Nov. 24, 1925. 1,562,528

J. F. TOOMEY ET AL

TELEPHONE SYSTEM

Filed Nov. 15, 1923 4 Sheets-Sheet 1

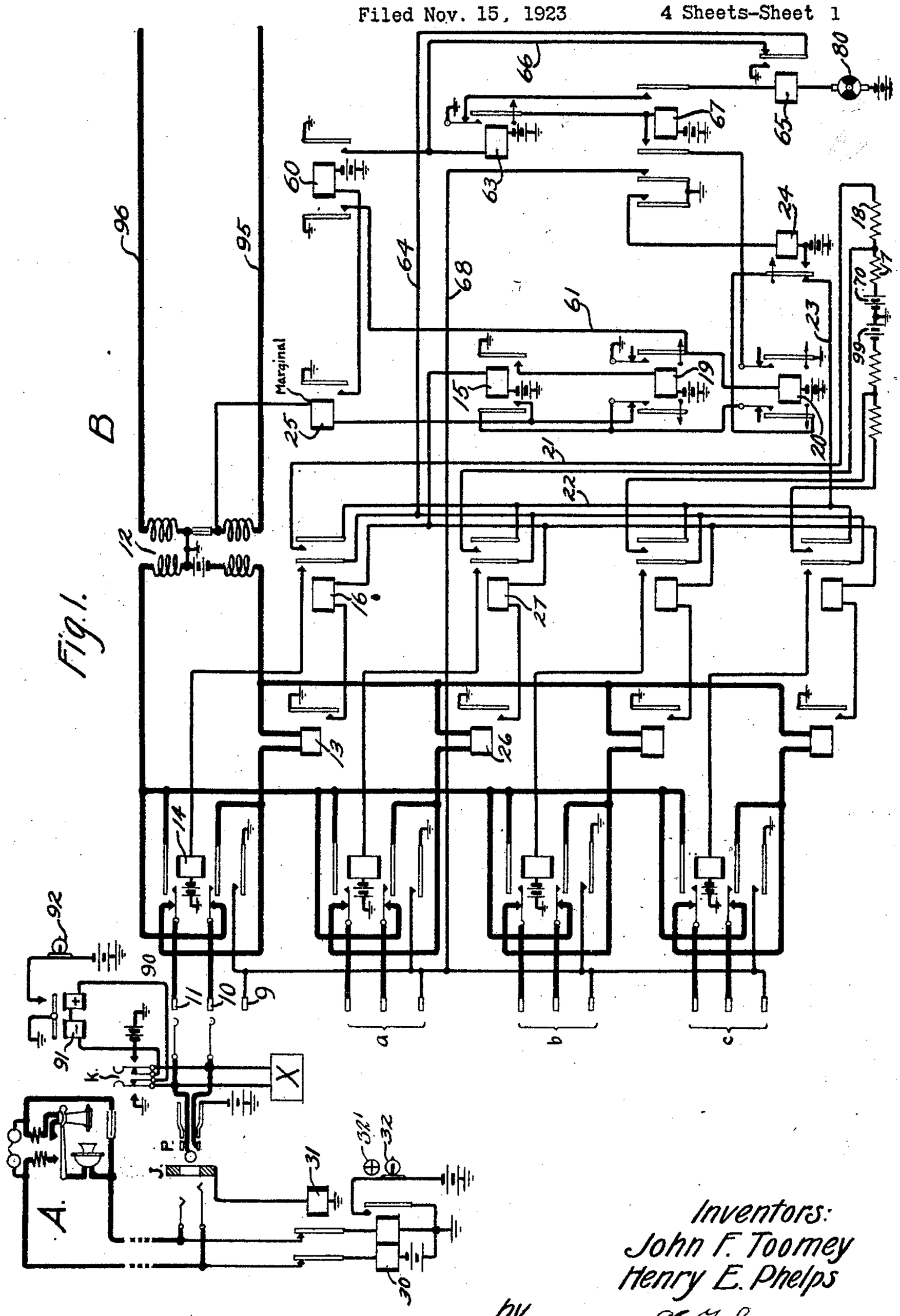

Fig. 1.

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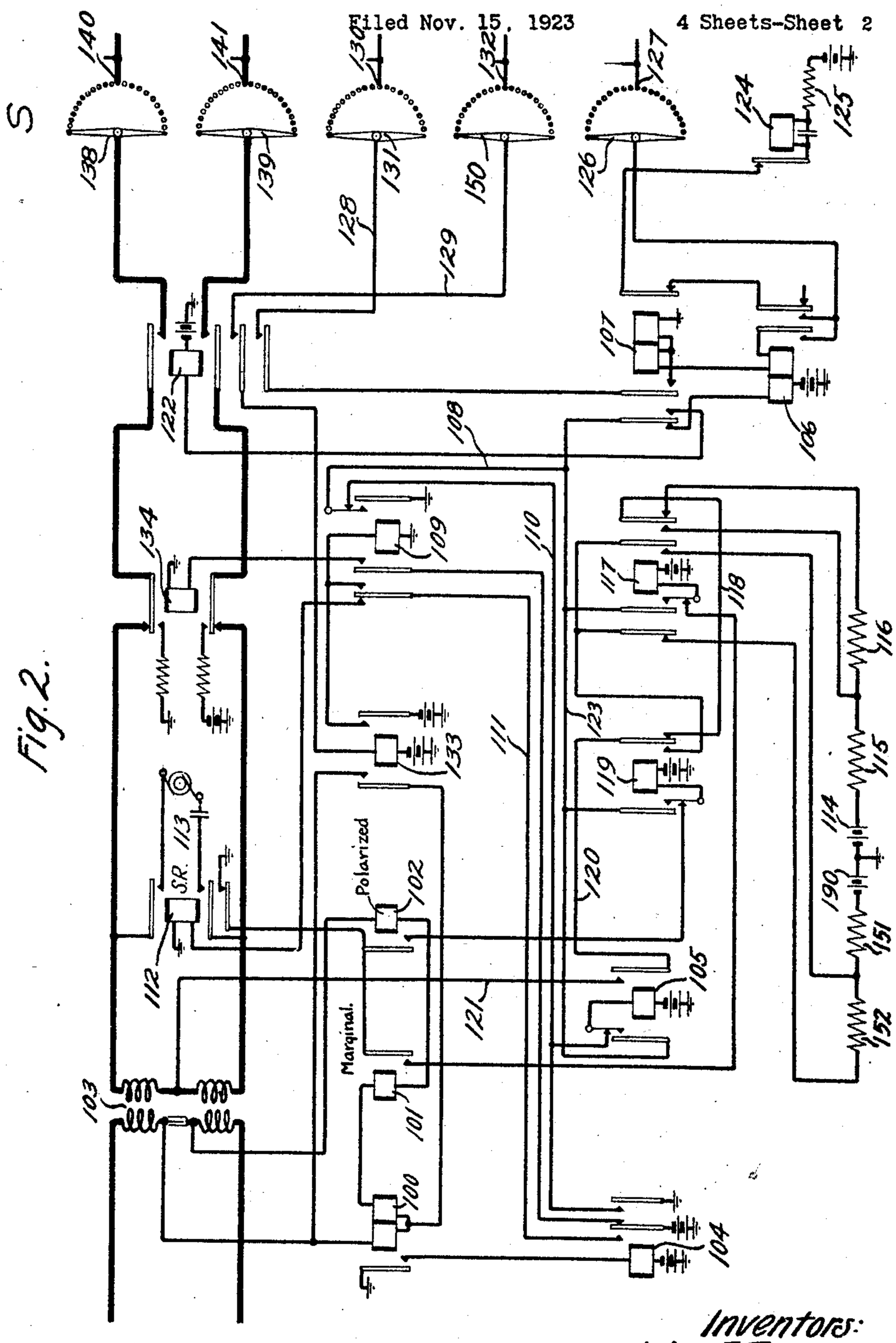

Fig. 2.

