

Dec. 22, 1942.

B. A. WALLACE

2,305,939

UNIVERSAL CORD CIRCUIT

Filed Sept. 20, 1940

2 Sheets-Sheet 1

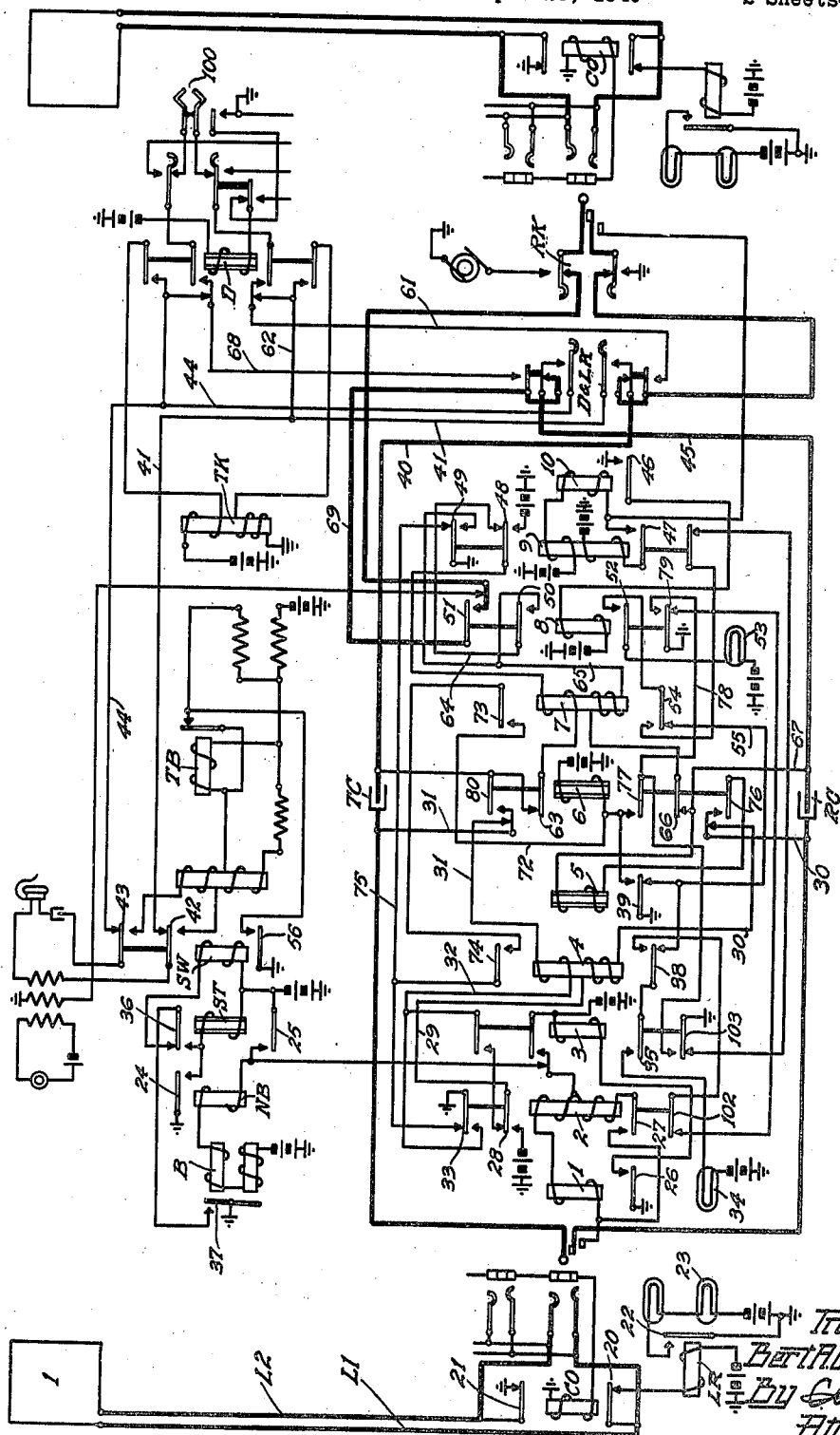


Fig. 1.

