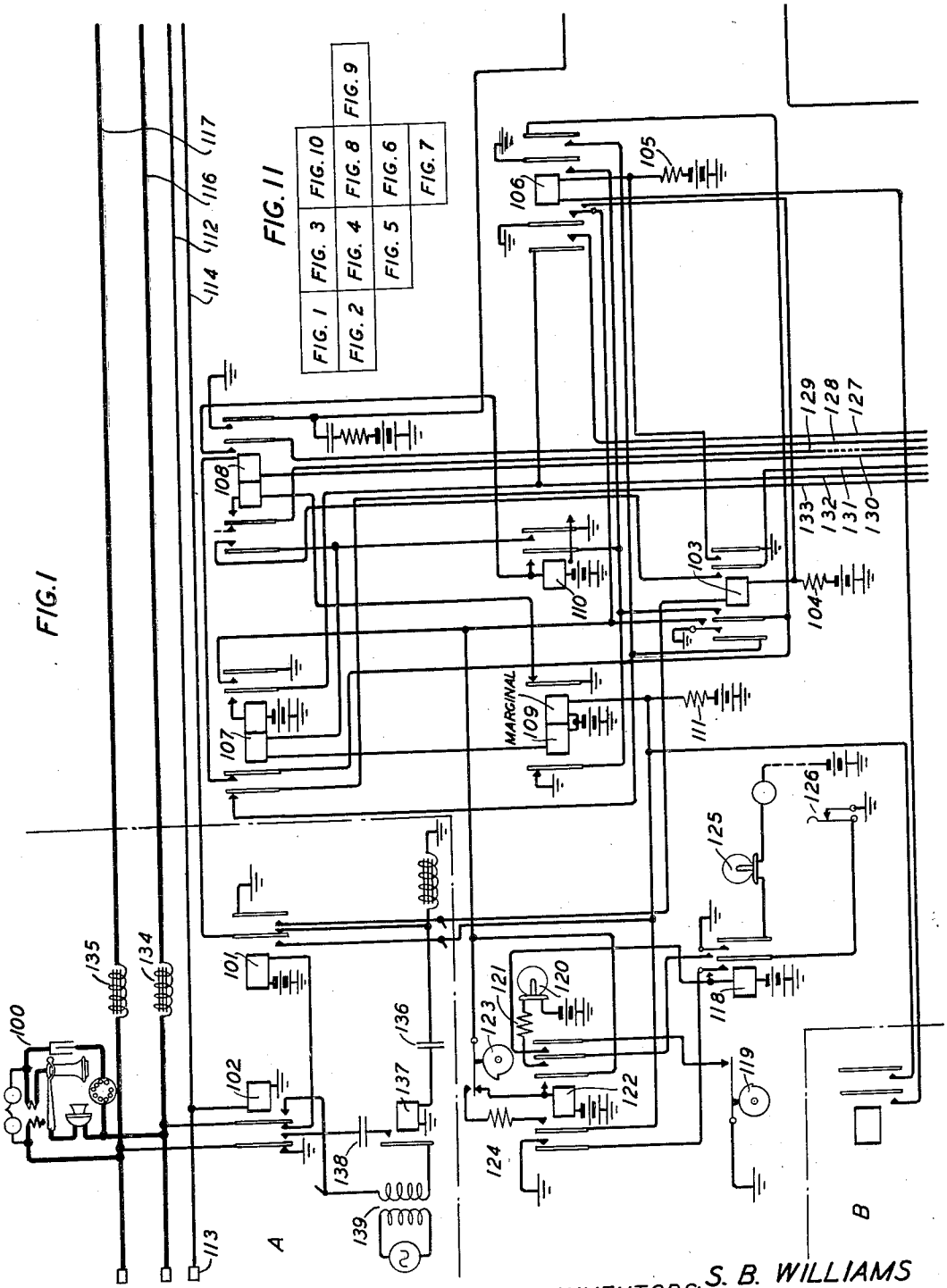
May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

Filed Aug. 19, 1932 10 Sheets-Sheet 1



INVENTORS: S. B. WILLIAMS
F. J. SCUDDER
BY P. C. Smith
ATTORNEY

May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

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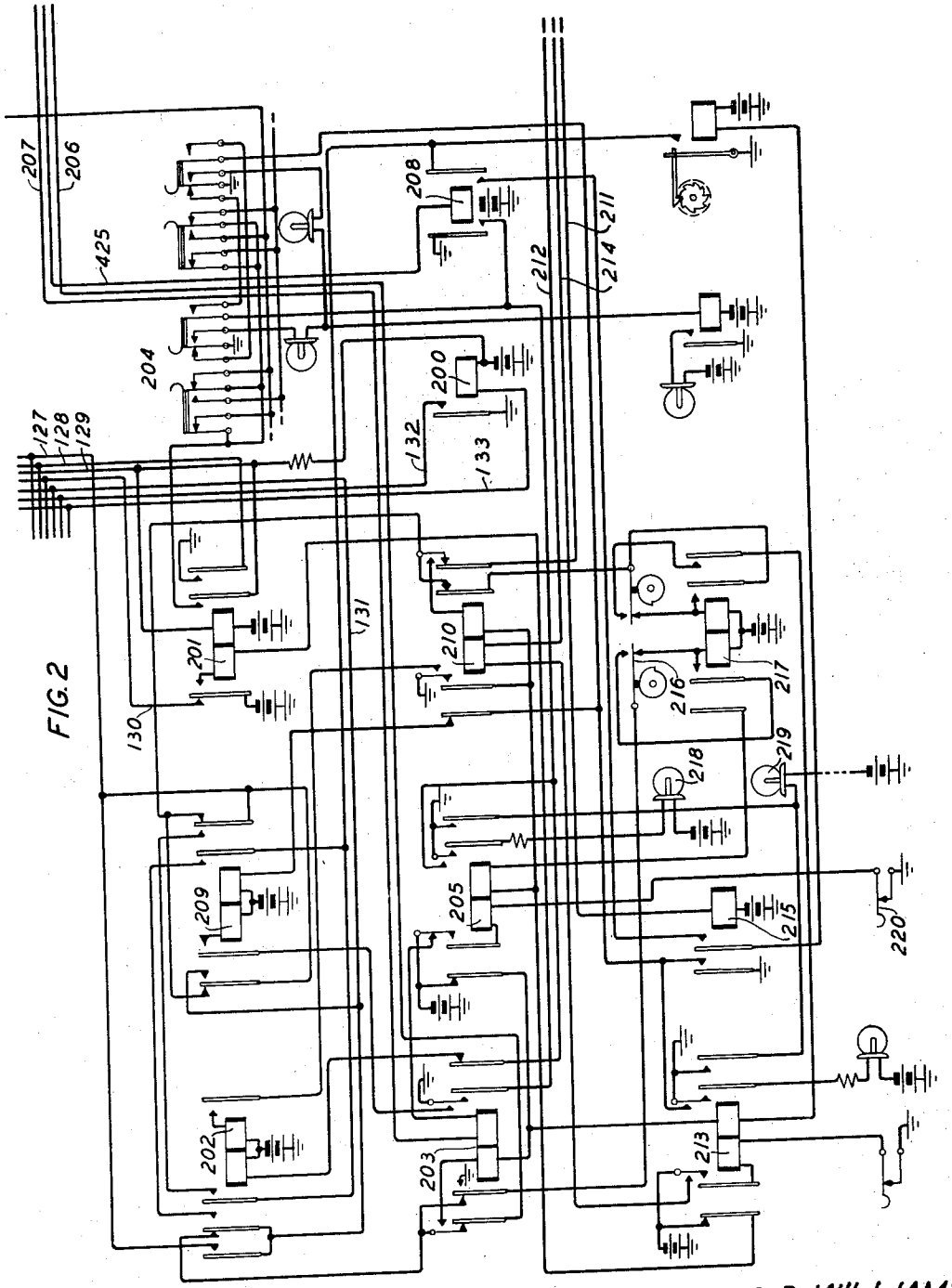

FIG. 2

INVENTORS: S. B. WILLIAMS
F. J. SCUDDER

BY P. C. Smith

ATTORNEY

May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

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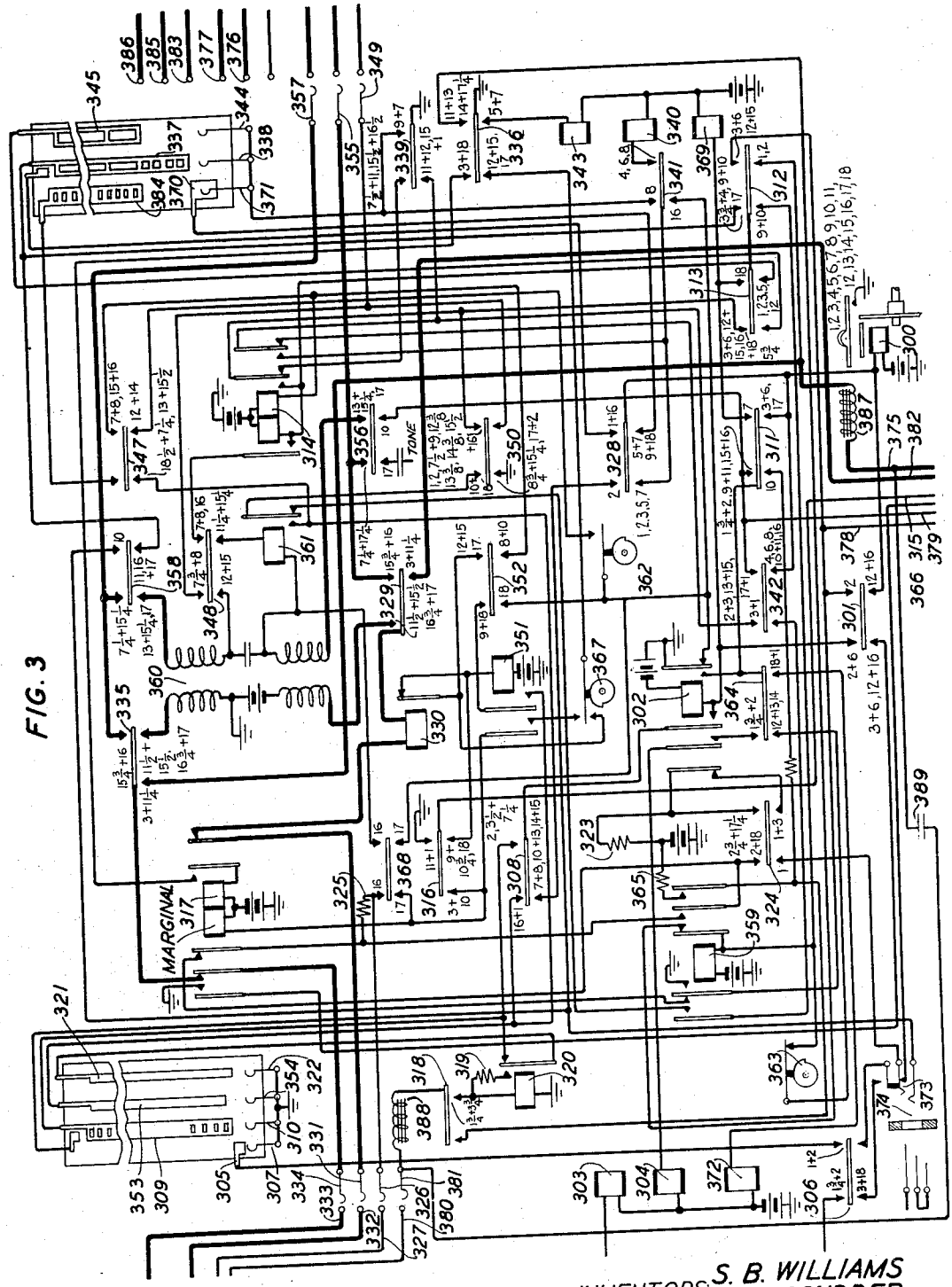

