

July 31, 1934.

A. C. POWELL

1,968,420

TELEPHONE SYSTEM

Filed Feb. 16, 1933

11 Sheets-Sheet 1

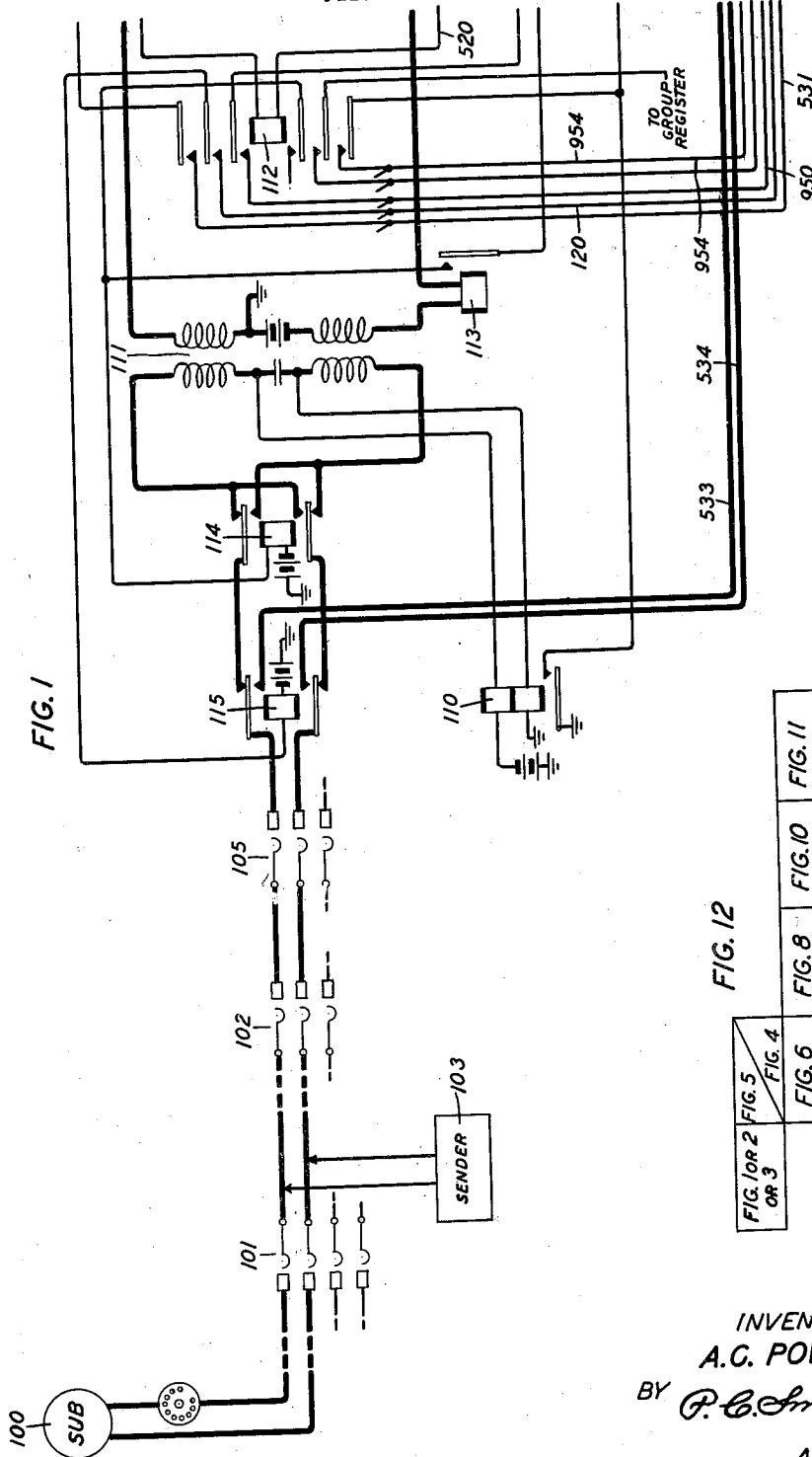


FIG. 12

FIG. 10R 2 OR 3	FIG. 5	FIG. 4	FIG. 8	FIG. 10	FIG. 11
	FIG. 6		FIG. 9		

INVENTOR
A.C. POWELL
BY *P. C. Smith*

ATTORNEY

July 31, 1934.

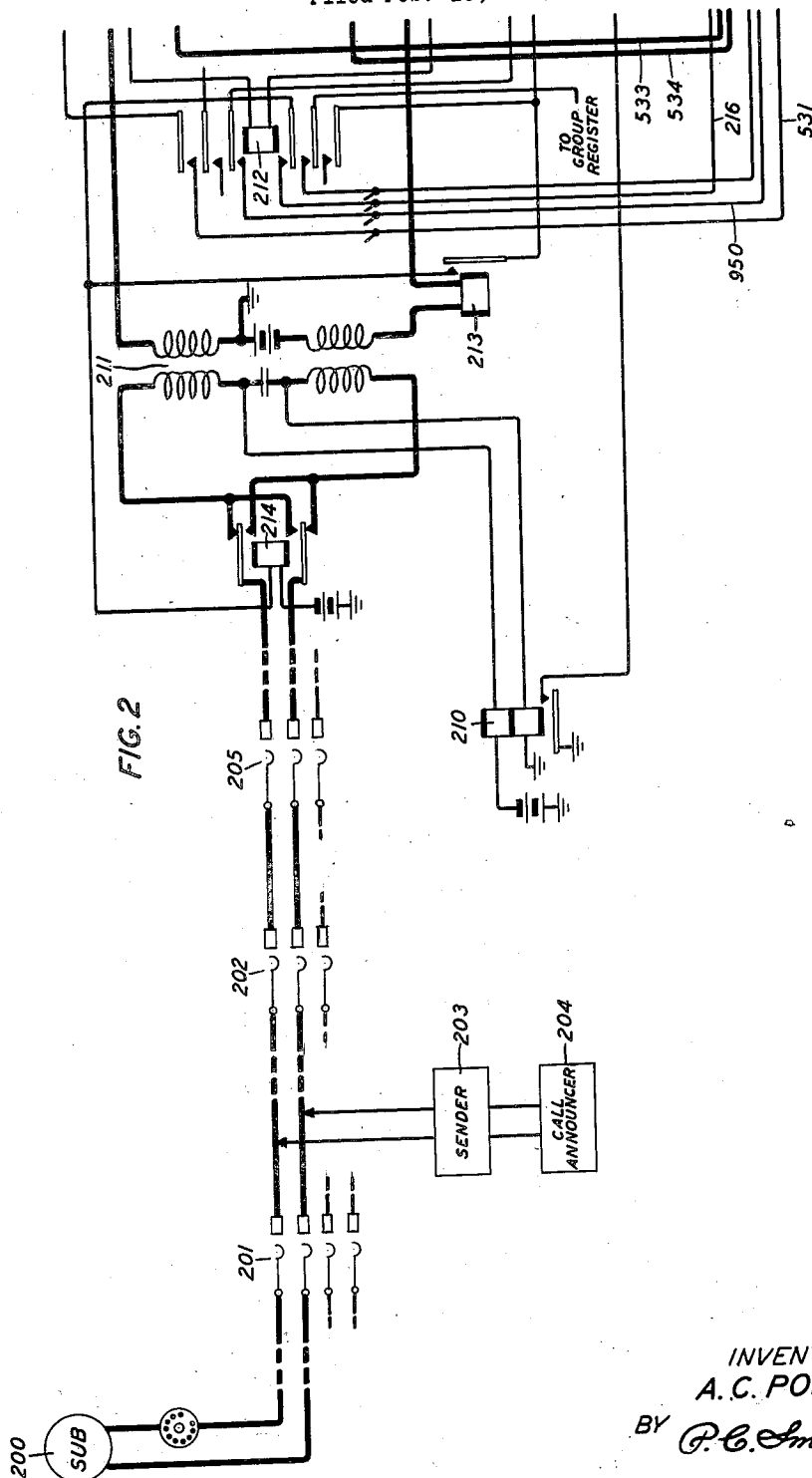
A. C. POWELL

1,968,420

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11 Sheets-Sheet 2



INVENTOR
A. C. POWELL
BY *P. C. Smith*

ATTORNEY.

July 31, 1934.

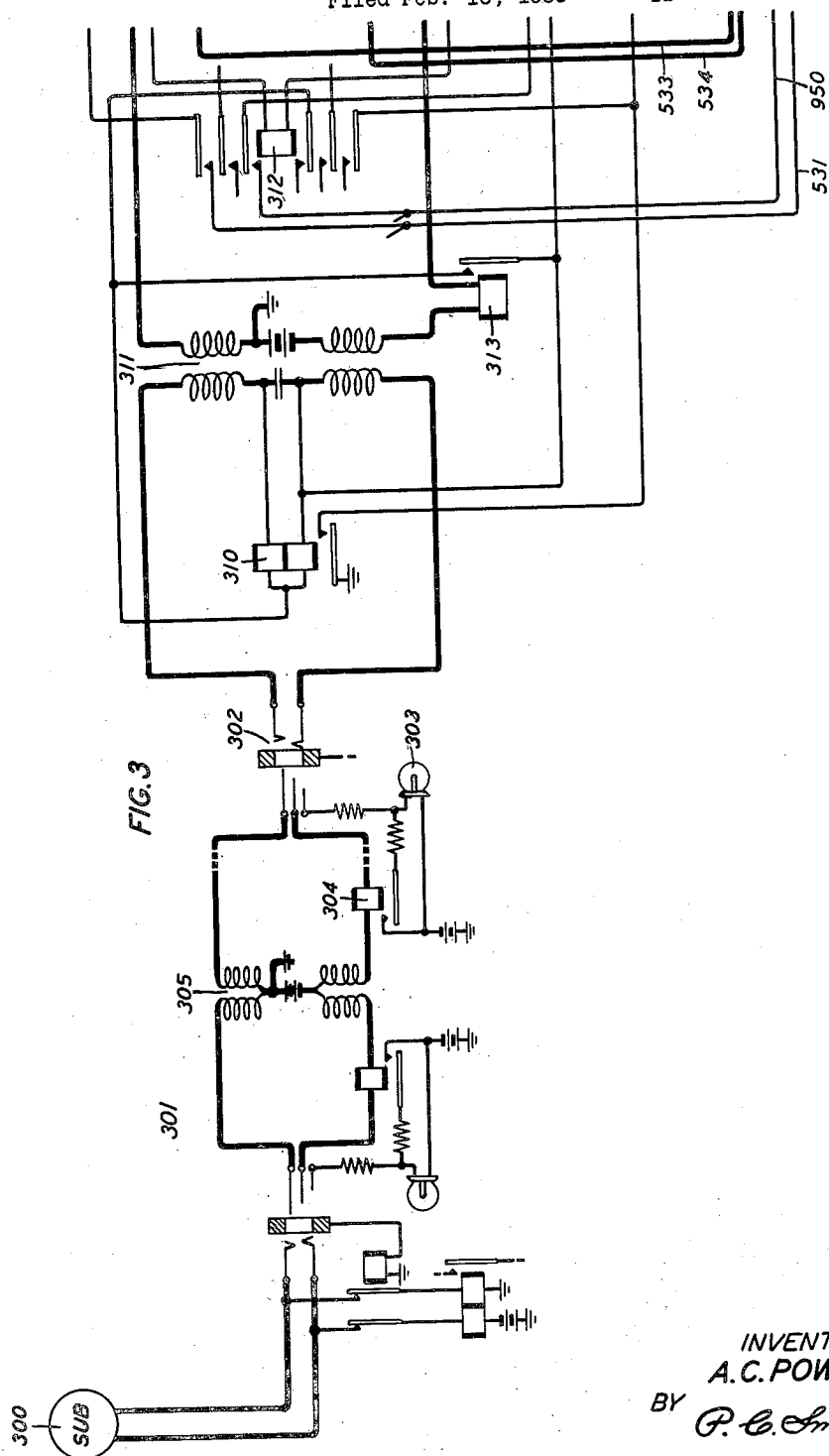
A. C. POWELL

1,968,420

TELEPHONE SYSTEM

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11 Sheets-Sheet 3



INVENTOR
A. C. POWELL.
BY *P. C. Smith*

ATTORNEY

July 31, 1934.

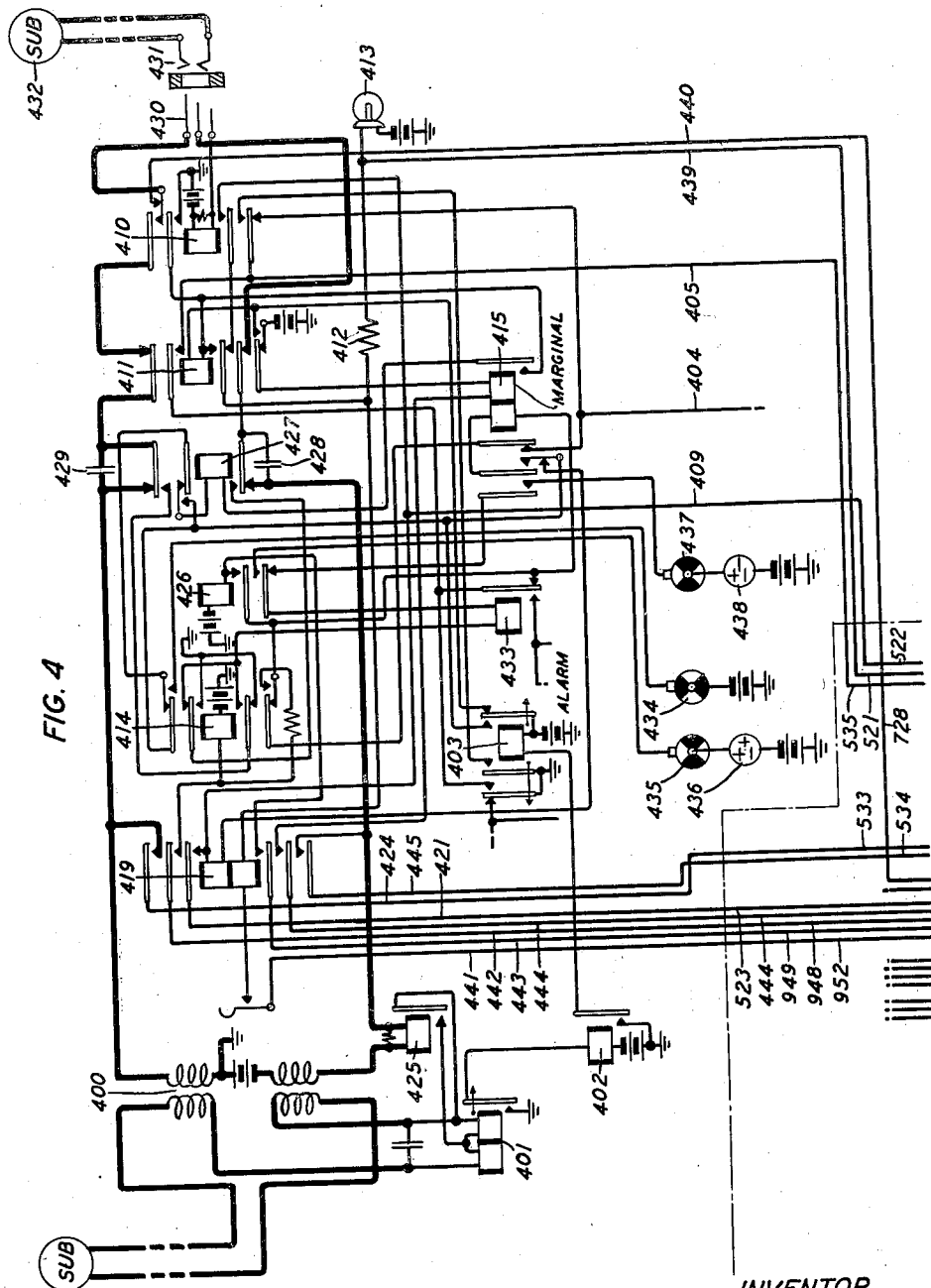
A. C. POWELL

1,968,420

TELEPHONE SYSTEM

Filed Feb. 16, 1933

11 Sheets-Sheet 4



INVENTOR
A. C. POWELL
BY *P. C. Smith*
ATTORNEY

July 31, 1934.