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2 Sheets-Sheet 2

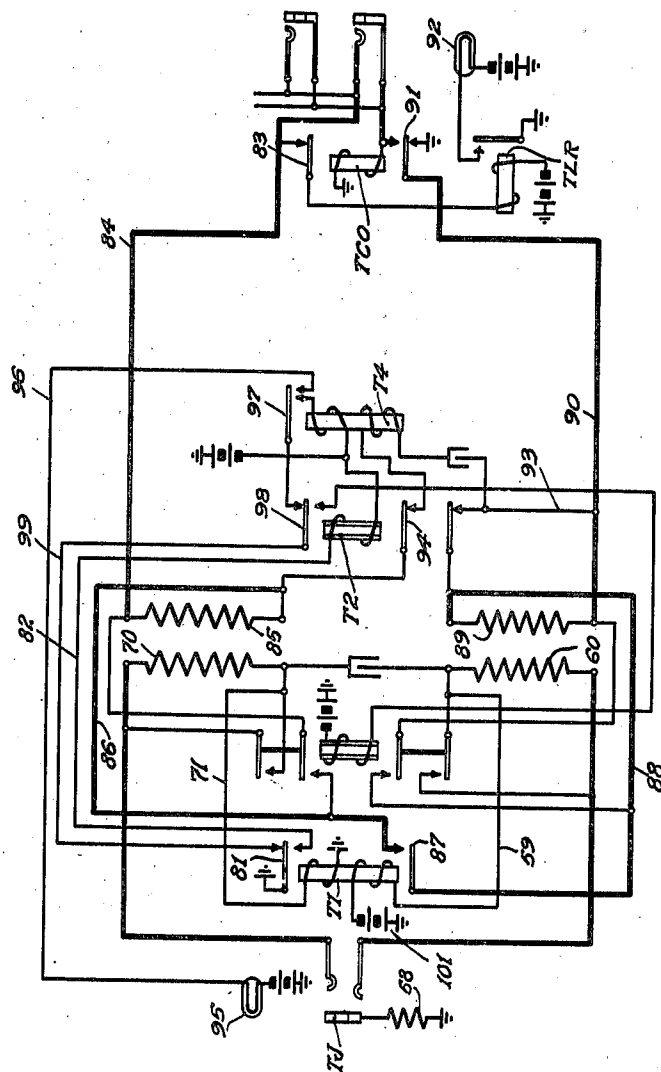


Fig. 2.

INVENTOR:
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Att.

UNITED STATES PATENT OFFICE

2,305,939

UNIVERSAL CORD CIRCUIT

Bert A. Wallace, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill., a corporation of Illinois

Application September 20, 1940, Serial No. 357,558

16 Claims. (Cl. 179—51)

This invention relates to electric circuits and more particularly to telephone cord and trunk circuit systems for multiple switchboards.

One feature of this circuit provides for answering and completing calls to local common battery lines, and two-way trunk lines, from a dial, or a common battery main exchange, with either end of the cord. In answering a trunk call, a holding bridge is automatically established, and the supervisory lamp of the cord used, lights as a holding guard lamp. The connection may then be extended to a local line, at which time the trunk holding guard lamp is extinguished and the lamp of the cord used, in the local line, lights as a ringing guard until the party answers. The holding bridge is automatically opened when the local station answers. Through supervision to the main exchange is given by the local station and both lamps of the cord light for disconnect at the switchboard. A manually operated through key is not required.

Another feature of the cord provides through dialing from local to trunk with double disconnect lamps at the completion of conversation, and through supervision to the main exchange without the use of a manually operated through key. The cord also uses non-interfering key listening on multiple lamp line circuits with automatic warning tone to an operator when she is barred.

The automatic trunk holding feature is also provided on the front or calling cord, which enables an operator to dial or call a party, over a trunk line to the main exchange and then establish the connection to the local line with the back cord while the trunk is held on the front cord, until the local station answers, after which through supervision is obtained with disconnect signals, as described above, using the back cord to answer a trunk call. The cord also gives standard double lamp supervision on local to local connections and can be used without the operator's bar feature.

The trunk circuit, also, operates with through battery-feed P. B. X. cord circuits and provides for re-ringing from the main exchange to the P. B. X. after the local station has hung up on a previous connection, but before the P. B. X. operator has taken down the cords. The trunk, without special equipment therein, also prevents a re-ringing signal from recalling the local station through the existing P. B. X. cord circuit.

One object of this invention is to provide an improved cord circuit having the foregoing features or other features not heretofore available.

Another object of the invention is to provide

a circuit for answering and completing calls to local common battery lines, and two-way trunk lines, from a dial or common battery main exchange, at either end of the cord; and, to provide such a circuit with non-interfering listening having a warning signal.

A further object is the provision of a cord circuit for answering and completing calls which avoids the need of a manual through key.

Yet another object is to provide circuit means whereby a dialing operation by the operator automatically opens the calling side of the cord circuit during the signaling and reconnects it upon completion of the ringing signal for answer.

