relay 47. The opening of contacts 57 of relay 19 breaks 70 the circuit through relay 75 which releases and permits relay 77 to reoperate. Operation of relay 47 also closes its contacts 81 and 82 which light the line lamp 83 and busy lamp 15 including multiples thereof. All calls from the toll center 75 are answered in the through supervision jack 8

and consequently when the operator at the tributary office notes the lighted line lamp 83 she inserts plug 7 in jack 8. Due to the fact that relay 47 is operated at this time, battery and ground are disconnected from the trunk and contacts 51 5 and 54 and therefore supervisory relay 50 does not operate and the supervisory lamp 55 remains dark.

When the plug is inserted in jack 8, auxiliary contacts 9 are closed thereby operating relay 10 10 which at its contact maintains the busy lamp 15 lighted independent of the circuit previously traced which was controlled by contact 82 of relay 47. Closure of contact 12 of relay 10 connects relay 16 to the sleeve of jack 8 in readiness 15 for operation, if and when a called common battery subscriber is connected to the other end of the cord and the subscriber answers. When this occurs relay 16 operates in series with high resistance 6 thereby closing its front contact and 20 closing a circuit to operate relay 17 which can be traced from ground, contact 13 of relay 10, front contact of relay 16, contact 20 of relay 86, and windings of relay 17 to battery. Relay 17 operates and short-circuits the high resistance 25 winding of relay 21 and causes relay 23 of the toll center to operate which in turn operates relay 24 thereby locking itself under control of relay 23. Relay 27 is also held operated at contact 36 of relay 24 under control of the tributary office and 30 independent of the holding effect exercised by the relay 39. Operation of relay 24 also opens its contact 60 thereby removing the ground from the sleeve of the jack 40 and extinguishing the supervisory lamp 62 as an indication that the called 35 subscriber has answered. Any further movement of the called subscriber's switchhook will release relay 24 to reapply grounded contact 60 to the sleeve of the jack to relight the supervisory lamp 62. 40

In case the call from the toll center was for a magneto subscriber at the tributary office, which would be answered in the same manner as before by the tributary operator, the response of the called subscriber will not operate relay 16 due 45 to the fact that supervisory relay 5 is not affected by a magneto subscriber's switchhook and consequently it is incumbent on the tributary operator, in such cases, to manually relay the subscriber's answer to the toll operator by operating the key 84. When this key is operated, it completes a circuit to cause operation of relay 17 which can be traced from ground, contacts 13 of relay 10, normal back contact of relay 16, contacts of key 84 and winding of relay 86 to battery. 55 Relay 86 closes its left front contacts thereby connecting ground at contact 13 of relay 10 to relay 17 which operates and extinguishes the toll cord supervisory lamp 62 as previously described. Relay 86 locks up at its front contact under control of contact 56 of relay 47. This locking circuit can be traced from battery, winding of relay 86, contacts 85 of relay 19, contacts 56 of relay 47, and contacts 58 of relay 19 to ground. This 65 locked condition of relay 86 maintains relay 17 operated and the toll cord supervisory lamp 62 extinguished under control of the plug 7 of jack 8. When the conversation is completed, the tributary operator removes plug 7 from jack 8 70 thereby releasing relay 10 which releases relay 17 and relights the toll cord supervisory lamp 62. Release of the trunk by the toll operator restores the circuit to normal thereby releasing relay 39 which reverses the line battery to release relay 75

21 which in turn releases relays 47, 19 and 86.

What is claimed is:

1. In a telephone system, a first operator's position, a subscriber's line terminating thereat, a trunk line also terminating at said position in a jack having a sleeve terminal, a cord circuit at said first position for interconnecting said line and trunk and having a sleeve conductor co-operating with said jack sleeve when said cord and trunk are connected, a second operator's position terminating the other end of the trunk, a supervisory relay in said first position cord circuit controlled over said subscriber's line, a link circuit at said second position adapted to be connected to the trunk, supervisory means in said link circuit, relay means in said trunk at the second position end thereof controlled over the trunk for controlling said supervisory means when said trunk and link are connected, means in the first position end of the trunk for transmitting signals over said trunk to operate said relay means at the other end, means responsive to connection of said first position cord circuit to said trunk jack to operate said signal transmitting means, locking relay means in the trunk at the first position operated when the distant link circuit is connected to the trunk, and thereafter held operated until both ends of the trunk are disconnected, for transferring control of said signaling means from said means responsive to connection of the cord to the trunk jack to said supervisory relay over said connected sleeve conductors of the trunk and cord.

