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TELEPHONE SYSTEM

Filed Dec. 23, 1926

3 Sheets-Sheet 1

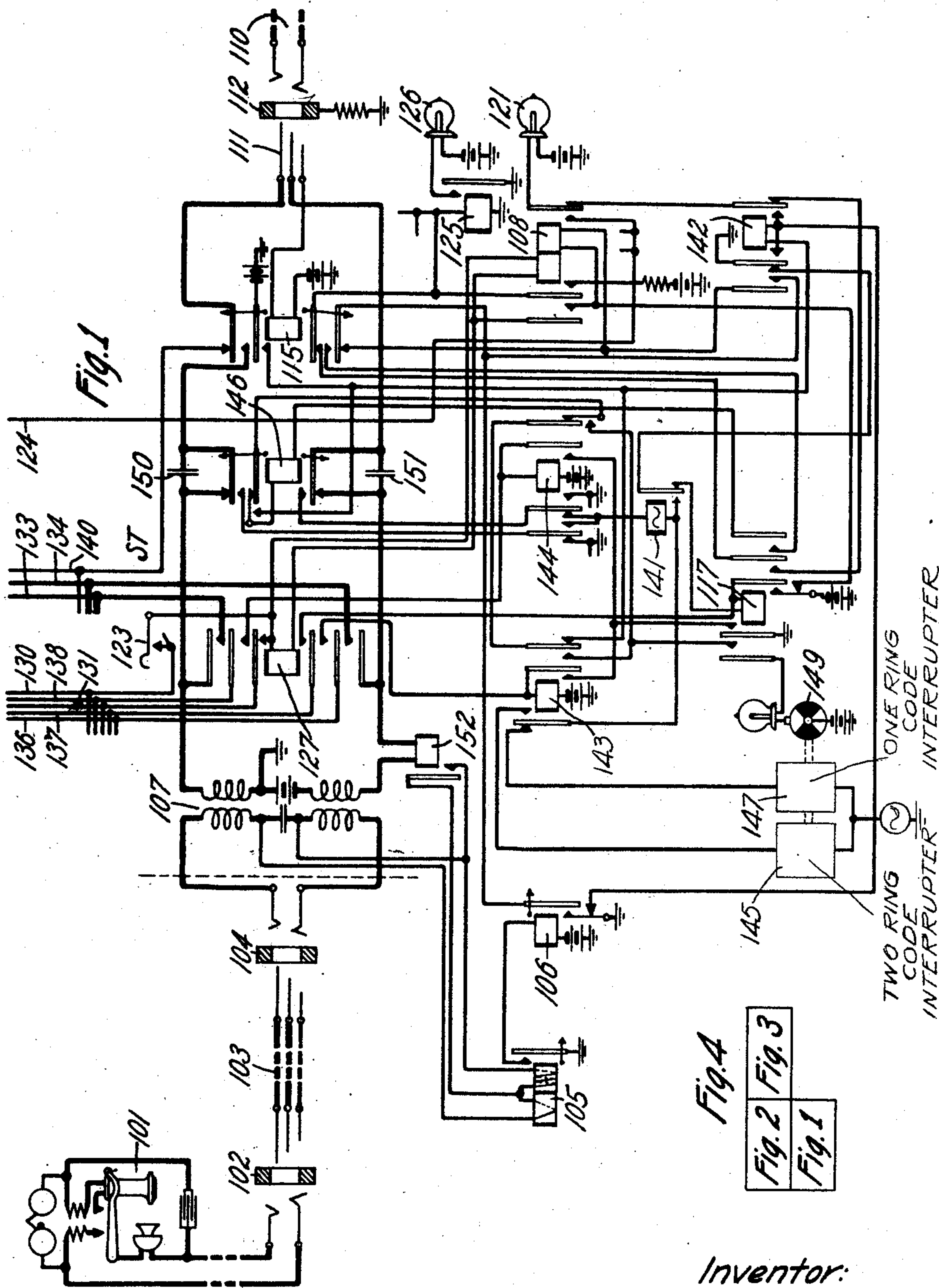


Fig. 2 Fig. 3
Fig. 1

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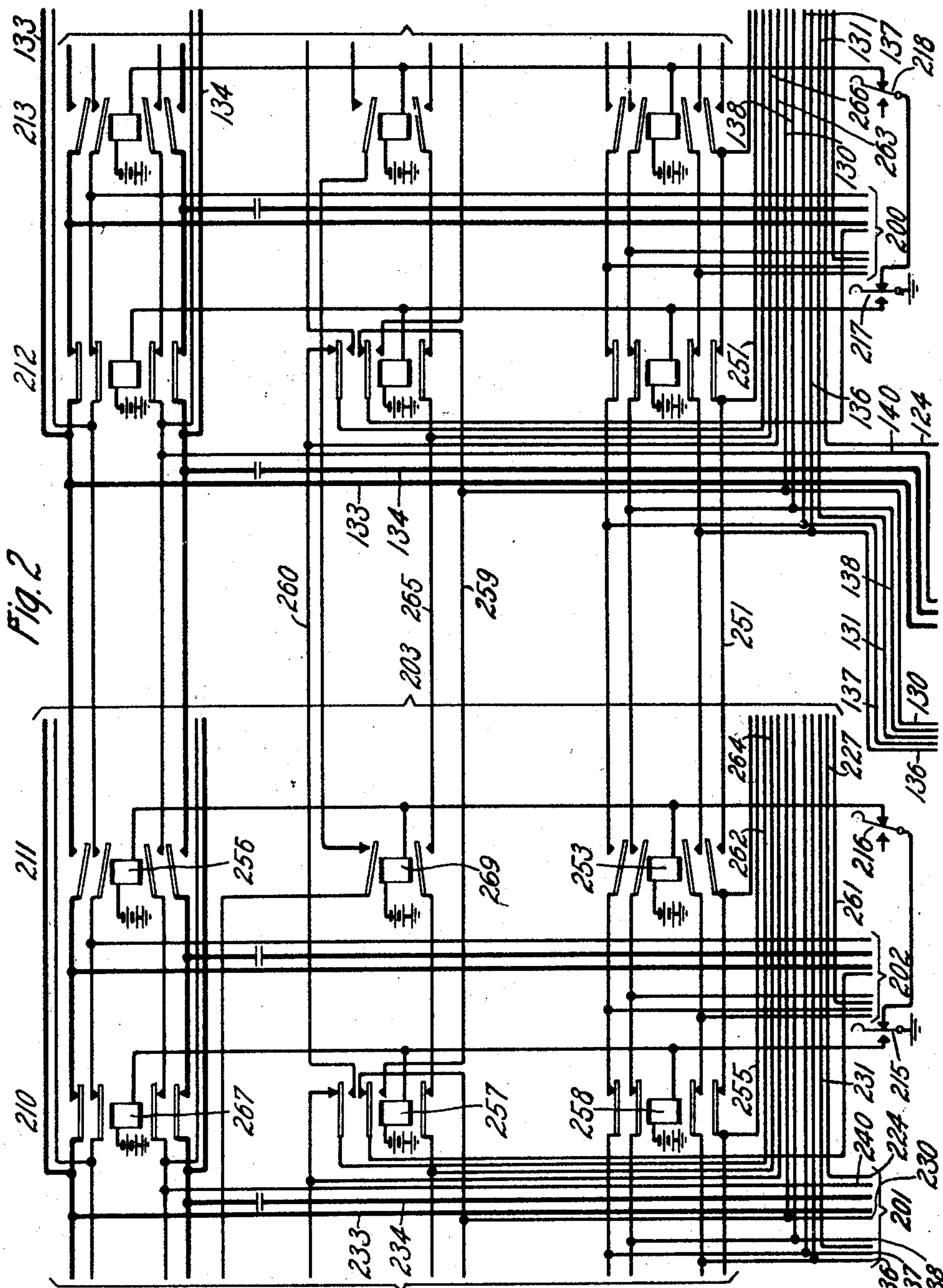
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TELEPHONE SYSTEM

