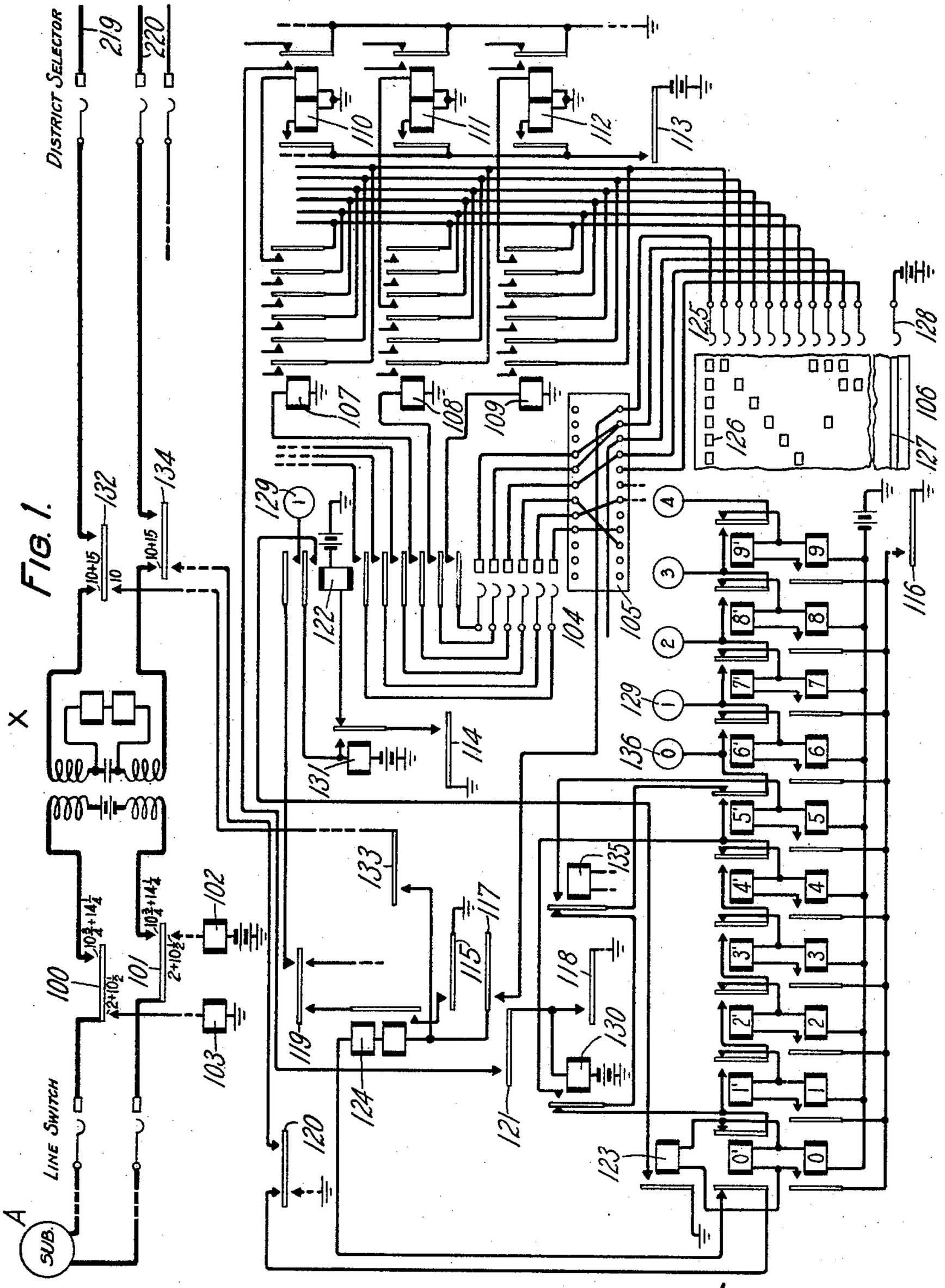
Feb. 18, 1930. W. W. CARPENTER 1,747,224

TELEPHONE EXCHANGE SYSTEM

Filed March 31, 1928 2 Sheets-Sheet 1

FIG. 1.