2. In a telephone system, a first operator's position, a subscriber's station line terminating thereat, a trunk line also terminating at said position, a cord circuit at said first position for interconnecting said line and trunk, a supervisory relay in said first position cord circuit controlled over said line, a second operator's position terminating the other end of said trunk, a cord circuit thereat adapted to be connected to the trunk, means in said trunk responsive to connection of one end of said first position cord circuit to the trunk to transmit a signal thereover independent of the cord supervisory relay, locking means in the trunk operated when the second position cord circuit is connected to the trunk following the connection of the first position cord circuit thereto, and thereafter held operated until both cords are disconnected from the trunk, for transferring control of said first means to the supervisory relay in the first position cord circuit, said control being exercised over the connected sleeve circuit of the cord and trunk.

3. In a telephone system, a first operator's position, a subscriber's station line terminating thereat, a second operator's position, a trunk line extending between said positions, a cord circuit at the first position for connecting the subscriber's line to the trunk and including supervisory means controlled over the subscriber's line, a cord circuit at the second position adapted to be connected to the trunk and including a supervisory signal device, means controlled over said trunk for controlling said device, and other means in said trunk at the first position controlled over the sleeve circuit of the cord by said supervisory means for controlling said means to control said device.

4. In a telephone system, a first operator's position, a subscriber's station line and a trunk line terminating thereat, a cord circuit at said position for interconnecting said trunk and subscriber's line, a second operator's position termi-

nating the other end of said trunk line, a cord circuit at said second position including a supervisory signal device, means in said trunk for controlling said signal device, a supervisory relay in said first position cord circuit controlled by the subscriber's station switchhook, and means, including the interconnected sleeve conductors of said first position cord and trunk, controlled by said supervisory relay, for controlling the means in said trunk.

5. In a telephone system, a first switchboard, a subscriber's station line terminating at said switchboard, a toll switchboard, an automatic signaling trunk extending between said switchboards, a cord circuit at the first switchboard adapted to connect said subscriber's line to the trunk line, a cord circuit, including a supervisory signal device, at the toll switchboard, adapted to be connected to the trunk line, means in said trunk for controlling said supervisory signal when the associated cord circuit is connected to the trunk, supervisory means associated with the cord circuit at the first switchboard responsive to removal of the subscriber's station receiver while the cord circuit is connected to the line, and means including the sleeve conductors of the cord at the first switchboard, effective when said supervisory means responds, to control said trunk means.

6. In a telephone system, a first operator's position, a subscriber's line terminating thereat, a trunk line also terminating thereat, a cord circuit thereat for interconnecting said line and trunk, a supervisory relay for said cord circuit controlled over the subscriber's line, sleeve conductors for said cord and trunk arranged to be interconnected when said cord and trunk are connected, a second position terminating the other end of the trunk, a link circuit at the second position for connecting to the trunk, a supervisory signal device associated with said link circuit, and means in said trunk controlled by said supervisory relay over the connected sleeve conductors of the cord and trunk for controlling the signal device in the link circuit.

7. In a telephone system, a first operator's position, a subscriber's line terminating thereat, a trunk line also terminating thereat, a cord circuit thereat for interconnecting said line and trunk, a supervisory relay for said cord circuit controlled over the subscriber's line, sleeve conductors for said cord and trunk arranged to be interconnected when said cord and trunk are connected, a second position terminating the other end of the trunk, a link circuit at the second position for connecting to the trunk, a line relay associated with the trunk at the second position, means responsive to connection of the first position cord to the trunk for operating said line relay independent of the condition of the other end of the cord and means responsive to the connection of said link circuit to the trunk to transfer control of said line relay to the supervisory relay in the first position cord, said means including the connected sleeve conductors of said first position cord and trunk.

8. In a telephone system, a jack-ended trunk line, a subscriber's station and line, a link circuit adapted for connecting said trunk and subscriber's line by way of said trunk jack, and means responsive to actuation of said subscriber's station switchhook for transmitting a signal over said trunk, said means being controlled over the sleeve conductors of said trunk and link circuit.

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