A. C. POWELL

1,968,420

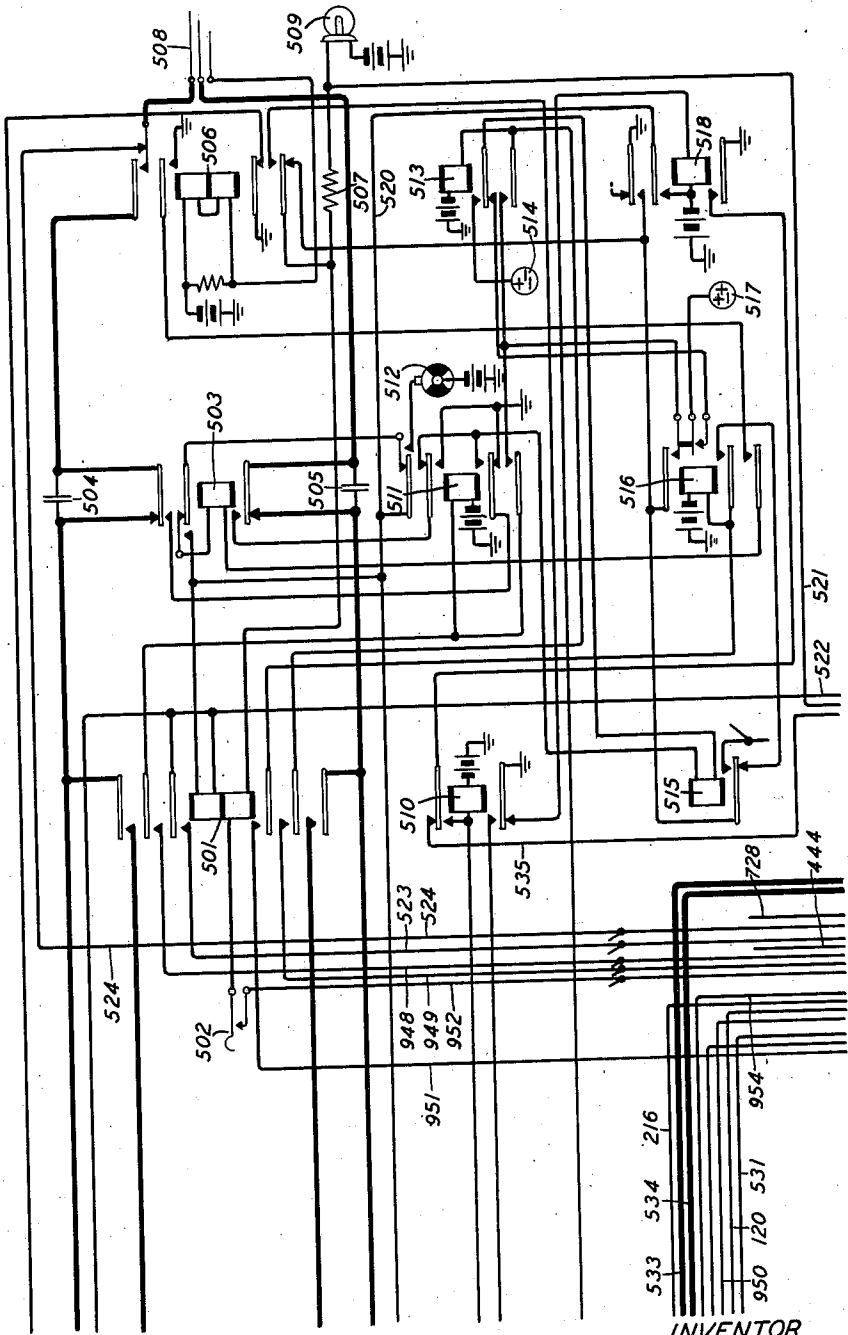
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FIG. 5

500



INVENTOR
A. C. POWELL
BY *P. C. Smith*
ATTORNEY

July 31, 1934.

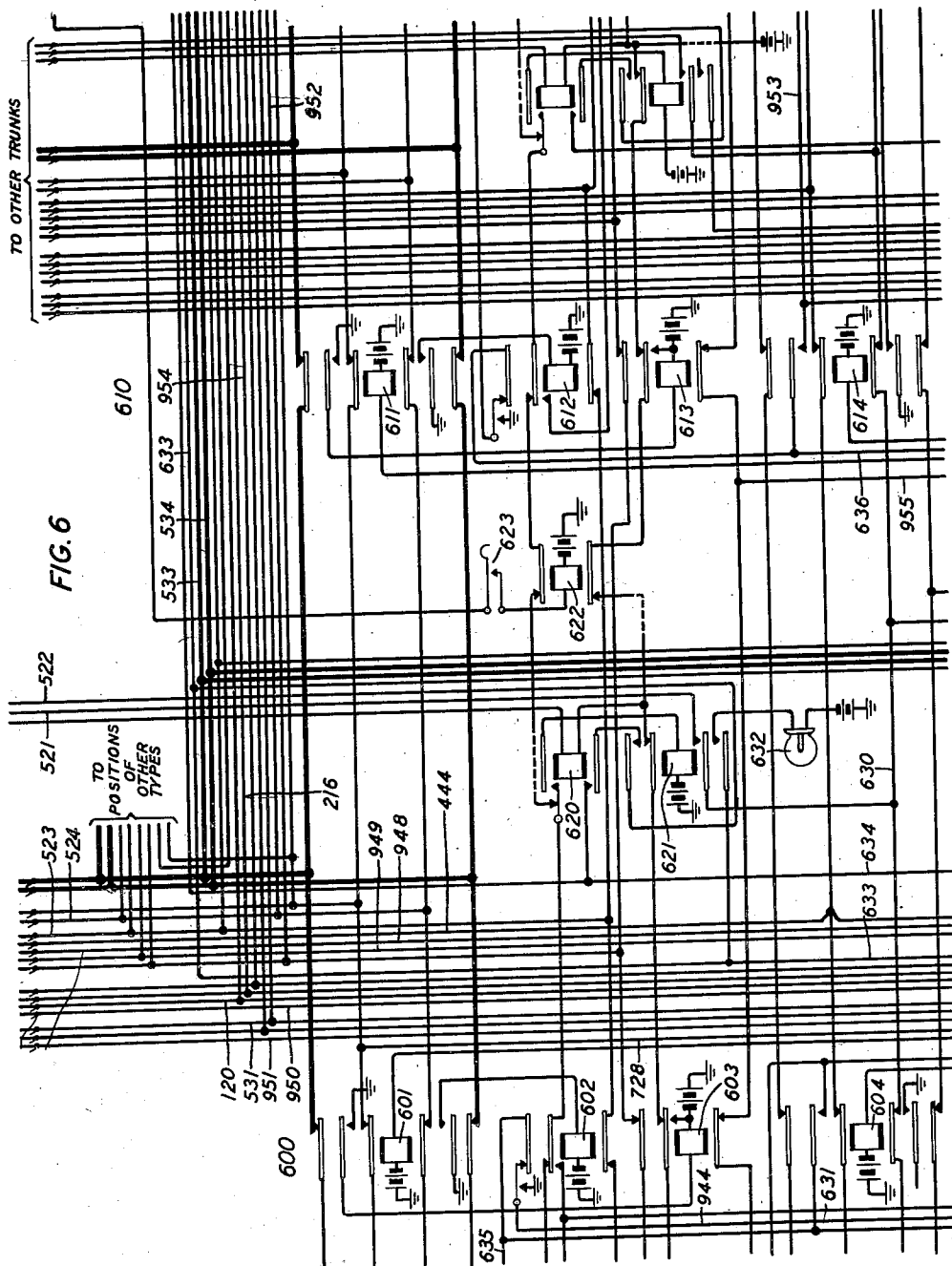
A. C. POWELL

1,968,420

TELEPHONE SYSTEM

Filed Feb. 16, 1933

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INVENTOR
A. C. POWELL

BY *P. C. Smith*

ATTORNEY

July 31, 1934.

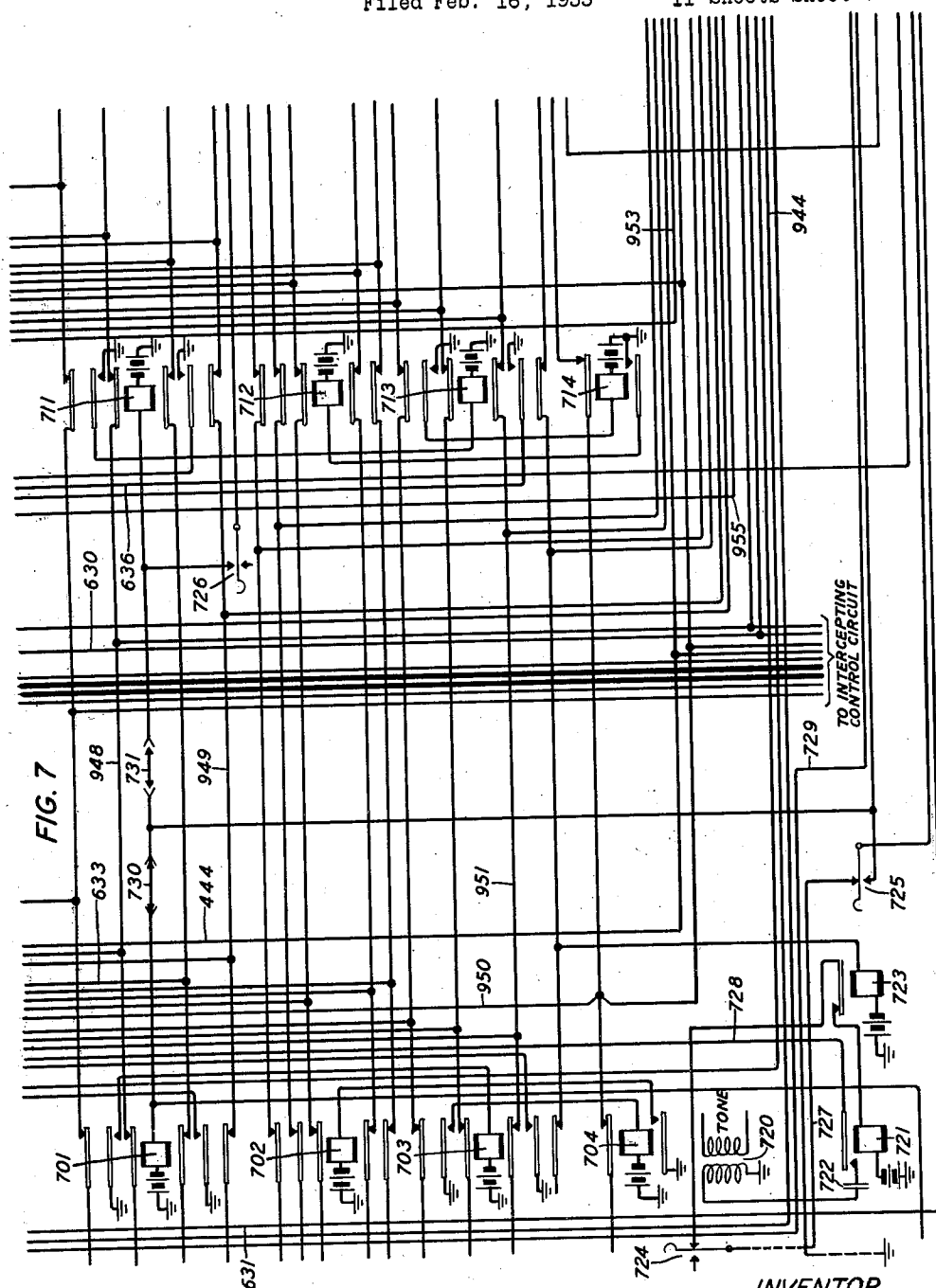
A. C. POWELL

1,968,420

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Filed Feb. 16, 1933

11 Sheets-Sheet 7



INVENTOR
A. C. POWELL
BY *P. C. Smith*

ATTORNEY

July 31, 1934.