INVENTOR
WARREN W. CARPENTER
BY P. C. Smith
ATTORNEY

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Filed March 31, 1923 2 Sheets-Sheet 2

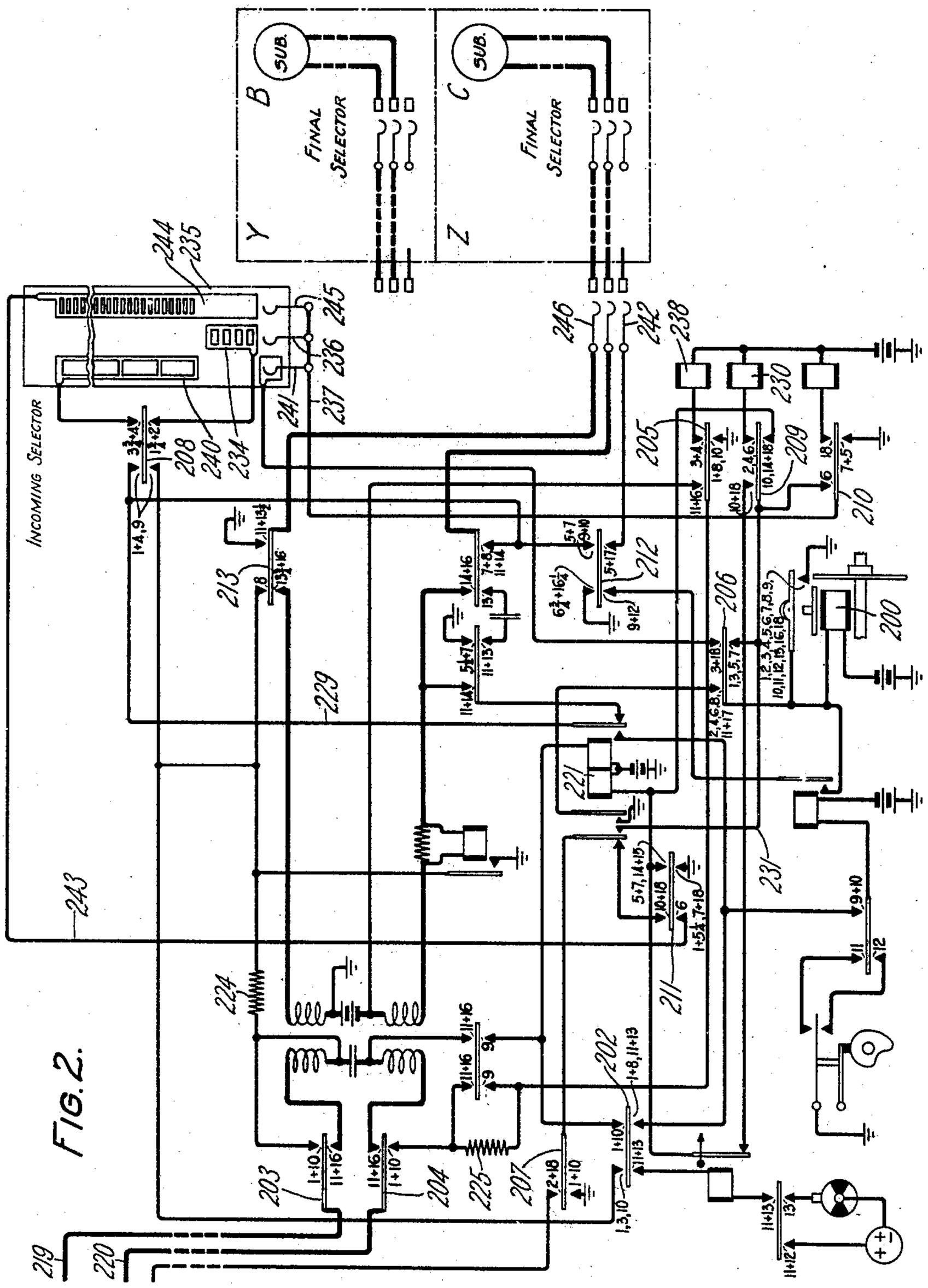

FIG. 2.

INVENTOR
WARREN W. CARPENTER
BY P. C. Smith
ATTORNEY

Patented Feb. 18, 1930 1,747,224

UNITED STATES PATENT OFFICE

WARREN W. CARPENTER, OF QUEENS VILLAGE, NEW YORK, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

TELEPHONE-EXCHANGE SYSTEM

Application filed March 31, 1928. Serial No. 266,136.