FIG. 3

INVENTORS: S. B. WILLIAMS
F. J. SCUDDER
BY P. C. Smith
ATTORNEY

May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

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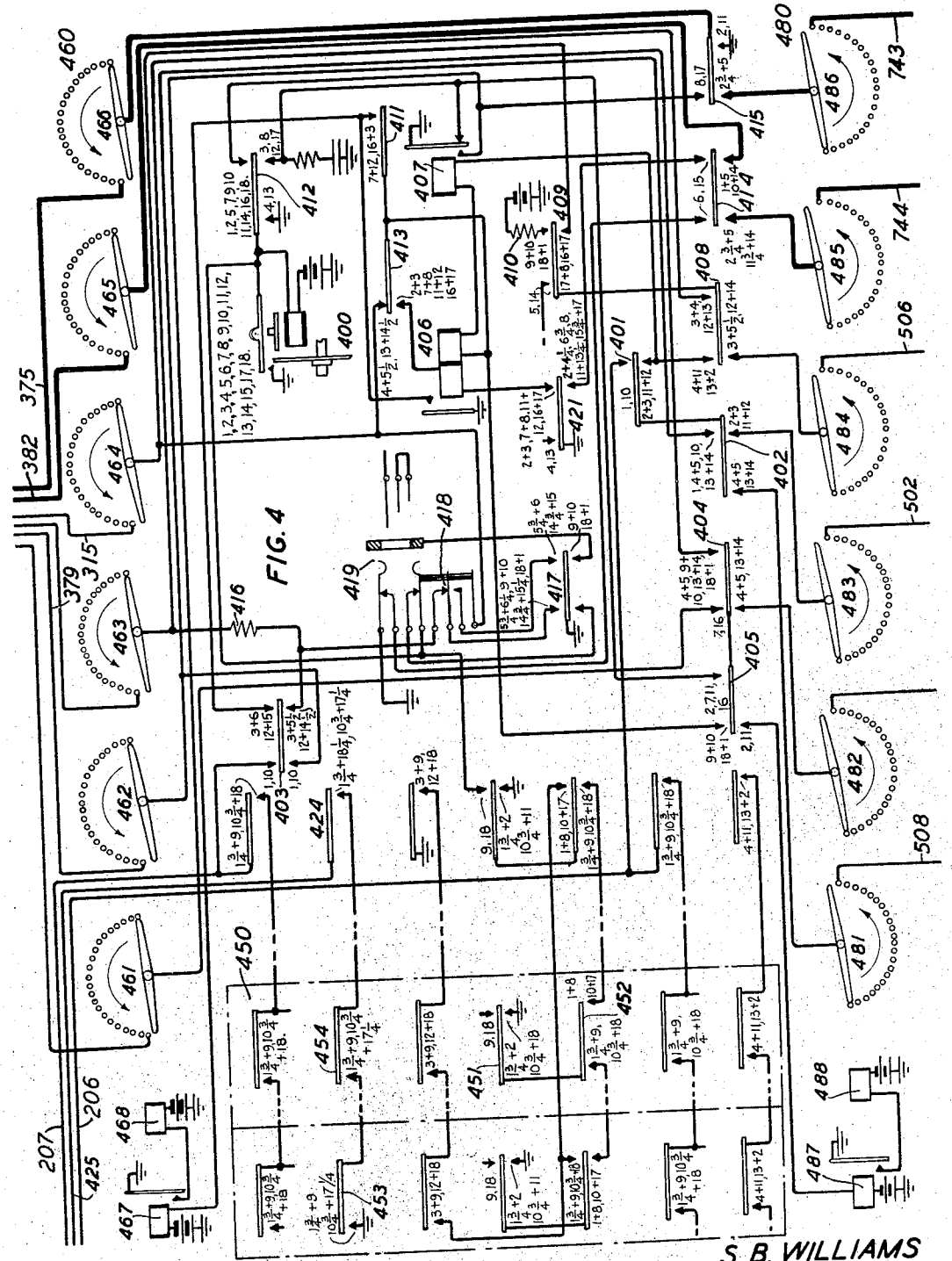

FIG. 4

INVENTORS: S. B. WILLIAMS
F. J. SCUDDER
BY P. C. Smith
ATTORNEY

May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

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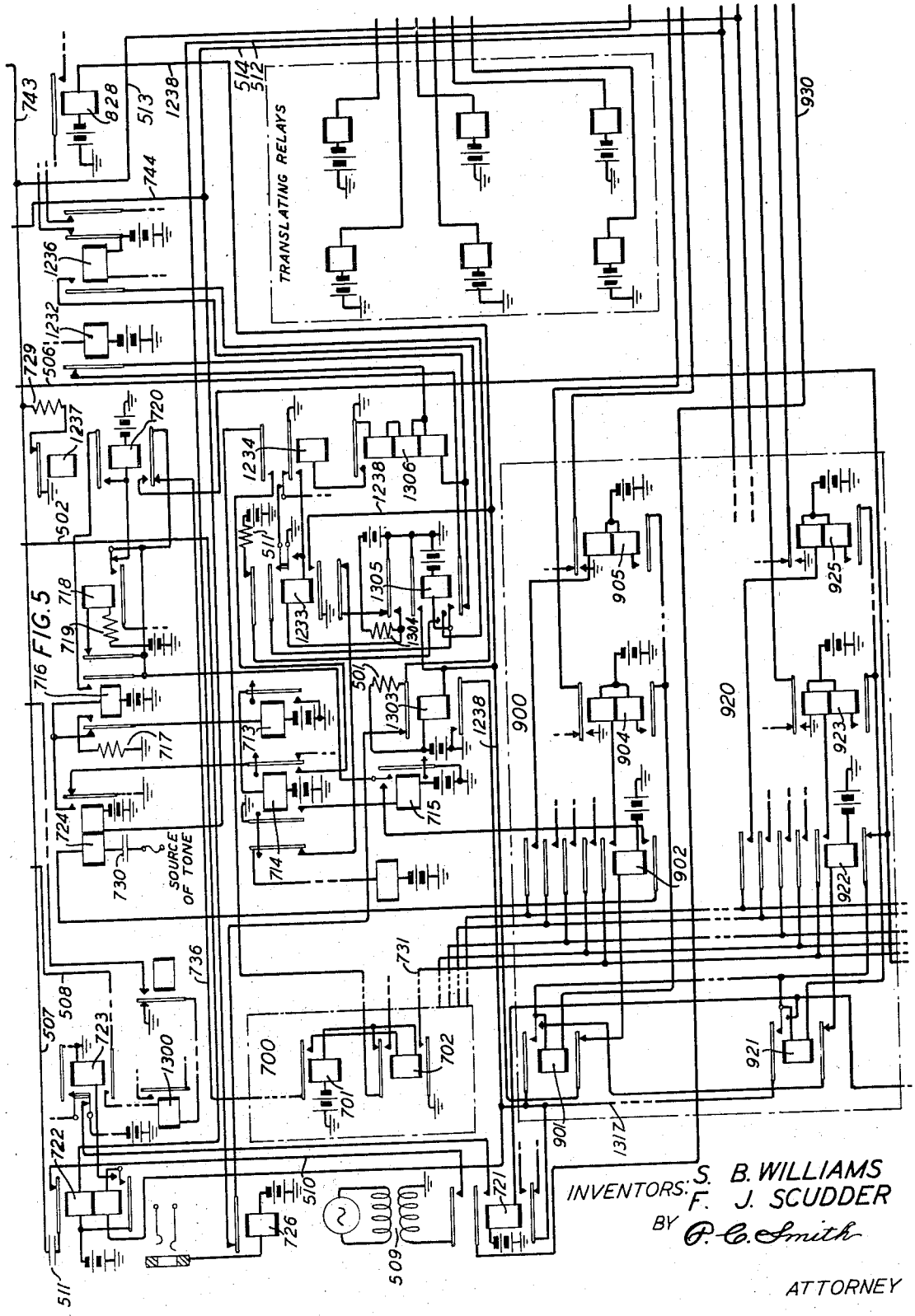

FIG. 5

INVENTORS: S. B. WILLIAMS
F. J. SCUDDER
BY P. C. Smith
ATTORNEY

May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

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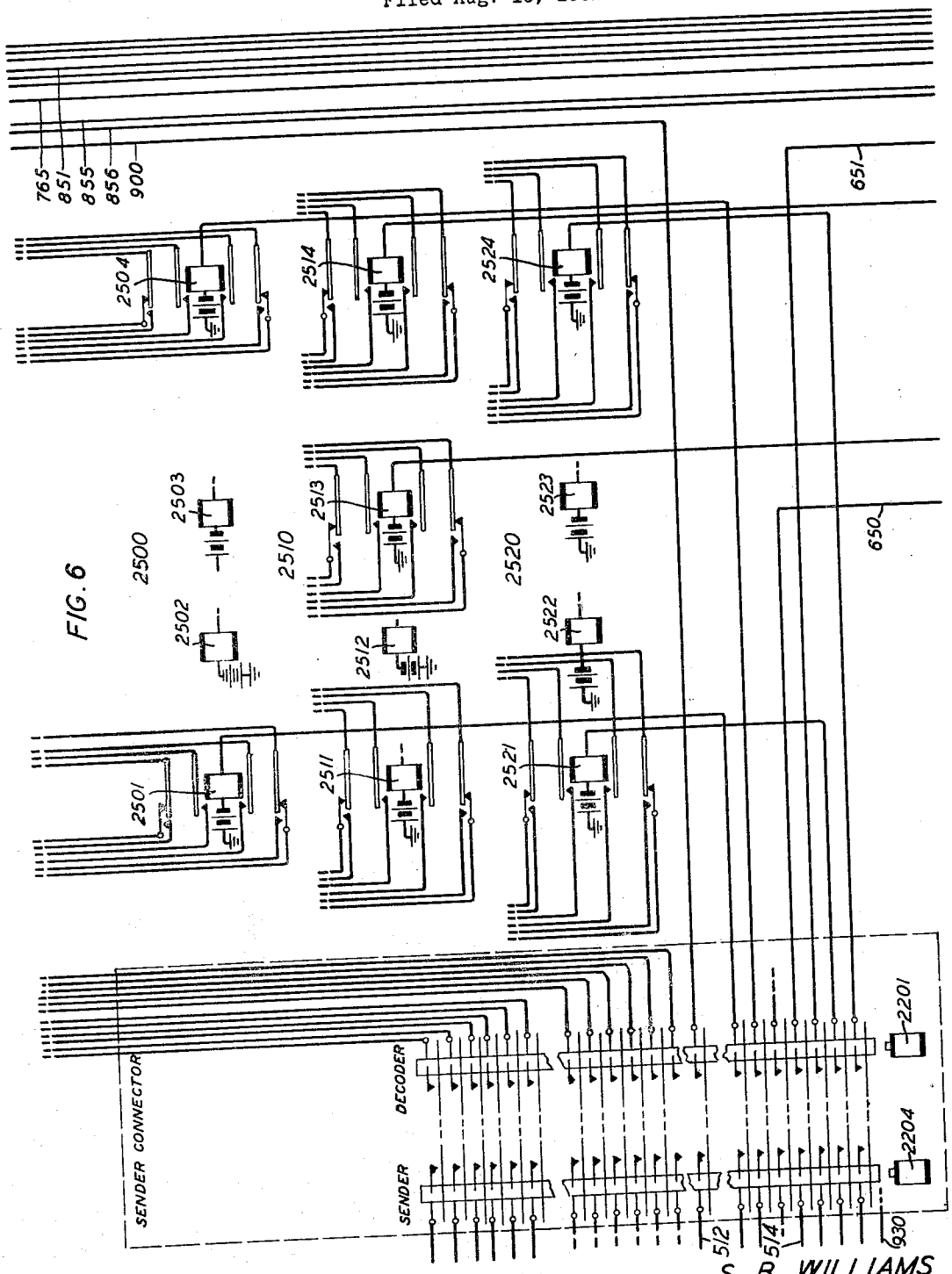