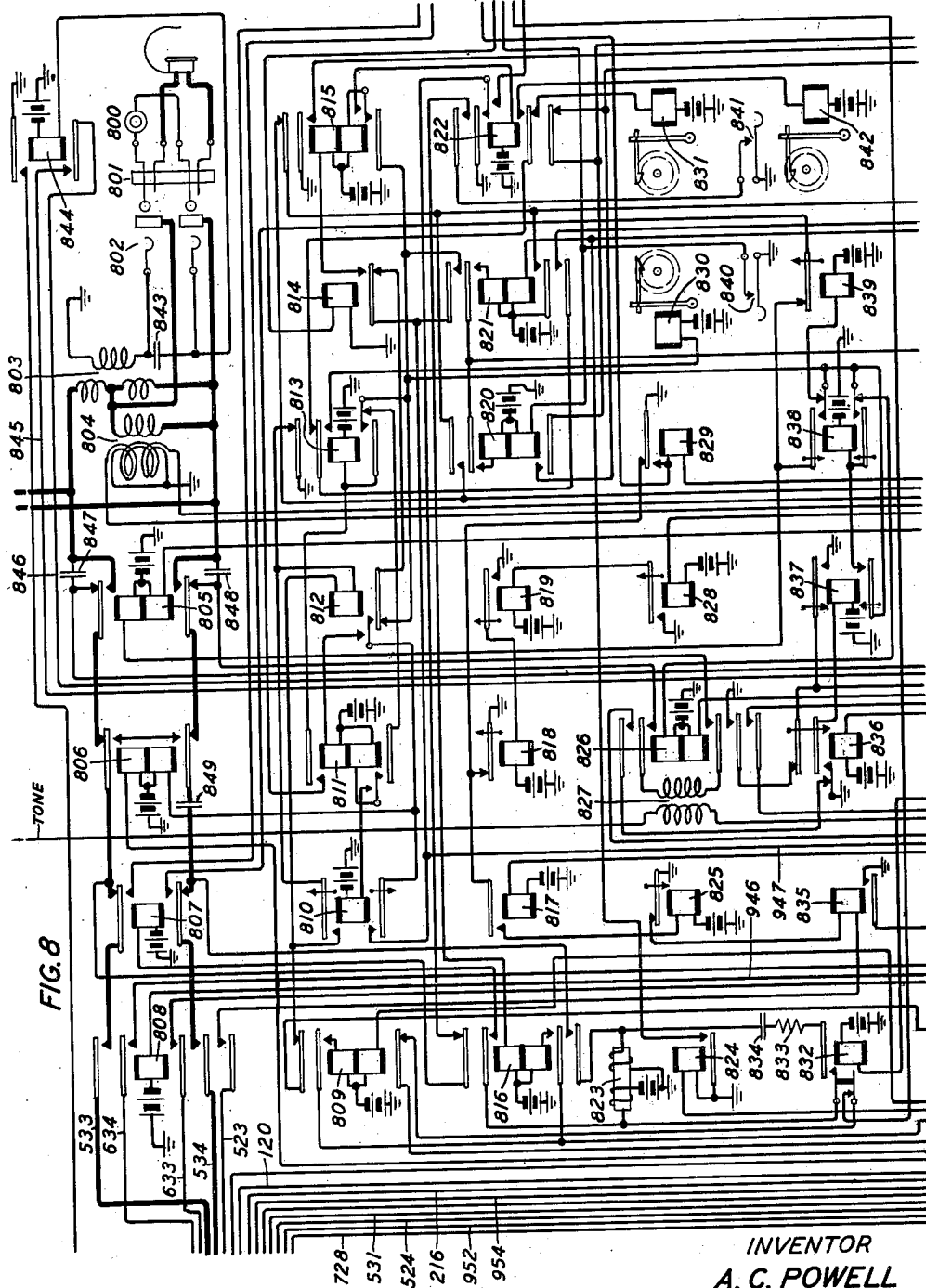
A. C. POWELL

1,968,420

TELEPHONE SYSTEM

Filed Feb. 16, 1933

11 Sheets-Sheet 8



INVENTOR
A. C. POWELL
BY *P. C. Smith*
ATTORNEY

July 31, 1934.

A. C. POWELL

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11 Sheets-Sheet 9

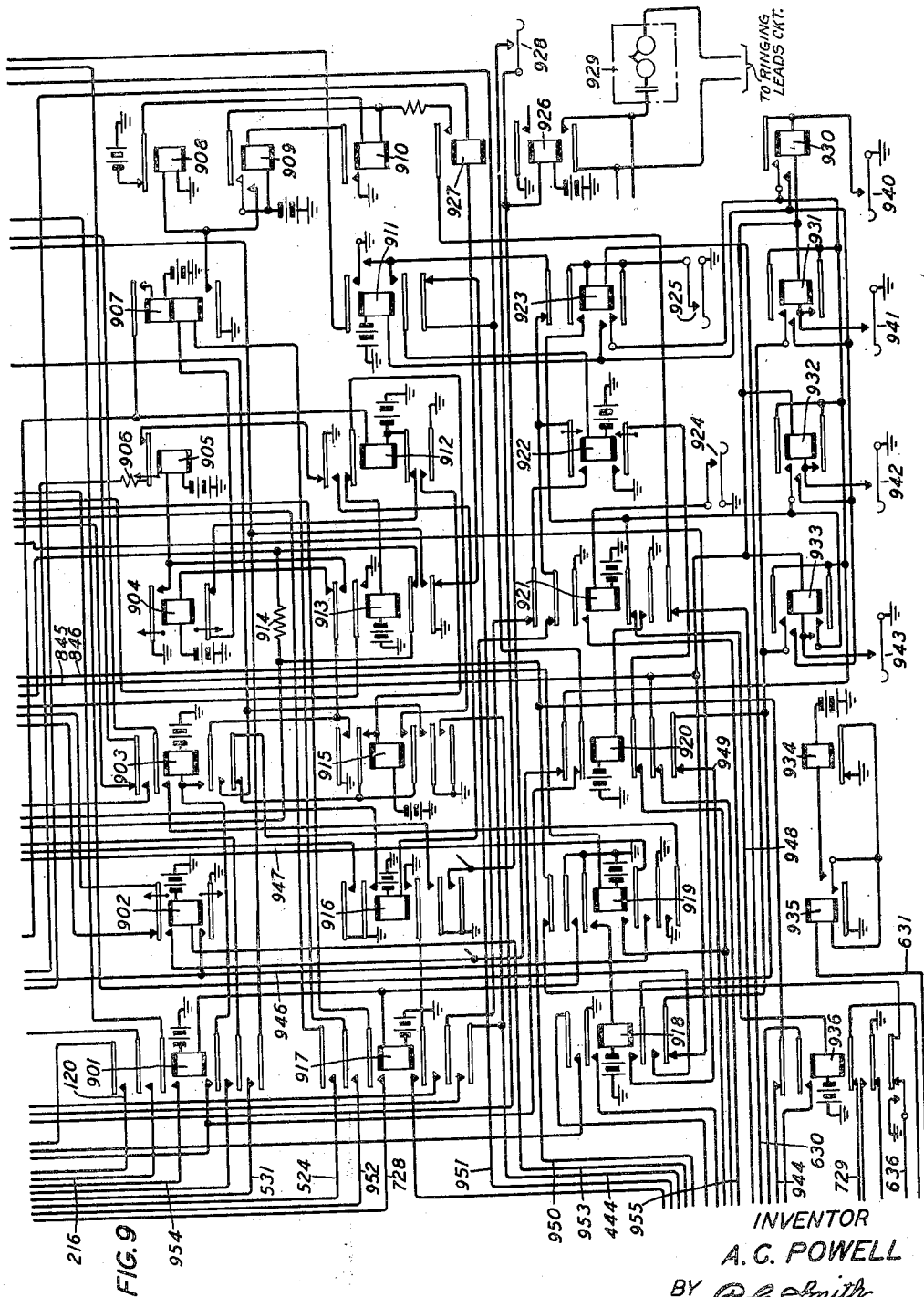


FIG. 9

INVENTOR

A. C. POWELL

BY *P. C. Smith*

ATTORNEY

July 31, 1934.

A. C. POWELL

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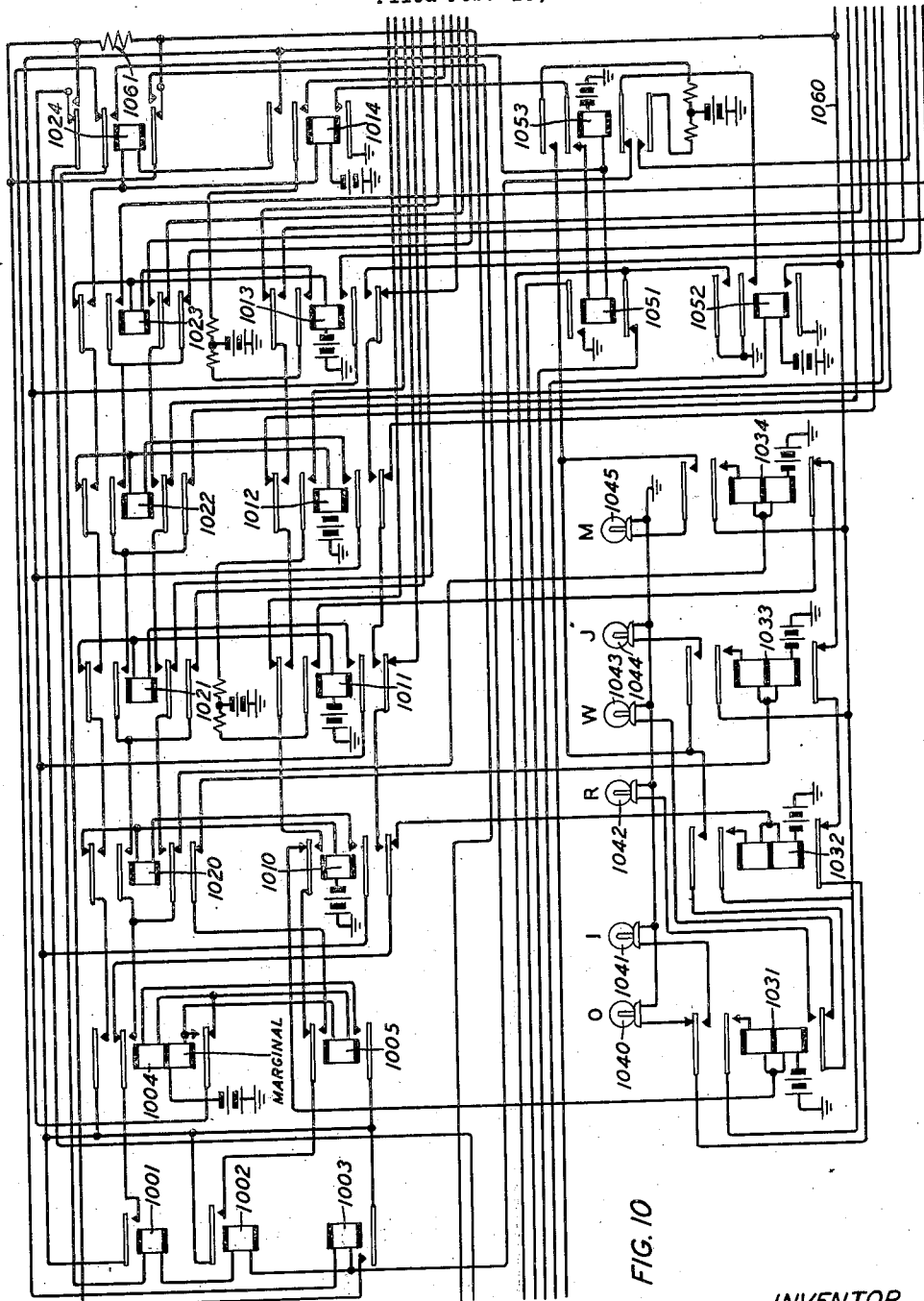


FIG. 10

INVENTOR
A. C. POWELL

BY *P. C. Smith*

ATTORNEY

July 31, 1934.

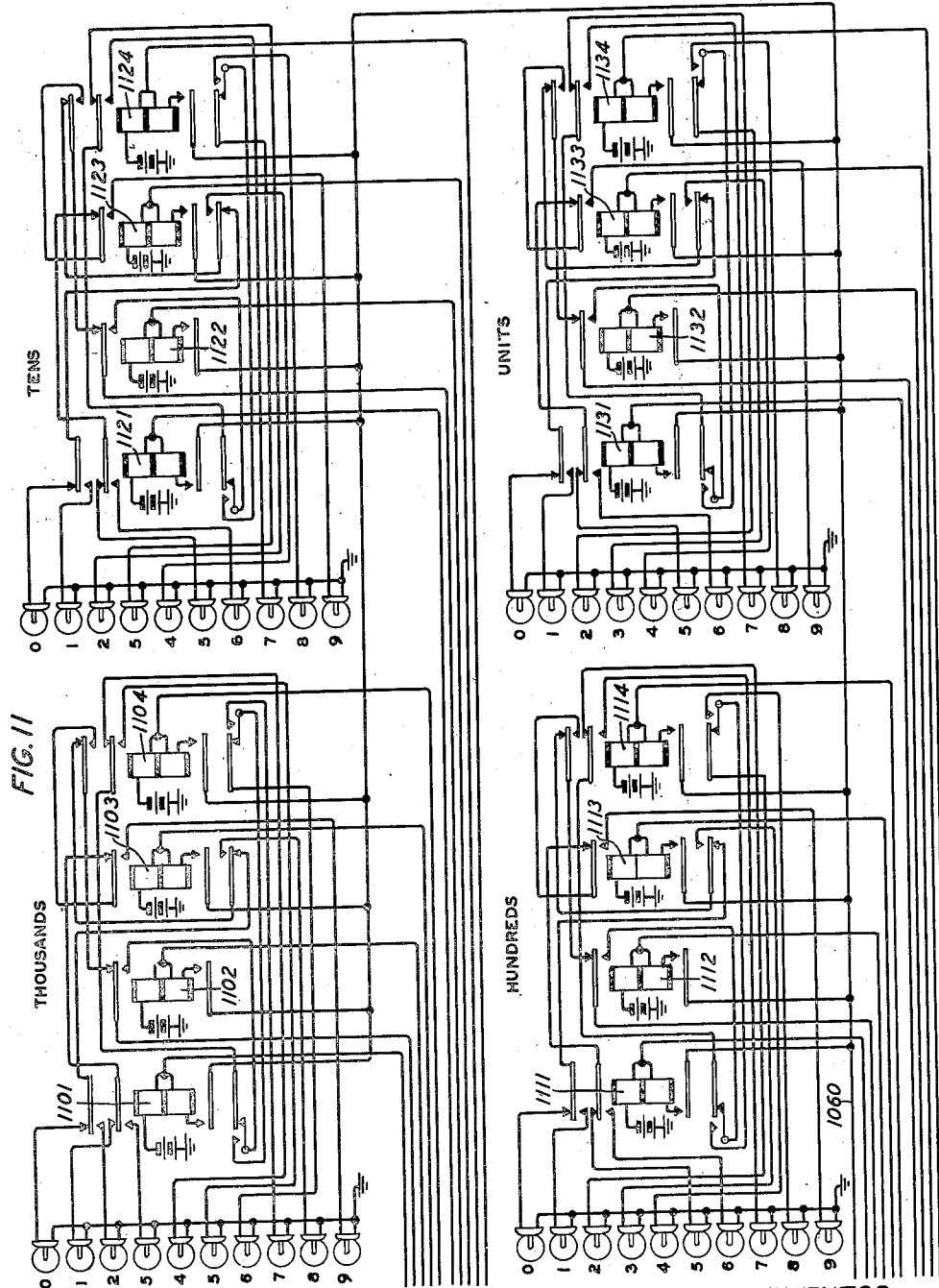
A. C. POWELL

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TELEPHONE SYSTEM

Filed Feb. 16, 1933

11 Sheets-Sheet 11



INVENTOR
A. C. POWELL
BY *P. C. Smith*
ATTORNEY

UNITED STATES PATENT OFFICE

1,968,420

TELEPHONE SYSTEM

Albert C. Powell, New York, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application February 16, 1933, Serial No. 657,027

29 Claims. (Cl. 179—27)

This invention relates to telephone systems and has for its object to increase the efficiency with which connections are established between telephone offices of different types.