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TELEPHONE SYSTEM

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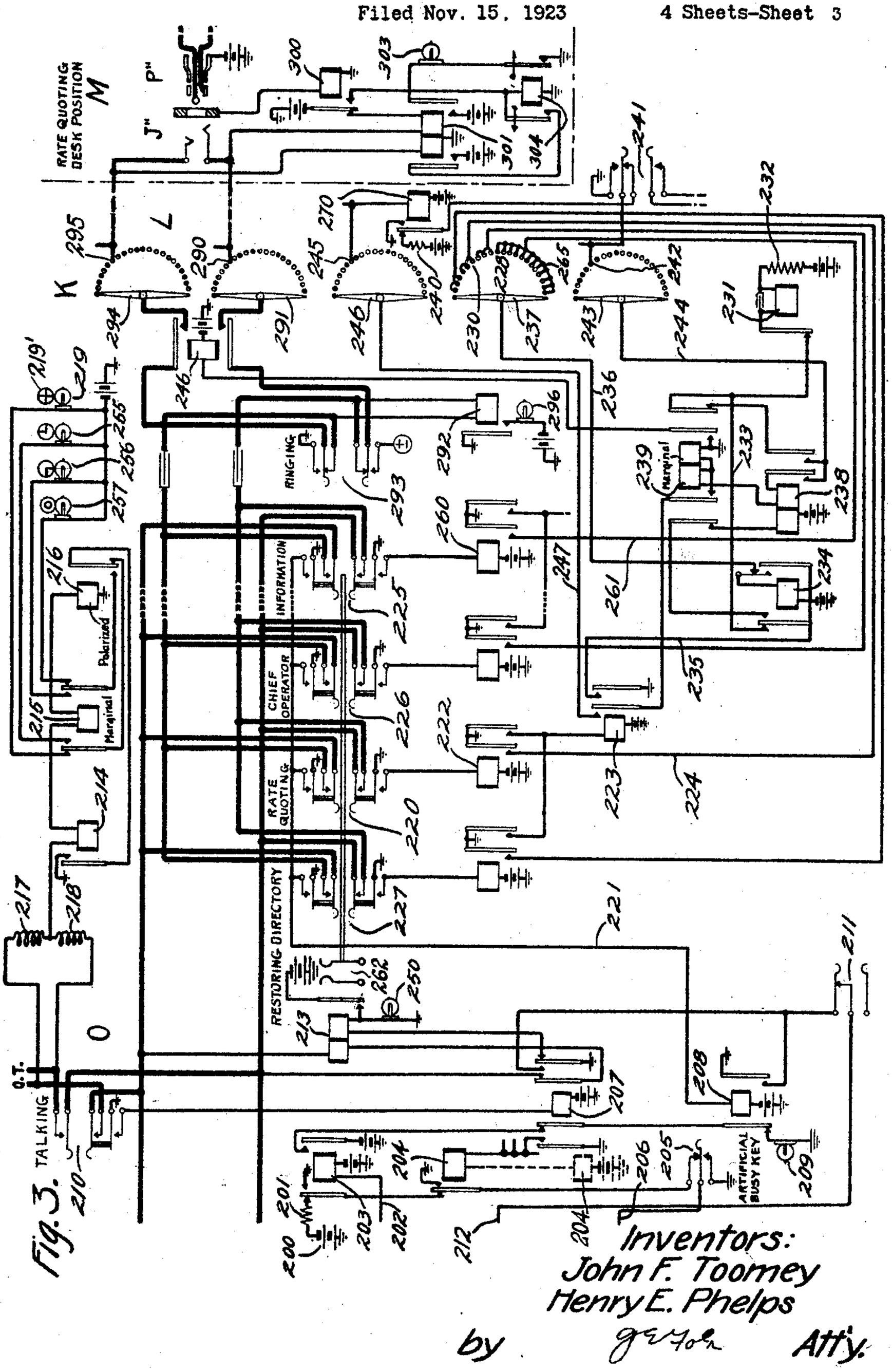

Fig. 3.

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TELEPHONE SYSTEM

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4 Sheets-Sheet 4

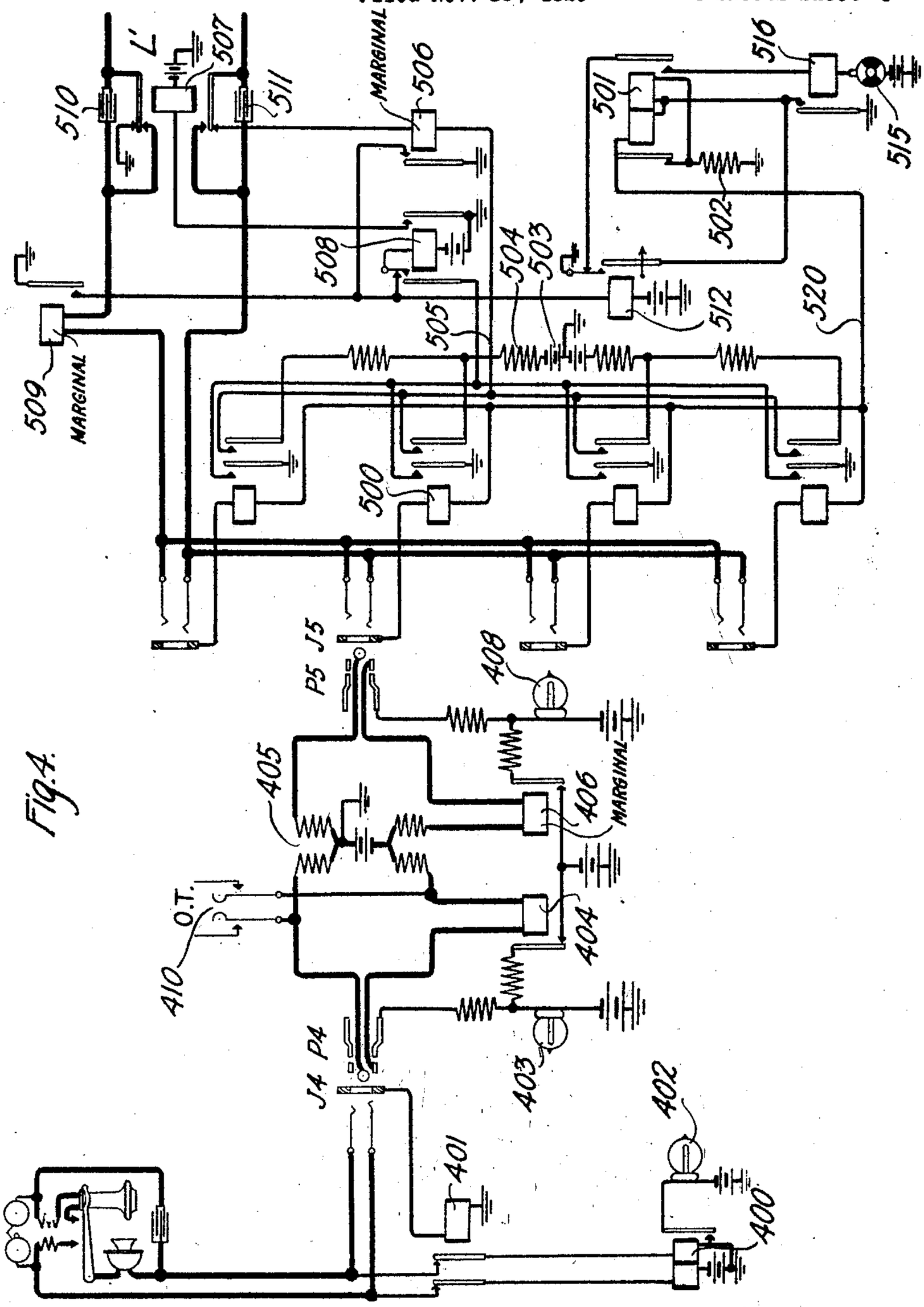

Fig.4.

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Patented Nov. 24, 1925. 1,562,528

UNITED STATES PATENT OFFICE.

JOHN F. TOOMEY AND HENRY E. PHELPS, OF NEW YORK, N. Y., ASSIGNORS TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEPHONE SYSTEM.

Application filed November 15, 1923. Serial No. 674,939.

To all whom it may concern:

Be it known that we, JOHN F. TOOMEY and HENRY E. PHELPS, residing at New York and New York, in the counties of New York and Bronx, and State of New York and New York, have invented certain Improvements in Telephone Systems, of which the following is a specification.

This invention relates to telephone systems, and more particularly, to systems wherein trunk lines are employed in connecting different switchboards or operators' positions.

It is broadly the object of this invention to simplify the operations performed by manual switchboard operators in completing telephone connections.

This object is attained in accordance with a feature of the invention by providing manual switchboard operators with cordless connecting circuits, that is, instead of providing the operator with a number of cords and jacks with which she may complete connections, each position is equipped with key sets, each set comprising a plurality of mechanically interlocking keys in which the connecting circuits serving that position terminate. By this arrangement the mere act of operating a key by an operator extends a call incoming to her position to the position or switchboard corresponding to the key actuated. Cordless connecting circuits are particularly adapted for use at what are known as recording operators' positions.

Another feature of the invention resides in the automatic distribution of calls incoming to a recording operator's position. When a recording trunk is taken up at its outgoing end for a new call, its incoming end is automatically connected to an idle connecting circuit appearing before an idle recording operator, by means of a rotary type selector switch. The lighting of a lamp signal indicates to the recording operator that a call has come in on one of her idle connecting circuits.