Still another object is to provide a cord circuit with automatic holding means. Other objects and advantages of this invention include various combinations of the foregoing and will appear from the following description taken in connection with the accompanying drawings.

In the drawings, wherein like reference characters indicate corresponding parts in the various figures,

Fig. 1 shows a cord circuit having a calling and a called station including features of this inventive concept.

Fig. 2 shows a trunk circuit using this invention. Although the drawings show the trunk terminating in a jack, it is obvious that it may terminate in an automatic selector switch as well.

Considering the drawings in greater detail, in Fig. 1 is shown a calling and called local station. Its operation will be described more specifically by describing the detailed circuits for each type of feature.

Operation

First, local to local operation will be considered more especially to actions of the circuit in answering such a call.

Answering; local to local.—When a local station #1 calls by removing its receiver, the appropriate line relay LR is actuated by the line circuit: ground—battery—LR—back contact of CO—armature 20—L1—calling station—L2—armature 21—back contact of CO—ground. The line relay LR moves its armature 22 to close the lamp circuit of appropriate calling multiple line lamp 23 as follows: battery—lamp 23—front contact of relay LR—armature 22—battery. The operator, upon observing the calling signal of line lamp 23, inserts her answering-cord plug into the calling local-line jack.

The partial circuits thus set up by the operator

through the tip and ring connections are left open at the front contacts of relays 2 and 3.

The sleeve contacts complete a circuit for common relays B and NB and for cutoff relay CO as follows: ground—winding CO—jack sleeve contact—plug sleeve contact—winding relay #1—upper winding of relay #2—back contact relay #3—winding NB—winding B—battery—ground. The actuation of relay CO trips line relay LR by breaking its circuit through the back contacts and armatures 20 and 21 of cutoff relay CO, thereby extinguishing light 23.

The operation of relay B closes a circuit for relay SW through the circuit: ground—battery—winding SW—back contact of ST—armature 36—front contact of B—armature 37—ground. Relays NB and ST operate so quickly, however, that the relay SW is not energized. The operation of relay NB operates relay ST by a circuit through armature 24 as follows: ground—armature 24—front contact of NB—winding of ST—battery—ground. The operation of relay ST in turn closes its front contact and armature 25 completing a battery circuit for relays 1 and 2, between relays NB and #2, thereby shorting the windings of B and NB to release them. The release of relay NB in turn releases relay ST at armature 24 and front contact of NB. The circuit through relays 1 and 2 is of much lower resistance than through B and NB, thereby taking the current and energizing relays #1 and #2.

The operation of relay #1 closes at its front contact and armature 26 a circuit: ground—armature 26—front contact of #1—winding of #3—battery—ground to operate relay 3. The operation of relay #2 puts the winding of #1 and the upper winding #2 in multiple with the lower winding of #2, at front contact and armature 27. The operation of relay #3 lights supervisory lamp 34 by circuit: ground—battery—lamp 34—front contact of #3—armature 38—back contact of #4—back contact of #5—armature 39—ground. The partial circuit of relay #4 is then completed by armatures of relays #2 and #3 as follows: ground—battery—front contact of #2—armature 28—conductor 29—lower winding of #4—conductor 30—normal contact of #6—ring circuit of answering cord—subscriber's station—tip of answering cord—conductor 31—normal contact of #6—upper winding of #4—conductor 32—front contact of #2—armature 33—ground. The operation of relay #4 in turn trips the supervisory lamp at armature 33.

The operator now has relays 1, 2, 3 and 4 of her answering cord circuit energized, with calling line lamp 53 and answering supervisory lamp 34 extinguished. She is now ready to answer and then complete the call. The operator then operates the dial and listening key D & LK which connects the operator's set circuit to the cord, under control of common relay SW, to permit her to talk to the calling subscriber. The dial and listening key has two sets of make-before-break contacts and two sets of make contacts, with the make contacts arranged to close before the break of the make-before-break contacts. The operator's listening circuit is through the calling subscriber's station—the cord answering tip—tip circuit condenser TC—conductor 40—front contact of D & LK—conductor 41—armature 42—operator's set—armature 43—conductor 44—front contact of D & LK—conductor 45 of cord condenser RC—ring contacts of plug and jack cord—subscriber's station. Upon receipt of the

called local station number, the operator makes the customary line test before completing the call. If the line tests idle, the operator then completes the circuit by inserting the calling cord plug into the jack of the wanted local line.