This invention relates to a telephone exchange system and more particularly to a multi-office system in which connections are established between subscribers' lines in different offices over inter-office trunks by automatic switching mechanism. The object of the invention is to economize in the use of inter-office trunks and switch mechanism.

In large telephone exchange areas the subscribers' lines are divided into office groups of 10,000 lines each and these several offices are interconnected either directly or through tandem points by inter-office trunks cables. The use of direct trunks between offices is preferable where the volume of traffic over the trunks is sufficient to so warrant, since connections may be established more quickly over direct trunks than through a tandem point and also a considerable saving of equipment is realized.

In the laying out of modern telephone plants, particularly in large cities such as New York, it is now the practice where possible to install several offces in one large building. Initially certain of these offices so grouped may have only three or four thousand lines and serve to supplement other offices which are equipped to capacity or with the full number of 10,000 lines. Since the traffic to such supplemental offices from other offices is obviously less than the ultimate, considerable economy may be realized in the use of inter-office trunks incoming to such offices if incoming connections may be handled over the same trunk groups which serve the offices which they supplement. It may also be found that two fully equipped offices of 10,000 lines each, located in the same building do not have a sufficient volume of incoming traffic from a certain originating office to warrant an individual group of direct incoming trunks to each such office, but that the combined volume of incoming traffic would be about sufficient to economically utilize a common group of direct incoming trunks. The present invention was developed for the purpose of utilizing a common group of incoming trunks for trunking calls directly to either one of two offices.

The standard panel type incoming selector is provided with five sets of brushes having access respectively to five banks of 100 terminals each. Each such brush bank is then divided into four groups of 24 trunks each. Each such group of trunks terminates in final selectors. Thus each incoming selector has access to 20 groups of final selectors and as each final selector has access to 500 lines it is possible through the brush and group selection movements of an incoming selector and the brush, group or tens and units selection movements of a selected final selector to reach any one of 10,000 lines.

In accordance with the present invention access is given to any one of 10,000 lines in either one of two offices by terminating each trunk of a group of incoming inter-office trunks in incoming selectors which are common to the two offices and which in turn have access to the 20 groups of final selectors in each of the two offices. To accomplish this each brush bank of each incoming selector is divided into eight groups of twelve trunks each, the lower four groups of trunks in each bank terminating in final selectors in one office and the upper four groups of trunks in each bank terminating in final selectors in the other office. Thus, by causing the incoming selector to select trunk groups in either the lower or upper halves of its banks in response to its group selection movement, calls may be extended to lines in either exchange at will. At the sender the group selection movement of the incoming selector is controlled in the usual manner by counting relays but this control is modified in accordance with the present invention by the addition of a relay which adds additional counting relays to the control train if a line in the office is to be selected, access to which is obtained over the upper half of an incoming selector bank. This relay is in turn controlled through the translator of the sender in accordance with the office code designation of the wanted line.

Referring to the drawings in which one embodiment of the invention has been disclosed for the purpose of illustration, Fig. 1 shows diagrammatically a calling line, a line switch, a district selector and as much of a central

office sender as is necessary for an understanding of the invention;

Fig. 2 shows in detail the circuits of an incoming selector modified in accordance with the present invention and diagrammatic disclosures of final selectors and called lines of two terminating offices Y and Z.

The line switch, district selector and the final selectors of Fig. 2 may be of the type fully disclosed in the patent to F. A. Stearn No. 1,505,171, granted August 19, 1924. The incoming selector of Fig. 2 may also be similar to the incoming selector disclosed in the patent to Stearn differing therefrom only in a modification of the commutator whereby eight group selections may be made by the selector rather than four as shown in the incoming selector of the patent. The sender disclosure is substantially similar to that of the patent to Stearn above referred to being modified, however, to enable the sender to control incoming selectors on calls to certain offices in accordance with the present invention.

It is believed that the invention will be best understood from a detailed consideration of the manner in which calls may be made from the line of subscriber A of Fig. 1, first to the line of subscriber B in office Y of Fig. 2, and then to the line of subscriber C in office Z of Fig. 2. It will be assumed that both offices Y and Z are in the same building with the incoming selector and that to call either office Y or Z the subscriber A dials office codes having different digital significance, but which will route both the calls to the same group of incoming selectors. For example, it will be assumed that to reach the line of subscriber B the subscriber A dials the office code CORtlandt followed by the numerical designation 2294 having a full digital equivalence of 267—2294, and that to reach the line of subscriber C the subscriber dials the office code ANTwerp followed by the numerical designation 2294 having a full digital equivalence of 268—2294. The call to the line of subscriber B will be first considered.