FIG. 6

INVENTORS: S. B. WILLIAMS
F. J. SCUDDER

BY P. C. Smith

ATTORNEY

May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

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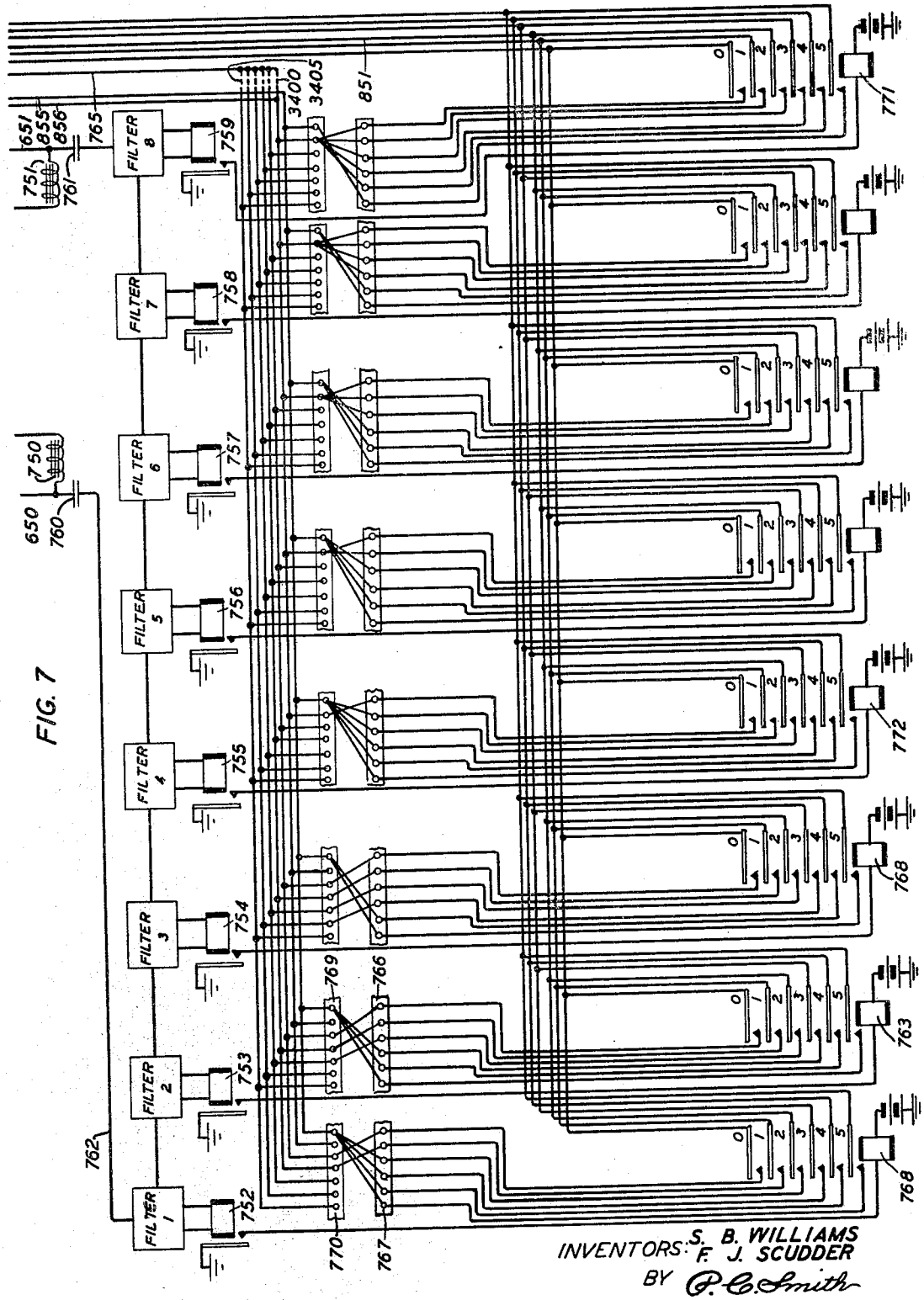

FIG. 7

INVENTORS: S. B. WILLIAMS
F. J. SCUDDER
BY P. C. Smith
ATTORNEY

May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

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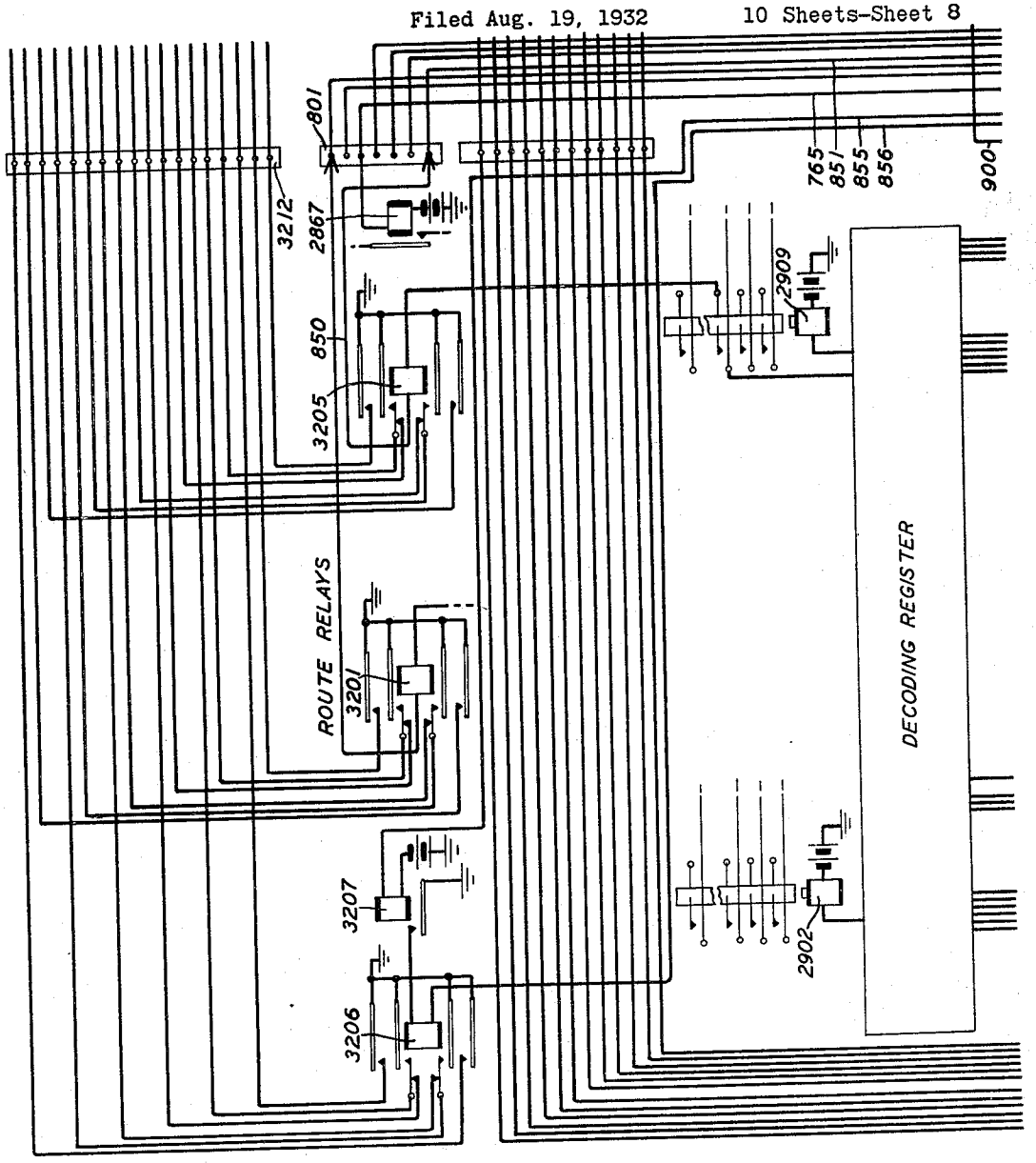