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3 Sheets-Sheet 2



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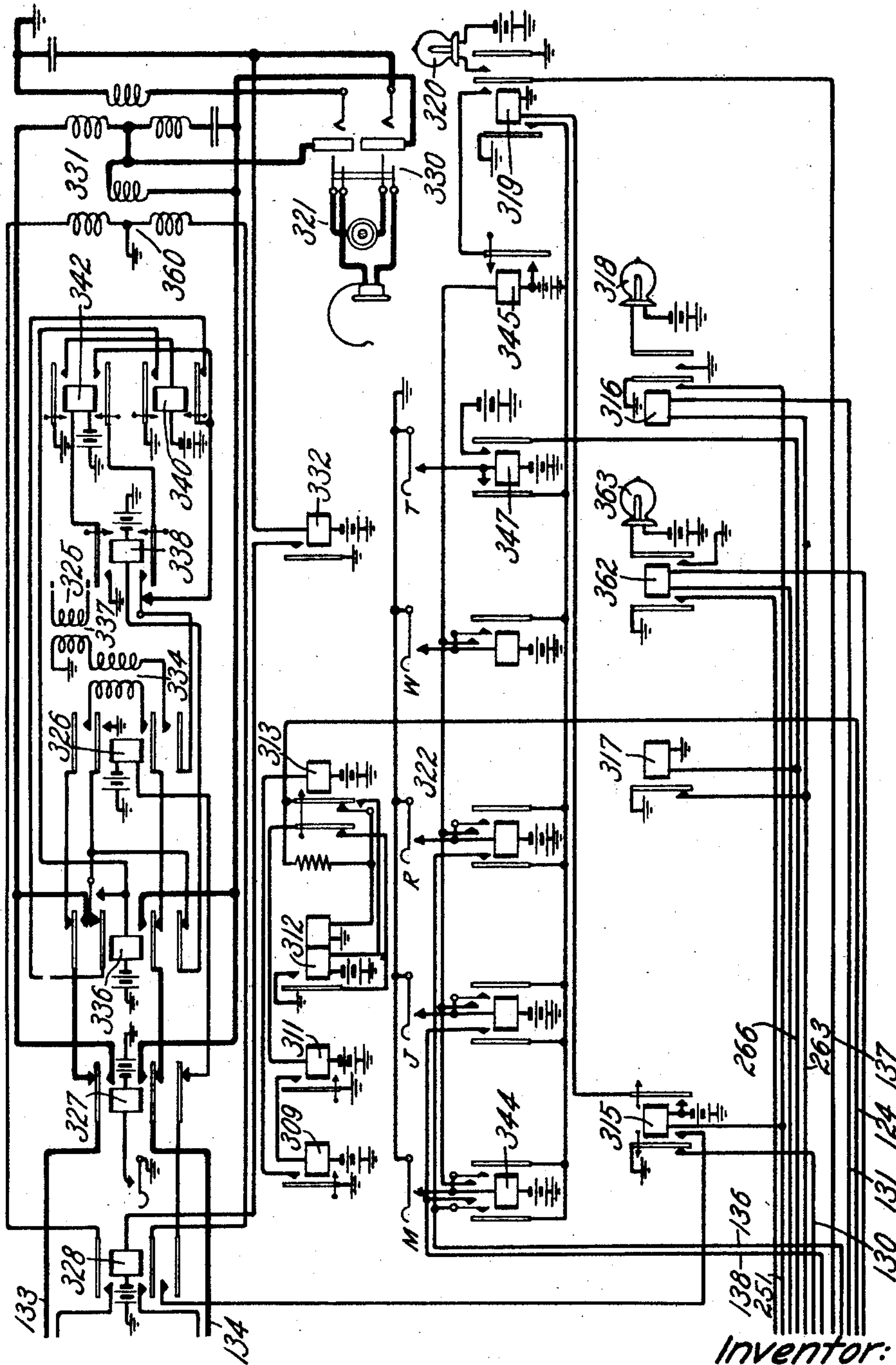
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

Application filed December 23, 1926. Serial No. 156,570.

This invention relates to telephone systems and more particularly to straightforward trunking systems.

In accordance with this invention there is provided means whereby seizure of a straightforward trunk and the actuation of a key individual thereto causes the connection to said trunk of a control equipment common to a plurality of trunks.

Another feature of the invention resides in a key controlled means whereby said trunks may be divided into groups, each group normally assigned for use with a certain control equipment and whereby the common control equipments may be transferred or arranged in any desired manner so that any one or more control equipments may be used for association with any trunk in any of said groups or be restricted for use with any particular group or groups of any one of said trunks.