Completing; local to local.—When the plug of the calling cord is inserted into a local line jack, relays #10, 9 and 8 operate, lighting the call supervisory lamp. The circuit for relays 9 and 10 also includes the called line cutoff relay, through the sleeve circuit: ground—CO—sleeve—winding of 10—winding of 9—battery—ground. The operation of the called line cutoff relay prevents operation of its line lamp. The operation of relay 10 in turn energizes relay 8 by circuit: ground—front contact of 10—armature 46—winding of 8—battery—ground. The energization of relay 9 attracts armature 47 to put the lower winding of 9 in multiple with the windings of relays 9 and 10. The operation of relay #9 connects battery and ground to the T and R of the calling cord, through its armatures 48 and 49, windings of relay #7 and contacts of relay #6. Since the called station's circuit is open, this circuit is not complete, and relay 7 does not operate. The operation of relay 8 closes armature 52 to its front contact to operate the supervisory lamp 53 by a circuit: ground—battery—53—armature 52—front contact of 8—armature 54—conductor 55—back contact of 5—armature 39—ground. The operator then rings by operating the manual ring key RK.

Upon restoration of the ringing key and after the called party answers, relay #7 operates through the subscriber's loop. The operation of relay #7 extinguishes the calling supervisory lamp 53. The circuit is now in talking condition.

Disconnecting; local to local.—When the called party hangs up, relay #7 releases, lighting the calling supervisory lamp 53. When the calling party hangs up, relay #4 releases, lighting the answering supervisory lamp 34. When the calling cord is taken down, the sleeve circuit is broken, tripping relays #9, 10 and CO. Relay 10 in turn trips relay 8 at armature 46, and its release in turn extinguishes the calling supervisory lamp 53. When the answering cord is taken down, the sleeve circuit is broken and releases relays #1, 2 and CO. Relay 1 in turn trips relay 3, which latter in turn extinguishes lamp 34, restoring the circuit to normal.

Operator's bar and warning tone.—If two operators answer the same calling local line, the cord of the first operator, to make connection, will function as heretofore described. The cord of the second operator, to make connection, will operate only common relays B and SW, since relay NB is marginal and is shunted out by the sleeve circuit of the first operator's cord. The operation of relay SW, at its armatures 42 and 43, switches the operator's listening commons to a tone buzzer TB, which is started by armature 56 of relay SW connecting it to ground, to indicate this call has been answered. The circuit goes back to normal when her plug is taken down.

Answering; local to trunk.—In answering a local subscriber calling a station requiring a trunk connection, the operator in answering follows the same procedure as described under local to local answering.

Completing; local to trunk.—In completing a local call through a trunk, the action is different. In this case, consider both Figs. 1 and 2.

When the plug of the calling cord is inserted into a trunk line jack TJ, relay #10 only operates. Relay 9 is marginal and, with the large resistance 58 of about 1500 ohms in the circuit, the relay 9 will not operate. This circuit is: ground—battery—upper winding of 9—winding of 10—calling plug sleeve circuit—sleeve of TJ—resistance 58—ground. Relay #10 in turn causes relay #3 to operate by closing its circuit at armature 46. Relay #3 energizes supervisory lamp 53 at armature 52.

Relay #8 also completes the circuit of relay #7 at its armatures 50 and 51. This circuit is (see Fig. 2): ground—battery—lower winding T1—conductor 59—repeater coil 60—ring conductor—contacts of jack TJ and plug (see Fig. 1)—calling cord ring conductor—contacts of key D & LK—conductor 61—normal contact of relay D—conductor 62—conductor 41 (to contacts of key D & LK)—conductor 40—back contact of relay 6—armature 63—upper winding of 7—armature 48—back contact of 9—conductor 64—armature 50—front contact of 2—conductor 65—lower winding of 7—armature 65—back contact of 6—conductor 67—conductor 45—key—conductor 44—operator's set and normal contact of D—conductor 63—listening key—conductor 69—armature 51—front contact of 8—cord tip (calling) circuit—tip of calling cord—(see Fig. 2) trunk tip—repeater coil 70—conductor 71—upper winding of T1—ground.

Relay #7 operates from the trunk battery and in turn connects ground through to the winding of relay #6 which operates and locks. The circuit of relay 6 is: ground—battery—winding of 6—conductor 72—front contact of 7—armature 73—front contact of 4—armature 74—conductor 75—back contact of 9—armature 49—ground. Its locking circuit is over path: ground—battery—winding of 6—front contact of 6—armature 77—conductor 78—front contact of 8—armature 79—ground. The operation of relay #6 also shorts out condensers TC and RC, respectively, at armature 80 and front contact of 6, and armature 76 and front contact of 6, connecting the calling party through to trunk battery. Relay 6 in turn releases relays 4 and 7. Relay 6 by armature 76 energizes relay #5 through the calling subscriber's telephone from trunk battery. Both supervisory lamps are out and the cord circuit is in a talking condition.