Manual telephone offices in large exchange areas must be equipped to handle calls incoming both from manual and dial offices and the operators must receive their instructions either directly from an originating operator or by means of code impulses or call announcements from dial offices. Even if single operators' positions may be arranged to receive instructions in only one manner, during periods when the traffic is light the number of calls incoming at certain positions may be insufficient to warrant the services of an individual operator and a single operator may have to handle calls incoming from a number of different types of offices.

It is also desirable to reduce the amount of work that the operator has to perform in completing a connection. Accordingly, the operator has been provided with equipment for automatically connecting her head set with the trunks over which calls are incoming and for preparing circuits for automatically ringing the called subscriber under control of keys common to the trunks of her position. In addition this equipment is arranged to identify the nature of the incoming trunks and reacts thereto to cause the transmission of the called line number either automatically or orally.

In accordance with the present invention, an improved trunk circuit is provided, in which the operation of a common ringing key operates a relay which locks under the control of the calling subscriber and releases to display a disconnect signal. In addition a control circuit is provided which will identify trunks of four different kinds and if an incoming trunk is one over which called line numbers are transmitted by means of code impulses, it transfers the trunk conductors to a recorder, provides a holding circuit for the trunk until the impulses have been received at which time the original holding circuit is reestablished, prevents the transmission of a signal to initiate the transmission of impulses if the trunk plug is still in the jack from a previous call, and renders the common ringing keys ineffective if the pulses are not completely recorded.

This position circuit is also equipped for handling calls incoming from other manual offices or from dial offices equipped with call announcer machines. If the position equipped with such a control circuit is grouped with a position having no recorder for receiving the call indicator impulses, all calls must be handled from the former

position. Means have therefore been provided to connect a continuous tone to the operator's telephone if under such a grouping arrangement she attaches her telephone to the wrong position.

This and other features of the invention will be more clearly understood from a consideration of the following description in connection with the drawings in which:

Fig. 1 shows in diagrammatic form a panel dial office and a portion of a trunk outgoing to a manual office;

Fig. 2 shows in diagrammatic form a panel tandem office equipped with call announcer mechanism and a portion of a trunk outgoing to a manual office;

Fig. 3 shows a manual office and a portion of a trunk outgoing to a second manual office;

Fig. 4 shows a complete trunk circuit at the manual office;

Fig. 5 shows a portion of a trunk circuit appearing at a manual office;

Figs. 6 and 7 show a trunk splitting circuit;

Figs. 8 and 9 show a position control circuit; and

Figs. 10 and 11 show a call indicator recorder. The portion of the trunk circuit shown on Fig. 5 is the same for each of the three types of trunks but has been shown only once. Figs. 1 and 5 show a complete trunk incoming from a panel office equipped with a call indicator impulse which will be referred to hereinafter as a call indicator trunk.

Figs. 2 and 5 together show a complete trunk incoming from a panel office equipped with a call announcer mechanism which will be referred to as a call announcer trunk. Although the office equipped with the call announcer has been shown as a tandem office, it might equally well be an originating office similarly equipped.

Figs. 3 and 5 together show a complete trunk connecting two manual offices which will be identified as a straightforward trunk.

Fig. 4 with the exception of the skeletonized incoming circuit is a copy of Fig. 3 of Patent No. 1,905,662, granted to H. M. Ulrich April 25, 1933. This trunk circuit differs in certain details from the trunks of Figs. 1 to 3 and is normally served by the position control circuit disclosed in the above identified application. However, it may also be served by the position control circuit of the present application.

The equipment at the manual office includes the trunk circuits of the four types shown in Figs. 1, 2, 3 and 4 which may all appear before a single operator or may appear in individual

positions. Assuming that there are a number of positions, each operator's position is provided with a trunk splitting or grouping circuit as shown in Figs. 6 and 7 and a position control circuit as shown in Figs. 8 and 9. For positions at which call indicator trunk circuits appear, a recorder such as shown in Figs. 10 and 11 is provided.

Other positions may or may not have such a recorder. The trunks appearing at an operator's position are divided into two groups and each group is connected in multiple to the splitting or grouping circuit. One group is also connected in multiple directly to the position control circuit, while the other group is connected thereto over the back contacts of the splitting relays. In addition each trunk is provided with a pair of sequence relays which determine the order in which the trunks may be connected to the position control circuit.

The splitting circuit of Figs. 6 and 7 has for its purpose to permit the establishment of operators' divisions of desirable size. Key 725 controls the relays of group 600 and key 726 controls the relays of group 610. When none of the splitting keys is operated the control circuit is connected through the splitting circuit to all of the trunks at the switchboard. The operation of key 725 upon operating the relays of group 600, opens the conductors between the positions and disconnects all of the trunks at the left. The operation, by key 726, of the relays of group 610 disconnects the trunks of the right group from the trunks of the left group and from the control circuit which normally serves them. Since each position normally serves forty trunks, it is therefore possible to form operators' positions containing forty or more trunks in multiples of twenty. Since the group of trunks at the right of the position is not directly connected to a control circuit, the operating circuit for the splitting relays has been carried over the back contact of the adjacent splitting keys to prevent creating a group of trunks to which no control circuit has access. For example, the circuit of the splitting relay of the left adjacent position corresponding to relay 711, which operates all of the remaining splitting relays of the group, extends over the operated contact of key 724 of the left adjacent position, normal contact of key 725, normal contact of the emergency relay 936 to ground over conductor 729 which extends over the back contact of the emergency relays of other positions to ground. The circuits of relays 701 and 711 are modified by the use of straps 730 and 731 where they appear at the right or left end positions, respectively. For the purpose of describing the action of the trunk and control circuit, it will be assumed that key 725 has been operated, operating relay 701 over strap 730, the operated contact of key 725, inner lower normal contact of relay 936 to ground over conductor 729. Relay 701 operates relays 604 and 703; relay 703 operates relays 601 and 704; relay 601 operates relays 602 and 603; and relay 704 operates relay 702. It will also be assumed that the similar key and relays at the next right position have also been operated.

Having prepared the operator's position by the use of the splitting keys, the operator then connects her head set with the position control circuit by inserting plug 801 in jack 802 thereby closing a circuit from ground through the right winding of repeating coil 803 through the plug and jack contacts and the transmitter 800 to battery through the winding of relay 844.

Relay 844 in operating closes a circuit from battery through the winding of relay 919, conductor 845, lower front contact of relay 844, conductor 846, upper back contact of relay 936, conductor 944 to ground over the outer upper front contact of relay 602. Relay 919 in operating closes obvious circuits for relays 901, 917 and 918 and also closes a circuit from battery through the winding of relay 808, conductor 946 to ground at the middle lower contact of relay 919, thereby operating that relay.

Call indicator call

The first call to be described will be one over a call indicator trunk. When the subscriber at substation 100 desires to call a subscriber in the office at which the equipment under consideration is located, he will remove his receiver from the switchhook whereupon his line will be connected by means of line finder 101 to district selector 102 and the sender 103. He will then dial the number of the wanted subscriber and the sender 103 will control the district selector 102 and the office selector 105 to select the trunk outgoing to the wanted office.

After the trunk has been selected, the sender connects a relay across the tip and ring conductors, establishing a circuit from battery through the upper winding of relay 110, upon left winding of repeating coil 111, upper back contacts of relays 114 and 115 over the tip brushes of the office selector 105 and the district selector 102 through the relay (not shown) in the sender, back over the ring brushes of the district and office selectors, lower back contacts of relays 115 and 114, lower left winding of repeating coil 111 to the lower winding of relay 110 and ground. Relay 110 operates, closing a circuit for relay 518. Relay 518 closes a circuit from battery through lamp 509, resistance 507, lower back contact of relay 506 to ground at the outer upper front contact of relay 518, lighting the trunk guard lamp as an indication that a call is incoming on the associated trunk. It also connects battery over its inner upper contact to conductor 520, preparing a circuit for relays 501, 112, etc. In addition, it closes a circuit from ground over its lower front contact, upper back contact of relay 510 to the winding of relay 620, and at its upper back contact it removes ground from a circuit for controlling a group busy register.

Relays 620 and 621 constitute a pair of sequence relays individual to the trunk and the circuits for these relays extend in series over the contacts of the corresponding relays of other trunks in the first group and over the contacts of the splitting relays 612 and 613, to the sequence relays of the second group so that the trunks of the entire position are served in a particular arbitrary order. The circuit of relay 620 extends over the back contact of relays corresponding to relay 621, over the back contact of relay 622, upper back contact of relay 613 and thence to battery over the front contact of a relay corresponding to relay 603 at the position on the right. Assuming that no other trunk is associated with the control circuit of Figs. 8 and 9, relay 620 will operate, in turn closing a circuit from battery through the winding of relay 621, upper front contact of relay 620, over the front contact of relay 602, conductor 631, through the winding of relay 935 to ground at the back contact of relay 934. With relays 620 and 621 operated the operator's

position is individualized to this particular trunk.

Relay 621 in operating closes a circuit from battery through lamp 632, outer lower front contact of relay 621, conductor 633, inner lower front contact of relay 808, winding of relay 927, to ground at the lower back contact of relay 913. Relay 927 operates in series with lamp 632, and closes a circuit from battery over the back contact of relay 908, through the winding of relay 910, upper front contact of relay 927, lower back contact of relay 921, conductor 630, inner lower front contact of relay 621, conductor 521, through resistance 507, back contact of relay 506 to ground at the upper front contact of relay 518. This circuit is in shunt of lamp 509, but, due to the high resistance of relay 910 has no effect on that lamp. However, relay 910 closes an obvious circuit for relay 909, which in turn closes a circuit for relay 908. Relay 909 connects battery over its upper front contact in shunt of the winding of relay 910 over the front contact of relay 927 to conductor 630. The connection of battery to the winding of relay 910 releases that relay and the connection of low resistance battery to conductor 630 reduces the current flow in lamp 509 sufficiently to dim that lamp. As soon as relay 910 releases, it in turn releases relays 909 and 908 so that battery is removed from the winding of relay 910 and conductor 630, permitting the lamp to return to full brilliance and relay 910 to reoperate. This cycle of operations is continued until ground is removed from conductor 630 by the operation of relay 506 as described hereinafter.

With relays 620 and 621 operated, a circuit is closed for relays 501 and 112 which extends from battery over the inner upper front contact of relay 518, conductor 520, upper winding of relay 501 in parallel with the winding of relay 112, conductor 522, upper front contact of relay 621, lower front contact of relay 620, conductor 634, inner upper front contact of relay 808, resistance 906, back contact of relay 905 to ground at the upper back contact of relay 912. Relay 501 closes a locking circuit for itself and for relay 112 over the inner upper front contact of relay 501, conductor 523, lowermost front contact of relay 808, through the winding of relay 835 to ground at the back contact of relay 825. Relay 835 in operating closes a circuit for relay 912 which removes ground from the operating circuit of relays 501 and 112 to prevent the connection of any other trunk to the control circuit. It also disconnects battery from the emergency operating circuit for relay 501 which will be described hereinafter. Relay 912 at its upper front contact, closes a circuit for relay 916, and at its lower front contact, closes a circuit through the winding of relay 915. Relay 915 locks over its inner upper front contact, lower back contact of relay 903 to ground at the outer lower front contact of relay 919. Relay 915 closes a circuit from ground over its upper front contact, back contact of relay 913, winding of relay 904 and battery. Relay 904 in turn operates relay 905, further disconnecting ground from the operating circuit of relay 501.

When relay 112 operates, the position circuit makes a test to determine whether or not the plug 508 is still in the jack with which it was last used. When the plug 508 is in a jack, relay 506 is operated, but with the plug removed, relay 506 is not operated and ground is closed

over its inner lower back contact, outer upper front contact of relay 112, conductor 531, outer lower front contact of relay 901, through the lower winding of relay 821 to battery. Relay 821 when operated locks through its upper winding and inner upper front contact to ground at the middle lower front contact of relay 915.

As stated hereinbefore, this control circuit is capable of handling trunks of a plurality of types and each type identifies itself to the control circuit. A call indicator trunk of the type being described is identified by the connection of battery through relay 115 over the middle upper front contact of relay 112 to conductor 120. Therefore, as soon as relay 112 operates, a circuit is closed from conductor 120 over the upper front contact of relay 901, lower back contact of relay 809, normal contact of relay 832, back contact of relay 1051 in the recorder circuit, winding of relay 814 to ground. Relay 115 cannot operate in series with relay 814, but relay 814 operates to identify the trunk as a call indicator trunk, and, in conjunction with other relays, prepares the position to handle a call indicator call. Relay 814 also opens the circuit of relay 826 to prevent the premature generation of the order tones.

With relay 814 operated, the operation of relay 916 closes a circuit from battery through the upper winding of relay 815, front contact of relay 814, conductor 947 to ground at the outer upper contact of relay 916. Relay 815 locks over its outer lower front contact, over the upper front contact of relay 821 to grounded conductor 947. It also extends its locking ground to the winding of relay 822 which operates. In addition, relay 815 closes a circuit from ground at its inner upper front contact over the upper back contact of relay 903 to the winding of relay 828 and battery. Relay 828 in turn operates relays 819 and 818. The function of these relays will be described hereinafter.

Relay 822 in operating closes a circuit from ground over its innermost upper contact through the winding of relay 1052 to battery to prepare the recorder circuit for receiving the call indicator impulses. Relay 1052 in operating connects ground to conductor 1060 thereby supplying locking ground for the register relays. It also connects ground to the winding of relay 814 in shunt of battery, thereby releasing relay 814, and back over the circuit of relay 814 to the winding of relay 115. Relay 115 operates in series with this direct ground disconnecting the tip and ring conductors from the windings of relay 110 and connecting them to conductors 533 and 534, respectively. Relay 1052 also closes a circuit from ground over its inner upper contact, back contact of relay 1053, through the winding of relay 829, inner upper front contact of relay 901, conductor 954, lowermost contact of relay 112 to the winding of relay 518 and battery holding that relay operated during the time that relay 110 is released by the disconnection of the trunk conductors from it. Relay 829 locks to ground at its front contact thus holding operated under the control of the trunk.

Relay 822 in operating also closes a circuit from battery through the winding of relay 807, back contact of relay 816 to ground at the middle upper contact of relay 822. The operation of relay 807 transfers the trunk conductors from the operator's repeating coil 803 to the windings of relays 1001, 1002 and 1003 of the recorder, the circuit extending from the tip conductor over the upper

front contact of relay 115, conductor 533, outer upper front contact of relay 808, upper front contact of relay 807, lower back contact of relay 1024, through the windings of relays 1003, 1002, and 1001 in series, outer upper back contact of relay 1024, front contacts of relays 807, 808, conductor 534, lower front contact of relay 115, to the ring conductor.