The subscriber A upon removing his receiver from the switchhook becomes connected in the usual manner with the district selector trunk over the brushes of the line switch and thereafter a connection is established with an idle sender. The sequence switch of the district selector then advances into a position to extend the conductors of the calling line over the brushes of the line switch, the lower contacts of cam 100 and 101, to the windings of the pulsing relay 102 and tone coil 103. The calling subscriber is then given a dialing tone in the well-known manner after which he proceeds to dial the digits 267—2294 corresponding to the office and numerical designations of the line of subscriber B.

In response to the dialing of the several digits the pulsing relay causes the setting of the code and numerical registers of the sender in the manner fully set forth in the patent to F. A. Stearn hereinbefore referred to. Following the setting of the code registers of the sender to record the office designation of the desired line the translator switch brushes which are designated at 104 take a setting in engagement with the set of terminals cross-connected through the rack 105 to brushes of the pulse machine 106. The primary function of the pulse machine is to effect the operation of translator register relays such as 110 to 112 in various combinations under the control of relay 107 to 109. A complete set of translator register relays comprises a considerable number of relays similar to relays 110 to 112 which may be operated in a large number of combinations, but for the purpose of illustration only a portion of these relays has been shown.

The cam contacts 113 to 121 inclusive and 133 are controlled by one or more sequence switches as disclosed in the patent to F. A. Stearn hereinbefore referred to. With sequence switch contact 114 closed, an obvious circuit is established for relay 122 which closes contacts thereby preparing circuit connections for relay 107, 108 and 109 extending to brushes of the pulse machine. With sequence switch contacts 117 and 120 closed a circuit is established from ground at contact 120, the back contact of the No. 0′ counting relay, the winding of sender stepping relay 124, the contact of cam 117, pulse machine brush 125 and drum segments 126, segment 127 to battery on brush 128. Relay 124 is momentarily energized seven times during 1-1/7 revolutions of the pulse machine in this circuit. At this time relay 135 is energized in the well-known manner, this relay always being energized whenever more than five impulses are to be counted by the counting relays of the sender.

Upon the first energization of relay 124 a circuit is closed from ground through sequence switch cam contact 115, the contact of relay 124, the contacts of cam 119, the upper contacts of relay 122, the counting relay lead 129, the back contact of the No. 6′ counting relay, the winding of the No. 6 counting relay to battery. The No. 6 counting relay energizes in this circuit and locks over a circuit extending through the No. 6′ counting relay, its own front contact and to ground at sequence switch cam contact 116. Counting relay No. 6′, however, does not energize in this circuit due to the fact that it is shunted by the ground through the contact of relay 124. As soon as the brush 125 moves off the first segment 126, relay 124 is momentarily deenergized and opens its contact thereby removing ground from lead 129 whereupon the No. 6′ counting relay energizes thereby extending the previously traced cir-

cuit from conductor 129, through its front contact, to the back contact of the No. 5′ counting relay, front contact of relay 135, to battery through the winding of the No. 5 counting relay, which in turn energizes upon the next energization of stepping relay 124. The foregoing operations continue until the brush 125 has engaged each segment 126 and the first segment of the group 126 a second time whereupon the No. 0′ counting relay energizes in parallel with relay 123. The No. 0′ counting relay opens the circuit of the stepping relay 124 and relay 123 closes a circuit for relay 131 extending from ground at the contact of relay 123, over the inner upper contact of relay 122, to battery through the winding of relay 131. Relay 131 operates and locks to the contact of cam 114 and opens the circuit of relay 122. Relay 122 also opens the circuits of relays 107, 108, 109, etc. In order to satisfy the counting relays, seven energizations of relay 124 are required and therefore since the six segments 126 are evenly distributed around the circumference of the pulse machine drum the drum will have made slightly more than a complete revolution.

