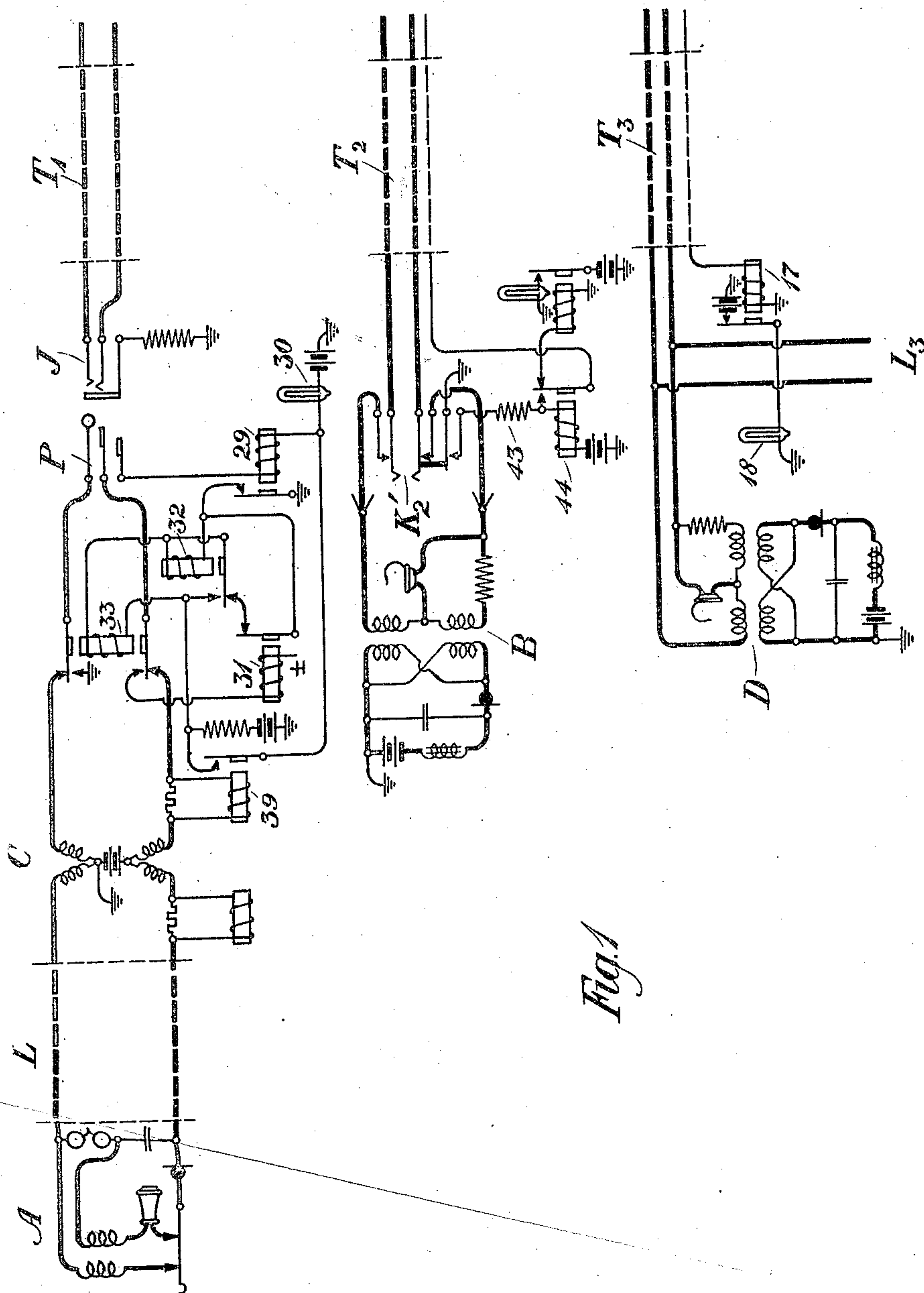


W. A. RHODES.
DESK OPERATOR'S CIRCUITS.
APPLICATION FILED DEC. 5, 1918.

1,429,972.

Patented Sept. 26, 1922.