A further feature of the invention resides in the provision of class of service signals. The operation of the talking key unit of a connecting key set at a recording operator's position completes a circuit for indicating to the recording operator the calling subscriber's class of service.

A still further feature resides in the automatic selection of trunks terminating at the recording operator's position. In case a call incoming to a recording operator's position is of such a nature that the recording operator must extend it to some other part of the office, she may do so by operating the proper unit of a connecting key set and an idle trunk leading to the desired position or desk will then be automatically selected by a rotary type selector switch.

Another feature resides in the prevention of intrusion on a busy operator. When a recording operator actuates a talking key in response to an incoming call all the connecting circuits serving that position are rendered busy, so that new calls are excluded during the time the operator is completing the first connection.

The above and other features of the invention will readily appear from the following detailed description made with reference to the accompanying drawings in which Figure 1 shows the outgoing end of a toll trunk line terminating in a semi-mechanical office together with the associated apparatus for transmitting class of service signals over the trunk line, a calling subscriber's line and a diagrammatic representation of the circuits of a semi-mechanical operator's position for extending a connection from the subscriber's line to the toll trunk. Fig. 2 shows the incoming end of the toll trunk line together with the necessary equipment for relaying the class of service signals, and a selector switch in which the cordless connecting circuits leading to recording operators' positions terminate. Fig. 3 shows a connecting circuit terminating in a plurality of keys at a recording operator's position some of which are employed in extending an incoming call to another position, such as the so-called "rate-quoting" position M, by way of the rotary type selector switch K. The equipment necessary for receiving the class of service signals is also shown in Fig. 3. Fig. 4 shows the outgoing end of a toll trunk line terminating in a manual office and the necessary equipment at that office for transmitting class of service signals over the toll trunk line. This figure corresponds to the arrangement shown in Fig. 1.

The following description will trace a call from the originating subscriber's line A over the toll trunk line B, by way of a semi-mechanical office, to the recording operator's

position O, Fig. 3. Thence the call is extended to a special operator's position M. Though the following description is directed to a call handled by a semi-mechanical operator, it is obvious that the multiple terminal shown in Fig. 1 may be seized by a mechanical subscriber's machine switching equipment direct, the choice of terminals being dictated by conditions inserted in the subscriber's line equipment.

A calling subscriber at A to initiate a call removes the receiver from the switchhook thereby closing the circuit of the line relay 30. This circuit extends from grounded battery, through the left-hand winding of relay 30, the outer armature and back contact of cut-off relay 31, thence over the subscriber's line loop and through the back contact and inner armature of relay 31, to ground, through the right-hand winding of relay 30. Relay 30 energizes in this circuit and closes an obvious circuit for line lamp 32. This line lamp is provided with a distinctive lamp cap 32′ which enables the answering operator to determine the class of service to which the calling subscriber is entitled. In the present case it will be assumed that the calling subscriber is entitled to regular toll service.

The semi-mechanical operator on noting the illumination of lamp 32 inserts the answering plug P of an idle cord circuit at her position in the jack J of the calling line whereupon a circuit is established over the sleeve contacts of the plug P and jack J, through the winding of cut-off relay 31, which relay operates and opens the circuit of line relay 30 thereby extinguishing the line lamp 32.

The operator now obtains from the calling subscriber the nature of the connection desired, and assuming that the subscriber desires a toll connection, the operator proceeds to set up on her sender X, the necessary code for setting the brushes of the district selector 90, in which her cord circuit terminates, upon the terminals of a toll trunk line extending to the recording operator's position at O, Fig. 3. The code which the semi-mechanical operator sets up upon her keyboard is also determined by the class of service to which the calling subscriber is entitled and therefore the brushes of district selector 90 will not only be set, by the sender X, upon the terminals of the toll trunk line but also upon a particular set of multiple terminals of the toll trunk line for causing the transmission thereover, of a special distinctive signal to inform the toll operator of the class of service to which the calling subscriber is entitled.

For this purpose each toll trunk line terminates at the terminal bank of the district selector 90 in four sets of terminals. In the case assumed the brushes of the district selector 90 will be set upon the first set of terminals 9, 10 and 11. A circuit is thereupon established which may be traced from grounded battery, through the lower left-hand winding of repeating coil 12, winding of relay 13, upper normal contacts of relay 14, terminal 11 and the associated brush of the district selector 90, the left-hand normal contacts of key K, through the windings of the polarized supervisory relay 91, right-hand normal contacts of key K, brush and terminal 10 of the district selector 90, lower normal contacts of relay 14, through the upper left-hand winding of repeating coil 12, to ground. The direction of current in this circuit is such as to permit relay 91 to operate causing an obvious circuit for the supervisory lamp 92 to be established. The illumination of lamp 92 at this time serves as a guard signal. Relay 13 also operates in this circuit and establishes a circuit extending from grounded battery, through the winding of relay 15, and winding of relay 16, to ground, over the front contact and armature of relay 13. Relays 15 and 16 operate in this circuit. Relay 16 at its inner armature prepares a circuit for the reversing relay 14, the purpose of which will be described at a later time. At its outer armature relay 16 prepares a circuit originating at the positive pole of battery 70 which circuit will be completed presently. Relay 15 operating in series with relay 16 establishes an obvious circuit for the slow-to-release relay 19. Relay 19 at its right-hand armature establishes an obvious circuit for slow-to-release relay 20 and at its left-hand armature removes the short circuit from the left-hand armature contacts of relay 15.

The circuit originally started by the attraction of the outer armature of relay 16 is now complete and may be traced from grounded battery 70, resistance elements 17 and 18, conductor 21, front contact and outer armature of relay 16, conductors 22 and 23, back contacts and armature of slow-to-operate relay 24, left-hand armature and front contact of slow-to-release relay 20, left-hand armature and front contact of relay 15, winding of marginal relay 25, lower right-hand winding of repeating coil 12, conductor 95, lower left-hand winding of repeating coil 103, through the windings of polarized relay 102, marginal relay 101 and relay 100, upper left-hand winding of repeating coil 103, conductor 96, through the upper right-hand winding of repeating coil 12, to ground. Relay 25 being marginal does not operate in this circuit.

The current in the circuit just traced is in such a direction and of such strength as to operate only relay 100 of relays 100, 101 and 102 which are bridged across the trunk conductors 95 and 96 through the left-hand

windings of repeating coil 103. Relay 100 in operating establishes an obvious circuit for relay 104. Relay 104 operates, and in attracting its outer armature establishes circuits for relays 105 and 106 the former extending from grounded battery, through the winding of relay 105, normal contacts of relay 105, over the front contact and outer right-hand armature of relay 104, to ground, and the latter extending from grounded battery through the left-hand winding of relay 106, back contact and outer left-hand armature of relay 107, conductor 108, normal contacts of relay 109, conductor 110, over the front contact and outer armature of relay 104, to ground. At its inner armature relay 104 causes relay 112 to operate in a circuit extending from grounded battery, over the inner armature and front contact of relay 104, conductor 111, outer left-hand armature and back contact of relay 109, through the winding of relay 112 to ground. Relay 112, operating in this circuit, connects a source of tone current 113 to the main conductors of the trunk to indicate to the calling subscriber that the recording operator is being signaled as will appear presently.

Relay 105, operating in the circuit hereinbefore traced, establishes a circuit extending from ground, through positive pole of the battery 114, resistance elements 115 and 116, back contact and outer right-hand armature of relay 117, conductor 118, back contact and outer right-hand armature of relay 119, conductor 120, right-hand armature and front contact of relay 105, conductor 121, to the mid-point of the right-hand windings of repeating coil 103 and thence over the tip and ring conductors of the trunk as far as the armatures of relay 122. This circuit will be completed presently. At its left-hand armature relay 105 establishes a locking circuit for itself extending from grounded battery, through the winding of relay 105, front contact and left-hand armature of relay 105, conductor 123, conductor 108, normal contacts of relay 109, conductor 110, over the front contact and right-hand armature of relay 104, to ground.