FIG. 8

INVENTORS: S. B. WILLIAMS
F. S. SCUDDER

BY P. C. Smith

ATTORNEY

May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

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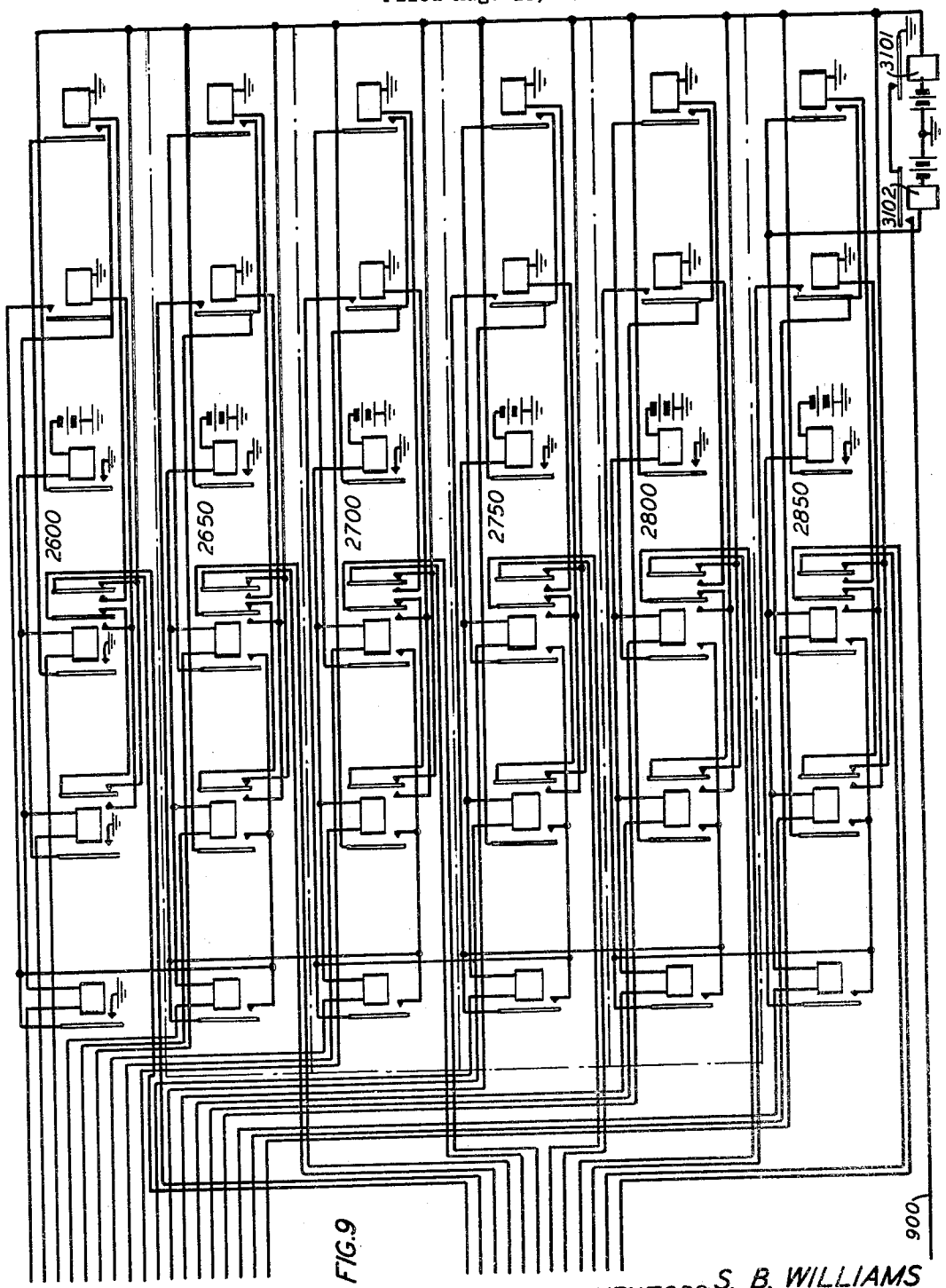

FIG. 9

INVENTORS: S. B. WILLIAMS
F. J. SCUDDER
BY P. C. Smith
ATTORNEY

May 22, 1934. S. B. WILLIAMS ET AL 1,960,037

TELEPHONE SYSTEM

Filed Aug. 19, 1932 10 Sheets-Sheet 10

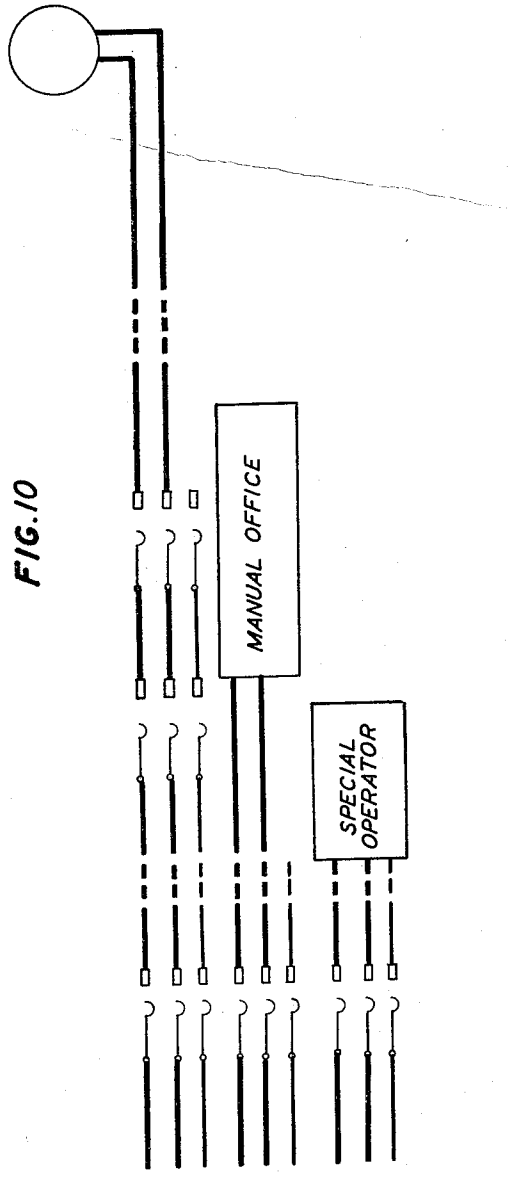

FIG. 10

INVENTORS: S. B. WILLIAMS
F. J. SCUDDER
BY P. C. Smith
ATTORNEY

Patented May 22, 1934 1,960,037

UNITED STATES PATENT OFFICE

1,960,037

TELEPHONE SYSTEM

Samuel B. Williams, Brooklyn, and Frederick J. Scudder, Queens Village, N. Y., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application August 19, 1932, Serial No. 629,452

10 Claims. (Cl. 179—18)

This invention relates to telephone systems and more particularly to automatic telephone exchange systems in which means are provided at a subscriber's line for transmitting a signal to a registering device for registering therein the class designation of said line.

In present day telephone systems there is a considerable diversity in the lines of an office with respect to their class or character and the sort of service each of said classes is to be accorded. One class of lines, for instance, may be provided with coin boxes at the subscriber's station and, in serving such lines, the central office automatic equipment must be provided with means for collecting the coin if the connection is completed, or to return the coin if the connection is not completed. Another class of lines may involve the writing of a charge ticket by an operator to whose position the call must be routed by the automatic apparatus; another class may require the automatic operation of the subscriber's message register a plurality of times on a toll call requiring no ticket and completed by automatic switches. Another class of lines may be given a so-called flat rate for the calls originated and in that case the switching selectors which complete the call are not required to operate the message register at all. Yet other classes of subscribers may be given access to call certain areas at one rate of tariff while other classes can call such areas upon the payment of a different tariff.

At the present time the most desirable arrangement of all the lines in an automatic office is to group them in accordance with their respective classes and to assign a separate group of line finders, links or other line extending switches to each class, the said switches having common access to a group of register senders whose function it is to control the setting of the necessary switching stages for the proper disposition of the call as is determined by the impulse code dialed thereinto from the calling line and the designation of the class of service to which the calling line is entitled. In order to apprise the register sender of the character of the calling line, one of the more commonly prevalent practices is to associate a distinctive electric potential on the line extending switch of the group serving a distinctive class of lines and the subsequent connection of the switch with a register sender causes responsive devices in said sender to take cognizance of the distinctive potential as a recognition of the class of said line. It is evident, however, that with such an arrangement, a particular group of line extending switches is needed for each class thereby, in the aggregate, requiring a larger number of line extending switches than would otherwise be necessary if a common group were used for all classes of lines.

It is the particular object of the present invention, therefore, to make it possible to use one common group of line extending switches for all lines by providing means whereby the indication of the subscriber's class is given by the line itself rather than by the line extending switch. Under such circumstances one group of line extending switches can be used for all the lines of the office thereby permitting the use of less line extending equipment. In accordance with the invention, therefore, one specific embodiment of which is disclosed herein by way of illustration, this is accomplished in the following improved manner:

In the present embodiment of our invention the manner of accomplishing this object is shown in part as a modification of the invention of R. Raymond and W. J. Scully, described in their Patent 1,862,549, granted June 14, 1932, which makes use of a register sender of a known type and a translating device commonly called a decoder. It is understood, however, that our invention is in no way limited to any specific organization of circuits and cooperating apparatus but may be applied by any one skilled in the art to any automatic or semi-automatic telephone system.

To each subscriber's line is connected a source of alternating current of a distinctive frequency which denotes the class to which the line belongs, there being as many distinctive frequencies as there are different classes of subscribers in the office. Appropriate filter band circuits are incorporated in the decoder, each filter band being responsive to one such frequency. In accordance with the operation of the sender and decoder as described in the above identified patent, when a subscriber initiates a call and a sender is attached thereto, the subscriber dials the code of the terminating office and when said code is registered in the sender, a decoder is operatively connected to the sender, through appropriate connecting devices, for the translation of the office code. According to our invention, during the momentary connection of the sender and the decoder, the source of alternating current which is connected to the line becomes operatively connected to the decoder over a circuit extending from the subscriber's line through the line extending switch, sender and decoder, for operating therein

the appropriate filter circuit which is responsive to the frequency of said alternating current connected to the subscriber's line. This filter circuit, in turn, controls responsive devices which, at the proper time, cause a distinct combination of a group of relays in the sender to be operated and locked. The locking of relays of said group provides the sender with a record of the class of the calling line. The sender proceeds to complete the call in accordance with the class registration in the same manner as it would complete it if it had received the class registration from the line extending switch in the group serving the particular group of lines comprising the class instead of directly from the calling line itself.

Obviously the filter band circuits may be located in the sender instead of the translator. In this respect it is simply a matter of economy whether said filter band circuits are placed in one or the other. Where the number of codes to be translated does not necessitate the use of a translator like a decoder or its equivalent, the sender may well contain the alternating current responsive devices. But where a translator is required and a few of them only are necessary to carry the office load, the number of such devices may be greatly reduced by locating them in the translators. In either event, the invention is not limited to any particular location of the filter circuits. They may be placed wherever they can function in the manner described to lock a record of the calling line class in the means used to effect the ultimate and correct disposition of the call.

This and other features of the invention will be apparent from a consideration of the following description in connection with the drawings and appended claims.

Referring to the drawings, Fig. 1 shows one of a group of subscribers' lines together with a trip circuit common to the group of lines.

Fig. 2 shows a start circuit serving a plurality of trip circuits.

Fig. 3 shows a line finder-district selector circuit for extending the line of Fig. 1 to subsequent selectors.

Fig. 4 shows one of a plurality of link circuits serving the start circuit of Fig. 2 and having access to the line finder-district selector circuit of Fig. 3. A portion of two other link circuits is also shown.

Fig. 5 shows a skeletonized form of the sender circuit disclosed in the above mentioned patent of Raymond-Scully and adapted to be selected by the link circuit of Fig. 4.

Fig. 6 shows a skeletonized form of the connector circuit disclosed in the above mentioned Raymond-Scully patent and also a part of the decoder.

Figs. 7, 8 and 9 show such other parts of the decoder disclosed in the above mentioned Raymond-Scully patent which contains elements used in our invention and such other elements as are necessary to a complete understanding thereof.

Fig. 10 gives a diagrammatic illustration of a number of possible extensions which can be made from a calling line with the mechanical system described; while

Fig. 11 shows the order in which the several figures of the drawings should be arranged with respect to each other in order to disclose the invention completely.

It is to be observed that the line finder group, start and link circuits shown in Figs. 1, 2 and 4 respectively, are a well known combination of circuits for extending automatic calling lines to switching selectors. These circuits are completely described in Patent No. 1,567,072 to W. H. Matthies, granted December 29, 1925, and therefore such parts only of these circuits as concern the operation of our invention are noted in this description, reference being made to said patent for a further and more complete description of their operation. Subscribers' lines, such as line 100, are connected to multiple terminals appearing before a plurality of line finders.

When the subscriber at substation 100 removes his receiver from the switchhook a circuit is closed for line relay 101 extending from battery through that relay, inner back contact of relay 102, over the subscriber's line loop, to ground at the outer back contact of relay 102. Relay 101 operates and closes a circuit from battery, resistance 104, through the winding of relay 103 to ground at the outer contact of relay 101.