During the revolution of the pulse machine drum other brushes of the pulse machine as determined bv the setting of the translator brushes 104 and the cross-connecting rack 105 will have engaged segments of the drum and translator register relays such as 110, 111, and 112 will have been selectively operated to determine the district brush and group selections and the office brush and group selections, if the latter selctions are necessary, to be made in accordance with the office code to route the connection to the office Y in which the desired line B terminates. Following the setting of the translator register relays the sender is prepared to control district selections in the maner set forth in the patent to F. A. Stearn hereinbefore referred to. Since the control of the district selector is exercised in the well-known manner under the control of the register relays, the stepping relay 124 and the counting relays, it will not be discussed herein and it will be assumed that the district selector after being set selects the idle trunk disclosed as terminating in the incoming selector shown in Fig. 2.

At this time the fundamental selector controlling circuit will be established from battery, right winding of relay 221, upper contacts of cam 202, resistance 224, the upper contact of cam 203, conductor 219, brush and bank terminal of the district selector, the upper right and lower left contacts of cam 132 now standing in its selection beyond position 10, the contact of sender sequence switch cam 133, sender stepping relay 124, the back contact of the No. 0′ counting relay, the upper contacts of cam 120, the lower left and upper right contacts of cam 134, a brush and terminal of the district selector, conductor 220, the lower contact of cam 204, resistance 205, to ground at the lower contact of cam 205. The sender stepping relay 124 and control relay 221 of the incoming selector now energize.

Relay 221 upon energizing closes a circuit extending through its outer left contact for driving sequence switch 200 out of its normal position into position 2, this circuit extending from battery, through the magnet winding of sequence switch 200, the lower right contact of cam 206, the outer left front contact of relay 221, thence to ground at the lower contact of cam 207. As soon as sequence switch 200 leaves position 1 the initial energizing circuit of relay 221 is opened at the upper left contact of cam 202, but relay 221 remains energized over the fundamental circuit through its right winding, the right contacts of cam 202, right front contact of relay 221, conductor 229 and the left contacts of cam 208.

With sequence switch 200 in position 2 a circuit is closed for the up drive magnet 230 from battery, through the winding of this magnet, the upper right contact of cam 209, conductor 231, the left front contact of relay 221, to ground at the lower contact of cam 207. Magnet 230 upon energizing causes the upward movement of the switch shaft. As the shaft approaches its first brush selection position a circuit is established in shunt of the windings of the sender stepping relay 124 which may be traced from battery, through the right winding of relay 221, the right contacts of cam 202, the right front contact of relay 221, conductor 229, the upper left and lower right contacts of cam 208, a segment of strip 234 of commutator 235, brush 236, conductor 237, thence to ground at the lower contact of cam 210. As the switch shaft continues in its upward movement the brush 236 engages an insulating portion of commutator strip 234 and the previously traced shunt is opened. In this manner during the upward movement of the switch shaft a shunt circuit is intermittently established and opened whereby the sender stepping relay 124 is energized and deenergized. Relay 221, however, remains energized over the shunt circuit.

It has been assumed that the calling subscriber has registered the thousands digit 2 on the thousands register of the sender and therefore upon the energization of relay 124 over the fundamental circuit above traced a circuit was established over lead 129 for the No. 6 counting relay which energizes and locks through the No. 6′ counting relay. As the incoming selector switch shaft advances the No. 6′ counting relay operates extending the operating circuit from lead 129, through the back contact of counting relay No. 5′, the

back contact of relay 135 which at this time is deenergized as the thousands digit registered has a value less than 5, back contact of relay 130, the back contact of the No. 0′ counting relay, to battery through the winding of the No. 0 counting relay. The No. 0′ counting relay operates when the brush 236 engages the next insulating segment of strip 234 to open the fundamental circuit at which time the switch shaft will have been positioned to trip the second set of brushes thereon.

Upon the opening of the fundamental circuit at the sender, relay 221 deenergizes opening at its outer left front contact the circuit of the magnet 230 to arrest the upward movement of the switch shaft and at its inner left back contact closes a circuit extending over the upper left contact of relay 206 for driving sequence switch 200 to position 3. Upon reaching position 3 sequence switch 200 closes a circuit for the trip magnet 238 extending from battery through the winding of magnet 238 and thence to ground over the right contacts of cam 205. The trip magnet 238 rotates the trip spindle of the selector into such a position as will trip the second set of brushes upon the subsequent upward movement of the switch shaft. The sequence switch of the sender upon the operation of relay 123 in parallel with the No. 0′ counting relay prepares the sender circuits in the well-known manner for controlling incoming group selection and, since it has been assumed that the incoming selector is to make connection with a line terminating in Office Y, the relay 130 of the sender will now be operated over a contact of cam 121 and contacts of the translator register relays.