Relay 106 operating in the circuit previously traced, causes the stepping magnet 124 to energize in a circuit extending from grounded battery, through the resistance element 125, winding and armature and back contact of magnet 124, armature and back contact of relay 107, both armatures and front contacts of relay 106, right-hand winding of relay 106, through both windings of relay 107 to ground. The stepping magnet 124, operating in this circuit, causes the selector switch S to start hunting for an idle trunk leading to the recording operator's position. As soon as the test wiper 126 of switch S encounters a contact which is supplied with battery, that is an idle trunk, the stepping magnet ceases to operate since it is shunted by the battery 200 (Fig. 3) associated with the idle trunk. Relay 107 now operates in a circuit extending from grounded battery 200, through the resistance element 201, back contact and left-hand armature of relay 203, back contact and armature of relay 204, upper contact of key 205, conductor 206, contact 127 and wiper 126 of the selector switch S, front contact and inner armature of relay 106, the right-hand winding of relay 106, through both windings of relay 107, to ground. Relay 107 in attracting its right-hand armature opens the original circuit of stepping magnet 124. At its outer left-hand armature relay 107 transfers the ground received from the make contact of relay 104 from the winding of relay 106 to the winding of relay 122. Relay 122 thereupon operates connecting the tip and ring conductors of the trunk to corresponding terminals of the selector switch S. At its two lower armatures relay 122 connects conductors 128 and 129 to the windings of relays 107 and 133 for purposes which will hereinafter appear. A circuit for relay 203 now exists which may be traced from grounded battery, through the winding of relay 203, conductor 202, terminal 130 and wiper 131 of switch S, conductor 128, front contact and lowermost armature of relay 122, left-hand inner armature and contact of relay 107, through the right-hand winding of relay 107, to ground. Relay 203 in attracting its left-hand armature removes battery 200 from the test terminal 127 of switch S and substitutes a ground therefor, in order to hold the multiple contacts of other selector switches busy. At its right-hand armature, relay 203 establishes a circuit extending from grounded battery, over the right-hand armature and front contact of relay 203, back contact and inner left-hand armature of relay 207, left-hand armature and back contact of relay 208, through the filament of lamp 209, to ground. The illumination of lamp 209 in this circuit indicates to the recording operator that there is a call awaiting her attention and she proceeds to answer it in the following manner.

It is to be understood that relay 107 remains operated in series with relay 203. The recording operator in response to the illumination of lamp 209 actuates the talking key 210, whereupon a circuit is established extending from grounded battery, through the winding of relay 207, to ground on the lower alternate contacts of key 210. Relay 207 operates in this circuit and performs the following functions: At its outer right-hand armature, it connects ground to the contact 132 of switch S by way of the normal contact of key 211, which ground

causes relay 133 to operate for a purpose hereinafter to be described. At its inner right-hand armature, relay 207 removes the left-hand winding of relay 213 from the incoming end of the connecting circuit; at its inner left-hand armature it opens the circuit for lamp 209 which thereupon is extinguished; at its outer left-hand armature it connects ground to the winding of relay 204 in a circuit connected to battery through the windings of all other such relays that are located in the connecting circuits to which this operator has access. All these relays will, therefore, operate and connect ground to the test terminals of these connecting circuits at all selector switches associated therewith and thereby causing said connecting circuits to test busy as long as any key, such as 210, at any one of the connecting circuits at this operator's position is operated. It is therefore evident that a position will not be selected by any incoming call as long as the operator at that position has one of her talking keys thrown. That is, any relay 207 which is operated causes the operation of all relays 204, as the lead from the inner contact of the outer left hand armature of these relays are multiplied together, as indicated by the taps on this lead. At its middle and upper alternate contacts key 210 bridges the operator's telephone set and the simplex circuit including the windings of relay 214, marginal relay 215 and polarized relay 216 across the tip and ring conductors of the trunk.

Upon the connection of ground to the contact 132 of selector switch S as hereinbefore described, relay 133 operates and at its right-hand armature establishes an obvious circuit for relay 109, while at its left-hand armature it short circuits the high resistance left-hand winding of relay 100. The shunting of the high resistance winding of relay 100 causes an increase in current in the circuit including the winding of marginal relay 25 hereinbefore traced. Marginal relay 25 thereupon operates and establishes an obvious circuit for relay 60. Relay 60 in attracting its left-hand armature establishes a new energizing circuit for slow-to-release relay 20 which may be traced from grounded battery, through the winding of slow-to-release relay 20, conductor 61, over the front contact and left-hand armature of relay 60, to ground. At its right-hand armature relay 60 establishes an obvious circuit for slow-to-release relay 63, and also a circuit for the reversing relay 14 which may be traced from grounded battery, through the winding of relay 14, front contact and inner armature of relay 16, conductor 64, armature and back contact of relay 65, conductor 66, over the front contact and right-hand armature of relay 60, to ground. Relay 14 operates in this circuit and in attracting its armatures reverses the tip and ring conductors of the trunk so that the current from the battery associated with the repeating coil 12 is reversed through the windings of polarized relay 91 so that this relay releases to extinguish the supervisory lamp 92. The darkening of lamp 92 at this time is of no importance as the semi-mechanical operator does not attend further to the connection, unless she is recalled by the calling subscriber, until she receives the disconnect signal.

Relay 63 which operated as a result of the energization of relay 60 establishes an obvious circuit for relay 67 which thereupon operates and locks to ground on the right-hand armature of relay 20. In attracting its right-hand armature, relay 67 performs no useful function at this time since the circuit for interrupter 80 is opened at the back contact of relay 63. Since relay 20 is now maintained energized over two circuits, one indirectly controlled by relay 13 in the outgoing end of the toll trunk, and the other indirectly controlled by relay 133 in the incoming end of the toll trunk, the locking circuit for relay 67 is therefore maintained as long as the trunk is held in service at either of its ends, and therefore ground potential is maintained on all multiples of test terminal 9 appearing in all district selectors having access to the outgoing end of the toll trunk. This ground is connected to the test terminal 9 in a circuit extending over conductor 68 to ground on the middle left-hand armature and front contact of relay 67. The toll trunk is thus made unavailable to other outgoing calls until after it has been released at both its ends. Relay 67 at its outer left-hand armature establishes an obvious circuit for relay 24 which operates, disconnecting battery 70 from the winding of marginal relay 25 and substituting therefor the battery associated with the front contact of relay 24, in order to hold relays 25 and 100 operated.

Relay 109 operating as a consequence of the operation of relay 133 as hereinbefore described, locks up over its outer left-hand armature to battery on the inner right-hand armature of relay 104. At its inner left-hand armature relay 109 prepares a circuit for relay 134, the purpose of which will hereinafter be described. At its right-hand armature relay 109 connects ground to the windings of relays 122 and 105 holding them operated independently of relay 104. In opening its left-hand normal contact, relay 109 opens the circuit for relay 112 which thereupon releases removing the tone source 113 from the trunk, which serves as an indication to the calling subscriber that the recording toll operator has answered the call and also removing ground from the armatures of relays 101 and 102.

As a consequence of the various operations

hereinbefore described, a circuit now exists which may be traced from ground, through battery 114, resistance elements 115 and 116, back contact and outer right-hand armature of relay 117, conductor 118, back contact and right-hand armature of relay 119, conductor 120, right-hand armature and front contact of relay 105, conductor 121, and thence in parallel through the right-hand windings of repeating coil 103, back contacts and armatures of relay 134, upper and innermost lower armatures and front contacts of relay 122, wipers 138 and 139, and terminals 140 and 141 of switch S, middle and upper alternate contacts of key 210, through the simplex windings 217 and 218, through the windings of relay 214, marginal relay 215 and polarized relay 216, to ground. The current in this circuit being of such a polarity and of a relatively low value does not cause either marginal relay 215 or polarized relay 216 to operate. Relay 214, however, operates causing lamp 219 to glow in a circuit extending from grounded battery, through the filament of lamp 219, back contact and left-hand armature of marginal relay 215, back contact and armature of polarized relay 216, over the armature and front contact of relay 214, to ground. The illumination of lamp 219 which is provided with a cap 219′ having a distinguishing marking corresponding to the marking on lamp 32, indicates to the recording operator the class of service to which this particular calling subscriber's line is entitled.