Other, more specific features of the invention, as applied to a system in which a control equipment may comprise a ringing key equipment and a B operator's telephone set arranged for association with the incoming end of said trunks, may be outlined as follows: An arrangement whereby only one trunk at a time may be connected to the common control equipment, that is, the operation of the individual key of one seized trunk will be ineffective while another trunk is connected to the operator's telephone set and ringing key equipment.

An arrangement whereby a tone signal comprising one or more impulses of tone current is transmitted over a seized trunk to an A operator's position after the individual key is operated but prior to the actual connection of the B operator's telephone set to said trunk.

An arrangement whereby the desired ringing key may be operated to set the ringing equipment of an associated trunk either before or after the trunk is connected to the wanted subscriber's line.

An arrangement whereby the usual pilot light common to the trunks in a group is prevented from lighting when the usual guard and disconnect lamp is lighted as a disconnect signal.

An arrangement whereby the common control equipment is prevented from being reconnected to a trunk, until a trunk is dis-

connected from the wanted subscriber's line and the A operator's cord is reconnected to the trunk at the A operator's position.

An arrangement whereby the reringing of a called subscriber is prevented until the connection to the subscriber has been taken down and reconnected and the ringing key equipment is reconnected to the trunk and a key thereof actuated.

This invention has been illustrated in the accompanying drawing in which Fig. 1 shows a straightforward trunk embodying certain features of the invention and in diagrammatic form a calling subscriber's line, the jack of a wanted subscriber's line and an "A" operator's cord circuit for connecting the calling subscriber's line with the outgoing end of the straightforward trunk. Fig. 2 shows a circuit arrangement whereby a plurality of groups of trunks, of the kind shown in Fig. 1, may be variously arranged for association with common ringing key equipments and "B" operator's telephone sets. In Fig. 3 has been shown a common ringing key equipment and an associated "B" operator's telephone set, which is normally associated for use with the group of trunks, of which the trunk shown in Fig. 1 is one. Fig. 4 shows the manner in which Figs. 1 to 3 may be assembled for the reading of the circuits.

It should be understood that the particular system shown is merely illustrative of the invention and that the invention is applicable to systems of different designs without departing from the spirit thereof.

Referring now to the drawings, it is assumed that the calling subscriber of line 101 has been connected to the straightforward trunk ST through an "A" operator's cord 103 and jacks 102 and 104. The following description will relate: First, to the association of the common ringing key equipment and the "B" operator's set shown in Fig. 3 to this trunk ST on the operation of key 123, and to manipulations of the party line ringing keys in the common ringing key equipment to prepare the ringing equipment associated with the trunk ST for the transmission of a ringing signal to a wanted subscriber's line 110, when the "B" operator inserts her plug 111 into jack 112 of this line, and how the common equipment is released from trunk ST after the manipulation of the ringing

key and the setting of the ringing equipment in the trunk; second, this description will relate to the transfer of the common equipment for use with different groups of trunks.

5 As trunk ST is seized by the "A" operator it is well known in the art how a loop circuit is established through the usual cord circuit battery for the operation of relay 105. Relay 105 when operated closes an obvious circuit for the operation of relay 106. 10 Relay 106 closes a circuit for the operation of relay 108 as follows: battery, make-before-break contacts of relay 117, right hand winding of relay 108, lower outer armature and back contact of relay 115, armature and front contact of relay 106 to ground. 15

Relay 108 in operating closes a circuit for the flashing of the guard lamp 121 as follows: battery, lamp 121, right hand armature and front contact of relay 108, lead 124, inner left hand armature and back contact of relay 313, right hand winding of relay 312 to ground. This circuit causes the 20 lighting of lamp 121 and the operation of relay 312. Relay 312 in operating closes an obvious circuit for the operation of the slow-to-operate relay 311 and this relay in turn closes an obvious circuit for the slow-to-operate relay 309. Relay 309 in operating 30 closes an obvious circuit for the operation of the slow-to-operate relay 313, which in operating inserts a resistance in the circuit for lamp 121 and at the same time places a shunt comprising the left-hand winding of relay 312 about the said resistance and lamp 35 121 which is now extinguished. On the operation of relay 313, the circuit through the right hand winding of relay 312 is extended through the make-before-break contacts of relay 313 through the left hand winding of relay 312 to battery. Relay 312 is therefore 40 now maintained operated as long as the connection for lamp 121 is completed through lead 124. On the operation of relay 313 the circuit for relay 311 is opened at the outer left hand armature and back contact of relay 313 and relay 311 in releasing releases relay 309, and relay 309 releases relay 313. On the 45 release of relay 313 the original circuit for lamp 121 is re-established so that this lamp is again lighted. These operations of relays 311, 309 and 313 as outlined above are now repeated so as to alternately light and extinguish lamp 121. The flashing of lamp 50 121 indicates to the "B" operator that a connection over trunk ST is desired.

The operation of relay 108 also closes at its inner left hand armature an obvious circuit for the operation of the pilot relay 125 60 and this relay in operating lights the usual pilot lamp 126. Another circuit is also partially prepared by the operation of relay 108 for the subsequent operation of relay 127 as will hereinafter be described.

The "B" operator now depresses key 123 to associate the common ringing key equipment and her telephone set to this trunk. The operation of this key closes the circuit 70 previously prepared by the operation of relay 108 for the operation of relay 127 as follows: battery, make-up-before-break contacts of relay 117, outer left hand armature and front contact of relay 108, the left hand winding of relay 108 and the winding of relay 127 in parallel through the closed contacts of key 123, lead 130, left hand armature and back contact of relay 315 to ground. Relay 127 in operating prepares a locking 75 circuit for itself and relay 108 independent of the circuit through key 123 over the upper inner armature and front contact of relay 127, lead 131, winding of relay 316, armature and back contact of relay 317 to ground. 80 85

Relay 316 operates in this circuit and lights lamp 318, which indicates the particular common ringing key equipment employed. The more specific purpose for the lighting of this lamp will be described hereinafter in connection with the description 90 relating to the grouping of the master ringing key equipments. The operation of relay 316 causes an obvious circuit to be closed for the operation of relay 315 and relay 315 in operating closes a circuit for the operation of relay 319. Relay 319 in operating closes a circuit for the lighting of lamp 320. This lamp in lighting indicates 95 to the "B" operator that her telephone set 321 and the common ringing key equipment, generally indicated by the numeral 322, have been connected to a trunk such as ST. 100

It will be noted that the operation of relay 315 removes the ground at its left hand armature and back contact for lead 130 and 105 as this lead is common to all trunks in the group, of which trunk ST is one, the common ringing key equipment and the operator's telephone set cannot be associated with any other trunk in the group as long as relay 127 of trunk ST is operated. That is, 110 only one trunk at a time can be associated with this common equipment.