The operation of relay 103 closes a circuit from battery, resistance 105 to ground at the outer right contact of relay 103. This circuit is in shunt of the winding of relay 106, which relay serves the second subgroup of the group to which line 100 belongs, thus preventing the extension of a call from that subgroup while the trip circuit is in use with line 100. The operation of relay 103 also closes a circuit from battery, through the winding of relay 200, conductor 133, outer left contact of relay 107, outermost left contact of relay 103 to ground. Relay 200 operates and connects ground over its contact, conductor 132, to the inner right armature of relay 107. When relay 107 operates, as subsequently described, it locks to this ground through its right winding and remains locked as long as relay 200 remains operated. With relay 107 operated, the operating circuit of relay 108 remains open and hence any other incoming calls in this group must await the release of relay 107 before they can be extended. Since relay 200 operates as soon as relay 103 or relay 106 operates it will remain operated as long as a call awaits attention in any subgroup served by the start circuit of Fig. 2. The relay of each trip circuit corresponding to relay 107 operates as each call is served and locks to the contact of relay 200. When all waiting calls have been served the circuit of relay 200 is opened and that relay releases, releasing the relay 107 to permit the extension of other calls. Since the circuit of relay 200 extends over the back contact of relay 107, should simultaneous calls exist in all the groups served by the start circuit of Fig. 2, when one call has been served in each group and relay 107 of the last trip circuit has been operated, no circuit would exist for holding relay 200 operated and that relay would release permitting the relays 107 to release and close over their back contacts, circuits for again operating relay 200 should additional calls await attention.

In addition, relay 103 closes a circuit from battery, over the back contact of relay 201, conductor 130, right winding of trip relay 108, inner left contact of relay 107, innermost left contact of relay 103, left contact of relay 109 to ground. Relay 108 operates in this circuit and closes a locking circuit for itself from ground, right contact of relay 109, left winding and inner left front contact of relay 108, over the inner left back contacts of the trip relays of the other groups

of lines, conductor 129, right winding of start relay 201 to battery.

Relay 201 operates in this circuit. A circuit is now closed for relay 110 extending from battery through the winding of relay 110, right inner contact of relay 108, conductor 128, to ground at the outer right contact of relay 201. Relay 110 locks in an obvious circuit to ground at the left back contact of relay 109. Relay 108, together with relay 103 prepares a circuit from ground on the outer contact of relay 110, outer left front contact of relay 108, inner right contact of relay 103, conductor 131, left back contact of relay 202, outer left back contact of relay 203, conductor 206, upper contact of cam 401, upper contact of cam 402, brush 461 and its associated terminal, conductor 378, upper contacts of cam 301, winding of relay 302, to battery, the line finder of Fig. 3 having been assumed to have been allotted for use by the switch 460 and the sequence switch 300 therefore standing in position 2.

The operation of relay 108 also closes a circuit from ground over its outer right contact, through the winding of the trip magnet 303, serving the group in which line 100 appears on the line finder frame, to battery. Relay 110, upon energizing, closes a circuit from battery through the left winding of relay 109, left winding of relay 107, outer contact of relay 110 to ground. Relay 107 operates and locks through its right winding and inner right contact, conductor 132, to the contact of relay 200.

The operation of relay 302 closes a circuit from battery, through the winding of updrive magnet 304, middle left contact of relay 302, upper contact of cam 364, right front contact of relay 302 to ground. Under the control of the updrive magnet 304 the line finder shaft is moved upwards. Due to the operation of the trip magnet 303 the set of brushes serving the group of lines to which line 100 belongs is tripped. When the shaft leaves the tripping zone a circuit is closed from ground over brush 307, through commutator segment 305, upper contacts of cam 306, outer left normal contact of key 204, inner right contact and right winding of relay 201 to battery. Relay 201 is held operated in this circuit but the circuit through the locking winding of relay 108 is shunted and that relay releases, in turn releasing the trip magnet 303. As soon as brush 307 leaves segment 305 the circuit of relay 201 is opened and that relay releases, again connecting battery to the operating winding of relay 108 and the corresponding relays in other trip circuits, so that subsequent calls may be served.

Relay 302 closes a locking circuit for itself over its inner left contact, right contact of cam 308, back contact of relay 320, commutator segment 321, brush 322, to ground, which is closed as soon as the line finder moves upward. Relay 302 also closes a circuit from battery, over the inner left contact of relay 205, right winding of relay 203, conductor 207, left contacts of cam 403, brush 462 and its associated terminal, conductor 379, upper left contact of cam 311, right front contact of relay 302 to ground. The operation of relay 203 removes ground from conductor 206 thus preventing the start of another line finder until the brushes are tripped. Relay 203 locks in a circuit from battery, over the outer left contact of relay 205, left winding and outer left front contact of relay 203, left back contact of relay 202, conductor 131, inner right contact of relay 103, outer left contact of relay 108, outer contact of relay 110 to ground. The operation of relay 203 also closes a locking circuit for relay 201 from battery, left contact and left winding of relay 201, inner right contact of relay 203 to ground. The circuits just traced are established before relay 108 is released by the shunting action of commutator segment 305. As soon, however, as relay 108 deenergizes it opens the locking circuit of relay 203, restoring the start circuit to a condition to serve subsequent calls.

When relay 302 operates it also closes a circuit from ground through its right front contact upper left contact of cam 311, conductor 379, brush 462 and its associated terminal, right contact of cam 404, upper left contact of cam 405, right winding of relay 406, winding of relay 407, upper left contact of cam 408, upper right contact of cam 409, resistance 410 to battery. Relays 406 and 407 operate, relay 406 closing a locking circuit for itself and relay 407 from battery, through resistance 410, upper right contact of cam 409, upper left contact of cam 408, winding of relay 407, right winding of relay 406, contact of cam 411, contact of relay 406 to ground. Relay 407 closes a circuit from battery, through the winding of sequence switch magnet 400, upper contact of cam 412, contact of relay 407 to ground. Magnet 400 operates advancing the link circuit sequence switch to position 2.

In position 2 ground is connected from the right contact of cam 415 to brush 466 and its associated terminal, conductor 375, inductance 387, lower right contact of cam 312, lower right contact of cam 313, left winding of relay 314 to battery. Relay 314 operates, but performs no function until the calling line has been found. Ground from the front contact of relay 406 is also extended over the contact of cam 411, upper left contact of cam 405, upper right contact of cam 404, left contacts of cam 403, conductor 207, right winding of relay 203, inner left contact of relay 205 to battery, holding relay 203 operated until the link circuit sequence switch is moved out of position 1. When the link circuit sequence switch arrives in position 2 relays 406 and 407 release. The release of relay 407 completes a circuit from ground at the back contact of relay 407, upper right and lower left contact of cam 405, winding of magnet 487 to battery. Magnet 487 operates and closes an obvious circuit for magnet 488. Magnet 488 is the operating magnet for sender selector rotary switch 480 and causes said switch to rotate in search of an idle sender.

An idle sender is characterized by the connection of battery through a 150-ohm resistance, such as resistance 501, top contacts of relay 1303, contacts of relay 726, to conductor 502 and the associated terminal in the set engaged by brush 483. With the link circuit sequence switch in position 2 ground is connected over the upper right contact of cam 421, through the left winding of relay 406, lower contact of cam 413, right winding of relay 406, winding of relay 407, lower contact of cam 401, lower right contact of cam 402 to brush 483.

When brush 483 encounters a terminal corresponding to an idle sender to which battery is connected, relay 406 operates, short-circuiting its left winding over its contact and the contact of cam 411 and causing relay 407 to operate in series with the right-hand winding of relay 406. The operation of relay 407 opens the circuit of magnet 487 and closes a circuit from battery through the winding of sequence switch magnet 400,

upper contact of cam 412, front contact of relay 407 to ground, advancing the link sequence switch to position 3.

In position 3 a circuit is prepared extending from ground through the top and middle windings of relay 1306, contacts of relay 1232, bottom back contact of relay 1305, conductor 506, brush 484 of sender selector 480, lower left and upper right contacts of cam 408, brush 464 of district finder 460 to conductor 315, left contact of cam 316, left winding of relay 317 to battery, which circuit is not completed until the district circuit reaches position 3.

As already observed, the sender shown in Fig. 5 is a skeletonized disclosure of the sender shown in the Raymond-Scully patent above referred to. In order to preserve the identity of the various pieces of apparatus and the different conductors therein, it has been found desirable wherever possible, to use in this description the same designations for identical elements as are employed in said patent. Consequently, all the designations in Fig. 5 except those beginning with the digit 5 are identical with the same or corresponding elements in the above mentioned patent. In this connection, attention is also called to the fact that the sender-connector shown in Fig. 6 and the parts of the decoder shown in Figs. 6, 7, 8 and 9 are likewise skeletonizations of the sender-connector and decoder described and disclosed in the above mentioned patent. Hence, in order to preserve the identity of the various elements, the same scheme of designation is used in these figures as is used in Fig. 5, that is, all designations not beginning with the numeral of the figure in which the element is disclosed in our drawings identify similar elements in the figures of said patent while designations beginning with the numeral of the figure in which the elements appear are not found in the disclosure of said application and are specific additions or changes relating to our invention.

In the meantime the line finder shaft continues to move upwards until it reaches the terminals corresponding to the calling subscriber's line. When these terminals are encountered a circuit is completed from battery, through the right winding of relay 109 and resistance 111 in parallel, inner front contact of line relay 101, conductor 114, terminal 380, brush 381, inductance 388, right contact of cam 318, winding of relay 320 to ground. Relay 320 operates and closes a circuit in shunt of its winding through resistance 319, right front contact of relay 320, commutator segment 321, brush 322 to ground. Relay 109, which is marginal, is so adjusted as not to operate in the circuit previously traced in series with relay 107 or in the circuit traced for the winding of relay 320. With resistance 319 in parallel with relay 320 relay 109 operates and locks through its left winding, left winding of relay 107, outer right contact of relay 110 to ground. The operation of relay 109 opens the locking circuit of relay 110 and relay 110 releases after an interval due to the fact that relay 110 is slow to release. Relay 320 opens the locking circuit of relay 302 and that relay releases as soon as brush 310 encounters an insulating segment of centering commutator 309.

The release of relay 302 opens the circuit of updrive magnet 304 and stops the line finder on the calling subscriber's line. It also connects battery through resistance 323 and its left back contact, lower right and upper left contacts of cam 324, left inner back contact of relay 317, resistance 325, brush 326 and terminal 327, over conductor 112, winding of cut-off relay 102 to ground. Relay 102 operates and releases line relay 101 removing the calling condition from terminal 380.

The release of relay 101 permits relay 103 to release and also opens the circuit of relay 320. The connection of battery to terminal 327 marks terminal 113 and the other multiple terminals of calling line 100 in the terminal banks of final selectors with reduced battery potential to render the line busy to such final selectors. The release of relay 302 also closes a circuit from battery through the winding of sequence switch magnet 300, lower left contact of cam 328, outer right front contact of relay 314, right back contact of relay 302 to ground. Sequence switch 300 is advanced in this circuit to position 3.