2 SHEETS—SHEET 1.



FOIA

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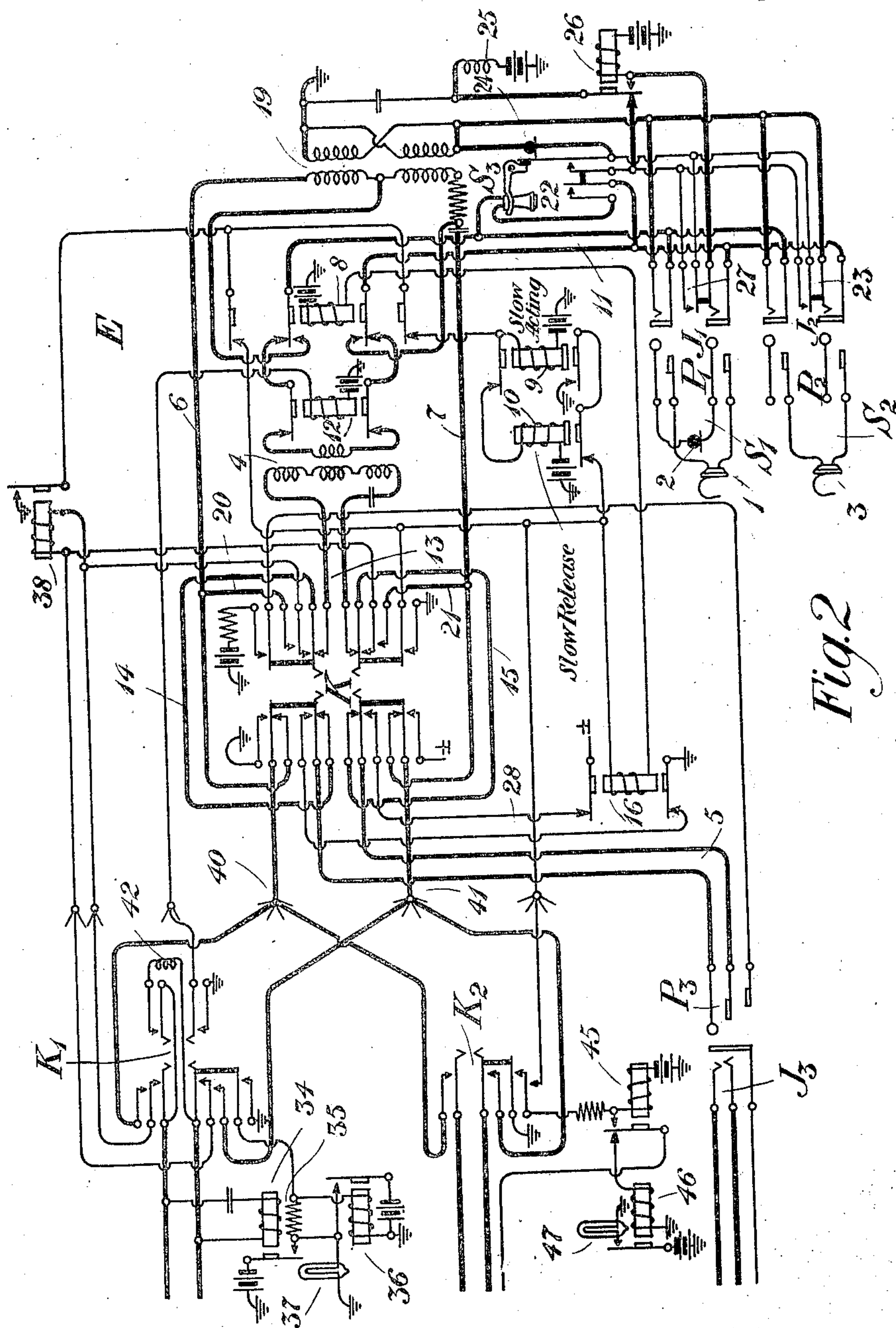


Fig. 2

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1,429,972

UNITED STATES PATENT OFFICE.

WILLIAM A. RHODES, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

DESK OPERATOR'S CIRCUITS.

Application filed December 5, 1918. Serial No. 265,435.

To all whom it may concern:

Be it known that I, WILLIAM A. RHODES, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Desk Operators' Circuits, of which the following is a specification.

This invention relates to telephone circuits, and more particularly to circuits whereby connections may be established to special operators' positions.

In accordance with this invention a desk circuit is provided for a special operator, such as a chief operator, and equipped with a single ended cord for either talking or monitoring, and with terminal equipment for monitoring lines, tie lines, trunks from the switchboard at the A operator's positions, and lines to supervisors. The circuit is arranged for reducing inductive discharges and receiver disturbances particularly when machine ringing is tripped upon answering a call over a trunk from the switchboard, and for monitoring upon an operator's or supervisor's line through a high impedance monitoring circuit. The circuit is also arranged for ringing out on a tie line, or trunk, or for ringing over the monitoring cord by means of a common ringing key, a talking key being also associated with the cord whereby the operator may talk over the monitoring cord. The arrangement of the circuit is such that the desk operator may perform routine monitoring work and may answer an incoming call or make an occasional outgoing call without being required to disconnect the monitoring cord or to operate a key for disconnecting this cord from her set, such disconnection being automatic upon the operation of any key by which the operator's set is connected to some other circuit.