The operator, by inserting her calling plug in the trunk jack, caused the operation of trunk relay T1 which in turn operated relay T2 by a circuit: ground—armature 81—front contact of T1—conductor 82—winding of T2—battery—ground. The operation of relay T1 also completed a circuit for trunk line relay TLR as follows: ground—battery—winding TLR—armature 83—back contact of TCO—conductor 34—repeater coil 85—conductor 86—front contact of T1—armature 87—conductor 88—repeater coil 89—conductor 90—armature 21—back contact of TCO—ground. This in turn operates trunk supervisory lamp 92. The exchange operator, in plugging in her answering cord, operates trunk cut-off relay TCO and extinguishes lamp 92. The entire circuit is now in talking condition.

The trunk is also arranged to permit the main exchange operator to resignal the local or P. B. X. operator after the local subscriber has hung up but before the local operator has taken down the cords. In this case, the main exchange operator applies ringing current (A. C.) to the trunk which operates relay T4 over a circuit through

the tip and ring trunk circuits as follows: conductor 90—conductor 93—condenser—lower winding of T4—back contact of T2—armature 94—winding 85—conductor 84—trunk tip circuit. The operation of relay T4 in turn operates the supervisory or recall signal 95 through circuit: ground—battery—lamp 95—conductor 96—front contacts of T4—armature 97—back contact of T2—armature 98—conductor 99—back contact of T1—armature 81—ground. Relay T4 also locks itself up by circuit: ground—battery—upper winding T4—front contact of T4—armature 97—armature 98—armature 81—ground. The inclusion of only one repeater coil 85 in the above prevents a re-ring or recall upon the local circuit, over the existing cord circuit of the P. B. X. board.

Disconnecting; local to trunk.—When the calling party hangs up, relay #5 releases, lighting both supervisory lamps. When the calling cord is taken down, relays #10 and #8 release, extinguishing the call supervisory lamp 53. When the answering cord is taken down, relays #1, 2, 3 and 6 release, restoring the circuit to normal.

Dialing.—When the call is for an automatic exchange, either the calling party or the operator can do the dialing. The operator can dial while the dial and listening key D & LK is operated. When the dial 100 is operated, the off-normal contact on the dial closes ground to relay D, operating it. The operation of the off-normal relay connects the operator's headset to the cord circuit through conductors 41 and 44 and the D & LK key. The operation of relay D also connects the dial to the calling cord and connects battery feed relay TK to the answering end of the cord. The energization of the cord relays from the trunk battery requires a holding bridge for the end during the operator dialing operation. This is provided by the battery at relay TK. The trunk battery, during dialing, supplies the dialing power. When the dial returns to normal at the end of each digit dialed, relay D releases, again connecting the cord circuit through to the trunk. When the desired number has been dialed, the operator restores the dial and listening key D & LK, and the circuit is in a talking condition.

Answering; trunk to local.—When an answering plug is inserted into a trunk line jack, common relays NB and B operate. The operation of relay NB in turn operates relay ST. The operation of relay ST shorts out relays NB and B, releasing same, followed by energization of #1 and the release of relay ST. The operation of relay #1 operates relay #3 which locks, disconnecting common relays, and closing a circuit for the winding of relay #4. Relay #4 then operates from trunk battery 101, lighting the answering supervisory lamp 34 by circuit: ground—battery—34—front contact of #3—armature 35—armature 38—front contact of #4—armature 102—back contact #2—back contact of #8—armature 79—ground.

The operation of the listening key connects the operator's circuit to the cord, under control of relay SW as heretofore described.

Completing; trunk to local.—When the calling plug is inserted into a jack of a local line, relays #10, 9 and 8 operate extinguishing the answering supervisory lamp and lighting the call supervisory lamp 53. Operation of relay #10 operates #8. The operation of relay #9 connects battery and ground to the calling cord through armatures 48 and 49 and through winding of re-

lay #7 and the contacts of relay #6. The operator then rings by operating the manual ringing key RK. When the called party answers, relay #7 operates, which in turn operates relay #6. The circuit for the latter is: ground—battery—winding of #6—conductor 72—front contact of #7—armature 73—front contact of #4—armature 74—back contact of #2—armature 33—ground. The operation of relay #6 locks itself, opens the leads to relays #4 and #7 releasing same. This short circuits condensers TC and RC connecting the called party through to the trunk battery. The locking circuit of relay #6 is over the following path: ground—battery—winding of #6—front contact of #6—armature 77—front contact of #3—armature 103—ground. Relay #5 operates through the called subscriber's telephone. The operation of relay #5 extinguishes the calling supervisory lamp. The connection is now in talking condition and the trunk is held to the called subscriber's telephone.