When sequence switch 300 leaves position 2 the circuit of relay 314 is opened and that relay releases. When the sequence switch 300 reaches position 3, the previously traced circuit for relays 1306 and 317 is completed. Relay 317, being marginal, does not operate at this time. Relay 1306 operates and closes a circuit for relay 1234 which, in turn, closes a circuit for relay 1233 extending from ground on the top inner front contacts of relay 1234, winding of relay 1233, resistance 1304, to battery. Relay 1233 operates, locks over its top inner contacts and grounds conductor 1238 over its bottom inner contacts. Conductor 1238 is the off-normal ground conductor, one branch of which extends to the winding of relay 828, another to the winding of relay 1303 and yet another to the bottom contacts of relay 901 and extending thereover to the winding of relay 902. Relay 828 operates and closes circuits for operating the time alarm equipment as described more particularly in the above mentioned patent. Relay 902 operates and prepares circuits for relays of the register 900 for registering the first digit dialled, while relay 1303 operates and opens the previously traced circuit from battery through resistance 501, to relays 406 and 407 and these relays release. The release of relay 407 closes a circuit from battery, through the winding of sequence switch magnet 400, lower right contact of cam 412, back contact of relay 407 to ground. Sequence switch 400 is advanced to position 4 from which position it is moved to position 5 by means of ground over the lower left contact of cam 412.

In position 5 of the link sequence switch the dialing leads and the fundamental circuit leads are cut through directly from the district circuit to the sender circuit. The dialing circuit may be traced from battery, through the right winding of relay 724, conductor 744, sender selector brush 485, and its associated terminal, lower contacts of cam 414, district finder brush 465 and its associated terminal, conductor 382, lower contact of cam 329, winding of relay 330, right back contact of relay 317, line finder brush 331, terminal 332, conductor 116, winding of retard coil 134 through the subscriber's substation, winding of retard coil 135, conductor 117, terminal 333, brush 334, middle left back contact of relay 317, left contact of cam 335, winding of retard coil 387, conductor 375, brush 466 and its associated terminal, lower left contact of cam 415, brush 486 and its associated terminal, conductor 743, resistance 729 to ground on the back contact of relay 1237.

In position 5 of the link circuit sequence switch 400, relays 406 and 407 are connected in a cir-

cuit extending from brush 484, left contacts of cam 408, winding of relay 407, right winding of relay 406, upper contact of cam 413, to brush 464. The circuit of these relays is extended from these brushes as will be described later. When the dialing circuit above traced is completed, relay 724 operates and closes a circuit from battery through the winding of relay 716, front contact of relay 724 to ground. Relay 716, in operating, connects ground through resistance 717 to the winding of relay 713 which also operates, in turn, operating relay 714 while the latter causes the operation of relay 715. With relay 715 operated, a circuit is closed from ground over the inner front contact of relay 715, bottom contact of relay 902, left winding of relay 724, condenser 730, to source of dial tone. A tone is thereby induced in the primary winding of relay 724 from whence it extends to the subscriber's line, informing him that he may proceed to dial.

When the subscriber operates his dial for the first digit, relay 724 momentarily releases as each pulse is received. Relay 716 releases each time that relay 724 releases but is not as quick to operate as relay 724 so that it may or may not reoperate each time that relay 724 does. Relays 713 and 714, on the other hand, are definitely slow to release so that they do not release during the possible short openings of their circuits and relays 713, 714 and 715 remain operated during the intervals between digits. When relay 724 closes its back contact in response to the first pulse, it connects ground over the right front contact of relay 714, top outer contact of relay 1234, over the upper back contacts of a group of register relays in primary register 700 of which only relays 701 and 702 are shown in the figure, to the winding of relay 701. Relay 701 operates, locking through the winding of relay 702, contact of relay 701, back contact of another register relay, not shown, conductor 736, back contact of relay 720 to ground on the contacts of relay 715. The release of relay 716 closes a circuit from battery through resistance 719, winding of relay 718, outer back contact of relay 716, to ground on the contacts of relay 715. Relay 718 is slow to release so that it remains operated even though relay 716 may momentarily break its operating path. At the end of the first impulse, relay 724 reoperates and relay 702 operates and locks in the circuit of relay 701. The operation of relay 702 closes a circuit from ground over the lower front contact of relay 702 to conductor 731. With relay 902 operated this circuit is completed over the top innermost contacts of relay 902, top winding of relay 904 of the first digit register 900, to battery, operating that relay. Each impulse of the train of impulses comprising the first digit is now similarly received and registered on the group of relays of the first digit register which is represented by relays 904 and 905 as disclosed and described in the above patent. When the last impulse of the digit has been received, relays 724 and 716 remain operated for a sufficient interval to permit relay 718, to release. Relay 718 upon releasing, closes a circuit from battery through the winding of relay 720, normal contacts of relay 718 to ground on the front contacts of relay 715. Relay 720 closes a holding circuit for itself under the control of relay 716. It also connects ground from the front contacts of relay 715, over the bottom front contact of relay 720, back contacts of cut-in register relays like relay 922, to the winding of relay 901 and thence over the bottom front contacts and bottom windings of the register relays like relays 904 and 905 which remain operated at the end of the train of impulses. This provides a locking circuit for these register relays as well as an operating circuit for relay 901. The operation of relay 720 also releases any of the relays of primary register 700 which were operated.

Relay 901, in operating, locks over its top outer contact to grounded conductor 1317. It also opens the circuit of relay 902, disconnecting the group of relays of the secondary register 900 on which the first digit was registered from the relays of the primary register 700.

The train of impulses comprising the second digit are next received and registered on the relays of a second register which is not shown in the drawings while the impulses comprising the third, and last digit, of the office code dialled are received and registered on the relays of a third register 920 of which register relays 923 and 925 are representative. Following the registration of the office code, the numerical digits are recorded on registers provided for that purpose but not shown in the drawings. Since that part of the sender which has to do with said registrations forms no part of our invention, it has not been thought desirable to incumber this specification with any description or disclosure thereof. Reference is made to the above identified patent granted to Raymond and Scully for any further description of operations not specifically contained herein.

When the code digits have been registered as indicated by the operation of relay 921 a circuit is closed from battery through the winding of relay 721, top inner front contacts of relay 921 to grounded conductor 1317. Relay 721 is operated and initiates the connection of a decoder to the sender through the medium of the decoder connector by closing a circuit extending from battery through the normal contacts of relay 723, top inner contacts of relay 721 to conductor 930 which conductor extends into the decoder connector, diagrammatically indicated in Fig. 6, completing circuits therein for operating a pair of multi-contact relays individual to the sender and one of whose operating magnets is designated 2204. Further circuits are closed to connect an idle decoder, one of whose connecting multi-contact relays is designated 2201, to the connector; all in accordance with the above identified patent to Raymond and Scully. Such parts of the decoder shown and described in said patent as is necessary to a complete understanding of our invention are shown in Figs. 6, 7, 8 and 9.

In the meanwhile the operation of relay 721 closes an alternating current circuit from the secondary winding of coil 509, the primary winding of which is connected to a source of alternating current, top outer contact of relay 721, conductor 510, top contact of relay 772, condenser 511, conductors 507 and 743, brush 486 and the terminal on which it stands, left lower contact of cam 415, brush 466 and terminal on which it stands, conductor 375, condenser 389, brush 381, terminal 380, conductor 114, back contact of relay 101, condenser 136, winding of relay 137 to ground. Relay 137 operates in this alternating current circuit and connects alternating current source 139 of a frequency specific to the calling line across the line conductors, in a circuit ex-

tending on one side from conductor 117, retard coil 135, outer front contact of relay 102, condenser 138, contact of relay 137, secondary winding of transformer 139 connected to said alternating source of specific frequency, inner front contact of relay 102, retard coil 134, to conductor 116. This circuit is completed in the decoder to perform a function to be described hereinafter.

The specific alternating current frequency indicated by 139 represents one which is common to a group of lines entitled to the same class of service. The number of such different frequencies in the entire office, therefore, depends on the number of different groups of subscriber lines in the office which are entitled to different grades of service. Previously it was not only necessary to separate such lines into their various groups but also to allot a separate group of line-extending switches to each separate group of lines as it was by identifying the line-extending switch group that the sender or other line controlling medium could indirectly identify the group of the calling line. According to our invention, this grouping is entirely eliminated by the identification of all lines entitled to the same grade of service by an alternating current of a specific frequency while the line-extending switches may all be used in a common group by all the lines in the office thereby providing decided economies in the quantity of such equipment necessary to carry the entire office traffic.

Returning now to the operation of the circuits, it may be briefly remarked that the decoder, as disclosed and described in the above identified patent of Raymond and Scully, comprises a set of receiving registers shown in Fig. 6, a set of decoding registers, Fig. 8, a set of route relays, Fig. 8, and a set of outgoing registers, Fig. 9. Fig. 7 shows the filter register class of service circuit which comprises that element of our invention cooperating with such parts of the decoder as have been mentioned above. When, therefore, a decoder is connected to the sender through the medium of the decoder connector, the office code recorded on sender registers 900, 910 and 920 is further recorded in receiving registers 2500, 2510 and 2520 over circuits completed from the contacts of the operated register relays of registers 900, 910 and 920 to the windings of the respective and corresponding relays in the receiving registers 2500, 2510 and 2520. An illustration will make this clear. For example, if relays 904 and 905 in register 900 are operated as a result of the train of impulses comprising the first digit and relays 923 and 925 of register 920 are operated from the train of impulses comprising the third digit then, when the decoder and sender are connected together, obvious circuits are closed from the contacts of said operated relays to the windings of relays 2501, 2504, 2521 and 2524 respectively, as well as other relays in receiving register 2510 from the operated relays of the second register upon which the second code digit is registered.

It will be observed that the circuits for the receiving register relays 2513 and 2514 extend in series through retard coils 750 and 751 respectively. A group of filter circuits are arranged in series and tapped in parallel to the circuit of each of said register relays at one terminal of their respective retard coils. Each of these filter circuits comprises an alternating current network responsive to a particular alternating current frequency, there being as many such filters provided in Fig. 7 as there are different frequencies provided at the subscribers' line groups to denote the different classes of service. Such filter circuits are old in the art and one may be cited by way of illustration which can be used in cooperation with our invention, namely, Patent 1,493,600 to G. A. Campbell, issued May 13, 1924. The filters, therefore, need to be but indicated in the drawings to show the complete independence of our invention from any particular form which the filter may take. So long as each has the capacity to respond to a given frequency and is opaque to all others, any filter will serve the purpose. A relay is provided in series with each filter, as for example, relay 752 for filter 1 which operates at the responsive frequency of the filter. Therefore, when the sender is operatively connected to the decoder and the record of digits comprising the called office code is being transmitted into the decoder, the alternating current circuit traced above from the calling subscriber's line to conductors 116 and 117 is now completed from conductor 116, terminal 332, brush 331, right back contact of relay 317, winding of relay 330, right lower contact of cam 329, conductor 382, brush 465, bottom contacts of cam 414, brush 485 and associated terminal conductors 744 and 514, contacts of relays 2204, and 2201, conductor 650, condenser 760, conductor 762, the frequency filters and their respective serially connected relays, condenser 761, conductor 651, contacts of multi-contact relays 2201 and 2204, conductors 513 and 743, brush 486, left lower contact of cam 415, brush 466, conductor 375, retard coil 387, left contact of cam 335, left middle contact of relay 317, brush 334 and terminal 333 to conductor 117. The alternating current circuit thus completed from the specific frequency source 139 to the plurality of filter networks in the decoder will cause the operation of the particular filter which is tuned to the frequency generated by source 139, and which, let it be assumed, is filter No. 2.