One of the features of the invention consists in the provision of means whereby the desk operator's receiver is normally connected to a monitoring cord, preferably through a high impedance coil, so that the operator may monitor any connection by simply inserting the plug of the monitoring cord in the jack associated with the desired connection.

Another feature of the invention relates to the arrangement of the circuit, so that no other operation is necessary for answering a call incoming from a trunk than throwing

the trunk key, which result in automatically disconnecting the operator's set from the monitoring cord and connecting it with the trunk without withdrawing the plug from the monitoring jack.

A further feature of the invention relates to the provision of means whereby the desk operator, in answering a trunk call by throwing the trunk key, trips machine ringing and automatically connects the desk operator's set to the trunk, after a substantially uniform interval sufficient to allow the electrical conditions of the circuit to reach a state of equilibrium, the interval being the same regardless of variations in the potential of the battery supplying current to operate the relays whereby the connection is made. This result is accomplished by providing two relays, one being slow to attract its armature and the other being slow-releasing, said relays jointly controlling the connection of the operator's set.

A further feature of the invention consists in the provision of a holding key, whereby a call incoming over a trunk may be held, and the operator's set maintained disconnected from the monitoring cord, ready to be connected to another trunk after the usual interval following the operation of the trunk key.

A still further feature of the invention resides in the arrangement of means whereby the operator's set may be immediately connected for talking over the monitoring cord or over a tie line extending to another desk by manipulation of a talking key.

Still another feature resides in the provision of means whereby ringing current may be applied to any one of several trunks or to the monitoring cord by the operation of a common ringing key, instrumentalities being provided whereby the operation of a trunk key automatically prevents ringing current from being applied to those contacts of the common ringing key which are associated with the monitoring cord.

An additional feature of the invention has reference to the operator's set which is so arranged that calls may, if desired, be answered by an ordinary desk telephone set, but when the operator is using a head receiver the call may be answered by using said receiver and the transmitter of the desk stand, without removing the receiver of the desk stand from the hook. When the op-

erator is using a chest transmitter and head receiver, the apparatus is arranged so that incoming calls may be answered by means of these instruments without removing the desk stand receiver from the switch hook, the transmitter of the desk stand being at the same time rendered inoperative.

The invention may now be more fully understood from the following description when read in connection with the accompanying drawings, Figures 1 and 2 of which when placed end to end constitute a circuit diagram of a preferred embodiment of the invention.

Referring to the drawing, a desk circuit E is shown provided with a desk stand telephone set S_3 , and auxiliary telephone sets S_1 and S_2 , the set S_1 consisting of a head receiver 1 and chest transmitter 2 and the set S_2 consisting of a head receiver 3. The circuit E is provided with twin jacks J_1 and J_2 whereby sets S_1 and S_2 may be associated with the circuit E through twin plugs P_1 and P_2 . The circuit E is also provided with a controlling key K whose contacts are so arranged that the receiver of one of the three operator's sets is normally connected through a high impedance transformer 4 and over conductors 5 to the contacts of a monitoring plug P_3 . The operator's circuit E is further provided with conductors 6 and 7 to which the operator's set may be connected, these conductors being provided with a plurality of branches which lead to the connections of a plurality of trunks such as T_1 , T_2 , etc.

The trunk T_1 shown in the drawing is illustrative of a group of trunks leading to A operators' positions, where they terminate in jacks such as the jack J. A trunk key such as K_1 is provided for each trunk of this type, said key being arranged so that when thrown to the left the conductors 6 and 7 are connected to the trunk, and the operator's set connected to the conductors 6 and 7 by means of a relay 8 after a suitable interval determined by the operation of a slow-operating relay 9 and a slow releasing relay 10. This combination of relays is provided in order that a sufficient interval will elapse after the operation of the key to permit of tripping the ringing current applied to the trunk before the operator's set is connected thereto. The relay 8 is so arranged that in connecting the operator's set to the trunk over conductors 6 and 7, the set is automatically disconnected from the plug P_3 so that the plug need not be withdrawn from the jack of any circuit over which the operator may have been monitoring. In order to illustrate the operation of tripping machine ringing, a subscriber's set A is shown connected over a line L, and an A operator's cord C terminating in a plug P, to the

trunk T_1 , the connection being completed by inserting the plug P of the A operator's cord circuit in the jack J of the trunk. The equipment of the cord circuit is of a standard type well known in the art and need not be further described.