Since the operator's telephone set is bridged across the main conductors of the connection by the actuation of key 210, the recording operator may now converse with the calling subscriber. It will be assumed that the subscriber desires a connection with some operating room desk such as the "rate quoting" desk and that such a request is made to the recording operator. The operator may then restore her talking key 210 and actuate the "rate quoting" key 220. The actuation of key 220 causes cut-off relay 208 to operate in a circuit extending from grounded battery, through the winding of relay 208, conductor 221, to ground over the uppermost alternate contact of key 220. Relay 208 at its left-hand armature cuts off the lamp 209 and at its right-hand armature applies ground to the terminal 132 by way of the lead 212 to hold busy the equipment in the recording trunk circuit. At its two inner alternate contacts key 220 prepares the tip and ring conductors of the connecting circuit for connection with the corresponding terminals of the selector switch K. At its lowermost alternate contact, key 220 establishes an obvious circuit for relay 222. Relay 222 operates in this circuit and connects ground to the winding of relay 223 and also to conductor 224. It will be noted that sector 228 of the switch K has its terminals divided into four groups, with a certain number of terminals allotted to each group and each group corresponding to one of the keys 227, 220, 226 and 225. The terminals of the sector 228 are allotted in accordance with the traffic, that is, calls for "information" being more numerous than calls for "rate quoting," for "chief operator" or for "directory," a greater number of terminals will be assigned to "information" than to the other desks. The "information" desk group of terminals obviously corresponds to key 225, whereas the key 226 corresponds to the "chief operator" desk group of terminals, key 220 corresponds to the "rate-quoting" desk group of terminals and key 227 corresponds to the "directory" desk group of terminals. The grounding of conductor 224 by relay 222 connects ground to the group of terminals 230 which is allotted to "rate quoting." The operation of relay 223 as hereinbefore described causes the stepping magnet 231 to energize in a circuit extending from grounded battery, through the resistance element 232, winding of magnet 231, armature and back contact of magnet 231, conductor 233, back contact and left-hand armature of relay 234, conductor 235, over the front contact and outer armature of relay 223, to ground. At its inner armature relay 223 prepares a circuit for relay 270 as will hereinafter appear. The stepping magnet 231 upon energizing, causes the selector switch K to step around until the group of grounded terminals 230 is reached, whereupon relay 234 energizes in a circuit extending from grounded battery, through the winding of relay 234, right-hand normal contacts of relay 234, conductor 236, wiper 237 of switch K, to ground on the group of contacts 230. Relay 234 operates and locks itself to ground on the outer armature of relay 223 and disconnects itself from the wiper 237 of switch K. At its left-hand armature relay 234 causes relay 238 to operate in a circuit which may be traced from grounded battery, through the left-hand winding of relay 238, back contact and outer left-hand armature of relay 239, front contact and left-hand armature of relay 234, conductor 235, front contact and outer armature of relay 223, to ground. In completing this circuit relay 234 opens the original energizing circuit for stepping magnet 231. Relay 238 in operating establishes a circuit extending from grounded battery, through the resistance element 232, winding of magnet 231, armature and back contact of magnet 231, outer right-hand armature and back contact of relay 239, outer armature and front contact of relay 238, front contact and inner armature of relay 238, right-hand winding of re-

lay 238, to ground, through both windings of relay 239. Owing to the inclusion of resistance element 232 in this circuit relay 239 does not receive sufficient current to operate at this time. The stepping magnet 231, however, operates and causes the selector switch K to hunt for an idle trunk in the group corresponding to the group of terminals 230 leading to the "rate quoting" desk. The idle condition of the trunk is indicated by the presence of battery on the test terminal 242. As soon as such an idle trunk such as L is encountered a circuit is established extending from grounded battery, through the resistance element 240, back contact and left-hand armature of relay 270, normal contact of key 241, test terminal 242 and wiper 243 of switch K, conductor 244, front contact and inner armature of relay 238, right-hand winding of relay 238, to ground, through both windings of relay 239. The battery associated with the resistance element 240 shunts out the stepping magnet 231 causing it to release. The current through the windings of relay 239 is sufficient now to cause this relay to operate and lock up in series with relay 270 in a circuit extending from grounded battery, through the winding of relay 270, terminal 245 and wiper 246 of switch K, conductor 247, front contact and inner armature of relay 223, inner left-hand armature and front contact of relay 239, right-hand winding of relay 239 to ground. Relay 239 at its outer left-hand armature opens the circuit for relay 238. Relay 270 operating in the circuit just traced for relay 239, removes battery from the test terminal 242 of switch K and substitutes a ground therefor, thereby causing all the multiple contacts of all selector switches such as K to cause the seized trunk L to test busy. At its inner right-hand armature relay 239 causes relay 246 to operate in an obvious circuit. Relay 246 in attracting its armatures connects the conductors of the connecting circuit through to the trunk leading to the "rate quoting" desk.

As a result of the operation of relay 246, a circuit is established which may be traced from grounded battery, through the armature and back contact of cut-off relay 300, right-hand winding of relay 301, ring conductor of the selected trunk leading to the "rate quoting" desk, ring terminal 290 and wiper 291 of switch K, front contact and lower armature of relay 246, lower normal contacts of key 293, winding of relay 292, upper normal contacts of key 293, upper armature and front contact of relay 246, wiper 294, and tip terminal 295 of switch K, tip conductor of the selected trunk leading to the "rate quoting" desk, left-hand winding of line relay 301 to ground. Relays 301 and 292 operate in this circuit, the latter establishing an obvious circuit for lamp 296 and the former establishing a circuit from grounded battery, front contact and right-hand armature of relay 301, through the filament of lamp 303, back contact and right-hand armature of slow-to-release relay 304 to ground. The illumination of lamp 303 in this circuit indicates to the "rate quoting" operator that a call is awaiting her attention. The illumination of lamp 296 as hereinbefore described serves as a guard signal to the recording operator.

The "rate quoting" operator in response to the illumination of lamp 303 inserts plug P'' into jack J'' of the selected trunk, whereupon cut-off relay 300 operates in an obvious sleeve circuit. Relay 300 opens the circuit for line relay 301 and for relay 292 which thereupon release causing the darkening of lamps 303 and 296 respectively, the latter indicating to the recording operator the response of the rate quoting operator.

By actuating her talking key (not shown), the "rate quoting" operator may converse with the calling subscriber. Assuming that the conversation has ended, the "rate quoting" operator withdraws plug P'' from jack J'' whereupon relay 300 releases opening the circuit for relay 304 and closing the circuit for line relay 301. Relay 304 does not release since it is a slow-to-release relay and its locking circuit will be completed at the left-hand armature and front contact of relay 301 before it has time to retract its armatures so that the operator at position M does not get a false signal when she disconnects.

The circuit for relay 292 is again established causing lamp 296 to become illuminated to indicate to the recording operator that she may proceed to release the connection.

To release the connection the operator actuates a restoring key 262 that is arranged, in a manner well known in the art, to restore any of the keys 220, 225, 226 and 227, whichever one of these keys may be operated. Key 220 which in this instance is operated consequently releases and thereby causes relay 208 to restore thereby removing ground from terminal 132 of switch S causing the release of relay 133. Relay 133 in releasing, removes the shunt about the high resistance left-hand winding of relay 100 thereby causing the current in the circuit including the winding of marginal relay 25 to decrease to such an extent as to permit this relay to release. Relay 25 in retracting its armature causes relay 60 to release. The release of relay 60 causes the opening of the circuit of the reversing relay 14 and also of relay 63. Relay 63 in releasing, causes the interrupter circuit including the winding of relay 65 to be completed, it being understood that relay 67 remains

locked up to ground on the right-hand armature of relay 20. The operation of the interrupter 80 causes a circuit for reversing relay 14 to be intermittently made and opened, this circuit extending from grounded battery, through the winding of relay 14, front contact and inner armature of relay 16, conductor 64, armature and front contact of relay 65, to ground. Relay 14 is intermittently energized in this circuit and in operating, intermittently reverses the current through the windings of polarized relay 91. Relay 91 thereupon causes lamp 92 to flash as a disconnect signal to the semi-mechanical operator.

The semi-mechanical operator, noting the flashing of lamp 92 removes the plug P from jack J of the calling line thereby restoring the calling line to its initial condition and causing the restoration of the district selector switch 90. Following the restoration of switch 90, the circuit previously traced through the winding of relay 13 is opened thereby opening the circuit for relays 16 and 15. At its inner armature, relay 16 opens the circuit for reversing relay 14. Relay 15 upon deenergizing, opens the circuit for relay 19 which in turn opens the circuit of relay 20 and since, at this time the auxiliary holding circuit of relay 20 previously traced over conductor 61 is opened at the left-hand armature and contacts of relay 60, relay 20 deenergizes, opening at its right-hand armature, the holding circuit for relay 67 which relay in turn opens the circuit for relay 24 and removes busy ground potential from conductor 68 and the multiple terminals of the toll trunk. The release of relay 100 as hereinbefore mentioned causes relay 104 to release whereupon the locking circuit for relay 109 is opened, so that this relay also releases removing the holding ground from the windings of relays 105 and 122. Relays 105 and 122 thereupon release. Relay 122 at its lowermost armature opens the circuit for relays 107 and 203 whereupon these relays release, the latter removing the busy ground potential from the test terminal 127 of switch S and substituting therefor battery 200. Relay 122 also disconnects the tip and ring conductors of the recording trunk from the corresponding terminals 140 and 141 of switch S. Relay 15 upon deenergizing also opens the circuit previously traced through the winding of relay 25 over the toll trunk and through the windings of relays 100, 101 and 102 whereupon these last three relays, if operated, release, relay 25 having been previously released. The circuits at the outgoing and incoming ends of the trunk are now in their normal positions.