The operator's telephone set 321 and the common ringing key equipment 322 are connected to the trunk ST and a tone signal is transmitted to the "A" operator's cord 103 to indicate that this connection has been 115 made as follows. This signal consists of two successive applications of tone current from a source 325. The operations that take place in order to transmit this tone will be traced as follows: On the operation of relay 315 a circuit is closed for the operation 120 of relay 326 as follows: battery, winding of relay 326, lower outer armature and back contact of relay 327, lower outer armature and front contact of relay 328 to ground at the left hand armature and front contact of 125 130

relay 315. It is noted that this circuit is traced through the lower, outer armature and front contact of relay 328. It is evident by examining the circuit that this relay is operated as soon as the operator's telephone set 321 is connected through the jacks and plugs 330 to the repeating coils 331. That is, when this connection is made a circuit is completed for the operation of relay 332 through the operator's transmitter and the operation of relay 332 closes an obvious circuit for the operation of relay 328. Hence, these two relays remain operated as long as the operator's telephone set is connected at this point. Relay 326 in operating connects the secondary winding of repeating coil 334 to the tip and ring leads now connected through the operation of relay 127 to the conductors of trunk ST. This circuit may be traced from the tip and ring conductors of trunk ST through the upper outer and lower outer armatures and front contacts of relay 127, tip and ring conductors 133 and 134, upper and lower inner armatures and back contacts of relay 327, upper outer and lower inner armatures and back contact of relay 336, upper outer and lower inner armatures and front contacts of relay 326 through the secondary winding of repeating coil 334. The primary winding of this repeating coil is connected through the operation of relay 326 as follows: ground, secondary winding of repeating coil 337, primary winding of repeating coil 334, lower outer armature and front contact of relay 326, make-before-break contacts of relay 338, lower armature and back contact of relay 340, upper inner armature and back contact of relay 336 to ground at the inner upper armature and front contact of relay 326. The secondary winding of repeating coil 337 is associated with the ringing source 325 so that an impulse of tone current is now transmitted from this source through trunk ST to the "A" operator's telephone set connected to cord 103. The operation of relay 326 now closes an obvious circuit for the operation of the slow-to-operate relay 338. This relay operates after a short interval and opens the circuit for the secondary winding of repeating coil 337 and the primary winding of repeating coil 334, so that the impulse of tone current applied through these windings to the trunk ST is cut off as soon as relay 338 operates. The operation of relay 338 closes an obvious circuit for the operation of the slow-to-operate relay 342. Relay 342 in operating again closes a circuit for the coupling between the ringing source 325 and the secondary winding of repeating coil 334 by closing a circuit that now extends through the lower armature and front contact of relay 338, the lower armature and front contact of relay 342 through the lower armature and back

contact of relay 340. Hence, a second application of tone current from source 325 is now effected. Relay 342 also closes an obvious circuit for the operation of the slow-to-operate relay 340. On the operation of relay 340 the circuit for the secondary winding of repeating coil 337 and primary winding of repeating coil 334 is again opened this time at the lower armature and back contacts of relay 340. Consequently, the second application of tone current to the trunk is disconnected as soon as relay 340 operates. The operation of relay 340 closes an obvious circuit for the operation of relay 336 and this relay in operating closes a locking circuit for itself to ground at the inner upper armature and front contact of relay 326. Relay 336 in operating opens the connection for the secondary winding of repeating coil 334 to the tip and ring conductors of the trunk and also the original circuit through the secondary winding of repeating coil 337. As long as relay 336 is operated, no further application of tone current will be made during the connection of the circuits shown in Fig. 3 to the trunk ST. On the operation of relay 336 the operator's telephone set 321 is connected through the repeating coils 331 to the tip and ring conductors of trunk ST at the upper outer and inner lower armatures and front contacts of relay 336. Thus the tone signals are sent before the operator's telephone set is connected to the trunk ST.

The operation of relay 127 connects certain other leads between the common ringing key equipment and the trunk ST, such as leads 136, 137 and 138, for the control of the ringing equipment associated with the trunk through manipulations of the ringing keys 322.

As the "B" operator's telephone is now connected to the trunk and the "A" operator has received a signal to this effect, this latter operator will pass the information for the extension of a connection by the "B" operator and the "B" operator will operate the corresponding key in the common ringing key equipment. If the subscriber wanted is on a party line the corresponding party line ringing key is operated. For example if a party M is wanted key M is depressed and the following operations will take place to prepare the ringing equipment associated with trunk ST for the sending of the proper signal when the plug 111 of trunk ST is associated with jack 112, of a party line 110.

As key M is depressed relay 344 is operated through an obvious circuit. This relay in operating prepares a locking circuit for itself through its right hand armature and front contact to ground at the left hand armature and front contact of relay 319. The operation of relay 344 causes circuits to be completed for the operation of relays 143

and 144. The circuit for relay 143 may be traced from battery, winding of relay 143, middle lower armature and front contact of relay 127, lead 136, left hand armature and a front contact of relay 344 to ground at the left hand armature and front contact of relay 319, while the circuit for relay 144 may be traced from battery through the winding of relay 144, middle upper armature and front contact of relay 127, lead 138, left hand armature and a front contact of relay 344 to ground at the left hand armature and front contact of relay 319. These relays 143 and 144 provide locking circuits for themselves through their right hand inner armatures and front contacts to ground at the inner left hand armatures and front contacts of relay 117 when this relay operates as will be described presently. Relays 143 and 144 in operating connect ringing current from source 145 for the subsequent application to the tip conductor of the trunk ST as follows: source 145, left hand armature and front contact of relay 143, winding of the alternating current responsive relay or the so-called "ringing trip" relay 141, outer left hand armature and front contact of relay 144 and the front contact associated with the upper outer armature of relay 146 which is connected to the tip conductor of trunk ST. The operation of relay 144 applies a ground at its inner left hand armature and front contact to the front contact associated with the lower armature of relay 146, which is connected to the ring conductor of trunk ST. Thus, the operation of key M prepares the ringing equipment associated with trunk ST for transmission of a signal for party M on a line when the trunk is connected therewith.