The trunk T_2 is illustrative of a type of trunk which extends between two operators' desks and is commonly known in the art as a tie line. This trunk terminates at each end in trunk keys such as K_2 and K_2' , whereby the operator's circuit E with its associated set and a similar or equivalent set B may be connected to the trunk. The trunk T_2 , in addition to the talking conductors, is provided with a third conductor over which signals may be transmitted from one desk to the other by simply throwing the key K_2 or K_2' as the case may be. As ringing is not employed for signaling over a trunk of this character, the key K_2 is so arranged that the operator's set is connected to the trunk immediately, without the interposition of the time interval employed in connection with trunks of the type of the trunk T_1 .

At T_3 is shown a trunk which illustrates the manner in which the monitoring cord terminating in the plug P_3 may be employed. The trunk T_3 terminates in a jack J_3 and connects to the line L_3 , which is in communication with an operator provided with the operator's set D. By inserting the plug P_3 in the jack J_3 the operator at E is enabled to monitor on the line L_3 by means of the trunk T_3 and check the work of the operator at D.

In order that the key K may be used for ringing either over the monitoring cord 5 or over trunk connections of the type T_1 , a relay 16 is provided which controls the application of ringing current to certain of the left hand contacts of the key K, whereby ringing current may be applied to the plug P_3 . The relay 16 is included in series with the relay 8 which connects the operator's set to trunk connections and is operated whenever a trunk key such as K_1 is actuated. In order to ring over a trunk such as T_1 , the trunk key K_1 must be thrown to the left, thereby causing the energization of relay 16, which disconnects ringing current from the contacts whereby ringing current may be applied to the plug P_3 . Consequently, when the key K is thrown to the left, ringing current is applied over the outer contacts of said key to the trunk corresponding to the actuated trunk key, but ringing current is not applied to the monitoring cord. If no trunk key is operated to connect the set at E to the trunk, the actuation of the key K to the left will apply ringing current over the monitoring cord 5 to the plug P_3 , since the relay 16 will not be energized, and ringing current will

not be applied to any other trunks, since no trunk keys are actuated.

The details of the apparatus may now be best understood from a description of the operation, which is as follows: Assuming that the chief operator at E wishes to monitor on the connection at L_3 , any one of the telephone sets S_1 , S_2 or S_3 may be employed. If the set S_2 is employed the plug P_2 will be inserted in the jack J_2 , and the receiver 3 will be connected over the ring contacts of the plug and jack, over conductors 11, inner back contacts of relay 8, back contacts of relay 12, through high impedance transformer 4, over conductors 13, normal right hand contacts of key K, conductors 14 and 15, normal left hand contacts of key K and conductors 5 to the tip and ring contacts of the plug P_3 . By simply inserting the plug P_3 in the jack J_3 , therefore, the chief operator's receiver 3 is connected over the trunk T_3 , so that the connection at L_3 may be observed.

Should the operator at E desire to signal the operator at D, the key K may be thrown to the right, thereby completing a circuit from battery over the upper right hand make contact of key K, over the sleeve contacts of the plug P_3 and the jack J_3 , and through the winding of the relay 17 to ground. Relay 17 upon being energized causes the lamp 18 to glow, thereby informing the operator at D that a call awaits her. Over the lower right hand make contact of the key K, a circuit is closed from ground through the winding of relay 16, and through the winding of relay 8 to battery. Relays 8 and 16 are energized over the circuit above traced, the latter disconnecting ringing current from certain of the left hand contacts of key K and the former operating to disconnect the receiver circuit 11 from the high impedance transformer 4 and connect said receiver circuit in shunt with one of the secondary windings of the transformer 19.

The plug P_3 is connected to the talking apparatus associated with the transformer 19 over the contacts of the key K as follows: plug P_3 , conductors 5, inner left hand normal contacts of key K, conductors 14 and 15, inner right hand make contacts of key K, conductors 20 and 21 and conductors 6 and 7, to transformer 19. The operator at E is now enabled to talk over the monitoring cord without removing the receiver 22 of the set S_3 from the hook. This arises from the fact that the insertion of the plug P_2 in the jack J_2 closes a pair of contacts 23 which are connected in parallel with the switch hook contacts, so that an energizing circuit for the transmitter 24 is completed from battery through the impedance coil 25, over the back contact of relay 26, over contacts 23 of the jack J_2 , through the transmitter 24 and pri-

mary windings of the transformer 19 to ground.