With relay 821 operated, the operation of relay 916 starts the generation of the order tones by closing a circuit from ground over the outer upper front contact of relay 916, conductor 947 to the upper front contact of relay 821 and thence over the lower normal contact of relay 838 to the upper winding of relay 826 and battery and over the upper normal contact of relay 838 to the winding of relay 839 and battery. Relay 839 performs no function in connection with call indicator trunks. Relay 826 in operating connects the right winding of tone coil 827 over its inner front contacts, through condensers 847 and 848 to the left winding of the operator's repeating coil 803. It also closes a circuit from the source of tone through the left winding of repeating coil 827, inner lower back contact of relay 913, back contact of relay 836 to ground at the middle lower front contact of relay 826, thereby completing the circuit for transmitting the first order tone. In addition, relay 826 operates relay 836 in a circuit extending from battery through the winding of relay 836, back contact of relay 902, outer lower front contact of relay 826, to ground at the inner upper front contact of relay 916. Relay 836, in operating, disconnects ground from the left winding of tone coil 827, interrupting the tone, and connects ground over its inner upper contact to the winding of relay 837. Relay 837 reconnects ground to tone coil 827 and closes a circuit from battery through the winding of relay 838, lower contact of relay 837, front contact of relay 821 to grounded conductor 947. Relay 838 opens the circuit of relay 839 and of relay 826 thereby disconnecting the tone coil from the operator's headset and in turn releasing relays 836 and 837, thereby removing ground from the primary winding of tone coil 827. Relay 838 locks over its inner lower front contact to ground over the front contact of relay 821 and conductor 947. Relays 836, 837 and 838 are slow to operate thereby determining the periods for which the tone is applied and the interval between tones. Relay 838 also closes a circuit from battery through the upper winding of relay 805, upper front contact of relay 838, front contact of relay 821 to grounded conductor 947, thereby operating relay 805. Relay 805 normally connects the operator's telephone to the tip and ring conductors of the trunk but, since relay 807 is operated, this is ineffective at the present time. The operation of relays 826, 836, 837, 838 and 805 serves to transmit a warning tone to the operator although it is not transmitted out over the trunk.

The substitution of the circuit through relays 1001, 1002 and 1003 for battery and ground through relay 110 as previously described causes the release of the relay in the sender to initiate the transmission of the call indicator impulses. These impulses are received on relays 1001, 1002 and 1003, relay 1003 responding to negative impulses, relay 1002 to positive impulses and relay 1001 to heavy impulses of either polarity although the code does not include heavy positive impulses except as a final pulse. The first time that relay 1003 operates it closes a circuit from grounded conductor 1060 over the front contact of relay

1003, inner upper back contact of relay 1024, lower back contact of relay 1004, winding of relay 1005, lower winding of relay 1004 to battery. Relay 1005 operates in this circuit closing a circuit from battery through the lower winding of relay 1004, winding of relay 1005, upper winding of relay 1004, front contact of relay 1005 to grounded conductor 1060. The upper operating winding of relay 1004 is maintained shunted at this time over the operating circuit of relay 1005. When the pulse ends this shunting ground is removed and relay 1004 operates. The next operation of relay 1003, therefore, closes a circuit from grounded conductor 1060 over the front contact of relay 1003, inner upper back contact of relay 1024, lower front contact of relay 1004, through the lower winding of relay 1004 to battery, holding relay 1004 operated and shunting the winding of relay 1005 so that relay 1005 now releases. At the termination of the second pulse, relay 1004 also releases.

As is well known, the call indicator code consists of two negative impulses which may be either light or heavy so that relays 1004 and 1005 operate and release as each digit is received. A light positive pulse may be transmitted either before the first negative impulse or between the two negative impulses and this positive impulse and the heavy negative impulses serve to operate the registers. The first time that relay 1004 operates a circuit is closed from battery through relay 1010, upper back contact of relay 1020, upper front contact of relay 1004 to grounded conductor 1060. When relay 1004 releases at the termination of the digit, the locking circuit closed by relay 1010, which extends from battery through the winding of relay 1010, winding of relay 1020, inner lower front contact of relay 1010 to grounded conductor 1060, becomes effective and relay 1020 operates. At each operation of relay 1004 one pair of the transfer relays is operated, relays 1010 and 1020 being operated during the reception of the first or station's digit, relays 1011 and 1021 following the thousands digit, relays 1012 and 1022 following the hundreds digit, relays 1013 and 1023 following the tens digit, and relays 1014 and 1024 following the units digit. Each of the five registers consists of four relays which may be numbered from left to right 1, 2, 3 and 4. During the first or station's digit, a positive impulse before the first negative impulse closes a circuit from grounded conductor 1060 over the front contact of relay 1002, back contact of relay 1005 which has not yet operated, back contact of relay 1010 which is also non-operated through the lower winding of relay 1031, while a positive impulse between the two negative pulses after the operation of relay 1005 closes a circuit from grounded conductor 1060 over the front contact of relay 1002, front contact of relay 1005, lower back contact of relay 1020 through the lower winding of relay 1033 to battery. Marginal relay 1001 which responds to heavy negative impulses, if operated during the first negative pulse closes a circuit from grounded conductor 1060 over the front contact of relay 1001, back contact of relay 1004, since relay 1004 does not operate until the termination of the first negative pulse, lower back contact of relay 1010, through the lower winding of relay 1032 to battery, while, if operated during the second negative pulse, it closes a circuit over the front contact of relay 1004, inner lower back contact of relay 1020 to the lower winding of relay 1034 and battery. Similar circuits may be traced under the control of the other transfer relays to the other registers.

When relay 1004 operates after the first negative pulse of the last or units digit, relay 1014 is operated closing a locking circuit through relay 1024 to grounded conductor 1060 which becomes effective after the last negative impulse has been received. Relay 1024 in operating rearranges the impulsing circuit so that the negative relay 1003 may respond to the final heavy positive pulse. For this purpose the circuit extends from the tip conductor, as previously traced, to the upper front contact of relay 807, thence over the lower front contact of relay 1024, through the winding of relay 1003, upper front contact of relay 1024, lower front contact of relay 807, back to the ring conductor instead of in series through the windings of the three relays. Relay 1024 also connects resistance 1061 in parallel with the winding of relay 1003 to protect it. Since relay 1024 is now operated, the operation of relay 1003 connects ground from conductor 1060 over the front contact of relay 1003, inner upper front contact of relay 1024, through the winding of relay 1053 to battery. Relay 1053 closes a locking circuit for itself through the winding of relay 1051 to ground at the lower front contact of relay 1014. When the final heavy positive pulse is terminated, relay 1003 releases and relay 1051 operates, disconnecting ground from the winding of relay 115 to permit that relay to release and restore the tip and ring conductors to the windings of relay 110. It also connects ground over its upper front contact to the lower winding of relay 820 which locks over its inner upper front contact to ground at the middle lower front contact of relay 915 as a signal that the designation has been completely received. The restoration of the circuit for relay 110 causes that relay to reclose the holding circuit for relay 518 and connects ground in shunt of the winding of relay 829 which thereupon releases.

The operator may now depress one of the ringing keys 940, 941, 942 or 943 to establish the proper ringing control for calling the wanted subscriber. Assuming that she operates key 943, a circuit is closed from ground over that key through the winding of relay 933, upper front contact of relay 820, inner lower front contact of relay 821 to battery. With relay 933 operated, ground from key 943 is extended over the inner lower contact of relay 933, inner lower back contact of relay 921, conductor 948, middle upper front contact of relay 501 to the winding of relay 511 and battery. A circuit is also closed from the contact of key 943, over the upper armature and outer upper front contact of relay 933, outer lower back contact of relay 920, over conductor 949, middle lower front contact of relay 501 through the winding of relay 513 and battery.

A third circuit is closed from key 943 over the lower contacts and lower armature of relay 933, outer upper back contact of relay 920, inner lower front contact of relay 901, winding of relay 903 to battery. Relay 903 locks over its inner lower front contact to ground at the outer upper front contact of relay 915. It also closes a circuit from ground at the middle lower contact of relay 916, inner upper front contact of relay 903, outer lower contact of relay 821, inner upper back contact of relay 813, lower front contact of relay 822 to battery through the winding of register 842 which records the number of calls handled over call indicator trunks. The operation of relay 903 also opens the circuit of relay 828 which in turn releases relays 819 and 818. It likewise closes a circuit from ground at the upper front contact of relay 815 over the outer upper front contact of

relay 903 to battery through the winding of relay 832. The functions of these relays will be described hereinafter. Relay 903 also connects ground over the lower contact of relay 919, over the lower front contact of relay 903 to the locking circuit for relays 820 and 821 to prevent battery from being disconnected from the common ringing keys and the release key. Furthermore, relay 903 opens the locking circuit of relay 915.

An additional circuit is closed from ground on key 943 over the lower contacts and armature of relay 933, upper armature and both upper contacts of relay 933, winding of relay 911 and battery. Relay 911 in operating closes ground over its outer upper front contact, over the lower front contact of relay 820, providing the recorder circuit has been completely operated, inner upper back contact of relay 920, conductor 950, inner upper front contact of relay 112 to the winding of relay 510 and battery. Relay 510 locks over its inner upper front contact to ground at the lower front contact of relay 518. Relay 911 connects ground over its two upper contacts, upper back contact of relay 923, inner upper back contact of relay 921, conductor 951, inner lower front contact of relay 501, through the winding of relay 516 and battery. In addition relay 911 connects ground over its two upper contacts and inner lower front contact to the winding of relay 922 and battery. Relay 922, in operating, connects ground over its lower front contact, inner lower back contact of relay 920, inner lower front contact of relay 919, through the winding of relay 817 and battery. Relay 817, if either relay 818 or 829 has released, connects ground from the back contact of that relay over the front contact of relay 817 to the winding of relay 825 and battery. Relay 825 disconnects ground from the winding of relay 835 thereby opening the locking circuit of relay 501 and relay 112 so that the position control circuit is now completely disconnected from the trunk circuit.

Relay 835 in releasing opens the circuit of relay 912 which in turn opens the operating circuit of relays 915 and 916. Relay 915 releases, if its locking circuit has been opened by relay 903, in turn opening the locking circuit of relay 903. In addition relay 915 releases relay 904 which in turn releases relay 905. Therefore after an interval measured by the slow releasing character of relays 904 and 905, ground over the upper back contact of relay 912 is connected to the operating circuit of relay 501 and battery over the lower back contact of relay 912 to the emergency circuit for operating relay 501 so that another trunk may be connected to the control circuit. Relay 916 immediately removes the ground from conductor 947 releasing relays 805, 838, 815 and 822. It also opens the operating circuit for the peg count meter. The release of the ringing key releases relays 911, 922, 817 and 825 and opens the operating circuit of relay 903. Relay 903 in releasing opens the holding circuits of relays 820 and 821 whereupon the position control circuit is completely restored to normal.

In the trunk circuit, relay 516 locks over its inner lower front contact, lower back contact of relay 515 to ground at the outer upper front contact of relay 518. With relay 516 operated, a holding circuit is closed for relays 513 and 511 over their outer lower front contacts and the outer upper front contact of relay 516, to ground at the front contact of relay 518, to prevent their release when the control circuit is disconnected from the trunk.

The operator then tests the jack of the wanted subscriber in the usual manner, the test circuit extending from the tip of plug 508 over the normal contact of relay 506, conductor 524, outer upper front contact of relay 917, through one winding of the repeating coil 804 to ground. Assuming that the subscriber's line is idle and no click occurs, the operator then inserts plug 508 in the subscriber's jack whereupon ground on the sleeve of the jack completes a circuit for the sleeve relay 506 which operates. Relay 506 in operating completes the tip conductor and disconnects the busy test circuit. It also connects ground over its inner upper front contact, lower front contact of relay 516, to the winding of relay 503, and its inner upper normal contact, upper front contact of relay 511 to interrupter 512 and battery. When the interrupter closes its contact, relay 503 operates, locking over its inner upper front contact to battery at the inner upper front contact of relay 518. With relay 503 operated the tip conductor is extended over the outer upper front contact of relay 503 and the inner lower front contact of relay 511, winding of the tripping relay 515, inner lower front contact of relay 513 to negative superimposed ringing current source 514, while the ring conductor is extended over the lower front contact of relay 503, inner upper front contact of relay 511 to ground. Relay 511 therefore determines to which conductor the ringing current is to be connected while relay 513 determines whether positive or negative superimposed current is to be employed.

The called subscriber is signaled in this circuit and when he removes his receiver from the switchhook, relay 515 is energized, opening the locking circuit for relay 516 which thereupon releases in turn releasing relays 511 and 513. The release of relay 511 also opens the circuit of relay 503 which in turn releases relay 515 and the circuit is now ready for conversation. While relay 515 is operated it connects ground over its front contact to an alarm circuit to guard against its failing to release and thereby preventing ringing the next subscriber. The restoration of the tip and ring conductors, by the release of relay 503, permits supervisory relay 113 to operate in series with the called subscriber's line thereby closing a circuit from battery through the winding of relay 114, front contact of relay 113 to ground at the inner lower front contact of relay 510 which is held locked under the control of relay 518. The operation of relay 114 reverses the connection of battery and ground through the windings of relay 110 to the incoming trunk conductors to cause a supervisory signal to be given to the district selector 102 for charging purposes.

When the called subscriber restores his receiver at the end of the conversation, relay 113 is released and in turn releases relay 114, signaling the district selector that conversation has been terminated. The district selector may also receive this information from the calling subscriber and release after an interval. The release of the district selector opens the circuit of relay 110 which opens the holding circuit for relay 518 thereby in turn releasing relay 510. With relay 510 released, a circuit is closed from ground at the back contact of relay 510, over the lower front contact of relay 506, resistance 507, to lamp 509 causing that lamp to light steadily as a disconnect signal, as long as the plug remains in the jack. When the operator removes the plug from the jack, relay 506 releases, extinguishing lamp 509. If this trunk should be reselected before the

plug is removed from the jack, the operations previously described take place for associating the trunk with the position circuit. However, since relay 506 is operated, ground is removed from conductor 531 and relay 821 can not operate and therefore neither the tone signal nor the signal to the sender can be transmitted.