The operation of relay 344 also closes a circuit for the operation of slow-to-operate relay 345 as follows: battery, winding of relay 345, right hand armature and a front contact of relay 344 to ground at left hand armature and front contact of relay 319. Relay 345 in operating closes a circuit to battery for the operation of relay 117 as follows: battery, right hand armature and front contact of relay 345, inner right hand armature and front contact of relay 319, lead 137, inner lower armature and front contact of relay 127, winding of relay 117, armature and back contact of relay 141, inner left hand armature and back contact of relay 142 to ground. Relay 117 in operating completes a locking circuit for itself from battery at its inner right hand armature and front contact to ground at the inner left hand armature and back contact of relay 142, and also completes the above mentioned locking circuits for relays 143 and 144.

The operation of relay 117 by opening its make-before-break contacts to battery opens the energizing circuits for relays 108 and

127, which are now released to disconnect the leads 136 to 138, 131, 133 and 134 from the trunk ST.

Relay 108 in releasing opens the circuit for the flashing of guard lamp 121, and this lamp will now be lighted with a steady light over a circuit as follows: battery, lamp 121, outer inner armature and back contact of relay 108, right hand armature and back contact of relay 142, middle right hand armature and front contact of relay 117, inner lower armature and back contact of relay 115, winding of relay 125 to ground. Thus, the pilot lamp 126 is maintained lighted and the lamp 121 will be steadily lighted. The steady light of lamp 121 indicates to the "B" operator that the ringing equipment associated with the trunk has been set by a ringing key.

If the ringing key J is operated instead of key M, relays 144 and 117 will operate. In this case ringing current from source 147 is connected for association with the tip conductor of trunk ST and ground is connected for association with the ring conductor.

If ringing key R is depressed, relays 117 and 143 are operated. In this case current from source 145 is connected for the ring conductor and ground for the tip conductor of trunk ST.

If ringing key W is operated relay 117 only is operated. In this case current from the ringing source 147 is connected for the ring conductor and ground for the tip conductor. When the trunk key T is operated relays 117, 144 and 143 remain unoperated and thereby prevent the setting of the ringing equipment in trunk ST. The circuits in this case only function to release the common control equipment from the trunk. That is, the operation of relay 347 closes a circuit for the operation of relay 317. This relay in operating opens the holding circuit for relays 316 and 127. It should be noted that relay 108 would, under these circumstances, remain actuated and lamp 121 would continue to flash. The trunk key T would be operated when it is desired to eliminate the ringing and connect the trunk for supervision or other purposes but not for extension to a wanted subscriber as is well known in the art.

As stated the lamp 121 would ordinarily be lighted steadily to indicate that the trunk is ready for extension to a wanted subscriber's line. Hence, the operator will now insert plug 111 into jack 112 of the desired line. Relay 115 will now operate through the sleeve circuit. The operation of relay 115 connects the tip conductor to the contacts of relay 146 and causes the guard lamp 121 to be extinguished on the opening of the circuit therefor at the lower inner armature and back contact of this relay. The operation of relay 115 also closes a circuit for the

operation of relay 146 as follows: from battery at the upper inner armature and front contact of relay 115, outer right hand armature and back contact of relay 143 through the outer right hand armature and back contact of relay 144, upper inner armature and back contact of relay 146 and the winding of this relay, outer right hand armature and front contact of relay 117, lower outer armature and front contact of relay 115 to ground at the armature and front contact of relay 106, that is, provided relays 143 and 144 are in released condition which would be the case if the W key had been operated. If either or both of the relays 143 and 144 were operated as would be the case when M, J or R keys are operated, the circuit for the operation of relay 146 will extend from the battery through pick-up interrupter 149, outer left hand armature and front contact of relay 117, outer right hand armature and front contact of relay 143 or make-before-break contacts of relay 144 to the upper inner armature and back contact of relay 146 and from there to the ground at the armature and front contact of relay 106 as hereinbefore traced. The particular type of ringing system shown here is that known as four-party semi-selective in which ringing current is connected to either the tip or ring conductor and the two stations on the selected conductor are called by a one or a two-ring code. The pick-up interrupter 149 is necessary to avoid mutilation of the two-ring code and, although its use is not necessary in ringing parties J and W, it is used in connection with party J merely as a matter of convenience in arranging the circuit details. A system of this nature is shown and described in Patent 1,609,395 granted to R. S. Bailey, December 7, 1926. Relay 146 provides a locking circuit for itself through its make-before-break contacts to battery at the upper inner armature and front contact of relay 115. Relay 146 in operating opens the short-circuits across the ring back condensers 150 and 151 for the tip and ring conductors of the trunk and connects ringing current to the tip and ring conductors of the trunk at its upper outer armature and front contact and lower armature and front contact in accordance with the various settings of the relays 143, 144 and 117 as hereinbefore described. Thus the wanted subscriber will be called as soon as his line is connected to the trunk.

If plug 111 has been inserted into jack 112 before the operation of a key of the common ringing key equipment relay 115 will operate while relay 146 would remain released and the lamp 121 will continue to flash, due to the fact that relay 108 would then still be maintained operated through its left hand winding. Lamp 121 would therefore indicate to the operator that a ringing

key should be actuated. When any of the ringing keys are now actuated the circuits of the trunk and the common equipments operate in the same manner as hereinbefore described, that is, the operation of relay 117 will cause the release of relays 127 and 108 and thus disconnect the common ringing key equipment and the operator's telephone set from the trunk, as hereinbefore described. The release of relay 108 causes the lamp 121 to be extinguished and the operation of relay 117 causes the operation of relay 146 as hereinbefore described to apply ringing current to the wanted subscriber's line.