The transmission of the alternating current signal to signify the class of the calling line in no wise interferes with the registration of the office code in the decoder because retard coils 750 and 751 are designed to choke out the passage of any alternating current through their respective windings to the windings of relays 2513 and 2514. Hence, if the direct current path of these relays is not closed in the sender by the operation of the relays of register 910 they will remain in an unoperated position during the transmission of the alternating current signal. It will be further noted that the alternating current circuit above described is also in parallel with the circuit through the right winding of relay 724, which, it will be recalled, responds to dial impulses from the subscriber's line. The alternating current passing through this relay during its transmission into the filters of the decoder will in no wise affect its response to dial impulses as the alternating current frequencies which are best adapted to our invention are within the voice frequency range and do not affect ordinary telephone relays such as relay 724.

The response of filter 2 causes the operation of relay 753 in the known manner which, in turn, closes an obvious circuit to operate service relay 763, to perform functions hereinafter described. In the meanwhile the relays of incoming registers 2500, 2510 and 2520 which were operated for the purpose of recording the called office code in turn control the operation of a decoding register whose function is to translate the three digit regis-

tration of the code for operating a particular route relay which identifies that code. As more completely described and disclosed in the above mentioned patent to Raymond and Scully, this decoding process comprises the operation of a multi-contact relay individual to the first digit of the code, such as, for example, relay 2909; the partial closing of a group of circuits through the contacts of said relay in accordance with the registration of the second digit of the code as recorded in register 2510, and finally, the complete closing of one circuit in said group in accordance with the value of the third digit of the code as recorded in register 2520. The actual circuit closed results in the operation of a "route" relay, such as relay 3205, which is individual to the code recorded. As many of these route relays are provided as there are different routes to be used in connecting with wanted offices. The windings of all route relays for called offices in the same zone of the exchange area are grouped together and carried to a terminal on cross-connecting terminal block 801 from whence the completion of their circuit is further placed under control of the class of service relays of which relay 763 is an example as described below. As disclosed provision is made for grouping the route relays in accordance with a maximum of six zones.

It will be remembered that the assumed operation of relay 753 in response to the specific frequency which caused the operation of filter 2 indicated the class of the calling subscriber's line. Each such relay, in turn, locally controls a service register relay like 763, there being as many service register relays as there are filter-responsive relays like relay 753. All of the armatures of these relays are correspondingly connected together and carried to a terminal block 801. The cooperating contacts of the armatures of each of said relays, however, are not connected together but those of each relay are connected to separate terminal blocks such as terminal block 766 for relay 763. The terminals of each of these blocks are then jumpered as may be required to terminal blocks such as 769, the terminals of which are connected through the windings of six zone relays (not shown) but which correspond to relays 3400 to 3405 inclusive of the Raymond and Scully patent above referred to and thence to battery over conductor 765 and the winding of alarm relay 2867 or over conductor 855 to battery through the winding of relay 3207. The zone relays correspond to the zones into which the exchange area is divided and, when operated, transmit to the sender a setting for the zone relays of the sender. Since the present invention is not concerned with the character of the zoning information transmitted to the sender, the zoning relays have been omitted for clarity.

It has been assumed that there are eight classes of subscribers and it will be further assumed that these classes include three groups of subscribers entitled to flat rate service, said groups differing from each other in the extent of the exchange area into which they may dial without incurring a special charge, one group of coin box subscribers' lines and also four groups of other subscribers entitled to message rate service, said latter groups also differing from each other in the extent of the exchange area into which they may dial for the basic charge. The no-charge area for flat rate subscribers may include a few local offices for subscribers of one group having the most limited service, more local offices for subscribers of a second group having less limited service and so on for the three groups, while it includes only official calls for message rate subscribers of the four message rate groups of subscribers. For offices outside of these local office areas a flat rate subscriber must have the assistance of an operator in order that the proper charge should be made whereas message rate subscribers may dial such offices directly and have their message registers operated a number of times determined by the zone in which the office lies. Still other more distant offices may be denied to some message rate subscribers and allowed to other subscribers. Coin box lines are entitled only to calls in the local office area in response to the deposit of a single coin, it being necessary when calls are initiated to other zones of the exchange area to bar such calls and reroute them for completion with the assessment of the proper toll charge. To take care of these varying conditions the route relays are connected in series with the proper zone relays through contacts of the service relays as previously described according to whether or not service in that zone is permitted and a particular charge is to be made. If service to a particular zone is denied to a class of subscribers, the contact of the service relay is connected to relay 3207 rather than to relay 2867. The route relay can not operate in series with relay 3207 but relay 3207 does and operates relay 3206 which causes the call to be rerouted. In the case of calls rerouted to an operator, since calls to operators are free, the circuit of relay 3206 extends over conductor 856 through the zone relay (not shown) for no charge calls, conductor 765 to battery through alarm relay 2867.

As previously assumed, the calling subscriber is in a class of service group which has caused the operation of service relay 763 and consequently the circuit of route relay 3205 is closed from ground supplied through the decoding register through its winding, conductor 850, terminal block 801, conductor 851, No. 2 contacts of service relay 763, jumpered terminals on terminal blocks 766 and 769, winding of zone relay (not shown), conductor 765, winding of relay 2867 to battery. Relay 3205 operates in this circuit and closes circuits to the outgoing registers of Fig. 9 to perform functions which will be noted briefly hereinafter. Thus, all subscribers in the group identified by service relay 763 would receive regular routing to all offices in the zone typified by route relay 3205.

On the other hand, if the calling subscriber's line is in a group which is not entitled to regular routing to the offices of the zone typified by route relay 3205 but to another routing, then the specific frequency which designates this group would not cause the response of filter 2 but the response of some other filter indicative of the group, for example, filter 1. Under such circumstances, filter relay 752 and service relay 768 are operated and the circuit of zone relay 3205 will be completed over conductors 850 and 851, the No. 2 contacts of service relay 768, jumpered contacts of terminal blocks 767 and 770, conductor 855 to battery through the winding of relay 3207. Relay 3207 operates in this circuit but relay 3205, being marginal with respect to the resistance of relay 3207, does not operate. Relay 3207 closes a circuit for route relay 3206 extending over the contact of relay 3207, conductor 856, the zone relay (not shown) for establishing a no-charge condition in the sender, conductor 765 to battery through the winding of relay 2867. Relay

3206 closes circuits to operate the outgoing registers for transmitting routing information to the sender different from what the routing information would have been if the regular route relay 3205 had been operated.

The strapping shown between terminal blocks 766 and 769; 767 and 770, etc., is to be considered as merely illustrative of the different types of service which might be allotted to subscribers in the several class of service groups, it being possible to arrange the strapping at will to vary the type of service afforded. For example, as illustrated, message rate subscribers in the first class of service group typified by class of service relay 768 would be enabled to regularly make calls in the local office area and to offices in zone 1 but would not be able to make calls into zones 2 to 5 such calls being rerouted whereas message rate subscribers in the second class of service group typified by service relay 763 would be enabled to regularly make calls in the local office area and to offices in zones 1 and 2 but not be able to make calls into zones 3 to 5, such calls being rerouted. Flat rate subscribers for example, in the eighth class of service group typified by the class of service relay 771 could make no charge calls into the local office area and into zones 1 to 4, but could not make calls into the more distant zone 5 without rerouting for charging purposes, whereas subscribers in the seventh class of service group typified by service relay 772, being entitled to very restricted service would be able to make no-charge calls into only the local office area and into zone 1, but could not make calls into zones 2 to 5 without rerouting for charging purposes. Coin box subscribers in the fourth class typified by the class of service relay 772 could make calls in the local office area only for the initially deposited coin, but could not make calls to zones 1 to 5 without the services of an operator who would inform the calling subscriber as to the amount of additional coins to be deposited.

It is now apparent from the foregoing description that each filter and its locally responsive relay controls the regular routing or required change to be made in disposing of the call in accordance with the requirements of the class of service indicated by the frequency allocated to subscriber groups. If the routing is to be regular the operation of the class of service relay like relay 763 completes the circuit of the regular route relay individual to the called office and the sender is informed through the decoder outgoing registers responsive to said route relay to complete the call in the regular way. If, on the other hand, the calling line is associated with a subscriber group which is denied regular access to that office, then the operation of a class of service relay like relay 768 in response to an alternating current frequency designating such a class will cancel the regular routing by completing the circuit of the called office route relay 3205 through a high resistance relay in series with which relay 3205 cannot operate. The high resistance relay operates a different route relay which operates the decoding register in accordance with the disposition to be made of calls of that class and the outgoing registers transmit to the sender the necessary information for the altered disposition to be made of the call.

Necessarily the total number of altered dispositions to be made of all calls depends on the different classes of service into which the subscribers' lines in the office are divided with respect to the entire exchange area, a special frequency and responsive filter being provided for each case. Hence, while all corresponding armatures of class of service relays like 763 and 768 are strapped together and carried to terminal block 801, as already described, nevertheless the corresponding cooperating contacts of each class of service relay are not strapped together but carried separately to their own cross-connecting block to the other side of whose terminals may be connected as many separate windings of relays like relay 3207 as there are separate treatments to be afforded all calls. For clarity only one of these relays, 3207 and its corresponding route relay 3206 has been disclosed. These relays are then strapped to as many different corresponding terminals on each separate class of service relay terminal block as there are groups of subscribers entitled to the same class of service for any particular called office or group of called offices. Thus, if all subscribers in the calling office were divided into eight different classes of service groups and yet all of them were entitled to the regular routing for the called office identified, say, by the route relay 3205, then conductor 765 is multipled to the corresponding terminal in each terminal block of the separate class of service relays so that no matter what class of service relay operates, relay 3205 is always operated. On the other hand, if each class is entitled to a different routing including the regular routing, for the office identified by route relay 3205, then conductor 765 would be connected only to the terminal block of the class of service relay identifying the subscriber class entitled to the regular routing while to each corresponding terminal in the terminal block of the remaining class of service relays is connected the appropriate conductors leading to the winding of a relay like 3207 which locally controls the operation of a special route relay for operating the decoding register in accordance with the requirements of the altered routing.

The outgoing registers, shown in Fig. 9, comprise the office group register 2600, office brush register 2650, district group register 2700, district brush register 2750, class register 2800 and compensating resistance register 2850. The circuits of these registers are controlled from the contacts of the route relays through the cross-connecting terminal block 3212, from which they are connected to the contacts of the route relays in appropriate combinations. These registers, when operated in the combination called for by the operation of a route relay, serve to ground certain transmitting conductors leading into the sender by way of the decoder connector. The major function of these registers in grounding these conductors is to cause the setting of correspondingly named registers in the sender although they also transmit certain minor information as well, all in accordance with the description fully set forth in the above mentioned Raymond and Scully patent. The relays in the sender responsive to the various combinations of the decoding registers in the decoder are schematically shown in Fig. 5 under the heading "Translating relays" and are the relays shown in Figs. 18, 19 and 20 of the above mentioned patent. When the required outgoing registers are operated and in turn have grounded the transmitting conductors to the sender a chain circuit is closed through each register for operating relay 3102. Relay 3102 operated, closes a circuit extending from ground on the contacts of relay 3101, contacts of relay 3102, conductor

900, contacts of the decoder connector multicontact relays, conductor 512, winding of relay 722 to battery. Relay 722 operates and, at its top contacts, opens the circuit of relay 137 causing this relay to release and open the alternating current circuit across conductors 116 and 117 thereby causing the consequent release of the relay in the decoder associated with the filter which responded to said alternating current circuit, like relay 753, for instance. Since the operation of relay 722 is the signal furnished by the decoder to the sender that all translations have been finished and that the said translated information has been properly transmitted into the sender, the class of service alternating frequency circuit can be disconnected. Relay 722 closes a locking circuit for itself from battery over its inner lower front contact and lower winding to grounded conductor 1317. Relay 722 also connects relay 723 to battery in parallel with its lower winding. Relay 723 operates and disconnects battery from conductor 930 thereby causing the disconnection of sender and decoder from the decoder connector.