In case the operator at E had been using the set S_1 including the chest transmitter 2 and the head receiver 1, the transmitter 24 of the set S_3 would not be employed in talking over the circuit above described, but the transmitter and receiver of the set S_1 would be used. In this case the plug P_1 would have been inserted in the jack J_1 , closing contacts 27 in parallel with the switch hook contacts. The closing of contacts 27 is, however, without any useful effect, as the circuit for the transmitter 24 which would otherwise have been completed over these contacts is at once opened by the energization of a relay 26 over a circuit as follows: from battery, through the winding of relay 26, over the lower tip contacts of jack J_1 and plug P_1 , through the transmitter 2, upper tip contacts of plug P_1 and jack J_1 , and through the primary windings of transformer 19 to ground. Relay 26 upon attracting its armature opens the circuit of the transmitter 24 and completes the battery supply circuit for transmitter 2 from battery, through the impedance 25 over the front contact of relay 26, and thence over the circuit previously traced through transmitter 2 to ground. The receiver 1 is, of course bridged across the conductors 11, so that it is connected in shunt with the lower secondary winding of the transformer 19. The transmitter 2 and the receiver 1 may, therefore, be employed in talking over the monitoring circuits, without regard to the desk stand set S_3 .

If the operator at E had been employing neither the head receiver 3 of the set S_2 nor the chest transmitter and head receiver of the set S_1 , the desk stand set S_3 would have been used by removing the receiver at 22 from the switch hook in the ordinary manner and talking into the transmitter 24. The removal of receiver 22 from the switch hook connects said receiver across conductors 11 over the switch hook contacts, and a circuit for the transmitter 24 is completed over the switch hook contacts from battery through the impedance coil 25, back contact of relay 26, switch hook contacts of the set S_3 , through the transmitter 24 and primary windings of inductance coil 19 to ground.

If the operator at E desires to ring over the monitoring cord terminating in the plug P_3 the key K may be thrown to the left. The circuit of relays 8 and 16 will now be open, and these relays will be deenergized so that ringing current is connected over the back contacts of relay 16, over conductors 28, inner left hand make contacts of key K and over conductors 5 to the tip and ring contacts of the plug P_3 .

Assuming now that with the key K restored to normal and the plug P_3 inserted

in the jack J_3 , the operator at E is monitoring over the trunk T_3 using the head receiver 3, and that a subscriber at A, whose line L terminated before an A operator's position, has been connected by an A operator's cord circuit C to the trunk T_1 by inserting the plug P in the jack J of said trunk, a circuit is completed from ground over the sleeve contacts of jack J and plug P, through the winding of the sleeve relay 29 and lamp 30 to battery. Relay 29 completes a circuit from ground over its front contact, over the back contact of tripping relay 31, back contact of relay 32, and through the winding of relay 33 to battery. Relay 33 is energized and applies ringing current through the winding of tripping relay 31 and over its front contacts to the trunk T_1 , thereby energizing the ringing responsive relay 34 of the trunk. Relay 34 upon being energized completes a circuit from battery, over its front contact and through resistance 35 and the winding of relay 36 to ground. Relay 36 at its front contact completes a circuit for the lamp 37 and establishes a locking circuit for its own winding from battery, over its front contact and through the resistance 35 and the winding of relay 36 to ground.

The operator at E upon observing the glowing of the lamp 37 operates the trunk key K_1 by throwing it to the left and thereby short circuiting the winding of relay 36 and effacing the lamp 37, and bridging the winding of relay 38 across the trunk T_1 . The establishment of this low resistance bridge in shunt with the high impedance bridge through relay 34, reduces the resistance of the trunk circuit to such an extent that the tripping relay 31 is energized, thereby opening the short circuit about the winding of relay 32 which is accordingly energized and short circuits the winding of the ringing relay 33. The ringing relay 33 is deenergized and disconnects ringing current from the trunk, the relay 32 being at the same time locked up over its lower front contact. The direct current path through the winding of relay 38 also results in the energization of the supervisory relay 39 of the cord circuit C, so that the lamp 30 is shunted, and no longer continues to glow.