When now the wanted subscriber answers the call by removing his receiver from the hook, the tripping relay 141 operates, which causes the release of relay 117. Relay 117 in releasing causes the release of relay 146 and either or both of the relays 143 and 144, if they are operated. Relay 146 therefore disconnects the ringing current from the line, releases the tripping relay 141, and short circuits the condensers 151 and 152 in the talking connection, which is thereby completed through the trunk. It should be noted that the called subscriber cannot be again called unless the connection is taken down and re-established as the relays 143, 144 and 117 have been released and consequently a new setting of these relays must be effected.

On the release of relay 146 the supervisory relay 152 will operate. The operation of this relay short-circuits the right hand high resistance winding of relay 105, thereby increasing the current flow through the trunk, which is sufficient to cause the usual supervisory relay in the "A" operator's cord 103 to operate and extinguish the supervisory lamp. This indicates to the "A" operator that the connection has been extended to the wanted subscriber and that conversation may now begin.

If an attempt is made to reconnect the common ringing key equipment before the trunk has been disconnected from the wanted subscriber's line by operating the trunk key 123, this attempt will not be successful as relay 108 is released and consequently there will be no circuit to battery at relay 117 for relay 127.

At the end of the conversation when the called subscriber's receiver is replaced on the hook relay 152 will release. The release of relay 152 removes the short circuit from the high resistance winding of relay 105 thus causing the supervisory lamp in the cord 103 to be relighted as a disconnect signal to the "A" operator. When now the "A" operator removes the plug of cord 103 from jack 104, relay 105 is released, causing the release of relay 106. Relay 106 in releasing closes a circuit for relay 142 as follows: battery, upper inner armature and front contact of relay 115, winding of relay 142, make-be-

fore-break contacts of relay 106 to ground. Relay 142 in operating locks to ground at its inner left hand armature and front contact and by operating its right hand armature closes an obvious circuit for the lighting of lamp 121. The lighting of this lamp indicates to the "B" operator that conversation has ceased and that the connection may be taken down. She will then remove plug 111 from jack 112, which causes the relay 115 to release. This relay in turn will release relay 142 and cause the lamp 121 to be extinguished, thus restoring the circuits to normal.

If the "A" operator should abandon the call before the called subscriber answers the ringing would be discontinued and the disconnect lamp lighted as relay 142 would operate to release relay 117 which would in turn release relays 143 and 144.

In reference to the arrangement for grouping the trunks and transferring the common control equipments from one group to another, a description will now be made of a circuit for this purpose which is shown in Fig. 2. It is evident, however, that other arrangements can be made than that illustrated and this arrangement should be considered only as illustrative of the invention.

The common control equipment shown in Fig. 3 is normally arranged for use with a group of trunks to which the trunk shown in Fig. 1 belongs and also for a group of trunks terminating in the leads marked 200. Two other groups of trunks may terminate in leads such as 201 and 202 respectively and leads marked 203 may terminate in a common control equipment identical with that shown in Fig. 3 normally arranged for use with said last mentioned two groups of trunks. Vertical groups of relays marked 210, 211, 212 and 213 are controlled respectively by means of keys 215, 216, 217 and 218 to transfer control equipments such as shown in Fig. 3 for use with other groups of trunks or for combining a plurality of groups of trunks for association with a certain control equipment or equipments in any manner desired.

For example, if it is desired to prevent the control equipment connected at 203 from being used in connection with the groups of trunks terminating at 201 and 202 and to transfer these trunks for association with the common equipment shown in Fig. 3, key 215 is left in its normal position to leave the group of relays 210 in their normal non-operated position while key 216 is operated to release the group of relays 211. This connects the leads from the points 201 and 202 through the armatures and back contacts of the relays in groups 210 and 211 that are required for the use of the common equipment shown in Fig. 3 in connection with these two groups of trunks. The operator's

telephone set of the common equipment type terminating at 203 is also removed from the use of this equipment. In this case, therefore, a call incoming from any trunk in either of the groups terminating at 201 or 202 will cause the common equipment shown in Fig. 3 to be connected to said trunk in the same manner as this equipment is connected to any of the trunks in the group terminating at 200 and to any of the trunks in the group to which the trunk shown in Fig. 1 belongs.

For example, if a trunk of the group terminating at 201 initiates a call, the following circuits are established on the operation of the corresponding key: The first circuit to be closed may be traced as follows, from battery supplied through the winding of the relay of the trunk that originates the call corresponding to relay 127 of trunk ST to lead 230 corresponding to lead 130 to ground at the left hand armature and back contact of the relay, in the common control equipment connected at 203, corresponding to relay 315. This causes the operation of the relay in this trunk corresponding to relay 127 to operate. The operation of this relay prepares a locking circuit for itself which may be traced through the upper armature and front contact of this relay through lead 231 corresponding to lead 131 through the relay corresponding to relay 316 to ground at the armature and front contact of the relay corresponding to relay 317 in the control equipment connected at 203. The operation of this relay provides a ground for the operation of the relay corresponding to relay 315 as well as the relay 315. The circuit for the operation of these two relays may be traced as follows: from battery through the winding of the relay corresponding to relay 315 of the common equipment connected at 203, to ground at the inner right hand armature and front contact of the relay corresponding to relay 316 in this equipment, while the circuit for the operation of relay 315 may be traced from battery through the winding of relay 315, lead 251, lower outer armature and back contact of relay 253, lower outer armature and back contact of relay 258, lead 255, to ground at the inner right hand armature and front contact of the relay corresponding to relay 316 in the common equipment connected at 203. The operation of the relay corresponding to relay 315 causes the operation of the relay corresponding to relay 319 in the common equipment connected at 203, but no further operation of relays takes place in this common equipment as the operator's telephone set is disconnected therefrom and consequently, the relays corresponding to relays 332 and 328 are not operated.

The operation of relay 315 in the equipment shown in Fig. 3 due to the connection

of the operator's telephone set 321, however, operates to associate the ringing key equipment and the operator's telephone set shown in Fig. 3 with the seized trunk in the group connected through leads 201 and it will function as hereinbefore described in connection with this trunk in the same manner as it functions when it was connected to trunk ST.