With the sequence switch 200 of the incoming selector in position 3 the fundamental circuit is again established through the windings of relays 124 and 221. Relay 221 upon energizing in this circuit again closes the circuit previously traced for driving sequence switch 200 out of position 3 into position 4 and at its right hand front contact closes the locking circuit previously traced for maintaining itself energized over the fundamental circuit after the sequence switch leaves position 3. With sequence switch 200 in position 4 and relay 221 energized, the circuit previously traced through the up drive magnet 230 is again closed and the switch shaft is again driven upwardly. During the initial upward movement of the shaft, the second set of brushes is tripped and during the subsequent upward movement of the shaft the second set of brushes travels in engagement with the set of terminals with which it is associated. As the switch shaft brushes move into the first group selection position a circuit is established in shunt of the windings of the sender stepping relay 124 which may be traced from battery, through the right winding of relay 221, right contacts of cam 202, the right front contact of relay 221, the upper contacts of cam 208, a segment of the commutator strip 240, brush 241, conductor 237 and thence to ground at the lower contact of cam 210. As the switch shaft continues in its upward movement brush 241 comes into engagement with an insulating portion of segment 240 and the previously traced shunt circuit is opened. Thus during the continued upward movement of the switch shaft the shunt circuit is intermittently established and opened and in consequence thereof the sender stepping relay 124 is intermittently energized and deenergized. Relay 221, however, is maintained energized over the shunt circuit.

At this point it should be noted that the incoming selector switch commutator has been modified in accordance with the present invention to provide eight segments in the strip 240 instead of the usual four segments as heretofore provided in the prior art. This is for the purpose of enabling the selective positioning of the switch brushes in relation to any one of eight groups of trunks extending from each brush group of the selector to eight groups of final selectors. The upper four groups of trunks in each brush group are assigned for establishing connections to final selectors in the office Y whereby 20 groups of final selectors may be reached. The lower four groups of trunks in each brush group are similarly assigned for establishing connections to the office Z. At the sender it has been assumed that the office code has indicated that a line terminating in office Y is to be selected and that the incoming group selection must therefore be made in one of the upper four groups of a brush group. To enable this the relay 130 has been operated as previously described. This relay when operated is instrumental in interpolating four additional counting relays between the end pair of relays, the No. 0 and No. 0′ and the No. 6 and No. 6′ pair of relays.

With this modified structure in mind, when the fundamental circuit was established through the windings of relays 221 and 124 for controlling incoming group selection, relay 124 becomes energized and under the assumption that the calling subscriber has dialed the hundreds digit 2 a circuit is established for the No. 4 counting relay which may be traced in part from ground at cam 115, through the contact of relay 124, the lower contacts of cam 119, thence through contacts of the sender registers (not shown), lead 136, the back contact of counting relay No. 5′, back contact of relay 135, the front contact of relay 130, the back contact of counting relay No. 4′, to battery through the winding of the No. 4 counting relay. This relay energizes and locks through the winding of the No. 4′ counting relay which latter relay energizes upon the first deenergization of stepping relay 124. The counting relays are successively ener-

gized through the intermittent operation of stepping relay 124, until the No. 0′ counting relay energizes in parallel with relay 123 whereupon the sender sequence switch is advanced in the well-known manner to release the operated counting relays and to prepare the sender for controlling the final brush selection, and the fundamental circuit is opened.

As soon following the opening of the fundamental circuit at the armature and back contact of the No. 0′ counting relay as the brush 241 engages an insulating segment of commutator strip 240, relay 221 deenergizes and opens the previously traced circuit for the up drive magnet 230 and closes the previously traced circuit for advancing the sequence switch 200 out of position 4 and into position 5. At this time the tripped set of brushes has been positioned on the lowermost terminals of the fifth group of terminals in the bank to which the brush set has access which group is the first of the four groups of trunks having access to final selectors in the office Y. In position 5 of sequence switch 200, relay 221 is again energized over a circuit extending from battery, through its left winding and thence to ground over the right contacts of cam 211. Relay 221 now closes a circuit extending from ground at cam 207, outer left front contact of relay 221, lower contact of cam 206 for driving sequence switch 200 out of position 5 into position 6. Upon leaving position 5-1/4 the energizing circuit of relay 221 is opened at cam 211, but relay 221 remains energized over a locking circuit extending from battery, through its right winding, the right contacts of cam 202, the right front contact of relay 221, the right contacts of cam 212 and thence through test brush 242, to ground on the test terminals of the first trunk of the group to which the brush has been moved during the group selection movement of the switch, if the first trunk of the group is at the time busy.