The relay 38, upon being bridged across the trunk T_1 is energized by current flowing through its windings, and operates in a manner about to be described, to connect the operator's set at E to the trunk, after an interval sufficiently long to permit of the tripping of the ringing current and other operations just described, so that the operator at E does not receive any click due to these operations. The relay 38 at its front contact completes a circuit from ground over the lower back contact of relay 8, and through the winding of the slow-acting relay 9 to

battery. A parallel circuit is completed over the back contact of relay 9 and through the winding of slow-releasing relay 10 to battery. Relay 9 being slow acting does not immediately pull up, but relay 10 is energized. As soon, however, as the relay 9 attracts its armature, the circuit of slow-releasing relay 10 is broken, and after an interval, said relay 10 releases its armature, so that a circuit is now completed from ground, over the front contact of slow-acting relay 9, and over the back contact of slow releasing relay 10, through the winding of relay 16 and through the winding of relay 8 to battery. Relays 8 and 16 are energized, the latter disconnecting ringing current from the contacts of the key K and the former operating as already described to bridge the receiver 3 across the winding of the transformer 19. The transmitter 24 of the desk stand set may be used by the operator at E in answering the call without removing the receiver 22 from the switch hook, since the circuit of the transmitter 24 is completed in the manner already described, and said transmitter is connected through the transformer 19 over conductors 6 and 7 and the outer left hand normal contacts of key K to junction points 40 and 41, the connection extending from said junction points over the left hand make contacts of trunk key K_1 to the trunk T_1 . It will be noted that the operator's set is connected to the trunk T_1 an interval of time after the operation of relay 38 determined by the amount of time necessary for the slow-acting relay 9 to pull up its armature, and for the slow-releasing relay 10 to permit its armature to retract, the two operations taking place in succession. The amount of time necessary for these two operations will always be substantially the same for variations in battery potential met with in practice. If the potential of the battery is high, the relay 9 will attract its armature more quickly, but this shortening of the time interval is compensated for by the fact that the slow-releasing relay 10 is correspondingly slower in releasing its armature, so that the total time for the two operations will be substantially the same. Similarly, if the potential of the battery is low, the increased amount of time taken by the relay 9 in attracting its armature is compensated by the shorter interval required for the relay 10 to release. This is an important feature of the invention, as it provides a means for connecting the operator's set to the trunk a predetermined and uniform interval of time after the operation of the trunk key.

Should the operator at E desire for any reason to hold the call incoming on the trunk T_1 , the key K_1 may be thrown to the right, thereby bridging a coil 42 across the trunk T_1 and completing a circuit over the lower right hand make contact of said key K_1 and

through the winding of relay 12 to battery. The relay 12 upon being energized holds open the connection from the receiver circuit 11 through the high impedance transformer 4 to the monitoring cord 5, which connection, however, had already been opened by the operation of relay 8. Consequently the receiver is maintained disconnected from the monitoring cord as long as the holding key of any trunk is operated. It will be noted that the relay 8, which was energized over a circuit under the joint control of relays 9 and 10, is locked up, independent of said relays, over a circuit as follows: from battery, through the winding of relay 8, winding of relay 16, upper front contact of relay 8, and front contact of relay 38 to ground. At its lower contact relay 8 opens a circuit originally traced for relays 9 and 10, so that both of these relays are restored to normal. Consequently, as soon as the key K_1 is thrown to its right hand or holding position, relay 38 is deenergized due to the fact that it is no longer bridged across the trunk and, upon releasing its armature, said relay at once opens the locking circuit of relays 8 and 16 which are restored to normal, the receiver, however, being maintained disconnected from the monitoring cord 5 by means of the relay 12. With the circuit in this condition the operator's set may be connected to any other trunk by operating the trunk key corresponding to that trunk the usual time interval being introduced by the operation of relays 9 and 10 as before described.

If an operator at B should desire to communicate with the operator at E over the tie line trunk T_2 , said operator at B will actuate the key K_2' thereby connecting her talking set to the trunk T_2 and completing a circuit over the lower contact of said key through a resistance 43 and through the winding of signal controlling relay 44 to battery. Relay 44 upon being energized attracts its armature and completes a circuit from battery, through the winding of relay 44, over the front contact of said relay, over the third conductor of the trunk T_2 , over the back contact of a relay 45 at station E corresponding to the relay 44 at station B, and through the winding of a signal responsive relay 46. The circuit just traced locks up the relay 44 independent of the key K_2' and results in the energization of the relay 46 which causes the signal lamp 47 to glow, calling the attention of the operator at E to the fact that a call is waiting upon the tie line T_2 .