Upon the release of key 220 at the recording operator's position, as hereinbefore mentioned, relay 222 releases removing ground from the winding of relay 223 and also from the group of terminals 230 of switch K. Relay 223 thereupon releases, opening the locking circuit for relay 234 and also for relays 239 and 270 which thereupon release. The deenergization of relay 270 removes the busy condition from the trunk L leading to the "rate quoting" desk, and again connects battery to the test terminal 242 of switch K to indicate the idle condition of the trunk. All the apparatus is now in its normal condition and the circuits prepared to receive another call.

If in the course of a connection, the recording operator at O should desire to signal the semi-mechanical operator, she may do so by successively actuating the flashing key 211, whereupon relay 133 is intermittently deenergized to alternately remove and complete the shunt about the high resistance winding of relay 100 so that the current in the circuit including marginal relay 25 will be varied causing this relay to follow the actuations of key 211. The circuit for relay 60 will thereupon be intermittently opened and closed to cause the circuit through slow-releasing relay 63 and reversing relay 14 to be opened and closed at the same rate. Relay 63, being slow-to-release, does not have sufficient time to restore its armatures to their initial positions between successive deenergizatons of relay 25, and therefore, the circuits which are established by relay 63 are maintained intact. Relay 14 however, responds to each deenergization of relay 60 and at its armature contacts reverses the current flowing through the windings of polarized supervisory relay 91 at the semi-mechanical operator's position. The lamp 92 which is controlled by relay 91 will, therefore, flash in synchronism with the actuations of key 211.

In response to this flashing signal, the semi-mechanical operator reconnects her telephone with the semi-mechanical cord and is then in a position to communicate with the recording toll operator.

Should the originating or semi-mechanical operator desire to signal the recording operator, she may do so by momentarily actuating the key k to disconnect the windings of polarized relay 91, from the cord and connect battery and ground to the ring and tip conductors of the cord whereupon the battery associated with repeating coil 12 is rendered ineffective to hold relay 13 operated. Relay 13 thereupon releases causing relays 16 and 15 to deenergize. Relay 15 causes the circuit for relay 19 to be opened but relay 19 being slow-to-release does not have sufficient time to retract its armatures. However, should relay 19 restore and open the circuit for relay 20 the slow-releasing characteristic of this relay would tend to maintain it operated. The characteristics of re-

lays 19 and 20 are therefore such as to maintain the circuit for relays 25, 100, 101 and 102 intact during the operation of key *k*. The release of relay 15 now causes the circuit previously traced through relays 25, 100, 101 and 102 to be opened, relay 100 causing the deenergization of relay 104. Relay 104 in retracting its inner armature connects battery to the winding of relay 134 by way of the inner left-hand armature and front contact of relay 109. Relay 134 thereupon operates to connect battery and ground to the incoming end of the trunk. Therefore, in response to the actuation of key *k*, a circuit for relay 213 is established which may be traced from grounded battery, over the front contact and lower armature of relay 134, inner lower armature and front contact of relay 122, wiper 139, and terminal 141 of switch S, back contact and inner right-hand armature of relay 207, through the left-hand winding of relay 213, terminal 140 and wiper 138 of switch S, front contact and upper armature of relay 122, upper armature and front contact of relay 134, through the resistance element to ground. Relay 213 operates in this circuit and in attracting its armature establishes an obvious circuit for the supervisory lamp 250 and locks itself to ground on the outer right-hand armature of relay 207. In response to the illumination of lamp 250, the recording operator again actuates key 210 to connect her head-set to the tip and ring conductors of the trunk and to establish an obvious circuit for relay 207. Relay 207 thereupon operates disconnecting the left-hand winding of relay 213 from the tip and ring conductors of the trunk and opening the locking circuit of relay 213. This relay thereupon releases causing the darkening of lamp 250.

If for any reason, the rate-quoting operator should desire to recall the recording toll operator, she may do so by successively withdrawing and inserting plug P'' into jack J''. This action causes relay 300 to be successively deenergized, and to thereby successively disconnect battery from the right-hand winding of relay 301, which relay together with relay 292 are bridged across the tip and ring conductors of the trunk. Relays 292 and 301, therefore, follow the interruptions of the bridge circuit caused by the intermittent actuations of sleeve relay 300. Lamp 296 which is controlled by relay 292, therefore, flashes in synchronism with the connections and disconnections of plug P'' with jack J''. It will be noted, however, that lamp 303 which is controlled by line relay 301 does not flash at this time since its circuit will be maintained opened at the back contact and left-hand armature of slow-to-release relay 304 during this period, relay 304 remaining energized owing to its slow-release characteristic.

The ringing key 293 which is furnished with the recording operator's equipment is supplied for the purpose of signaling a special operator whose position may be equipped with a ringdown type of signaling equipment.

The previous description was directed to a call originated by a subscriber who is entitled to regular toll service. If, however, a subscriber other than the subscriber at station A who is entitled to some other class of service, should initiate a call, the semi-mechanical operator would set up a special code, which would cause the brushes associated with her semi-mechanical cord circuit to come in contact with a different set of trunk terminals such as *a*, *b* or *c*. Depending on which of these terminals are employed in the establishment of a connection, currents of different strengths and polarities are transmitted over the recording trunk from the sources 70 and 99 to effect the operation of relays 100, 101 and 102 in various combinations. Depending upon the combination of relays operated, currents from the sources 114 and 190 are sent out through resistance elements 115, 116, 151 and 152 over the outgoing end of the trunk to the recording toll operator's position to effect the operation of relays 214, 215 and 216 in various combinations, and depending upon these combinations effected, one of the class of service signal lamps 257, 256, 255 and 219 will be illuminated, the variously marked caps of which will indicate to the recording operator the class of service to which the calling subscriber is entitled. That is, the class of service to which each subscriber is entitled is indicated by a particular figure or sign on the caps illuminated by the corresponding lamps.

Referring now to Fig. 4 taken in connection with Figs. 2 and 3, a subscriber at substation B on initiating a call removes the receiver from the switchhook whereupon a circuit is established for line relay 400, this circuit extending over the subscriber's line loop. Relay 400 operates in this circuit and establishes an obvious circuit for line lamp 402. The lamp 402 is provided with a distinctive lamp cap which designates the class of service to which the calling subscriber is entitled. In response to the illumination of lamp 402 the A operator inserts plug P_4 of her answering cord into the jack J_4 which is associated with the illuminated line lamp 402 whereupon a circuit is established extending from grounded battery, through the lower left-hand winding of repeating coil 405, through winding of supervisory relay 404, ring contacts of plug P_4 and jack J_4 over the subscriber's line loop, tip contacts of jack J_4 and plug P_4, upper left-hand winding of repeating coil 405 to ground. Supervisory relay 404 operates in this cir-

cuit and in attracting its armature shunts out the lamp 403 to prevent it from being illuminated at this time. A circuit now exists extending from grounded battery through front contact and armature of relay 404, sleeve contact of plug P_4 and jack J_4 through the winding of relay 401 to ground, relay 401 operating in this circuit removes the line relay 400 from the subscriber's line whereupon relay 400 becomes deenergized causing the darkening of lamp 402.

The A operator now actuates key 410 in order to connect her telephone set with the talking strands of the cord circuit. The operator now learns from the calling subscriber the nature of the desired connection. It will be assumed, as in the previous case, that the calling subscriber desires a connection with the recording toll operator.

The A operator tests for an idle recording trunk in the well-known manner. Assuming that the trunk L′ is the first idle trunk encountered and that the calling subscriber is entitled to the class of service corresponding to jack J_5, the operator will insert plug P_5 into this jack J_5 whereupon a circuit is established which may be traced from grounded battery through the filament of lamp 408, sleeve contacts of plug P_5 and jack J_5, winding of relay 500, conductor 520, left-hand armature and back contact of relay 501, resistance element 502 to ground. The lamp 408 energizes in this circuit and serves as a guard signal to the A operator. Relay 500 also operates in this circuit and in attracting its inner armature performs no immediate function. However, at its outer armature, relay 500 establishes a circuit extending from grounded battery 503, through the resistance element 504, outer armature and front contact of relay 500, conductor 505, winding of marginal relay 506, back contact and lower armature of relay 507, lower left-hand winding of repeating coil 103, windings of polarized relay 102, marginal relay 101 and relay 100, upper left-hand winding of repeating coil 103, upper armature and back contact of relay 507 to ground. The current in the circuit just traced is of such strength as to prevent marginal relay 506 from energizing at this time, but is of sufficient strength and proper polarity to cause relays 100 and 101 to operate. Relay 100 in operating establishes an obvious circuit for relay 104. Relay 101 in operating establishes an obvious circuit for relay 117.