It will be noted that the leads in this trunk corresponding to the leads 136, 137 and 138 will be connected as follows to the common equipment shown in Fig. 3. The lead corresponding to lead 136 is identified as lead 236 and may be traced to the common equipment in Fig. 3 over the lower inner armatures and back contacts of relays 258 and 253 to lead 136; while the lead corresponding to lead 137 is marked 237 and may be traced through the upper outer armatures and back contacts of relays 258 and 253 to the lead 137 and finally the lead corresponding to lead 138 is marked 238 and may be traced through the upper inner armatures and front contacts of relays 258 and 253 to lead 138. The talking leads of a trunk connected at 201 corresponding to leads 133 and 134 from trunk ST are marked 233 and 234 respectively and may be traced through the upper outer and lower outer armatures and back contact of relays 267 and 256 to leads 135 and 134 respectively. The busy test lead from the trunk connected at 201 may be traced from lead 240 to the upper and lower inner armatures and back contacts of relays 267 and 256 to the lower inner armatures and front contacts of relay 328 to the lower busy test winding 360 to ground. The lead in the trunk ST corresponding to this busy test lead 240 is marked 140. The lead in the trunk connected at 201 corresponding to lead 124 in trunk ST that leads to the flashing equipment for the lamp corresponding to lamp 121 is marked 224.

The above description of the use of a common equipment such as the one shown in Fig. 3 for trunks associated with leads 201 is illustrative of the connections that can be made for using a common equipment for any number of groups of trunks by means of the transfer equipment shown in Fig. 2. If it is decided, for example, to have the trunks connected at 202 served by the common equipment shown in Fig. 3 and exclude the trunks connected at 201, key 215 may be operated to actuate the relays 267, 257 and 258. In this manner the operation of a key of a trunk of the group connected at 201 will not cause the operation of the relay 315 of the common equipment shown in Fig. 3 while the operation of a key of a trunk of the group connected at 202 will cause such an operation. It seems unnecessary to trace the circuits for doing this, as it is evident that it is done in a

similar manner to the operation of this relay from a trunk connecting at leads 201. However, to illustrate the use of relay 257 in this connection, it should be noted how the lead from the group of trunks terminating at 202, corresponding to lead 230, is cut off from 230 at the upper inner armature and back contact of relay 257 and connected to lead 259 which in turn is connected to lead 130. Similarly, the operation of the relay corresponding to relay 362, and the lighting of the lamp corresponding to lamp 363, in place of the operation of the relay corresponding to relay 316 and the lighting of the lamp corresponding to lamp 318 in Fig. 3 when a trunk of the group terminating at 202 is initiating a call to indicate the fact to the operator that a trunk in this group is initiating a call is established over the lead 260. The circuit in this case may be traced as follows: from battery at the inner upper armature and front contact of the relay corresponding to relay 127, through the lead 261, winding of the relay corresponding to relay 362 lead 262, upper armature and front contact of relay 257, leads 260 and 263, armature and back contact of relay 317 to ground.

It may also be illustrated how lead 265 is employed. This lead is normally not completed when only the group of trunks terminating at 202 is associated for use with the common equipment shown in Fig. 3, except when both groups of trunks terminating at 201 and 202 are associated for use with the common equipment shown in Fig. 3. In this latter case, both the relay 317 and the relay corresponding to this relay in the common equipment connected at 203 are connected through to the battery at the outer left hand armature and front contact of relay 347 so that these relays operate on the actuation of the trunk key T to release the relay 316 and the relay corresponding to relay 362 in the common equipment connected at 203. The circuit in this case is as follows: battery, right hand armature and front contact of relay 347, winding of relay 317 to ground, and from the above mentioned battery through leads 266 and 265, lower armatures and back contacts of relays 269 and 257 and lead 264 to ground, through the winding of the relay corresponding to relay 317 in the common equipment connected at 203.

To further illustrate the flexibility of this system for transferring of the trunks normally assigned to be controlled by one control equipment to be controlled by another equipment, it should be mentioned that it is not necessary for an operator to use the particular key equipment assigned to be used with certain groups of trunks when such trunks have been transferred thereto, but that the keys of another control equipment,

notably the keys of the control equipment to which these trunks are normally assigned, may be employed to set the ringing equipment of a calling trunk in any of said groups of trunks. It is quite evident from the drawings that this may be done, as the relays 315, 317 and 362 or 316 and all other corresponding relays in each equipment for the groups or trunks transferred are operated. Consequently the keys of all these control equipments are normally available. The purpose of this arrangement is to enable an operator to sit at any position of the positions segregated and while she will connect her telephone set with one of the control equipments she may use the keys of the same or any other control equipment the trunks of which have been transferred. It seems unnecessary to describe how this is done in much detail as it is readily seen that, for example, if the operator has her telephone set connected to the equipment shown in Fig. 3 and the groups of trunks terminating at 201 and 203 have been transferred to be controlled by this equipment, the keys of the control equipment terminating at 203 may be used to set the ringing equipment in any of the trunks calling in any of the groups terminating at 201, 202, 200 or in the group to which trunk ST belongs in the same manner as the keys 322 may be used for this purpose.

What is claimed is:

1. In a telephone system, a plurality of lines, a ringing key equipment and an operator's telephone set common to said lines, a key individual to each of said lines and means responsive to the initiation of a call over a line and to the operation of the corresponding key for associating the ringing key equipment and the operator's telephone set with said line.

2. In a telephone system a plurality of calling lines, a ringing control equipment and an operator's telephone set common to said lines, a key individual to each line, means individual to a line responsive to the seizure of said line for preparing it for the subsequent connection thereto of the common ringing equipment and the operator's telephone set and means responsive to the actuation of said means of a seized line and the actuation of the corresponding key for connecting the common ringing equipment and the operator's telephone set to said seized line.

3. In a telephone system a plurality of calling lines, a ringing control equipment and an operator's telephone set common to said lines, a key individual to each of said lines, means individual to a line automatically responsive when a call is incoming thereover to prepare said line for the subsequent connection of the ringing control equipment and the operator's telephone set

to said line on the operation of the corresponding key.

4. In a telephone system a plurality of lines, a common control equipment for said lines, a key individual to each of said lines, means responsive when a call is incoming over a line and the corresponding key is operated for connecting said control equipment to said line and means for preventing more than one of said lines from being connected to the common equipment at any one time.

5. In a telephone system a plurality of lines, a ringing key equipment and an operator's telephone set common to said lines, a key individual to each of said lines, means responsive to a call incoming over a line and to the operation of the corresponding key for associating the ringing key equipment and the operator's telephone set with said line and means in said line responsive to the operation of the ringing key equipment for preparing said line for the transmission of a signal thereover.