The operator at E, who may at this time have been monitoring over the cord 5, now throws the key K_2 without withdrawing the plug P_3 from the monitoring jack. The operation of key K_2 causes the energization of relay 45 over a lower make contact of said key. Relay 45, upon attracting its

armature, opens the circuit of relay 46, thereby effacing lamp 47 and establishing a locking circuit for the relay 45 from battery, through the winding and over the front contact of relay 45, over the third conductor of the trunk T_2 and over the front contact of relay 44, through resistance 43, and over the lower make contact of key K_2' to ground. At the same time a new locking circuit is completed for the relay 44 from battery, through the winding and over the front contact of said relay, over the third conductor of the trunk, over the front contact of relay 45 and over the lower make contact of Key K_2 to ground. It will be seen that both relays 44 and 45 are maintained energized over circuits jointly controlled by the keys K_2 and K_2' , so that if either operator should restore her key, both of these relays will be maintained energized to prevent a false operation of the signal lamp which would otherwise occur. As soon as both operators have restored their keys, however, these relays will be deenergized and the circuits restored to normal. It will be noted that the arrangement of signal controlling and signal responsive relays, as well as the signal lamps and keys at the two ends of the trunk, are identical, so that calls may be made in either direction in the same manner as that already described.

When the operator at E actuates the key K_2 in response to the signal lamp 47, in addition to the operations already described, the actuation of said key closes a circuit from ground, over the lower make contact of said key, through the winding of relay 16, and through the winding of relay 8 to battery. Relays 8 and 16 are energized, the latter disconnecting ringing current from certain contacts of the key K and the former operating to disconnect the monitoring receiver 3 from the monitoring cord 5, and to connect the operator's set over the conductors 6 and 7 and the normal left hand contacts of key K to junction points 40 and 41, from which points the circuit is completed over the contacts of the trunk key K_2 to the tie line T_2 . It will be observed that the connection of the operator's set to the trunk in this case follows immediately upon the actuation of the trunk key, no delayed interval being introduced by the slow-acting relays 9 and 10. This interval is not necessary in this case, as ringing current is not employed in connection with the tie line T_2 .

Should the operator at E desire to ring over a tie line trunk such as T_2 , which is arranged for ring-down operation, the key K_2 of such trunk will be actuated, thereby completing the circuit already described for relays 8 and 16. The operator then throws the key K to the left, so that ringing current is applied over the outer left hand make contacts of said key and over the make

contacts of the trunk key such as K_2 , to the trunk. The energization of relay 16 prevents ringing current from being applied over the contacts of said relay and over the inner left hand make contacts of the key K to the monitoring cord 5. It will be seen, therefore, that the arrangement of the key K and relay 16 is such that the key K may be used for ringing either over a trunk, or over the monitoring cord independently, the ringing current being applied only to the trunk if a trunk key is actuated, since the energization of relay 16 prevents ringing current from being applied to the monitoring cord; and ringing current being applied only to the monitoring cord if no trunk key is actuated, since in this case the relay 16 will be maintained deenergized and no path for ringing current over the trunk will be provided by the trunk key.

By means of the circuit arrangement above described the desk operator may perform routine monitoring work and answer incoming calls; or make occasional outgoing calls, without disconnecting the monitoring cord or operating a special key for disconnecting this cord from her set, such disconnection being automatic upon the operation of any other key. Furthermore, it will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from that illustrated, without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a telephone system, a monitoring cord, an operator's set, switching means normally connecting the operator's set to the monitoring cord, a trunk connection, switching means for the trunk connection, and means whereby when the switching means of the trunk is operated the operator's set is disconnected from the monitoring cord and connected to the trunk by said first mentioned switching means.

2. In a telephone system, a monitoring cord, an operator's set normally connected thereto, a plurality of trunk connections, switching means for the trunk connections, and means whereby when the switching means of a trunk is operated the operator's set is disconnected from the monitoring cord and connected to the trunk, after a predetermined interval.

3. In a telephone system, a monitoring cord, an operator's set normally connected thereto over a high impedance path, a plurality of trunk connections, switching means for the trunk connections and means whereby when the switching means of a trunk is operated the operator's set is disconnected from the monitoring cord and connected to the trunk over a low impedance path.

4. In a telephone system, a monitoring

cord, an operator's set normally connected thereto over a high impedance path, a plurality of trunk connections, switching means for the trunk connections, and means whereby when the switching means of a trunk is operated the operator's set is disconnected from the monitoring cord and connected to the trunk over a low impedance path, after a predetermined interval.

5. In a telephone system, a monitoring cord, an operator's set normally connected thereto over a high impedance path, a plurality of trunk connections, switching means for the trunk connections, and means whereby when the switching means of a trunk is operated the operator's set is disconnected from the monitoring cord and connected to the trunk over a low impedance path, after a predetermined interval and whereby when the switching means is restored the operator's set is immediately disconnected from the trunk.

6. In a telephone system, a monitoring cord, an operator's set normally connected thereto, a trunk circuit, a trunk key and a holding key therefor, means whereby when the trunk key is operated the operator's set will be disconnected from the monitoring cord and connected to the trunk, and means whereby when the holding key is operated the operator's set will be maintained disconnected from the monitoring cord and from the trunk.