With the sequence switch 300 in position 3 the fundamental is completed from battery through the left winding of relay 314, lower right contact of cam 313, upper right contact of 312, conductor 378, brush 461 and its associated terminal, upper right and lower left contacts of cam 402, brush 481 and its associated terminal, conductor 508, bottom contact of relay 723, winding of stepping relay 1300, back contact of a switching relay to ground. The contacts of the stepping relay 1300 are connected through the operated contacts of the translating relays and through them serve to operate an appropriate number of counting relays which determine the positioning of the selectors. When district selections are made, district switch 300 is advanced to position 10, the aforementioned switching relay in the sender is operated and the fundamental circuit is extended to the next switching stage, the stepping relay, together with another signaling relay in series with it, being looped across the fundamental circuit to ground in the next selector stage. All of these operations are well known and are described in the aforementioned patent and since they form no part of our invention need not be repeated here.

After the wanted line has been found relay 1232 is operated. The operation of this relay opens the shunt around the high resistance winding of relay 1306, including this resistance in the circuit of the left winding of relay 317 and the winding of relay 351 in parallel as already described. This increase in resistance decreases the current through relay 351 to such an extent that it deenergizes. The release of relay 351 in turn releases relay 314 which closes a circuit from battery through the winding of sequence switch magnet 300, lower right and upper left contacts of cam 342, outer right back contact of relay 314, back contact of relay 302 to ground. As soon as sequence switch 300 reaches position 11 ground is connected over the upper contact of cam 316, conductor 315, brush 464 and its associated terminal, upper contact of cam 413, right winding of relay 406, winding of relay 407, left contacts of cam 408, brush 484 and its associated terminal, conductor 506, back contact of relay 1305, winding of relay 1306. Since both sides of this relay are now connected to ground, relay 1306 releases which, in turn releases relay 1234. With relay 1234 released, a circuit is closed from ground over its middle back contact, top outer contacts of relay 1233, winding of relay 1305 to battery. Relay 1305 locks over its bottom front contacts to conductor 506. It also connects ground in shunt of battery through resistance 1304 so that relay 1233 now releases. With relay 1233 released talking selection takes place as described in the patent of Raymond and Scully supra. When talking selection has taken place, the calling subscriber's line is transferred from the sender and extended through the district selector to the called subscriber's line. In virtue of this, relay 724 is disconnected from the calling line extension into the sender and releases, in turn releasing relays 716, 713, 714 and 715.

In the meanwhile the connection of battery through the winding of relay 1305 in parallel with resistance 509 to conductor 506 closes a circuit extending over brush 484 and its associated terminal, left contacts of cam 408, winding of relay 407, right winding of relay 406, upper contact of cam 413, brush 464 and its associated terminal, upper left contact of cam 316 to ground. Relays 406 and 407 operate in this circuit. The operation of relay 407 closes a circuit from battery through the winding of sequence switch magnet 400, upper right contact of cam 412, front contact of relay 407 to ground. Sequence switch 400 advances in this circuit to position 6. The operation of relay 406 connects ground through its contact and the right contacts of cam 403, resistance 416, brush 463 and its associated terminal to conductor 366 to mark the district selector busy to other link circuits until ground is placed on conductor 366 over the upper left contact of cam 417, contact 418 of make-busy jack 419, through resistance 416 and brush 463 in positions 5¾ to 6¼ of sequence switch 400 which keeps the district busy until the link circuit is disconnected. When switch 400 leaves position 5½ the circuit of relays 406 and 407 is opened and these relays release. At the same time the circuit of relay 1305 is opened at cam 408 and that relay releases, thereby releasing the remainder of the sender.

Since the establishment of a talking connection between the two subscribers and the subsequent control of the selector switches forms no part of our invention, reference is made to Patent 1,589,402 to O. H. Kopp, granted June 22, 1926 for a further description of the operation of the district selector shown in Fig. 3.

What is claimed is:

1. In a telephone system, a plurality of groups of calling lines, a plurality of sources of alternating current of different frequencies, each of said sources being associable respectively with each of said groups of lines, a plurality of filter circuits each including a relay and responsive respectively to said sources of current, means for extending any one of said calling lines to said filter circuits whereby the relay of the filter which is responsive to the source of current associated with the particular calling line is operated, and a registering device comprising a plurality of register relays, said register relays controlled respectively by said filter relays.

2. In a telephone system, calling lines divided into groups in accordance with the class of service to which they are entitled, a plurality of sources of alternating current of different frequencies, said sources being associable respectively with said groups of lines, a plurality of filter circuits each including a relay and responsive

respectively to said sources of current, means for extending any one of said calling lines to said filter circuits whereby the relay of the filter which is responsive to the source of current associated with the particular calling line is operated, and a registering device having a plurality of register relays selectively operable by said filter relays for registering the class of any calling line.

3. In a telephone system, calling lines divided into groups in accordance with the class of service to which they are entitled, a plurality of sources of alternating current of different frequencies, said sources being associable respectively with said groups of lines, switching mechanism for extending connections from said lines, a register sender for controlling said switching mechanism, a plurality of filter circuits, each including a relay and responsive respectively to said sources of current, means for extending any one of said lines to said sender and to said filter circuits, means controlled from a connected calling line for setting the registers of said sender for controlling said switching mechanism and for operating the relay of the filter circuit which is responsive to the source of alternating current associated with the calling line, and a registering device having a plurality of register relays selectively operable by said filter relays for registering the class of the calling line and for determining the manner in which the sender shall function in the control of said switching mechanism.

4. In a telephone system, calling lines divided into groups in accordance with the class of service to which they are entitled, a plurality of sources of alternating current of different frequencies, said sources being associable, respectively, with said groups of lines, switching mechanism for extending connections from said lines, a register sender for controlling said switching mechanism, a plurality of filter circuits, each including a relay and responsive respectively to said sources of current, means for extending any one of said lines to said sender and to said filter circuits, means controlled from a connected calling line for setting the registers of said sender for controlling said switching mechanism and for operating the relay of the filter circuit which is responsive to the source of alternating current associated with the calling line, a registering mechanism having a plurality of register relays selectively operable by said filter relays for registering the class of the calling line, and means controlled by the operated register relay for determinating whether the sender shall control said switching mechanism in accordance with the setting of its registers or shall control said switching mechanism in a different manner to reroute the connection.

5. In a telephone system, calling lines divided into groups in accordance with the class of service to which they are entitled, a plurality of sources of alternating current of different frequencies, said sources being associable respectively with said groups of lines, switching mechanism for extending connections from said lines, a register sender for controlling said switching mechanism, a plurality of filter circuits each including a relay and responsive respectively to said sources of current, means for extending a dialing circuit from any one of said lines to said sender over which the registers of said sender may be set for controlling said switching mechanism, means for associating said filter circuits with said calling line over said dialing circuit for operating the relay of the filter circuit which is responsive to the source of alternating current associated with the calling line and registering mechanism having a plurality of register relays selectively operable by said filter relays for registering the class of the calling line and for determining the manner in which the sender shall function in the control of said switching mechanism.

6. In a telephone system, calling lines divided into groups in accordance with the class of service to which they are entitled, a plurality of sources of alternating current of different frequencies, said sources being associable respectively with said groups of lines, switching mechanism for extending connections from said lines, a register sender for controlling said switching mechanism, a decoder associable with said sender, a plurality of filter circuits in said decoder, each including a relay and responsive respectively to said sources of current, means for extending a dialing circuit from any one of said lines to said sender over which the registers of said sender may be set, registers in said decoder, control circuits extending from said sender to said decoder over which the register of said decoder are set from the registers of said sender, means for associating said filter circuits over certain of said control circuits with said dialing circuit for operating the relay of the filter circuit which is responsive to the source of alternating current associated with the calling line and registering mechanism selectively operable by said filter relays for registering the class of the calling line and for determining the manner in which the sender shall function in the control of said switching mechanism.

7. In a telephone system, calling lines divided into groups in accordance with the class of service to which they are entitled, a plurality of sources of alternating current of different frequencies, said sources being associable respectively with said groups of lines, switching mechanism for extending connections from said lines, a register sender for controlling said switching mechanism, a decoder associable with said sender, a plurality of filter circuits in said decoder, each including a relay and responsive respectively to said sources of current, means for extending a dialing circuit from any one of said lines to said sender over which the registers of said sender may be set, registers in said decoder, control circuits extending from said sender to said decoder over which the registers of said decoder are set from the registers of said sender, means for associating said filter circuits over certain of said control circuits with said dialing circuit for operating the relay of the filter circuit which is responsive to the source of alternating current associated with the calling line, said means including means to prevent the setting of said decoder registers from being affected by said alternating current, and registering mechanism selectively operable by said filter relays for registering the class of the calling line and for determining the manner in which the sender shall function in the control of said switching mechanism.

8. In a telephone system, a calling line, a source of alternating current associable with said line, a relay for said line responsive to alternating current for connecting said sources of alternating current with said line, an alternating current responsive device, a second source of alternating current, means for extending a connection from said calling line to said responsive device, and means for controlling the relay of said calling line

thereover from said second source of alternating current whereby said responsive device is rendered operable from said first source of current.

9. In a telephone system, a plurality of groups of calling lines, a plurality of sources of alternating current of different frequencies, said sources being associable respectively with said groups of lines, a relay for each line responsive to alternating current for connecting the source of alternating current allotted to its group thereto, a register sender, a source of alternating current and a plurality of responsive devices in said sender, said devices being tuned to respond respectively to said plurality of sources of alternating current, means for extending a connection from a calling line to said sender, and means for controlling the relay of the calling line thereover from said alternating current source in said sender for operating said relay to connect the source of alternating current associated with the calling line to said responsive devices whereby a particular one of said responsive devices is operated.

10. In a telephone system, a plurality of groups of calling lines, a plurality of sources of alternating current of different frequencies, said sources being associable respectively with said groups of lines, a relay for each line responsive to alternating current for connecting the source of alternating current allotted to its group thereto, a register sender, an alternating current source in said sender, a decoder, a plurality of responsive devices in said decoder, said devices being tuned to respond respectively to said plurality of sources of alternating current, means for extending a connection from a calling line to said sender and to said decoder, and means for controlling the relay of the calling line thereover from said alternating current source in said sender for operating said relay to connect the source of alternating current associated with the calling line to said responsive devices whereby a particular one of said responsive devices is operated.

SAMUEL B. WILLIAMS.
FREDERICK J. SCUDDER.