Call announcer call

Trunks incoming from tandem offices where the connection is to be completed through the operation of a call announcer are made up of the portion shown on Fig. 2 and the same portion shown on Fig. 5 as is used in connection with the call indicator trunk. These trunks are identified to the control circuit by the connection of battery through the winding of relay 214, inner lower front contact of relay 212, conductor 216, middle upper front contact of relay 901, upper back contact of relay 809, through the winding of relay 812 to ground at the upper back contact of relay 813. Relay 812 in operating opens the operating circuit of relay 826 which controls the order tone relays to prevent the order tone signal from being transmitted to the operator prematurely. When relay 916 operates in response to the connection of the trunk with the position control circuit in the manner previously described, relays 811 and 806 are operated over the front contacts of relay 812 and the back contact of the call indicator relay 814. Relay 811 in operating locks through its lower winding and lower front contact, normal contact of relay 813, front contact of relay 821, which operates if the plug 508 is not in a jack as described, to grounded conductor 947. Relay 810 is also operated over the locking circuit of relay 811. Relay 806 in operating disconnects the tip and ring conductors of the trunk from the operator's headset to prevent clicks from being transmitted to the telephone circuit when the trunk reversing relay operates and releases to signal the sender. It also connects the tip and ring conductors together at its front contacts to charge condenser 849 before connecting the operator's telephone to the trunk.

Relay 810 closes a shunt around the winding of relay 812 which now releases. This shunt reduces the resistance in series with relay 214 which now operates and reverses the tip and ring conductors to the sender, thereby preparing for the operation of the call announcer 204. At the same time relay 810 connects ground from conductor 947 over its lower front contact, to the lower winding of relay 806 to hold it operated after relay 812 releases. Relay 812 in releasing connects ground from conductor 947 over the lower back contacts of relays 814 and 812, lower normal contact of relay 838 to the upper winding of relay 826 and battery. Relay 826 causes the successive operation of relays 836, 837, 838 and 805 in the manner previously described, thereby transmitting an order tone to the operator whose headset is connected to the control circuit.

The order tone relays in this case are also used to time the duration of the interval during which ground is connected to relay 214, that is the duration of the signal to the sender. The operation of relay 810 simultaneously operates relays 214 and 826, and in parallel with relay 826, relay 839. When relay 838 operates it terminates the second tone impulse and operates relay 805. It also opens the operating circuit of relay 839 which releases slowly to extend the time during which relay 214 is held operated slightly beyond the last tone. When it completely releases, it closes a

circuit from battery through the winding of relay 813, upper front contact of relay 811, back contact of relay 839, upper front contact of relay 838, front contact of relay 821 to grounded conductor 947. Relay 813 on operating locks over its lower front contact and the back contacts of relays 812 and 814 or the front contact of relay 821 to grounded conductor 947 and disconnects ground from the upper armature of relay 810 thereby releasing relay 214 to terminate the reverse battery signal and start the transmission of the call announcement. In addition relay 813 releases relays 811 and 810 and prepares the circuit for the call announcer peg count meter 830.

The release of relay 810 in turn releases relay 806 removing the short circuit from the condenser 849 and connecting the tip and ring conductors through to the armatures of relay 805 which now being operated extends them through the left winding of the operator's talking coil 803 so that the operator may receive the wanted number from the call announcer. Relay 810 is slow to release and slightly delays the release of relay 806 until the reversing relay in the trunk has had time to release in order to prevent an objectionable click from being received by the operator.

The completion of the call takes place as described for the call indicator trunk. When the ringing key is operated, in turn operating relay 903, a circuit is closed from battery through the winding of peg count meter 830, inner upper front contact of relay 813, outer lower front contact of relay 821, inner upper front contact of relay 903 to ground at the middle lower front contact of relay 915, thereby recording on meter 830 the completion of a call over a call announcer trunk.

Straightforward call

Trunks incoming from manual offices, commonly known as straightforward trunks are made up by combining the circuit of Fig. 5 with a portion of Fig. 3. In the case of a straightforward call, the subscriber removes the receiver from the switchhook, operating his line relay and displaying a lamp (not shown) in front of an operator who inserts the answering plug of cord 301 (shown schematically) in the answering jack and ascertains the wanted number from the calling subscriber. She then inserts the calling plug in the jack 302 of the outgoing trunk. In this case battery and ground are supplied from the cord and the circuit extends through the two windings of relay 310 in series and the winding of supervisory relay 304 of the operator's cord. However, the lower winding of relay 310 is of such high resistance that supervisory relay 304 can not operate.

Relay 310 in operating closes a circuit for relay 518, which is a slow-to-release relay for straightforward trunks, and the connection of the trunk with the position control circuit proceeds as previously described. A straightforward trunk is identified to the control circuit by the absence of potential on conductors 216 and 120 and therefore neither relay 814 nor relay 812 is operated. In consequence, neither relay 806 nor relay 807 is operated to prevent the transmission of the tone to the calling operator and the order tones are audible to both operators. Since neither relay 814 nor relay 812 is operated, the order tones are not delayed, and relay 826 operates in a circuit through its upper winding, lower back contact of relay 838, back contact of relay 812, back contact of relay 814 to grounded conductor 947, without waiting for the test by relay

821 to determine whether or not the plug has been withdrawn. The tones and wanted number may therefore be transferred from one operator to the other, but the battery for the operation of any of the ringing relays, such as relays 930, 931, 932 is not available until relay 821 has operated indicating that the plug has been removed from the multiple. Likewise, since neither relay 822 nor relay 813 is operated, the operation of the ringing key followed by the operation of relay 903 completes the circuit for register 831 over the lower back contact of relay 822, inner upper back contact of relay 813, lower front contact of relay 821, inner upper front contact of relay 903 to ground at the middle lower front contact of relay 916 to record the completion of a connection over a straightforward trunk.

This control equipment may also be used in connection with the older type of automatic listening common key ringing trunk such as shown in the patent to H. W. Ulrich above mentioned and shown completely in Fig. 4. The sequence relay similar to relay 621 individual to this trunk carries an extra pair of contacts which connect conductors 404 and 405 together. This type of trunk is identified to the position circuit by the connection of battery from the lower back contact of relay 411, through to the right winding of relay 415, middle lower front contact of relay 419 to conductor 444, over the outer lower front contact of relay 917 through the winding of relay 824 to ground. Relay 415 does not operate in this circuit, but relay 824 in operating connects ground over its lower front contact through the lower winding of relay 821 to battery, operating that relay which locks and prepares the ringing and release keys as previously described. It is to be noted that with the plug 430 in the jack 431, relay 410 is operated and connects ground over its inner upper front contact to the winding of relay 411 which receives battery over the back contact of relay 403 when the trunk is released at the originating office. Relay 411 locks from battery over its outer lower front contact, through the winding of relay 411 to ground at the front contact of relay 410 therefore preventing the connection of battery to the winding of relay 415 as long as the plug 430 remains in a jack. The operation of relay 824 therefore both identifies the type of trunk and acts as a test of whether or not the plug is in a jack. The operation of one of the ringing keys, in turn operating relays 922 and 911, connects ground over the inner upper contact of relay 911, back contact of relay 923, upper contact of relay 922, outer upper back contact of relay 921, to conductor 444 in shunt of the winding of relay 824, operating relay 415. Relay 415 locks through its left winding over the front contact of relay 403 and the back contact of the tripping relay 433. Relay 415 releases the trunk from the control circuit and prepares the trunk for ringing the wanted subscriber. Otherwise, the operation of the control circuit is the same as for the previously described straightforward trunk.

In case a call comes in over a straightforward trunk which must be connected to the intercepting operator, after the intercepting operator has determined the correct routing, she will be connected under the control of a pair of sequence relays similar to relays 620 and 621 to the position control circuit. The intercepting operator then passes the correct number to the trunk operator whereupon the operator depresses key 502 to reconnect the trunk with the position and

then disconnects plug 508 from the jack leading to the intercepting operator's position. When the trunk is disconnected from the intercepting jack, the position control circuit releases from the intercepting position and when relay 506 releases with key 502 operated, a circuit is completed from ground at the upper front contact of relay 518, lower back contact of relay 506, the lower winding of relay 501, key 502, conductor 952, middle upper front contact of relay 917, through the lower winding of relay 907, lower back contact of relay 904, lower back contact of relay 912 to battery. Relay 907 operates locking over its upper contact to the operating circuit of relay 912 which is closed when relays 501 and 312 lock. Relay 907 prevents the flashing relays 908 to 910 from functioning. From this point the operation is the same as previously described. Key 502 may also be used for emergency operation in case of failure of the sequence relay chain circuit.

If a call comes in over a trunk which is either a call announcer or call indicator trunk as shown in Figs. 1 and 2, requiring the services of an intercepting operator, and is then reconnected to the trunking operator's position, it is necessary for the control circuit to recognize that the trunk has been previously connected for the same call in order to prevent the control circuit from functioning the trunk to signal the sender in the panel office to transmit a called number. This feature is accomplished by the use of relay 809. When the trunk was connected with the intercepting jack, the position was released from the trunk by the operation of trunk release key 925, operating relay 911 which in turn operated relay 510 in the trunk circuit. Relay 510 locks under the control of relay 518 as previously described. When the control circuit is reconnected with the trunk, relay 809 is connected in a circuit from battery through its lower winding, middle lower front contact of relay 917, lower back contact of relay 911, inner upper back contact of relay 920 to conductor 950, which extends over the inner upper contact of relay 212, for example, to the winding of relay 510 and over the locking circuit of that relay to ground at the lower front contact of relay 518. Since relay 911 is operated, before relay 510 is operated on an ordinary call, relay 809 can not operate, but when the position circuit is connected with a trunk on which relay 510 has already been operated, relay 809 operates locking through its upper winding and inner upper contact to ground at the outer lower contact of relay 915. With relay 809 operated, the circuit of relays 814 and 115 is opened as well as the circuit of relays 812 and 214 and, therefore, the control circuit is prevented from sending a signal to the sender. When relay 911 is operated as a result of operating one of the ringing keys, relay 809 is disconnected from the circuit of relay 510 and when the control circuit releases, the locking circuit of relay 809 is opened.

When a call is abandoned after the trunk has been connected to the position control circuit, relay 310, for example, releases in turn releasing relay 518. The release of relay 518 disconnects battery from the winding of relay 501 thereby opening the locking circuit of that relay and in turn opening the circuit of relay 835. Relay 835 in turn releases relay 912 and the position control circuit is restored to normal in the usual manner with one exception. Relay 915 remains locked over the back contact of relay 903 to ground at the lower front contact of relay 919. With relay 915 operated and relays 912 and 903 released, a circuit is

closed from battery through the winding of relay 913, upper back contact of relay 912, inner lower front contact of relay 915, back contact of relay 903 to ground at the lower front contact of relay 919. Relay 913 in operating closes a circuit from ground at the outer upper front contact of relay 915, outer upper front contact of relay 913 to the winding of relay 905 holding that relay operated. It also closes a circuit from ground at its outer lower front contact, through the lower winding of relay 821 holding that relay operated. In addition, it closes a circuit from ground at its inner upper front contact through the lower winding of relay 826 to battery. With relays 826 and 913 operated, a circuit is closed through the primary winding of tone coil 827, through resistance 914, back contact of relay 836 to ground at the middle lower front contact of relay 826 thereby creating a tone in the right winding of relay 826 which is transmitted over the condensers 847 and 848 to the left winding of the operator's repeating coil 803. This tone is reduced in volume due to the introduction of resistance 914 in the circuit. In addition relay 913 disconnects ground from the winding of relay 927 thereby disabling the flashing relays and preventing the flashing of the guard lamp of any trunk. With relay 905 held operated, the operating circuit for relay 501 is also opened, preventing the connection of another trunk with the position control circuit. The reduced steady tone created by the joint operation of relays 913 and 826 is a signal to the operator that the call is abandoned. She will therefore operate release key 925 which in turn operates relay 923 in a circuit from ground over key 925, winding of relay 923, outer lower front contact of relay 918 to battery at the lower front contact of relay 821. Relay 923 connects ground from key 925 over its outer lower front contact, upper back contact of relay 920, inner lower front contact of relay 901 to the winding of relay 903 and battery. Relay 903 locks over its inner lower front contact to ground at the front contact of relay 915. Relay 923 also connects ground over its inner lower front contact to the winding of relay 911 which performs its usual functions in the release of the control circuit. In addition it connects ground over its upper front contact, lower back contact of relay 921, conductor 948, middle upper front contact of relay 501 to the winding of relay 511 and battery. Relay 511 is ineffective at this time, since none of the other ringing relays is operated. Relay 903 in operating opens the holding circuit of relay 915 and that relay releases, in turn releasing relay 913. Relay 913 in releasing opens the circuit of relay 826 which terminates the abandoned call tone. It also reconnects ground to the winding of relay 927 permitting the flashing circuit to function if a call is incoming at the time. It also releases relay 905 thereby preparing a circuit for connecting trunks with the position control circuit and in addition closes the shunt at its lower back contact around resistance 914 so that the order tones may be of the normal strength.

On call indicator calls, once the call has been extended to the trunk, the abandonment of the call by the calling subscriber is ineffective to release the connection, but is effective to change the wanted number to a series of zeros. If, due to some error in the functioning of the circuit, the pulsing is incomplete, no abandoned call signal will be given. Since the pulsing is not completed, the ground from the lower front contact of relay 1052 remains connected in shunt of the winding of relay 814 and in series with the winding of

relay 115 holding the trunk connected to the recorder and preventing the trunk relay from releasing to transfer the trunk conductors from the position control circuit back to the line relay of the trunk. The trunk therefore cannot recognize that the call has met with difficulty. However, as long as this condition continues no other trunk can be connected to the position control circuit until the operator recognizes the condition and releases the position by operating the release key.

The position control circuit has several other special functions in connection with call indicator trunks. For example, it is arranged to create a delay before disconnecting the trunk in order to allow enough time for the district selector circuit in the dial office to advance and complete a circuit over the trunk for the line relay 110, before the holding circuit for relay 518 is opened at the position control circuit. For this purpose, when relay 815 operates following the association of a call indicator trunk with the position control circuit, it closes a circuit from battery through the winding of relay 828, upper back contact of relay 903 to ground at the inner upper front contact of relay 815. Relay 828 closes an obvious circuit for relay 819 which in turn operates relays 818. Relay 818 disconnects ground from the armature of relay 817. When one of the ringing keys or the release key is operated, in turn operating relay 903, the circuit of relay 828 is opened and relay 828 starts to release, and in turn releases relays 819 and 818. All three of these relays are slow-to-release relays and introduce an average delay of approximately one second before relay 818 again closes ground to the armature of relay 817 thereby permitting the operation of relay 825, the release of relay 835 and the disconnection of the trunk from the control circuit. If relay 110 is reoperated promptly by the advance of the district selector, the reoperation of relay 110 shunts the winding of relay 829 and causes that relay to release connecting ground to the armature of relay 817 over the back contact of relay 829 and canceling the balance of the time delay.