6. In a telephone system calling lines, called lines, a ringing key equipment and an operator's telephone set common to said calling lines, a key individual to each of said calling lines, means responsive to a call incoming over a calling line and to the operation of the corresponding key for associating the ringing key equipment and the operator's telephone set with said line, means for connecting said calling line to a called line, and means in said calling line responsive to the actuation of the ringing key equipment for preparing said line for the transmission of a signal over the connected called line, the preparation of said means for the transmission of a signal being effected regardless of the operation of the ringing key equipment before or after said calling line is connected to a called line.

7. In a telephone system calling lines, called lines, a ringing key equipment and an operator's telephone set common to said lines, a key individual to each of said calling lines, means responsive to a call incoming over a calling line and to the operation of the corresponding key for associating the ringing key equipment and the operator's telephone set with said line, means for connecting a calling line with a called line, means in said calling line responsive to the actuation of the ringing key equipment for the transmission of a signal to a called line when said called line is connected to said calling line and means for automatically disconnecting the ringing key equipment and the operator's telephone set from said calling line responsive to the actuation of ringing key equipment.

8. In a telephone system lines, a ringing key equipment and an operator's telephone set common to said lines, a key individual

to each of said lines, ringing means individual to each line, means responsive to the seizure of a line and the operation of the key individual to said line for connecting the ringing key equipment and the operator's telephone set to said line and for setting the ringing means individual to said line in accordance with the setting of the common ringing key equipment and for thereafter removing the common ringing key equipment and the operator's telephone set from said line.

9. In a telephone system incoming lines, outgoing lines, means for connecting an incoming line with an outgoing line, ringing means individual to each of said incoming lines, a key individual to each incoming line, a ringing key equipment and an operator's telephone set common to said incoming lines, means responsive when a call is incoming over a line and the corresponding key is actuated to connect the ringing key equipment and the operator's telephone set to said incoming line, means to prepare the corresponding ringing means of said incoming line for signaling under control of said common ringing key equipment, means responsive to said last means for removing the operator's telephone set and the ringing key equipment from said incoming line and means for actuating said ringing means to transmit the prepared signal to an outgoing line effected on the connection of said incoming line with said outgoing line.

10. In a telephone system a plurality of groups of lines, a control equipment for each group of lines, a key individual to each of said lines, means responsive when a call is incoming over a line and the corresponding key is operated for connecting the corresponding control equipment to said line, and means for eliminating a variable number of said control equipments from the respective groups of lines and substituting a variable number of the remaining control equipments therefor.

11. In a telephone system, link circuits, called lines for association with said link circuits, a ringing equipment individual to each link circuit, a ringing key equipment common to said link circuits for controlling said ringing equipments, means responsive to the appropriation of one of said link circuits for associating said common ringing key equipment with said appropriated one of said link circuits, means for disconnecting the common ringing key equipment from said link circuit in response to its operation, and means for preventing said common ringing key equipment from being reconnected to said link circuit until after said link circuit has been connected to a called line and disconnected therefrom.

12. A telephone system comprising lines, a control equipment common to said lines,

a key individual to each of said lines, and means responsive to the seizure of one of said lines and the actuation of its individual key for temporarily and exclusively connecting said control equipment with said seized line, characterized by the provision of means for transmitting a signal comprising a plurality of impulses of tone current over said seized line during the operations incident to the connection of said control equipment to said seized line.

13. In a telephone system, a plurality of lines, a ringing key equipment and an operator's telephone set common to said lines, a key individual to each of said lines, and means responsive to the initiation of a call over a line and to the operation of the corresponding key for exclusively associating the ringing key equipment and the operator's telephone set with said line.

14. In a telephone system, a plurality of lines, a ringing key equipment, and an operator's telephone set common to said lines, a key individual to each of said lines, means responsive to the initiation of a call over a line and to the operation of the corresponding key for associating the ringing key equipment and the operator's telephone set with said line, and means for rendering the corresponding individual keys of other lines ineffective while said ringing key equipment and said operator's telephone set are connected to said line.

15. In a telephone system, lines, individual signals, a common signal, means responsive to the seizure of one of said lines for operating the signal individual to said line and said common signal as a calling signal, and means for operating said individual signal only as a disconnect signal.

16. In a telephone system, a straightforward trunk, a signal individual to said trunk, a signal common to said trunk, an operator's control equipment, means responsive to the seizure of said trunk for connecting said operator's control equipment to said trunk and for operating said signals as a calling signal, and means for operating said individual signal only as a disconnect signal.

17. In a telephone system, a straightforward trunk, a signal individual to said trunk, a signal common to said trunk, an operator's control equipment, means responsive to the seizure of said trunk for operating said common signal and for operating said individual signal in one manner, means responsive to the manipulation of said operator's control equipment for operating said individual signal in another manner, and means for operating said individual signal only as a disconnect signal.

18. In a telephone system, a straightforward trunk, a called line, a signal individual to said trunk, a signal common to said trunk, an operator's control equipment,

means responsive to the seizure of said trunk
for operating said common signal and for
operating said individual signal in one
manner, means for connecting said opera-
5 tor's control equipment to said trunk, means
responsive to the manipulation of said op-
erator's control equipment for operating
said individual signal in another manner,
means responsive to the extension of said
10 trunk to said called line for disabling said
signals, and means for operating said indi-
vidual signal only as a disconnect signal.

19. In a telephone system, a straightfor-
ward trunk, a called line, a signal individ-
15 ual to said trunk, a signal common to said
trunk, an operator's control equipment,
means responsive to the seizure of said
trunk for operating said common signal and

for operating said individual signal in one
manner, a key individual to said trunk, 20
means responsive to the operation of said
key after said trunk has been seized and
said signals are operating in the aforesaid
manner for connecting said operator's con-
25 trol equipment to said trunk, means respon-
sive to the manipulation of said operator's
control equipment for operating said indi-
vidual signal in another manner, means re-
sponsive to the extension of said trunk to
said called line for disabling said signals, 30
and means for operating said individual
signal only as a disconnect signal.

In witness whereof, I hereunto subscribe
my name this 20th day of December, A. D.
1926.

HORACE W. ULRICH.