At its outer armature, relay 104 establishes an obvious circuit for relay 105; at its inner armature relay 104 causes the energization of relay 112 to connect the tone source 113 to the tip and ring conductors of the trunk in order to indicate to the calling subscriber that the recording operator is being signaled. Relay 117 and relay 105 in operating both lock up to ground on the outer armature of relay 104 by way of the normal right-hand contacts of relay 109. As a result of the energization of relays 117 and 105, a circuit now exists extending from grounded battery 114, through resistance element 115, front contact and outer right-hand armature of relay 117, conductor 118, back contact and right-hand armature of relay 119, conductor 120, right-hand armature and front contact of relay 105, conductor 121 to the midpoint of the right-hand windings of repeating coil 103 and thence over the tip and ring conductors of the incoming end of the recording trunk as far as the upper and lower inner armatures of relay 122. It is believed unnecessary to repeat the operations which extend the incoming end of the trunk circuit to the recording operator's position O since these steps were described in detail in the previous description. However, it will be assumed that the lamp 209 has been illuminated as a signal to the recording operator and she has responded to the call by actuating talking key 210.

As a result of the actuation of talking key 210, relay 207 is operated for the purposes hereinbefore mentioned. One effect of the operation of relay 207 is to connect ground to the terminal 132 of switch S by way of conductor 212. This ground causes relay 133 to operate which in attracting its right-hand armature performs the same function as it did in the preceding case. In attracting its left-hand armature, relay 133 again shunts the high resistance left-hand winding of relay 100 so that the current in the circuit including marginal relay 506, previously traced, is increased sufficiently to permit relay 506 to operate. Relay 506 in operating establishes an obvious circuit for relay 508 which thereupon operates and locks itself to ground on the inner armature of relay 500, at its right-hand armature relay 508 establishes an obvious circuit for relay 507 which in operating disconnects the circuit including the marginal relay 506 from the trunk circuit and bridges the condensers 510 and 511 so that a circuit now exists which may be traced from grounded battery through lower right-hand winding of repeating coil 405, winding of relay 406, ring contacts of plug P_5 and jack J_5, front contact and lower armature of relay 507, lower left-hand winding of repeating coil 103, windings of polarized relay 102, marginal relay 101, right-hand winding of relay 100, left-hand armature and front contact of relay 133, upper left-hand winding of repeating coil 103, upper armature and front contact of relay 507, winding of marginal relay 509, tip contacts of jack J_5 and plug P_5, through the upper right-hand winding of repeating coil 405 to ground. Relays 406 and 509 operate in this circuit, the former

shunting out the lamp 408 as an indication to the "A" operator that the recording operator has responded to the call, while the latter establishes an obvious circuit for relay 512. Relay 512 in operating shunts the resistance element 502 and the right-hand winding of relay 501 so that relay 501 energizes over the sleeve circuit through its left-hand winding to ground on the alternate contacts of relay 512. Relay 501 in energizing in the sleeve circuit prepares a peremptory disconnect signaling circuit which will be completed hereinafter.

As a result of the actuation of talking key 210 at the recording operator's position O, and as a result of the extension of the trunk circuit as far as the recording operator's position, the circuit which was previously traced from grounded battery 114 as far as the upper and inner lower armatures of relay 122 is now completed over the wipers 138 and 139 and terminals 140 and 141 of the selector switch S, over the upper and middle alternate contacts of key 210 through both simplex windings 217 and 218 through the windings of relay 214, marginal relay 215 and polarized relay 216 to ground. The current in this circuit is such as to cause only relays 214 and 215 to operate, so that a circuit may now be traced extending from grounded battery through the filament of lamp 255, front contact and left-hand armature of relay 215, back contact and armature of relay 216, armature and front contact of relay 214 to ground. The lamp 255 energizing in this circuit indicates to the recording operator the class of service of the calling subscriber.

When the recording operator actuates key 210, her telephone is connected across the main conductors of the trunk so that she may converse with the calling subscriber to ascertain the nature of the call. It will be assumed that the calling subscriber requests a connection with "information," whereupon the recording operator actuates the key 225 at her position which is designated "information." She also restores her talking key 210. As a result of the actuation of key 225, relay 208 operates as in the previous connection. At its lower alternate contact, key 225 establishes an obvious circuit for relay 260 which corresponds to relay 222 in the previous description. At its outer right-hand armature relay 260 establishes a circuit for a relay similar to relay 223, whereas at its inner armature it connects ground to the conductor 261, leading to the group of terminals 265 of sector 228 of switch K, which group is allotted to "information."

As in the preceding connection, the stepping magnet 231 causes the wipers of switch K to advance over the terminals until, in this instance, the grounded group of terminals 265 is reached, whereupon similar operations as described in connection with the "rate quoting" group 230 are performed, so that the selector switch K hunts for an idle trunk leading to the "information" operator's desk.

The remaining operations which take place in the case of a call for "information" are similar to those described in connection with the call described for the "rate quoting" operator so that these operations need not be repeated. However, the manner in which a disconnect signal is given to the A operator differs and this operation will now be described. The recording operator at the termination of the connection, actuates the restore key 262, whereupon key 225 is released. The release of key 225 deenergizes relay 208 whereupon ground is removed from the winding of relay 133 so that this relay releases, removing the shunt from the high resistance left-hand winding of relay 100. The removal of this shunt causes the current in the circuit including marginal relay 509 to decrease to such an extent as to deenergize this relay. The deenergization of relay 509 removes ground from the winding of relay 512 whereupon this relay releases so that the circuit for interrupter 515 is now completed. The reduction of current in the above mentioned circuit also causes relay 406 in the A operator's cord to release. The operation of the interrupter 515 causes relay 516 to intermittently attract and release its armature so that the sleeve circuit including the left-hand winding of relay 501, winding of relay 500 and the filament of lamp 408 is intermittently opened so that the lamp 408 flashes in synchronism with the interruptions caused by the interrupter 515.

The A operator upon noting the flashing of the lamp 408 proceeds to take down the connection by withdrawing plug P_5 from jack J_5 whereupon relays 500 and 501 release. The release of relay 500 opens the locking circuit for relay 508 which in turn releases relay 507, restoring the outgoing end of the recording toll trunk to normal. In withdrawing the plug P_4 from jack J_4, the circuit for sleeve relay 401 is opened whereupon the line relay 400 is again connected to the conductors of the subscriber's line in preparation for another call. The release of the remaining apparatus is effected in the same manner as described in the preceding description.

Keys such as 205 at the recording operator's position are provided in the leads from the armatures of the relays 204 of the connecting circuits at this position so that when the position is unattended these keys will be actuated to place a busy potential on all test terminals such as 127 of connecting circuits leading to these positions and thereby rendering the position unavailable to incoming

calls. Keys such as 241 serve the same purpose for the trunks leading to the special operator's desk.

What is claimed is:

1. In a telephone system, a trunk circuit terminating in a plurality of terminals, an operator's position, a group of connecting circuits terminating in keys at said position, a signaling device at said position for each of said trunk terminals, means responsive to the seizure of said trunk by way of one of said terminals for selecting an idle one of said connecting circuits, and means responsive to the actuation of one of said keys at said position for actuating the signaling device corresponding to the trunk terminal taken for use.

2. In a telephone system, a trunk circuit terminating in a plurality of terminals, an operator's position, a signaling device thereat, a plurality of connecting circuits terminating in keys at said position, means responsive to the seizure of said trunk by way of one of said terminals for associating said trunk with an idle one of said connecting circuits and operating said signaling device, indicating means at said position corresponding in number to said trunk terminals, and means responsive to the actuation of one of said keys for operating the indicating means corresponding to the trunk terminal taken for use.

3. In a telephone system, a trunk circuit terminating at its outgoing end in a plurality of terminals, an operator's position, a plurality of connecting circuits terminating at said position in keys, a signaling device for each of said connecting circuits, means responsive to the seizure of said trunk by way of one of said terminals for automatically connecting the incoming end of said trunk with an idle one of said connecting circuits to cause said signaling device to be actuated, indicating means at said position corresponding in number to the terminals of said trunk, and means responsive to the actuation of one of said keys for restoring said signaling device to normal and actuating the indicating means corresponding to the trunk terminal taken for use.

4. In a telephone system, a trunk circuit, first and second operators' positions, a plurality of connecting circuits terminating at said first position in keys, a switch for said connecting circuits, means responsive to the seizure of said trunk for causing said switch to hunt for and connect said trunk with an idle connecting circuit and extend said trunk to said first position, and means responsive to the actuation of one of said keys at said first position for extending the selected connecting circuit to said second position.