When for any reason the recorder circuit is not satisfied by the sender, resulting in a partial or no display of the called number, relay 820 is not operated and ground is not removed from the winding of relay 115 by the completion of the call indicator pulses. The common ringing keys having been made ineffective by the operation of relay 815 and key 925 having been made partially ineffective by the operation of relay 822, as already explained, the non-operation of relay 820 permits the keys to remain in this condition, this is to prevent the operator from releasing the trunk by a common ringing key and thereby setting the trunk for ringing without knowing the called number or to release the trunk by the release key and thereby lock out the trunk leaving the calling subscriber to abandon the call. Since ground remains connected to relay 115, the tip and ring conductors of the trunk circuit remain connected to the control circuit. In the case of such a partial or no display condition, the operator is instructed to operate key 841 and challenge on the trunk and if the calling party is present to obtain the desired number and complete the call. The operation of key 841 closes a circuit for relay 816 over the front contact of relay 822, relay 816 locking over its lower contact to ground at the outer lower front contact of relay 915. In operating, it connects battery

and ground through the windings of coil 823 to the tip and ring conductors leading to the trunk to hold the connection. It also releases relay 807 thereby connecting the trunk through to the operator's repeating coil. After the number is obtained from the calling party the operator will make the common keys effective by operating key 840 which closes a local operating circuit for relay 820, relay 820 locking under the control of relay 915. Relay 820 closes the circuits for rendering the ringing and release keys effective which were opened by the operation of relays 815 and 822. The operation of a ringing key or the release key will then cause the circuit to function as already described, with the exception that the operation of relay 903 closes a circuit from ground over the inner upper front contact of relay 815, outer upper front contact of relay 903, winding of relay 832 and battery. Relay 832 connects resistance 833 and condenser 834 around coil 823 to protect the contacts of relay 115 and then opens the energizing circuit for relay 115 so that this relay releases reestablishing the circuit for relay 110 over the trunk. When the position control circuit returns to normal, releasing relay 915, relay 816 is released.

Several emergency features are also provided. If for any reason the sequence relays 620 and 621 fail to function properly to automatically connect the associated trunks to the common equipment, the sequence emergency key 623 may be operated closing a circuit from ground at the front contact of relay 844 over key 623, through the winding of relay 622 to battery. Relay 622 opens the battery and ground supplies for the sequence relays and therefore suspends their operation, as well as releasing all operated sequence relays. Key 623 is a locking key and therefore, following its operation, the trunks are connected to the control circuit only by the operation of individual trunk keys such as key 502. With this operation the flashing circuit does not function and the trunk guard lamp retains a steady light while the trunk is connected to the common equipment.

Assuming that the position control circuit of Figs. 8 and 9 is serving trunks at two physical positions, for example the position indicated by the splitting circuit of Figs. 6 and 7 and the similar circuit to the left of it, if the position control circuit should fail to function properly, or the recorder circuit of Figs. 10 and 11 fail, the position emergency key 924 would be operated. Key 924 operates relay 921 which in turn operates relay 920 and relay 936 which is associated with the splitting circuit of Figs. 6 and 7. Relay 936 in turn releases relays 844, 901, 917 and 918 and 808. The operation of relays 920, 921 and 936 opens all the conductors between the control circuit and the associated splitting circuit thus isolating the control circuit that is in trouble. The operation of relay 936 with strap 730 connected and strap 731 open closes a circuit over its middle lower front contact for relay 701. Relay 701 in turn operates relays 703 and 604 and these relays in turn operate relays 704, 702, 601, 602, and 603 thereby preventing the association of the trunks of this position with the control circuit of the position at the left which has been assumed to be unequipped with a call indicator recorder. For an intermediate position, which is wired with strap 730 open and strap 731 closed, the operation of relay 936 would cause the operation of relay 711 and the corresponding splitting relays of set 610, thereby splitting half

of the trunks to the position on the left and the other half of the trunks to that on the right. The relay corresponding to relay 701 of the adjacent right position has an operating circuit over its corresponding splitting key similar to key 725, a normal contact of a relay of that position corresponding to relay 936, and a normal contact of relay 936 so that the operation of relay 936 prevents the position at the right of this position from being disconnected from the trunks of this position. The circuit of the relay corresponding to relay 711 in the left adjacent position is also carried over the operated contact of key 724 of that position corresponding to key 726, normal contact of key 725, a back contact of relay 936 to prevent the trunks of the right half of that position from being cut off from that position control circuit. Relay 936 also closes a substitute circuit at its inner upper contact for the middle upper front contact of relay 604 thereby providing ground for the operation of the vacated position relay similar to relay 902 in the position control circuit which becomes effective. It also connects ground over its outermost lower contact and the upper back contact of relay 612 for supplying ground to the position circuit at the right. These operations will take place regardless of the positions of the splitting keys prior to the operation of the position emergency key thereby making it unnecessary for the operator to consider the splitting keys at the time of an emergency condition.

An operator's division may consist of two or more physical positions and may include automatic listening positions served by control circuits that differ from the present control circuit. If the operator's division consists solely of positions equipped with the control circuit of this disclosure, the operator may occupy any position, provided it is equipped with a call indicator recorder. If it does not include trunks incoming from call indicator offices, a position circuit lacking a recorder may be used. The control circuit in the position to which the operator is connected will handle the calls over all the trunks in all the positions of the division. The control circuits in the other positions will be disconnected since the relays similar to relays 919, 917, 901, 918 and 808 in those positions are released. The common ringing keys and the common release keys of all of the positions will be effective, to control the position control circuit of the occupied position for completing a call over any trunk of the division except when a partial display or no display occurs in connection with a call indicator call. Where the key is operated at an unoccupied position, the circuit for the ringing relay, for example, relay 933, may be traced from ground over the key contact 943, winding of relay 933, middle lower back contact of relay 920, conductor 955 over the back contact of relay 613, and the relay corresponding to relay 603 in the adjacent right position or over the back contact of relay 603 and the back contact of relay 613 of the adjacent left position, to the conductor 955 of that position over the middle back contact of the relay corresponding to relay 920 in the occupied position and thence to battery over the front contact of the relay corresponding to relay 821 by way of the front contact of relay 820 or the back contact of relay 815 depending on the type of call.

If the recorder circuit of the occupied position is not satisfied on a call indicator call, all of the common ringing keys are ineffective since relay

820 is not operated and battery is disconnected from all of the ringing relays. Under this condition release relay 923 can operate as previously described, disconnecting the position control circuit from the trunk, but the trunk is not placed in condition for talking. In order to establish the talking circuit, the operator must operate key 841 of the occupied position, thereby permitting her to talk with the calling subscriber in the manner previously described. Key 840 of the occupied position is also employed for permitting the ringing to take place, by operating relay 820 to make the ringing keys of all the positions of the division effective. The keys 840 and 841 are only effective in the occupied position since they depend on the operated condition of relays 822 and 815 for performing their functions. The purpose of arranging the circuits so that the ringing keys and the release keys are common is to permit the operator under normal operation to complete a call from the position where the trunk is located as well as at the occupied position. This is to facilitate the handling of calls by not requiring the operator to return to the home position to operate the ringing keys for a call on a trunk in any other position of the division.

If an operator's division consists of trunks served by the position circuit shown and trunks of the type shown in Fig. 4 which were originally served by a slightly different type of control circuit such as that shown in the above identified Ulrich patent, the operator must always occupy a position having a control circuit such as shown in Figs. 8 and 9 and preferably one which is also provided with a recorder circuit, necessarily so if any position in the division is so equipped. To guard against the connection of the operator's telephone to the wrong type of position, a circuit is provided from ground over conductor 729 from the circuit at the left, inner lower back contact of the emergency relay 936, normal contact of splitting key 725, conductor 727, normal contact of the middle splitting key 724 of the left position, back contact of relay 723 to the winding of relay 721 and battery. Relay 721 in operating closes a circuit from ground through the secondary of tone coil 720, condenser 722, contact of relay 721 to conductor 728. Conductor 728 extends to the busy test repeating coil of all positions constituting the division. If the operator connects with the position at the left, she hears the tone in her telephone which informs her that she has connected with the wrong position. If the operator connects with a position having a control circuit such as shown in Figs. 8 and 9, the operation of relay 918 closes a circuit from ground at its inner upper front contact, through the winding of relay 723 to battery thereby disconnecting the tone from the division. This tone arrangement is provided in connection with positions, such as that shown, which appear adjacent to a position of the type which will not serve trunks of all sorts. If the operator inserts her telephone at a position of this sort, one or two positions to the right, the circuit closed by relay 918 will be carried over the back contacts of relays such as relays 703 and 713 to the end position where the tone is applied.

When an operator's division consists of more than one physical position and an operator's headset is connected at more than one position in the division, the one connected to the position nearest the left end of the division will be the one that is effective. The position control circuit of this position will be connected and used to handle

the trunks of all positions in the division. An operator's headset connected to any other position will be ineffective in operating the connecting relays of their associated position control circuit.

5 This is accomplished by carrying the operating circuit for relay 919 as traced to conductor 846 over the conductor 944, to the front contact of relay 602 if relay 919 is in the position at the left end of a division, or if in an intermediate or right
10 end position over the back contacts of relays such as relay 602 and relay 612 and in each position over conductor 636, lowermost back contact of relay 936, upper back contact of the relay corresponding to relay 919, upper back contact of
15 relay 936, and conductor corresponding to conductor 944, to ground at the front contact of relay 602 in the left end position. Therefore, if an attempt is made to operate relay 919 in two positions, in the position at the left, relay 919 will operate directly to ground at the front contact of
20 relay 602 and will open the circuit for operating the similar relay in the position at the right. Since the relay corresponding to relay 919 in the right position can not be operated, the headset of that position is ineffective, as well as the position control circuit as a whole.

If an operator's headset is withdrawn from an operator's division consisting of one or more positions, leaving the division unattended or a division is created by the operation of a splitting key, without attaching an operator's telephone thereto, a circuit is closed from battery through the winding of relay 902 in the rightmost position, over conductor 953 extending to the leftmost
35 splitting circuit of the division on the right and in that position over the upper front contact of the relay corresponding to relay 604 to ground over conductor 635 and the back contacts of relays such as relays 612 and 602 of the vacated division to ground at the front contact of the relay similar
40 to one of these relays which is operated to mark the left end of the division. With relay 902 operated, relay 808 is operated over conductor 946 and the circuit controlled by relays 916 and 826 which normally operates relay 836 is transferred to the winding of relay 926 which controls the night alarm and the vacated position alarm. When relay 826 operates in response to the connection of a trunk to the control circuit, it connects the
50 secondary winding of coil 827 to the tip and ring conductors in the usual manner and ground to the primary winding of coil 827 thereby transmitting a steady tone over the trunk which acts as a vacated position signal to the A operator when a straightforward trunk is connected. When an operator's headset is connected to the position, the operation of relay 919 in that position opens the circuit of relay 902 and that relay releases stopping the night alarm and tone and
60 permitting the operation of the order tone relays and the completion of the call in the usual manner. Otherwise the alarm and tone will continue until the call is abandoned. During the night, key 928 may be operated so that the reception of a call over one of the trunks served by this position circuit, causing the operation of relay 916, will complete a circuit from ground over the outer lower contact of relay 916, key 928, through the winding of relay 926 which operates the night
70 alarm.

A position peg count circuit is furnished for each class of trunk served by the position control circuit. One circuit registers the number of calls handled on straightforward trunks, whether of
75 the type shown in Figs. 3 and 5 or of that shown

in Fig. 4, one the number of calls handled on call indicator trunks and one the calls handled on call announcer trunks. The operating path for these peg count circuits is closed by the operation of relay 903 when one of the common ringing keys
80 or the release key is operated. The circuit is normally connected to the straightforward trunk register circuit and may be traced from ground over the middle lower front contact of relay 916, inner upper front contact of relay 903, outer lower front
85 contact of relay 821, over the back contacts of relays 813 and 822 to the winding of the straightforward peg count meter 831. When a call indicator trunk is connected, the operation of relay 822 transfers the circuit traced from meter 831 to the call indicator meter 842, and relay 813 transfers the circuit to the call announcer meter 830 when a call over a call announcer trunk is completed. The operating circuits for the position
90 registers are connected over a contact on relay 821 to prevent the registration of calls handled at other types of positions when they are grouped with this type of position. When a call is handled in one of these grouped positions, the ringing key at the grouped circuit will operate relay 903, but
95 relay 821 will remain non-operated, thereby preventing false operation to take its place.

Relays 935 and 914 are employed to introduce a momentary delay in the connection of ground to conductor 631 following a complete cycle of the
105 sequence relay circuit and insures the start of the next cycle with the waiting trunk nearest the left end of the chain.

What is claimed is:

1. In a telephone system, a trunk circuit, an operator's telephone, a set of ringing keys, means responsive to the seizure of said trunk circuit to automatically associate said operator's telephone and said ringing keys with said trunk circuit, a relay in said trunk circuit, means responsive to the operation of one of said ringing keys to disconnect said operator's telephone and said ringing
110 keys from said trunk circuit and to operate said relay, a signal, and means effective on the release of said relay to display said signal. 120

2. In a telephone system, a subscriber's substation, a trunk circuit, an operator's telephone, a set of ringing keys, means to connect said substation with said trunk circuit, means responsive to the connection of said substation with said trunk circuit to automatically associate said operator's telephone and said ringing keys with said trunk circuit, a relay in said trunk circuit, means responsive to the operation of one of said ringing keys to disconnect said operator's telephone and said ringing keys from said trunk circuit and to operate said relay, means to hold said relay operated under the control of said substation, a signal, and means responsive to the release of said relay by said substation to display said signal. 135

3. In a telephone system, a subscriber's substation, a register sender, a trunk circuit, an operator's telephone, a set of ringing keys, means under the control of said sender to connect said substation with said trunk circuit, means responsive to the connection of said substation with said trunk circuit to automatically associate said operator's telephone and said ringing keys with said trunk circuit and to transmit a signal to said sender, a relay in said trunk circuit, means responsive to the operation of one of said ringing keys to disconnect said operator's telephone and said ringing keys from said trunk circuit and to operate said relay, means to hold said relay op-
140 145 150

erated under the control of said substation, means to reconnect said trunk with said operator's telephone, and means under the control of said relay to prevent the transmission of said signal.

5 4. In a telephone system, a subscriber's substation, register senders of different types, trunk circuits of different types, an operator's telephone, a set of ringing keys, means under the control of one of said register senders for connecting a subscriber's substation with one of said trunk circuits, means responsive to the connection of said substation with said trunk circuit to automatically connect said operator's telephone and said ringing keys with said trunk circuit, to automatically identify the type of said trunk and to automatically transmit an appropriate signal to said sender, a relay in said trunk circuit, means responsive to the operation of one of said ringing keys to disconnect said operator's telephone and said ringing keys from said trunk circuit and to operate said relay, means to hold said relay operated under the control of said substation, means to reconnect said trunk with said operator's telephone, and means under the control of said relay to prevent the operation of said identifying means and the transmission of said signal.