Disconnecting; trunk to local.—When the called party places the receiver on the hook switch, relay #5 releases, lighting both supervisory lamps. When the calling cord is taken down, relays #10 and #8 release. Upon release of 8, the calling supervisory lamp is extinguished. When the answering cord is taken down, relays #1, 3 and 6 release restoring the circuit to normal.

The system and operation as described provides an automatic local and trunk line through supervision; and automatically establishes a holding bridge by the operator answering a trunk or local signal. Upon the answering of a local station, the holding bridge is released and the local then automatically maintains a holding bridge. The back cord may be used for answering local or trunk lines.

The operator's answering circuit has a non-interfering control providing a bar to interference by a second operator, and also supplying a tone to indicate that the call has been answered. The circuit is so arranged that the calling party can be permitted to dial through the cord circuit. The operator can dial with the listening key on, thereby automatically connecting the dial to the trunk and disconnecting the calling cord circuit from the bell ringing side. Completion of the dialing by the operator actuates a relay to automatically break the dial connection and reconnect the answering cord to the calling cord.

The subscriber or operator can answer or call in either direction through the trunk if the calling local hangs up before answering. The operator rings the called local. When the called local answers, the automatic bridging circuit holds the call, and the operator recalls the original calling local. The local then clears through for supervision. Local battery feed through the cord circuit instead of from the main exchange battery always insures current for operation. Supervisory relay 1 can relight the line lamp of the trunk even though the plug is still in the jack. This permits a second call to come through on the trunk and properly signal the operator even though a jack connection from the previous call has not been removed. The supervisory relays 2 and 9 can operate from either end of the cord.

The foregoing detailed description illustrates the preferred circuits and method of operation, but variations within the true spirit and scope of the invention are to be determined from the appended claims.

Having thus described my invention, what I

claim is new and desire to secure by United States Letters Patent is:

I claim:

1. In a telephone system, an exchange, jacks at said exchange, subscribers' lines terminating in said jacks, interoffice trunk lines, jacks in which said trunks terminate, cord circuits each having an answering end and a calling end, plugs in which said ends respectively terminate, an answering plug being arranged to be associated with either a local line jack or a trunk jack in answering a call, a calling plug being arranged for association with either a local jack or a trunk jack in completing a call, a bridge across the conductors of said cord, a relay in said bridge, means responsive to the insertion of a plug at the corresponding end of the cord in a jack for closing the said bridge, a sleeve circuit, a marginal relay in said sleeve circuit, means controlled by said marginal relay for including battery in said bridge if the said plug is associated with the jack of a local line and excluding battery if said plug is associated with a trunk jack, a supervisory signal, and a circuit for said signal controlled by said bridge relay.

2. In a telephone system, a local exchange, jacks at said exchange, subscribers' lines terminating in said jacks, interoffice trunk lines, jacks in which said trunks terminate, universal cord circuits, each having an answering end and a calling end, plugs in which said ends respectively terminate, each plug being arranged for association with either a local line jack or a trunk jack, a bridge across the conductors of each end of said cord, a relay in each bridge, means responsive to the insertion of a plug in a jack for closing the said bridge at the corresponding end of the cord, a sleeve circuit at each end of said cord, a marginal relay in each sleeve circuit, and means controlled by said marginal relays, respectively, for including battery in a bridge if the plug at the corresponding end of a cord is associated with the jack of a local line and excluding battery if said plug is associated with a trunk jack.

3. In a telephone system, a local exchange, jacks at said exchange, subscribers' lines terminating in said jacks, interoffice trunk lines, jacks in which said trunks terminate, cord circuits, each having an answering end and a calling end, plugs in which said ends respectively terminate, an answering plug being arranged to be associated with either a local line jack or a trunk jack in answering a call, a calling plug being arranged for association with either a local jack or a trunk jack in completing a call, a bridge across the conductors of each end of said cord, a relay in each bridge, means responsive to the insertion of a plug in a jack for closing the said bridge at the corresponding end of the cord, a sleeve circuit, a marginal relay in each sleeve circuit, and means controlled by said marginal relays, respectively, for including battery in a bridge if the plug at the corresponding end of a cord is associated with the jack of a local line and excluding battery if said plug is associated with a trunk jack.