5. In a telephone system, a trunk circuit, a first operator's position, a signaling device thereat, a second operator's position, a signaling device thereat, a plurality of connecting circuits terminating in keys at said second position, means including a switch responsive to the seizure of said trunk for automatically hunting for and connecting said trunk with an idle one of said connecting circuits to extend said trunk to said first position and actuate the signaling device thereat, and means responsive to the actuation of one of said keys for extending the selected connecting circuit to said second operator's position and actuating the signaling device thereat.

6. In a telephone system, a trunk circuit terminating in a plurality of terminals, an operator's position, a group of connecting circuits terminating in keys at said position, a signaling device at said position for each of said trunk terminals, means responsive to the seizure of said trunk by way of one of said terminals for selecting one of said connecting circuits and extending said trunk to said position, means responsive to the actuation of one of said keys at said position for actuating the signaling device corresponding to the trunk terminal taken for use, a second operator's position, and means responsive to the actuation of another of said keys for extending the selected connecting circuit to said second position.

7. In a telephone system, a trunk circuit terminating in a plurality of terminals, an operator's position, a signaling device thereat, a plurality of connecting circuits terminating in keys at said position, means responsive to the seizure of said trunk by way of one of said terminals for associating said trunk with an idle one of said connecting circuits and operating said signaling device, indicating means at said position corresponding in number to said trunk terminals, means responsive to the actuation of one of said keys for operating the indicating means corresponding to the trunk terminal taken for use, a second operator's position, a signaling device thereat, and means responsive to the actuation of another of said keys for extending a selected connecting circuit to said second position and actuating said signaling device.

8. In a telephone system, a trunk circuit terminating at its outgoing end in a plurality of terminals, an operator's position, a plurality of connecting circuits terminating at said position in keys, a signaling device for each of said connecting circuits, means responsive to the seizure of said trunk by way of one of said terminals for automatically connecting the incoming end of said trunk with an idle one of said connecting circuits to cause said signaling device to be actuated, indicating means at said position corresponding in number to the terminals of said trunk, means responsive to the actuation of one of said keys for restoring said signaling device

to normal and actuating the indicating means corresponding to the trunk terminal taken for use, a second operator's position, a signaling device thereat and means responsive to the actuation of another of said keys for extending the selected connecting circuit to said second position and actuating the signaling device thereat.

9. In a telephone system, a trunk circuit terminating in a plurality of terminals, a first operator's position, a connecting circuit terminating in keys at said position, a signaling device at said position for each of said trunk terminals, means responsive to the seizure of said trunk circuit by way of one of said terminals for extending said trunk circuit to said first position by way of said connecting circuit, means responsive to the actuation of one of said keys for operating the signaling device corresponding to the trunk terminal taken for use, a second operator's position, and means responsive to the actuation of another of said keys for extending said connecting circuit to said second position.

10. In a telephone system, a trunk circuit terminating in a plurality of terminals, a first operator's position, a connecting circuit terminating in keys at said position, a signaling device at said position for each of said trunk terminals, a selector switch responsive to the seizure of said trunk circuit by way of one of said terminals for seizing said connecting circuit and extending said trunk circuit to said first position by way of said connecting circuit, means responsive to the actuation of one of said keys for operating the signaling device corresponding to the trunk terminal taken for use, a second operator's position, and a selector switch responsive to the actuation of another of said keys for extending said connecting circuit to said second position.

11. In a telephone system, first and second operators' positions, a trunk circuit, a plurality of connecting circuits terminating at said first position in a plurality of keys, means including a switch associated with said trunk and responsive to the seizure of said trunk at its outgoing end for causing said switch to hunt for and connect said trunk with an idle one of said connecting circuits to extend said trunk to said first position, a group of trunks leading to said second position, and means responsive to the actuation of one of said keys for selecting an idle one of said group of trunks and extending the selected connecting circuit to said second position.

12. In a telephone system, a trunk circuit, a primary operator's positions, a group of connecting circuits terminating in keys at said primary operator's position, a switch responsive to the seizure of said trunk for hunting for and connecting said trunk with an idle one of said connecting circuits to extend said trunk to said primary operator's position, secondary operators' positions corresponding in number to said keys, groups of trunks, each group serving a corresponding secondary position, a switch associated with each connecting circuit and in which all of said groups of trunks terminate and means responsive to the actuation of one of the keys in the selected connecting circuit for operating the corresponding switch to select a group of trunks corresponding to the actuated key and seize an idle trunk in that group whereby said connecting circuit is extended to the secondary position corresponding to the key actuated.

13. In a telephone system, a trunk circuit, primary and secondary operators' positions, a plurality of connecting circuits terminating at said primary position in keys, said keys corresponding in number to said secondary positions, means responsive to the seizure of said trunk for selecting one of said connecting circuits and extending said trunk to said primary position, a group of trunks serving said secondary positions, said group being divided into sub-groups and each sub-group serving a particular secondary position, a switch associated with each connecting circuit in which all of said sub-groups of trunks terminate, means responsive to the actuation of one of the keys of the selected connecting circuit for actuating the corresponding switch for the selecting of the corresponding sub-group of trunks and for seizing an idle trunk in said group whereby the selected connecting circuit is extended to the secondary position corresponding to the key actuated.

14. In a telephone system, a trunk circuit, first and second operators' positions, a group of connecting circuits terminating in keys at said first operator's position, means responsive to the seizure of said trunk for selecting one of said connecting circuits and extending said trunk to said first operator's position, means responsive to the actuation of one of said keys for rendering said first operator's position inaccessible to calls incoming over the remaining connecting circuits and means responsive to any one of the remaining keys for extending the selected connecting circuit to said second operator's position.

15. In a telephone system, a trunk circuit, first and second operators' positions, a group of connecting circuits terminating in keys at said first operator's position, means responsive to the seizure of said trunk for selecting one of said connecting circuits and extending said trunk to said first operator's position, means for causing said first operator's position to test busy to calls incoming over the remaining connecting circuits when the first call is answered and means respon-

sive to the actuation of one of said keys for extending the selected connecting circuit to said second operator's position.

16. In a telephone system, a trunk circuit, first and second operators' positions, a signaling device thereat, a group of connecting circuits serving said first operator's position and terminating thereat in a plurality of keys, means responsive to the seizure of said trunk for selecting one of said connecting circuits and extending said first operator's trunk circuit to said position whereby the signaling device thereat is actuated, means responsive to the actuation of one of said keys for disabling said signaling device and for rendering said position busy to the remaining connecting circuit as long as said key is actuated and means responsive to any one of the remaining keys for extending the selected connecting circuit to said second operator's position.

17. In a telephone system, a plurality of classes of telephone lines, a trunk circuit terminating at its outgoing end in as many terminals as there are classes of lines, an operator's position, means thereat responsive to a call incoming over one of said lines for indicating the class of service of the calling line, switching means at said position for connecting the calling line with said trunk by way of the terminal corresponding to the class of the calling line, a second operator's position, a signaling device thereat for each of said classes of telephone lines, a group of connecting circuits serving said second operator's position and terminating thereat in keys, means responsive to the actuation of the aforesaid switching means for selecting one of said connecting circuits and extending said trunk to said second position, means responsive to the actuation of one of said keys for connecting said signaling devices with the selected connecting circuit whereby the signaling device corresponding to the class of the calling line is operated, a third operator's position, a group of trunks serving said third operator's position, and means responsive to the actuation of another of said keys for selecting one of said trunks and extending the selected connecting circuit thereover to said third position.

18. In a telephone system, a trunk circuit terminating in a plurality of terminals, operators' positions, connecting circuits terminating in keys at said positions, a signaling device at each of said positions for each of said trunk terminals, means responsive to the seizure of said trunk circuit by way of one of said terminals for selecting one of said connecting circuits, and means responsive to the actuation of one of said keys associated with the selected connecting circuit for actuating a signaling device corresponding to the trunk terminal taken for use.

19. In a telephone system, trunk circuits, first and second operators' positions, a plurality of connecting circuits terminating at said first operator's position, a plurality of keys associated with each connecting circuit, an individual switch associated with the incoming end of each trunk circuit for connecting an idle one of said connecting circuits thereto operative in response to the seizure of a trunk circuit at its outgoing end, a telephone circuit at said first operator's position, means for associating said telephone circuit with any one of said connecting circuits, means for preventing the selection of any connecting circuits by any of said switches operative in response to the connecting of the telephone set to any one of said connecting circuits, and means responsive to the actuation of any one of said keys of a selected connecting circuit for extending it to said second operator's position.

In testimony whereof, we have signed our names to this specification this 14th day of November, 1923.

JOHN F. TOOMEY.
HENRY E. PHELPS.