7. In a telephone system, a monitoring cord, an operator's set normally connected thereto, a plurality of trunk circuits, trunk keys and holding keys therefor, means whereby when any trunk key is operated the operator's set will be disconnected from the monitoring cord and connected to the corresponding trunk after a predetermined interval, and means whereby when the holding key of a trunk is operated the operator's set will be maintained disconnected from the corresponding trunk and the monitoring cord and in condition to be connected to any other trunk a predetermined interval after the operation of the trunk key thereof.

8. In a telephone system, a monitoring cord, an operator's set normally connected thereto, a plurality of trunk circuits, trunk keys and holding keys therefor, means whereby when any trunk key is operated the operator's set will be disconnected from the monitoring cord and connected to the corresponding trunk, and means whereby when the holding key of a trunk is operated the operator's set will be maintained disconnected from the corresponding trunk and the monitoring cord and in condition to be connected to any other trunk upon the operation of the trunk key thereof.

9. In a telephone system, a trunk, an operator's telephone set, a circuit over which said set may be connected to said trunk,

switching means for said circuit, and means responsive to the actuation of said switching means to connect said set to said trunk over said circuit after a predetermined interval, said means including a slow attracting relay and a slow releasing relay.

10. In a telephone system, a trunk, an operator's telephone set, a circuit over which said set may be connected to the trunk, switching means for associating said circuit with the trunk, a slow attracting relay and a slow releasing relay, and means responding to the actuation of said switching means, after said slow attracting relay has operated and said slow releasing relay has in turn released, to connect said set to said circuit.

11. In a telephone system, a trunk, an operator's set, a transmission circuit over which said set may be connected to the trunk, switching means for associating said circuit with the trunk, a slow attracting relay and a slow releasing relay, means operating upon the actuation of said switching means to complete circuits for said relays, means to open the circuit of the slow releasing relay upon the energization of said slow attracting relay, and means responsive to the energization of said slow attracting relay after the release of said slow releasing relay to connect said set with said transmission circuit.

12. In a telephone system, a line circuit, a trunk leading to a special position, a link circuit for connecting said line circuit to said trunk and applying ringing current to said trunk, an operator's set at said special position and switching means therefor, means responsive to the actuation of said switching means to disconnect the ringing current from the trunk, and means responsive to the actuation of said switching means to connect said operator's set to said trunk after a predetermined interval, said last mentioned means including a slow attracting relay and a slow releasing relay.

13. In a telephone system, a line circuit, a trunk leading to a special position, a link circuit for connecting said line circuit to said trunk and applying ringing current to said trunk, an operator's set at said special position and switching means therefor, means responsive to the actuation of said switching means to disconnect the ringing current from the trunk, a slow attracting relay and a slow releasing relay, and means responsive to the actuation of said

switching means to connect said operator's set with the trunk after said slow attracting relay has operated and said slow releasing relay has thereafter released.

14. In a telephone system, a plurality of trunks, an operator's telephone set, switching means for each trunk, means responsive to the actuation of the switching means of a trunk to connect said set to the trunk after a predetermined interval, said means including a slow attracting relay and a slow releasing relay, means whereby when the switching means is restored said set is immediately disconnected, said relays then being in condition to connect the set to another trunk, a predetermined interval after the actuation of the switching means of said other trunk.

15. In a telephone system, a ring-down trunk, a direct current signaling trunk, an operator's set, switching means whereby said operator's set may be connected to said ring-down trunk, a predetermined interval after the switching means has been actuated, and switching means operating to immediately connect the operator's set to the direct current signaling trunk.

16. In a telephone system, a monitoring cord, a trunk connecting circuit, an operator's set adapted to be connected either to said cord or said circuit and a common ringing key for applying ringing current either to said trunk connection or said cord exclusively.

17. In a telephone system, a monitoring cord, an operator's set normally connected thereto, a trunk, a transmission circuit over which said set may be associated with said trunk, switching means for disconnecting said set from said cord and connecting it to said trunk over said transmission circuit, a common ringing key having contacts for applying ringing current to said trunk and other contacts for applying ringing current to said cord, and means responsive to the actuation of said switching means to disconnect ringing current from said last mentioned contacts, whereby when said switching means are actuated together with said ringing key ringing current is applied to said trunk only and whereby when said ringing key is actuated alone ringing current is applied to said cord only.

In testimony whereof I have signed my name to this specification this third day of December, 1918.

WILLIAM A. RHODES.