4. In a telephone system, a local exchange, jacks at said exchange, subscribers' lines terminating in said jacks, interoffice trunk lines, jacks in which said trunks terminate, cord circuits, each having an answering end and a calling end, plugs in which said ends respectively terminate, an answering plug being arranged to be associated with either a local line jack or a

trunk jack in answering a call, a calling plug being arranged for association with either a local jack or a trunk jack in completing a call, a bridge across the conductors of each end of said cord, a relay in each bridge, means responsive to the insertion of a plug in a jack for closing the said bridge at the corresponding end of the cord, a sleeve circuit at each end of said cord, a marginal relay in each sleeve circuit, means controlled by said marginal relays, respectively, for including battery in a bridge if the plug at the corresponding end of a cord is associated with the jack of a local line and excluding battery if said plug is associated with a trunk jack, supervisory signals, and circuits for said signals, controlled by said bridged relays, respectively.

5. In a telephone system, an exchange, jacks at said exchange, local telephone lines terminating in certain of said jacks, trunk lines terminating in other of said jacks, a cord circuit for connecting local lines to trunk line or trunk lines to local line, an answering end and a calling end for said cord circuit, bridges, one across each end of said cord circuit, means for completing said bridges, respectively, incident to inserting the corresponding plug in a jack, a bridge cutoff relay arranged upon operation to interrupt said bridges, means for actuating said cutoff relay upon calls to a trunk line incident to inserting the calling plug in the trunk line jack, and means for actuating said bridge cutoff relay upon calls to a local line incident to response of the called local subscriber.

6. In a telephone system, a local exchange, local lines, jacks at said exchange in which said lines terminate, a distant exchange, trunks extending from said local exchange to said distant exchange, jacks at said local exchange in which said trunks terminate, a cord circuit for connecting a local line to a trunk or a trunk to local line, an answering supervisory signal in said cord, means to actuate said signal incident to the answering plug of said cord being inserted in the jack of a calling trunk line and means to efface said signal when the calling plug of said cord is inserted in the jack of a called local line.

7. In a telephone system, local subscribers' lines and trunk lines, jacks in which said lines terminate, a cord circuit for interconnecting said local lines and trunk lines, inductive devices separating said cord circuits into answering ends and calling ends, a relay, short circuits of said inductive devices arranged to be closed by said relay, a relay in one of said short circuits, calling and answering supervisory signals in said cord circuit and circuits for said supervisory signals controlled by said relay in said short circuit.

8. In a telephone system, local subscribers' lines and trunk lines, jacks in which said lines terminate, a cord circuit for interconnecting said local lines and trunk lines, inductive devices separating said cord circuits into answering ends and calling ends, a relay, short circuits of said inductive devices arranged to be closed by said relay, a relay in one of said short circuits, calling and answering supervisory signals in said cord circuit and circuits for said supervisory signals arranged to be closed by said relay in said short circuit, upon deenergization thereof.

9. In a telephone system, local subscribers' lines and trunk lines, jacks in which said lines terminate, a cord circuit for interconnecting said local lines and trunk lines, inductive devices sep-

arating said cord circuits into answering ends and calling ends, a relay, short circuits of said inductive devices arranged to be closed by said relay, a relay in one of said short circuits, calling and answering supervisory signals in said cord circuit and circuits for said supervisory signals arranged to be closed by said relay in said short circuit, incident to opening the circuit at the calling substation.

10. In a telephone system, an exchange, jacks at said exchange, subscribers' lines terminating in said jacks, interoffice trunk lines, jacks in which said trunks terminate, a universal cord circuit, inductive devices separating said cord circuit into an answering end and a calling end, plugs in which said ends respectively terminate, an answering plug being arranged to be associated with either a local line jack or a trunk jack in answering a call, a calling plug being arranged for association with either a local jack or a trunk jack in completing a call, a bridge across the conductors of each end of said cord, a relay in each bridge, means responsive to the insertion of a plug in a jack for closing the said bridge at the corresponding end of the cord, short circuits of said inductive devices, respectively, a cutoff relay arranged upon operation thereof to interrupt said bridges and close said short circuits, and means for actuating said cutoff relay incident to the response of a called local subscriber.