When sequence switch 200 reaches position 6 the previously traced circuit for the up drive magnet 230 is again established for driving the switch shaft upwardly in its trunk hunting movement. This movement continues so long as the test brush 242 encounters ground potential on the multiples of the test terminals of the trunks over which this brush moves. As soon, however, as an idle trunk is found which will be assumed is the trunk disclosed leading to the final selector in the office Y, the relay 221 will be deenergized when the brushes are properly centered on the terminals of the selected idle trunk, relay 221 being maintained energized until the brushes are so centered by an additional locking circuit extending from battery through the left winding of relay 221, the upper right and lower left contacts of relay 211, conductor 243, centering strip 244 of the commutator 235, brush 245, conductor 237, the upper left contact of cam 210, left front contact of relay 221 to ground at the lower contact of cam 207. As soon as relay 221 deenergizes the circuit of the up drive magnet 230 is opened and the previously traced circuit is closed for advancing sequence switch 200 out of position 6 and into position 7.

In position 7 relay 221 again energizes in a circuit extending through its left winding and the right contacts of cam 211 and closes a circuit for driving sequence switch 200 out of position 7 and into position 8 in which position the tip conductor of the fundamental circuit is extended over the upper left contact of cam 213, brush 246 and bank terminal 247 to battery through the control relay (not shown) of the selected final selector, and the ring conductor of the fundamental circuit is extended to ground at the lower contact of cam 205.

Inasmuch as the setting of the final selector upon the terminals of the desired line B, the further operation of the incoming selector circuit to ring the wanted subscriber's bell and the remaining operations of the apparatus used in the establishment and release of the connection are identical with the similar operations fully described in the patent to F. A. Stearn hereinbefore referred to, they will not be discussed herein.

Had the calling subscriber desired a connection with the line of subscriber C terminating in the office Z, he would have dialed the designation ANT—2294 as hereinbefore assumed and the translator registers would not in this case have prepared a circuit for the operation of the special relay 130 during incoming group selection. Therefore, when the incoming group selection is being made with relay 130 deenergized, in accordance with the registered hundreds digit 2, and the counting relay lead 136 is grounded through the energization of the stepping relay 124 over the fundamental circuit, the No. 0 relay is operated in a circuit extending from ground on lead 136, the back contact of the No. 5′ counting relay, the back contact of relay 135, the back contact of relay 130, the back contact of the No. 0′ counting relay to battery through the winding of the No. 0 relay. Upon the first deenergization of relay 124, when the brush 241 engages an insulating segment of commutator strip 240 of the incoming selector, the No. 0′ counting relay operates in the locking circuit of the No. 0 relay opening the fundamental circuit. The incoming selector is thus advanced to trip the selected second set of brushes and to position it on the lowermost terminal of the lowermost group of terminals in the bank to which it has access. This group is the first of the four lower groups which are connected to trunks extending to final selectors in the office Z. The further extension of the connection to the terminals of the line C is

made in the manner well-known in the art.

From the foregoing it is apparent that by a simple change in the commutator of the incoming selector by means of which eight group selections may be made instead of four and by the addition of a single relay to the sender which is selectively operated during the incoming group selection in accordance with the office code registered in the sender, it is possible to enable an incoming selector to be used common to two offices whereby connections may be established therethrough to 20,000 lines. Thus a considerable economy of incoming selector switches and inter-office trunks is made possible.

What is claimed is:

1. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to either of said other offices, and selector mechanism individual to each of said other offices and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line for completing a connection to a wanted line in either of said other offices.

2. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to either of said other offices, and selector mechanism individual to each of said other offices and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line for completing a connection to a wanted line in either of said other offices, said common selector mechanism being also operable in accordance with said code designation.

3. In a telephone exchange system, a first office, other offices, a trunk line for connecting said first office to any of said other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line in any of said other offices to extend a connection over said trunk line, and selector mechanism individual to each of said other offices, and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line for completing a connection to a wanted line in any of said offices.

4. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to any of said other offices, selector mechanism individual to each of said other offices and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line for completing a connection to a wanted line in any of said other offices, and means for controlling said common selector mechanism in accordance with the office code designation of a wanted line to select the selector mechanism which is individual to the desired line.

5. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to any of said other offices, an incoming selector common to said other offices, final selectors individual to each of said other offices, said incoming selectors having access to final selectors in all of said other offices, and means controlled by said sender jointly in accordance with the office and numerical designation of a wanted line to extend said connection to a wanted line in any of said offices.

6. In a telephone exchange system, a first office, other offices, a trunk line extending from said first office to said other offices, means for extending a connection from said first office over said trunk line, an incoming selector in which said trunk line terminates, a plurality of groups of final selectors in each of said offices accessible from the said incoming selector, means for controlling said incoming selector to select an idle final selector in a particular group in any of said offices, and means for then controlling the selected final selector to extend the connection to a wanted line.

7. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to either of said other offices, selector mechanism individual to said other offices and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line for completing a connection to a wanted line in either of said other offices, and means in said sender operable in

accordance with the registered office code to determine whether said last selector mechanism shall extend a connection to selector mechanism in one or another of said other offices.

8. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines, a train of counting relays for controlling the selective movements of selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to either of said other offices, final selectors individual to said other offices for completing connections to wanted lines terminating therein, incoming selectors common to said other offices having access to equivalent groups of final selectors in each of said other offices, and means in said sender operable in accordance with the registered office code to vary the number of effective relays in said train to determine in which equivalent group said incoming selector shall select a final selector.

9. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines, a train of counting relays for controlling the selective movements of selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to either of said other offices, final selectors individual to said other offices for completing connections to wanted lines terminating therein, incoming selectors common to said other offices the terminal banks of which are divided into upper and lower sections, trunks extending from the terminals of the lower sections to final selectors in one of said other offices and trunks extending from the terminals of the upper sections extending to final selectors of the other of said offices, and means in said sender operable in accordance with the registered office code to vary the number of effective relays in said train to determine whether said incoming selectors shall select a trunk in the upper or lower sections of their banks.

In witness whereof, I hereunto subscribe my name this 27th day of March, 1928.

WARREN W. CARPENTER.

DISCLAIMER

1,747,224.—*Warren W. Carpenter*, Queens Village, N. Y. TELEPHONE-EXCHANGE SYSTEM. Patent dated February 18, 1930. Disclaimer filed May 15, 1931, by the assignee, *Bell Telephone Laboratories, Incorporated.*

Hereby enters this disclaimer to the said claims of said Letters Patent which are in the following words to wit:

"1. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to either of said other offices, and selector mechanism individual to each of said other offices and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line for completing a connection to a wanted line in either of said other offices.

"2. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to either of said other offices, and selector mechanism individual to each of said other offices and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line for completing a connection to a wanted line in either of said other offices, said common selector mechanism being also operable in accordance with said code designation.

"3. In a telephone exchange system, a first office, other offices, a trunk line for connecting said first office to any of said other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line in any of said other offices to extend a connection over said trunk line, and selector mechanism individual to each of said other offices, and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line for completing a connection to a wanted line in any of said offices.

"4. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to any of said other offices, selector mechanism individual to each of said other offices and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line in any of said other offices, and means for controlling said common selector mechanism in accordance with the office code designation of a wanted line to select the selector mechanism which is individual to the desired line.

"5. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to any of said other offices, an incoming selector common to said other offices, final selectors individual to each of said other offices, said incoming selectors having access to final selectors in all of said other offices, and means controlled by said sender jointly in accordance with the office and numerical designation of a wanted line to extend said connection to a wanted line in any of said offices."

"7. In a telephone exchange system, a first office, other offices, a sender at said first office having registers for registering the office code and numerical designations of wanted lines for controlling selector mechanism, selector mechanism operable in accordance with the office code designation of a wanted line for extending a connection to either of said other offices, selector mechanism individual to said other offices and selector mechanism common to said other offices operable in accordance with the numerical designation of a wanted line for completing a connection to a wanted line in either of said other offices, and means in said sender operable in accordance with the registered office code to determine whether said last selector mechanism shall extend a connection to selector mechanism in one or another of said other offices."

[*Official Gazette June 9, 1931.*]