10 5. In a telephone system, subscribers' substations, trunk circuits, dial equipment for connecting certain of said substations with certain of said trunk circuits, manual equipment for connecting others of said substations with others of said trunk circuits, an operator's telephone, a set of ringing keys, means responsive to the connection of a subscriber's substation with one of said trunk circuits to automatically associate said operator's telephone and said ringing keys with said trunk circuit, means to determine whether said connection was established by said dial or said manual equipment and to transmit a signal to said dial equipment, a relay in said trunk circuit, means responsive to the operation of one of said ringing keys to disconnect said operator's telephone and said ringing keys from said trunk circuit and to operate said relay, means to hold said relay operated under the control of said substation, means to reconnect said trunk circuit with said operator's telephone, and means under the control of said relay to disable said identifying and signaling means.

15 6. In a telephone system, an originating office, a terminating office, a trunk connecting said offices, operator's equipment at said terminating office, a relay in said trunk circuit, means for operating said relay under the control of said originating office, means under the control of said relay for automatically connecting said operator's equipment with said trunk circuit, means for removing said relay from the control of said originating office, and means for placing said relay under the control of said operator's equipment to maintain the connection between said trunk circuit and said operator's equipment.

20 7. In a telephone system, a dial office, code impulse generating means at said dial office, a manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office, an operator's position equipment at said manual office, means at said dial office for seizing said trunk circuit and for preparing said code impulse generating means for operation, a relay individual to said trunk circuit, means responsive to the seizure of said trunk circuit for operating said relay to cause the automatic connection of said operator's position equipment with said trunk circuit, a recorder,

means responsive to the association of said position equipment with said trunk circuit to cause the transfer of said trunk conductors to said recorder and the transmission of a signal to said dial office to start said code impulse generating means, and means in said position equipment to hold said relay operated to maintain the connection between said position and said trunk circuit during said transfer.

8. In a telephone system, an operator's position, equipment thereat, a plurality of types of trunk circuits appearing at said position, means responsive to the seizure of said trunk circuits to cause the automatic connection of said operator's position equipment with said trunk circuits one at a time, means in said position equipment for identifying the types of trunk circuits connected with, and means for recording the number of trunk circuits of each type with which said position equipment has been connected.

9. In a telephone system, an operator's position, equipment thereat, a plurality of types of trunk circuits appearing at said position, means responsive to the seizure of said trunk circuits to cause the automatic connection of said operator's position equipment with said trunk circuits one at a time, means in said position equipment for identifying the types of trunk circuits connected with, and means under the control of said identifying means for recording the number of trunk circuits of each type with which said position equipment has been connected.

10. In a telephone system, an operator's position, equipment thereat, a plurality of types of trunk circuits appearing at said position, means responsive to the seizure of said trunk circuits to cause the automatic connection of said operator's position equipment with said trunk circuits one at a time, means in said position equipment for identifying the types of trunk circuits connected with, meters for recording the number of trunk circuits of each type with which said position equipment has been connected, a control circuit for said meters, and means under the control of said identifying means for extending said control circuit to the corresponding meter.

11. In a telephone system, an operator's position, equipment thereat, straightforward trunks, call indicator trunks and call announcer trunks appearing in said position, means responsive to the seizure of said trunk circuits to cause the automatic connection of said operator's position equipment with said trunk circuits one at a time, means in said position equipment for identifying the types of trunk circuits connected with, a meter for each type of trunk, a control circuit for said meters normally extending to the meter corresponding to said straightforward trunks, and means under the control of said identifying means to transfer said meter control circuit to the proper one of said other meters.

12. In a telephone system, a dial office, code impulse generating means at said dial office, a manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office and terminating in a plug at said manual office, an operator's position equipment thereat, jacks at said position, means at said dial office for seizing said trunk circuit and for preparing said code impulse generating means for operation, means responsive to the seizure of said trunk circuit to cause the automatic connection of said operator's position equipment with said trunk circuit, a recorder at said operator's position, means to test whether

the plug of said trunk is in a jack, and means under the control of said test means to render said impulse generating means and said recorder effective.

5 13. In a telephone system, a dial office, code impulse generating means at said dial office, a manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office and terminating in a plug at
10 said manual office, an operator's position equipment thereat, jacks at said position, means at said dial office for seizing said trunk circuit and for preparing said code impulse generating means for operation, means responsive to the seizure
15 of said trunk circuit to cause the automatic connection of said operator's position equipment with said trunk circuit, a recorder at said operator's position, a relay operable only if the plug of said trunk is disassociated from said jack, and means under the control of said relay to render
20 said code impulse generating means and said recorder effective.

14. In a telephone system, a dial office, code impulse generating means at said dial office, a
25 manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office and terminating in a plug at said manual office, an operator's position equipment thereat, jacks at said position, means
30 at said dial office for seizing said trunk circuit and for preparing said code impulse generating means for operation, means responsive to the seizure of said trunk circuit to cause the automatic connection of said operator's position equipment with said trunk circuit, a recorder at said
35 operator's position, means responsive to the association of said position equipment with said trunk circuit to cause the transfer of said trunk conductors to said recorder and the transmission of a signal to said dial office to start said code
40 impulse generating means, and means to prevent the connection of said trunk conductors with said recorder if said trunk plug is in the jack of a called line.

45 15. In a telephone system, a dial office, code impulse generating means at said dial office, a manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office and terminating in a plug
50 at said manual office, an operator's position equipment thereat, jacks at said position, means at said dial office for seizing said trunk circuit and for preparing said code impulse generating means for operation, means responsive to the seizure of
55 said trunk circuit to cause the automatic connection of said operator's position equipment with said trunk circuit, a recorder at said operator's position, means to cause the transfer of said trunk conductors to said recorder and the transmission of a signal to said dial office to start
60 said code impulse generating means, means to test whether the plug of said trunk is in a jack, and means under the control of said testing means to prevent connection of said trunk conductors with said recorder if said trunk plug is in the
65 jack of a called line.

16. In a telephone system, a dial office, code impulse generating means at said dial office, a manual office, a trunk circuit including a plurality
70 of conductors connecting said dial office with said manual office and terminating in a plug at said manual office, an operator's position equipment thereat, jacks at said position, means at said dial office for seizing said trunk circuit and
75 for preparing said code impulse generating means

for operation, means responsive to the seizure of said trunk circuit to cause the automatic connection of said operator's position equipment with said trunk circuit, a recorder at said operator's position, and a relay operable only if the plug of said trunk is disassociated from said jack to cause the transfer of said trunk conductors to said recorder and the transmission of a signal to said dial office to start said code impulse generating means.

17. In a telephone system, a dial office, code impulse generating means at said dial office, a manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office, an operator's position equipment
90 at said manual office including a plurality of ringing keys, means at said dial office for seizing said trunk circuit and for preparing said code impulse generating means for operation, means responsive to the seizure of said trunk circuit
95 for automatically connecting said operator's position equipment with said trunk circuit, a recorder, means responsive to the association of said position equipment with said trunk circuit to cause the transfer of said trunk conductors to said
100 recorder and the transmission of a signal to said dial office to start said code impulse generating means, and means if said recorder is not completely operated to render said ringing keys ineffective.

18. In a telephone system, a dial office, code impulse generating means at said dial office, a manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office, an operator's position
110 equipment at said manual office including a telephone set and a plurality of ringing keys, means at said dial office for seizing said trunk circuit and for preparing said code impulse generating means for operation, means responsive to the
115 seizure of said trunk circuit for automatically connecting said operator's position equipment with said trunk circuit, a recorder, means responsive to the association of said position equipment with said trunk circuit to cause the transfer of
120 said trunk conductors to said recorder and the transmission of a signal to said dial office to start said code impulse generating means, means effective if said recorder is not completely operated to render said ringing keys ineffective, and op-
125 erator controlled means to associate said operator's telephone set with said trunk circuit and to render said ringing keys effective.

19. In a telephone system, a dial office, code impulse generating means at said dial office, a
130 manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office, an operator's position equipment at said manual office including a plurality of ringing keys, means at said dial office
135 for seizing said trunk circuit and for preparing said code impulse generating means for operation, means responsive to the seizure of said trunk circuit for automatically connecting said operator's position equipment with said trunk circuit
140 and to cause the transfer of said trunk conductors to said recorder and the transmission of a signal to said dial office to start said code impulse generating means, automatic means for rendering said ringing keys effective only if said
145 recorder is completely operated and manual means for releasing said recorder from said trunk circuit and rendering said keys effective.

20. In a telephone system, a dial office, code impulse generating means at said dial office, a

manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office, an operator's position equipment at said manual office including a plurality of ringing keys, means at said dial office for seizing said trunk circuit and for preparing said code impulse generating means for operation, means responsive to the seizure of said trunk circuit for automatically connecting said operator's position equipment with said trunk circuit, a recorder, means responsive to the association of said position equipment with said trunk circuit to cause the transfer of said trunk conductors to said recorder and the transmission of a signal to said dial office to start said code impulse generating means, automatic means for rendering said ringing keys effective only if said recorder is completely operated, manual means to release said recorder from said trunk circuit and other manual means to render said keys effective.

21. In a telephone system, a dial office, code impulse generating means at said dial office, a manual office, a trunk circuit including a plurality of conductors connecting said dial office with said manual office, an operator's position equipment at said manual office including an operator's telephone and a plurality of ringing keys, means at said dial office for seizing said trunk circuit, and for preparing said code impulse generating means for operation, means responsive to the seizure of said trunk circuit for automatically connecting said operator's position equipment with said trunk circuit, a recorder, means responsive to the association of said position equipment with said trunk circuit to cause the transfer of said trunk conductors to said recorder and the transmission of a signal to said dial office to start said code impulse generating means, automatic means for rendering said ringing keys effective only if said recorder is completely operated, manual means to release said recorder from said trunk circuit and to establish a talking circuit between said trunk circuit and said operator's telephone, and other manual means to render said ringing keys effective.

22. In a telephone system, a dial office, code generating means in said dial office, other offices, a manual office, trunk circuits connecting said dial office and said other offices with said manual office, an operator's position at said manual office including a plurality of ringing keys, means at said dial office and said other offices for seizing said trunk circuits, means responsive to the seizure of a trunk circuit for automatically connecting said operator's position equipment with said trunk circuit, means in said position equipment for identifying trunks incoming from said dial office, a recorder, means responsive to the association of said position equipment with a trunk circuit and the operation of said identifying means to cause the transfer of said trunk conductors to said recorder and the transmission of a signal to said dial office, and means also under the control of said identifying means to disable said ringing keys until said recorder is completely operated.

23. In a telephone system, a dial office, code generating means in said dial office, other offices, a manual office, trunk circuits connecting said dial office and said other offices with said manual office, an operator's position at said manual office including a plurality of ringing keys, means at said dial office and said other offices for seizing said trunk circuits, means responsive to the

seizure of a trunk circuit for automatically connecting said operator's position equipment with said trunk circuit, means in said position equipment for identifying trunks incoming from said dial office, a recorder, means responsive to the association of said position equipment with a trunk circuit and the operation of said identifying means to cause the transfer of said trunk conductors to said recorder and the transmission of a signal to said dial office, means also under the control of said identifying means to disable said ringing keys until said recorder is completely operated, and manual means operable if said recorder is not completely operated to release said recorder from said trunk circuit and to render said ringing keys effective.

24. In a telephone system, trunk circuits of a plurality of types, operators' positions at which said trunk circuits appear, equipment at a first plurality of said positions capable of handling calls over all types of trunk circuits, equipment at a second plurality of said positions capable of handling calls over only a single type of trunk circuit, means for connecting said positions in groups, means effective only if positions of said first plurality and positions of said second plurality are connected together to connect a tone to all of said positions, an operator's telephone, means responsive to the association of said telephone with one of said position equipments to render said position equipment effective, and means responsive to the connection of said operator's telephone with one of said first plurality of positions to disconnect said tone from all of said positions.

25. In a telephone system, trunk circuits of a plurality of types, operators' positions at which said trunk circuits appear, equipment at a first plurality of said positions capable of handling calls over all types of trunk circuits, equipment at a second plurality of said positions capable of handling calls over only a single type of trunk circuit, means for connecting said positions in groups, means effective only if positions of said first plurality and positions of said second plurality are connected together to connect a tone to all of said positions, an operator's telephone, means responsive to the association of said telephone with one of said position equipments to render said position equipment effective, and means responsive to the connection of said operator's telephone with one of said first plurality of positions to disconnect said tone from all of said positions, the connection of an operator's telephone to one of said second plurality of positions being ineffective to disconnect said tone.

26. In a telephone system, a plurality of operators' positions, equipment thereat including call indicator recorders, a second plurality of operators' positions, equipment at said second plurality of positions not including call indicator recorders, a plurality of trunk circuits appearing at each of said positions, means for grouping said positions so that any trunk circuit may be associated with any position equipment, an operator's telephone, means responsive to the association of said telephone with one of said position equipments to render said position equipment effective, and means associated with said grouping means to warn the operator if she connects said telephone with one of said position equipments not including a call indicator recorder.

27. In a telephone system, a plurality of operators' positions, equipment thereat including call indicator recorders, a second plurality of op-

erators' positions, equipment at said second plurality of positions not including call indicator recorders, a plurality of trunk circuits appearing at each of said positions, means for grouping
5 said positions so that any trunk circuit may be associated with any position equipment, an operator's telephone, means responsive to the operation of said grouping means to associate positions of said first plurality with positions of
10 said second plurality to connect a tone to all of the associated positions, and means responsive to the connection of an operator's telephone with one of said first plurality of positions to disconnect said tone from all of said positions.
15 28. In a telephone system, a plurality of operators' positions, equipment thereat including call indicator recorders, a second plurality of operators' positions, equipment at said second plurality of positions not including call indicator
20 recorders, a plurality of trunk circuits appearing at each of said positions, means for grouping said positions so that any trunk circuit may be associated with any position equipment, an operator's telephone, means responsive to the operation of said grouping means to associate positions of said first plurality with positions of

said second plurality to connect a tone to all of the associated positions, and means responsive to the connection of an operator's telephone with one of said first plurality of positions to disconnect
80 said tone from all of said positions, the connection of an operator's telephone to one of said second plurality of positions being ineffective to disconnect said tone.

29. In a telephone system, a plurality of operators' positions, equipment thereat including call
85 indicator recorders, a second plurality of operators' positions, equipment at said second plurality of positions not including call indicator recorders, a plurality of trunk circuits appearing at each of said positions, means for grouping said positions
90 so that any trunk circuit may be associated with any position equipment, an operator's telephone, means effective only if positions of said first plurality and positions of said second plurality are grouped together to connect a tone to all of
95 said positions, and means responsive to the connection of an operator's telephone with one of said first plurality of positions to disconnect said tone from all of said positions.

ALBERT C. POWELL.

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