11. In a telephone system, an exchange, jacks at said exchange, subscribers' lines terminating in said jacks, interoffice trunk lines, jacks in which said trunks terminate, a universal cord circuit, inductive devices separating said cord circuit into an answering end and a calling end, plugs in which said ends respectively terminate, an answering plug being arranged to be associated with either a local line jack or a trunk jack in answering a call, a calling plug being arranged for association with either a local jack or a trunk jack in completing a call, a bridge across the conductors of each end of said cord, a relay in each bridge, means responsive to the insertion of a plug in a jack for closing the said bridge at the corresponding end of the cord, short circuits of said inductive devices, respectively, a relay in one of said short circuits, a cutoff relay arranged upon operation thereof to interrupt said bridges and close said short circuits, and means for actuating said cutoff relay incident to the response of a called local subscriber, supervisory signals for said cord circuit and circuits for said signals controlled by said relay in one of said short circuits.

12. In a telephone system, an exchange, local subscribers' lines, jacks at said exchange in which said local lines terminate, trunk lines, jacks at said exchange in which said trunk lines terminate, a universal cord circuit for connecting local lines with trunk lines, inductive devices separating said cord circuit into an answering end and a calling end, shunts about said inductive devices, a relay for closing said shunts incident to the establishment of a connection from a local line to a trunk line, a holding relay in one of said shunts, a normal energizing circuit for said holding relay including a source of energy associated with the connected trunk circuit, the talking conductors of the cord, said shunts, the local subscriber's line and substation thereon, operator's impulse mechanism associated with said cord, a switch for joining said impulse mechanism to the calling end of said cord, a substitute circuit for

said holding relay established incident to operation of said switch including normally closed contacts controlled by the sending device off normal and the source of energy at the trunk and a second substitute circuit for said holding relay established upon movement of said sending device from normal, under control of its off normal contacts, wherein a source of energy local to the cord is substituted for the source of energy at the trunk, while said sending device is off normal.

13. In a telephone system, an exchange, local subscribers' lines, jacks at said exchange in which said local lines terminate, trunk lines, jacks at said exchange in which said trunk lines terminate, a cord circuit for connecting local lines with trunk lines, inductive devices separating said cord circuit into an answering end and a calling end, shunts about said inductive devices, means for closing said shunts incident to the establishment of a connection from a local line to a trunk line, a holding relay in one of said shunts, a normal energizing circuit for said holding relay including a source of energy associated with a trunk circuit, the talking conductors of the cord, said shunts, the conductors of the local subscriber's line and substation thereon, operator's impulse mechanism associated with said cord, a key for joining said impulse mechanism to the calling end of said cord, and a substitute circuit for said holding relay established incident to operation of said switch including alternate contacts of said key, contacts controlled by the sending device off normal and the source of energy at the trunk.

14. In a telephone system, an exchange, local subscribers' lines, jacks at said exchange in which said local lines terminate, trunk lines, jacks at said exchange in which said trunk lines terminate, a cord circuit for connecting local lines with trunk lines, inductive devices separating said cord circuit into an answering end and a calling end, shunts about said inductive devices, means for closing said shunt incident to the establishment of a connection from a local line to a trunk line, a holding relay in one of said shunts, a normal energizing circuit for said holding relay including a source of energy associated with a

trunk circuit, the talking conductors of the cord, said shunts, the local subscriber's line and substation thereon, operator's impulse mechanism associated with said cord, an off normal for said sending device, means for joining said impulse mechanism to the calling end of said cord, and a substitute circuit for said holding relay established upon movement of said sending device from normal under control of its off normal contacts wherein a source of energy local to the cord is substituted for the source of energy at the trunk while said sending device is off normal.

15. A telephone system including a plurality of telephone lines associated with multiple switchboards, a station for each line, a cord circuit for interconnecting any two of said stations or lines, an answering cord and a calling cord for said cord circuit, an operator's circuit, a dialing means including a dialing circuit, a listening key for connecting the operator's circuit to said cord circuit, an off-normal contact associated with said dialing means, relay means associated with said dialing circuit for connecting the same to the calling cord of the cord circuit and for disconnecting the calling cord from the answering cord of the cord circuit, during a dialing operation, and for automatically restoring the interconnection at the completion of the dialing operation, and battery supply means operated by said off-normal contact when said dialing means is in operation for connection to the answering cord.

16. A telephone system including a plurality of telephone lines and trunk lines at a local exchange, a cord circuit for interconnecting any two of said lines, an answering end and a calling end for said cord circuit, supervisory signals at each end of the said cord circuit and the trunk circuit, operating circuits for said signals, relay means for operating said signals according to accepted practice, said trunk lines extending to a main exchange, and means at the main exchange providing re-ring at the local exchange over a previous connection upon which the local call has been completed and while the connections are still up, but said means excluding a recall of the local line.

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